SonicWall® SonicOS 6.5 NS*v* System Setup

Administration

Contents

Part 1

SYSTEM SETUP | About System Setup

1

About Setting Up Your SonicOS NS*v* System

About the SonicOS NS*v* Management Interface

The web-based SonicOS NS*v* Management Interface allows you to configure SonicWall Security Appliances (firewalls) running SonicOS NS*v* 6.5 and above. For a complete list of appliances supported by SonicOS NS*v*, see SonicOS NS*v 6.5 About* SonicOS NS*v*.

SonicOS NS*v* provides an easy-to-use, graphical Management Interface for configuring your SonicWall Security Appliance. For information about the dynamic Management Interface and its features, such as tooltips and dynamic tables, see SonicOS NS*v 6.5 About* SonicOS NS*v*.

This guide provides instructions about configuring:

- Passwords, login security, web management, certificates, and schedules
- User authentication, groups, guest services and accounts, and partitioning
- Network settings, such as interfaces, zones, and routing
- SD-WAN
- High availability
- VOIP

For Information about Configuring	See the
Connectivity: VPN, SSLVPN	SonicOS NS*v 6.5 Connectivity*
Polices: access rules, NAT polices, and all the objects, such as address, action, match, service, and bandwidth	SonicOS NS*v 6.5 Policies*
Licenses, updating firmware, and backing/restarting your system	SonicOS NS*v 6.5 Updates*
Monitoring: dashboard, threat prevention, traffic, capture ATP	SonicOS NS*v 6.5 Monitoring*
Security: Security Appliance settings, security services, Deep Packet Inspection (DPI)	SonicOS NS*v 6.5 Security Configuration*
Logs and reporting: AppFlow settings, logs, legal	SonicOS NS*v 6.5 Logs and Reporting*
Quick configuration	SonicOS NS*v Quick Configuration*
SonicOS NS*v* API	SonicOS NS*v 6.5 About* SonicOS NS*v*

Part 2

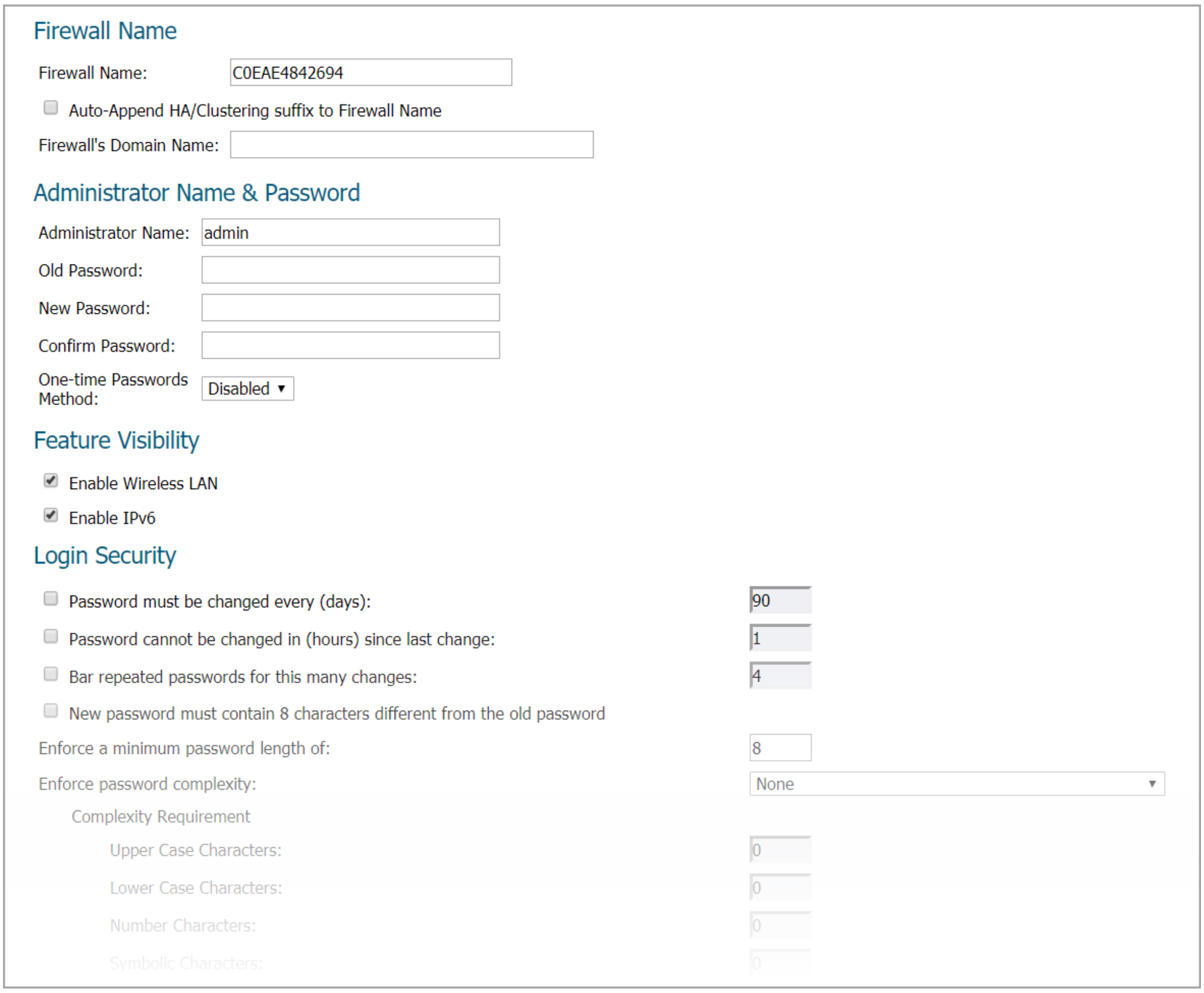
SYSTEM SETUP | Appliance

2

Configuring Base Settings

About Appliance | Base Settings

MANAGE | System Setup > **Appliance | Base Settings** provides settings for configuring the SonicWall Security Appliance for secure and remote management.



Firewall Name

Firewall Name: C0EAE4842694

□ Auto-Append HA/Clustering suffix to Firewall Name

Firewall's Domain Name:

Administrator Name & Password

Administrator Name: admin

Old Password:

New Password:

Confirm Password:

One-time Passwords Method: Disabled ▾

Feature Visibility

☑ Enable Wireless LAN

☑ Enable IPv6

Login Security

□ Password must be changed every (days): 90

□ Password cannot be changed in (hours) since last change: 1

□ Bar repeated passwords for this many changes: 4

□ New password must contain 8 characters different from the old password

Enforce a minimum password length of: 8

Enforce password complexity: None ▾

Complexity Requirement

Upper Case Characters: 0

Lower Case Characters: 0

Number Characters: 0

Symbolic Characters: 0

You can manage the firewall using a variety of methods, including HTTPS, SNMP or SonicWall Global Management System (SonicWall GMS).

ⓘ **NOTE:** To apply all changes to the SonicWall appliance, click **ACCEPT**; a message confirming the update displays at the bottom of the browser window.

Configuring the Appliance

Topics:

- Accessing the Appliance | Base Settings Page on page 17
- Configuring the Firewall Name on page 17
- Changing the Administrator Name & Password on page 18
- Enabling IPv6 on page 19
- Configuring Login Security on page 19

Accessing the Appliance | Base Settings Page

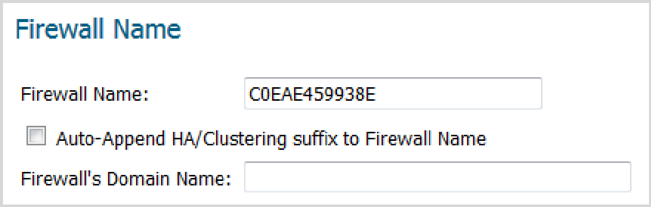
Accessing the Appliance | Base Settings page:

1. Navigate to **MANAGE | System Setup > Appliance** to expand the navigation pane.
2. Click **Base Settings**.

Configuring the Firewall Name

To configure the firewall name:

1. Navigate to **MANAGE | System Setup > Appliance > Base Settings**.
2. Scroll to the **Firewall Name** section.



Firewall Name

Firewall Name: C0EAE459938E

□ Auto-Append HA/Clustering suffix to Firewall Name

Firewall's Domain Name:

3. Enter the hexadecimal serial number of the firewall in the **Firewall Name** field. This number uniquely identifies the SonicWall Security Appliance and defaults to the serial number of the firewall. The serial number is also the MAC address of the unit. To change the **Firewall Name**, enter a unique alphanumeric name in the **Firewall Name** field. It must be at least 8 characters in length and can be up to 63 characters long.
4. To facilitate recognition of the primary/secondary firewalls in the Event Logs, check **Auto-Append HA/Clustering suffix to Firewall Name**. When this option is enabled, an appropriate suffix is appended automatically to the firewall name in **MANAGE | INVESTIGATE > Log > Event Logs**:
   - **Primary**
   - **Secondary**
   - **Primary Node** <***nodeNumber***>
   - **Secondary Node** <***nodeNumber***>

This option is not selected by default. For more information about Event Logs, see SonicOS NSv *6.5 Investigate*.

5 Enter a friendly name in the **Firewall's Domain Name**. The name can be private, for internal users, or an externally registered domain name. This domain name is used in conjunction with **User Web Login Settings** on the **System Setup > Users > Settings** view for user-authentication redirects. For more information about user web login settings, see User Web Login Settings on page 107.

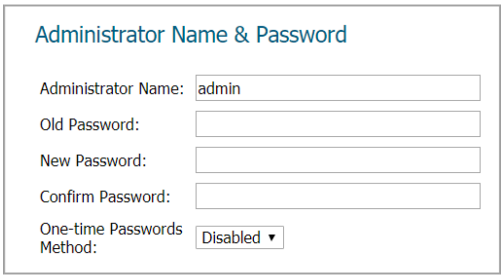
Changing the Administrator Name & Password

Each SonicWall Security Appliance has a default administrator name of `admin` and a password of `password`. If you did not change the password with the Initial **Setup Guide** or **Startup Guide**, or with the **Setup Quick Configuration Guide**, it is highly recommended that you do so now.

To change the administrator name and/or password:

1 Navigate to **MANAGE | System Setup > Appliance > Base Settings**.

2 Scroll to **Administrator Name & Password**.



Administrator Name & Password

Administrator Name:	admin
Old Password:	
New Password:	
Confirm Password:	
One-time Passwords Method:	Disabled ▾

3 Type the new name in the **Administrator Name** field. The **Administrator Name** can be changed from the default setting of **admin** to any word using alphanumeric characters up to 32 characters in length. It must be at least one character long.

4 Click **ACCEPT**.

To set a new password for SonicWall management interface access:

1 Type the old password in the **Old Password** field. The old password is shown encrypted in the **Old Password** field.

2 Type the new password in the **New Password** field. The new password can be up to 32 alphanumeric and special characters.

> ⓘ **IMPORTANT:** It is recommended you change the default password, **password**, to your own custom password. Enter a strong password that cannot be easily guessed by others. A strong password should have at least one uppercase letter, one lowercase letter, one number, and one special character. For example, `MyP@ssw0rd`.

3 Type the new password again in the **Confirm Password** field.

4 To enforce the use of a One-time Passwords Method, select TOTP from the drop-down. Leave this feature disabled to allow for the reuse of old passwords.

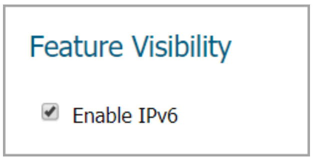
5 Click **ACCEPT**.

Enabling IPv6

To enable the visibility of IPv6:

1 Navigate to **MANAGE | System Setup > Appliance > Base Settings**.

2 Scroll to **Feature Visibility**.



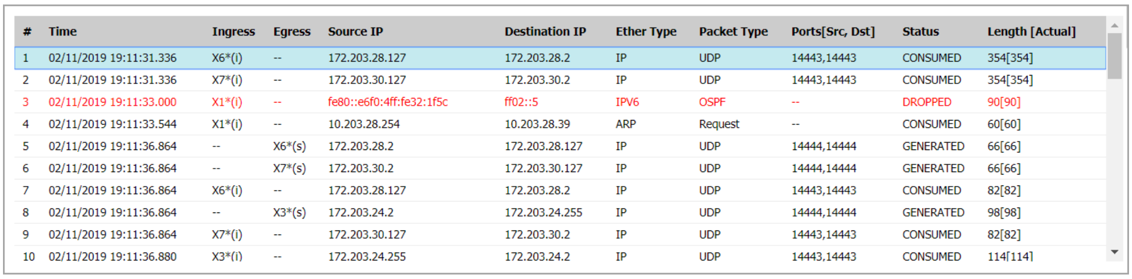
Feature Visibility

☑ Enable IPv6

3 Click **Enable IPv6**. This options is selected by default. A confirmation message displays.

By selecting this option, you allow the feature to be used and visible on the **MONITOR | Current Status > System Status** page. If the option is not selected, the **System Status** page displays that it is disabled.

When IPv6 is disabled, all IPv6 packets are dropped by the firewall and the **INVESTIGATE | Tools > Packet Monitor** page displays the log messages.



#	Time	Ingress	Egress	Source IP	Destination IP	Ether Type	Packet Type	Ports[Src, Dst]	Status	Length [Actual]
1	02/11/2019 19:11:31.336	X6*(i)	--	172.203.28.127	172.203.28.2	IP	UDP	14443,14443	CONSUMED	354[354]
2	02/11/2019 19:11:31.336	X7*(i)	--	172.203.30.127	172.203.30.2	IP	UDP	14443,14443	CONSUMED	354[354]
3	02/11/2019 19:11:33.000	X1*(i)	--	fe80::e6f0:4ff:fe32:1f5c	ff02::5	IPV6	OSPF	--	DROPPED	90[90]
4	02/11/2019 19:11:33.544	X1*(i)	--	10.203.28.254	10.203.28.39	ARP	Request	--	CONSUMED	60[60]
5	02/11/2019 19:11:36.864	--	X6*(s)	172.203.28.2	172.203.28.127	IP	UDP	14444,14444	GENERATED	66[66]
6	02/11/2019 19:11:36.864	--	X7*(s)	172.203.30.2	172.203.30.127	IP	UDP	14444,14444	GENERATED	66[66]
7	02/11/2019 19:11:36.864	X6*(i)	--	172.203.28.127	172.203.28.2	IP	UDP	14443,14443	CONSUMED	82[82]
8	02/11/2019 19:11:36.864	--	X3*(s)	172.203.24.2	172.203.24.255	IP	UDP	14444,14444	GENERATED	98[98]
9	02/11/2019 19:11:36.864	X7*(i)	--	172.203.30.127	172.203.30.2	IP	UDP	14443,14443	CONSUMED	82[82]
10	02/11/2019 19:11:36.880	X3*(i)	--	172.203.24.255	172.203.24.2	IP	UDP	14443,14443	CONSUMED	114[114]

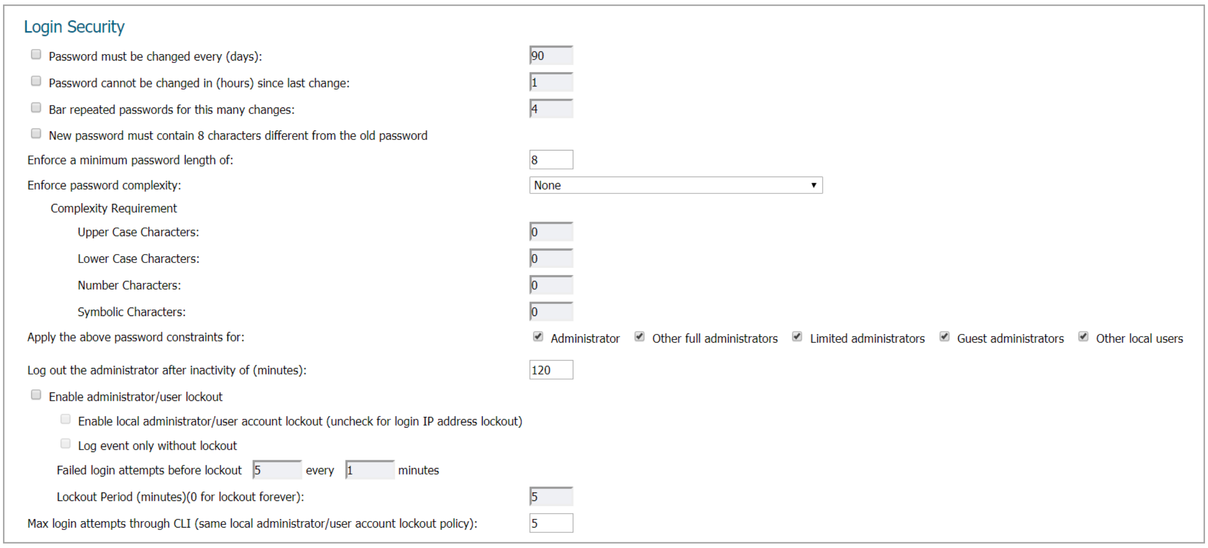
4 Click **OK**.

Configuring Login Security

The internal SonicOS NS*v* Web-server supports TLS 1.1 and above with strong ciphers (128 bits or greater) when negotiating HTTPS management sessions. SSL implementations are not supported. This heightened level of HTTPS security protects against potential SSLv2 rollback vulnerabilities and ensures compliance with the Payment Card Industry (PCI) and other security and risk-management standards.

> ⓘ **TIP:** SonicOS NS*v* uses advanced browser technologies, such as HTML5, which are supported in most recent browsers. SonicWall recommends using the latest Chrome, Firefox, Internet Explorer, or Safari (does not operate on Windows platforms) browsers for administration of SonicOS NS*v*. Mobile device browsers are not recommended for SonicWall system administration.

Configuring SonicOS NS*v* password constraint enforcement ensures that administrators and users are using secure passwords. This password constraint enforcement can satisfy the confidentiality requirements as defined by current information security management systems or compliance requirements, such as Common Criteria and the Payment Card Industry (PCI) standard.



Login Security

□ Password must be changed every (days): 90

□ Password cannot be changed in (hours) since last change: 1

□ Bar repeated passwords for this many changes: 4

□ New password must contain 8 characters different from the old password

Enforce a minimum password length of: 8

Enforce password complexity: None

Complexity Requirement

Upper Case Characters: 0

Lower Case Characters: 0

Number Characters: 0

Symbolic Characters: 0

Apply the above password constraints for: ☑ Administrator ☑ Other full administrators ☑ Limited administrators ☑ Guest administrators ☑ Other local users

Log out the administrator after inactivity of (minutes): 120

□ Enable administrator/user lockout

□ Enable local administrator/user account lockout (uncheck for login IP address lockout)

□ Log event only without lockout

Failed login attempts before lockout 5 every 1 minutes

Lockout Period (minutes)(0 for lockout forever): 5

Max login attempts through CLI (same local administrator/user account lockout policy): 5

Topics:

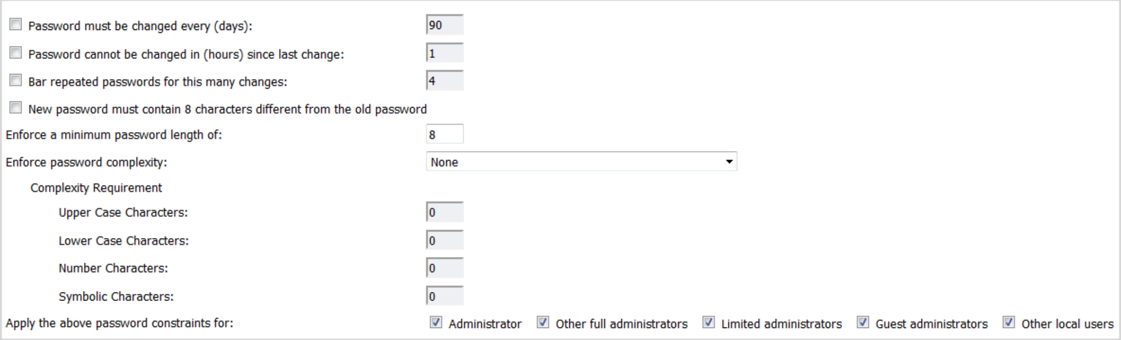
- Configuring Password Compliance on page 20
- Configuring Login Constraints on page 21

Configuring Password Compliance

To configure password compliance:

1 Navigate to **MANAGE | System Setup > Appliance > Base Settings**.

2 Scroll to **Login Security**.



□ Password must be changed every (days): 90

□ Password cannot be changed in (hours) since last change: 1

□ Bar repeated passwords for this many changes: 4

□ New password must contain 8 characters different from the old password

Enforce a minimum password length of: 8

Enforce password complexity: None

Complexity Requirement

Upper Case Characters: 0

Lower Case Characters: 0

Number Characters: 0

Symbolic Characters: 0

Apply the above password constraints for: ☑ Administrator ☑ Other full administrators ☑ Limited administrators ☑ Guest administrators ☑ Other local users

3 To require users to change their passwords after a designated number of days has elapsed:

a Select **Password must be changed every (days)**. The field becomes active. This option is not selected by default.

b Enter the elapsed time in the field. The default number of days is **90**, the minimum is 1 day, and the maximum is 9999.

When a user attempts to login with an expired password, a popup window prompts the user to enter a new password. The **User Login Status** window now includes **Change Password** so users can change their passwords at any time.

4 To specify the minimum length of time, in hours, allowed between password changes:

a. Select **Password cannot be changed in (hours) since the last change**. The field becomes active. This option is not selected by default.

b. Enter the number of hours. The minimum – and default – time is **1** hour; the maximum is 9999 hours.

5. To require users to use unique passwords for the specified number of password changes:

   a. Select **Bar repeated passwords for this many changes**. The field becomes active. This option is not selected by default.

   b. Enter the number of changes. The default number is **4**, the minimum number is 1, and the maximum number is 32.

6. To require users to change at least 8 alphanumeric/symbolic characters of their old password when creating a new one, select **New password must contain 8 characters different from the old password**. For how to specify what characters are allowed, see Step 8.

7. Specify the shortest allowed password, enter the minimum number of characters in the **Enforce a minimum password length of** field. The default number is **8**, the minimum is 1, and the maximum is 99.

8. Choose how complex a user's password must be to be accepted from the **Enforce password complexity** drop-down menu:

   - **None** (default)
   - **Require both alphabetic and numeric characters**
   - **Require alphabetic, numeric, and symbolic characters** – for symbolic characters, only **!**, **@**, **#**, **$**, **%**, **^**, **&**, *****, **(**, and **)** are allowed; all others are denied

9. When a password complexity option other than **None** is selected, the options under **Complexity Requirement** become active. Enter the minimum number of alphanumeric and symbolic characters required in a user's password. The default number for each is **0**, but the total number of characters for all options cannot exceed 99.

   - **Upper Case Characters**
   - **Lower Case Characters**
   - **Number Characters**
   - **Symbolic Characters**

   ⓘ **NOTE:** The **Symbolic Characters** field becomes active only if **Require alphabetic, numeric and symbolic characters** is selected.

10. Select to which classes of users the password constraints are applied under **Apply the above password constraints for**. By default, all options are selected:

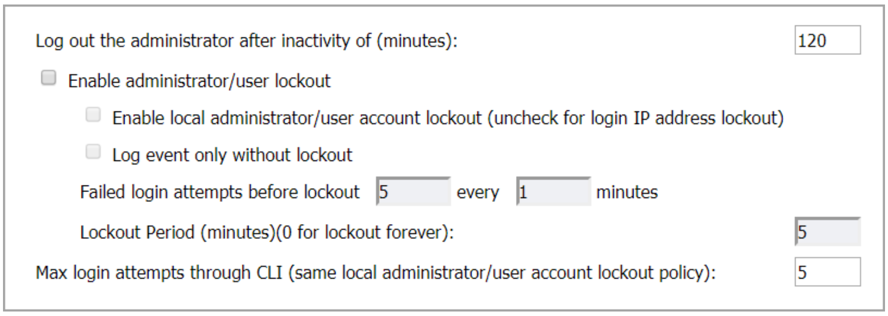
    - **Administrator** – Refers to the default administrator with the username **admin**.
    - **Other full administrators**
    - **Limited administrators**
    - **Guest administrators**
    - **Other local users**

Configuring Login Constraints

To configure login constraints:

1. Navigate to **MANAGE | System Setup > Appliance > Base Settings**.

2 Scroll to **Login Security**.



Log out the administrator after inactivity of (minutes): 120

□ Enable administrator/user lockout

□ Enable local administrator/user account lockout (uncheck for login IP address lockout)

□ Log event only without lockout

Failed login attempts before lockout 5 every 1 minutes

Lockout Period (minutes)(0 for lockout forever): 5

Max login attempts through CLI (same local administrator/user account lockout policy): 5

3 To specify the length of inactivity time that elapses before you are automatically logged out of the Management Interface, enter the time, in minutes, in the **Log out the Administrator after inactivity of (minutes)** field. By default, the SonicWall Security Appliance logs out the administrator after **5** minutes of inactivity. The inactivity timeout can range from 1 to 9999 minutes.

> **TIP:** If the Administrator Inactivity Timeout is extended beyond five minutes, you should end every management session by clicking **Logout** in the upper right corner of the view to prevent unauthorized access to the firewall's Management Interface.

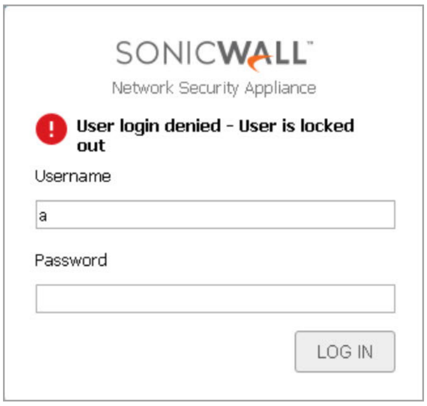
4 To configure the SonicWall Security Appliance to lockout an administrator or a user if the login credentials are incorrect, select **Enable administrator/user lockout**. Both administrators and users are locked out of accessing the firewall after the specified number of incorrect login attempts. This option is disabled by default. When this option is enabled, the following fields become active.

> **CAUTION: If the administrator and a user are logging into the firewall using the same source IP address, the administrator is also locked out of the firewall. The lockout is based on the source IP address of the user or administrator.**

a Select **Enable local administrator/user account lockout (uncheck for login IP address lockout)**. This option locks out user accounts and IP addresses when they have surpassed a specified number of incorrect login attempts. This option is only available when **Enable administrator/user lockout** is selected.

b Select **Log event only without lockout** for SonicOS NS*v* to log failed user login attempts that have reached the established threshold, but does not lock out the user or IP address. This option is only available when **Enable administrator/user lockout** is selected.

After a user or IP address is locked out, a "User login denied - User is locked out" message displays on the login screen and the login is rejected.



User login denied - User is locked out

Username: a

Password:

> **NOTE:** You can review and edit all locked out user accounts on the **MONITOR | Current Status | User Sessions > Active Users** page when **Enable local administrator/user account lockout (uncheck for login IP address lockout)** is selected.

c Enter the number of failed attempts within a specified time frame before the user is locked out in the first **Failed login attempts per minute before lockout** field. The default number is **5**, the minimum is 1, and the maximum is 99.

d Enter the maximum time in which failed attempts can be made. The default is **5** minutes, the minimum is 1 minute, and the maximum is 240 minutes (4 hours)

e Enter the length of time that must elapse before the user is allowed to attempt to log into the firewall again in the **Lockout Period (minutes)** field. The default is **5** minutes, the minimum is 0 (permanent lockout), and the maximum is 60 minutes.

5 Enter the number of incorrect login attempts from the command line interface (CLI) that triggers a lockout in the **Max login attempts through CLI** field. The default is **5**, the minimum is 3, and the maximum is 15.

6 Click **ACCEPT**.

Locked Out User Accounts

SonicOS NS*v* maintains an Unauthenticated Users record indicating how many unauthenticated user accounts or IP addresses have been locked out. The **Enable local administrator/user account lockout (uncheck for login IP address lockout)** feature is meant to lockout unauthenticated users and IP addresses when the user or administrator authentication/login fails. See that record on the **MONITOR | Current Status | User Sessions > Active Users** page.

Unlocking Unauthenticated User Accounts

There are three ways that you can unlock a locked user account:

- **Lockout timer** - This method unlocks the unauthenticated account automatically after the established waiting period has elapsed.
- **Unlock in the SonicOS web management interface** - This method requires that an administrator unlocks unauthenticated users manually by clicking an **Unlock** icon on the **MONITOR | Current Status | User Sessions > Active Users** page.
- **Disable checkbox** - Deselecting **Enable local administrator/user account lockout (uncheck for login IP address lockout)** unlocks all unauthenticated users unless a specific user has been marked locked “forever.” The lockout period for that particular unauthenticated user would show as finite minutes, and would not be unlocked by deselecting the option.

Configuring Multiple Administrator Access

SonicOS NS*v* supports multiple concurrent administrators with full administrator privileges, read-only privileges, and limited privileges.

Topics:

About Multiple Administrator Support

Topics:

What is Multiple Administrators Support?

The original version of SonicOS supported only a single administrator to log on to a firewall with full administrative privileges. Additional users could be granted “limited administrator” access, but only one administrator could have full access to modify all areas of the SonicOS web management interface at one time.

SonicOS currently provides support for multiple concurrent administrators. This feature allows for multiple users to log-in with full administrator privileges. In addition to using the default **admin** user name, additional administrator user names can be created.

Because of the potential for conflicts caused by multiple administrators making configuration changes at the same time, only one administrator at a time is allowed to make configuration changes. The additional administrators are given full access to the web management interface, but they cannot make configuration changes.

Benefits

Multiple Administrators Support provides the following benefits:

Improved productivity	Allowing multiple administrators to access a firewall simultaneously eliminates auto logout, a situation that occurs when two administrators require access to the appliance at the same time and one is automatically forced out of the system.
Reduced configuration risk	The new read-only mode allows users to view the current configuration and status of a firewall without the risk of making unintentional changes to the configuration.

How Does Multiple Administrators Support Work?

Topics:

Configuration Modes

To allow multiple concurrent administrators, while also preventing potential conflicts caused by multiple administrators making configuration changes at the same time, these configuration modes have been defined:

Configuration mode	Administrator has full privileges to edit the configuration. If no administrator is already logged into the appliance, this is the default behavior for administrators with full and limited administrator privileges (but not read-only administrators). **NOTE:** Administrators with full configuration privilege can also log in using the Command Line Interface.
Read-only mode	Administrator cannot make any changes to the configuration, but can view the entire web management interface and perform monitoring actions. Only administrators who are members of the **SonicWall Read-Only Admins** user group are given read-only access, and it is the only configuration mode they can access.

Non-configuration mode

Administrator can view the same information as members of the read-only group and they can also initiate management actions that do not have the potential to cause configuration conflicts.

Only administrators who are members of the **SonicWall Administrators** user group can access non-configuration mode. This mode can be entered when another administrator is already in configuration mode and the new administrator chooses not to preempt the existing administrator. By default, when an administrator is preempted out of configuration mode, he or she is converted to non-configuration mode. On the **System Setup > Administration** page, this behavior can be modified so that the original administrator is logged out.

Access Rights Available to Configuration Modes provides a summary of the access rights available to the configuration modes. Access rights for limited administrators are included also, but note that this table does not include all functions available to limited administrators.

Access Rights Available to Configuration Modes

Function	Full Admin in Config Mode	Full Admin in Non-config Mode	Read-only Administrator	Limited Administrator
Import certificates	X			
Generate certificate signing requests	X			
Export certificates	X			
Export appliance settings	X	X	X	
Download TSR	X	X	X	
Use other diagnostics	X	X		X
Configure network	X			X
Flush ARP cache	X	X		X
Setup DHCP Server	X			
Renegotiate VPN tunnels	X	X		
Log users off	X	X		X guest users only
Unlock locked-out users	X	X		
Clear log	X	X		X
Filter logs	X	X	X	X
Export log	X	X	X	X
Email log	X	X		X
Configure log categories	X	X		X
Configure log settings	X			X
Generate log reports	X	X		X
Browse the full UI	X	X	X	
Generate log reports	X	X		X

User Groups

The Multiple Administrators Support feature supports two new default user groups:

SonicWall Administrators

Members of this group have full administrator access to edit the configuration.

SonicWall Read-Only Admins Members of this group have read-only access to view the full management interface, but they cannot edit the configuration and they cannot switch to full configuration mode.

It is not recommended to include users in more than one of these user groups. If you do so, however, the following behavior applies:

If members of this user group	Are
SonicWall Administrators	Also included in the **Limited Administrators** or **SonicWall Read-Only Admins** user groups, the members have full administrator rights.
Limited Administrators	Included in the **SonicWall Read-Only Admins** user group, the members have limited administrator rights.
Read-Only Admins	Later included in another administrative group, the **If this read-only admin group is used with other administrative groups** option in the **SonicWall Read-Only Admins** group configuration determines whether the members are still restricted to read-only access or have the full administration capabilities set by their other group.

Priority for Preempting Administrators

These rules govern the priority levels that the various classes of administrators have for preempting administrators that are already logged into the appliance:

1 The **admin** user and SonicWall Global Management System (GMS) both have the highest priority and can preempt any users.

2 A user who is a member of the **SonicWall Administrators** user group can preempt any users except for the **admin** and SonicWall GMS.

3 A user who is a member of the **Limited Administrators** user group can only preempt other members of the **Limited Administrators** group.

GMS and Multiple Administrator Support

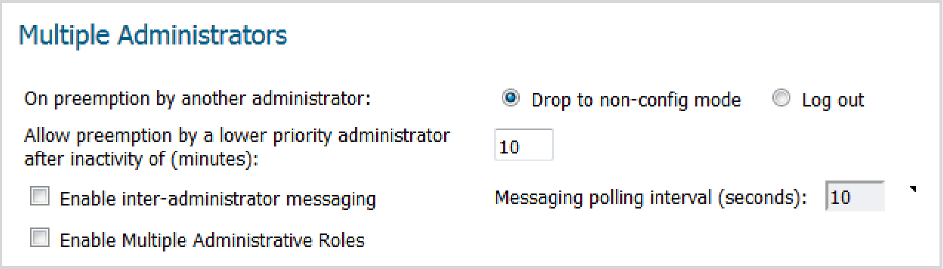
When using SonicWall GMS to manage a firewall, GMS frequently logs in to the appliance (for such activities as ensuring that GMS management IPsec tunnels have been created correctly). These frequent GMS log-ins can make local administration of the appliance difficult because the local administrator can be preempted by GMS.

Configuring Multiple Administrator Access

To configure multiple administrator access:

1 Navigate to **MANAGE | System Setup > Appliance > Base Settings**.

2 Scroll to **Multiple Administrators**.



Multiple Administrators

On preemption by another administrator: ● Drop to non-config mode ○ Log out

Allow preemption by a lower priority administrator after inactivity of (minutes): 10

□ Enable inter-administrator messaging — Messaging polling interval (seconds): 10

□ Enable Multiple Administrative Roles

3 To configure what happens when one administrator preempts another administrator, from the **On preemption by another administrator** options, select whether the preempted administrator can be converted to non-config mode or logged out:

To Allow	Select
More than one administrator to access the appliance in non-config mode without disrupting other administrators. This option is not selected by default.	**Drop to non-config mode**
The new administrator to preempt other sessions. **NOTE:** Selecting **Log Out** disables Non-Config mode and prevents entering Non-Config mode manually.	**Log Out**

4 To allow a lower-priority administrator to preempt the current administrator after a specified time, enter the time, in minutes, in the **Allow preemption by a lower priority administrator after inactivity of (minutes)** field. The default is **10** minutes, the minimum is 1 minute, and the maximum is 9999 minutes.

5 The SonicOS NS*v* Management Interface allows administrators to send text messages through the Management Interface to other administrators logged into the appliance. The message appears in the browser's status bar. This option is not selected by default. To enable this option:

a Select **Enable inter-administrator messaging**. The **Messaging polling interval (seconds)** field becomes active.

b Specify how often an administrator's browser checks for inter-administrator messages in the **Messaging polling interval (seconds)** field. Specify a reasonably short interval to ensure timely delivery of messages, especially if there are likely to be multiple administrators who need to access the appliance. The default is **10** seconds, the minimum is 1 second, and the maximum is 99 seconds.

6 To enable access by System Administrators, Cryptographic (Crypto) Administrators, and Audit Administrators, select **Enable Multiple Administrator Roles**. When this option is disabled, the these administrators cannot access the system, and all related user groups and information about them are hidden. This option is not selected by default.

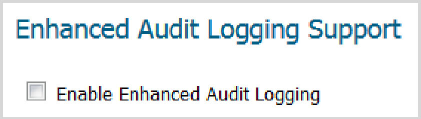
Enabling Enhanced Audit Logging Support

An enhanced log entry contains the parameter changed and user name in the **Investigate | Logs > Event Logs** page. For further information about logs, see SonicOS NS*v* *6.5 Investigate*.

To enable logging of all configuration changes in the INVESTIGATE | Logs > Event Logs page:

1 Navigate to **MANAGE | System Setup > Appliance | Base Settings**.

2 Scroll to **Enhanced Audit Logging Support**.



Enhanced Audit Logging Support

□ Enable Enhanced Audit Logging

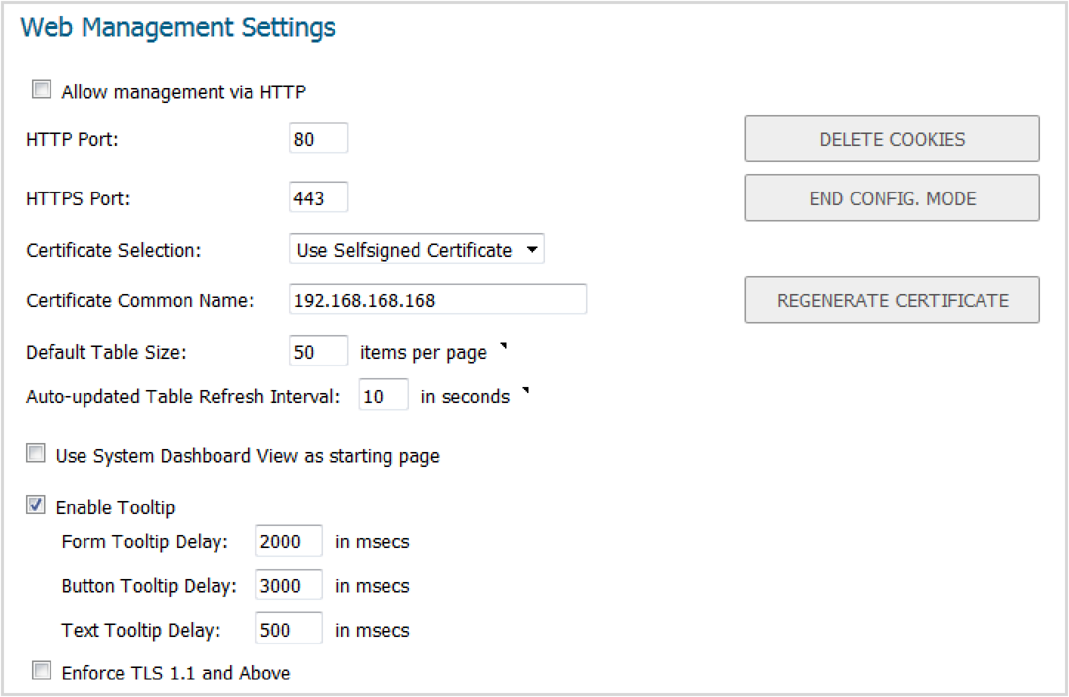
3 Select **Enable Enhanced Audit Logging**. This option is not selected by default.

4 Click **ACCEPT**.

Configuring the Management Interface

In this section, you configure:

- How the Management Interface tables display
- Certificate usage
- Which page displays as a starting page
- Whether you are operating in Configuration or Non-Config mode
- Tooltip behavior
- Other management options



Web Management Settings

□ Allow management via HTTP

HTTP Port: 80

HTTPS Port: 443

Certificate Selection: Use Selfsigned Certificate

Certificate Common Name: 192.168.168.168

Default Table Size: 50 items per page

Auto-updated Table Refresh Interval: 10 in seconds

□ Use System Dashboard View as starting page

☑ Enable Tooltip

Form Tooltip Delay: 2000 in msecs

Button Tooltip Delay: 3000 in msecs

Text Tooltip Delay: 500 in msecs

□ Enforce TLS 1.1 and Above

Topics:

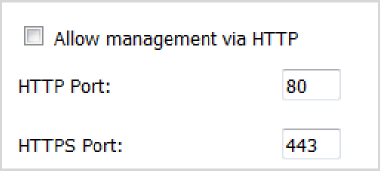
- Managing through HTTP/HTTPS on page 28
- Deleting Browser Cookies on page 29
- Switching Configuration Modes on page 30
- Controlling the Management Interface Tables on page 31
- Specifying the Starting Page on page 32
- Managing Tooltips on page 32
- Enforcing TLS Version on page 32

Managing through HTTP/HTTPS

You can manage the SonicWall Security Appliance using HTTP or HTTPS and a Web browser. HTTP web-based management is disabled by default. Use HTTPS to log into the SonicOS NS*v* Management Interface with factory default settings.

To manage through HTTP or HTTPS:

1. Navigate to **MANAGE | System Setup > Appliance > Base Settings**.
2. Scroll to **Web Management Settings**.



☐ Allow management via HTTP

HTTP Port: 80

HTTPS Port: 443

3. To enable HTTP management globally, select **Allow management via HTTP**. This option is not selected by default.
4. The default port for HTTP is port **80**, but you can configure access through another port. Enter the number of the desired port in the **HTTP Port** field.

   > ⓘ **IMPORTANT:** If you configure another port for HTTP management, you must include the port number when you use the IP address to log into the SonicWall Security Appliance. For example, if you configure the port to be `76`, then you must type *`LAN IP Address`*`:76` into the Web browser, for example, `http://192.18.16.1:76`.

5. The default port for HTTPS management is **443**. To add another layer of security for logging into the SonicWall Security Appliance by changing the default port, enter the preferred port number into the **HTTPS Port** field.

   > ⓘ **IMPORTANT:** If you configure another port for HTTPS management Port, you must include the port number when you use the IP address to log into the SonicWall Security Appliance. For example, if you use `700` for the port, then you must log into the SonicWall using the port number as well as the IP address; for example, `https://192.18.16.1:700`.

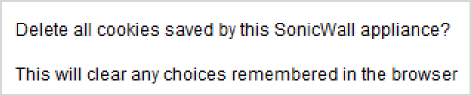
Deleting Browser Cookies

> ⓘ **IMPORTANT:** Deleting cookies causes you to lose any unsaved changes made in the Management Interface.

To delete all browser cookies saved by the Security Appliance:

1. Navigate to **MANAGE | System Setup > Appliance > Base Settings**.
2. Scroll to **Web Management Settings**.
3. Click **Delete Cookies**.

A confirmation message displays.



Delete all cookies saved by this SonicWall appliance?

This will clear any choices remembered in the browser

4. Click **OK**. All cookies saved since the last time you deleted cookies are deleted.

Switching Configuration Modes

Each appliance includes a **Mode** option that toggles the configuration mode of the Management Interface. If you are in **Configuration Mode**, you can switch to **Non-Config Mode** at any time, or if you are in **Non-Config Mode**. You can switch to **Configuration Mode**.

ⓘ **TIP:** This method is in addition to switching modes from the **Mode** setting on each view. For more information about modes, see *SonicOS About Guide*.

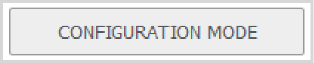
To switch modes:

1 Navigate to **MANAGE | System Setup > Appliance > Base Settings**.

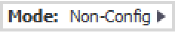
2 Scroll to **Web Management Settings**.

3 If you are in:

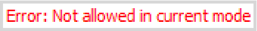
- Configuration Mode, click **END CONFIG. MODE**. The button changes to:



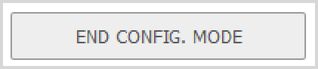
The **Mode** indicator in the top right of the page displays **Non-Config**:


Mode: Non-Config ▸

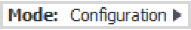
If you attempt to save any changes on any view, an error message displays:


Error: Not allowed in current mode

- Non-Config Mode, click **CONFIGURATION MODE**. The button changes to:



The **Mode** indicator in the top right of the page displays **Configuration**:


Mode: Configuration ▸

There is no need to click **ACCEPT**.

4 To return to:

- Configuration Mode, click **CONFIGURATION MODE**.
- Non-Config Mode, click **END CONFIG. MODE**.

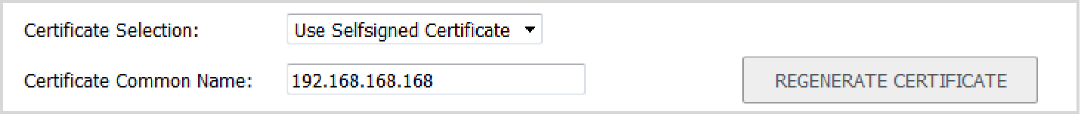
Selecting a Security Certificate

Security certificates provide data encryption and a secure web site.

To specify the type of security certificate:

1 Navigate to **MANAGE | System Setup | Appliance > Base Settings**.

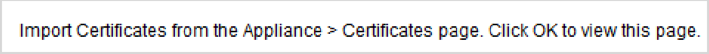
2 Scroll to **Web Management Settings**.


Certificate Selection: Use Selfsigned Certificate ▾

Certificate Common Name: 192.168.168.168

3 From **Certificate Selection**, select the type of certificate for your web site:

- **Use Self-signed Certificate**, which allows you to continue using a certificate without downloading a new one each time you log into the SonicWall Security Appliance. This option is selected by default. Go to Step 4.
- **Import Certificate** to select an imported certificate from the **Appliance > Certificates** page to use for authentication to the management interface. A confirmation message displays:



Import Certificates from the Appliance > Certificates page. Click OK to view this page.

  a) Click **OK**. The **Appliance > Certificates** page displays.

  b) Go to Managing Certificates on page 52.

4 In the **Certificate Common Name** field, enter the IP address or common name for the firewall. If you choose **Use Selfsigned Certificate**, SonicOS NS*v* populates the field with the firewall's IP address.

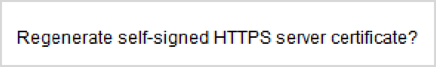
5 Click **ACCEPT**.

To regenerate a Self-Signed Certificate:

1 Navigate to **MANAGE | System Setup > Appliance > Base Settings**.

2 Scroll to **Web Management Settings**.

3 Click **REGENERATE CERTIFICATE**. A confirmation message displays:



Regenerate self-signed HTTPS server certificate?

4 Click **OK**.

Controlling the Management Interface Tables

The SonicWall Management Interface allows you to control the display of large tables of information across all tables in the Management Interface by changing the:

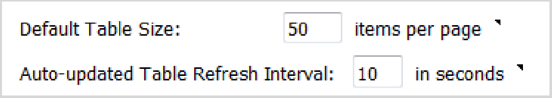
- Number of table entries displayed on a page.
- Frequency of background automatic refresh of tables.

Some tables have individual settings for items per page that are initialized at login to the value configured here. After these pages are viewed, their individual settings are maintained. Subsequent changes made here affect these pages only following a new login.

To change the display and refresh of tables:

1 Navigate to **MANAGE | System Setup > Appliance > Base Settings**.

2 Scroll to **Web Management Settings**.



Default Table Size: 50 items per page

Auto-updated Table Refresh Interval: 10 in seconds

3 Enter the desired number of **items per page** in the **Default Table Size** field. The minimum is 1, the maximum is 5000, and the default is **50**.

4 Enter the desired refresh interval, in seconds, in the **Auto-updated Table Refresh Interval** field. The minimum is 1 second, the maximum is 300 seconds, and the default is **10** seconds.

5 Click **ACCEPT**.

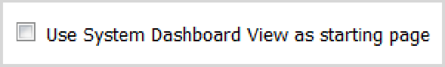
Specifying the Starting Page

When you log in to the Management Interface, the view where you logged out of the Management Interface is displayed. You can have the System Dashboard View displayed instead.

To see the MONITOR | Dashboard page first when you log in:

1 Navigate to **MANAGE | System Setup > Appliance > Base Settings**

2 Scroll to **Web Management Settings**.



□ Use System Dashboard View as starting page

3 Select **Use System Dashboard View as starting page**.

4 Click **ACCEPT**. The next time you log in, the Monitor Dashboard page displays regardless of which view was displayed when you logged out.

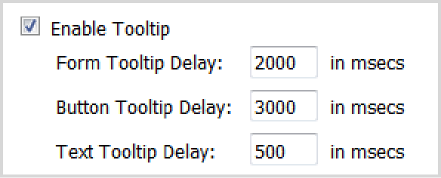
Managing Tooltips

The SonicOS Management Interface has embedded tooltips for many elements. For more information about tooltips, see SonicOS NSv *6.5 About* SonicOS NSv.

To configure tooltip behavior:

1 Navigate to **MANAGE | System Setup > Appliance > Base Settings**.

2 Scroll to **Web Management Settings**.



☑ Enable Tooltip

Form Tooltip Delay: 2000 in msecs

Button Tooltip Delay: 3000 in msecs

Text Tooltip Delay: 500 in msecs

3 To enable tooltips, select **Enable Tooltip**.

ⓘ | **TIP:** Tooltips are enabled by default. To disable tooltips, clear **Enable Tooltip**.

4 To configure the delay, in milliseconds, before tooltips display, enter the appropriate time(s):

In this field	Enter the delay for
Form Tooltip Delay	Fields. The default is **2000** ms., the minimum is 500 ms., and the maximum is 5000 ms.
Button Tooltip Delay	Radio buttons and checkboxes. The default is **3000** ms., the minimum is 500 ms., and the maximum is 5000 ms.
Text Tooltip Delay	Management Interface text. The default and minimum is **500** ms. and the maximum is 5000 ms.

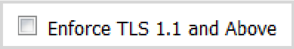
5 Click **ACCEPT**.

Enforcing TLS Version

SonicOS NSv supports versions 1.0, 1.1, and 1.2 of the Transport Layer Security (TLS) protocol. You can ensure that the more secure version 1.1 and above are used.

To enforce use of TLS versions 1.1 and above:

1. Navigate to **MANAGE | System Setup > Appliance > Base Settings**.
2. Scroll to **Web Management Settings**.

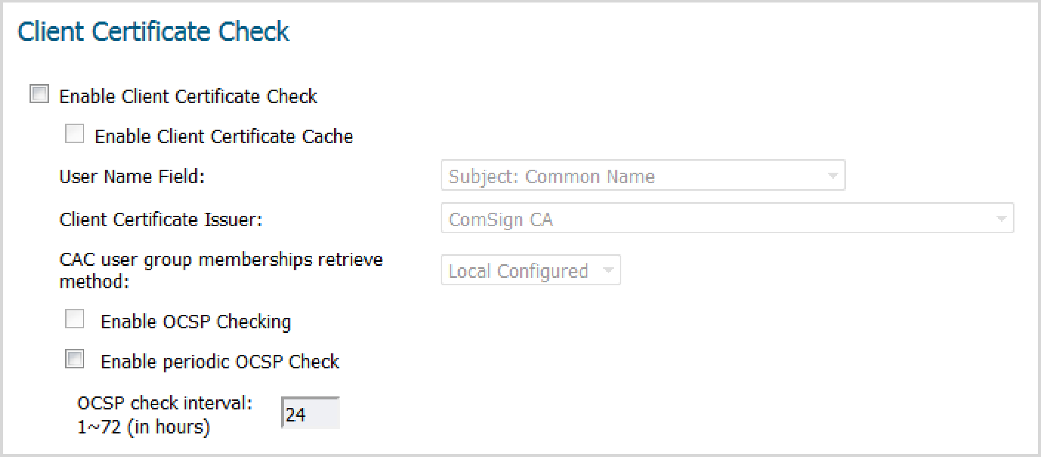


□ Enforce TLS 1.1 and Above

3. Select **Enforce TLS 1.1 and Above**. This option is not selected by default.
4. Click **ACCEPT**.

Configuring Client Certificate Verification

You can configure certificate verification with or without a Common Access Card (CAC).



Client Certificate Check

□ Enable Client Certificate Check

□ Enable Client Certificate Cache

User Name Field: Subject: Common Name

Client Certificate Issuer: ComSign CA

CAC user group memberships retrieve method: Local Configured

□ Enable OCSP Checking

□ Enable periodic OCSP Check

OCSP check interval: 1~72 (in hours) 24

ⓘ **NOTE:** None of the options are selected by default.

Topics:

- About Common Access Card on page 33
- Configuring Client Certificate Verification on page 34
- Using the Client Certificate Check on page 35
- Troubleshooting User Lock Out on page 36

About Common Access Card

A Common Access Card (CAC) is a United States Department of Defense (DoD) smart card used by military personnel and other government and non-government personnel who require highly secure access over the Internet. A CAC uses PKI authentication and encryption.

ⓘ **NOTE:** Using a CAC requires an external card reader connected on a USB port.

The Client Certificate Check was developed for use with a CAC; however, it is useful in any scenario that requires a client certificate on an HTTPS/SSL connection. CAC support is available for client certification only on HTTPS connections.

ⓘ **NOTE:** CACs might not work with browsers other than Microsoft Internet Explorer.

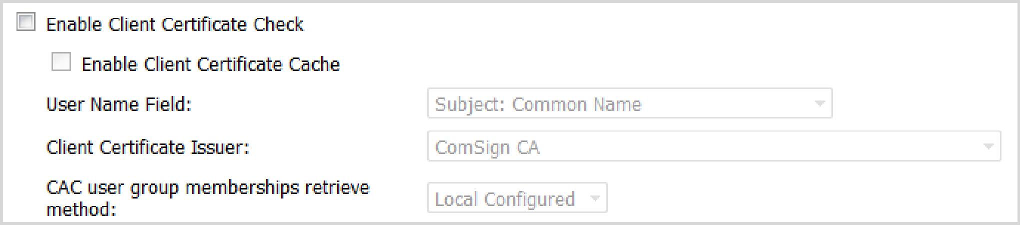
Configuring Client Certificate Verification

ⓘ **NOTE:** By default, all options are not selected.

To configure Client Certificate Check:

1 Navigate to **MANAGE | System Setup > Appliance > Base Settings**.

2 Scroll to **Client Certificate Check**.



□ Enable Client Certificate Check

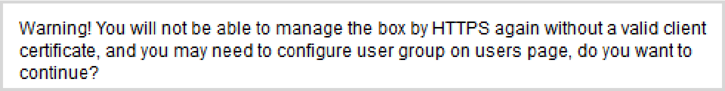
□ Enable Client Certificate Cache

User Name Field: Subject: Common Name

Client Certificate Issuer: ComSign CA

CAC user group memberships retrieve method: Local Configured

3 To enable client certificate checking and CAC support on the SonicWall Security Appliance, select **Enable Client Certificate Check**. If you enable this option, the other options become available. A warning confirmation message displays:



Warning! You will not be able to manage the box by HTTPS again without a valid client certificate, and you may need to configure user group on users page, do you want to continue?

4 Click **OK**.

5 To activate the client certification cache, select **Enable Client Certificate Cache**.

ⓘ **NOTE:** The cache expires 24 hours after being enabled.

6 To specify from which certificate field the user name is obtained, choose an option from **User Name Field**:

- **Subject: Common Name** (default)
- **Sub Alt: Email**
- **Sub Alt: Microsoft Universal Principal Name**

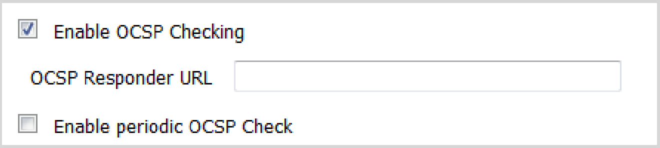
7 To select a Certification Authority (CA) certificate issuer, choose one from the **Client Certificate Issuer** drop-down menu. The default is **ComSign CA**.

ⓘ **NOTE:** If the appropriate CA is not listed, you need to import that CA into the SonicWall Security Appliance. See Managing Certificates on page 52.

8 To select how to obtain the CAC user group membership and, thus, determine the correct user privilege, choose from the **CAC user group memberships retrieve method** drop-down menu:

- **Local Configured** (default) – If selected, you should create local user groups with proper memberships.
- **From LDAP** – If selected, you need to configure the LDAP server on the **Manage | Users > Settings** (see Configuring the SonicWall for LDAP on page 134).

9 To enable the Online Certificate Status Protocol (OCSP) check to verify the client certificate is still valid and has not been revoked, select **Enable OCSP Checking**. When this option is enabled, the **OCSP Responder URL** field displays and the **Enable periodic OCSP Check** option displays.



☑ Enable OCSP Checking

OCSP Responder URL

☐ Enable periodic OCSP Check

a Enter the URL of the OSCP server that verifies the status of the client certificate in the **OCSP Responder URL** field.

The **OCSP Responder URL** is usually embedded inside the client certificate and does not need to be entered. If the client certificate does not have an OCSP link, you can enter the URL link. The link should point to the Common Gateway Interface (CGI) on the server side, which processes the OCSP checking. For example: `http://10.103.63.251/ocsp`.

10 To enables a periodic OCSP check for the client certificate for verifying that the certificate is still valid and has not been revoked:

a Select **Enable periodic OCSP Check**. the OCSP check interval field becomes available.

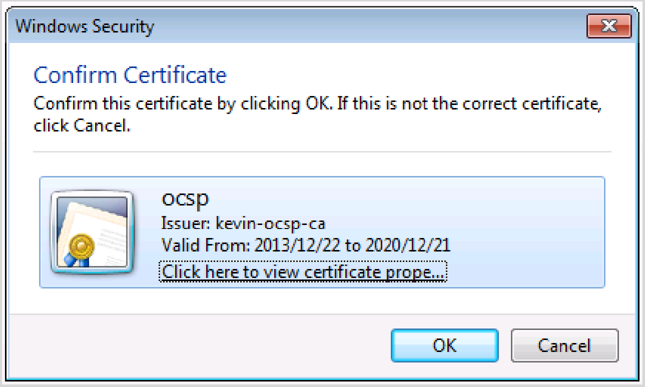
b Enter the interval between OCSP checks, in hours, in the **OCSP check interval 1~72 (in hours)** field. The minimum interval is 1 hour, the maximum is 72 hours, and the default is **24** hours.

11 Click **ACCEPT**.

Using the Client Certificate Check

If you use the client certificate check without a CAC, you must manually import the client certificate into the browser.

If you use the **Client Certificate Check** with a CAC, the client certificate is automatically installed on the browser by middleware. When you begin a management session through HTTPS, a certificate selection window asks you to confirm the certificate.



Windows Security

Confirm Certificate

Confirm this certificate by clicking OK. If this is not the correct certificate, click Cancel.

ocsp
Issuer: kevin-ocsp-ca
Valid From: 2013/12/22 to 2020/12/21

After you select the client certificate from the drop-down menu, the HTTPS/SSL connection is resumed, and the SonicWall Security Appliance checks the **Client Certificate Issuer** to verify that the client certificate is signed by the CA. If a match is found, the administrator login page displays. If no match is found, the browser displays a standard browser connection fail message, such as:

```
.....cannot display web page!
```

If OCSP is enabled, before the administrator login page is displayed, the browser performs an OCSP check and displays the following message while it is checking.

```
Client Certificate OCSP Checking.....
```

If a match is found, the administrator login page is displayed, and you can use your administrator credentials to continue managing the SonicWall Security Appliance.

If no match is found, the browser displays:

```
OCSP Checking fail! Please contact system administrator!
```

Troubleshooting User Lock Out

When using the client certificate feature, these situations can lock the user out of the SonicWall Security Appliance:

- **Enable Client Certificate Check** is checked, but no client certificate is installed on the browser.
- **Enable Client Certificate Check** is checked and a client certificate is installed on the browser, but either no **Client Certificate Issuer** is selected or the wrong **Client Certificate Issuer** is selected.
- **Enable OSCP Checking** is enabled, but either the OSCP server is not available or a network problem is preventing the SonicWall Security Appliance from accessing the OSCP server.

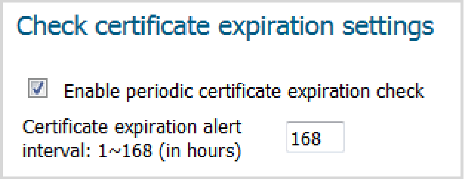
To restore access to a user who is locked out, the following CLI commands are provided:

- `web-management client-cert disable`
- `web-management ocsp disable`

Checking Certificate Expiration

To activate periodic checks of certificate's expiration:

1. Navigate to **MANAGE | System Setup > Appliance > Base Settings**.
2. Scroll to **Check Certificate Expiration Settings**.



Check certificate expiration settings

☑ Enable periodic certificate expiration check

Certificate expiration alert interval: 1~168 (in hours) 168

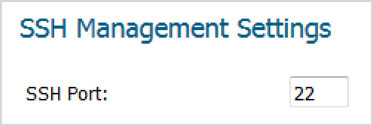
3. Select **Enable periodic certificate expiration check**. This option is selected by default. When enabled, the **Certificate expiration alert interval** field becomes available.
4. To set the interval between certificate checks, in hours, enter the interval in the **Certificate expiration alert interval: 1 - 168 (in hours)** field. The minimum time is 1 hour, the maximum is 168 hours, and the default is **168**.
5. Click **ACCEPT**.

Configuring SSH Management

If you use SSH to manage the firewall, you can change the SSH port for additional security.

To change the SSH port:

1. Navigate to **MANAGE | System Setup > Appliance > Base Settings**.
2. Scroll to **SSH Management Settings**.



3 Enter the port in the **SSH Port** field. The default SSH port is **22**.

4 Click **ACCEPT**.

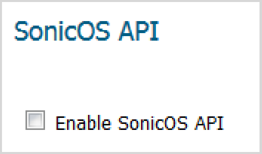
Enabling SonicOS API

You can use SonicOS API as an alternative to the SonicOS command line interface (CLI) for configuring selected functions. To do so, you must first enable SonicOS API.

To enable SonicOS API:

1 Navigate to **MANAGE | System Setup | Appliance > Base Settings**.

2 Scroll to **SonicOS API**.



3 Select **Enable SonicOS API**. This option is not selected by default.

4 Click **ACCEPT**.

Configuring Advanced Management Options

Advanced Management options allow you to specify:

- Whether the SonicWall Security Appliance is managed by SNMP (default) or the SonicWall Global Management System (GMS). For more information about GMS, see the *GMS Admin Guide* and the *Cloud GMS Admin Guide*.
- The creation of a Management Interface address object for the MGMT interface.

  This Management Interface provides a trusted interface to the management appliance. Network connections to this interface is very limited. If the NTP, DNS, and SYSLOG servers are configured in the MGMT subnet, the appliance uses the MGMT IP as the source IP and creates MGMT address object and route policies automatically. All traffic from the Management Interface is routed by this policy. Created routes display on the **System Setup > Network > Routing** page (for more information about routing, see Configuring Route Advertisements and Route Policies on page 335).

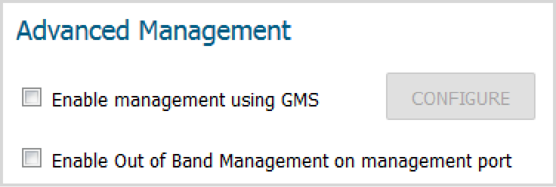
  The MGMT address object and route policies create/update IPv4 management IP. As the IPv6 management IP address object is created by default, this feature doesn't work on IPv6 management IP address object creation.

ⓘ | **NOTE:** By default, neither of these options is enabled.

To configure advanced management options:

1 Navigate to **MANAGE | System Setup > Appliance > Base Settings**.

2 Scroll to **Advanced Management**.



Advanced Management

☐ Enable management using GMS CONFIGURE

☐ Enable Out of Band Management on management port

3 To allow SonicWall GMS to manage the firewall, select **Enable management using GMS**. **Configure** becomes available. For how to configure GMS management, see Enabling GMS Management on page 38.

4 To enables automatic creation of a Management Interface address object for the MGMT interface, which works as an out-of-band interface, and configures a route policy for the newly created address object, select **Out of Band Management on the management port**. Click **ACCEPT**.

> ⓘ **IMPORTANT:** To avoid confliction for delete/create route policies, updating this option to create a Management Interface address object and configure route policy causes system reboot.

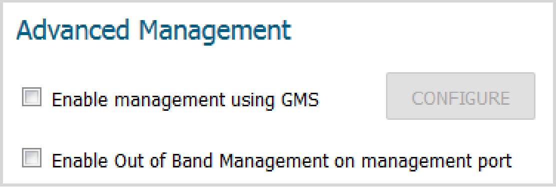
Enabling GMS Management

> ⓘ **NOTE:** For more information on SonicWall Global Management System, go to http://www.SonicWall.com or see the *GMS Admin Guide*.

To configure the Security Appliance for GMS management:

1 Navigate to **MANAGE | System Setup > Appliance > Base Settings**.

2 Scroll to **Advanced Management**.



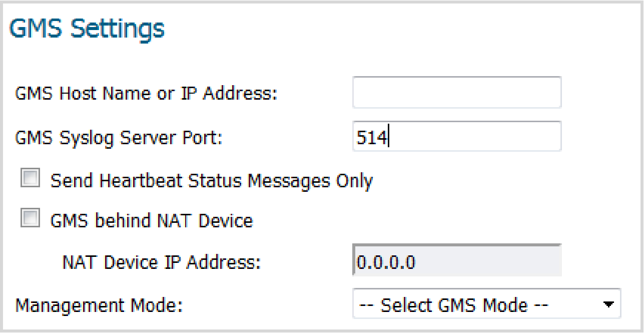
Advanced Management

☐ Enable management using GMS CONFIGURE

☐ Enable Out of Band Management on management port

3 Select **Enable Management using GMS**. **CONFIGURE** becomes available.

4 Click **CONFIGURE**. The **Configure GMS Settings** dialog displays.



GMS Settings

GMS Host Name or IP Address:

GMS Syslog Server Port: 514

☐ Send Heartbeat Status Messages Only

☐ GMS behind NAT Device

NAT Device IP Address: 0.0.0.0

Management Mode: -- Select GMS Mode --

5 Enter the host name or IP address of the GMS Console in the **GMS Host Name or IP Address** field.

6 Enter the port in the **GMS Syslog Server Port** field. The default value is **514**.

7 To send only heartbeat status instead of log messages, select **Send Heartbeat Status Messages Only**. This option is disabled by default.

8 If the GMS Console is placed behind a device using NAT on the network, select **GMS behind NAT Device**. This option is disabled by default.

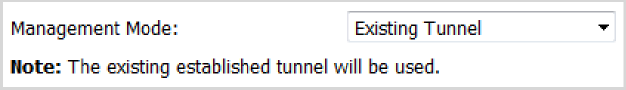
When this option is selected, the **NAT Device IP Address** field becomes active.

a Enter the IP address of the NAT device in the **NAT Device IP Address** field.

9 Select one of the following GMS modes from **Management Mode**.

IPSEC Management Tunnel Allows the firewall to be managed over an IPsec VPN tunnel to the GMS management console. Go to Step 10.

Existing Tunnel Uses an existing VPN tunnel over the connection between the GMS server and the firewall. A message displays:



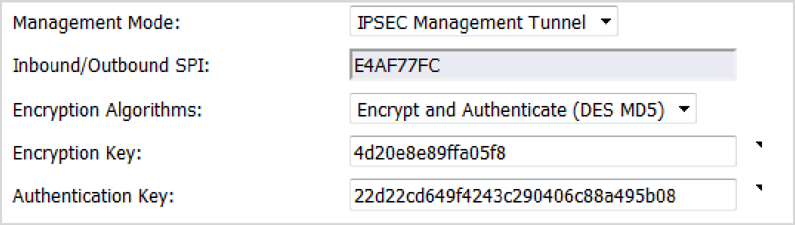
Management Mode: Existing Tunnel

Note: The existing established tunnel will be used.

Go to Step 12.

HTTPS Allows HTTPS management from two IP addresses: the GMS Primary Agent and the Standby Agent IP address. The SonicWall firewall also sends encrypted syslog packets and SNMP traps using 3DES and the firewall administrator's password. Options for configuring the GMS reporting server display. Go to Step 11.

10 The default IPsec VPN settings are displayed with values populated by SonicOS NS*v*. Verify the settings.



Management Mode: IPSEC Management Tunnel

Inbound/Outbound SPI: E4AF77FC

Encryption Algorithms: Encrypt and Authenticate (DES MD5)

Encryption Key: 4d20e8e89ffa05f8

Authentication Key: 22d22cd649f4243c290406c88a495b08

a From **Encryption Algorithms**, select the appropriate algorithm.

b Optionally, enter a new encryption key in the **Encryption Key** field:

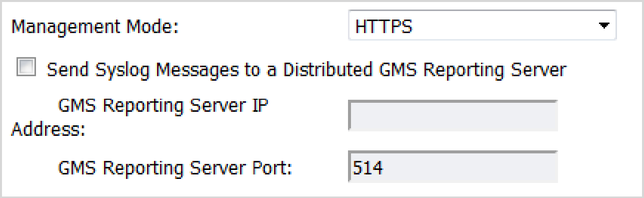
For	The key must be
DES	16 hexadecimal characters
3DES	48 hexadecimal characters

c Optionally, enter a new authentication key in the **Authentication Key** field:

For	The key must be
MD5	32 hexadecimal characters
SHA1	40 hexadecimal characters

d Go to Step 12.

11 SonicOS NS*v* needs to know the GMS reporting server.



Management Mode: HTTPS

□ Send Syslog Messages to a Distributed GMS Reporting Server

GMS Reporting Server IP Address:

GMS Reporting Server Port: 514

a Select **Send Syslog Messages to a Distributed GMS Reporting Server.** This option is not selected by default. The following options become available.

b In the **GMS Reporting Server IP Address** field, enter the IP address of the GMS server.

c In the **GMS Reporting Server Port** field, enter the port of the GMS server. The default port is **514**.

12 Click **OK**.

13 Click **ACCEPT**.

Selecting a Language

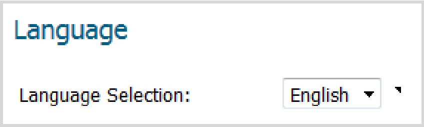
If your firmware contains other languages besides English, one can be selected from **Language Selection**.

ⓘ **NOTE:** Changing the language of the SonicOS NS*v* Management Interface requires that the SonicWall Security Appliance be rebooted.

To select a language for the Management Interface:

1 Navigate to **Manage | System Setup > Appliance > Base Settings**.

2 Scroll to **Language**.



Language

Language Selection: English ▾

3 Select the language from **Language Selection**.

4 Click **ACCEPT**.

3

Administering SNMP

About Appliance > SNMP

You can manage the SonicWall Security Appliance using SNMP or SonicWall Global Management System (GMS). This section describes how to configure the SonicWall for management using SNMP. For managing the SonicWall with GMS, see the SonicOS NS*v* *GMS Guide*.

Topics:

- About SNMP on page 41
- Setting Up SNMP Access on page 42
- Configuring SNMP as a Service and Adding Rules on page 50
- About SNMP Logs on page 51

About SNMP

SNMP (Simple Network Management Protocol) is a network protocol used over User Datagram Protocol (UDP) that allows network administrators to monitor the status of the SonicWall Security Appliance and receive notification of critical events as they occur on the network. The SonicWall Security Appliance supports SNMP v1/v2c/v3 and all relevant Management Information Base II (MIB-II) groups except **egp** and **at**.

SNMPv3 expands on earlier versions of SNMP and provides secure access to network devices by means of a combination of authenticating and encrypting packets.

Packet security is provided through:

- **Message Integrity**: ensures a packet has not been tampered with in transit
- **Authentication**: verifies a message comes from a valid source
- **Encryption**: encodes packet contents to prevent its being viewed by an unauthorized source.

SNMPv3 provides for both security models and security levels. A security model is an authentication strategy set up between a user and the group in which the user resides. The security level is the permitted level of security within a given security model. The security model and associated security level determine how an SNMP packet is handled. SNMPv3 provides extra levels of authentication and privacy, as well as additional authorization and access control.

Security Level, Authentication, and Encryption Based on SNMP Version shows how security levels, authentication, and encryption are handled by the different versions of SNMP.

Security Level, Authentication, and Encryption Based on SNMP Version

Version	Level	Authentication Type	Encryption	Means of Authentication
v1	noAuthNoPriv	Community String	No	Community string match
v2c	noAuthNoPriv	Community String	No	Community string match
v3	noAuthNoPriv	Username	No	Username match
	authNoPriv	MD5 or SHA	No	Authentication is based on the HMAC-MD5 or HMSC-SRA algorithms.
	authPriv	MD5 or SHA	DES or AES	Provides authentication is based on the HMAC-MD5 or HMSC-SRA algorithms. Provides DES 56-bit encryption in addition to authentication based on the CBC-DES (DES-56) standard, or AES 128-bit encryption, as well.

The SonicWall Security Appliance replies to SNMP `Get` commands for MIB-II, using any interface, and supports a custom SonicWall MIB for generating trap messages. The custom SonicWall MIB is available for download from the SonicWall Web site and can be loaded into third-party SNMP management software such as HP Openview, Tivoli, or SNMPC.

You can view and configure SNMP settings. Settings cannot be viewed or modified by the user. SNMPv3 can be modified at the User or Group level. Access Views can be read, write, or both, and can be assigned to users or groups. A single View can have multiple Object IDs (OIDs) associated with it.

SNMPv3 settings for the SNMPv3 Engine ID are configurable under the **General Settings** menu of the **Configure SNMP** dialog. The Engine ID is used to authorize a received SNMP packet. Only matching packet EngineIDs are processed.

Setting Up SNMP Access

Setting up SNMP consists of:

- Enabling and Configuring SNMP Access on page 42
- Setting Up SNMPv3 Groups and Access on page 45

Enabling and Configuring SNMP Access

You can use either SNMPv1/v2 for basic functionality or configure the SonicWall Security Appliance to use the more extensive SNMPv3 options.

To use SNMP, you must first enable it.

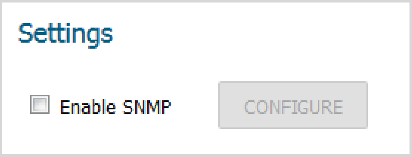
Topics:

- Configuring Basic Functionality on page 43
- Configuring SNMPv3 Engine IDs on page 44
- Configuring Object IDs for SNMPv3 Views on page 46
- Creating Groups and Adding Users on page 47
- Adding Access on page 49

Configuring Basic Functionality

To enable SNMP:

1 Navigate to the **MANAGE | System Setup > Appliance > SNMP** page.

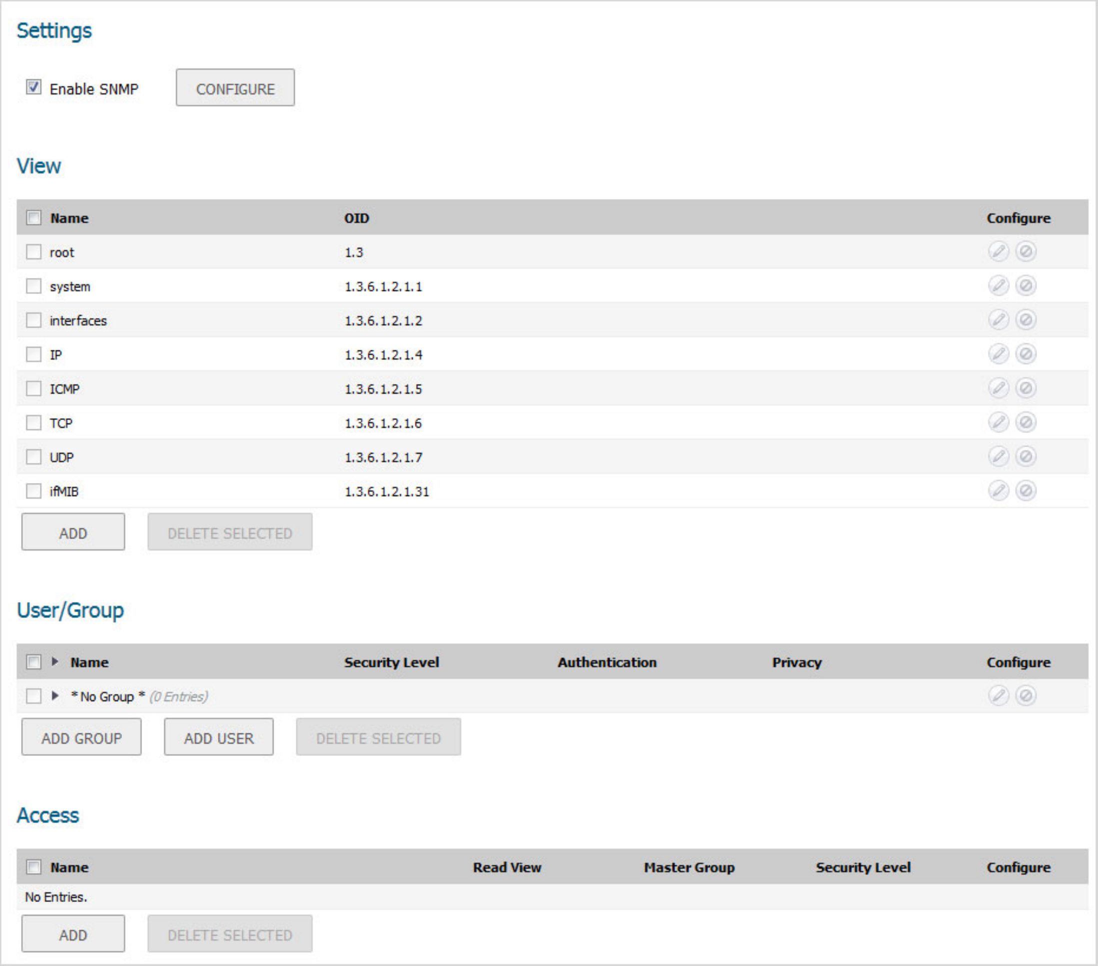


Settings

□ Enable SNMP

2 Select **Enable SNMP**. By default, SNMP is disabled.

3 Click **ACCEPT**. The SNMP information is populated on the SNMP page, and **CONFIGURE** becomes available.



Settings

☑ Enable SNMP

View

□ Name	OID	Configure
□ root	1.3	
□ system	1.3.6.1.2.1.1	
□ interfaces	1.3.6.1.2.1.2	
□ IP	1.3.6.1.2.1.4	
□ ICMP	1.3.6.1.2.1.5	
□ TCP	1.3.6.1.2.1.6	
□ UDP	1.3.6.1.2.1.7	
□ ifMIB	1.3.6.1.2.1.31	

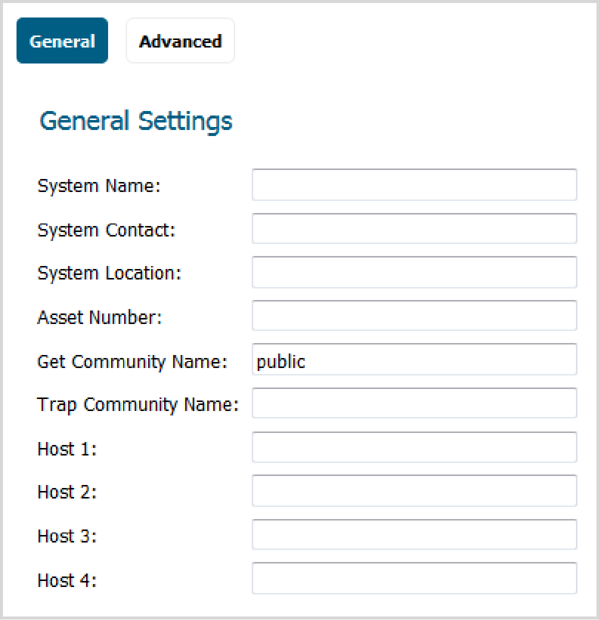
User/Group

□ ▸ Name	Security Level	Authentication	Privacy	Configure
□ ▸ * No Group * *(0 Entries)*				

Access

□ Name	Read View	Master Group	Security Level	Configure
No Entries.				

4 To configure the SNMP interface, click **CONFIGURE**. The **Configure SNMP** dialog displays.



General Settings

System Name:	
System Contact:	
System Location:	
Asset Number:	
Get Community Name:	public
Trap Community Name:	
Host 1:	
Host 2:	
Host 3:	
Host 4:	

5 On the **General** page, enter the host name of the SonicWall Security Appliance in the **System Name** field.

6 Optionally, enter the network administrator's name in the **System Contact** field.

7 Optionally, enter an email address, telephone number, or pager number in the **System Location** field.

8 If the SNMPv3 configuration option is used, enter an asset number in the **Asset Number** field. Otherwise, this field is optional.

9 Enter a name for a group or community of administrators who can view SNMP data in the **Get Community Name** field. The default name is **public**.

10 Optionally, enter a name for a group or community of administrators who can view SNMP traps in the **Trap Community Name** field.

11 Enter the IP address(es) or host name(s) of the SNMP management system receiving SNMP traps in the **Host 1** through **Host *n*** fields. You must configure at least one IP address or host name, but up to the maximum number of addresses or host names for your system can be used.

12 If you:

- Want to set up SNMPV3, go to Configuring SNMPv3 Engine IDs on page 44.
- Finished setting up SNMP for now, click **OK**.

Configuring SNMPv3 Engine IDs

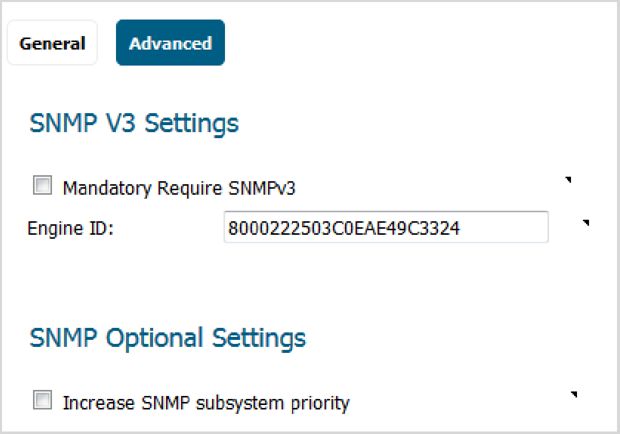
If SNMPv3 is used, you can configure the SNMPv3 Engine ID and SNMP priority. Configuring the SNMPv3 Engine ID provides maximum security for SNMP management.

To configure SNMPv3 engine IDs:

1 Navigate to **MANAGE | System Setup > Appliance > SNMP**.

2 If you have not configured SNMP for your system, follow Step 1 through Step 11 in Configuring Basic Functionality on page 43.

3 Click **Advanced**. The **Advanced** page displays.



SNMP V3 Settings

□ Mandatory Require SNMPv3

Engine ID: 8000222503C0EAE49C3324

SNMP Optional Settings

□ Increase SNMP subsystem priority

4 Select **Mandatory Require SNMPv3**. This disables SNMPv1/v2 and allows only SNMPv3 access, which provides maximum security for SNMP management.

> **IMPORTANT:** If you select this option, you must specify an asset number on the **General** page before clicking **OK**.

5 Enter the hexadecimal Engine ID number in the **Engine ID** field. SonicOS NS*v* automatically populates this field, but you can change it. This number is matched against received SNMP packets to authorize their processing; only packets whose Engine ID matches this number are processed.

6 Optionally, select the **Increase SNMP subsystem** priority checkbox.

For efficient system operation, certain operations might take priority over responses to SNMP queries. Enabling this option causes the SNMP subsystem to always respond and operate at a higher system priority.

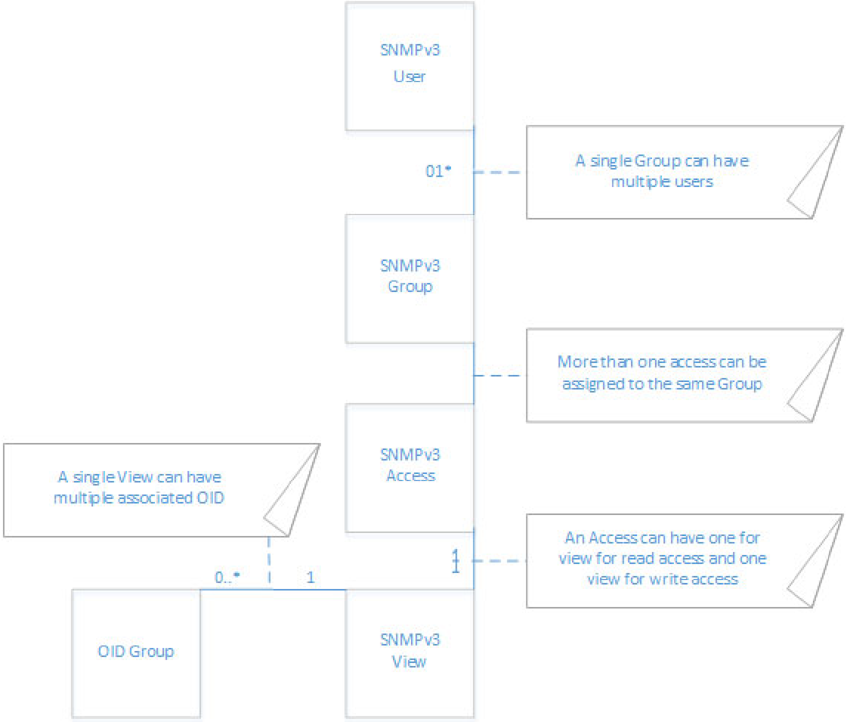
> **IMPORTANT:** Enabling this option might affect the performance of the overall system.

7 Click **OK**. The SNMPv3 security options are now used in processing packets.

Setting Up SNMPv3 Groups and Access

SNMPv3 allows you to set up and assign groups and access with differing levels of security. Object IDs are associated with various levels of permissions, and a single view can be assigned to multiple objects. SNMPv3 Group and User Access shows how access for groups and users are associated with these different permission levels.

SNMPv3 Group and User Access



Configuring Object IDs for SNMPv3 Views

The SNMPv3 **View** shows access settings for Users and Groups. You create settings for users and groups, and these security settings are not user-modifiable. The SNMPv3 View defines the Object IDs (OID) and Object ID Groups, and is sometimes known as the SNMPv3 Access Object.

The SNMP **View** defines a collection of OIDs and OID groups. The initial set of default views cannot be changed or deleted. The default views reflect the most often used views, such as the root view, system view, IP, interfaces. The OIDs for these views are preassigned.

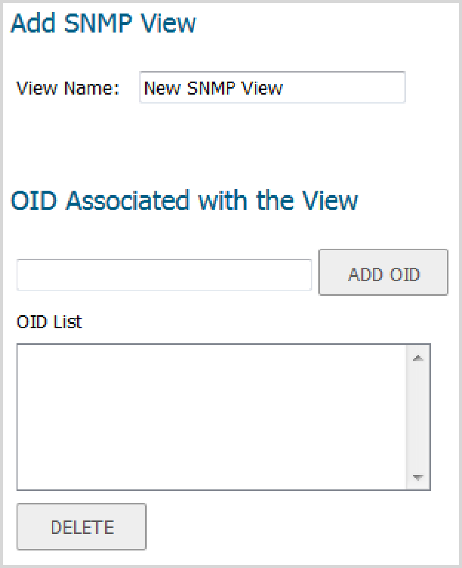
Additionally, you can create a custom view for specific users and groups.

You can modify views you create. You cannot modify the ones the system creates.

To configure OIDs for SNMPv3 views:

1 Navigate to **MANAGE | System Setup > Appliance > SNMP**.

2 To add a view, in the **View** section, click **ADD**. The **Add SNMP View** dialog displays.



Add SNMP View

View Name: New SNMP View

OID Associated with the View

OID List

3 Enter a meaningful name in the **View Name** field. The default name is **New SNMP View**.

> ⓘ **NOTE:** If editing an existing view, the name is not editable.

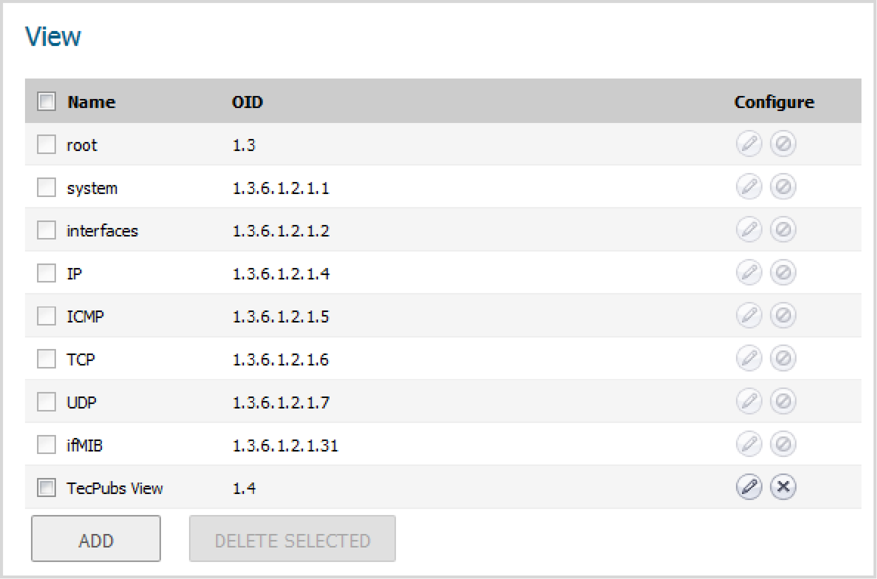
4 Enter an unassigned OID in the **OID Associated with the View** field.

5 Click **ADD OID**.

The new view appears in the **OID List**. To delete an OID from the OID List, select the OID and click **Delete**.

6 Add any more new views with associated OIDs.

7 Click **OK**. The new views are added to the **View** table.



View

☐ Name	OID	Configure
☐ root	1.3	✎ ⊘
☐ system	1.3.6.1.2.1.1	✎ ⊘
☐ interfaces	1.3.6.1.2.1.2	✎ ⊘
☐ IP	1.3.6.1.2.1.4	✎ ⊘
☐ ICMP	1.3.6.1.2.1.5	✎ ⊘
☐ TCP	1.3.6.1.2.1.6	✎ ⊘
☐ UDP	1.3.6.1.2.1.7	✎ ⊘
☐ ifMIB	1.3.6.1.2.1.31	✎ ⊘
☐ TecPubs View	1.4	✎ ✕

Creating Groups and Adding Users

By default, there is one group, ***No Group***, that cannot be configured or deleted. You can, however, add users to this default group.

Topics:

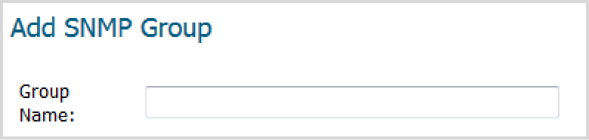
- Creating a Group on page 48
- Adding Users on page 48

Creating a Group

To create a group:

1 Navigate to **MANAGE | System Setup > Appliance > SNMP**.

2 Click **ADD GROUP** under the **User/Group** table. The **Add SNMP Group** dialog displays.

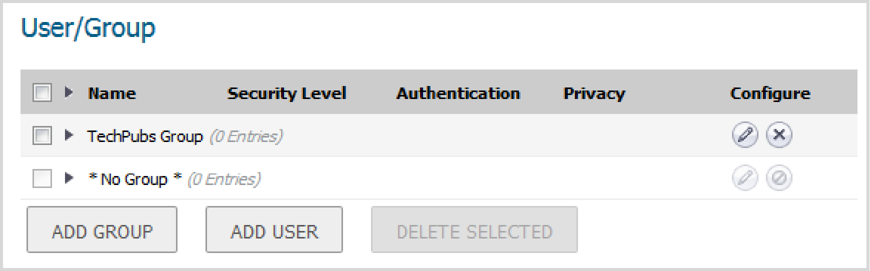


Add SNMP Group

Group Name:

3 Enter a friendly name in the **Group Name** field. The group name can contain up to 32 alphanumeric characters.

4 Click **OK**. The **User/Group** table is updated, and the **Edit** and **Delete** icons in the **Configure** column are available.



User/Group

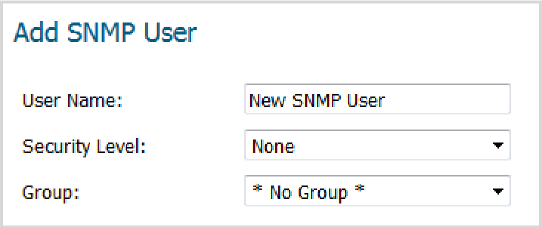
□	Name	Security Level	Authentication	Privacy	Configure
□	▸ TechPubs Group *(0 Entries)*				✎ ⊗
□	▸ * No Group * *(0 Entries)*				✎ ⊘

Adding Users

To add users:

1 Navigate to **MANAGE | System Setup > Appliance > SNMP**.

2 Click **ADD USER** under the **User/Group** table. The **Add SNMP User** dialog displays.



Add SNMP User

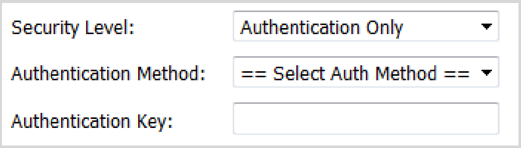
User Name:	New SNMP User
Security Level:	None
Group:	* No Group *

3 Enter the user name in the **User Name** field.

4 Select a security level from **Security Level**:

- **None** (default)

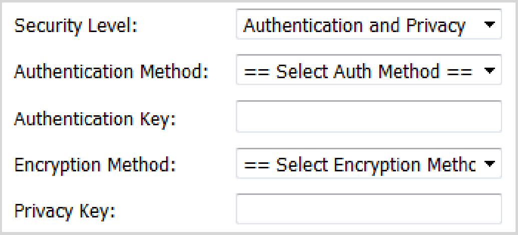
- **Authentication –** Two new options appear:



Security Level:	Authentication Only ▾
Authentication Method:	== Select Auth Method == ▾
Authentication Key:	

  - **Authentication Method** – Select one of these authentication methods: **MD5** or **SHA1**.
  - **Authentication Key** – Enter an authentication key in the field. The key can be any string of 8 to 32 printable characters.

- **Authentication and Privacy** – More options appear:

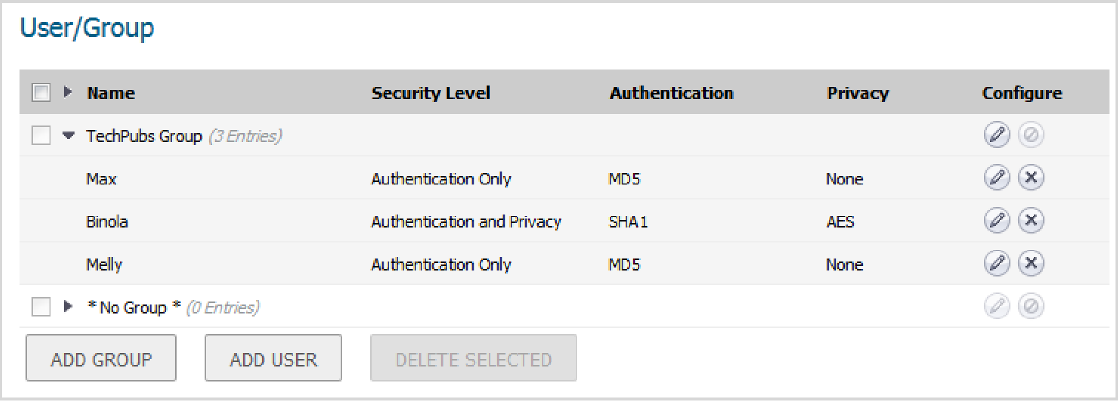


Security Level:	Authentication and Privacy ▾
Authentication Method:	== Select Auth Method == ▾
Authentication Key:	
Encryption Method:	== Select Encryption Methc ▾
Privacy Key:	

  - **Authentication Method** – See above.
  - **Authentication Key** – See above.
  - Select an encryption method from the **Encryption Method** drop-down menu: **AES** or **DES**.
  - Enter the encryption key in the **Privacy Key** field. The key can be any string of 8 to 32 printable characters.

5 Select a group from **Group**. The default is ***No Group***.

6 Click **OK** when finished. The user is added to the **User/Group** table and added to the appropriate group (including ***No Group***).



User/Group

□ ▸ Name	Security Level	Authentication	Privacy	Configure
□ ▾ TechPubs Group *(3 Entries)*				✎ ⊘
Max	Authentication Only	MD5	None	✎ ⊗
Binola	Authentication and Privacy	SHA1	AES	✎ ⊗
Melly	Authentication Only	MD5	None	✎ ⊗
□ ▸ *No Group * *(0 Entries)*				✎ ⊘

Adding Access

SNMPv3 Access is an object that:

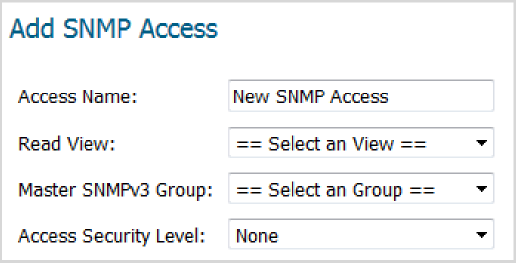
- Defines the read/write access rights of an SNMPv3 View.
- Can be assigned to an SNMPv3 Group.

Multiple groups can be assigned to the same Access object. An Access object can also have multiple views assigned to it.

To create an access object:

1 Navigate to **MANAGE | System Setup > Appliance > SNMP**.

2 Under the **Access** table, click **ADD**. The **Add SNMP Access** dialog displays.



Add SNMP Access

Access Name:	New SNMP Access
Read View:	== Select an View ==
Master SNMPv3 Group:	== Select an Group ==
Access Security Level:	None

3 Enter a friendly name in the **Access Name** field.

> ⓘ **NOTE:** Names of existing entries are non-editable.

4 From **Read View**, select a view from the list of available views.

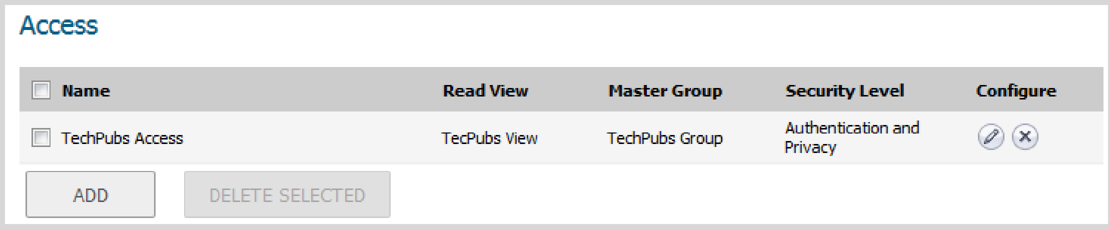
5 From **Master SNMPv3 Group**, select a group from the list of available groups.

> ⓘ **NOTE:** Access can be assigned to only one SNMPv3 group, but a group can be associated with multiple Access objects.
>
> Access cannot be given to ***No Group***.

6 From **Access Security Level**, select a security level:

- **None**
- **Authentication Only**
- **Authentication and Privacy**

7 Click **OK**. The Access object is added to the **Access** table.



Access

□ Name	Read View	Master Group	Security Level	Configure
□ TechPubs Access	TecPubs View	TechPubs Group	Authentication and Privacy	

Configuring SNMP as a Service and Adding Rules

By default, SNMP is disabled on the SonicWall Security Appliance. To enable SNMP, you must first enable SNMP on the **MANAGE | System Setup > Appliance > SNMP** page, and then enable it for individual interfaces. To do this, go to the **MANAGE | System Setup > Network > Interfaces** page and click on **Configure** for the interface you want to enable SNMP on. For more information about configuring SNMP as a service and adding rules, see Configuring Interfaces on page 242.

If your SNMP management system supports discovery, the SonicWall Security Appliance agent automatically discovers the SonicWall Security Appliance on the network. Otherwise, you must add the SonicWall Security Appliance to the list of SNMP-managed devices on the SNMP management system.

About SNMP Logs

SNMP logs can be viewed on the **INVESTIGATE | Log > Event Logs** page. For more information about Event Logs, see SonicOS NS*v 6.5 Investigate*.

Trap messages are generated only for the alert message categories normally sent by the SonicWall Security Appliance. For example, attacks, system errors, or blocked Web sites generate trap messages. If none of the categories are selected on the **INVESTIGATE | Log > Event Logs** page, then no trap messages are generated.

4

Managing Certificates

Topics:

About Certificates

To implement the use of certificates for VPN policies, you must locate a source for a valid CA certificate from a third-party CA service. When you have a valid CA certificate, you can import it into the firewall to validate your Local Certificates. Import the valid CA certificate into the firewall using the **MANAGE | System Setup > Appliance > Certificates** page. After you import the valid CA certificate, you can use it to validate your local certificates.

SonicOS NS*v* provides a large number of certificates with the SonicWall Security Appliance; these are built-in certificates and cannot be deleted or configured.

SonicOS NS*v* supports a local Certificate Revocation List (CRL), which is a list of digital certificates that have been revoked by the issuing Certificate Authority (CA) before their scheduled expiration date and should no longer be trusted. For further information about local CRL, contact Technical Support.

About Digital Certificates

A digital certificate is an electronic means to verify identity by a trusted third-party known as a Certificate Authority (CA). The X.509 v3 certificate standard is a specification used with cryptographic certificates and allows you to define extensions that you can include with your certificate. SonicWall has implemented this standard in its third-party certificate support.

You can use a certificate signed and verified by a third-party CA to use with an IKE (Internet Key Exchange) VPN policy. IKE is an important part of IPsec VPN solutions, and it can use digital certificates to authenticate peer devices before setting up Security Associations (SAs). Without digital certificates, VPN users must authenticate by manually exchanging shared secrets or symmetric keys. Devices or clients using digital signatures do not require configuration changes every time a new device or client is added to the network.

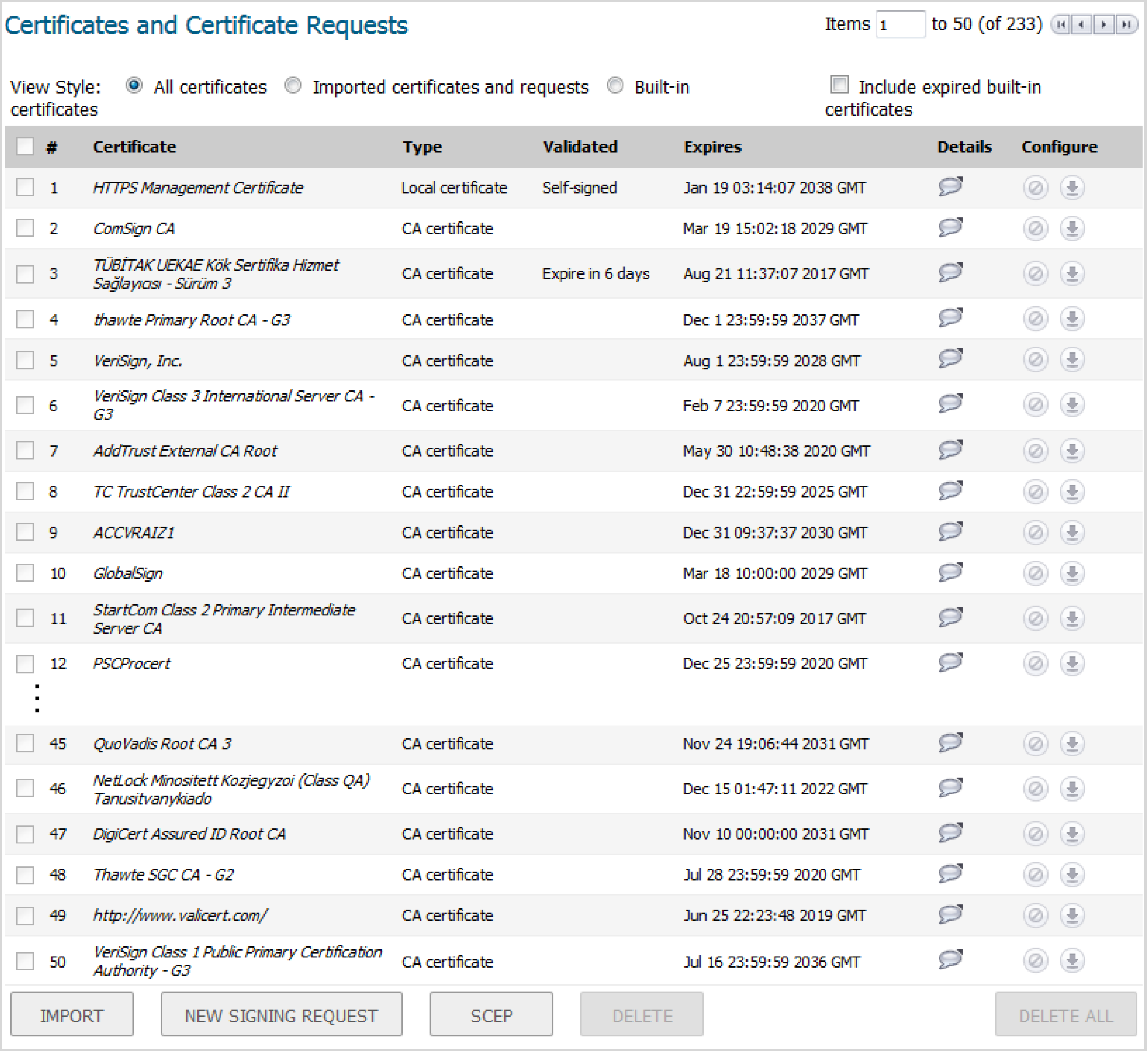
A typical certificate consists of two sections: a data section and a signature section. The data section typically contains information such as the version of X.509 supported by the certificate, a certificate serial number, information about the user’s public key, the Distinguished Name (DN), validation period for the certificate, and optional information such as the target use of the certificate. The signature section includes the cryptographic algorithm used by the issuing CA, and the CA digital signature.

SonicWall Security Appliances interoperate with any X.509v3-compliant provider of Certificates. SonicWall Security Appliance have been tested with the following vendors of Certificate Authority Certificates:

- Entrust
- Microsoft
- OpenCA
- OpenSSL and TLS
- VeriSign

Topics:

About the Certificates and Certificate Requests Table



Certificates and Certificate Requests

Items 1 to 50 (of 233)

View Style: ● All certificates ○ Imported certificates and requests ○ Built-in certificates □ Include expired built-in certificates

□	#	Certificate	Type	Validated	Expires	Details	Configure
□	1	*HTTPS Management Certificate*	Local certificate	Self-signed	Jan 19 03:14:07 2038 GMT	💬	⊘ ⬇
□	2	*ComSign CA*	CA certificate		Mar 19 15:02:18 2029 GMT	💬	⊘ ⬇
□	3	*TÜBİTAK UEKAE Kök Sertifika Hizmet Sağlayıcısı - Sürüm 3*	CA certificate	Expire in 6 days	Aug 21 11:37:07 2017 GMT	💬	⊘ ⬇
□	4	*thawte Primary Root CA - G3*	CA certificate		Dec 1 23:59:59 2037 GMT	💬	⊘ ⬇
□	5	*VeriSign, Inc.*	CA certificate		Aug 1 23:59:59 2028 GMT	💬	⊘ ⬇
□	6	*VeriSign Class 3 International Server CA - G3*	CA certificate		Feb 7 23:59:59 2020 GMT	💬	⊘ ⬇
□	7	*AddTrust External CA Root*	CA certificate		May 30 10:48:38 2020 GMT	💬	⊘ ⬇
□	8	*TC TrustCenter Class 2 CA II*	CA certificate		Dec 31 22:59:59 2025 GMT	💬	⊘ ⬇
□	9	*ACCVRAIZ1*	CA certificate		Dec 31 09:37:37 2030 GMT	💬	⊘ ⬇
□	10	*GlobalSign*	CA certificate		Mar 18 10:00:00 2029 GMT	💬	⊘ ⬇
□	11	*StartCom Class 2 Primary Intermediate Server CA*	CA certificate		Oct 24 20:57:09 2017 GMT	💬	⊘ ⬇
□	12	*PSCProcert*	CA certificate		Dec 25 23:59:59 2020 GMT	💬	⊘ ⬇
⋮							
□	45	*QuoVadis Root CA 3*	CA certificate		Nov 24 19:06:44 2031 GMT	💬	⊘ ⬇
□	46	*NetLock Minositett Kozjegyzoi (Class QA) Tanusitvanykiado*	CA certificate		Dec 15 01:47:11 2022 GMT	💬	⊘ ⬇
□	47	*DigiCert Assured ID Root CA*	CA certificate		Nov 10 00:00:00 2031 GMT	💬	⊘ ⬇
□	48	*Thawte SGC CA - G2*	CA certificate		Jul 28 23:59:59 2020 GMT	💬	⊘ ⬇
□	49	*http://www.valicert.com/*	CA certificate		Jun 25 22:23:48 2019 GMT	💬	⊘ ⬇
□	50	*VeriSign Class 1 Public Primary Certification Authority - G3*	CA certificate		Jul 16 23:59:59 2036 GMT	💬	⊘ ⬇

The **Certificate and Certificate Requests** table provides all the settings for managing CA and Local Certificates.

The **View Style** menu allows you to display your certificates based on these criteria:

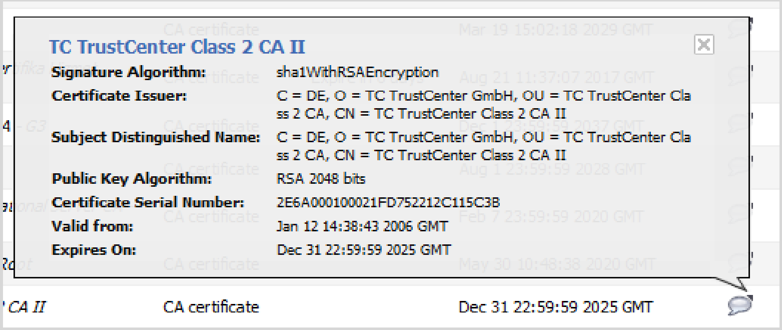
This criterion	Displays
All Certificates	All built-in and imported certificates and certificate requests. This is the default.
Imported certificates and requests	Only imported certificates and generated certificate requests. This option is not selected by default.
Built-in certificates	Only built-in certificates. This option is not selected by default.
Include expired and built-in certificates	All expired and built-in certificates. This option is not selected by default.

The **Certificates and Certificate Requests** table displays this information about certificates:

This column	Displays the
Certificate	Name of the certificate.
Type	Type of certificate: • **CA certificate** • **Local certificate** • **Pending request**
Validated	Validation information: • Blank • **Self-signed** • **Expire in *n* days** • **Expired**
Expires	Date and time the certificate expires.
Details	Details of the certificate. Moving the pointer over the **Comment** icon displays the details of the certificate. For information about certificate details, see About Certificate Details on page 55.
Configure	Contains the • **Delete** icon to delete a certificate entry • **Import** icon to import either certificate revocation lists (for CA certificates) or signed certificates (for Pending requests). **NOTE:** You cannot delete or import built-in certificates.

About Certificate Details

Clicking the **Comment** icon in the **Details** column displays information about the certificate that might include the following, depending on the type of certificate:



TC TrustCenter Class 2 CA II

Signature Algorithm:	sha1WithRSAEncryption
Certificate Issuer:	C = DE, O = TC TrustCenter GmbH, OU = TC TrustCenter Class 2 CA, CN = TC TrustCenter Class 2 CA II
Subject Distinguished Name:	C = DE, O = TC TrustCenter GmbH, OU = TC TrustCenter Class 2 CA, CN = TC TrustCenter Class 2 CA II
Public Key Algorithm:	RSA 2048 bits
Certificate Serial Number:	2E6A000100021FD752212C115C3B
Valid from:	Jan 12 14:38:43 2006 GMT
Expires On:	Dec 31 22:59:59 2025 GMT

CA II CA certificate Dec 31 22:59:59 2025 GMT

- Signature Algorithm
- Certificate Issuer
- Subject Distinguished Name
- Public Key Algorithm
- Certificate Serial Number
- Valid from
- Expires On
- Status (for Pending requests and local certificates)

The details depend on the type of certificate. **Certificate Issuer**, **Certificate Serial Number, Valid from**, and **Expires On** are not shown for Pending requests as this information is generated by the Certificate provider.

Importing Certificates

After your CA service has issued a Certificate for your Pending request, or has otherwise provided a Local Certificate, you can import it for use in VPN or Web Management authentication. CA Certificates might also be imported to verify local Certificates and peer Certificates used in IKE negotiation.

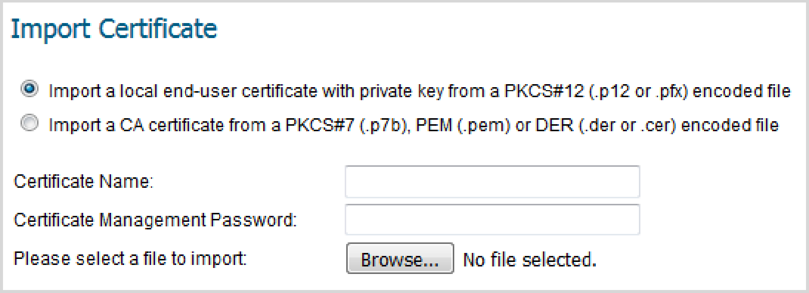
Topics:

- Importing a Local Certificate on page 56
- Importing a Certificate Authority Certificate on page 56
- Creating a PKCS-12 Formatted Certificate File (Linux Systems Only) on page 57

Importing a Local Certificate

To import a local certificate:

1. Navigate to **MANAGE | System Setup > Appliance > Certificates**.
2. Click **IMPORT**. The **Import Certificate** dialog displays.



Import Certificate

● Import a local end-user certificate with private key from a PKCS#12 (.p12 or .pfx) encoded file
○ Import a CA certificate from a PKCS#7 (.p7b), PEM (.pem) or DER (.der or .cer) encoded file

Certificate Name:

Certificate Management Password:

Please select a file to import: Browse... No file selected.

3. Enter a certificate name in the **Certificate Name** field.
4. Enter the password used by your Certificate Authority to encrypt the PKCS#12 file in the **Certificate Management Password** field.
5. Click **Browse** to locate the certificate file.
6. Click **Open** to set the directory path to the certificate.
7. Click **Import** to import the certificate into the firewall. When it is imported, you can view the certificate entry in the **Certificates and Certificate Requests** table.
8. Moving your pointer to the **Comment** icon in the **Details** column displays the certificate details information.

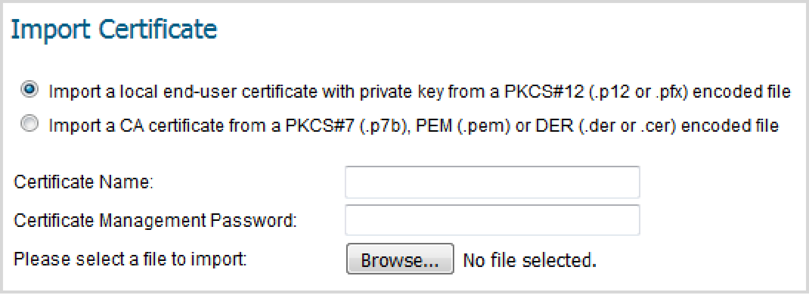
> ⓘ **NOTE:** If the certificate was uploaded successfully, the **Status** in the mouseover popup is **Verified**.

Importing a Certificate Authority Certificate

To import a certificate from a certificate authority:

1. Navigate to **MANAGE | System Setup > Appliance > Certificates**.

2 Click **IMPORT**. The **Import Certificate** dialog displays.



Import Certificate

● Import a local end-user certificate with private key from a PKCS#12 (.p12 or .pfx) encoded file

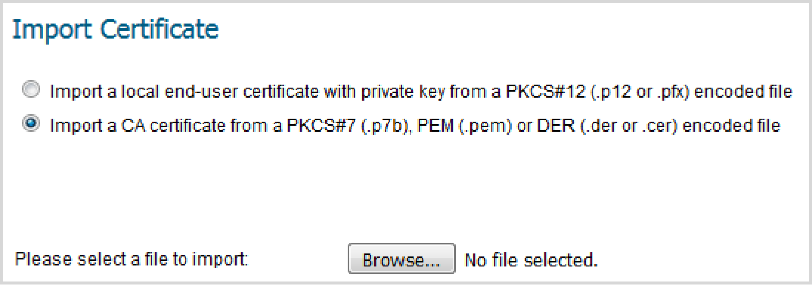
○ Import a CA certificate from a PKCS#7 (.p7b), PEM (.pem) or DER (.der or .cer) encoded file

Certificate Name:

Certificate Management Password:

Please select a file to import: Browse... No file selected.

3 Choose **Import a CA certificate from a PKCS#7 (*.p7b) or DER (.der or .cer) encoded file**. The **Import Certificate** dialog settings change.



Import Certificate

○ Import a local end-user certificate with private key from a PKCS#12 (.p12 or .pfx) encoded file

● Import a CA certificate from a PKCS#7 (.p7b), PEM (.pem) or DER (.der or .cer) encoded file

Please select a file to import: Browse... No file selected.

4 Click **Browse** to locate the certificate file.

5 Click **Open** to set the directory path to the certificate.

6 Click **Import** to import the certificate into the firewall. When it is imported, you can view the certificate entry in the **Certificates and Certificate Requests** table.

7 Moving your pointer to the **Comment** icon in the **Details** column displays the certificate details information.

Creating a PKCS-12 Formatted Certificate File (Linux Systems Only)

A PKCS12-formatted certificate file can be created using Linux system with OpenSSL. To create a PKCS-12 formatted certificate file, you need to have two main components of the certificate:

- Private key (typically a file with `.key` extension or the word key in the filename)
- Certificate with a public key (typically a file with a `.crt` extension or the word cert as part of filename).

For example, the Apache HTTP server on Linux has its private key and certificate in these locations:

- `/etc/httpd/conf/ssl.key/server.key`
- `/etc/httpd/conf/ssl.crt/server.crt`

With these two files available, run the following command:

```
openssl pkcs12 -export -out out.p12 -inkey server.key -in server.crt
```

In this example **`out.p12`** become the PKCS-12 formatted certificate file and **`server.key`** and **`server.crt`** are the PEM-formatted private key and the certificate file respectively.

After running the **`openssl`** command, you are prompted for the password to protect/encrypted the file. After choosing the password, the creation of the PKCS-12-formatted certificate file is complete, and it can be imported into the appliance.

Deleting a Certificate

ⓘ **NOTE:** Built-in certificates cannot be deleted.

You can delete an imported certificate if it has expired or if you decide not to use third-party certificates for VPN authentication. You can always delete certificates you created.

To delete:

- A certificate, click its **Delete** icon.
- One or more certificates:
  a Click their checkbox(es). **DELETE** and **DELETE ALL** become available.
  b Click either **DELETE** or **DELETE ALL**.
- All non built-in certificates:
  a Click the checkbox in the table heading. **DELETE** and **DELETE ALL** become available.
  b Click either **DELETE** or **DELETE ALL**.

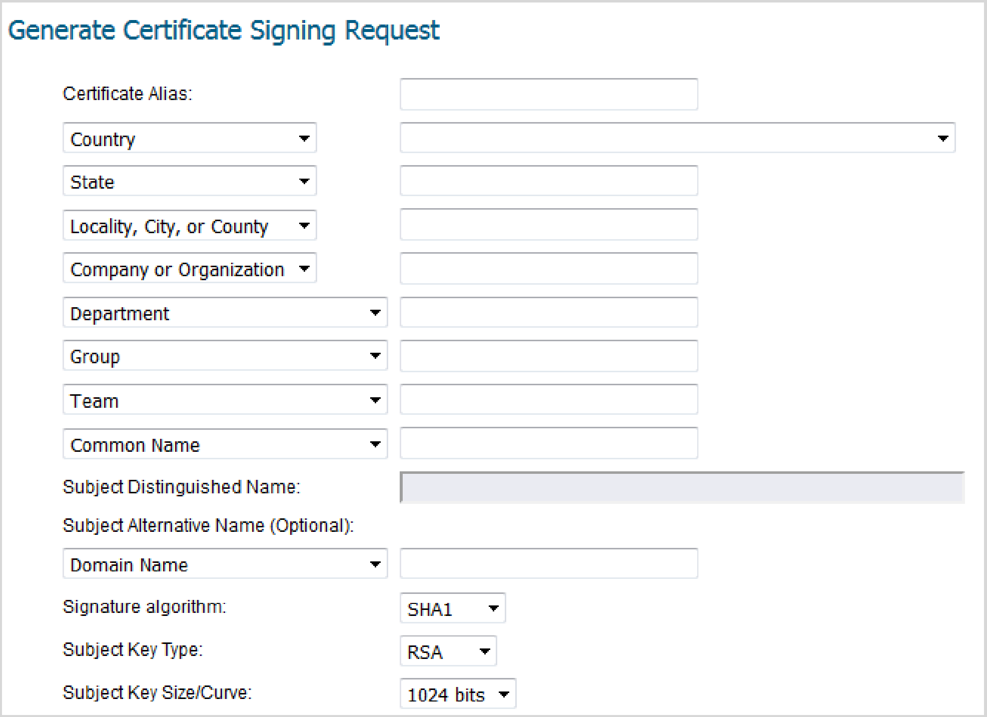
Generating a Certificate Signing Request

ⓘ **TIP:** You should create a Certificate Policy to be used in conjunction with local certificates. A Certificate Policy determines the authentication requirements and the authority limits required for the validation of a certificate.

To generate a certificate signing request:

1 Navigate to **MANAGE | System Setup > Appliance > Certificates**.

2 Click **NEW SIGNING REQUEST**. The **Certificate Signing Request** dialog displays.



Generate Certificate Signing Request

Certificate Alias:	
Country ▾	▾
State ▾	
Locality, City, or County ▾	
Company or Organization ▾	
Department ▾	
Group ▾	
Team ▾	
Common Name ▾	
Subject Distinguished Name:	
Subject Alternative Name (Optional):	
Domain Name ▾	
Signature algorithm:	SHA1 ▾
Subject Key Type:	RSA ▾
Subject Key Size/Curve:	1024 bits ▾

3 Enter an alias name for the certificate in the **Certificate Alias** field.

4 Create a Distinguished Name (DN) using the drop-down menus shown in Distinguished Name Components, then enter information for the certificate in the associated fields.

ⓘ **NOTE:** For each DN, you can select your country from the associated drop-down menu; for all other components, enter the information in the associated field.

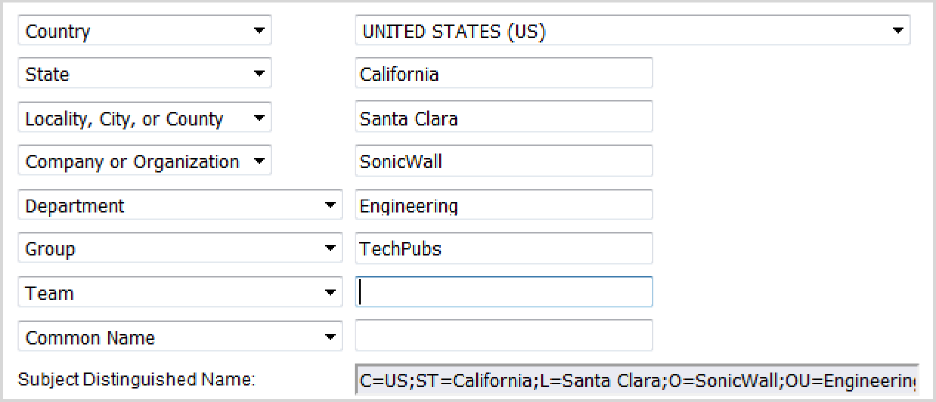
Distinguished Name Components

From this drop-down menu	Select/enter the appropriate information
Country	**Country** (default) **State** **Locality or County** **Company or Organization**
State	**Country** **State** (default) **Locality, City, or County** **Company or Organization** **Department**
Locality, City, or County	**Locality, City, or County** (default) **Company or Organization** **Department** **Group** **Team**
Company or Organization	**Company or Organization** (default) **Department** **Group** **Team** **Common Name** **Serial Number** **E-Mail Address**
Department	**Department** (default) **Group** **Team** **Common Name** **Serial Number** **E-Mail Address**
Group	**Group (default)** **Team** **Common Name** **Serial Number** **E-Mail Address**

Distinguished Name Components (Continued)

From this drop-down menu	Select/enter the appropriate information
Team	**Team** (default) **Common Name** **Serial Number** **E-Mail Address**
Common Name	**Common Name** (default) **Serial Number** **E-Mail Address**

As you enter information for the components, the Distinguished Name (DN) is created in the **Subject Distinguished Name** field.



Country	UNITED STATES (US)
State	California
Locality, City, or County	Santa Clara
Company or Organization	SonicWall
Department	Engineering
Group	TechPubs
Team	
Common Name	
Subject Distinguished Name:	C=US;ST=California;L=Santa Clara;O=SonicWall;OU=Engineerin

5 Optionally, you can also attach a **Subject Alternative Name** to the certificate after selecting the type from the drop-down menu:

- **Domain Name**
- **Email Address**
- **IPv4 Address**

6 Select a signature algorithm from the **Signature algorithm** drop-down menu:

- **MD5**
- **SHA1** (default)
- **SHA256**
- **SHA384**
- **SHA512**

7 Select a subject key type from the **Subject Key Type** drop-down menu:

RSA (default)	A public key cryptographic algorithm used for encrypting data.
ECDSA	Encrypts data using the Elliptic Curve Digital Signature Algorithm, which has a high strength-per-key-bit security.

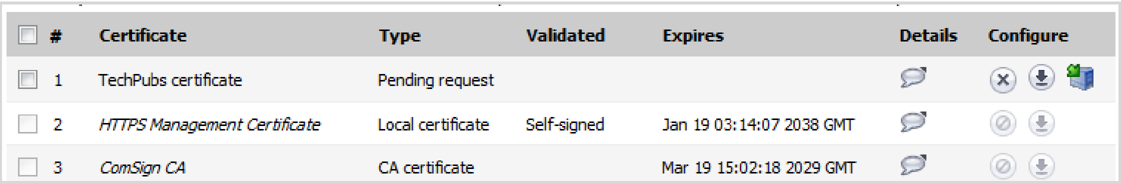
8 Select a subject key size or curve from the **Subject Key Size/Curve** drop-down menu.

NOTE: Not all key sizes or curves are supported by a Certificate Authority, therefore, you should check with your CA for supported key sizes.

If you selected a Key Type of	
RSA, select a key size	**ECDSA, select a curve**
1024 bits (default)	**prime256vi: X9.62.SECG curve over a 256 bit prime field** (default)
1536 bits	**secp384r1: NIST/SECG curve over a 384 bit prime field**
2048 bits	**secp521r1: NIST/SECG curve over a 521 bit prime field**
4096 bits	

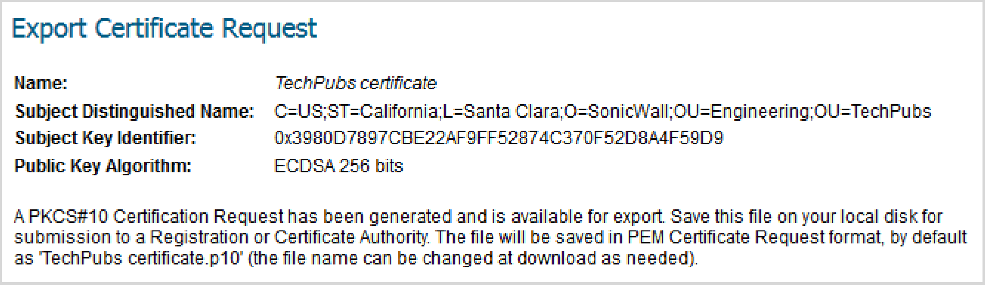
9 Click **GENERATE** to create a certificate signing request file.

When the **Certificate Signing Request** is generated, a message describing the result is displayed in the Status area at the bottom of the browser window and a new entry appears in the **Certificates and Certificate Requests** table with the type **Pending request**.



□	#	Certificate	Type	Validated	Expires	Details	Configure
□	1	TechPubs certificate	Pending request				
□	2	*HTTPS Management Certificate*	Local certificate	Self-signed	Jan 19 03:14:07 2038 GMT		
□	3	*ComSign CA*	CA certificate		Mar 19 15:02:18 2029 GMT		

10 Click the **Export** icon. The **Export Certificate Request** dialog displays.



Export Certificate Request

Name: *TechPubs certificate*
Subject Distinguished Name: C=US;ST=California;L=Santa Clara;O=SonicWall;OU=Engineering;OU=TechPubs
Subject Key Identifier: 0x3980D7897CBE22AF9FF52874C370F52D8A4F59D9
Public Key Algorithm: ECDSA 256 bits

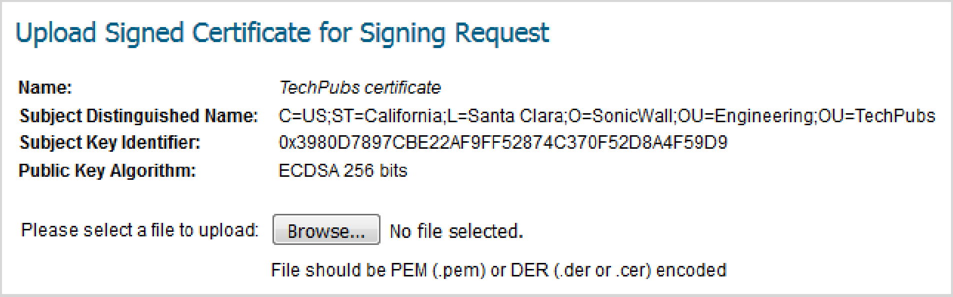
A PKCS#10 Certification Request has been generated and is available for export. Save this file on your local disk for submission to a Registration or Certificate Authority. The file will be saved in PEM Certificate Request format, by default as 'TechPubs certificate.p10' (the file name can be changed at download as needed).

11 Click the **Export** icon to download the file to your computer. An **Opening *<certificate>*** dialog displays.

12 Click **OK** to save the file to a directory on your computer.

You have generated the **Certificate Request** that you can send to your Certificate Authority for validation.

13 Click **Upload** to upload the signed certificate for a signing request. The **Upload Certificate** dialog displays.



Upload Signed Certificate for Signing Request

Name: *TechPubs certificate*
Subject Distinguished Name: C=US;ST=California;L=Santa Clara;O=SonicWall;OU=Engineering;OU=TechPubs
Subject Key Identifier: 0x3980D7897CBE22AF9FF52874C370F52D8A4F59D9
Public Key Algorithm: ECDSA 256 bits

Please select a file to upload: Browse... No file selected.
File should be PEM (.pem) or DER (.der or .cer) encoded

14 Click **Browse** to select a file. The Open File dialog displays.

15 Select the file.

16 Click **Open**.

17 Click **UPLOAD**.

Configuring Simple Certificate Enrollment Protocol

The Simple Certificate Enrollment Protocol (SCEP) is designed to support the secure issuance of certificates to network devices in a scalable manner. There are two enrollment scenarios for SCEP:

- SCEP server CA automatically issues certificates.
- SCEP request is set to PENDING and the CA administrator manually issues the certificate.

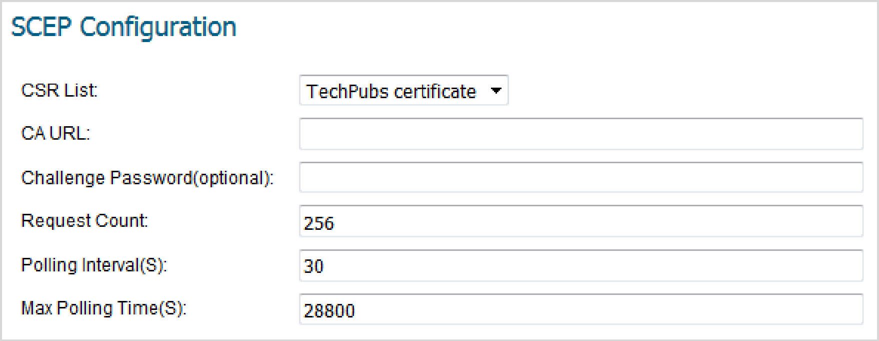
More information about SCEP can be found at: http://tools.ietf.org/html/draft-nourse-scep-18 (*Cisco Systems' Simple Certificate Enrollment Protocol draft-nourse-scep-18*).

To use SCEP to issue certificates:

1 Generate a signing request as described previously in Generating a Certificate Signing Request on page 58.

2 Scroll to the bottom of the **Appliance > Certificates** page.

3 Click **SCEP**. The **SCEP Configuration** dialog displays.



SCEP Configuration

CSR List:	TechPubs certificate ▾
CA URL:	
Challenge Password(optional):	
Request Count:	256
Polling Interval(S):	30
Max Polling Time(S):	28800

4 From **CSR List**, SonicOS NS*v* selects a default CSR list automatically. If you have multiple CSR lists configured, you can modify this.

5 In the **CA URL** field, enter the URL for the Certificate authority.

6 If the **Challenge Password(optional)** field, enter the password for the CA if one is required.

7 In the **Request Count** field, enter the number of requests. The default value is **256**.

8 In the **Polling Interval(S)** field, you can modify the default value for duration of time, in seconds, between the sending of polling messages. the default value is **30** seconds.

9 In the **Max Polling Time(S)** field, you can modify the default value for the duration of time, in seconds, the firewall waits for a response to a polling message before timing out. The default value is **28800** seconds (8 hours).

10 Click **SCEP** to submit the SCEP enrollment.

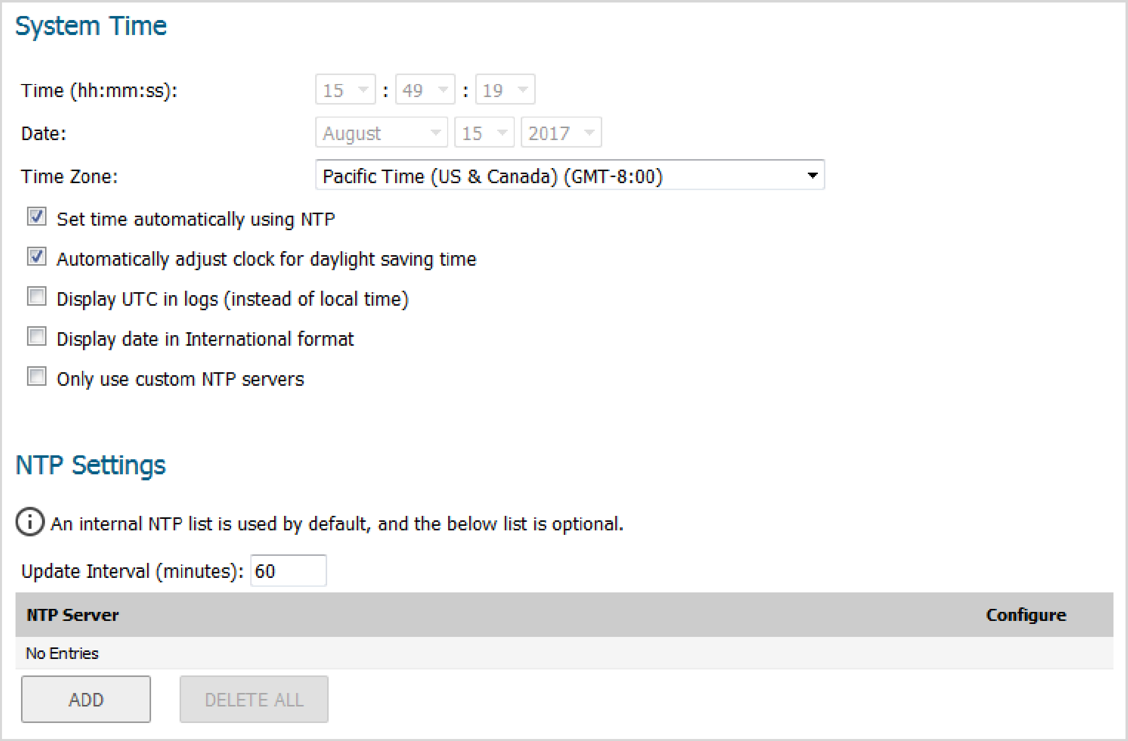
The firewall contacts the CA to request the certificate. The time this takes depends on whether the CA issues certificates automatically or manually. After the certificate is issued, it is displayed in the list of available certificates on the **Appliance > Certificates** page, under the **Imported certificates and requests** or **All certificates** category.

5

Configuring System Time Settings

About Appliance > System Time

MANAGE | System Setup > Appliance > System Time defines the time and date settings to time stamp log events, to automatically update SonicWall Security Services, and for other internal purposes.



System Time

Time (hh:mm:ss): 15 : 49 : 19

Date: August 15 2017

Time Zone: Pacific Time (US & Canada) (GMT-8:00)

☑ Set time automatically using NTP

☑ Automatically adjust clock for daylight saving time

□ Display UTC in logs (instead of local time)

□ Display date in International format

□ Only use custom NTP servers

NTP Settings

An internal NTP list is used by default, and the below list is optional.

Update Interval (minutes): 60

NTP Server	Configure
No Entries	

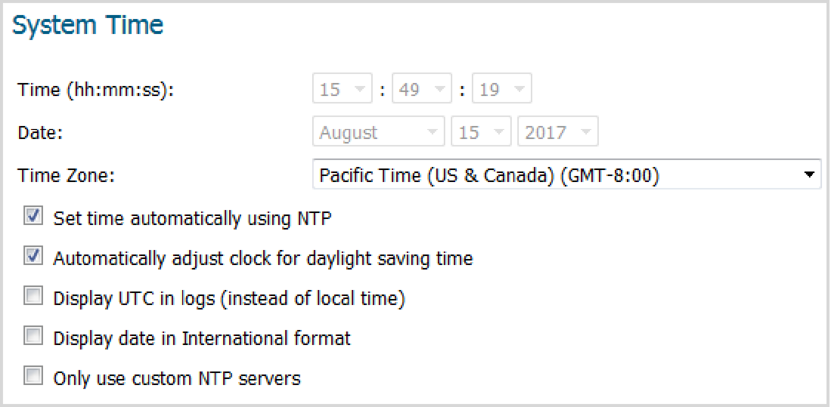
By default, the SonicWall Security Appliance uses an internal list of public NTP servers to update the time automatically. Network Time Protocol (NTP) is a protocol used to synchronize computer clock times in a network of computers. NTP uses Coordinated Universal Time (UTC) to synchronize computer clock times to a millisecond, and sometimes to a fraction of a millisecond.

Topics:

- Setting System Time on page 64
- Configuring NTP Settings on page 65

Setting System Time

Set the system time in the **System Time** section of **Appliance > System Time**.



System Time

Time (hh:mm:ss): 15 : 49 : 19

Date: August 15 2017

Time Zone: Pacific Time (US & Canada) (GMT-8:00)

☑ Set time automatically using NTP

☑ Automatically adjust clock for daylight saving time

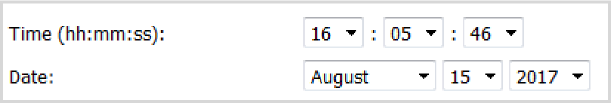
□ Display UTC in logs (instead of local time)

□ Display date in International format

□ Only use custom NTP servers

To set the system time:

1. Navigate to **MANAGE | System Setup > Appliance > System Time**.
2. Select the time zone you are in from **Time Zone**.
3. To set the time:
   - Automatically, select **Set time automatically using NTP** to use NTP (Network Time Protocol) servers from an internal list. This option is selected by default.
   - Manually, clear **Set time automatically using NTP**. The **Time** and **Date** options become available.

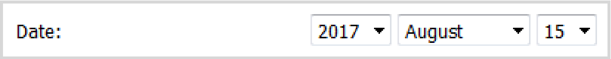
     

     Time (hh:mm:ss): 16 : 05 : 46

     Date: August 15 2017

     1) Select the time in the 24-hour format using the **Time (hh:mm:ss)** drop-down menus

     2) Select the date from the **Date** drop-down menus.
4. To enable automatic adjustments for daylight savings time, select **Automatically adjust clock for daylight saving time**. For those areas that observe daylight savings time, this option is selected by default.
5. To use universal time (UTC) rather than local time for log events, select **Display UTC in logs (instead of local time)**. This option is not selected by default.
6. To display the date in International format, with the day preceding the month, select **Display date in International format**.

   Date: 2017 August 15

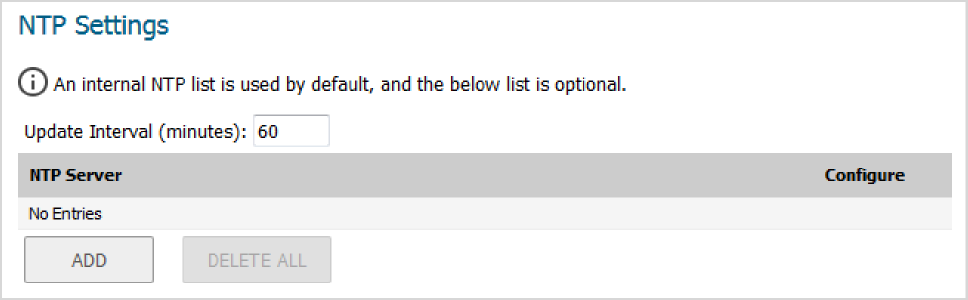
   This option is not selected by default.
7. To use the manually entered list of NTP servers to set the firewall clock rather than the internal list of NTP servers, select **Only use custom NTP servers**.

   ⓘ **IMPORTANT:** Select this option only if you have configured one or more NTP servers. For more information about NTP servers, see Configuring NTP Settings on page 65.
8. Click **ACCEPT**.

Configuring NTP Settings

Network Time Protocol (NTP) is a protocol used to synchronize computer clock times in a network of computers. NTP uses Coordinated Universal Time (UTC) to synchronize computer clock times to a millisecond, and sometimes, to a fraction of a millisecond.

ⓘ **TIP:** The SonicWall Security Appliance uses an internal list of NTP servers, so manually entering a NTP server is optional.



NTP Settings

ⓘ An internal NTP list is used by default, and the below list is optional.

Update Interval (minutes): 60

NTP Server	Configure
No Entries	

Topics:

- Using an NTP Server for Updating the Firewall Clock on page 65
- Adding an NTP Server on page 65
- Editing an NTP Server Entry on page 66
- Deleting NTP Server Entries on page 66

Using an NTP Server for Updating the Firewall Clock

To use a local server to set the firewall clock:

1 Navigate to **MANAGE | System Setup > Appliance > System Time**.

2 Add one or more NTP servers as described in Configuring NTP Settings on page 65.

3 Select **Use NTP to set time automatically** (see Setting System Time on page 64). This option is not selected by default.

4 To configure the frequency for the NTP server to update the firewall, enter the interval in **Update Interval (minutes)**. The default value is **60** minutes.

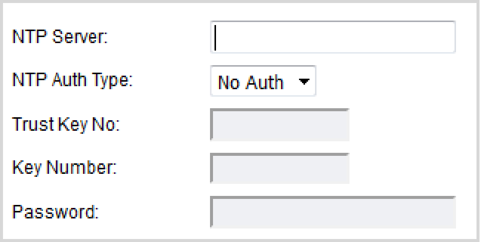
5 Click **Accept**.

Adding an NTP Server

To add an NTP server to the firewall configuration:

1 Navigate to **MANAGE | System Setup > Appliance > System Time**.

2 In the **NTP Settings** section, click **ADD**. The **Add NTP Server** dialog displays.



NTP Server:	
NTP Auth Type:	No Auth
Trust Key No:	
Key Number:	
Password:	

3 Type the IP address of the remote NTP server in the **NTP Server** field.

4 Select the authentication type from the **NTP Auth Type** drop-down menu:

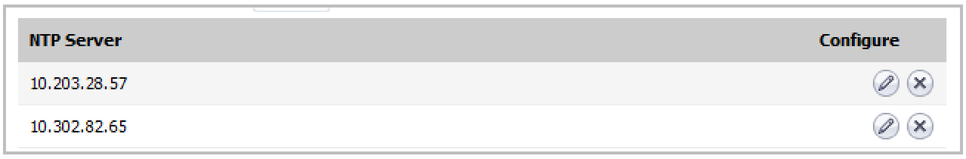
- **No Auth** – Authentication is not required and the following three options are dimmed. Go to Step 8.
- **MD5** – Authentication is required and the following three options are active.

5 Enter the Trust Key number in the **Trust Key No** field. The minimum is 1 and the maximum is 99999.

6 Enter the Key number in the **Key Number** field. The minimum is 1 and the maximum is 99999.

7 Enter the password in the **Password** field.

8 Click **OK**. The **NTP Server** section shows the server.



NTP Server	Configure
10.203.28.57	✎ ⊗
10.302.82.65	✎ ⊗

Editing an NTP Server Entry

To edit an NTP server entry:

1 Navigate to **MANAGE | System Setup > Appliance > System Time**.

2 In the **NTP Server** table, click the entry's **Edit** icon. The **Edit NTP Server** dialog displays; it is the same as the **Add NTP Server** dialog; see Adding an NTP Server on page 65.

3 Make the changes.

4 Click **OK**.

Deleting NTP Server Entries

To delete an NTP server entry:

1 Navigate to **MANAGE | System Setup > Appliance > System Time**.

2 In the **NTP Server** table, click the entry's **Delete** icon.

To delete all servers:

3 Navigate to **MANAGE | System Setup > Appliance > System Time**.

4 Below the **NTP Server** table, click **DELETE ALL**.

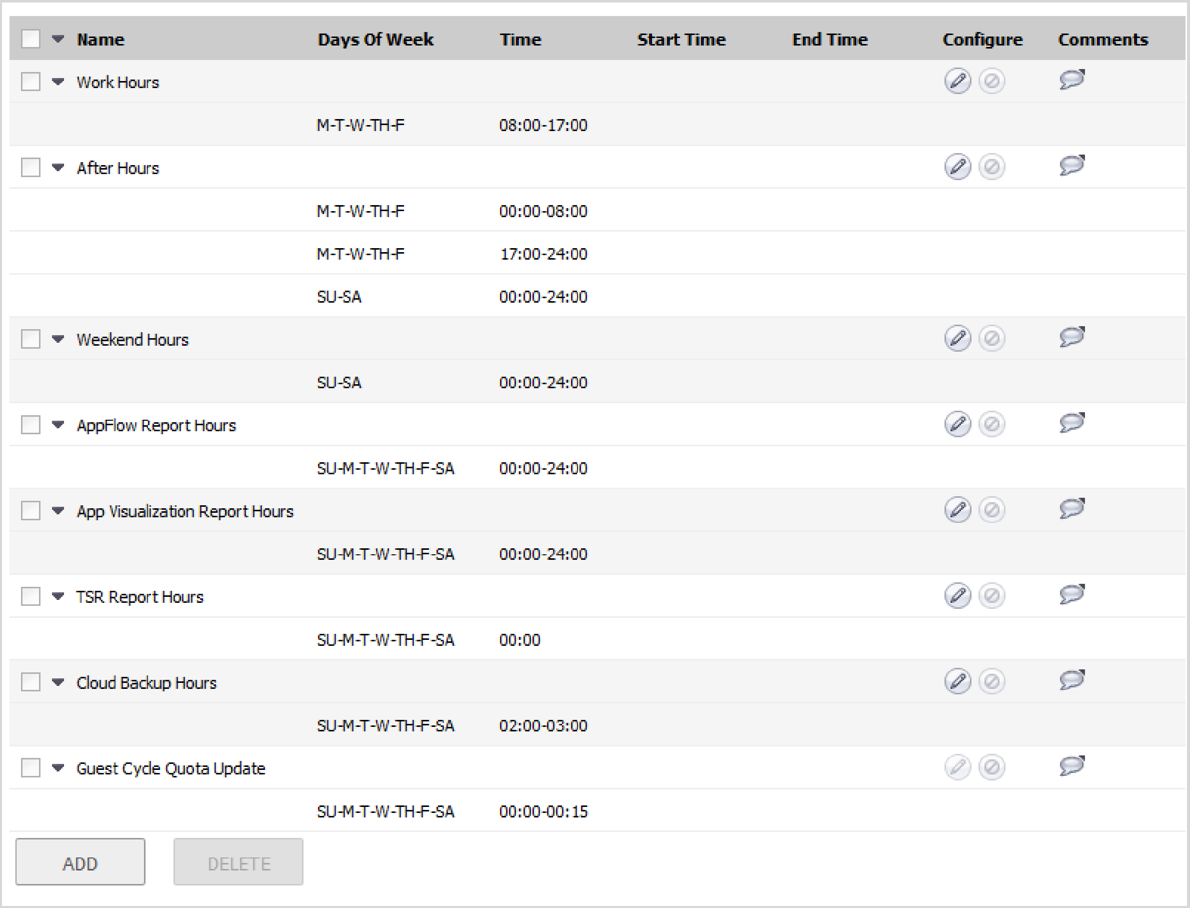
6

Setting System Schedules

About System Schedules

SonicOS NS*v* uses schedule objects in conjunction with its security features and policies. Create schedule objects with **MANAGE | System Setup > Appliance > System Schedules**. Apply schedule objects for a specific security feature or policy (rule). For example, if you add an access rule in the **MANAGE | Policies > Rules > Access Rules** page, the **Add Rule** dialog lists all the available predefined schedule objects as well as the schedule objects you create with the **MANAGE | System Setup > Appliance > System Schedules** page. A schedule can include multiple day and time increments for rule enforcement with a single schedule.

About Appliance > System Schedules



☐	Name	Days Of Week	Time	Start Time	End Time	Configure	Comments
☐	Work Hours					✎ ⊘	💬
		M-T-W-TH-F	08:00-17:00				
☐	After Hours					✎ ⊘	💬
		M-T-W-TH-F	00:00-08:00				
		M-T-W-TH-F	17:00-24:00				
		SU-SA	00:00-24:00				
☐	Weekend Hours					✎ ⊘	💬
		SU-SA	00:00-24:00				
☐	AppFlow Report Hours					✎ ⊘	💬
		SU-M-T-W-TH-F-SA	00:00-24:00				
☐	App Visualization Report Hours					✎ ⊘	💬
		SU-M-T-W-TH-F-SA	00:00-24:00				
☐	TSR Report Hours					✎ ⊘	💬
		SU-M-T-W-TH-F-SA	00:00				
☐	Cloud Backup Hours					✎ ⊘	💬
		SU-M-T-W-TH-F-SA	02:00-03:00				
☐	Guest Cycle Quota Update					✎ ⊘	💬
		SU-M-T-W-TH-F-SA	00:00-00:15				

MANAGE | System Setup > Appliance > System Schedules allows you to create and manage default and custom schedule objects for enforcing schedule times for a variety of SonicWall Security Appliance features.

ⓘ **NOTE:** You can modify default schedules, but you cannot delete them.

The **Schedules** table displays all predefined and custom schedules. The default schedules consist of:

Work Hours
After Hours
Weekend Hours
AppFlow Report Hours
App Visualization Report Hours
TSR Report Hours
Cloud Backup Hours
Guest Cycle Quota Update

Topics:

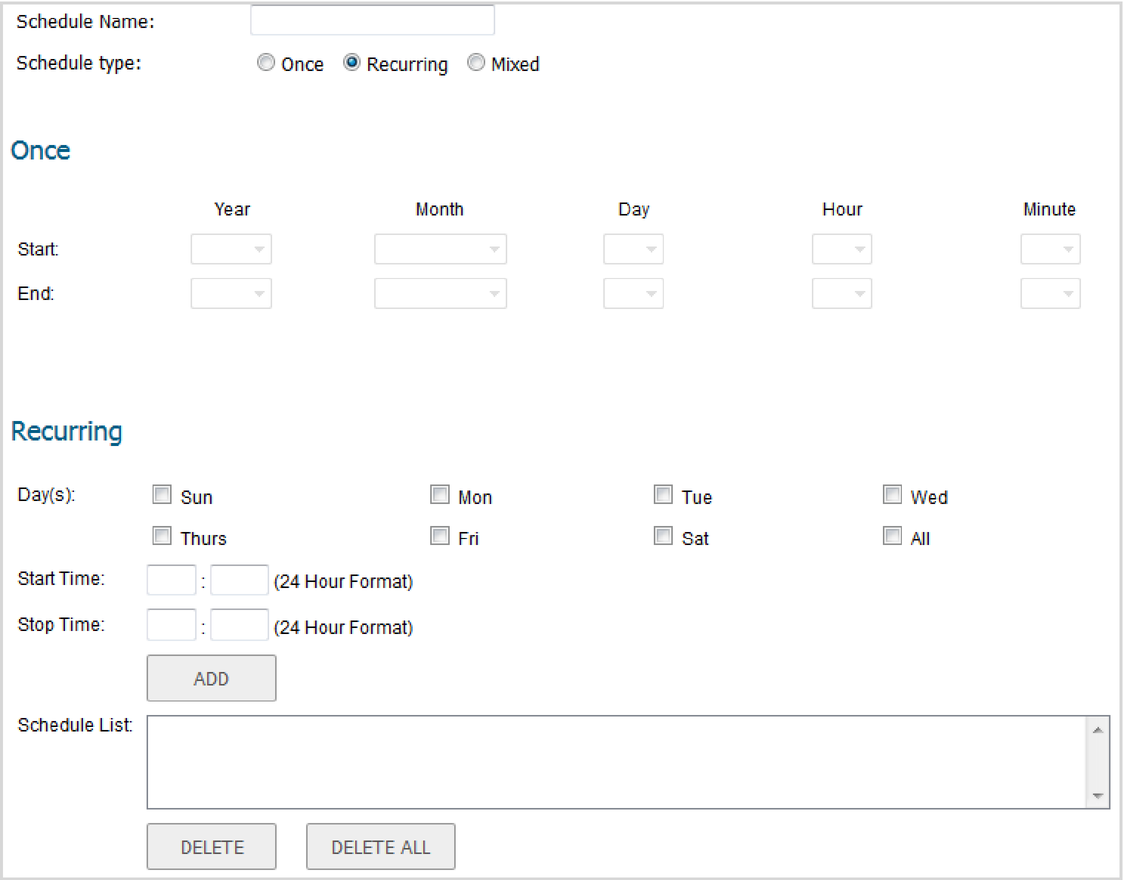
- Adding a Custom System Schedule on page 69
- Modifying System Schedules on page 70
- Deleting Custom System Schedules on page 71

Adding a Custom System Schedule

To create custom schedules:

1 Navigate to **MANAGE | System Setup > Appliance > System Schedules**.

2 Click **ADD**. The **Add Schedule** dialog displays.



Schedule type: ○ Once ● Recurring ○ Mixed

3 Enter a descriptive name for the schedule in the **Schedule Name** field.

4 Choose one of the following radio buttons for **Schedule type**:

Once For a one-time schedule between the configured **Start** and **End** times and dates. When selected, the fields under **Once** become available, and the fields under **Recurring** become dimmed.

Recurring (default) For a schedule that occurs repeatedly during the same configured hours and days of the week, with no start or end date. When selected, the fields under **Recurring** become available, and the fields under **Once** become dimmed.

Mixed For a schedule that occurs repeatedly during the same configured hours and days of the week, between the configured start and end dates. When selected, all fields on the page become active.

ⓘ | **IMPORTANT:** Time must be in 24-hour format, for example, 17:00 for 5 p.m.

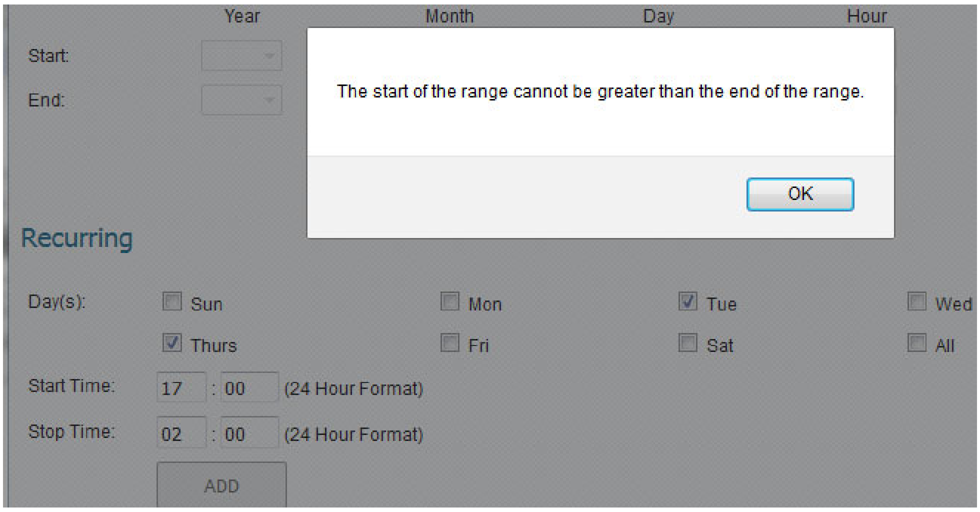
5 If the fields under **Once** are available, configure the:

- Starting date and time by selecting the **Year**, **Month**, **Date**, **Hour**, and **Minute** from the drop-down menus in the **Start** row. The hour is represented in 24-hour format.

- Ending date and time by selecting the **Year**, **Month**, **Date**, **Hour**, and **Minute** from the drop-down menus in the **End** row. The hour is represented in 24-hour format.

6 If the fields under **Recurring** are available:

  - Select the checkboxes for the days of the week to apply to the schedule or select **All**.
  - Enter the time of day for the schedule to begin in the **Start Time** field.
  - Enter the time of day for the schedule to stop in the **Stop Time** field.



The start of the range cannot be greater than the end of the range.

Recurring

Day(s): □ Sun □ Mon ☑ Tue □ Wed ☑ Thurs □ Fri □ Sat □ All

Start Time: 17 : 00 (24 Hour Format)

Stop Time: 02 : 00 (24 Hour Format)

7 Click **ADD** to add the schedule to the **Schedule List**.

8 To delete:

  - An existing schedule from the **Schedule List**:
    1) Select the schedule.
    2) Click **DELETE**.
  - All existing schedules, click **DELETE ALL**.

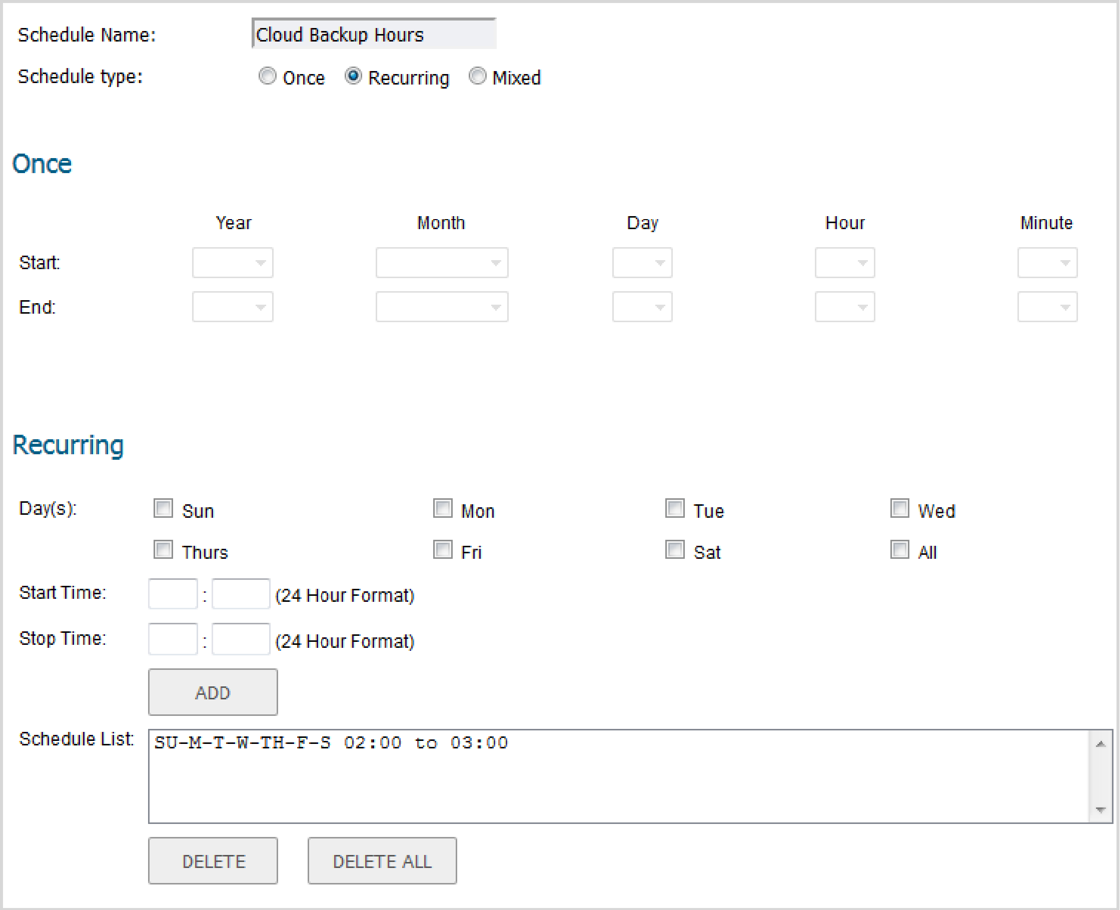
9 Click **OK**. The **Schedules** table is updated.

Modifying System Schedules

To modify both default and custom schedules:

1 Navigate to **MANAGE | System Setup > Appliance > System Schedules**.

2 Click the **Edit** icon for the schedule to be modified. The **Edit Schedule** dialog displays.



Schedule Name: Cloud Backup Hours

Schedule type: ○ Once ● Recurring ○ Mixed

Once

	Year	Month	Day	Hour	Minute
Start:					
End:					

Recurring

Day(s): □ Sun □ Mon □ Tue □ Wed □ Thurs □ Fri □ Sat □ All

Start Time: : (24 Hour Format)

Stop Time: : (24 Hour Format)

Schedule List:

```
SU-M-T-W-TH-F-S 02:00 to 03:00
```

3 You can change any component of the schedule, such as time(s), type, and/or days, except the name of default schedules cannot be changed and the field is dimmed. To make changes, follow the procedure in Adding a Custom System Schedule on page 69.

4 Click **OK**.

Deleting Custom System Schedules

You can delete custom schedules, but you cannot delete default schedules.

Deleting Individual System Schedules

To delete individual schedule objects that you created:

1 Navigate to **MANAGE | System Setup > Appliance > System Schedules**.

2 In the **Schedules** table, to delete:

- A custom schedule, click its **Delete** icon.
- Multiple custom schedules:
    1) Select the checkboxes next to the custom schedules to delete. **DELETE** becomes available.
    2) Click **DELETE**.

Deleting All System Schedules

To delete all schedule objects you created:

1. Navigate to **MANAGE | System Setup > Appliance > System Schedules**.
2. In the **Schedules** table, select the checkbox next to the **Name** column header to select all custom schedules. **DELETE** becomes available.
3. Click **DELETE**.

Part 3

SYSTEM SETUP | Users

- About Managing Users
- Configuring Settings for Managing Users
- Managing Authentication Partitions
- Configuring Local Users and Groups
- Managing Guest Services
- Managing Guest Accounts

7

About Managing Users

About User Management

NOTE: This topic provides an overview of the management capabilities of your SonicWall Security Appliance.

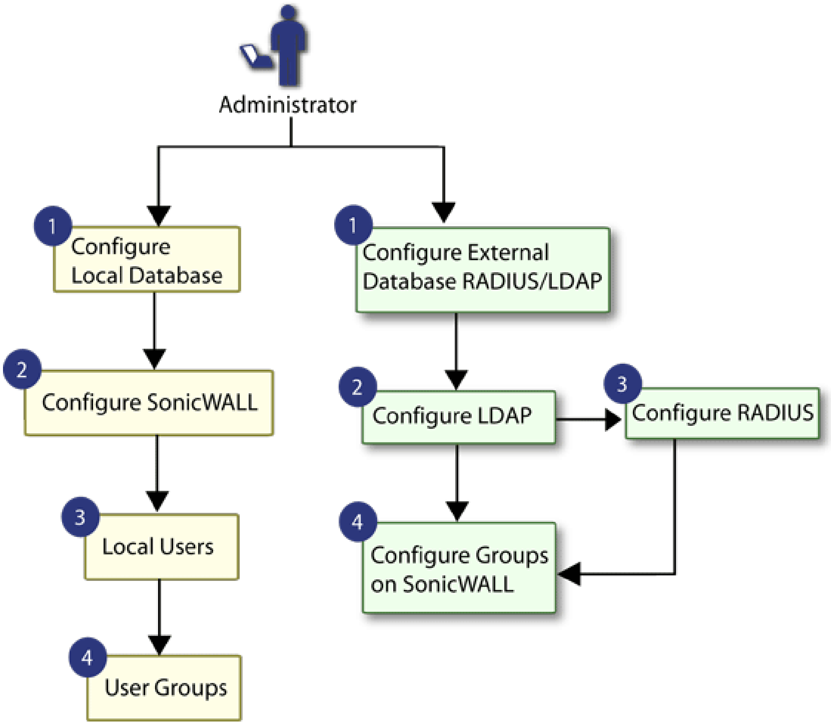
For detailed information and procedures about	See these topics
Setting up user authentication, web login, session management, accounting, and policies	Configuring Settings for Managing Users on page 102.
Creating partitions for user authentication in environments with multiple non-interconnected domains	Managing Authentication Partitions on page 173
Creating and managing local users and local groups	Configuring Local Users and Groups on page 204.
Setting up guest services and accounts	Managing Guest Services on page 225 and Managing Guest Accounts on page 230

The SonicWall Security Appliance (firewall) provides a mechanism for managing locally and remotely authenticated users. User-level authentication gives users access to the LAN from remote locations on the Internet as well as a means to enforce or bypass content filtering policies for LAN users attempting to access the Internet. You can also permit only authenticated users to access VPN tunnels and send data across the encrypted connection.

The firewall authenticates all users as soon as they attempt to access network resources in a different zone (such as WAN or VPN), which causes the network traffic to pass through the firewall. Users who log into a computer on the LAN, but perform only local tasks are not authenticated by the firewall. User-level authentication can be performed using a local user database, LDAP, or a combination of a local databases. For networks with a large numbers of users, user authentication using LDAP servers can be more efficient.

SonicOS NS*v* also provides a Single Sign-On (SSO) capability. SSO can be used in conjunction with LDAP. See User Management Topology.

User Management Topology


Administrator
1 Configure Local Database
2 Configure SonicWALL
3 Local Users
4 User Groups
1 Configure External Database RADIUS/LDAP
2 Configure LDAP
3 Configure RADIUS
4 Configure Groups on SonicWALL

Topics:

- Using Local Users and Groups for Authentication on page 75
- Using LDAP/Active Directory/eDirectory Authentication on page 77
- About Single Sign-On on page 81
- Installing the Single Sign-On Agent and/or Terminal Services Agent on page 89
- About Multiple Administrator Support on page 98
- Configuring Multiple Administrator Support on page 100

Using Local Users and Groups for Authentication

Topics:

- About User Databases on page 75
- About User Groups on page 76

About User Databases

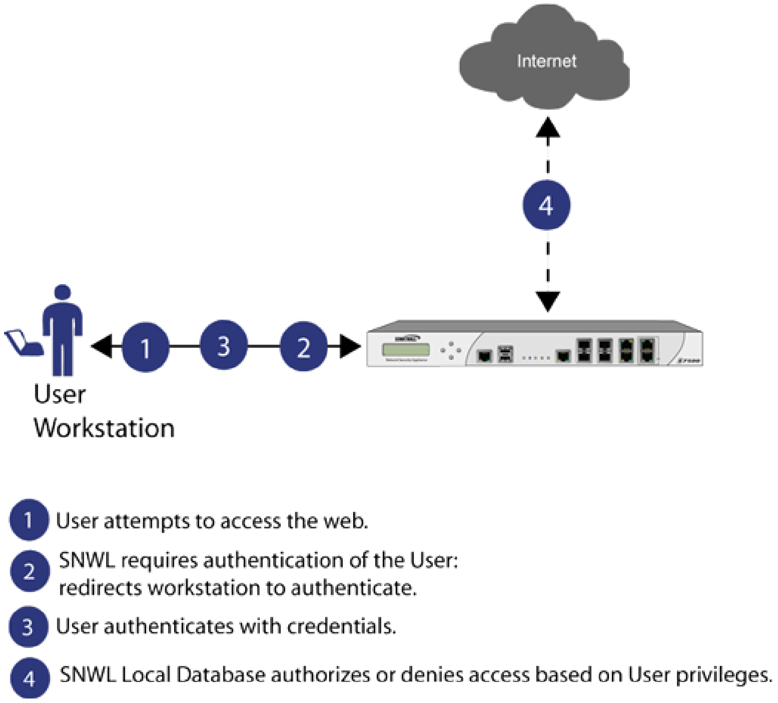
The firewall provides a local database for storing user and group information. You can configure the firewall to use this local database to authenticate users and control their access to the network. The local database is a good choice over LDAP when the number of users accessing the network is relatively small. Creating entries for dozens of users and groups takes time, although when the entries are in place they are not difficult to maintain.

The number of users supported by the local database on the firewall varies by platform. The maximum overall user limit is equal to the maximum number of SSO users and the maximum number of native users is equal to the maximum number of SSO users. The maximum web users is the maximum combined user logins from the web and the GVC, and SSL-VP clients.

About User Groups

To apply Content Filtering Service (CFS) policies to users, the users must be members of local groups and the CFS policies are then applied to the groups. To use CFS, you cannot use LDAP without combining that method with local authentication. When using the combined authentication method to use CFS policies, the local group names must be an exact match with the LDAP group names. When using the **LDAP + Local Users** authentication method, you can import the groups from the LDAP server into the local database on the firewall. This greatly simplifies the creation of matching groups, to which CFS policies can then be applied. See User Management: Using Local Users and Groups for Authentication.

User Management: Using Local Users and Groups for Authentication



1 User attempts to access the web.

2 SNWL requires authentication of the User: redirects workstation to authenticate.

3 User authenticates with credentials.

4 SNWL Local Database authorizes or denies access based on User privileges.

The SonicOS NS*v* Management Interface provides a way to create local user and group accounts. You can add users and edit the configuration for any user, including settings for:

Group membership Users can belong to one or more local groups. By default, all users belong to the groups **Everyone** and **Trusted Users**. You can remove these group memberships for a user and can add memberships in other groups.

VPN access You can configure the networks that are accessible to a VPN client started by a user. When configuring VPN access settings, you can select from a list of networks. The networks are designated by their Address Group or Address Object names.

NOTE: The VPN access configuration for users and groups affects the ability of remote clients using GVC, NetExtender, and SSL VPN Virtual Office bookmarks to access network resources. To allow GVC, NetExtender, or Virtual Office users to access a network resource, the network address objects or groups must be added to the “allow” list on the VPN Access tab.

You can also add or edit local groups. Here are the configurable settings for groups:

Group settings For administrator groups, you can configure SonicOS NS*v* to allow login to the Management Interface without activating the login status popup window.

Group members Groups have members that can be local users or other local groups.

VPN access VPN access for groups is configured in the same way as VPN access for users. You can configure the networks that are accessible to a VPN client started by a member of this group. When configuring VPN access settings, you can select from a list of networks. The networks are designated by their **Address Group** or **Address Object** names.

CFS policy You can apply a content filtering (CFS) policy to group members. The CFS policy setting is only available if the firewall is currently licensed for Premium Content Filtering Service.

Using LDAP/Active Directory/eDirectory Authentication

Lightweight Directory Access Protocol (LDAP) defines a directory services structure for storing and managing information about elements in your network, such as user accounts, user groups, hosts, and servers. Several different standards exist that use LDAP to manage user account, group, and permissions. Some are proprietary systems like Microsoft Active Directory (AD), which you can manage using LDAP, or Novell eDirectory, which provides an LDAP API for managing the user repository information. Some are open standards like SAMBA, which are implementations of the LDAP standards.

In addition to the local user database, SonicOS NS*v* supports LDAP for user authentication, with support for numerous schemas including Microsoft Active Directory, Novell eDirectory directory services, and a fully configurable user-defined option that should allow SonicOS NS*v* to interact with any schema.

Microsoft Active Directory also works with SonicWall Single Sign-On and the SonicWall SSO Agent. For more information, see About Single Sign-On on page 81.

Topics:

- LDAP Terms on page 77
- LDAP Directory Services Supported in SonicOS NS*v* on page 78
- LDAP User Group Mirroring on page 78

LDAP Terms

These terms are useful when working with LDAP and its variants.

Active Directory (AD) Microsoft directory service, commonly used with Windows-based networking. Microsoft Active Directory is compatible with LDAP.

Attribute Data item stored in an object in an LDAP directory. Objects can have required attributes or allowed attributes. For example, the `dc` attribute is a required attribute of the `dcObject` (domain component) object.

cn Common name attribute, a required component of many object classes throughout LDAP.

dc Domain component attribute, commonly found at the root of a distinguished name and is commonly a required attribute.

dn Distinguished name, which is a globally unique name for a user or other object. It is made up of a number of components, usually starting with a common name (`cn`) component and ending with a domain specified as two or more domain components (`dc`). For example, `cn=john,cn=users,dc=domain,dc=com`.

eDirectory Novell directory service, used for Novell NetWare-based networking. Novell eDirectory has an LDAP gateway that can be used for management.

Entry Data stored in the LDAP directory. Entries are stored in attribute/value (or name/value) pairs, where the attributes are defined by object classes. A sample entry would be `cn=john` where `cn` (common name) is the attribute and `john` is the value.

Object In LDAP terminology, the entries in a directory are referred to as objects. For the purposes of the SonicOS NS*v* implementation of the LDAP client, the critical objects are User and Group objects. Different implementations of LDAP can refer to these object classes in different fashions, for example, Active Directory refers to the user object as `user` and the group object as `group`, while RFC2798 refers to the user object as `inetOrgPerson` and the group object as `groupOfNames`.

Object class Defines the type of entries that an LDAP directory might contain. A sample object class, as used by AD, would be `user` or `group`.

Microsoft Active Directory’s Classes can be browsed at http://msdn.microsoft.com/library/.

ou Organizational unit attribute, a required component of most LDAP schema implementations.

Schema Set of rules or the structure that defines the types of data that can be stored in a directory and how that data can be stored. Data is stored in the form of entries.

TLS Transport Layer Security, the IETF standardized version of SSL (Secure Sockets Layer). TLS 1.1 and 1.2 are supported.

LDAP Directory Services Supported in SonicOS NS*v*

To integrate with the most common directory services used in company networks, SonicOS NS*v* supports integration with these LDAP schemas:

- Microsoft Active Directory
- RFC2798 InetOrgPerson
- RFC2307 Network Information Service
- Samba SMB
- Novell eDirectory
- User-defined schemas

SonicOS NS*v* provides support for directory servers running these protocols:

- LDAPv3 (RFC2251-2256, RFC3377)
- LDAPv3 over TLS (RFC2830)
- LDAPv3 with STARTTLS (RFC2830)
- LDAPv2 (RFC3494)
- LDAP Referrals (RFC2251)

LDAP User Group Mirroring

LDAP User Group Mirroring provides automatic duplication of LDAP User Group configurations from an LDAP server to a SonicWall Security Appliance. You can manage LDAP User Groups exclusively on the LDAP server and do not need to manually duplicate configurations on the firewall. User group configurations are periodically read from the LDAP server and copied to the firewall.

LDAP User Group names that are copied to the firewall include the domain name in the format, `name@domain.com`. This ensures that user group names from various domains are unique.

These features and restrictions apply to mirrored LDAP User Groups:

- You can delete LDAP User Groups only on the LDAP server. They cannot delete the mirrored LDAP User Groups on the SonicWall Security Appliance. When a user group is deleted on the LDAP server, its mirrored group on the firewall is also deleted automatically.
- You can edit LDAP User Group names (and their comment fields) only on the LDAP server. They cannot edit the mirrored LDAP User Group name or its comment field on the firewall. The comment field displays `Mirrored from LDAP` on the firewall.
- You can add users as members to an LDAP User Group on the SonicWall Security Appliance.
- You cannot add groups to other groups on the SonicWall Security Appliance. Default user groups can only be configured on the LDAP server.
- You can configure things such as VPNs, SSL VPNs, CFS policies, and ISP policies for LDAP User Groups on the SonicWall Security Appliance (for more information about policies, see SonicOS NS*v* *6.5 Policies*.

  ⓘ **NOTE:** LDAP User Groups are not deleted if they are configured in any Access Rules, App Control Rules, or other policies.

- When you disable LDAP User Group Mirroring, the mirrored user groups on the SonicWall Security Appliance are not deleted. They are changed so you can delete them manually. Local mirrored user groups can be re-enabled if they have not been deleted manually.
- When the system creates a mirrored group on the SonicWall Security Appliance, and the name of the mirrored group matches the name of an already existing, user-created (non-mirrored) local group, the local group is not replaced. The local group memberships are updated to reflect the group settings that are configured on the LDAP server.
- If the system finds a user group on the LDAP server with a name that is the same as one of the default user groups on the SonicWall Security Appliance, no mirrored user group is created on the SonicWall Security Appliance. The memberships in the default user group are updated to reflect the group settings that are configured on the LDAP server.
- For groups created before SonicOS NS*v* 6.2, if a local user group exists on the SonicWall Security Appliance with a simple name only (no domain) and that name matches the name of a user group on the LDAP server (which includes a domain), a new local user group is created on the SonicWall Security Appliance and is given the same domain as the corresponding user group on the LDAP server. The original local user group is retained with no domain. Users of the original group are given memberships in the LDAP group, the new local mirrored group, and the original local group (with no domain).

Integrating LDAP into the SonicWall Security Appliance

Integrating your firewall with an LDAP directory service requires configuring your LDAP server for certificate management, installing the correct certificate on your firewall, and configuring the firewall to use the information from the LDAP Server. For an introduction to LDAP, see Using LDAP/Active Directory/eDirectory Authentication on page 77.

Topics:

- Preparing Your LDAP Server for Integration on page 79
- Configuring the CA on the Active Directory Server on page 80

Preparing Your LDAP Server for Integration

Before beginning your LDAP configuration, you should prepare your LDAP server and your SonicWall for LDAP over TLS support. This requires:

- Installing a server certificate on your LDAP server.
- Installing a CA (Certificate Authority) certificate for the issuing CA on your firewall.

The following procedures describe how to perform these tasks in an Active Directory environment.

Configuring the CA on the Active Directory Server

To configure the CA on the Active Directory server:

ⓘ **TIP:** Skip the first five steps if Certificate Services are already installed.

1. Navigate to **Start > Settings > Control Panel > Add/Remove Programs**
2. Select **Add/Remove Windows Components**
3. Select **Certificate Services**
4. Select **Enterprise Root CA** when prompted.
5. Enter the requested information. For information about certificates on Windows systems, see http://support.microsoft.com/kb/931125.
6. Launch the **Domain Security Policy** application: Navigate to **Start > Run** and run the command: **dompol.msc**.
7. Open **Security Settings > Public Key Policies**.
8. Right click **Automatic Certificate Request Settings**.
9. Select **New > Automatic Certificate Request**.
10. Step through the wizard, and select **Domain Controller** from the list.

Exporting the CA Certificate from the Active Directory Server

To export the CA certificate from the AD server:

1. Launch the **Certification Authority** application: **Start > Run > certsrv.msc**.
2. Right click on the CA you created, and select **properties**.
3. On the **General** tab, click **View Certificate**.
4. On the **Details** tab, select **Copy to File**.
5. Step through the wizard, and select the **Base-64 Encoded X.509 (.cer)** format.
6. Specify a path and filename to which to save the certificate.

Importing the CA Certificate in to SonicOS NS*v*

To import the CA certificate in to SonicOS NSv:

1. Browse to **System > CA Certificates**.
2. Select **Add new CA certificate**. Browse to and select the certificate file you just exported.
3. Click **Import certificate**.

LDAP Group Membership by Organizational Unit

The LDAP Group Membership by Organizational Unit feature provides the ability to set LDAP rules and policies for users located in certain Organizational Units (OUs) on the LDAP server.

When a user logs in, if user groups are set to grant memberships by LDAP location, the user is made a member of any groups that match its LDAP location.

You can set any local group, including default local groups (except for the **Everyone** group and the **Trusted Users** group) as a group with members that are set by their location in the LDAP directory tree.

When a user is a member of any local groups that are configured for LDAP location:

- The location of those local groups in the LDAP tree is learned.
- The location of the user's local groups is checked against all other local groups. If any other groups have the same LDAP location as that of the user's membership groups, the user is automatically set as a member of those groups for that login session.

When a user attempts to log in, whether with success or failure, the user's distinguished name is logged in the event log. This helps with troubleshooting if a user fails to get memberships to the expected groups.

Using TACACS+

SonicOS NS*v* supports TACACS+ (Terminal Access Controller Access-Control System latest generation) for user authentication. The main characteristics of TACACS+ are:

- Provides separate authentication, authorization and accounting (AAA) services.
- Uses TCP for its transport.
- Entire TACACS+ body might be protected by the encryption.

About Single Sign-On

Topics:

What Is Single Sign-On?

Single Sign-On (SSO) is a transparent user-authentication mechanism that provides privileged access to multiple network resources with a single domain login to a workstation or through a Windows Terminal Services or Citrix server.

SonicWall Security Appliances provide SSO functionality using the Single Sign-On Agent (SSO Agent) and SonicWall Terminal Services Agent (TSA) to identify user activity. The SSO Agent identifies users based on workstation IP address. The TSA identifies users through a combination of server IP address, user name, and domain.

SonicWall SSO is also available for Mac and Linux users when used with Samba. Additionally, browser NTLM authentication allows SonicWall SSO to authenticate users who send HTTP traffic without involving the SSO Agent or Samba.

SonicWall SSO is configured in the **MANAGE | System Setup > Users > Settings** page of the SonicOS NS*v* management interface. SSO is separate from the **Authentication method for login** settings, which can be used at the same time for authentication of VPN client users or administrative users.

Based on data from SonicWall SSO Agent or TSA, the Security Appliance queries LDAP or the local database to determine group membership. Memberships are optionally checked by firewall policies to control who is given access, and can be used in selecting policies for Content Filtering and Application Control to control what they are allowed to access. User names learned through UNIX SSO are reported in logs of traffic and events from the users, and in AppFlow Monitoring.

The configured inactivity timer applies with SSO but the session limit does not, though users who are logged out are automatically and transparently logged back in when they send further traffic.

Users logged into a workstation or Terminal Services/Citrix server directly, but not logged into the domain, are not authenticated unless they send HTTP traffic and browser NTML authentication is enabled (although they can optionally be authenticated for limited access). For users who are not authenticated by SonicWall SSO, a message displays indicating that a manual login to the Security Appliance is required for further authentication.

Users that are identified but lack the group memberships required by the configured policy rules are redirected to the Access Barred page.

Benefits of SonicWall SSO

SonicWall SSO is a reliable and time-saving feature that utilizes a single login to provide access to multiple network resources based on administrator-configured group memberships and policy matching. SonicWall SSO is transparent to end users and requires minimal administrator configuration.

By automatically determining when users have logged in or out based on workstation IP address traffic, or, for Terminal Services or Citrix, traffic from a particular user at the server IP address, SonicWall SSO is secure and hands-free. SSO authentication is designed to operate with any external agent that can return the identity of a user at a workstation or Terminal Services/Citrix server IP address using a SonicWall Directory Connector-compatible protocol.

SonicWall SSO works for any service on the firewall that uses user-level authentication, including Content Filtering Service (CFS), Access Rules, group membership and inheritance, and security services (IPS, GAV, and Anti-Spyware) inclusion/exclusion lists.

SonicWall SSO Agent can be installed on any Windows server on the LAN, and TSA can be installed on any terminal server. Other benefits of SonicWall SSO include:

Ease of use	Users only need to sign in once to gain automatic access to multiple resources.
Improved user experience	Windows domain credentials can be used to authenticate a user for any traffic type without logging into the appliance using a Web browser.
Transparency to users	Users are not required to re-enter user name and password for authentication.
Secure communication	Shared key encryption for data transmission protection.
Multiple SSO Agents	Up to eight agents are supported to provide capacity for large installations
Multiple TSAs	Multiple terminal services agents (one per terminal server) are supported. The number depends on the model of the SonicWall Security Appliance and ranges from 8 to 512.
Login mechanism	Works with any protocol, not just HTTP.

Browser NTLM authentication	SonicWall SSO can authenticate users sending HTTP traffic without using the SSO Agent.
Mac and Linux support	With Samba 3.5 and higher, SonicWall SSO is supported for Mac and Linux users.
Per-zone enforcement	SonicWall SSO can be triggered for traffic from any zone even when not automatically initiated by firewall access rules or security services policies, providing user identification in event logging or AppFlow Monitoring.

Platforms and Supported Standards

The SSO Agent is compatible with all versions of SonicOS NS*v* that support SonicWall SSO. SonicWall TSA also is supported.

The SSO feature supports LDAP and local database protocols. SonicWall SSO supports SonicWall Directory Connector. For all features of SonicWall SSO to work properly, SonicOS NS*v* should be used with Directory Connector 3.1.7 or higher.

To use SonicWall SSO with Windows Terminal Services or Citrix, SonicOS NS*v* 6.0 or higher is required, and SonicWall TSA must be installed on the server.

To use SonicWall SSO with browser NTLM authentication, SonicOS NS*v* 6.0 or higher is required. The SSO Agent is not required for browser NTLM authentication.

Except when using only browser NTLM authentication, using SonicWall SSO requires that the SSO Agent be installed on a server within your Windows domain that can reach clients and can be reached from the appliance, either directly or through a VPN path, and/or TSA be installed on any terminal servers in the domain.

The following requirements must be met to run the SSO Agent:

- UDP port 2258 (by default) must be open; the firewall uses UDP port 2258 by default to communicate with SonicWall SSO Agent; if a custom port is configured instead of 2258, then this requirement applies to the custom port
- Windows Server, with latest service pack
- .NET Framework 2.0
- Net API or WMI

> ⓘ **NOTE:** Mac and Linux PCs do not support the Windows networking requests that are used by the SSO Agent, and consequentially require Samba 3.5 or newer to work with SonicWall SSO. Without Samba, Mac and Linux users can still get access, but you need to log in to do so. You can be redirected to the login prompt if policy rules are set to require authentication. For more information, see Accommodating Mac and Linux Users on page 94.

To run the TSA, the following requirements must be met:

- UDP port 2259 (by default) must be open on all terminal servers on which TSA is installed; the firewall uses UDP port 2259 by default to communicate with SonicWall TSA; if a custom port is configured instead of 2259, then this requirement applies to the custom port
- Windows Server, with latest service pack
- Windows Terminal Services or Citrix installed on the Windows Terminal Server system(s)

How Does Single Sign-On Work?

SonicWall SSO requires minimal administrator configuration and is transparent to the user.

SSO is triggered in these situations:

- If firewall access rules requiring user authentication apply to traffic that is not incoming from the WAN zone
- When no user groups are specified in access rules, but any of the following conditions exist, SSO is triggered for all traffic on the zone and not just for traffic subject to these conditions:
  - CFS is enabled on the zone and multiple CFS policies are set
  - IPS is enabled on the zone and there are IPS policies that require authentication
  - Anti-Spyware is enabled on the zone and there are Anti-Spyware policies that require authentication
  - Application Control policies that require authentication apply to the source zone
  - Per-zone enforcement of SSO is set for the zone

The SSO user table is also used for user and group identification needed by security services, including Content Filtering, Intrusion Prevention, Anti-Spyware, and Application Control.

SonicWall SSO Authentication Using the SSO Agent

For users on individual Windows workstations, the SSO Agent (on the SSO workstation) handles the authentication requests from the firewall. There are six steps involved in SonicWall SSO authentication using the SSO Agent.

The SSO authentication process is initiated when user traffic passes through a firewall. For example, when a user accesses the Internet. The sent packets are temporarily blocked and saved while the firewall sends a “User Name” request and workstation IP address to the authorization agent running the SSO Agent (the SSO workstation).

The authorization agent running the SSO Agent provides the firewall with the user name currently logged into the workstation. A User IP Table entry is created for the logged in user, similarly to LDAP.

SonicWall SSO Authentication Using the Terminal Services Agent

For users logged in from a Terminal Services or Citrix server, the TSA takes the place of the SSO Agent in the authentication process. The process is different in several ways:

- The TSA runs on the same server that the user is logged into, and includes the user name and domain along with the server IP address in the initial notification to the firewall.
- Users are identified by a user number as well as the IP address (for non-Terminal Services users, there is only one user at any IP address and so no user number is used). A non-zero user number is displayed in the SonicOS NS*v* Management Interface using the format `x.x.x.x user n`, where `x.x.x.x` is the server IP address and `n` is the user number.
- The TSA sends a close notification to SonicOS NS*v* when the user logs out, so no polling occurs.

After a user has been identified, the Security Appliance queries LDAP or a local database (based on administrator configuration) to find user group memberships, match the memberships against policy, and grant or restrict access to the user accordingly. Upon successful completion of the login sequence, the saved packets are sent on. If packets are received from the same source address before the sequence is completed, only the most recent packet is saved.

User names are returned from the authorization agent running the SSO Agent in the format `<domain>/<user-name>`. For locally configured user groups, the user name can be configured to be:

- The full name returned from the authorization agent running the SSO Agent (configuring the names in the firewall local user database to match).
- A simple user name with the domain component stripped off (default).

For the LDAP protocol, the `<domain>/<user-name>` format is converted to an LDAP distinguished name by creating an LDAP search for an object of class `domain` with a `dc` (domain component) attribute that matches the domain name. If one is found, then its distinguished name is used as the directory sub-tree to search for the user’s object. For example, if the user name is returned as `SV/bob`, then a search for an object with `objectClass=domain` and `dc=SV` i performed. If that returns an object with distinguished name `dc=sv,dc=us,dc=sonicwall,dc=com`, then a search under that directory sub-tree is created for (in the Active Directory case) an object with `objectClass=user` and `sAMAccountName=bob`. If no domain object is found, then the search for the user object is made from the top of the directory tree.

When a domain object has been found, the information is saved to avoid searching for the same object. If an attempt to locate a user in a saved domain fails, the saved domain information is deleted and another search for the domain object is made.

User logout is handled slightly differently by SonicWall SSO using the SSO Agent as compared to SSO with TSA. The Security Appliance polls the authorization agent running the SSO Agent at a configurable rate to determine when a user has logged out. Upon user logout, the authentication agent running the SSO Agent sends a User Logged Out response to the firewall, confirming that the user has been logged out and terminating the SSO session. Rather than being polled by the Security Appliance, the TSA itself monitors the Terminal Services/Citrix server for logout events and notifies the Security Appliance as they occur, terminating the SSO session. For both agents, configurable inactivity timers can be set, and for the SSO Agent the user name request polling rate can be configured (set a short poll time for quick detection of logouts, or a longer polling time for less overhead on the system).

SonicWall SSO Authentication Using Browser NTLM Authentication

For users who are browsing using Mozilla-based browsers (including Internet Explorer, Firefox, Chrome, and Safari) the firewall supports identifying them through NTLM (NT LAN Manager) authentication. NTLM is part of a browser authentication suite known as “Integrated Windows Security” and is supported by all Mozilla-based browsers. NTLM allows a direct authentication request from the appliance to the browser without involving the SSO agent. NTLM is often used when a domain controller is not available, such as when the user is remotely authenticating over the Web.

NTLM Authentication is currently available for HTTP; it is not available for use with HTTPS traffic.

Browser NTLM authentication can be tried before or after the SSO agent attempts to acquire the user information. For example, if the SSO agent is tried first and fails to identify the user, then, if the traffic is HTTP, NTLM is tried.

To use this method with Linux or Mac clients as well as Windows clients, you can also enable SSO to probe the client for either **NetAPI** or **WMI**, depending on which is configured for the SSO Agent. This causes the firewall to probe for a response on the NetAPI/WMI port before requesting that the SSO Agent identify a user. If no response occurs, these devices fail SSO immediately. For a:

- Windows PC, the probe generally works (unless blocked by a personal firewall) and the SSO agent is used.
- Linux/Mac PC (assuming it is not set up to run Samba server), the probe fails, the SSO agent is bypassed, and NTLM authentication is used when HTTP traffic is sent.

NTLM cannot identify the user until they browse with HTTP, so any traffic sent before that is treated as unidentified. The default CFS policy is applied, and any rule requiring authenticated users does not allow the traffic to pass.

If NTLM is configured to be used before the SSO agent, then if HTTP traffic is received first, the user is authenticated with NTLM. If non-HTTP traffic is received first, the SSO agent is used for authentication.

How Does SSO Agent Work?

The SSO Agent can be installed on any workstation or server with a Windows domain that can communicate with clients and the firewall directly using the IP address or using a path, such as VPN. It is recommended, however, that the SSO Agent be installed on separate, standalone workstations or servers. For installation instructions for the SSO Agent, see Installing the SonicWall SSO Agent on page 89.

Multiple SSO agents are supported to accommodate large installations with thousands of users. You can configure up to eight SSO agents, each running on a dedicated, high-performance PC in your network.

ⓘ **NOTE:** When using NetAPI or WMI, one SSO Agent can support up to approximately 2500 users, depending on the performance level of the hardware that it is running on, how it is configured on the firewall, and other network-dependent factors. Depending on similar factors, when configured to read from domain controller security logs, one SSO Agent can support a much larger number of users identified through that mechanism, potentially up to 50,000+ users

The SSO Agent only communicates with clients and the firewall. The SSO Agent uses a shared key for encryption of messages between the SSO Agent and the firewall.

ⓘ **NOTE:** The shared key is generated in the SSO Agent and the key entered in the firewall during SSO configuration must match the SSO Agent-generated key exactly.

The firewall queries the SSO Agent over the default port 2258. The SSO Agent then communicates between the client and the firewall to determine the client's user ID. The SSO Agent is polled, at a rate that is configurable by the administrator, by the firewall to continually confirm a user's login status.

Logging

The SSO Agent sends log event messages to the Windows Event Log based on administrator-selected logging levels.

The firewall also logs SSO Agent-specific events in its event log:

ⓘ **NOTE:** The **Notes** field of log messages specific to the SSO Agent contain the text `<domain/user-name>, authentication by SSO Agent`. For more information about log messages, see SonicOS NS*v* *6.5 Investigate*.

User login denied - not allowed by policy rule	User has been identified but does not belong to any user groups allowed by the policy blocking the user's traffic.
User login denied - not found locally	User has not been found locally and **Allow only users listed locally** is selected in the firewall.
User login denied - SSO Agent agent timeout	Attempts to contact the SSO Agent have timed out.
User login denied - SSO Agent configuration error	SSO Agent is not properly configured to allow access for this user.
User login denied - SSO Agent communication problem	Problem communicating with the workstation running the SSO Agent.
User login denied - SSO Agent agent name resolution failed	SSO Agent is unable to resolve the user name.
SSO Agent returned user name too long	User name is too long.
SSO Agent returned domain name too long	Domain name is too long.

How Does Terminal Services Agent Work?

The TSA can be installed on any Windows Server machine with Terminal Services or Citrix installed. The server must belong to a Windows domain that can communicate with the firewall directly using the IP address or using a path, such as VPN.

For installation instructions for the TSA, refer to Installing the SonicWall Terminal Services Agent on page 89.

Topics:

- Multiple TSA Support on page 87

Multiple TSA Support

To accommodate large installations with thousands of users, firewalls are configurable for operation with multiple terminal services agents (one per terminal server). The number of agents supported depends on the model.

For all SonicWall Security Appliances, a maximum of 32 IP addresses is supported per terminal server, where the server might have multiple NICs (network interface controllers). There is no limit on users per terminal server.

Encryption of TSA Messages and Use of Session IDs

The TSA uses a shared key for encryption of messages between the TSA and the firewall when the user name and domain are contained in the message. The first open notification for a user is always encrypted, because the TSA includes the user name and domain.

ⓘ **NOTE:** The shared key is created in the TSA, and the key entered in the firewall during SSO configuration must match the TSA key exactly.

The TSA includes a user session ID in all notifications rather than including the user name and domain every time. This is efficient, secure, and allows the TSA to re-synchronize with Terminal Services users after the agent restarts.

Connections to Local Subnets

The TSA dynamically learns network topology based on information returned from the appliance and, after being learned, it does not send notifications to the appliance for subsequent user connections that do not go through the appliance. As there is no mechanism for the TSA to “unlearn” these local destinations, the TSA should be restarted if a subnet is moved between interfaces on the appliance.

Non-Domain User Traffic from the Terminal Server

The firewall has the **Allow limited access for non-domain users** setting for optionally giving limited access to non-domain users (those logged into their local machine and not into the domain), and this works for terminal services users as it does for other SSO users.

If your network includes non-Windows devices or Windows computers with personal firewalls running, select **Probe user for** and choose the radio button for either **NetAPI** or **WMI** depending on which is configured for the SSO Agent. This causes the firewall to probe for a response on the NetAPI/WMI port before requesting that the SSO Agent identify a user. If no response occurs, these devices fail SSO immediately. Such devices do not respond to, or could block, the Windows networking messages used by the SSO Agent to identify a user.

Non-User Traffic from the Terminal Server

Non-user connections are opened from the Terminal Server for Windows updates and anti-virus updates. The TSA can identify a connection from a logged-in service as being a non-user connection, and indicates this in the notification to the appliance.

To control handling of these non-user connections, an **Allow Terminal Server non-user traffic to bypass user authentication in access rules** checkbox is available in the TSA configuration on the appliance. When selected, these connections are allowed. If this checkbox is not selected, then the services are treated as local users and can be given access by selecting the **Allow limited access for non-domain users** setting and creating user accounts on the appliance with the corresponding service names.

ⓘ **NOTE:** Ping (ICMP) traffic from the TSA is recognized as non-user traffic, but not as system service traffic. Therefore, it is not allowed to bypass user authentication and is dropped after the Agent times out. To prevent ICMP traffic from being dropped, add an access rule in the **MANAGE | Policies | Rules > Access Rules** page to allow ICMP from the terminal server(s) without requiring user authentication. For further information about access rules, see *SonicOS NSv 6.5 Policies*.

How Does Browser NTLM Authentication Work?

Topics:

- NTLM Authentication of Non-Domain Users on page 88
- Credentials for NTLM Authentication in the Browser on page 88

NTLM Authentication of Non-Domain Users

With NTLM, non-domain users could be users who are logged into their PC rather than into the domain, or could be users who were prompted to enter a user name and password and entered something other than their domain credentials. In both cases, NTLM allows for distinguishing these from domain users.

If the user name matches a local user account on the firewall, then the NTLM response is validated locally against the password of that account. If successful, the user is logged in and given privileges based on that account. User group memberships are set from the local account, not from LDAP, and (as the password has been validated locally) include membership of the Trusted Users group.

If the user name does not match a local user account, the user is not logged in. The **Allow limited access for non-domain users** option does not apply for users authenticated through NTLM.

Credentials for NTLM Authentication in the Browser

For NTLM authentication, the browser either uses the domain credentials (if the user is logged into the domain), thus providing full single-sign-on functionality, or prompts the user to enter a name and password for the website being accessed (the firewall in this case). Different factors affect the browser's ability to use the domain credentials when the user is logged into the domain. These factors depend on the type of browser being used:

Internet Explorer (9.0 or above)	Uses the user's domain credentials and authenticates transparently if the website that it is logging into the firewall (the SonicWall Security Appliance) is in the local intranet, according to the Security tab in its Internet Options. This requires adding the firewall to the list of websites in the Local Intranet zone in the Internet Options. This can be done through the domain's group policy in the Site to Zone Assignment List under Computer Configuration, Administrative Templates, Windows Components, Internet Explorer, Internet Control Panel, Security Page.
Google Chrome	Behaves the same as Internet Explorer, including requiring that the firewall be added to the list of websites in the Local Intranet zone in the Internet Options.
Firefox	Uses the user's domain credentials and authenticates transparently if the website that it is logging into the firewall is listed in the **network.automatic-ntlm-auth.trusted-uris** entry in its configuration (accessed by entering **about:config** in the Firefox address bar).

Safari	Although Safari does support NTLM, it does not currently support fully transparent log on using the user's domain credentials. **NOTE:** Safari does not operate on Windows platforms.
Browsers on Non-PC Platforms	Non-PC platforms, such as Linux and Mac, can access resources in a Windows domain through Samba, but do not have the concept of "logging the PC into the domain" as Windows PCs do. Consequentially, browsers on these platforms do not have access to the user's domain credentials and cannot use them for NTLM.

When a user is not logged into the domain or the browser cannot use their domain credentials, it prompts for a name and password to be entered, or uses cached credentials if the user has previously opted to have it save them.

In all cases, should authentication fail when using the user's domain credentials (which could be because the user does not have the privileges necessary to get access), then the browser prompts the user to enter a name and password. This allows the user to enter credentials different from the domain credentials to get access.

ⓘ **NOTE:** When NTLM is enabled for Single Sign-On enforcement, an HTTP/HTTPS access rule with **Trusted Users** as **Users Allowed** must be added to the **LAN to WAN** rules in the **MANAGE | Policies > Rules > Access Rules** page (for more information, see *SonicOS NSv 6.5 Policies*). This rule triggers an NTLM authentication request to the user. Without the access rule, other configurations, such as restrictive Content Filter policies, might block the user from Internet access and prevent the authentication request.

Installing the Single Sign-On Agent and/or Terminal Services Agent

Configuring SSO is a process that includes installing and configuring the SonicWall SSO Agent and/or the SonicWall Terminal Services Agent (TSA), and configuring a firewall running SonicOS NSv to use the SSO Agent or TSA. For an introduction to SonicWall SSO, see About Single Sign-On on page 81.

Topics:

- Installing the SonicWall SSO Agent on page 89
- Installing the SonicWall Terminal Services Agent on page 89

Installing the SonicWall SSO Agent

The SonicWall SSO Agent is part of the SonicWall Directory Connector. The SonicWall SSO Agent must be installed on at least one, and up to eight, workstations or servers in the Windows domain that have access to the Active Directory server using VPN or IP. It is recommended that these workstations or servers be separate, standalone workstations or servers. The SonicWall SSO Agent must have access to your firewall.

To install the SonicWall SSO Agent, see the procedure in the *SonicWall Directory Services Connector Administration Guide*. You can download this guide from SonicWall Support.

Installing the SonicWall Terminal Services Agent

Install the SonicWall TSA on one or more terminal servers on your network within the Windows domain. The SonicWall TSA must have access to your SonicWall Security Appliance, and the Security Appliance must have access to the TSA. If you have a software firewall running on the terminal server, you might need to open up the UDP port number for incoming messages from the Security Appliance.

SonicWall TSA is available for download without charge from MySonicWall.

For instructions on installing the SonicWall TSA, see the *SonicWall Directory Services Connector Administration Guide*.

Topics:

- Accessing the SonicWall Terminal Services Agent on page 90
- Creating a SonicWall TSA Trouble Shooting Report on page 90

Accessing the SonicWall Terminal Services Agent

After installing the SonicWall TSA and restarting your Windows Server system, you can double click the SonicWall TSA desktop icon created by the installer to launch it for configuration, to generate a trouble shooting report (TSR), or to see the status and version information.

For more information, see the *SonicWall Directory Services Connector Administration Guide*.

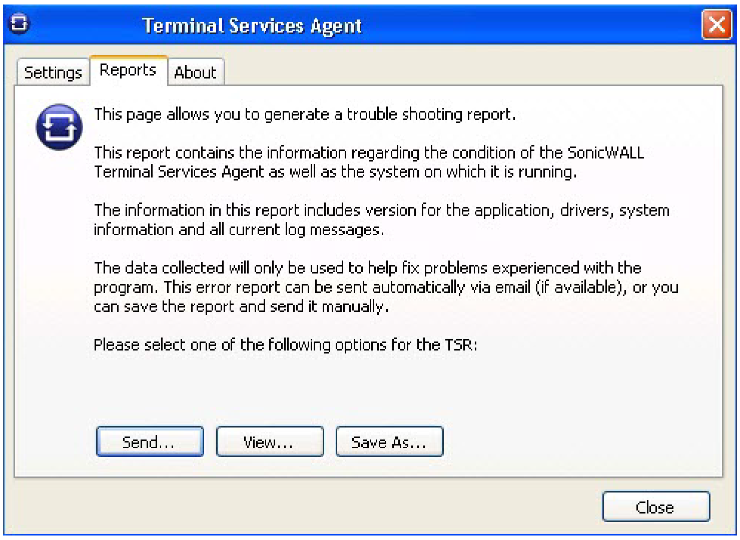
Creating a SonicWall TSA Trouble Shooting Report

You can create a trouble shooting report (TSR) containing all current log messages and information about the agent, driver, and system settings to examine or to send to SonicWall Technical Support for assistance.

To create a TSR for the SonicWall TSA:

1 Double-click the **SonicWall TSA** desktop icon. The **SonicWall Terminal Services Agent** window displays.

2 Click the **Reports** tab.



This page allows you to generate a trouble shooting report.

This report contains the information regarding the condition of the SonicWALL Terminal Services Agent as well as the system on which it is running.

The information in this report includes version for the application, drivers, system information and all current log messages.

The data collected will only be used to help fix problems experienced with the program. This error report can be sent automatically via email (if available), or you can save the report and send it manually.

Please select one of the following options for the TSR:

3 To generate the TSR and:

- Automatically email it to SonicWall Technical Support, click **Send**.
- Examine it in your default text editor, click **View**.
- Save it as a text file, click **Save As**.

4 When finished, click **Close**.

Single Sign-On Advanced Features

Topics:

- About Single Sign-On on page 91
- About the Advanced Settings on page 91
- Viewing SSO Mouseover Statistics on page 92
- Using the Single Sign-On Statistics in the TSR on page 92
- Examining the Agent on page 93
- Remedies on page 93

About Single Sign-On

When a user first tries to send traffic through a SonicWall Security Appliance that is using Single Sign-On (SSO), the Security Appliance sends a “who is this” request to SonicWall SSO Agent. The agent queries the user’s PC through Windows networking, and returns the user name to the firewall. If the user name matches any criteria set in the policies, then the user is considered as “logged on” by the SonicWall. When users are logged into the SonicWall using SSO, the SSO feature also provides detection of logouts. To detect logouts, the Security Appliance repeatedly polls the agent to check if each user is still logged in. This polling, along with the initial identification requests, could potentially result in a large loading on the SonicWall SSO Agent application and the PC on which it is running, especially when very large numbers of users are connecting.

The SonicWall SSO feature utilizes a rate-limiting mechanism to prevent the appliance from swamping the agent with these user requests. Both automatic calculations and a configurable setting on the appliance govern how this rate-limiting operates. The SonicWall SSO feature automatically calculates the maximum number of user requests contained in each message to the agent that can be processed in the poll period, based on recent polling response times. Also, the timeout on a multi-user request is automatically set to be long enough to reduce the likelihood of an occasional long timeout during polling. The configurable setting controls the number of requests to send to the agent at a time, and can be tuned to optimize SSO performance and prevent potential problems. This section provides a guide to choosing suitable settings.

The potential for problems resulting from overloading the agent can be reduced by running the agent on a dedicated high-performance PC, and possibly also by using multiple agents on separate PCs, in which case the load is shared between them. The latter option also provides redundancy in case one of the agent PCs fails. The agent should run on a Windows Server PC.

About the Advanced Settings

The **Maximum requests to send at a time** setting is available when configuring SSO agents (for more information about configuring SSO agents, see Configuring SonicOS NS*v to Use the SonicWall SSO Agent* on page 150).

This setting controls the maximum number of requests that can be sent from the appliance to the agent at the same time. The agent processes multiple requests concurrently, spawning a separate thread in the PC to handle each. Sending too many requests at a time can overload the PC on which the agent is running. If the number of requests to send exceeds the maximum, then some are placed on an internal “ring buffer” queue (see Using the Single Sign-On Statistics in the TSR on page 92 and Viewing SSO Mouseover Statistics on page 92). Requests waiting on the ring buffer for too long could lead to slow response times in SSO authentication.

This setting works in conjunction with the automatically calculated number of user requests per message to the agent when polling to check the status of logged in users. The number of user requests per message is calculated based on recent polling response times. SonicOS NS*v* adjusts this number as high as possible to minimize the number of messages that need to be sent, which reduces the load on the agent and helps reduce network traffic between the appliance and the agent. However, the number is kept low enough to allow the agent to process all of the user requests in the message within the poll period. This avoids potential problems such as timeouts and failures to quickly detect logged out users.

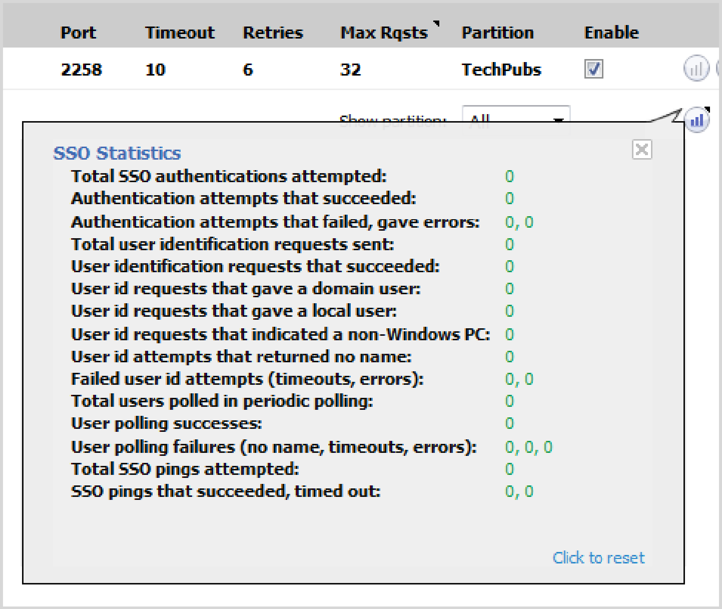
Viewing SSO Mouseover Statistics

The **SSO Authentication Configuration** dialog provides mouseover statistics about each agent and for all SSO agents. On the **SSO Agents** page, a green LED-style icon next to an agent indicates the agent is up and running. A red LED icon indicates the agent is down.

To view the statistics for:

- A particular agent, hover your mouse over the **Statistics** icon for the SSO agent.
- All SSO agents, hover your mouse over the **Statistics** icon under the table.

ⓘ | **TIP:** This also works for individual TSAs on **Terminal Services**.



Port	Timeout	Retries	Max Rqsts	Partition	Enable
2258	10	6	32	TechPubs	☑

SSO Statistics

Total SSO authentications attempted:	0
Authentication attempts that succeeded:	0
Authentication attempts that failed, gave errors:	0, 0
Total user identification requests sent:	0
User identification requests that succeeded:	0
User id requests that gave a domain user:	0
User id requests that gave a local user:	0
User id requests that indicated a non-Windows PC:	0
User id attempts that returned no name:	0
Failed user id attempts (timeouts, errors):	0, 0
Total users polled in periodic polling:	0
User polling successes:	0
User polling failures (no name, timeouts, errors):	0, 0, 0
Total SSO pings attempted:	0
SSO pings that succeeded, timed out:	0, 0

To close the statistics display, click the **Close** icon.

To clear all the displayed values, click **Click to reset**.

Using the Single Sign-On Statistics in the TSR

A rich set of SSO performance and error statistics is included in the Tech Support Report (TSR). These can be used to gauge how well SSO is performing in your installation. Download the TSR on the **INVESTIGATE | Tools > System Diagnostics** page and search for the title, SSO operation statistics. Here are the counters to look at in particular:

1. Under **SSO ring buffer statistics**, look at **Ring buffer overflows** and **Maximum time spent on ring**. If the latter approaches or exceeds the polling rate, or if any ring buffer overflows are shown, then requests are not being sent to the agent quickly enough. Also, if the **Current requests waiting on ring** is constantly increasing, that would indicate the same. This means that the **Maximum requests to send at a time** value should be increased to send requests faster. However, that increases the load on the agent, and if the agent cannot handle the additional load, then problems result, in which case it might be necessary to consider moving the agent to a more powerful PC or adding additional agents.

2. Under **SSO operation statistics**, look at **Failed user id attempts with time outs** and **Failed user id attempts with other errors**. These should be zero or close to it – significant failures shown here indicate a problem with the agent, possibly because it cannot keep up with the number of user authentications being attempted.

3. Also under **SSO operation statistics**, look at the **Total users polled in periodic polling**, **User polling failures with time outs**, and **User polling failures with other errors**. Seeing some timeouts and errors here is acceptable and probably to be expected, and occasional polling failures do not cause problems. However, the error rate should be low (an error rate of about 0.1 percent or less would be acceptable). Again, a high failure rate here would indicate a problem with the agent, as above.

4. Under **SSO agent statistics**, look at the **Avg user ID request time** and **Avg poll per-user resp time**. These should be in the region of a few seconds or less – something longer indicates possible problems on the network. Note, however, that errors caused by attempting to authenticate traffic from non-Windows PCs through SSO (which can take a significantly long time) can skew the **Avg user ID request time** value, so if this is high but **Avg poll per-user resp time** looks correct, that would indicate the agent is probably experiencing large numbers of errors, likely caused by attempting to authenticate non-Windows devices – see Step 6.

5. If using multiple agents, then also under **SSO agent statistics** look at the error and timeout rates reported for the different agents, and also their response times. Significant differences between agents could indicate a problem specific to one agent that could be addressed by upgrading or changing settings for that agent in particular.

6. Traffic from devices other than PCs can trigger SSO identification attempts and that can cause errors and/or timeouts to get reported in these statistics. This can be avoided by configuring an address object group with the IP addresses of such devices, and doing one or both of the following:

   - If using Content Filtering, select that address object with the **Bypass the Single Sign On process for traffic from** setting on the **Enforcement** tab of the SSO configuration dialog.
   - If access rules are set to allow only authenticated users, set separate rules for that address object with **Users Allowed** set to **All**.

   To identify the IP addresses concerned, look in the TSR and search for “IP addresses held from SSO attempts”. This lists SSO failures in the preceding period set by the **Hold time after failure** setting.

   ⓘ **NOTE:** If any of the listed IP addresses are for are Mac/Linux PCs, see Accommodating Mac and Linux Users on page 94.

   To limit the rate of errors caused by this, you can also extend the **Hold time after failure** setting on the **Users** tab.

Examining the Agent

If the statistics in the TSR report indicate a possible problem with the agent, a good next step would be to run Windows Task Manager on the PC on which the agent is running and look at the CPU usage on the **Performance** tab, plus the CPU usage by the `CIAService.exe` process on the **Processes** tab. If the latter is using a large percentage of the CPU time and the CPU usage is spiking close to 100 percent, this is an indication that the agent is getting overloaded. To try to reduce the loading, you can decrease the **Maximum requests to send at a time** setting; see Using the Single Sign-On Statistics in the TSR, Step 1.

Remedies

If the settings cannot be balanced to avoid overloading the agent’s PC while still being able to send requests to the agent fast enough, then one of the following actions should be taken:

- Consider reducing the polling rate configured in the **Users** section of the **SSO Authentication** dialog by increasing the poll time. This reduces the load on the agent, at the cost of detecting logouts less quickly.

  ⓘ **NOTE:** In an environment with shared PCs, it is probably best to keep the poll interval as short as possible to avoid problems that could result from not detecting logouts when different users use the same PC, such as the initial traffic from the second user of a PC possibly being logged as sent by the previous user.

- Move the agent to a higher-performance, dedicated PC.
- Configure an additional agent or agents.

Configuring Access Rules

Enabling SonicWall SSO affects policies on the **MANAGE | Policies | Rules > Access Rules** page of the SonicOS NS*v* Management Interface. Rules set under **MANAGE | Policies | Rules > Access Rules** are checked against the user group memberships returned from a SSO LDAP query, and are applied automatically.

Topics:

Automatically Generated Rules for SonicWall SSO

When a SonicWall SSO agent or TSA is configured in the SonicOS NS*v* Management Interface, an access rule and corresponding NAT policy are created to allow the replies from the agent into the LAN. These rules use either a **SonicWall SSO Agents** or **SonicWall Terminal Services Agents** address group object, which has a member address object for each configured agent. The member address objects are automatically added to and deleted from the group object as agents are added or deleted. The member address objects are also updated automatically as an agent's IP address changes, including when an IP address is resolved through DNS (where an agent is given by DNS name).

If SonicWall SSO agents or TSAs are configured in different zones, the access rule and NAT policy are added to each applicable zone. The same **SonicWall SSO Agents** or **SonicWall Terminal Services Agents** address group is used in each zone.

ⓘ **NOTE:** Do not enable Guest Services in the same zone where SonicWall SSO is being used. Enabling Guest Services disables SSO in that zone, causing users who have authenticated through SSO to lose access. Create a separate zone for Guest Services.

Accommodating Mac and Linux Users

Mac and Linux systems do not support the Windows networking requests that are used by the SonicWall SSO agent, but can use Samba 3.5 or newer to work with SonicWall SSO.

Using SSO on Mac and Linux With Samba

For Windows users, SonicWall SSO is used by a Security Appliance to automatically authenticate users in a Windows domain. It allows the users to get access through the Security Appliance with correct filtering and policy compliance without the need to identify themselves through any additional login process after their Windows domain login.

Samba is a software package used by Linux/UNIX or Mac machines to give their users access to resources in a Windows domain (through Samba's `smbclient` utility) and/or to give Windows domain users access to resources on the Linux or Mac machine (through a Samba server).

A user working on a Linux PC or Mac with Samba in a Windows domain can be identified by SonicWall SSO, but it requires proper configuration of the Linux/Mac machine, the SSO Agent, and possibly some reconfiguration of the appliance. For example, the following configuration is necessary:

- To use SonicWall SSO with Linux/Mac users, the SonicWall SSO Agent must be configured to use **NetAPI** rather than **WMI** to get the user login information from the user's machine.
- For Samba to receive and respond to the requests from the SonicWall SSO Agent, it must be set up as a member of the domain and the Samba server must be running and properly configured to use domain authentication.

SonicWall SSO is supported by Samba 3.5 or newer.

ⓘ **NOTE:** If multiple users log into a Linux PC, access to traffic from that PC is granted based on the most recent login.

Using SSO on Mac and Linux Without Samba

Without Samba, Mac and Linux users can still get access, but you need to log in to the firewall to do so. This can cause the following problems:

- Traffic from Mac or Linux systems might keep triggering SSO identification attempts unless the user logs in. This could potentially be a performance overhead to the SSO system if there are a large number of such systems, although the effect would be somewhat mitigated by the "hold after failure" timeout.
- If per-user Content Filtering (CFS) policies are used without policy rules with user level authentication, the default CFS policy is applied to users of Mac and Linux systems unless they manually log in first.
- If policy rules are set requiring user level authentication, Web browser connections from users of Mac and Linux systems are redirected to the login page after the SSO failure, but the failure might initiate a timeout that would cause a delay for the user.

To avoid these problems, the **Don't invoke Single Sign On to Authenticate Users** option is available when configuring access rules on the **MANAGE | Policies** > **Rules > Access Rules** page (for more information about configuring access rules, see SonicOS NS*v 6.5 Policies*). This option is visible only when SonicWall SSO is enabled. If this option is selected, SSO is not attempted for traffic that matches the rule, and unauthenticated HTTP connections that match it are directed straight to the login page. Typically, the **Source** drop-down menu would be set to an address object containing the IP addresses of Mac and Linux systems.

In the case of CFS, a rule with this option enabled can be added "in front of" CFS so that HTTP sessions from Mac and Linux systems are automatically redirected to log in, avoiding the need for these users to log in manually.

ⓘ **NOTE:** Do not select the **Don't invoke Single Sign On to Authenticate Users** option for use with devices that are allowed to bypass the user authentication process entirely. Any devices that could be affected by an access rule when this option is enabled must be capable of logging in manually. A separate access rule should be added for such devices, with **Users Allowed** set to **All**.

Allowing ICMP Pings from a Terminal Server

In Windows, outgoing ICMP pings from users on the Terminal Server are not sent through a socket, so they are not seen by the TSA, and consequentially, the Security Appliance receives no notifications for them. Therefore, if firewall rules are using user-level authentication and pings are to be allowed through, you must create separate access rules to allow them from All.

About Access Rules

Access rules provide you with the ability to control user access. Rules set from the **MANAGE | Policies > Rules > Access Rules** page are checked against the user group memberships returned from a SSO LDAP query, and are applied automatically. Access rules are network management tools that allow you to define inbound and outbound access policy, configure user authentication, and enable remote management of the Security Appliance. The **MANAGE | Policies | Rules > Access Rules** page provides a sortable access rule management interface.

ⓘ **NOTE:** More specific policy rules should be given higher priority than general policy rules. The general specificity hierarchy is source, destination, service. User identification elements, for example, user name and corresponding group permissions, are not included in defining the specificity of a policy rule.

By default, the firewall's stateful packet inspection allows all communication from the LAN to the Internet, and blocks all traffic to the LAN from the Internet.

Additional network access rules can be defined to extend or override the default access rules. For example, access rules can be created that block certain types of traffic such as IRC from the LAN to the WAN, or allow certain types of traffic, such as Lotus Notes database synchronization, from specific hosts on the Internet to specific hosts on the LAN, or restrict use of certain protocols such as Telnet to authorized users on the LAN.

△ **CAUTION: The ability to define network access rules is a powerful tool. Using custom access rules can disable firewall protection or block all access to the Internet. Use caution when creating or deleting network access rules.**

For detailed information about access rules, see *SonicOS NSv 6.5 Policies*.

Managing SonicOS NS*v* with HTTP Login from a Terminal Server

The SonicWall Security Appliance normally grants access through policies based on authentication credentials supplied through an HTTP login for one user at an IP address. For users on a terminal server, this method of authenticating one user per IP address is not possible. However, HTTP login is still allowed from a terminal server only for the purpose of administration of the appliance, subject to the following limitations and requirements:

- Internet access from the terminal server is controlled from the TSA, and HTTP login does not override that — a user on a terminal server is not granted any access through the Security Appliance based on credentials supplied through an HTTP login.
- HTTP login from a terminal server is allowed only for the built-in **admin** account and other user accounts with administrator privileges. An attempt to log in with a non-administrative account fails with the error, `Not allowed from this location`.
- On successful HTTP login, an administrative user is taken straight to the Management Interface. The small **User Login Status** page is not displayed.
- The administrative user account used for HTTP login from the terminal server does not need to be the same user account that was used for login to the terminal server. It is shown on the Security Appliance as an entirely separate login session.
- Only one user at a time can manage the Security Appliance from a given terminal server. If two users attempt to do so simultaneously, the most recently logged in user takes precedence, and the other user sees the error, `This is not the browser most recently used to log in`.
- On a failure to identify a user caused by communication problems with the TSA, an HTTP browser session is not redirected to the Web login page (as happens on a failure in the SSO case). Instead, it goes to a new page with the message, `The destination that you were trying to reach is temporarily unavailable due to network problems`.

Viewing and Managing SSO User Sessions

Topics:

Logging Out SSO Users

The **MONITOR | Current Status > User Sessions > Active Users** page displays user sessions on the Security Appliance. For information about viewing the user's settings and how to log out users, see *SonicOS NSv 6.5 Monitoring*.

ⓘ **NOTE:** Changes in a user's settings, configured under **MANAGE | System Setup | Users > Settings**, are not reflected during that user's current session; you must manually log the user out for changes to take effect. The user is transparently logged in again, with the changes reflected.

Configuring Additional SSO User Settings

The **MANAGE | System Setup | Users > Settings** page provides configuration options for user session settings, global user settings, and acceptable use policy settings, in addition to SSO and other user login settings.

The options to limit user sessions under **User Session** apply to users logged in using SSO. SSO users are logged out according to session limit settings, but are automatically and transparently logged back in when they send further traffic.

ⓘ **NOTE:** Do not set the login session limit interval too low. This could potentially cause performance problems, especially for deployments with many users.

Changes applied in the **Users > Settings** page during an active SSO session are not reflected during that session.

ⓘ **TIP:** You must log the user out for changes to take effect. The user is immediately and automatically logged in again, with the changes made.

Viewing SSO and LDAP Messages with Packet Monitor

The Packet Monitor feature available on **Investigate | Tools > Packet Monitor** provides options to enable capture of decrypted messages to and from the SSO agent, and decrypted LDAP over TLS (LDAPS) messages. For further information, see *SonicOS NSv 6.5 Investigate*.

Capturing SSO Messages

For further information about using the Packet Monitor, see *SonicOS NSv 6.5 Investigate*.

To capture decrypted messages to or from the SSO authentication agent:

1 Navigate to **INVESTIGATE | Tools > Packet Monitor**.

2 Under the **Hex Dump** section, click **CONFIGURE**. The **Packet Monitor Configuration** dialog displays.

3 Click **Advanced Monitor Filter.**

4 Select **Monitor intermediate Packets**.

5. Select **Monitor intermediate decrypted Single Sign On agent messages**.
6. Click **OK**.

The packets are marked with **(sso)** in the ingress/egress interface field. They have dummy Ethernet, TCP, and IP headers, so some values in these fields might not be correct.

This enables decrypted SSO packets to be fed to the Packet Monitor, but any monitor filters are still applied to them.

Captured SSO messages are displayed fully decoded on the **Tools > Packet Monitor** page.

Capturing LDAP Over TLS Messages

To capture decrypted LDAP over TLS (LDAPS) packets:

1. Navigate to **INVESTIGATE | Tools > Packet Monitor**.
2. Under the **Hex Dump** section, click **CONFIGURE**. The **Packet Monitor Configuration** dialog displays.
3. Click **Advanced Monitor Filter.**
4. Select **Monitor intermediate Packets**.
5. Select **Monitor intermediate decrypted LDAP over TLS packets**.
6. Click **OK**.

The packets are marked with (**ldp**) in the ingress/egress interface field. They have dummy Ethernet, TCP, and IP headers, so some values in these fields might not be correct. The LDAP server port is set to 389 so that an external capture analysis program (such as Wireshark) knows to decode these packets as LDAP. Passwords in captured LDAP bind requests are obfuscated. The LDAP messages are not decoded in the Packet Monitor display, but the capture can be exported and displayed in WireShark to view them decoded.

This enables decrypted LDAPS packets to be fed to the packet monitor, but any monitor filters are still applied to them.

> **NOTE:** LDAPS capture only works for connections from the firewall’s LDAP client, and does not display LDAP over TLS connections from an external LDAP client that pass through the firewall.

About Multiple Administrator Support

You can configure multiple administrator profiles, as described in Configuring Local Users and Groups on page 204.

When using LDAP authentication, if you want to ensure that some or all administrative users are always able to manage the appliance, even when the LDAP server becomes unreachable, then you can use the **LDAP + Local Users** option and configure the accounts for those particular users locally.

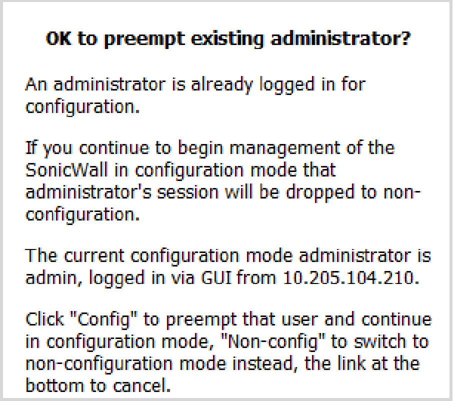
For users authenticated by LDAP, create user groups named **SonicWall Administrators** and/or **SonicWall Read-Only Admins** on the LDAP server (or its back-end) and assign the relevant users to those groups.

Topics:

- Preempting Administrators on page 99
- Logging In with Administrator Rights on page 99

Preempting Administrators

When an administrator attempts to log in while another administrator is logged in, this message is displayed:



OK to preempt existing administrator?

An administrator is already logged in for configuration.

If you continue to begin management of the SonicWall in configuration mode that administrator's session will be dropped to non-configuration.

The current configuration mode administrator is admin, logged in via GUI from 10.205.104.210.

Click "Config" to preempt that user and continue in configuration mode, "Non-config" to switch to non-configuration mode instead, the link at the bottom to cancel.

This message gives you three options:

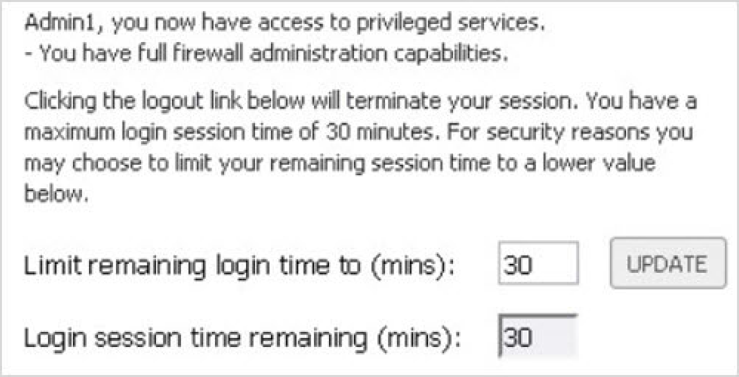
Config	Preempts the current administrator. The current administrator is dropped to non-config mode and you are given full administrator access.
Non-config	You are logged into the SonicWall Security Appliance in non-config mode. The current administrator's session is not disturbed.
do not begin management	Returns to the login screen.

Logging In with Administrator Rights

A user other than admin (that is, not the **admin** user) can log in with administrator rights.

To log in with Administrator rights:

1 Log in with your administrator credentials. The **User Login Status** message displays.



Admin1, you now have access to privileged services.
- You have full firewall administration capabilities.

Clicking the logout link below will terminate your session. You have a maximum login session time of 30 minutes. For security reasons you may choose to limit your remaining session time to a lower value below.

Limit remaining login time to (mins): 30

Login session time remaining (mins): 30

2 To

- Go to the SonicWall management interface, click **MANAGE**. You are prompted to enter your password again. This is a safeguard to protect against unauthorized access when administrators are away from their computers and do not log out of their sessions.
- Change your password click **CHANGE PASSWORD**. The dialog for changing your password displays.

Disabling the User Login Status Popup

You can disable the **User Login Status** popup, if you prefer to allow certain users to log in solely for the purpose of managing the SonicWall Security Appliance, rather than for privileged access through the Security Appliance. To disable the popup, select the **Members go straight to the management UI on web login** option when adding or editing the local group.

If you want some user accounts to be administrative only, while other users need to log in for privileged access through the appliance, but also with the ability to administer it (that is, some go straight to the management interface on login, while others get the **User Login Status** popup dialog with a **MANAGE** button), this can be achieved by:

1. Creating a local group with the **Members go straight to the management UI on web login** option selected.
2. Adding the group to the relevant administrative group, but do not select this option in the administrative group.
3. Adding those user accounts that are to be administrative-only to the new user group. The **User Login Status** popup is disabled for these users.
4. Adding the user accounts that are to have privileged and administrative access directly to the top-level administrative group.

Configuring Multiple Administrator Support

Topics:

- Configuring Additional Administrator User Profiles on page 100
- Configuring Administrators Locally when Using LDAP on page 100
- Preempting Administrators on page 99
- Logging In with Administrator Rights on page 99
- Verifying Multiple Administrators Support Configuration on page 101
- Viewing Multiple Administrator Related Log Messages on page 101

Configuring Additional Administrator User Profiles

Configuring additional administrators is the same as configuring additional local users and then adding them to the proper local group:

This group	Gives the user
Limited Administrators	Limited administrator configuration privileges.
SonicWall Administrators	Full administrator configuration privileges.
SonicWall Read-Only Admins	Viewing privileges only for the entire Management Interface.

For how to configure local users and local groups, see Configuring Local Users and Groups on page 204.

Configuring Administrators Locally when Using LDAP

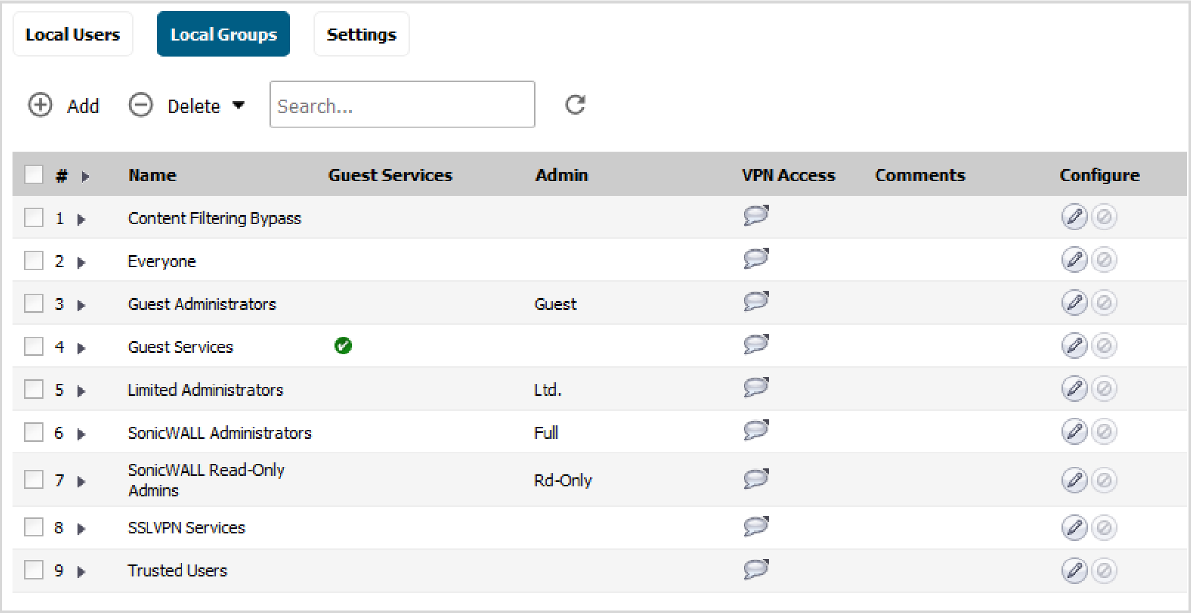
When using LDAP authentication, if you want to ensure that some or all administrative users are always able to manage the SonicWall Security Appliance, even if the LDAP server becomes unreachable, then you can use the **LDAP + Local Users** option and configure the accounts for those particular users locally.

For users authenticated by LDAP, create user groups named **SonicWall Administrators** and/or **SonicWall Read-Only Admins** on the LDAP server (or its back-end) and assign the relevant users to those groups.

For how to configure administrators when using LDAP, see Configuring Local Users and Groups on page 204.

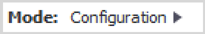
Verifying Multiple Administrators Support Configuration

User accounts with administrator and read-only administrators can be viewed on the **MANAGE | System Setup > Users > Local Users & Groups > Local Groups** page.



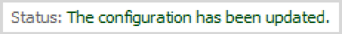
□	#	Name	Guest Services	Admin	VPN Access	Comments	Configure
□	1	Content Filtering Bypass					
□	2	Everyone					
□	3	Guest Administrators		Guest			
□	4	Guest Services	✓				
□	5	Limited Administrators		Ltd.			
□	6	SonicWALL Administrators		Full			
□	7	SonicWALL Read-Only Admins		Rd-Only			
□	8	SSLVPN Services					
□	9	Trusted Users					

You can determine which configuration mode you are in by looking at **Mode** in the top right corner of the Management Interface:

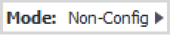


Mode: Configuration ▶

When changes are made, the status bar reads:

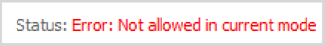


Status: The configuration has been updated.



Mode: Non-Config ▶

When changes are attempted, the status bar reads:



Status: Error: Not allowed in current mode

Viewing Multiple Administrator Related Log Messages

Log messages are generated for these events:

- A SonicOS web management or CLI user begins configuration mode (including when an admin logs in).
- A SonicOS web management or CLI user ends configuration mode (including when an admin logs out).
- A SonicOS web management user begins management in non-config mode (including when an admin logs in and when a user in configuration mode is preempted and dropped back to read-only mode).
- A SonicOS web management user begins management in read-only mode.

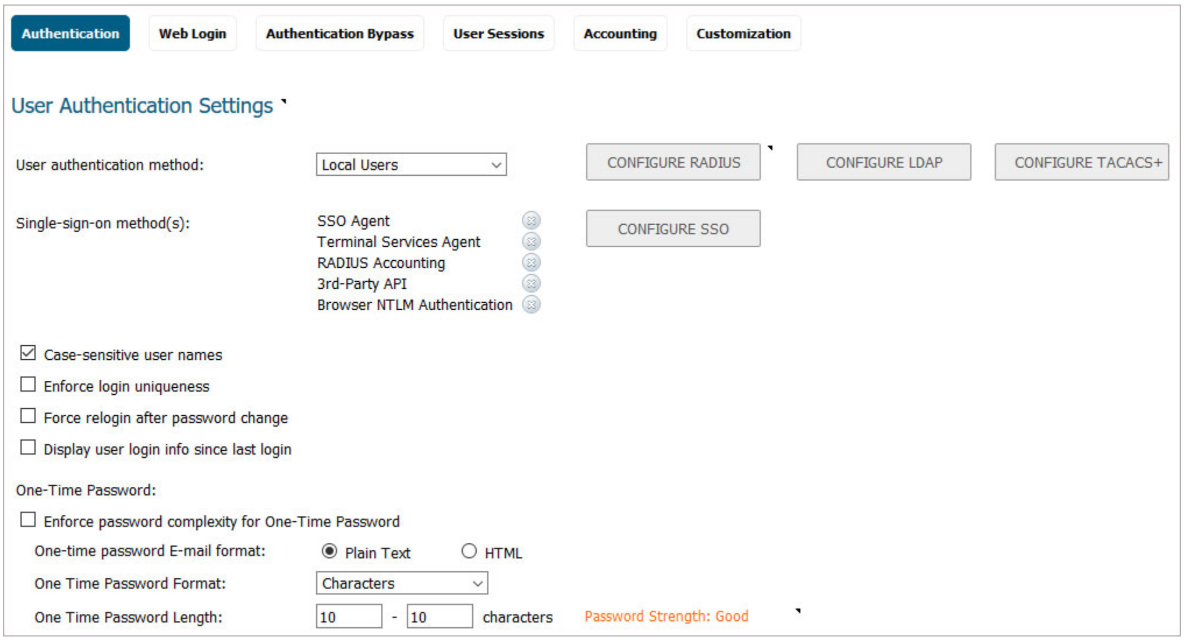
A SonicOS web management user terminates either of the above management sessions (including when an admin logs out).

8

Configuring Settings for Managing Users

Topics:

Users > Settings



User Authentication Settings

User authentication method: Local Users

Single-sign-on method(s): SSO Agent, Terminal Services Agent, RADIUS Accounting, 3rd-Party API, Browser NTLM Authentication

☑ Case-sensitive user names

□ Enforce login uniqueness

□ Force relogin after password change

□ Display user login info since last login

One-Time Password:

□ Enforce password complexity for One-Time Password

One-time password E-mail format: ● Plain Text ○ HTML

One Time Password Format: Characters

One Time Password Length: 10 - 10 characters Password Strength: Good

On **MANAGE | System Setup > Users > Settings**, you can configure the authentication method required, global user settings, and an acceptable user policy that is displayed to users when logging onto your network.

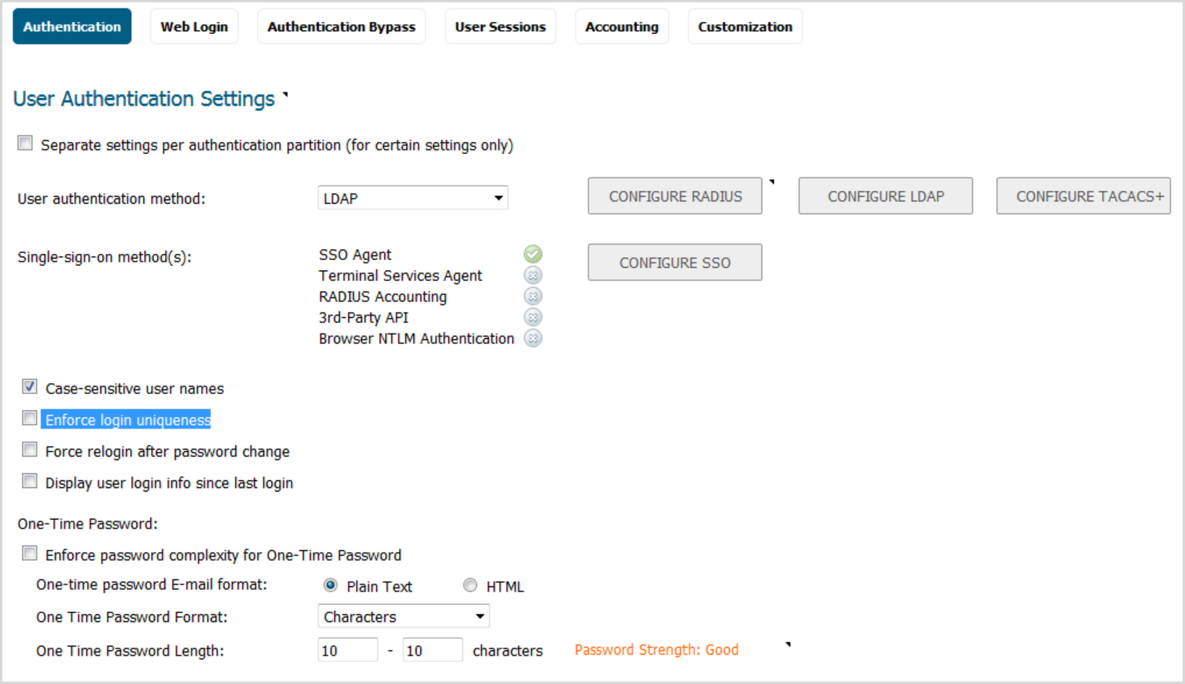
Topics:

Configuring User Authentication and Login Settings

ⓘ **IMPORTANT:** When you have finished configuring the **MANAGE | System Setup | Users > Settings** page, click **ACCEPT**.

Topics:

User Authentication Settings



User Authentication Settings

□ Separate settings per authentication partition (for certain settings only)

User authentication method: LDAP

Single-sign-on method(s):
SSO Agent ✓
Terminal Services Agent
RADIUS Accounting
3rd-Party API
Browser NTLM Authentication

☑ Case-sensitive user names

□ Enforce login uniqueness

□ Force relogin after password change

□ Display user login info since last login

One-Time Password:

□ Enforce password complexity for One-Time Password

One-time password E-mail format: ● Plain Text ○ HTML

One Time Password Format: Characters

One Time Password Length: 10 - 10 characters Password Strength: Good

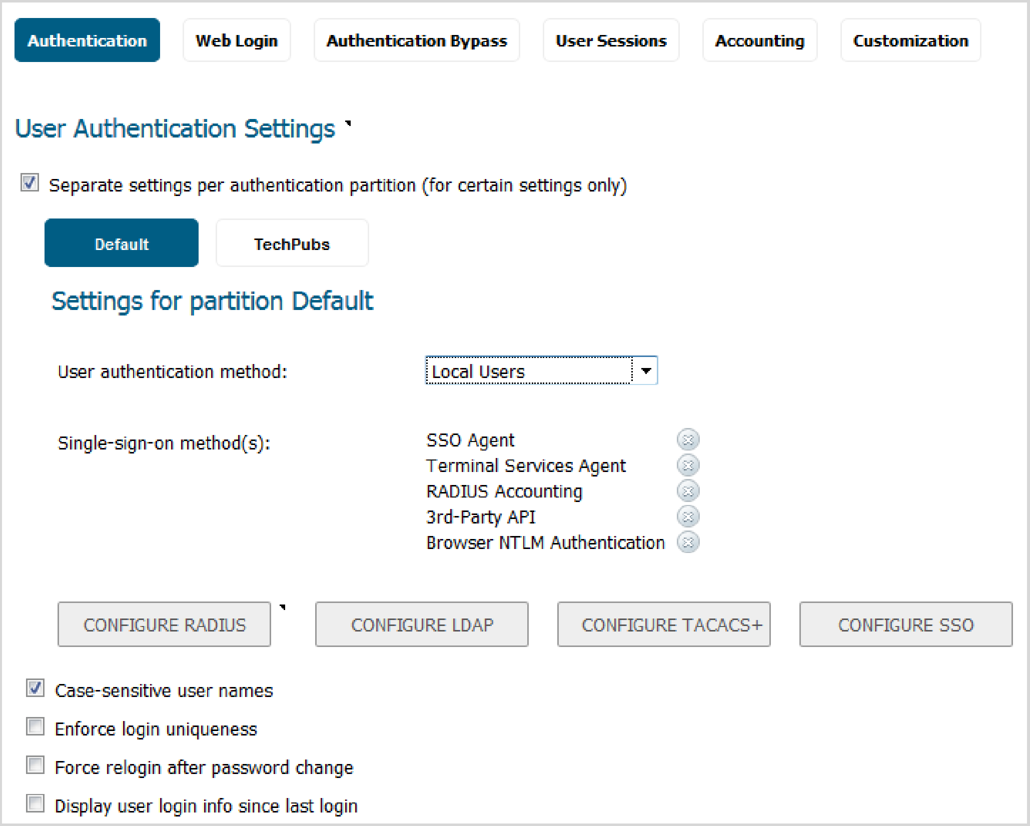
To configure user authentication settings:

1 Navigate to **MANAGE | System Setup > Users > Settings**.

2 If partitioning is:

- Not enabled, go to Step 4.

- Enabled, the **Separate settings per authentication partition (for certain settings only)** option displays. Select the option. the **Settings for partition** options display.



User Authentication Settings

☑ Separate settings per authentication partition (for certain settings only)

Settings for partition Default

User authentication method: Local Users

Single-sign-on method(s): SSO Agent, Terminal Services Agent, RADIUS Accounting, 3rd-Party API, Browser NTLM Authentication

☑ Case-sensitive user names

□ Enforce login uniqueness

□ Force relogin after password change

□ Display user login info since last login

3 For each partition, perform Step 4 onward.

4 From **User Authentication method**, select the type of user account management your network uses:

Local Users To configure users in the local database in the Security Appliance using the **MANAGE | System Setup > Users > Local Users & Groups** page.

For information about using the local database for authentication and detailed configuration instructions, see these sections, see Using Local Users and Groups for Authentication on page 75.

RADIUS You have more than 1,000 users or want to add an extra layer of security for authenticating the user to the Security Appliance. If you select RADIUS for user authentication, users must log into the Security Appliance using HTTPS to encrypt the password sent to the Security Appliance. If a user attempts to log into the Security Appliance using HTTP, the browser is automatically redirected to HTTPS.

RADIUS might be required in addition to LDAP in a number of cases:

- LDAP does not usually support CHAP/MS-CHAP authentication (Microsoft Active Directory and Novell eDirectory do not), so the SonicWall authenticates CHAP/MS-CHAP through RADIUS if that is the case and RADIUS is configured.
- If NTLM is used for SSO, it can only be authenticated through RADIUS in MS-CHAP mode.

RADIUS might be required for CHAP/MS-CHAP with VPN or SSL VPN clients, including NetExtender and Portal, or if it might be required for NTLM.

NOTE: LDAP is generally still used for non-CHAP authentications when RADIUS is used for CHAP.

For information about using a RADIUS database for authentication, see Using LDAP/Active Directory/eDirectory Authentication on page 77.

For detailed configuration instructions, see Configuring RADIUS Authentication on page 127.

RADIUS + Local Users You want to use both RADIUS and the Security Appliance local user database for authentication.

LDAP You use a Lightweight Directory Access Protocol (LDAP) server, Microsoft Active Directory (AD) server, or Novell eDirectory to maintain all your user account data.

For information about using an LDAP database for authentication, see Using LDAP/Active Directory/eDirectory Authentication on page 77.

For detailed configuration instructions, see Integrating LDAP into the SonicWall Security Appliance on page 79.

LDAP + Local Users You want to use both LDAP and the Security Appliance local user database for authentication.

TACACS + You want to use TACACS + (Terminal Access Controller Access-Control System latest generation) for user authentication.

TACACS + + Local User You want to use both TACACS + and the Security Appliance's local user database for authentication.

5 For **Single-sign-on method**, select one of the following:

ⓘ | **NOTE:** Do not select any of these options if you are not using Single Sign-On to authenticate users.

SSO Agent You are using Active Directory for authentication and the SSO Agent is installed on a computer in the same domain. For detailed SSO configuration instructions, see About Single Sign-On on page 91.

Terminal Services Agent You are using Terminal Services and the Terminal Services Agent (TSA) is installed on a terminal server in the same domain.

RADIUS Accounting You want a network access server (NAS) to send user login session accounting messages to an accounting server.

3rd Party API You want to use a third-party API.

Browser NTLM authentication only You want to authenticate Web users without using the SSO Agent or TSA. Users are identified as soon as they send HTTP traffic. NTLM requires RADIUS to be configured (in addition to LDAP, if using LDAP), for access to MSCHAP authentication. If LDAP is selected above, a separate **CONFIGURE** for RADIUS appears here when NTLM is selected.

6 Select **Case-sensitive user names** to enable matching based on capitalization of user account names.

7 Select **Enforce login uniqueness** to prevent the same user name from being used to log into the network from more than one location at a time. This option applies to both local users and RADIUS/LDAP users, but it does not apply to the default administrator with the username, **admin**. This option is not selected by default.

8 To make users log in after changing their passwords, select **Force relogin after password change**. This option is not selected by default.

9 To display user login information since the last log in on the **MONITOR | Current Status > System Status** page, select **Display user login info since last login**. This option is not selected by default.

If this option is enabled, user login information—including last successful login timestamp, number of all user successful login attempts, unsuccessful login attempts, and administrator privilege changes—are displayed in **INVESTIGATE | Logs > Event Logs**. For more information about logs, see *SonicOS NSv 6.5 Investigate*.

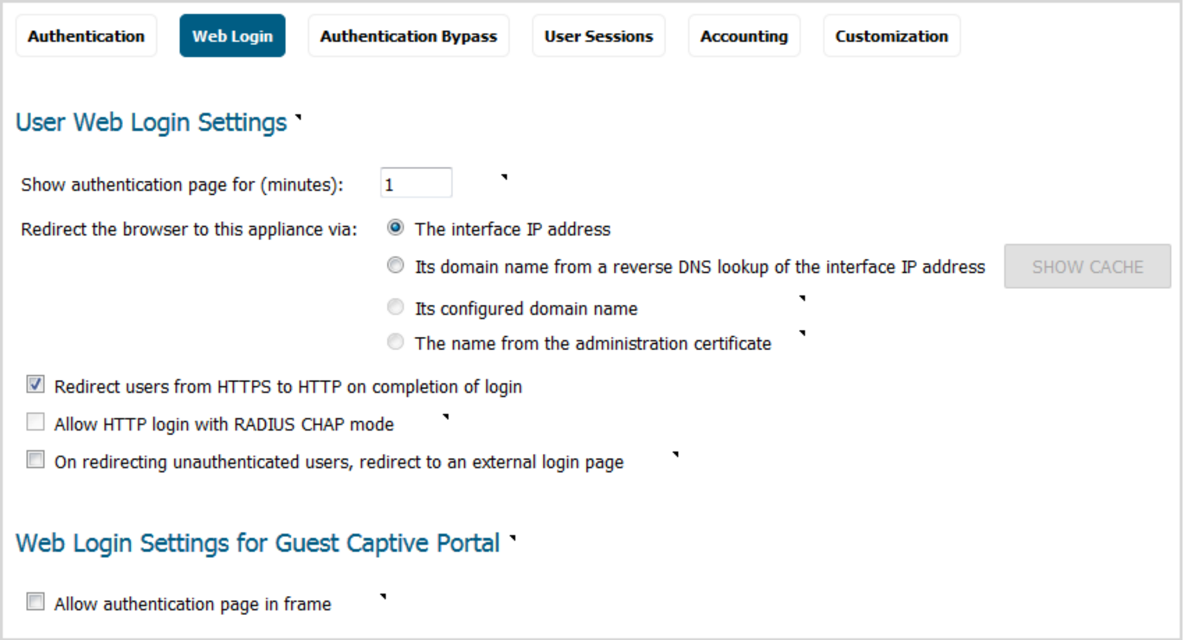
10 Configure the following **One-Time Password** options:

- **One-time password Email format** – Select either **Plain text** or **HTML**.
- **One Time Password Format** – Select **Characters** (default), **Characters+Numbers**, or **Numbers** from the drop-down menu.

  > **TIP:** The format selection along with the two values for password length result in a password strength of Poor, Good, or Excellent. The strongest passwords have long lengths and either **Characters** or **Characters+Numbers** format; The weakest password strength is the **Numbers** format regardless of length.

- At **One Time Password Length**, enter the minimum length in the first field and the maximum length in the second field. The minimum and maximum must be within the range of 4 to 14, with a default value of **10** for each field. The minimum length cannot be greater than the maximum length.

User Web Login Settings



User Web Login Settings

Show authentication page for (minutes): 1

Redirect the browser to this appliance via:
● The interface IP address
○ Its domain name from a reverse DNS lookup of the interface IP address
○ Its configured domain name
○ The name from the administration certificate

☑ Redirect users from HTTPS to HTTP on completion of login

□ Allow HTTP login with RADIUS CHAP mode

□ On redirecting unauthenticated users, redirect to an external login page

Web Login Settings for Guest Captive Portal

□ Allow authentication page in frame

To configure user web login settings:

1 Navigate to **MANAGE | System Setup | Users > Settings**.

2 Click **Web Login**.

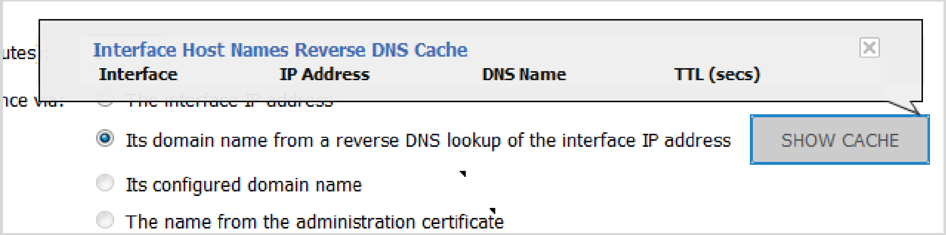
3 In the **Show user authentication page for (minutes)** field, enter the number of minutes that users have to log in with their username and password before the login page times out. If it times out, a message displays informing them what they must do before attempting to log in again. The default time is **1** minute.

While the login authentication page is displayed, it uses system resources. By setting a limit on how long a login can take before the login page is closed, you free up those resources.

4 From **Redirect the browser to this appliance via**, choose the option that determines how a user's browser is initially redirected to the SonicWall appliance's Web server:

- **The interface IP address** – Select this to redirect the browser to the IP address of the appliance Web server interface. This option is selected by default.
- **Its domain name from a reverse DNS lookup of the interface IP address** – Enables **Show Cache** which, when clicked, displays the appliance Web server's Interface, IP Address, DNS Name, and TTL (in seconds). This option is not selected by default.

  Click **Show Cache** to verify the domain name (DNS name) being used for redirecting the user's browser.



utes
Interface Host Names Reverse DNS Cache
Interface
IP Address
DNS Name
TTL (secs)
nce via:
○ The interface IP address
● Its domain name from a reverse DNS lookup of the interface IP address
SHOW CACHE
○ Its configured domain name
○ The name from the administration certificate

- **Its configured domain name** – Select to enable redirecting to a domain name configured on **MANAGE | System Setup | Appliance > Base Settings**. Redirecting to the name from the administration certificate is allowed when an imported certificate has been selected for HTTPS web management on that page.

  ⓘ **NOTE:** This option is available only if a domain name has been specified on **System Setup | Appliance > Base Settings**. Otherwise, this option is dimmed.

- **The name from the administration certificate** – Select to enable redirecting to a domain name with a properly signed certificate. Redirecting to the name from this administration certificate is allowed when an imported certificate has been selected for HTTPS web management on that page. Configure the domain name on **MANAGE | System Setup | Appliance > Base Settings**.

  ⓘ **NOTE:** This option is available only if a certificate has been imported for HTTPS management in the **Web Management Settings** section of **MANAGE | System Setup | Appliance > Base Settings**. See Configuring Base Settings on page 15.

  ⓘ **TIP:** If you are using imported administration certificates, use this option. If you are not going to use an administration certificate, select the **Its configured domain name** option.

  To do HTTPS management without the browser displaying invalid-certificate warnings, you need to import a certificate properly signed by a certification authority (administration certificate) rather than use the internally generated self-signed one. This certificate must be generated for the appliance and its host domain name. A properly signed certificate is the best way to obtain an appliance's domain name.

  If you use an administration certificate, then to avoid certificate warnings, the browser needs to redirect to that domain name rather than to the IP address. For example, if you browse the Internet and are redirected to log in at `https://gateway.SonicWall.com/auth.html`, the administration certificate on the appliance says that the appliance really is `gateway.SonicWall.com`, so the browser displays the login page. If you are redirected to `https://10.0.02/auth.html`, however, even though the certificate says it is `gateway.SonicWall.com`, the browser has no way to tell if that is correct, so it displays a certificate warning instead.

5 Select **Redirect users from HTTPS to HTTP on completion of login** if you want users to be connected to the network through your Security Appliance through HTTP after logging in through HTTPS. If you have a

large number of users logging in through HTTPS, you might want to redirect them to HTTP, because HTTPS consumes more system resources than HTTP. This option is selected by default. If you deselect this option, a warning dialog displays.

6 Select **Allow HTTP login with RADIUS CHAP mode** to have a CHAP challenge be issued when a RADIUS user attempts to log in using HTTP. This allows for a secure connection without using HTTPS. Be sure to check that the RADIUS server supports this option. This option is not selected by default.

> **NOTE:** If you log in using this method, you are restricted in the management operations you can perform because some operations require the appliance to know the administrator's password; with CHAP authentication by a remote authentication server, the appliance does not know the password.
>
> If this setting is checked, therefore, any users who are members of administrative user groups might need to manually log in through HTTPS if logging in for administration. This restriction does not apply to the built-in **admin** account.

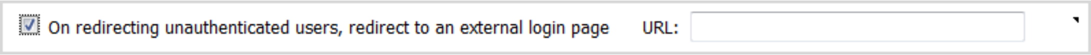
> **NOTE:** When using LDAP, this mechanism can normally be used by setting the **Authentication method for login** to **RADIUS** and then selecting LDAP as the mechanism for setting user group memberships in the RADIUS configuration.

7 To redirect HTTP/HTTPS traffic from unauthenticated users to a specified URL instead of the SonicWall’s own login page, select **On redirecting unauthenticated users, redirect to an external login page**. This option allows users to be authenticated by an external authentication system. This option is not selected by default.

> **TIP:** To allow only unauthenticated users to be redirected, you need to create one or more access rules for this situation.

> **NOTE:** The external system can subsequently use the SSO third-party API or RADIUS Accounting to pass the user’s name and credentials to the firewall so they are identified for such activities as access control and logging.

When you select this option, the **URL** field displays.



☑ On redirecting unauthenticated users, redirect to an external login page URL:

Enter the URL for redirection in the field.

8 To configure options elated to the captive portal configured in a zone’s guest settings, scroll to **Web Login Settings for Guest Captive Portal**.

9 For captive portal guest authentication, to allow the authentication page to show in a portal host page as a frame, select **Allow authentication page in frame**. This option is not selected by default.

10 Click **ACCEPT**.

Authentication Bypass Settings

SonicOS NS*v* Guest Services allows guest users to have access through your network directly to the Internet without access to your protected network. To do this, SonicOS NS*v* uses the IP address of the user’s computer.

Using the IP address as the identifier is useful when guest user traffic passes through a network router, as this changes the source MAC address to that of the router. However, the user’s IP address passes through unchanged.

If only the MAC address is used for identification, two clients behind the same router have the same MAC address upon reaching the Security Appliance. When one client gets authenticated, the traffic from the other client is also treated as authenticated and bypasses the guest service authentication.

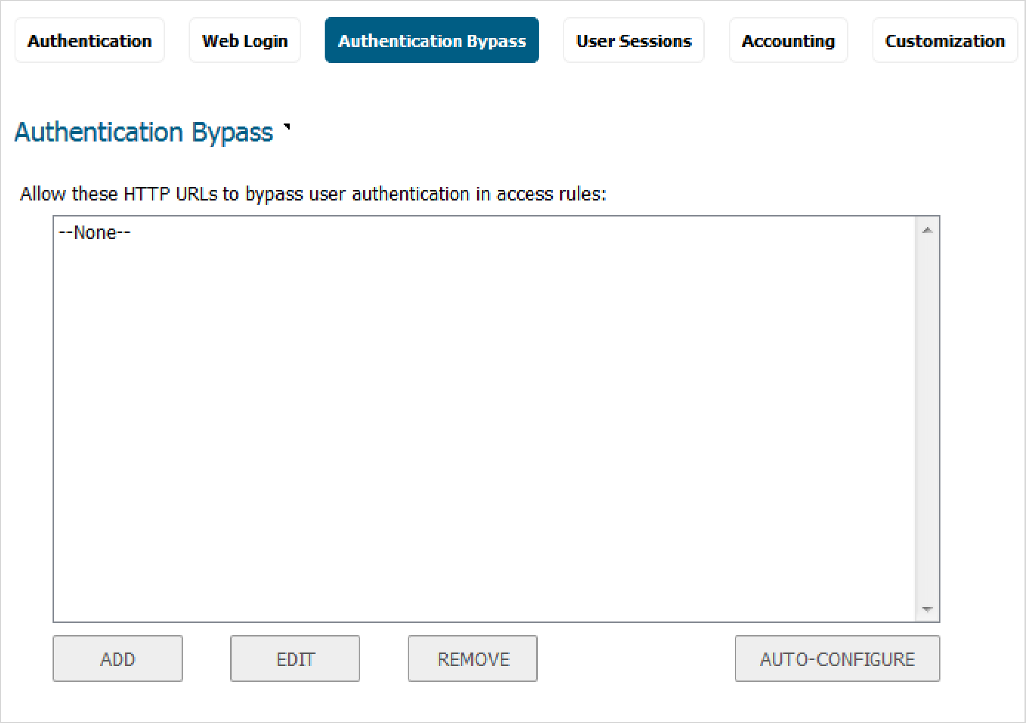
By using the client IP address for identification, all guest clients behind the routed device are required to authenticate independently.

Topics:

Adding URLs to Authentication Bypass

To add HTTP URLs user authentication bypass in Access Rules:

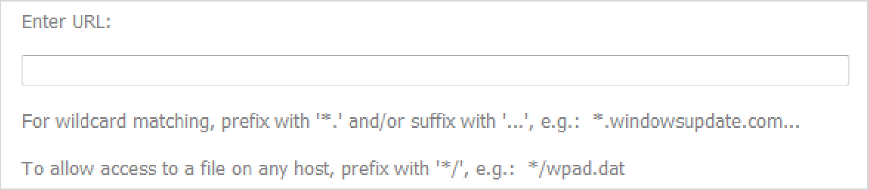
1 Navigate to **MANAGE | System Setup | Users > Settings > Authentication Bypass**.



Allow these HTTP URLs to bypass user authentication in access rules:

--None--

2 Click **ADD**. The **Add URL** popup displays.



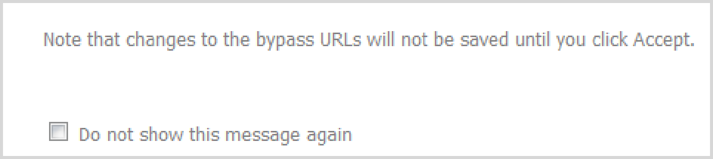
Enter URL:

For wildcard matching, prefix with '*.' and/or suffix with '...', e.g.: *.windowsupdate.com...

To allow access to a file on any host, prefix with '*/', e.g.: */wpad.dat

3 Enter the URL in the **Enter URL** field.

4 Click **OK**. A popup confirmation message displays.



Note that changes to the bypass URLs will not be saved until you click Accept.

□ Do not show this message again

5 Click **OK**.

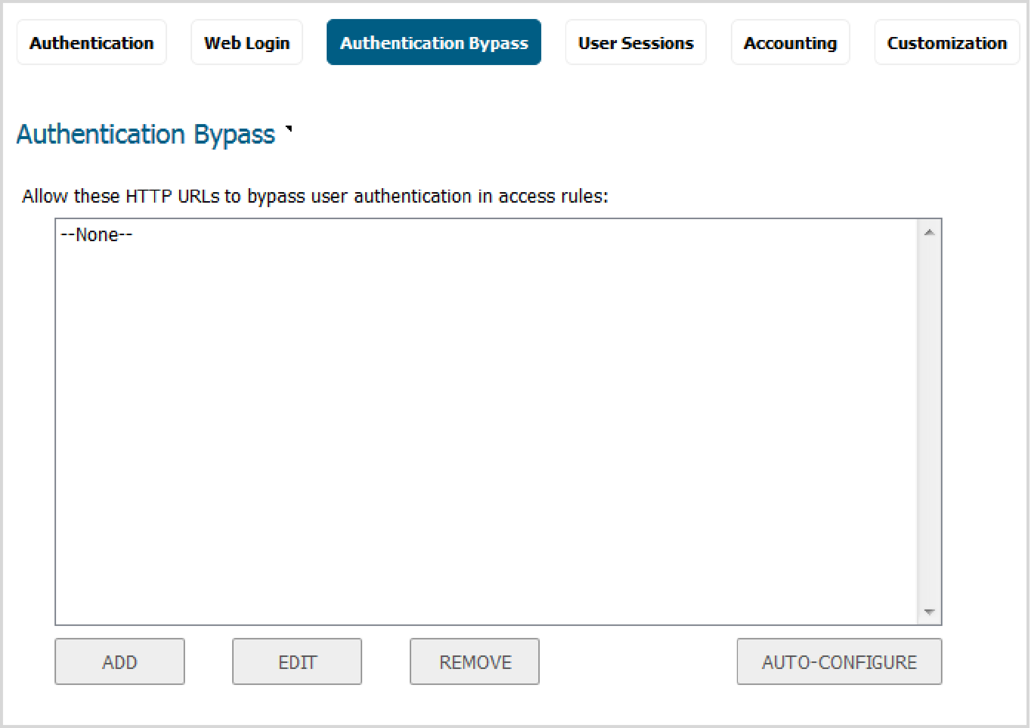
6 When finished adding URLs, click **ACCEPT**.

Configuring Auto-configuration

Auto-configuration of URLs to bypass user authentication in firewall rules is achieved by allowing through (from one IP address only) traffic that would otherwise have been blocked by rules requiring user authentication and recording the destinations accessed.

To configure Auto-configuration.

1 Navigate to **MANAGE | System Setup | Users > Settings > Authentication Bypass**.

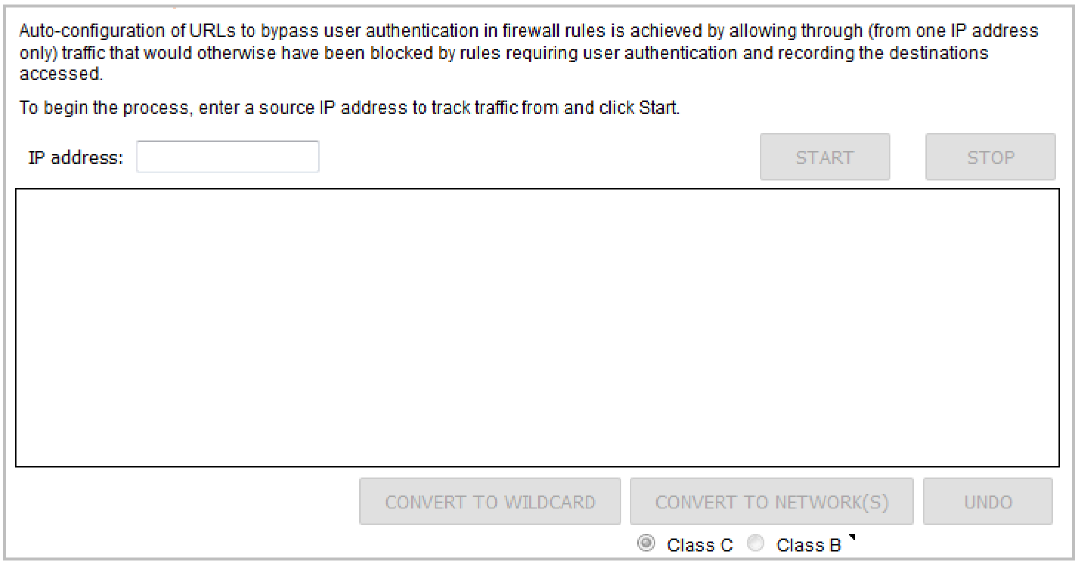


Authentication Bypass

Allow these HTTP URLs to bypass user authentication in access rules:

--None--

2 Click **AUTO-CONFIGURE**. The **Policy User Authentication Bypass Auto-Configuration** dialog displays.



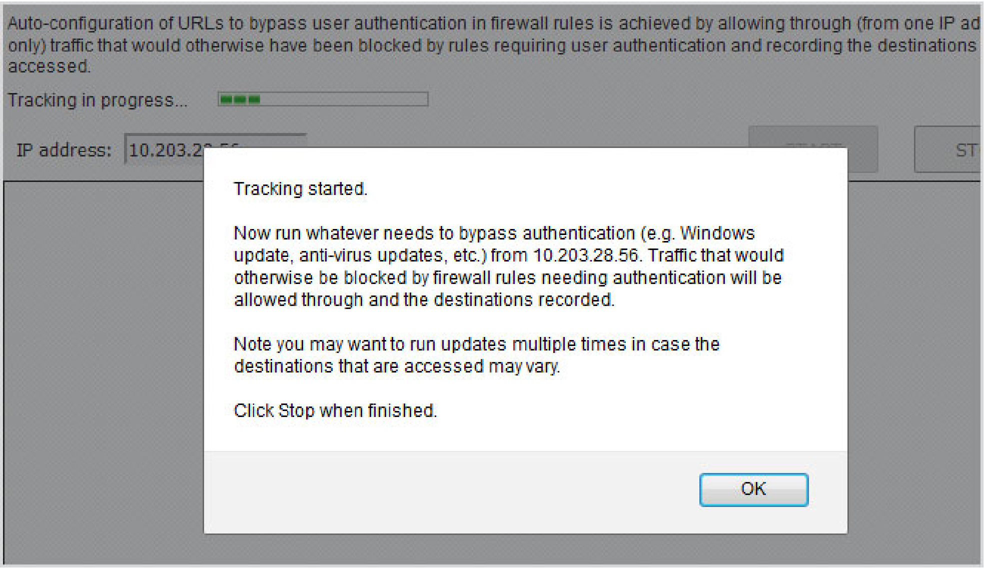
Auto-configuration of URLs to bypass user authentication in firewall rules is achieved by allowing through (from one IP address only) traffic that would otherwise have been blocked by rules requiring user authentication and recording the destinations accessed.

To begin the process, enter a source IP address to track traffic from and click Start.

IP address:

3 Enter the source IP address in the **IP Address** field. **START** becomes available.

4 Click **START**. A T**racking in progress** indicator and a **Tracking started** message displays.



Auto-configuration of URLs to bypass user authentication in firewall rules is achieved by allowing through (from one IP ad only) traffic that would otherwise have been blocked by rules requiring user authentication and recording the destinations accessed.

Tracking in progress...

IP address: 10.203.2

Tracking started.

Now run whatever needs to bypass authentication (e.g. Windows update, anti-virus updates, etc.) from 10.203.28.56. Traffic that would otherwise be blocked by firewall rules needing authentication will be allowed through and the destinations recorded.

Note you may want to run updates multiple times in case the destinations that are accessed may vary.

Click Stop when finished.

5 Click **OK**.

Converting URLs for Wildcard Matching

Bypass authentication supports wildcard matching. This allows one or more tracked URLs to be converted to a single wildcard that matches against all currently selected URLs.

ⓘ **NOTE:** The selected URLs must be in the same domain.

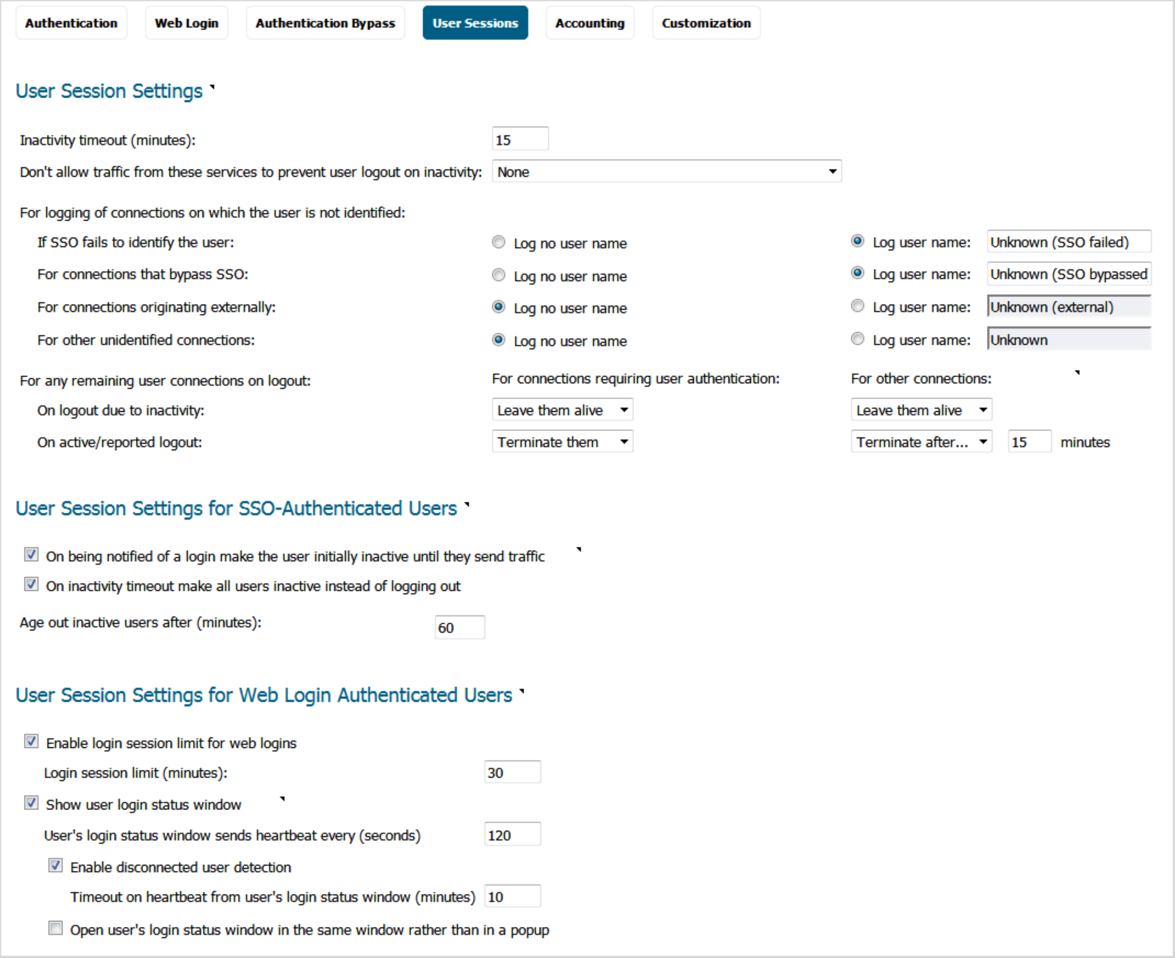
Converting to Network(s)

Windows Update accesses some destinations through HTTPS, and those destinations can be tracked only by IP address. The actual IP addresses accessed each time could vary, however, so rather than trying to set up a bypass for each such IP address, you can allow bypass for HTTPS to all IP addresses in that network.

Converting to network bypass allows tracked HTTPS destination IP address to be converted to either a:

- Class B (16 bit) network (default)
- Class C (24 bit) network

Configuring User Sessions



User Session Settings

Inactivity timeout (minutes): 15

Don't allow traffic from these services to prevent user logout on inactivity: None

For logging of connections on which the user is not identified:

If SSO fails to identify the user: ○ Log no user name ● Log user name: Unknown (SSO failed)

For connections that bypass SSO: ○ Log no user name ● Log user name: Unknown (SSO bypassed

For connections originating externally: ● Log no user name ○ Log user name: Unknown (external)

For other unidentified connections: ● Log no user name ○ Log user name: Unknown

For any remaining user connections on logout: For connections requiring user authentication: For other connections:

On logout due to inactivity: Leave them alive Leave them alive

On active/reported logout: Terminate them Terminate after... 15 minutes

User Session Settings for SSO-Authenticated Users

☑ On being notified of a login make the user initially inactive until they send traffic

☑ On inactivity timeout make all users inactive instead of logging out

Age out inactive users after (minutes): 60

User Session Settings for Web Login Authenticated Users

☑ Enable login session limit for web logins

Login session limit (minutes): 30

☑ Show user login status window

User's login status window sends heartbeat every (seconds) 120

☑ Enable disconnected user detection

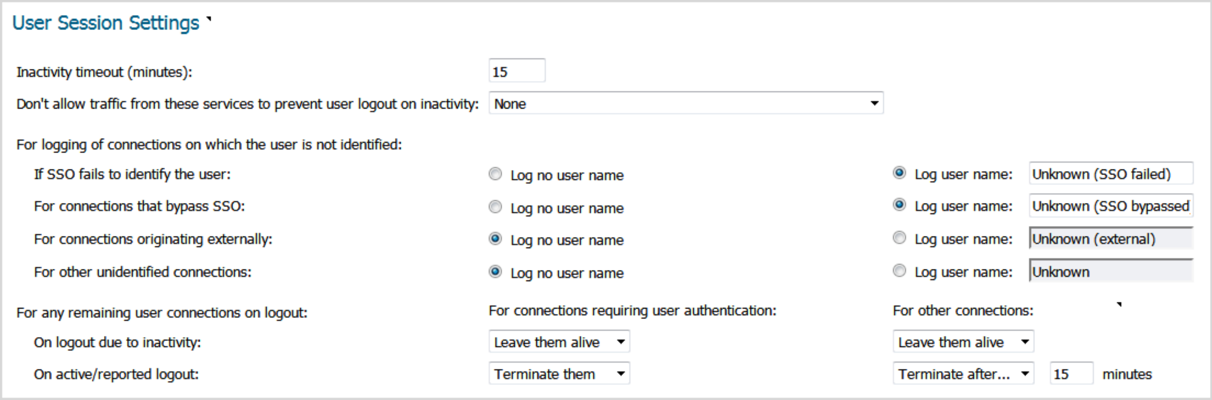
Timeout on heartbeat from user's login status window (minutes) 10

☐ Open user's login status window in the same window rather than in a popup

Topics:

- User Session Settings on page 114
- User Session Settings for SSO Authenticated Users on page 115
- User Session Settings for Web Login on page 116

User Session Settings



User Session Settings

Inactivity timeout (minutes):	15		
Don't allow traffic from these services to prevent user logout on inactivity:	None		
For logging of connections on which the user is not identified:			
If SSO fails to identify the user:	○ Log no user name	● Log user name:	Unknown (SSO failed)
For connections that bypass SSO:	○ Log no user name	● Log user name:	Unknown (SSO bypassed
For connections originating externally:	● Log no user name	○ Log user name:	Unknown (external)
For other unidentified connections:	● Log no user name	○ Log user name:	Unknown
For any remaining user connections on logout:	For connections requiring user authentication:	For other connections:	
On logout due to inactivity:	Leave them alive	Leave them alive	
On active/reported logout:	Terminate them	Terminate after...	15 minutes

To configure settings that apply to all users who are authenticated through the Security Appliance:

1 Specify the length of time for inactivity after which users are logged out of the Security Appliance in the **Inactivity timeout (minutes)** field. The default is **15** minutes.

2 From the **Don't allow traffic from these services to prevent user logout on inactivity** drop-down menu, select the service or service group option to be prevented from logging out inactive users. This option saves system overhead and possible delays re-identifying aged-out authenticated users by making them inactive instead of logging them out. Inactive users do not use up system resources and can be displayed on the **Users > Status** page. The default is **None**.

3 For the following **For logging of connections on which the user is not identified** options, select the type of logging, **Log no user name** or **Log user name**, to be done, and optionally, the log user name:

- **If SSO fails to identify the user: Log user name Unknown SSO failed** (default)
- **For connections that bypass SSO: Log user name SSO Bypass** (default)

  > **NOTE:** This option also can be set in the **SSO Bypass section of the Enforcement** tab of the **SSO Authentication Configuration** dialog.

- **For connections originating externally: Log no user name** (default); if **Log user name** is selected, the default user name is **Unknown (external)**
- **For other unidentified connects: Log no user name** (default); if **Log user name** is selected, the default user name is **Unknown**

4 Specify how to handle a user's connections that remain after the user logs out from the SonicWall appliance with the **Actions for remaining user connections on logout** options.

	Action	
Type of logout	**For connections requiring user authentication** [1]	**For other connections** [2]
On logout caused by inactivity	Leave them alive (default) Terminate them Terminate after… minutes	Leave them alive (default) Terminate them Terminate after… minutes
On active/reported logout	Leave them alive Terminate them (default) Terminate after… minutes	Leave them alive Terminate them Terminate after… 15 minutes (default)

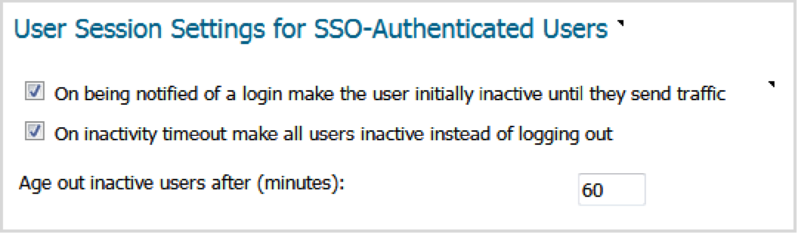
[1] Applies for connections through access rules that allow only specific users.

[2] Applies for other connections that do not have a specific user authentication requirement.

You can set different actions for:

- Inactivity logout, where the user might or might not still be logged into the domain/computer
- Users actively logging themselves out or being reported to the SonicWall appliance as being logged out (the latter normally means that the user has logged out from the domain/user)

User Session Settings for SSO Authenticated Users



User Session Settings for SSO-Authenticated Users

☑ On being notified of a login make the user initially inactive until they send traffic

☑ On inactivity timeout make all users inactive instead of logging out

Age out inactive users after (minutes): 60

To specify how inactive SSO-authenticated users are handled:

1 To put a user identified to the SonicWall appliance through an SSO mechanism, but no traffic has yet been received from the user, into an inactive state so they do not use resources, select the **On being notified of a login make the user initially inactive until they send traffic** checkbox. The users remain in an inactive state until traffic is received. This option is selected by default.

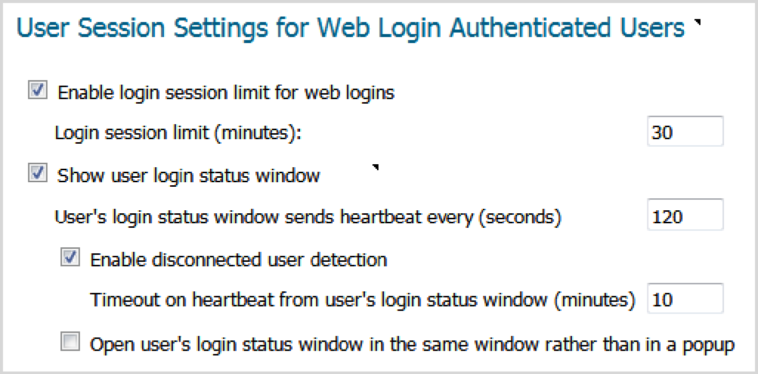
Some SSO mechanisms do not give any way for the SonicWall appliance to actively re-identify a user, and if users identified by such a mechanism do not send traffic, they remain in the inactive state until the appliance eventually receives a logout notification for the user. For other users who can be re-identified, if they stay inactive and do not send traffic, they are aged-out and removed after a period that can be set in Step 3.

2 If an SSO-identified user who has been actively logged in is timed out because of inactivity, then users who cannot be re-identified are returned to an inactive state. To have users who would otherwise be logged out on inactivity to be returned to an inactive state, select the **On inactivity timeout make all user inactive instead of logged out** checkbox. Doing this avoids overhead and possible delays re-identifying the users when they become active again. This setting is selected by default.

3 For inactive users who are subject to getting aged out, you can set the time, in minutes, after which they are aged-out and removed if they stay inactive and do not send traffic by selecting the **Age out inactive users after (minutes)** checkbox and specifying the timeout in the field. This setting is selected by default, and the minimum timeout value is 10 minutes, the maximum is 10000 minutes, and the default is **60** minutes.

> ⓘ **NOTE:** As the reason for keeping inactive user separate from active users is to minimize the resources used to manage them, the age-out timer runs once every 10 minutes. It might, therefore, take up to 10 minutes longer to remove inactive users from active status.

User Session Settings for Web Login



User Session Settings for Web Login Authenticated Users

☑ Enable login session limit for web logins

Login session limit (minutes): 30

☑ Show user login status window

User's login status window sends heartbeat every (seconds) 120

☑ Enable disconnected user detection

Timeout on heartbeat from user's login status window (minutes) 10

□ Open user's login status window in the same window rather than in a popup

To configure user session settings for web login:

1. **Enable login session limit for web logins**: Limit the time a user is logged into the Security Appliance through web login by selecting the checkbox and typing the amount of time, in minutes, in the **Login session limit (minutes)** field. This setting is selected by default The default value is **30** minutes.
2. **Show user login status window** — For users logging in through web login, displays a status window with a **Log Out** button during the user's session. You can click **Log Out** to log out of your session.

   NOTE: The window must be kept open throughout the user's session as closing it logs the user out.

   IMPORTANT: If this option is not enabled, the status window is not displayed and users might not be able to log out. In this case, a login session limit must be set to ensure that they do eventually get logged out.

   The **User Login Status** window displays the number of minutes the user has left in the login session. The user can set the remaining time to a smaller number of minutes by entering the number and clicking **Update**.

   When this option is enabled, a mechanism that monitors heartbeats sent from that window also can be enabled to detect and log out users who disconnect without logging out.

   If the user is a member of the SonicWall Administrators or Limited Administrators user group, the **User Login Status** window has a **Manage** button the user can click to automatically log into the Security Appliance's management interface. See Disabling the User Login Status Popup on page 100 for information about disabling the **User Login Status** window for administrative users. See Configuring Local Users and Groups on page 204 for group configuration procedures.

   - **User's login status window sends heartbeat every (seconds)** — Sets the frequency of the heartbeat signal used to detect whether the user still has a valid connection. The minimum heartbeat frequency is 10 seconds, the maximum is 65530 seconds, and the default is **120** seconds.
3. **Enable disconnected user detection** — Causes the Security Appliance to detect when a user's connection is no longer valid and ends the session. This setting is selected by default.
   - **Timeout on heartbeat from user's login status window (minutes)** — Sets the time needed without a reply from the heartbeat before ending the user session. The minimum delay before ending the user session is 1 minute, the maximum is 65535 minutes, and the default is **10** minutes.
4. Optionally, select to have the user's login status window display in the same window rather than a popup window by selecting **Open user's login status window in the same window rather than in a popup** checkbox.

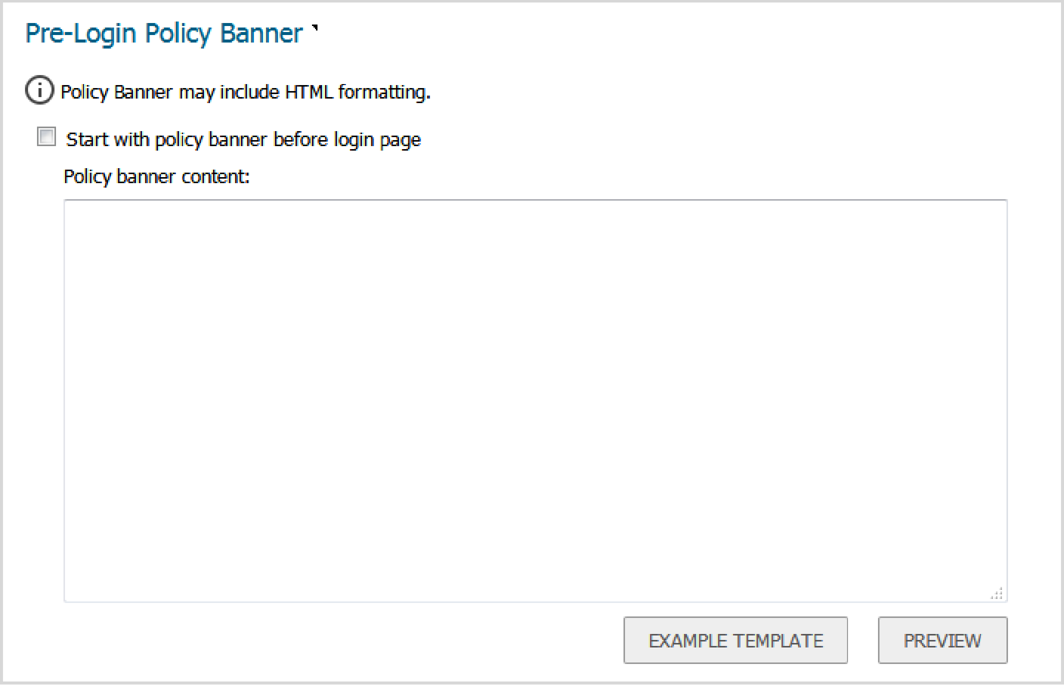
Customization

Topics:

- Pre-Login Policy Banner on page 117
- Post-Login Acceptable Use Policy on page 119
- Customized Login Pages on page 121

Pre-Login Policy Banner

In this section, you create a policy statement that is presented to all users as a banner in the window before web login. The policy banner might include HTML formatting.



Pre-Login Policy Banner

ⓘ Policy Banner may include HTML formatting.

□ Start with policy banner before login page

Policy banner content:

To create a pre-login policy banner:

1 Navigate to **MANAGE | System Setup | Users > Settings**.

2 Click **Customization**.

3 Scroll to the **Pre-Login Policy Banner** section.

4 In the **Pre-Login Policy Banner** section, select **Start with policy banner before login page**. This option is not selected by default.

5 In the **Policy banner content** field, enter your policy text. You can include HTML formatting. The page that is displayed to the user includes **I Accept** and **Cancel** for user confirmation.

> ⓘ **TIP:** Clicking **EXAMPLE TEMPLATE** creates a preformatted HTML template for your policy banner window; see Example Template on page 118.

6 Click **ACCEPT**.

Topics:

- Example Template on page 120
- Preview Message on page 118

Example Template

Click **EXAMPLE TEMPLATE** to populate the content with the default AUP template, which you can modify:

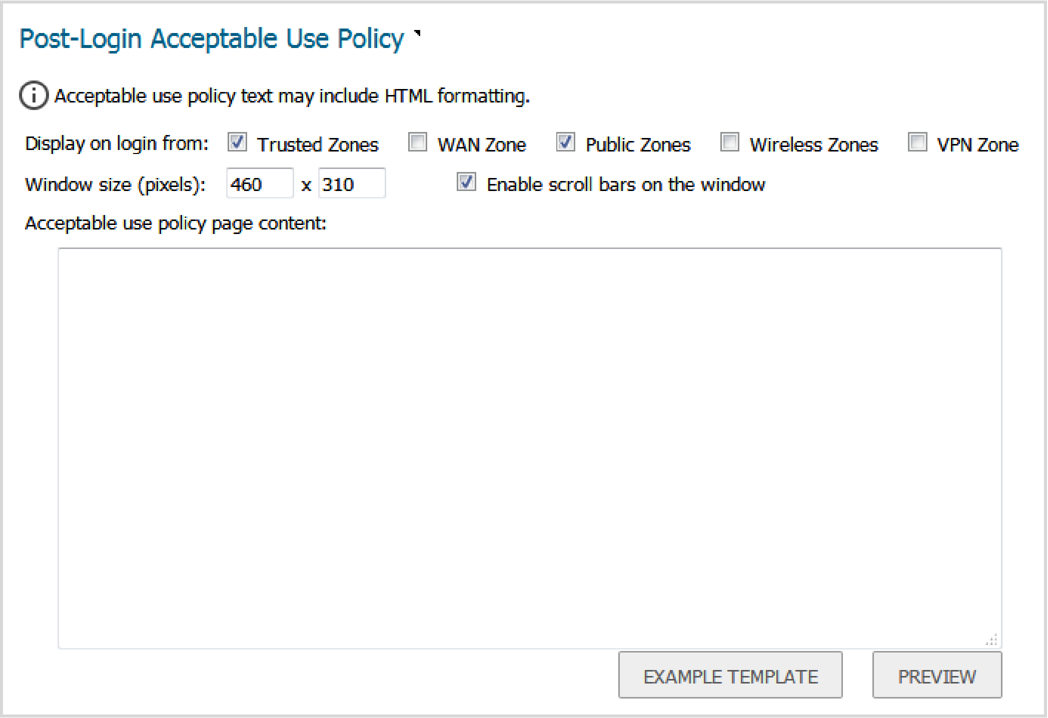
```
<font face=arial size=3>
<center><b><i>Welcome</center></b></i>
<font size=2>

<table width="100%" border="1">
<tr><td>
<font size=2>
<br><br><br>
<center>Enter your usage policy terms here.
<br><br><br>
</td></tr>
</table>

Click "I Accept" only if you wish to accept these terms and continue, or otherwise select
"Cancel."
```

Preview Message

Click **PREVIEW** to display your AUP message as it appears to the user.

Post-Login Acceptable Use Policy

An acceptable use policy (AUP) is a policy that users must agree to follow to access a network or the Internet. It is common practice for many businesses and educational facilities to require that employees or students agree to an acceptable use policy before accessing the network or Internet through the Security Appliance.



Post-Login Acceptable Use Policy

ⓘ Acceptable use policy text may include HTML formatting.

Display on login from: ☑ Trusted Zones □ WAN Zone ☑ Public Zones □ Wireless Zones □ VPN Zone

Window size (pixels): 460 x 310 ☑ Enable scroll bars on the window

Acceptable use policy page content:

The **Post-Login Acceptable Use Policy** section allows you to create the AUP message window for users. You can use HTML formatting in the body of your message. Clicking **EXAMPLE TEMPLATE** creates a preformatted HTML template for your AUP window; see Example Template on page 120.

To create a post-login AUP message window:

1. Navigate to **MANAGE | System Setup | Users > Settings**.
2. Click **Customization**.
3. Scroll to the **Post-Login Acceptable Use Policy** section.
4. Specify these settings:
   - **Display on login from** - Select the network interface(s) you want to display the Acceptable Use Policy page when users login. You can choose **Trusted Zones** (default), **WAN Zone, Public Zones** (default), and **VPN Zone** in any combination.
   - **Window size (pixels)** - Allows you to specify the size of the AUP window, in pixels:
     - Width: Minimum size is 400 pixels, maximum size is 1280 pixels, and the default is **460** pixels.
     - Height: Minimum size is 200 pixels, maximum size is 1024 pixels, and the default is **310** pixels.
   - **Enable scroll bars on window** - Turns on the scroll bars if your content exceeds the display size of the window. This option is selected by default.
   - **Acceptable use policy page content** - Enter your Acceptable Use Policy text in this field. You can include HTML formatting. The page that is displayed to the user includes **I Accept** and **Cancel** for user confirmation.

5 Click **ACCEPT**.

Topics:

- Example Template on page 120
- Preview Message on page 120

Example Template

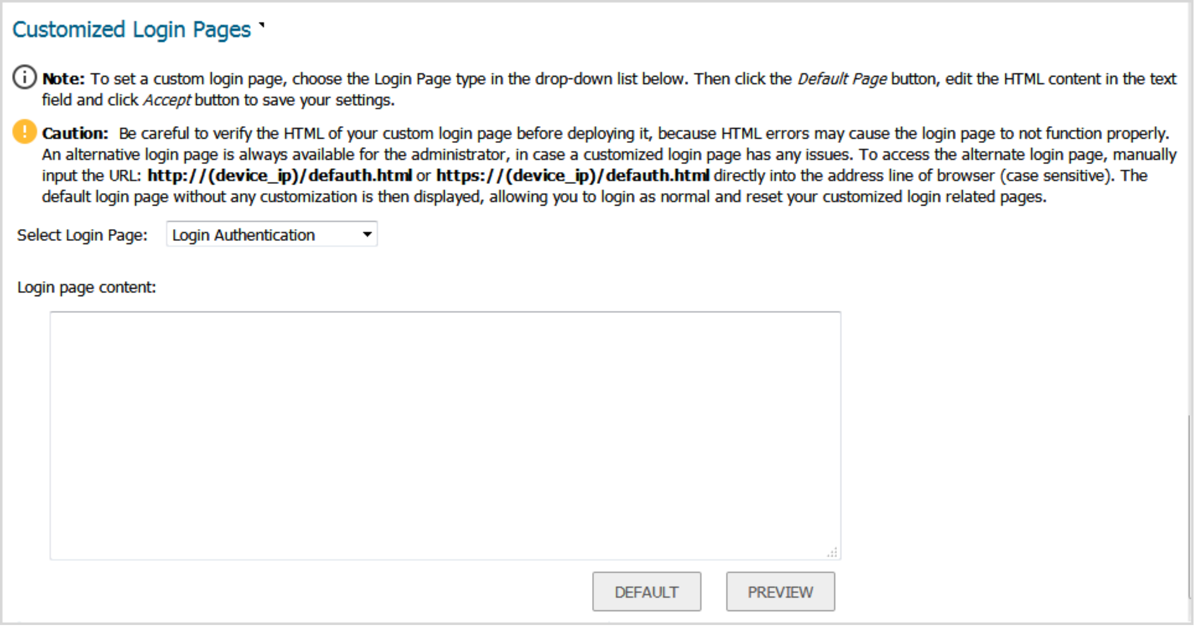
Click **EXAMPLE TEMPLATE** to populate the content with the default AUP template, which you can modify:

```
<font face=arial size=3>
<center><b><i>Welcome to the SonicWall</center></b></i>
<font size=2>

<table width="100%" border="1">
<tr><td>
<font size=2>
<br><br><br>
<center>Enter your usage policy terms here.
<br><br><br>
</td></tr>
</table>

Click "I Accept" only if you wish to accept these terms and continue,
or otherwise select "Cancel."
```

Preview Message

Click **PREVIEW** to display your AUP message as it appears to the user.

Customized Login Pages



Customized Login Pages

ⓘ **Note:** To set a custom login page, choose the Login Page type in the drop-down list below. Then click the *Default Page* button, edit the HTML content in the text field and click *Accept* button to save your settings.

Caution: Be careful to verify the HTML of your custom login page before deploying it, because HTML errors may cause the login page to not function properly. An alternative login page is always available for the administrator, in case a customized login page has any issues. To access the alternate login page, manually input the URL: **http://(device_ip)/defauth.html** or **https://(device_ip)/defauth.html** directly into the address line of browser (case sensitive). The default login page without any customization is then displayed, allowing you to login as normal and reset your customized login related pages.

Select Login Page: Login Authentication

Login page content:

SonicOS NS*v* provides the ability to customize the text of the login authentication pages that are presented to users. You can translate the login-related pages with their own wording and apply the changes so that they take effect without rebooting.

Although the entire SonicOS web management interface is available in different languages, sometimes you do not want to change the entire management interface language to a specific local language.

However, if the Security Appliance requires authentication before users can access other networks, or enables external access services (for example, VPN, SSL-VPN), those login-related pages usually should be localized to make them more usable for typical users.

The **Customize Login Page** feature provides the following functionality:

- Keeps the style of original login by default
- Customizes login related pages
- Uses the default login related pages as templates
- Saves customized pages into system preferences
- Allows preview of changes before saving to preferences
- Presents customized login-related pages to typical users

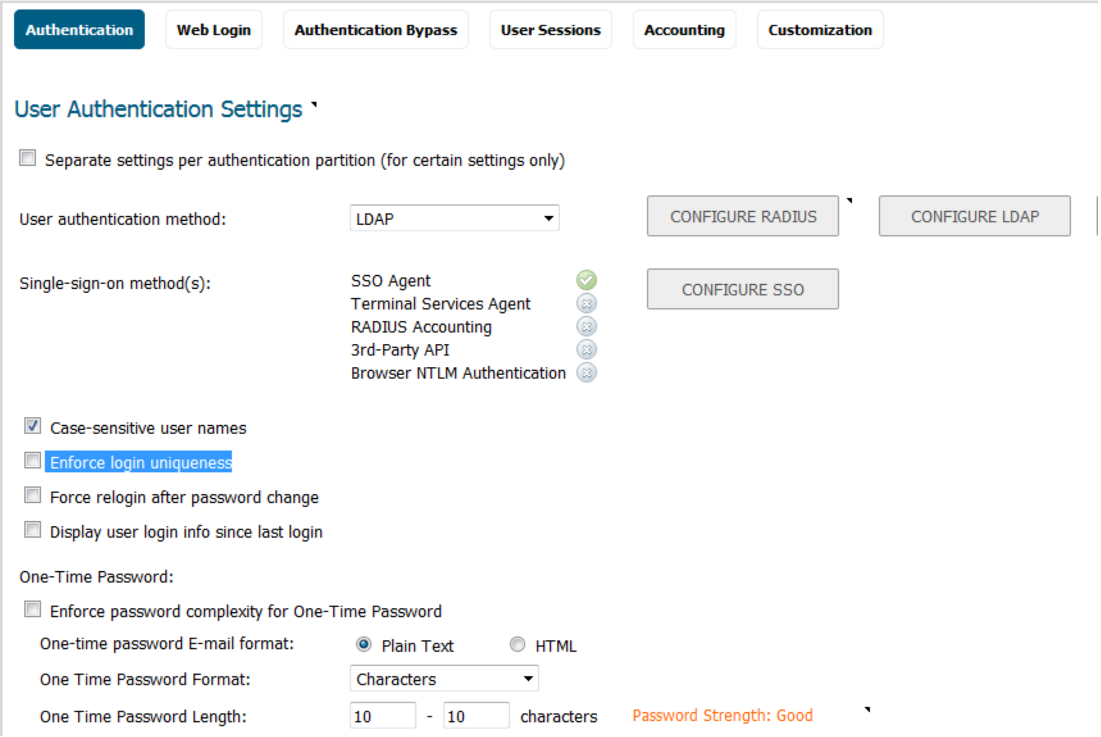
The following login-related pages can be customized:

- Admin Preempt
- Login Authentication
- Logged Out
- Login Full
- Login Disallowed
- Login Lockout
- Login Status
- Guest Login Status

- Policy Access Barred
- Policy Access Down
- Policy Access Unavailable
- Policy Login Redirect
- Policy SSO Probe Failure
- User Password Update
- User Login Message

To customize one of these pages:

1 Navigate to **MANAGE | System Setup > Users > Settings**.



User Authentication Settings

□ Separate settings per authentication partition (for certain settings only)

User authentication method: LDAP

Single-sign-on method(s): SSO Agent ✓, Terminal Services Agent, RADIUS Accounting, 3rd-Party API, Browser NTLM Authentication

☑ Case-sensitive user names

□ Enforce login uniqueness

□ Force relogin after password change

□ Display user login info since last login

One-Time Password:

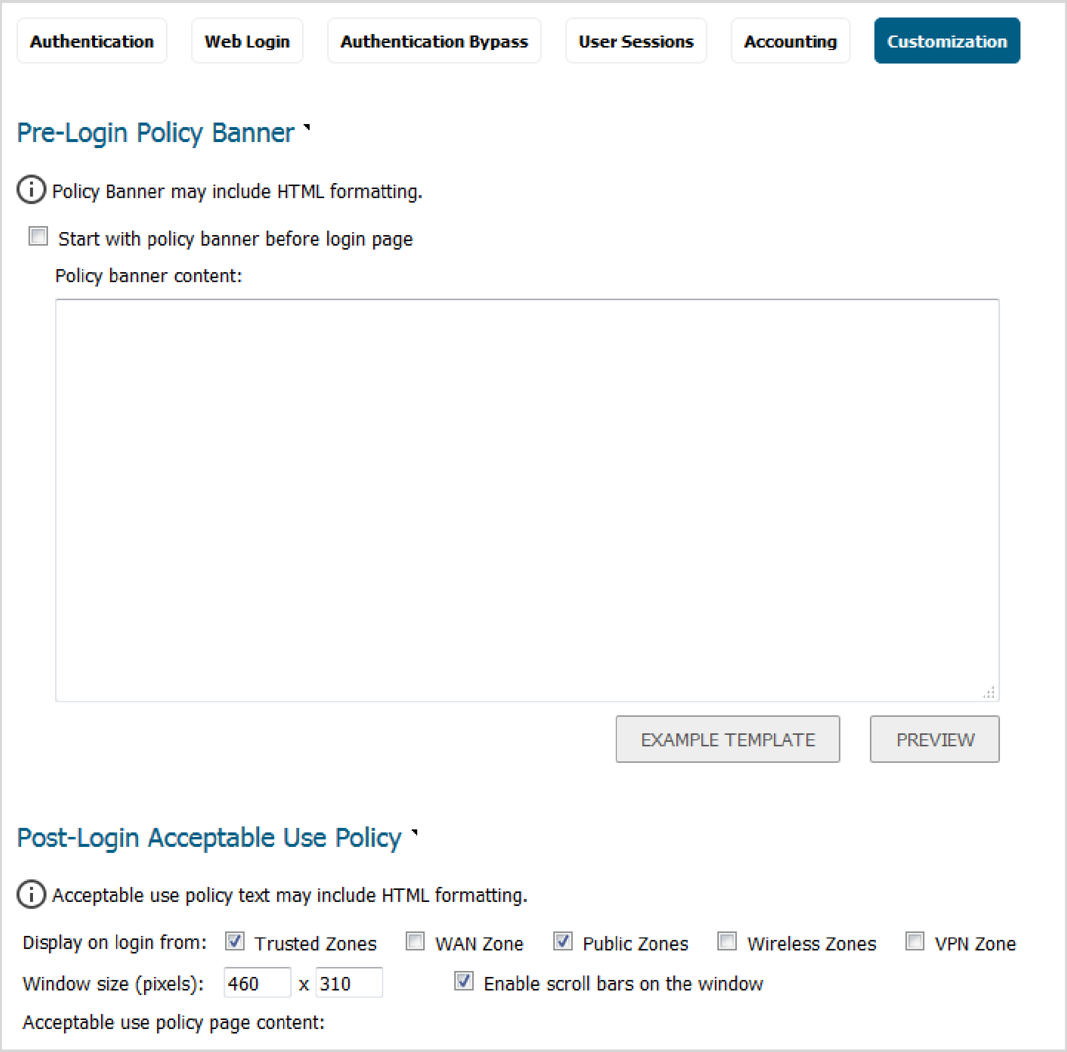
□ Enforce password complexity for One-Time Password

One-time password E-mail format: ● Plain Text ○ HTML

One Time Password Format: Characters

One Time Password Length: 10 - 10 characters Password Strength: Good

2 Click **Customization**.



Pre-Login Policy Banner

Policy Banner may include HTML formatting.

□ Start with policy banner before login page

Policy banner content:

Post-Login Acceptable Use Policy

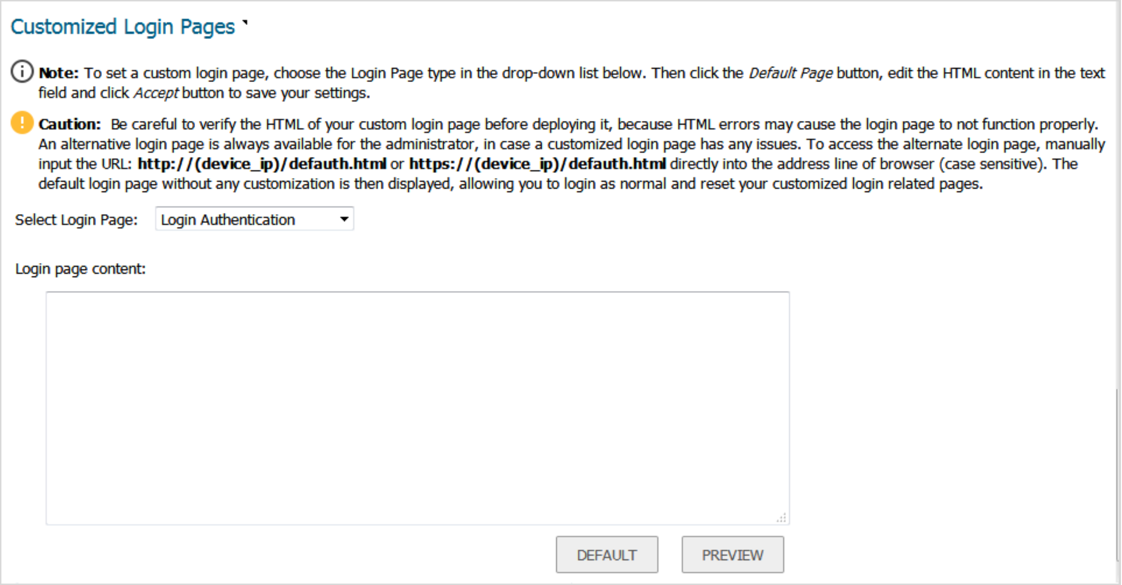
Acceptable use policy text may include HTML formatting.

Display on login from: ☑ Trusted Zones □ WAN Zone ☑ Public Zones □ Wireless Zones □ VPN Zone

Window size (pixels): 460 x 310 ☑ Enable scroll bars on the window

Acceptable use policy page content:

3 Scroll to the **Customize Login Pages** section.



Customized Login Pages

Note: To set a custom login page, choose the Login Page type in the drop-down list below. Then click the *Default Page* button, edit the HTML content in the text field and click *Accept* button to save your settings.

Caution: Be careful to verify the HTML of your custom login page before deploying it, because HTML errors may cause the login page to not function properly. An alternative login page is always available for the administrator, in case a customized login page has any issues. To access the alternate login page, manually input the URL: **http://(device_ip)/defauth.html** or **https://(device_ip)/defauth.html** directly into the address line of browser (case sensitive). The default login page without any customization is then displayed, allowing you to login as normal and reset your customized login related pages.

Select Login Page: Login Authentication

Login page content:

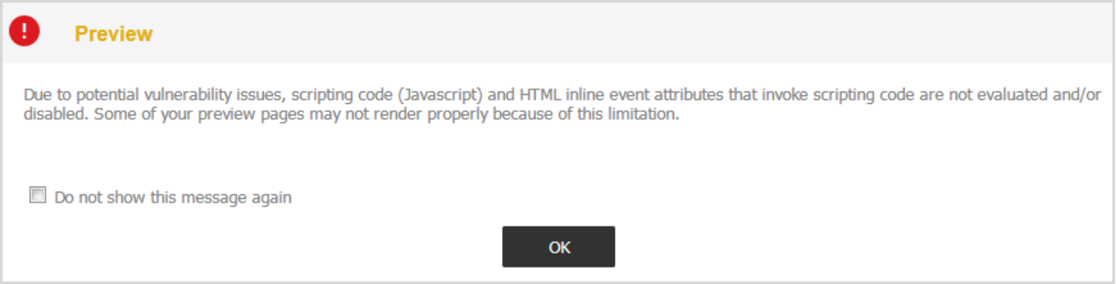
4 Select the page to be customized from **Select Login Page**.

5 Click **DEFAULT** to load the default content for the page.

6 Edit the content of the page.

> ⓘ **NOTE:** The `var strXXX =` lines in the template pages are customized JavaScript Strings. You can change them into your preferred wording. Modifications should follow the JavaScript syntax. You can also edit the wording in the HTML section.

7 Click **PREVIEW** to preview how the customized page looks. A message displays.



Preview

Due to potential vulnerability issues, scripting code (Javascript) and HTML inline event attributes that invoke scripting code are not evaluated and/or disabled. Some of your preview pages may not render properly because of this limitation.

□ Do not show this message again

8 Click **OK**. Your customized page displays.

9 Close the window.

10 Make any changes.

11 When you are finished editing the page, click **ACCEPT**.

> △ **CAUTION: Be careful to verify the HTML of your custom login page before deploying it, because HTML errors might cause the login page to not function properly. An alternative login page is always available for the administrator, in case a customized login page has any issues. To access the alternate login page, manually input the URL: *https://(device_ip)/defauth.html* directly into the address line of browser (case sensitive). The default login page without any customization is then displayed, allowing you to login as normal and reset your customized login related pages.**

> ⓘ **TIP:** Leave the **Login page content** field blank and apply the change to revert to the default page to users.

Accounting

SonicOS NS*v* supports both RADIUS accounting and TACACS+ accounting. If both a RADIUS server and a TACACS+ server are configured, a user's accounting messages are sent to both servers.

Topics:

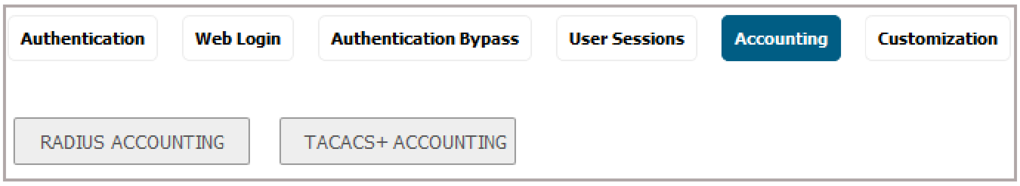
Configuring TACACS+ Accounting

SonicOS NS*v* supports TACACS+ accounting Start, Watchdog and Stop messages, but not the TACACS+ accounting proxy, that is, SonicOS NS*v* does not forward the accounting request to the accounting server.

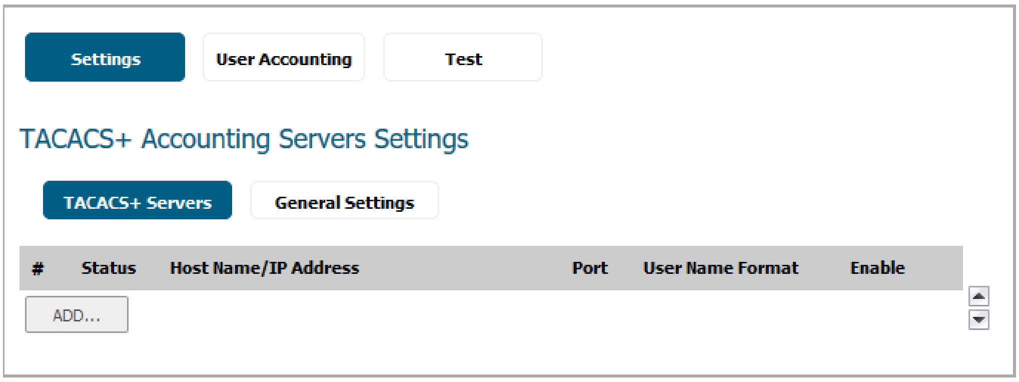
To configure TACACS+ accounting:

1 Navigate to **MANAGE | System Setup > Users > Settings**.

2 Click **Accounting**.

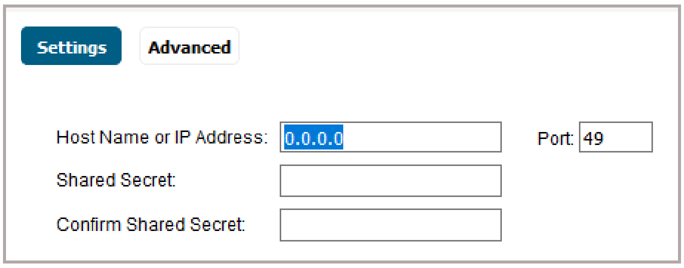


3 Click **TACACS+ ACCOUNTING**. The **TACACS+ Accounting Configuration** dialog displays.



4 To add a TACACS+ server, click **TACACS+ Servers**.

5 Click **Add**. The **Add TACACS+ accounting server** dialog displays.



Host Name or IP Address: 0.0.0.0

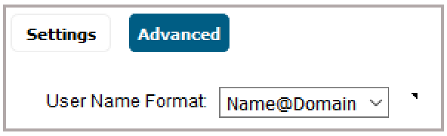
Port: 49

6 Enter the host name or IP address of the TACACS+ server in the **Host Name or IP Address** field.

7 Enter the port number of the server in the **Port** field. The default is **49**.

8 Enter the shared secret in the S**hared Secret** and **Confirm Shared Secret** fields.

9 Click **Advanced**.



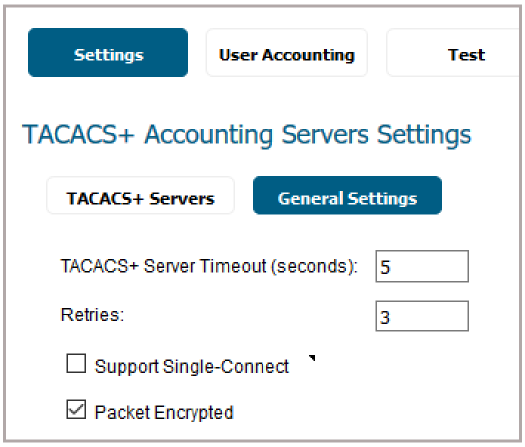
User Name Format: Name@Domain

10 Select the format of the user name from **User Name Format**:

- **Simple-Name**
- **Name@Domain** (default)
- **Domain\Name**
- **Name.Domain**

11 Click **SAVE**.

12 Click **Settings**.



TACACS+ Accounting Servers Settings

TACACS+ Server Timeout (seconds): 5

Retries: 3

☐ Support Single-Connect

☑ Packet Encrypted

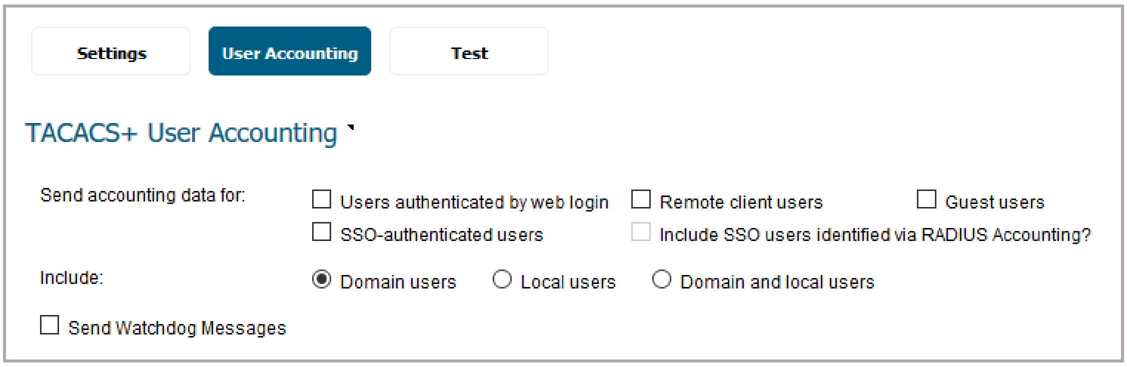
13 Enter the server timeout in the **TACACS+ Server Timeout (seconds)** field. The default is **5** seconds.

14 Enter the maximum number of retries in the **Retries** field. The default is **3**.

15 To support single connect, select **Support Single Connect**. This option is not selected by default.

16 To allow encrypted packets, select **Packet Encrypted**. This option is selected by default.

17 Click **User Accounting**.



TACACS+ User Accounting

Send accounting data for: ☐ Users authenticated by web login ☐ Remote client users ☐ Guest users
☐ SSO-authenticated users ☐ Include SSO users identified via RADIUS Accounting?

Include: ● Domain users ○ Local users ○ Domain and local users

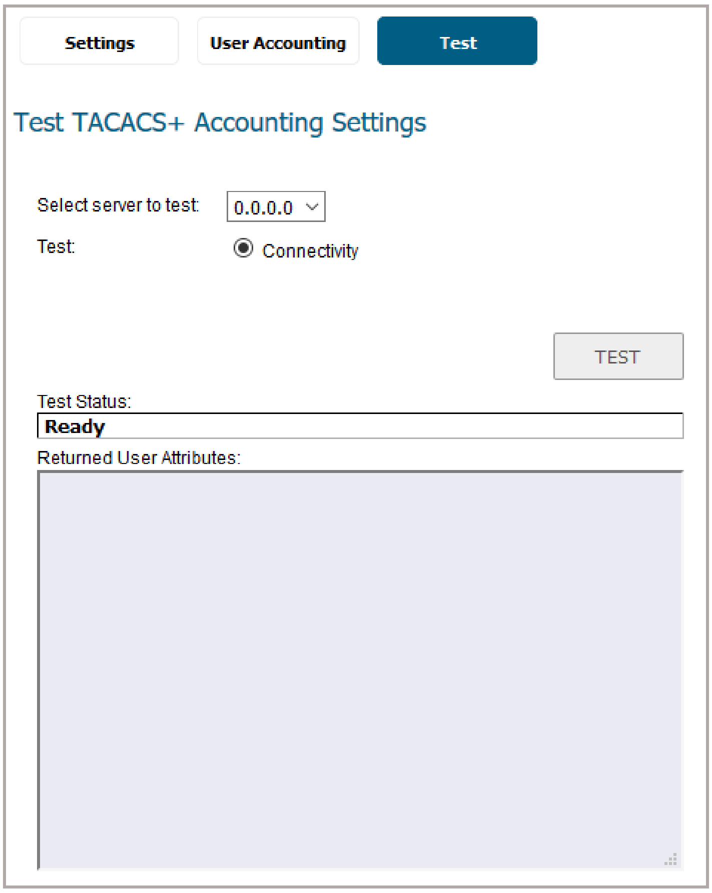
☐ Send Watchdog Messages

18 From **Send accounting data for**, select one or more types of users. **Include SSO users identified via RADIUS Accounting?** is not available by default. To make it selectable, first select the **SSO-authenticated users** field.

19 Choose whether to track domain and/or local users from **Include**. **Domain users** is selected by default.

20 To receive watchdog messages, select **Send Watchdog Messages**. This option is not selected by default. After selecting this option, the **Every:....minutes** option appears. Indicate how often you would like to receive **Watchdog Messages**.

21 Click **Test**.



Test TACACS+ Accounting Settings

Select server to test: 0.0.0.0

Test: ● Connectivity

Test Status:

Ready

Returned User Attributes:

22 From **Select server to test**, select the IP address of the TACACS+ server.

23 Choose the type of test from **Test**. **Connectivity** is selected by default.

24 Click **Test**. The results of the test display in **Returned User Attributes**.

25 Click **APPLY**.

26 Repeat the above steps for each server.

27 Click **OK**.

Configuring RADIUS Authentication

ⓘ **NOTE:** For configuring RADIUS forSonicPoints or SonicWaves, see SonicOS NSv *6.5 Connectivity*.

For an introduction to RADIUS authentication in SonicOS NSv, see Using LDAP/Active Directory/eDirectory Authentication on page 77. If you selected **RADIUS** or **RADIUS + Local Users** from the **Authentication method for login** drop-down menu on the **MANAGE | System Setup** > **Users > Settings** page, **CONFIGURE RADIUS** becomes available.

Topics:

- Configuring RADIUS Settings on page 128
- RADIUS Users Page on page 130
- RADIUS with LDAP for User Groups on page 132

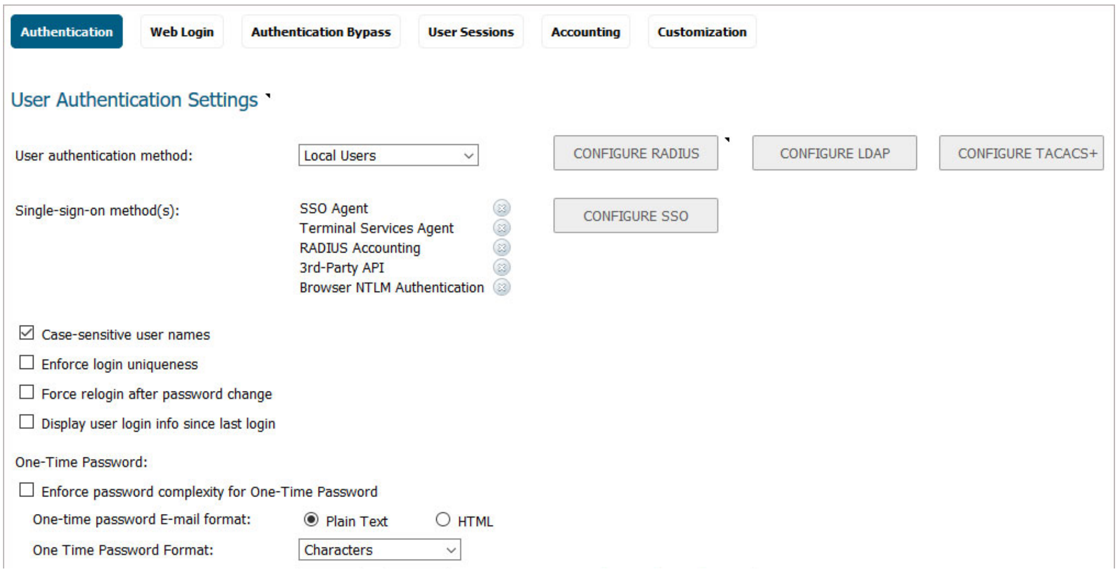
- RADIUS Client Test on page 132

Configuring RADIUS Settings

To configure RADIUS settings:

1 Navigate to **MANAGE | System Setup | Users > Settings**.

2 Click **Authentication**.



User Authentication Settings

User authentication method: Local Users

Single-sign-on method(s):
SSO Agent
Terminal Services Agent
RADIUS Accounting
3rd-Party API
Browser NTLM Authentication

☑ Case-sensitive user names

☐ Enforce login uniqueness

☐ Force relogin after password change

☐ Display user login info since last login

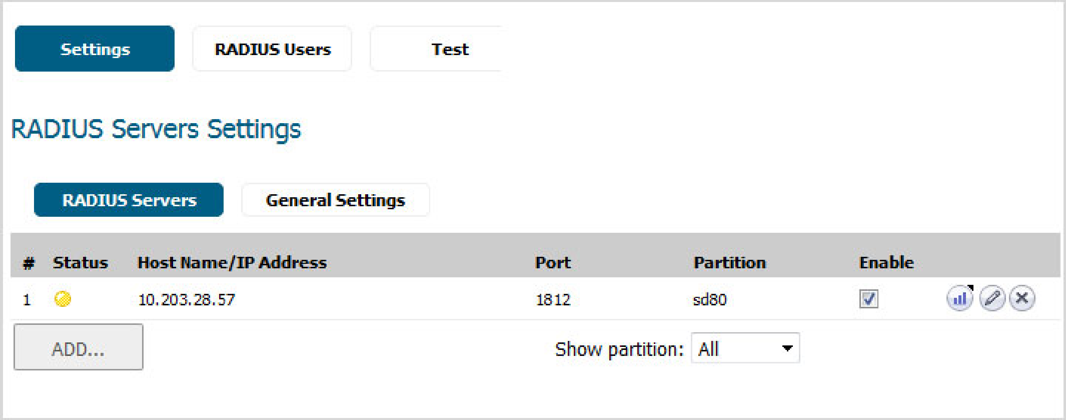
One-Time Password:

☐ Enforce password complexity for One-Time Password

One-time password E-mail format: ● Plain Text ○ HTML

One Time Password Format: Characters

3 Click **CONFIGURE RADIUS**. The **RADIUS Configuration** dialog displays.

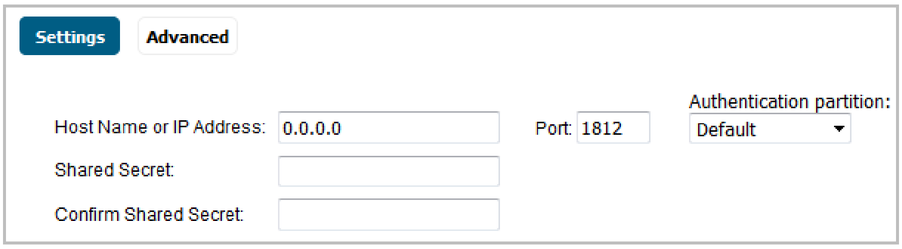


RADIUS Servers Settings

#	Status	Host Name/IP Address	Port	Partition	Enable
1	●	10.203.28.57	1812	sd80	☑

Show partition: All

4 Under **Settings > RADIUS Servers Settings**, click **ADD**. The **Add server** dialog displays.



Host Name or IP Address: 0.0.0.0

Port: 1812

Authentication partition: Default

Shared Secret:

Confirm Shared Secret:

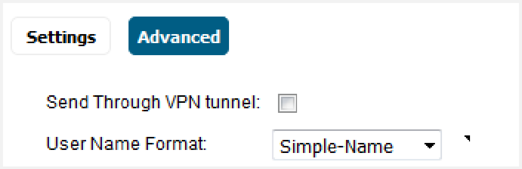
5 If partitioning is enabled, the **Select partition** popup displays over the **Add server** dialog. Select a partition and click **OK**.

6 Under **Settings**, enter an IP address or host name in the **Host Name or IP Address** field. The default is `0.0.0.0`.

7 In the **Port** field, enter the port for the RADIUS server to use for communication with SonicOS NS*v*. The default is **1812**.

8 Enter the RADIUS server administrative password or shared secret in the **Shared Secret** and **Confirm Shared Secret** fields. The case-sensitive, alphanumeric **Shared Secret** can range from 1 to 31 characters in length.

9 Click **Advanced**.



Send Through VPN tunnel: □

User Name Format: Simple-Name

10 Optionally, select **Send Through VPN tunnel**. This option is not selected by default.

11 Select the format for the user name from **User Name Format**:

- **Simple-Name** (default)
- **Name@Domain**
- **Domain\Name**
- **Name.Domain**

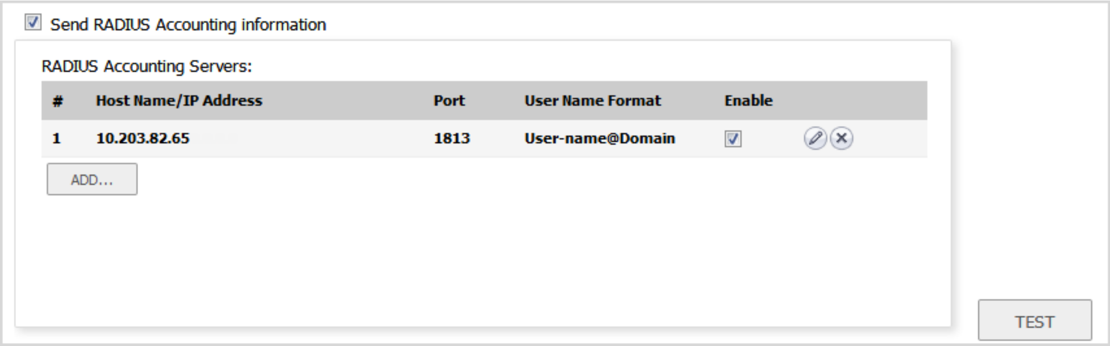
If the RADIUS server requires user names be sent with the domain component included, then select the format for that here.

NOTE: If the server accepts either the simple name without any domain component or a qualified name with the domain, then you can leave the selection as the default simple name unless you specifically want to force including the domain in the name sent to the server.

NOTE: In a Windows domain, if users are to be allowed to log in with a qualified user-name format that differs from what is set here (for example, to allow login to the firewall with `domain\name` if `name@domain` is selected or *vice versa*), then LDAP must be enabled for looking up the domain name mappings; otherwise, the user must enter a correctly formatted name acceptable by the RADIUS server.

12 Click **SAVE**.

13 Click **OK**. The server is added to the **RADIUS Accounting Servers** table.

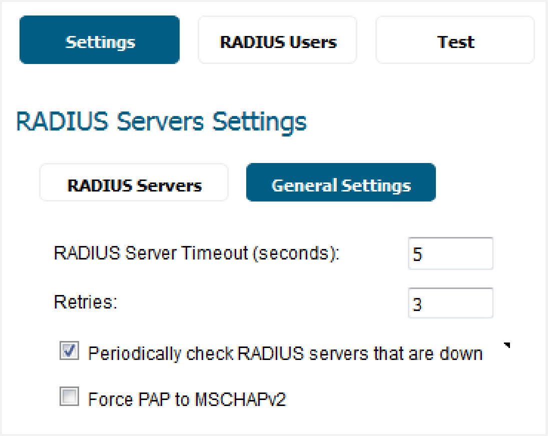


☑ Send RADIUS Accounting information

RADIUS Accounting Servers:

#	Host Name/IP Address	Port	User Name Format	Enable
1	10.203.82.65	1813	User-name@Domain	☑

14 Click **General Settings**.



RADIUS Server Timeout (seconds): 5

Retries: 3

☑ Periodically check RADIUS servers that are down

□ Force PAP to MSCHAPv2

15 Enter a timeout value in the **RADIUS Server Timeout (seconds)** field. The allowable range is 1-60 seconds with a default value of **5**.

16 In the **Retries** field, enter the number of times SonicOS NS*v* attempts to contact the RADIUS server. If the RADIUS server does not respond within the specified number of retries, the connection is dropped. This field can range between 0 and 10, with a default setting of **3** RADIUS server retries.

17 To periodically check the status of RADIUS servers, select **Periodically check Radius server that are down**. This option is selected by default.

If the primary RADIUS server fails to respond to a request, then its status is changed to down (showing red on the **RADIUS servers** table of the **RADIUS Configuration** dialog and further authentication requests are sent to the secondary server until the primary comes back up. If this setting is checked, then while a a server is down, dummy authentication requests are periodically sent to check it. When the server responds to one, its status is restore to up. Your RADIUS server might log an occasional authentication request failure with user name, `status check`.

Disabling this option generally does not adversely affect user authentication. However, if it is disabled when the primary server goes down temporarily, then the firewall does not know when it becomes up, and so continues to show the server as down and sends authentication requests to the secondary server. This continues until secondary fails to respond to a request or the primary's status is checked manually, which can be done through the RADIUS test under **Test** on the **Configure RADIUS** dialog.

ⓘ **NOTE:** If the secondary server goes down while the primary server is down, then the firewall reverts to sending requests to the primary server, so the firewall detects when/if the primary server is responsive regardless of this setting.

18 To Optionally, to enforce MS-CHAPv2 RADIUS authentication, select **Force PAP to MSCHAPv2.** This option is not selected by default.

19 Click **APPLY**.

20 Click **OK**.

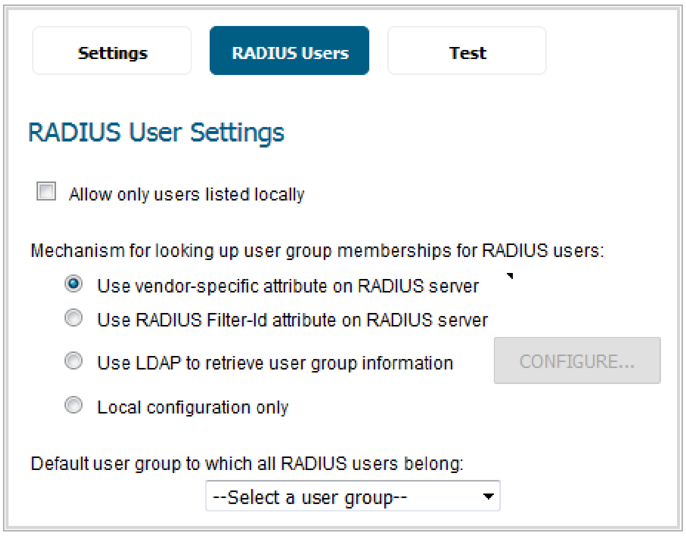
21 To configure RADIUS users, go to RADIUS Users Page on page 130

RADIUS Users Page

On the **RADIUS Users** page of the **RADIUS Configuration** dialog, you can specify what types of local or LDAP information to use in combination with RADIUS authentication. You can also define the default user group for RADIUS users.

To configure the RADIUS user settings:

1 Click **RADIUS Users**.



RADIUS User Settings

□ Allow only users listed locally

Mechanism for looking up user group memberships for RADIUS users:

● Use vendor-specific attribute on RADIUS server

○ Use RADIUS Filter-Id attribute on RADIUS server

○ Use LDAP to retrieve user group information

○ Local configuration only

Default user group to which all RADIUS users belong: --Select a user group--

2 Select **Allow only users listed locally** if only the users listed in the SonicOS NS*v* database are authenticated using RADIUS.

3 Select the **Mechanism used for setting user group memberships for RADIUS users** option:

> ⓘ **NOTE:** If the **Use SonicWall vendor-specific attribute on Radius server** or **Use RADIUS Filter-ID attribute on RADIUS server** options are selected, the RADIUS server must be properly configured to return these attributes to the SonicWall appliance when a user is authenticated. The RADIUS server should return aero (0) or more instances of the selected attribute, each giving the name of a user group to which the user belongs.
>
> For details of the vendor-specific attribute settings, see the tech note, SonicOS NS*v* Enhanced: Using User Level Authentication, and the SonicOS NS*v* Enhanced RADIUS Dictionary file, `SonicWall.dct`. Both are available at https://support.SonicWall.com/.

- **Use SonicWall vendor-specific attribute on RADIUS server** – To apply a configured vendor-specific attribute from the RADIUS server. The attribute must provide the user group to which the user belongs. The preferred vendor-specific RADIUS attribute is `SonicWall-User-Group`. `SonicWall-User-Privilege` also works for certain user groups, but it is supported primarily for backwards compatibility and is not governed by the **Mechanism for setting user group memberships for RADIUS users** setting; that is, it is still effective even if something other than the **Use SonicWall vendor-specific attribute on RADIUS server** is selected.
- **Use RADIUS Filter-ID attribute on RADIUS server** – To apply a configured Filter-ID attribute from the RADIUS server. The attribute must provide the user group to which the user belongs.
- **Use LDAP to retrieve user group information** (default) – To obtain the user group from the LDAP server. You can click **Configure** to set up LDAP if you have not already configured it or if you need to make a change. For information about configuring LDAP, see Configuring the SonicWall for LDAP on page 134.
- **Local configuration only** – If you do not plan to retrieve user group information from RADIUS or LDAP.
- **Memberships can be set locally by duplicating RADIUS user names** – For a shortcut for managing RADIUS user groups. When you create users with the same name locally on the Security Appliance and manage their group memberships, the memberships in the RADIUS database automatically change to mirror your local changes.

4 If you have previously configured User Groups in SonicOS NS*v*, select the group from the **Default user group to which all RADIUS users belong** drop-down menu. To create a new user group, see Creating a New User Group for RADIUS Users on page 132.

5 Either click

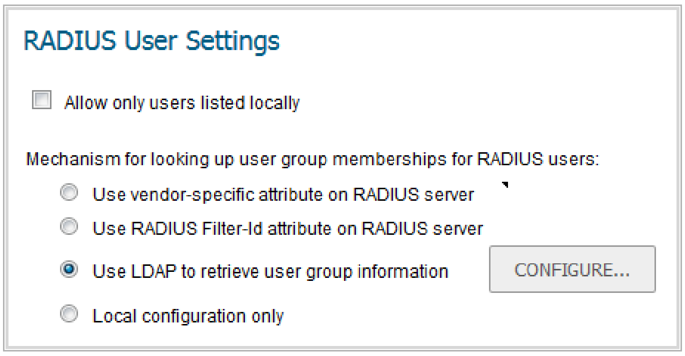
- **OK** if you have finished configuring the RADIUS server.
- **Apply** to continue configuring RADIUS users and/or testing the settings.

Creating a New User Group for RADIUS Users

In the **RADIUS User Settings** dialog, you can create a new group by choosing **Create a new user group...** from the **Default user group to which all RADIUS users belong** drop-down menu. The **Add Group** dialog displays. For the procedure for creating a new user group, see Creating or Editing a Local Group on page 218.

RADIUS with LDAP for User Groups

When RADIUS is used for user authentication, there is an option on the **RADIUS Users** page in the **RADIUS Configuration** dialog to allow LDAP to be selected as the mechanism for setting user group memberships for RADIUS users:



RADIUS User Settings

□ Allow only users listed locally

Mechanism for looking up user group memberships for RADIUS users:

○ Use vendor-specific attribute on RADIUS server

○ Use RADIUS Filter-Id attribute on RADIUS server

● Use LDAP to retrieve user group information

○ Local configuration only

When **Use LDAP to retrieve user group information** is selected, after authenticating a user through RADIUS, his/her user group membership information is looked up through LDAP in the directory on the LDAP/AD server.

ⓘ **NOTE:** If this mechanism is **not** selected, and one-time password is enabled, a RADIUS user receives a one-time password fail message when attempting to login through SSL VPN.

Clicking **CONFIGURE** launches the **LDAP Configuration** dialog. For more information on configuring LDAP settings, see Preparing Your LDAP Server for Integration on page 79.

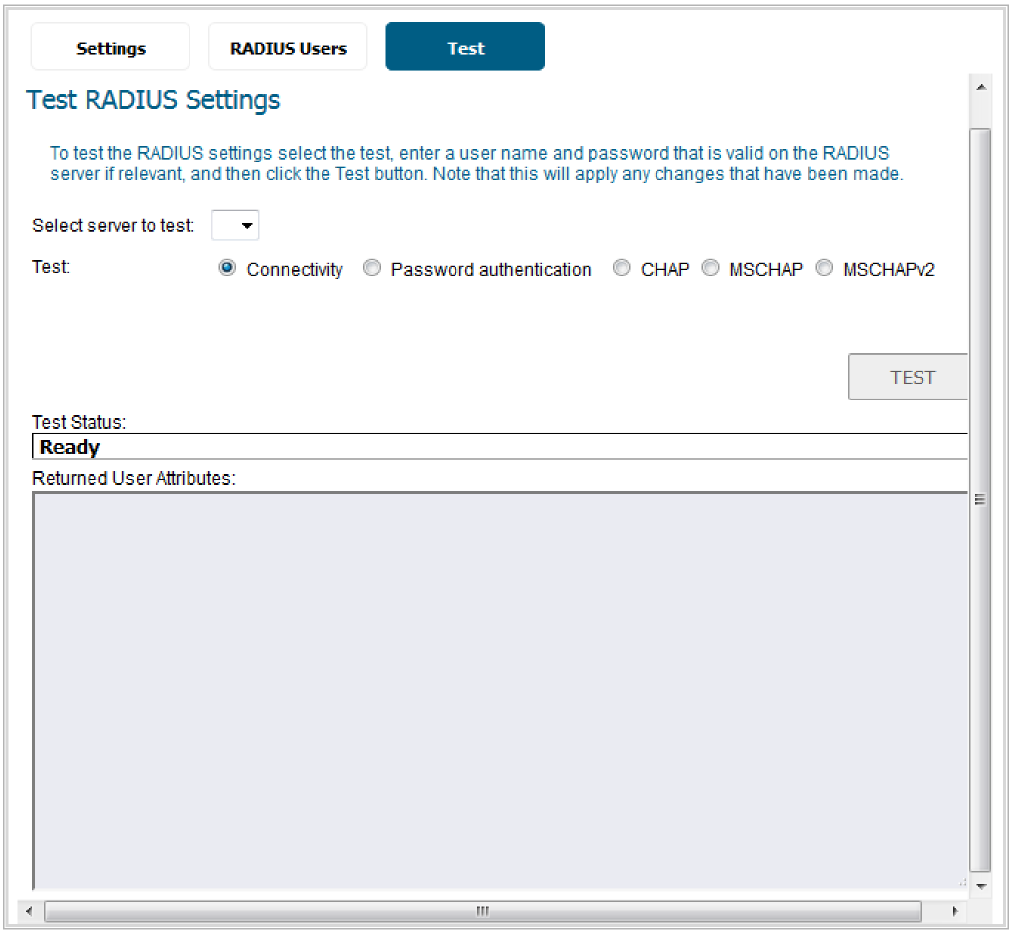
ⓘ **NOTE:** In this case LDAP is not dealing with user passwords and the information that it reads from the directory is normally unrestricted, so operation without TLS could be selected, ignoring the warnings, if TLS is not available (for example, if certificate services are not installed with Active Directory). However, it must be ensured that security is not compromised by SonicOS NS*v* doing a clear-text login to the LDAP server – for example, create a user account with read-only access to the directory dedicated for SonicOS NS*v* use. Do not use the administrator account in this case.

RADIUS Client Test

In the **RADIUS Configuration** dialog, you can test your RADIUS Client user name, password and other settings by typing in a valid user name and password and selecting one of the authentication choices for **Test**. Performing the test applies any changes you have made.

To test your RADIUS settings:

1 Click **Test**.



Test RADIUS Settings

To test the RADIUS settings select the test, enter a user name and password that is valid on the RADIUS server if relevant, and then click the Test button. Note that this will apply any changes that have been made.

Select server to test:

Test: ● Connectivity ○ Password authentication ○ CHAP ○ MSCHAP ○ MSCHAPv2

Test Status: **Ready**

Returned User Attributes:

2 In the **User** field, type a valid RADIUS login name.

3 In the **Password** field, type the password.

4 For **Test**, select one of the following:

- **Connectivity**: Select this to test RADIUS connectivity.
- **Password authentication**: Select this to use the password for authentication.
- **CHAP**: Select this to use the Challenge Handshake Authentication Protocol. After initial verification, CHAP periodically verifies the identity of the client by using a three-way handshake.
- **MSCHAP**: Select this to use the Microsoft implementation of CHAP. MSCHAP works for all Windows versions before Windows Vista.
- **MSCHAPv2**: Select this to use the Microsoft version 2 implementation of CHAP. MSCHAPv2 works for Windows 2000 and later versions of Windows.

5 Click **TEST**. If the validation is successful, the **Status** messages changes to **Success**. If the validation fails, the **Status** message changes to **Failure**.

6 To complete the RADIUS configuration, click **OK**.

After SonicOS NS*v* has been configured, a VPN Security Association requiring RADIUS authentication prompts incoming VPN clients to enter a User Name and Password into a dialog.

Configuring the SonicWall for LDAP

Topics:

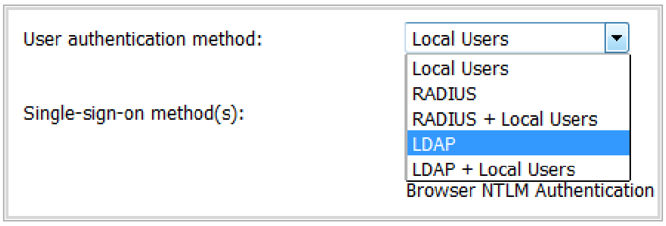
- Managing LDAP Integration on page 134
- About Extended Support for Multiple LDAP Servers on page 145
- About Importing and Mirroring from LDAP on page 147

Managing LDAP Integration

To manage your LDAP integration:

1 Navigate to **MANAGE | System Setup > Users > Settings**.

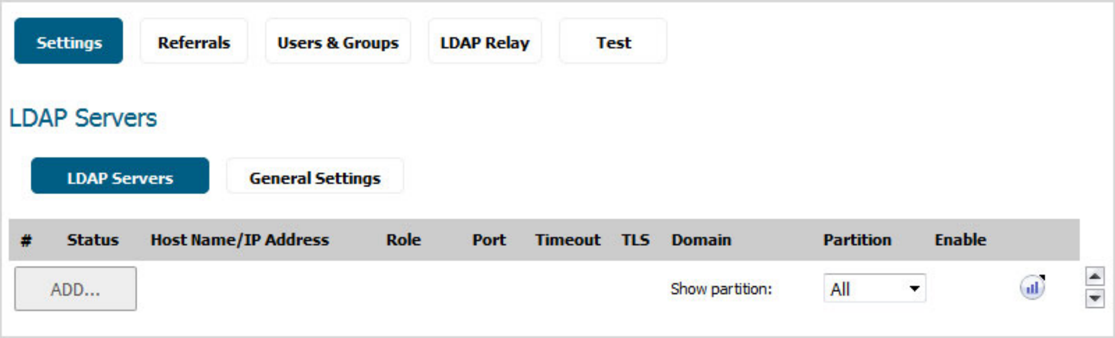
2 From **User Authentication method**, select either **LDAP** or **LDAP + Local Users**.



User authentication method: Local Users

3 Click **CONFIGURE LDAP**.

4 If you are connected to your Security Appliance through HTTP rather than HTTPS, a message displays warning you of the sensitive nature of the information stored in directory services and offering to change your connection to HTTPS. If you have HTTPS management enabled for the interface to which you are connected (recommended), click **Yes**. The **LDAP Configuration** dialog displays.



NOTE: Dynamically learned secondary servers are shown in blue to distinguish them from configured servers.

Topics:

- Settings on page 135
- Schema Page on page 137
- Directory Page on page 138
- Referrals Page on page 141
- Users & Groups Page on page 142
- LDAP Relay Page on page 144

- Test Page on page 145

Settings

To configure the LDAP server settings:

1 Configure the following fields:

  - **Name or IP Address** – The FQDN or the IP address of the LDAP server against which you wish to authenticate. If using a name, be certain that it can be resolved by your DNS server. Also, if using TLS with the 'Require valid certificate from server' option, the name provided here must match the name to which the server certificate was issued (such as the CN) or the TLS exchange fails.
  - **Port Number** – The default LDAP over TLS port number is TCP 636. The default LDAP (unencrypted) port number is TCP 389. If you are using a custom listening port on your LDAP server, specify it here.
  - **Server timeout** – The amount of time, in seconds, that SonicOS NS*v* waits for a response from the LDAP server before timing out. The range is 1 to 99999, with a default of **10** seconds.
  - **Overall operation timeout** – The amount of time, in minutes, to spend on any automatic operation. Some operations, such as directory configuration or importing user groups, can take several minutes, especially when multiple LDAP servers are in use.
  - Choose one of the following radio buttons:
    - **Anonymous Login** – Some LDAP servers allow for the tree to be accessed anonymously. If your server supports this (Active Directory generally does not), then you might select this option.
    - **Give login name/location in tree** – Select this option to build the distinguished name (dn) that is used to bind to the LDAP server from the `Login user name` and `User tree for login to server fields` according to the following rules:
      - The first name component begins `cn=`
      - The 'location in tree' components all use `ou=` (apart from certain Active Directory built-ins that begin with `cn=`)
      - The domain components all use `dc=`
      - If the User tree for login to server field is given as a `dn`, you can also select this option if the bind dn conforms to the first bullet above, but not to the second and/or the third bullet.
    - **Give bind distinguished name** – Select this option if the bind dn does not conform to the first bullet above (if the first name component does not begin with `cn=`). This option can always be selected if the dn is known. You must provide the bind dn explicitly if the bind dn does not conform to the first bullet above.
  - **Login user name** – Specify a user name that has rights to log in to the LDAP directory. The login name is automatically presented to the LDAP server in full 'dn' notation. This can be any account with LDAP read privileges (essentially any user account); Administrative privileges are not required.

    NOTE: This is the user's name, not their login ID (for example, John Smith rather than jsmith).

  - **Login password** – The password for the user account specified above.
  - **Protocol version** – Select either LDAPv3 or LDAPv2. Most modern implementations of LDAP, including Active Directory, employ LDAPv3.

- **Use TLS (SSL)** – Use Transport Layer Security (SSL) to log in to the LDAP server. It is strongly recommended that TLS be used to protected the username and password information that is sent across the network. Most modern implementations of LDAP server, including Active Directory, support TLS. Deselecting this default setting displays an alert that you must accept to proceed.
- **Send LDAP 'Start TLS' Request** – Some LDAP server implementations support the Start TLS directive rather than using native LDAP over TLS. This allows the LDAP server to listen on one port (normally 389) for LDAP connections, and to switch to TLS as directed by the client. Active Directory does not use this option, and it should only be selected if required by your LDAP server.
- **Require valid certificate from server** – Validates the certificate presented by the server during the TLS exchange, matching the name specified above to the name on the certificate. Deselecting this default option presents an alert, but exchanges between SonicOS NS*v* and the LDAP server still use TLS – only without issuance validation.
- **Local certificate for TLS** – Optional, to be used only if the LDAP server requires a client certificate for connections. Useful for LDAP server implementations that return passwords to ensure the identity of the LDAP client (Active Directory does not return passwords). This setting is not required for Active Directory.

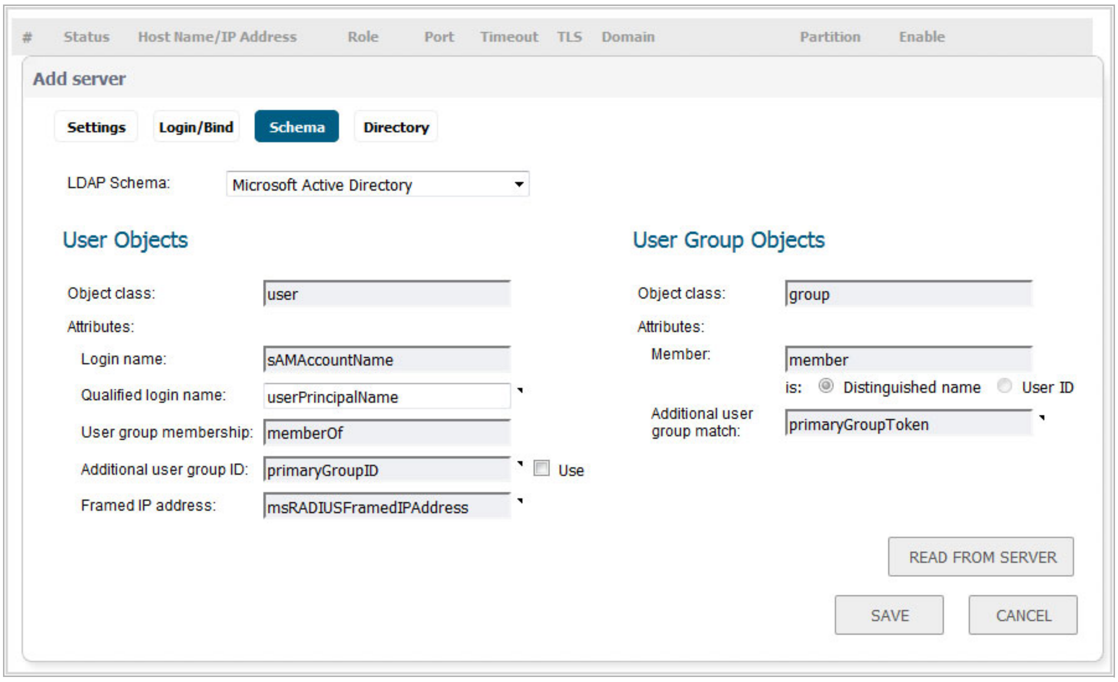
  If your network uses multiple LDAP/AD servers with referrals, then select one as the primary server (probably the one that holds the bulk of the users) and use the above settings for that server. It then refers SonicOS NS*v* to the other servers for users in domains other than its own. For SonicOS NS*v* to be able to log in to those other servers, each server must have a user configured with the same credentials (user name, password and location in the directory) as the login to the primary server. This might entail creating a special user in the directory for the SonicOS NS*v* login. Note that only read access to the directory is required.
- **Force PAP to MSCHAPv2** – Optional, to enforce MS-CHAPv2 LDAP authentication select this option. If a RADIUS server is also configured, it provides authentication if LDAP authentication fails. This option is not selected by default.

2 Click **APPLY**.

Schema Page

To configure the LDAP server schema settings:

1 Click **Schema**.



# Status Host Name/IP Address Role Port Timeout TLS Domain Partition Enable
Settings
Login/Bind
Schema
Directory
READ FROM SERVER
SAVE
CANCEL

Add server

LDAP Schema: Microsoft Active Directory

User Objects

Object class: user

Attributes:

Login name: sAMAccountName

Qualified login name: userPrincipalName

User group membership: memberOf

Additional user group ID: primaryGroupID □ Use

Framed IP address: msRADIUSFramedIPAddress

User Group Objects

Object class: group

Attributes:

Member: member

is: ● Distinguished name ○ User ID

Additional user group match: primaryGroupToken

2 **LDAP Schema** – Select one of the following from the **LDAP Schema** drop-down menu:

> **NOTE:** Selecting any of the predefined schemas automatically populates the fields used by that schema with their correct values. These values cannot be changed and their fields are dimmed.

- **Microsoft Active Directory** (default)
- **RFC2798 inetOrgPerson**
- **RFC2307 Network Information Service**
- **Samba SMB**
- **Novell eDirectory**
- **User defined** – Allows you to specify your own values; use this only if you have a specific or proprietary LDAP schema configuration.

3 **Object class** – Select the attribute that represents the individual user account to which the next two fields apply.

4 **Login name attribute** – Select one of the following to define the attribute that is used for login authentication:

- **sAMAccountName** for Microsoft Active Directory
- **inetOrgPerson** for RFC2798 inetOrgPerson
- **posixAccount** for RFC2307 Network Information Service
- **sambaSAMAccount** for Samba SMB
- **inetOrgPerson** for Novell eDirectory

5 **Qualified login name attribute** – Optionally, select an attribute of a user object that sets an alternative login name for the user in `name@domain` format. This might be needed with multiple domains in particular, where the simple login name might not be unique across domains.

> ⓘ **NOTE:** For **Microsoft Active Directory**, this is normally set to **userPrinicpalName** for log in using `name@domain`, but could be set to **mail** to enable log in by email address. For **RFC2798 inetOrgPerson**, it is set to **mail**.

6 **User group membership attribute** – Select the attribute that contains information about the groups to which the user object belongs. This is **memberOf** in Microsoft Active Directory. The other predefined schemas store group membership information in the group object rather than the user object, and therefore do not use this field.

7 **Framed IP address attribute** – Select the attribute that can be used to retrieve a static IP address that is assigned to a user in the directory. In the future this might also be supported for Global VPN Client. In Active Directory the static IP address is configured on the Dial-in tab of a user's properties.

8 **User Group Objects** – This section is auto-configured unless you select **User Defined** for the **LDAP Schema**.

- **Object class** – Specify the name associated with the group of attributes.
- **Member attribute** – Specify the attribute associated with a member.
  - Select whether this attribute is a **Distinguished name** or **User ID**.
- **Read from server** – Click to read the user group object information from the LDAP server.

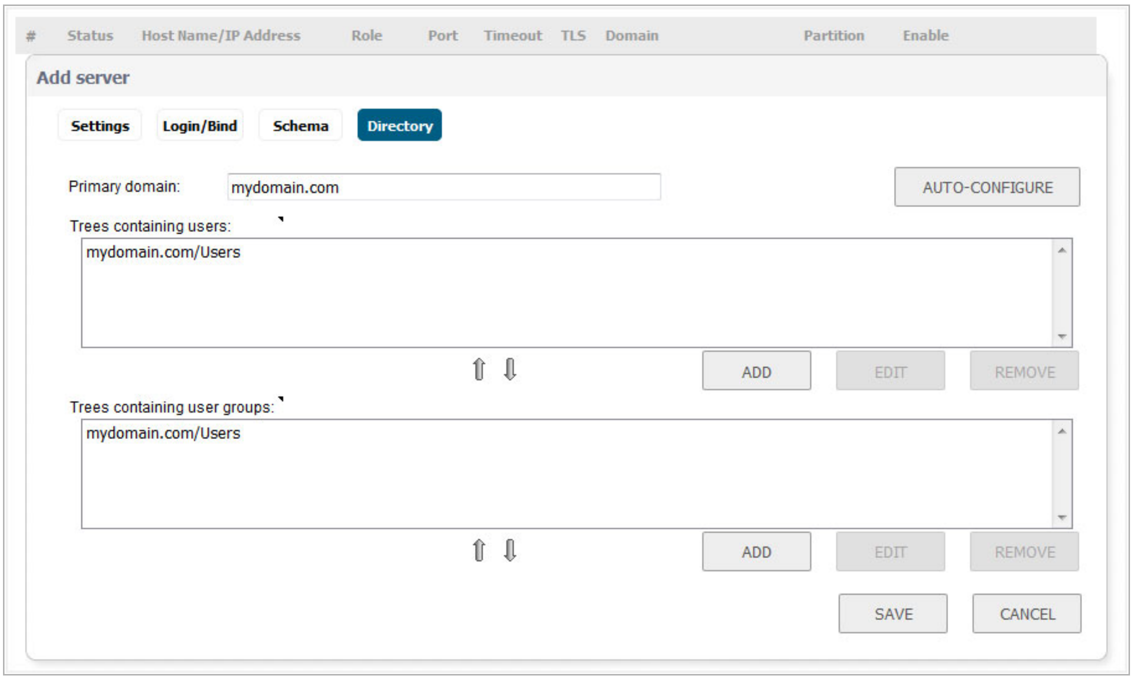
  > ⓘ **NOTE:** You must enter the primary domain on the **Directory** tab first.

  - Select whether you want to **Automatically update the schema configuration** or **Export details of the schema**.

Directory Page

To configure the LDAP server directory settings:

1 On the **Directory** page, configure the following fields:



Primary domain: mydomain.com

Trees containing users: mydomain.com/Users

Trees containing user groups: mydomain.com/Users

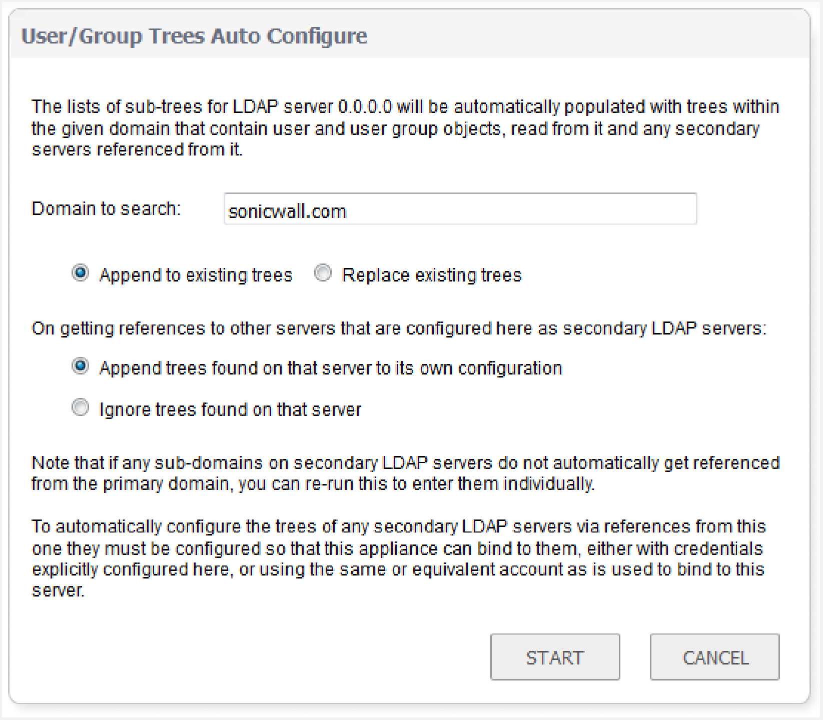
- **Primary Domain** – The user domain used by your LDAP implementation. For AD, this is the Active Directory domain name, for example, *yourADdomain.com*. Changes to this field, optionally, automatically update the tree information in the rest of the page. This is set to **mydomain.com** by default for all schemas except Novell eDirectory, for which it is set to **o=mydomain**.
- **Trees containing users** – The trees where users commonly reside in the LDAP directory. One default value is provided which can be edited, and up to a total of 64 DN values could be provided. SonicOS NS*v* searches the directory using them all until a match is found, or the list is exhausted. If you have created other user containers within your LDAP or AD directory, you should specify them here.
- **Trees containing user groups** – Same as above, only with regard to user group containers, and a maximum of 32 DN values might be provided. These are only applicable when there is no user group membership attribute in the schema's user object, and are not used with AD.
- All the above trees are normally given in URL format but can alternatively be specified as distinguished names (for example, `myDom.com/Sales/Users` could alternatively be given as the DN `ou=Users,ou=Sales,dc=myDom,dc=com`). The latter form is necessary when the DN does not conform to the normal formatting rules as per that example. In Active Directory the URL corresponding to the distinguished name for a tree is displayed on the Object tab in the properties of the container at the top of the tree.

  > ⓘ **NOTE:** AD has some built-in containers that do not conform (for example, the DN for the top level Users container is formatted as `cn=Users,dc=…`, using `cn` rather than `ou`) but SonicOS NS*v* knows about and deals with these, so they can be entered in the simpler URL format.

  Ordering is not critical, but because they are searched in the given order it is most efficient to place the most commonly used trees first in each list. If referrals between multiple LDAP servers are to be used, then the trees are best ordered with those on the primary server first, and the rest in the same order that they are referred.

  > ⓘ **NOTE:** When working with AD, to determine the location of a user in the directory for the **User tree for login to server** field, the directory can be searched manually from the Active Directory Users and Settings control panel applet on the server, or a directory search utility such as queryad.vbs in the Windows NT/2000/XP Resource Kit can be run from any PC in the domain.

- **AUTO-CONFIGURE** – This causes SonicOS NS*v* to auto-configure the **Trees containing users** and **Trees containing user groups** fields by scanning through the directory/directories looking for all trees that contain user objects. To use auto-configure, first enter a value in the **User tree for login to server** field (unless anonymous login is set), and then click **AUTO-CONFIGURE** to display the **User/Group Trees Auto Configure** dialog:



User/Group Trees Auto Configure

The lists of sub-trees for LDAP server 0.0.0.0 will be automatically populated with trees within the given domain that contain user and user group objects, read from it and any secondary servers referenced from it.

Domain to search: sonicwall.com

● Append to existing trees ○ Replace existing trees

On getting references to other servers that are configured here as secondary LDAP servers:

● Append trees found on that server to its own configuration

○ Ignore trees found on that server

Note that if any sub-domains on secondary LDAP servers do not automatically get referenced from the primary domain, you can re-run this to enter them individually.

To automatically configure the trees of any secondary LDAP servers via references from this one they must be configured so that this appliance can bind to them, either with credentials explicitly configured here, or using the same or equivalent account as is used to bind to this server.

a) Enter the desired domain in the **Domain to search** field.

b) Choose one of the following:

- **Append to existing trees** – This selection appends newly located trees to the current configuration. This is the default.
- **Replace existing trees** – This selection starts from scratch removing all currently configured trees first.

c) Choose one of the following for **On getting references to other servers that are configured here as secondary LDAP servers**:

- **Append trees found on that server to its own configuration** – This selection appends newly located trees found on the server to its own configuration. This is the default.
- **Ignore trees found on that server** – This selection ignores trees on the specified server.

2 Click **OK**.

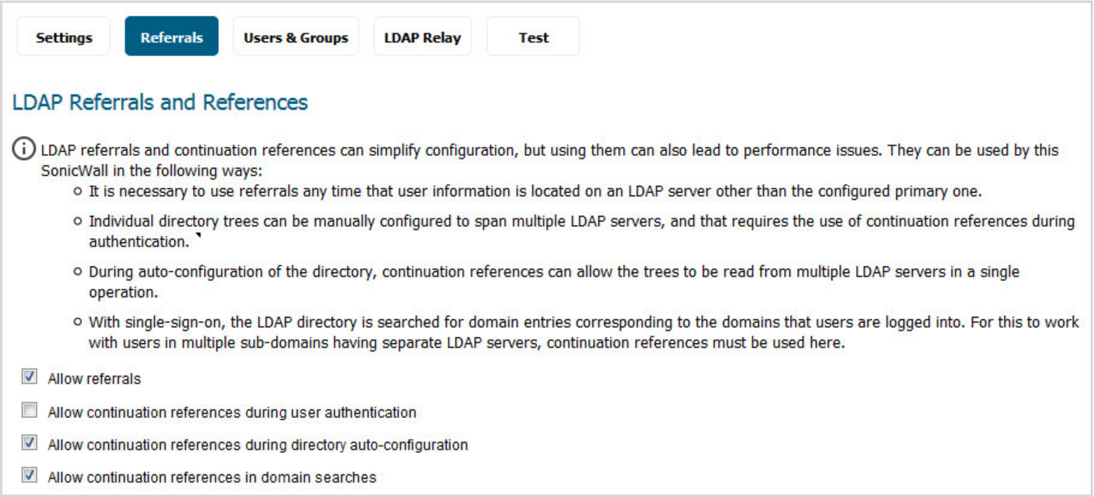
The auto-configuration process might also locate trees that are not needed for user login. You can manually remove these entries.

If using multiple LDAP/AD servers with referrals, this process can be repeated for each, replacing the **Domain to search** value accordingly and selecting **Append to existing trees** on each subsequent run.

Referrals Page

To configure the LDAP server referrals settings:

1 Click **Referrals**.



LDAP Referrals and References

LDAP referrals and continuation references can simplify configuration, but using them can also lead to performance issues. They can be used by this SonicWall in the following ways:

- It is necessary to use referrals any time that user information is located on an LDAP server other than the configured primary one.
- Individual directory trees can be manually configured to span multiple LDAP servers, and that requires the use of continuation references during authentication.
- During auto-configuration of the directory, continuation references can allow the trees to be read from multiple LDAP servers in a single operation.
- With single-sign-on, the LDAP directory is searched for domain entries corresponding to the domains that users are logged into. For this to work with users in multiple sub-domains having separate LDAP servers, continuation references must be used here.

☑ Allow referrals

□ Allow continuation references during user authentication

☑ Allow continuation references during directory auto-configuration

☑ Allow continuation references in domain searches

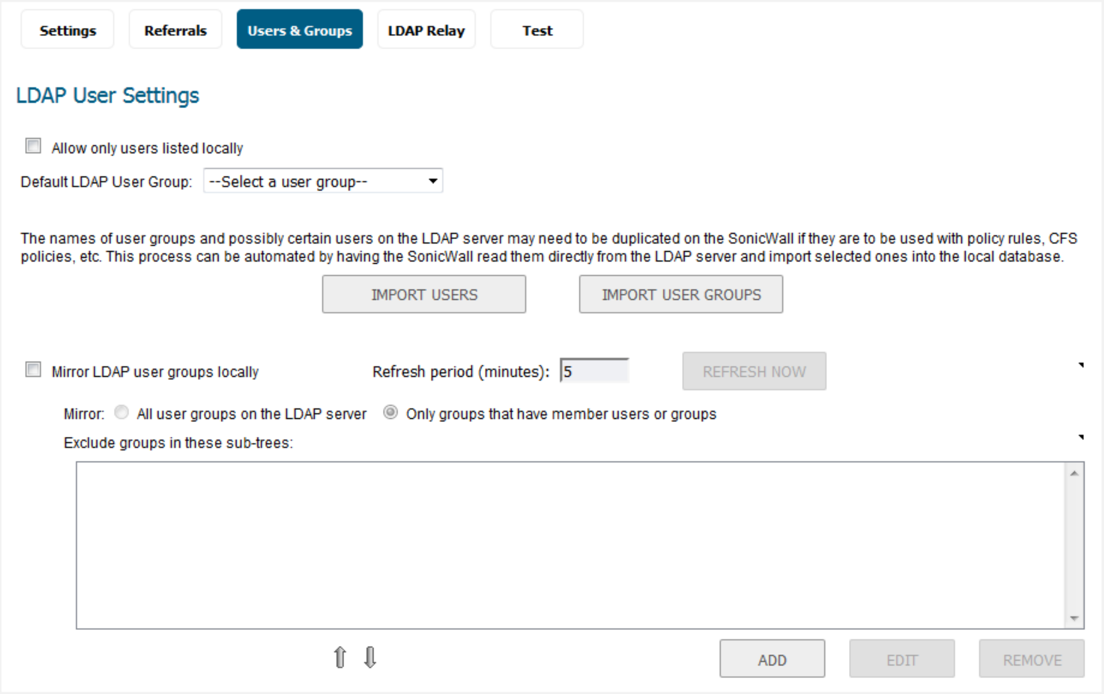
2 Configure the following fields:

- **Allow referrals** – Select this option any time that user information is located on an LDAP server other than the configured primary one. This option is selected by default.
- **Allow continuation references during user authentication** – Select this option any time that individual directory trees have been manually configured to span multiple LDAP servers. This option is not selected by default.
- **Allow continuation references during directory auto-configuration** – Select this option to allow the trees to be read from multiple LDAP servers in a single operation. This option is selected by default.
- **Allow continuation references in domain searches** – Select this option when using single-sign-on with users in multiple sub-domains having separate LDAP servers. This option is selected by default.

Users & Groups Page

To configure the LDAP users and groups settings:

1 Click **Users & Groups**.



LDAP User Settings

□ Allow only users listed locally

Default LDAP User Group: --Select a user group--

The names of user groups and possibly certain users on the LDAP server may need to be duplicated on the SonicWall if they are to be used with policy rules, CFS policies, etc. This process can be automated by having the SonicWall read them directly from the LDAP server and import selected ones into the local database.

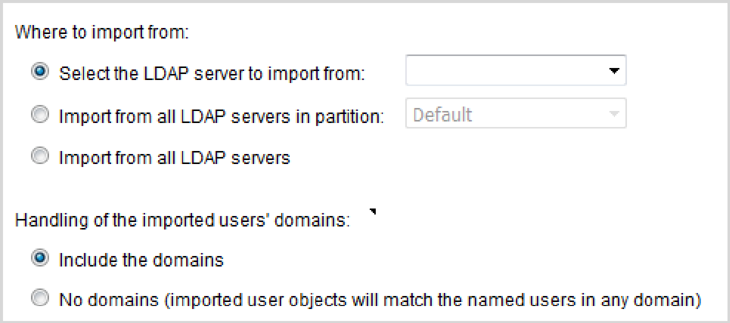
□ Mirror LDAP user groups locally Refresh period (minutes): 5

Mirror: ○ All user groups on the LDAP server ● Only groups that have member users or groups

Exclude groups in these sub-trees:

2 Configure the following fields:

- **Allow only users listed locally** – Requires that LDAP users also be present in the SonicOS NS*v* local user database for logins to be allowed.
- **Default LDAP User Group** – A default group in SonicOS NS*v* to which LDAP users belong in addition to group memberships configured on the LDAP server.
- **IMPORT USERS** – You can click this button to configure local users in SonicOS NS*v* by retrieving the user names from your LDAP server. **IMPORT USERS** launches the **Select Server–User** dialog.



Where to import from:

● Select the LDAP server to import from:

○ Import from all LDAP servers in partition: Default

○ Import from all LDAP servers

Handling of the imported users' domains:

● Include the domains

○ No domains (imported user objects will match the named users in any domain)

a) Choose the server from which to import users:

- Select an LDAP server from **Select the LDAP server to import from**.
- Select a partition containing the servers from **Import from all LDAP servers in partition**.
- To import users from all LDAP servers, choose **Import from all LDAP servers**.

b) Choose whether to include domains in imported user objects:

- **Include the domains**
- **No domains (imported user objects will match the named users in any domain)**

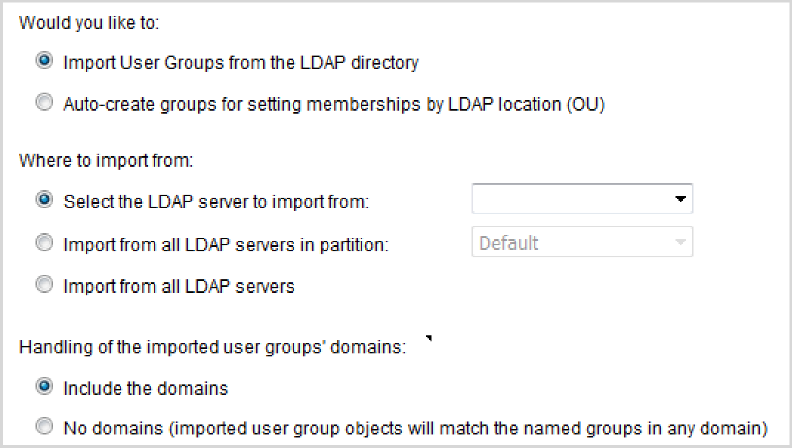
Including domains when importing users allows for distinguishing users from different domains who might have the same user name. Including domains is generally recommended, especially if there are multiple domains. Settings, such as local user group memberships and account expiry time, made for an imported user object that includes the domain are applied only when the named user is authenticated from that domain.

If domains are not included, then each imported user object matches any user with that name from any domain, and any settings made for such an imported user object is applied for all those matching users regardless of their domains.

c) Click **OK**.

Having users in SonicOS NS*v* with the same name as existing LDAP users allows SonicWall user privileges to be granted upon successful LDAP authentication.

- **IMPORT USER GROUPS** – You can click this button to configure SonicOS NS*v* user groups by retrieving the user group names from your LDAP server. **IMPORT USER GROUPS** launches the **Select Server–User Groups** dialog.



Would you like to:

● Import User Groups from the LDAP directory

○ Auto-create groups for setting memberships by LDAP location (OU)

Where to import from:

● Select the LDAP server to import from:

○ Import from all LDAP servers in partition: Default

○ Import from all LDAP servers

Handling of the imported user groups' domains:

● Include the domains

○ No domains (imported user group objects will match the named groups in any domain)

a) Choose how to import users:

- **Import User Groups from the LDAP directory**
- **Auto-create groups for setting memberships by LDAP location (OU)**

Having user groups in SonicOS NS*v* with the same name as existing LDAP/AD user groups allows SonicWall group memberships and privileges to be granted upon successful LDAP authentication.

Alternatively, you can manually create user groups on the LDAP/AD server with the same names as SonicWall built-in groups (such as 'Guest Services', 'Content Filtering Bypass', 'Limited Administrators') and assign users to these groups in the directory. This also allows SonicWall group memberships to be granted upon successful LDAP authentication.

b) Choose the server from which to import users:

- Select an LDAP server from **Select the LDAP server to import from**.
- Select a partition containing the servers from **Import from all LDAP servers in partition**.

- To import users from all LDAP servers, choose **Import from all LDAP servers**.

c) Choose whether to include domains in imported user objects:

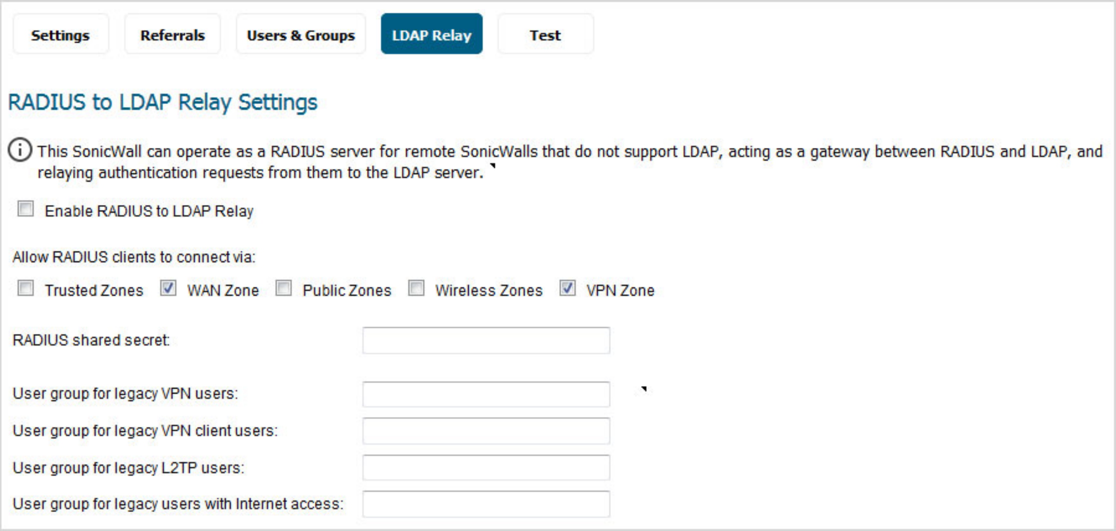
- **Include the domains**
- **No domains (imported user objects will match the named users in any domain)**

The Security Appliance can retrieve group memberships efficiently in the case of Active Directory by taking advantage of its unique trait of returning a 'memberOf' attribute for a user.

LDAP Relay Page

To configure the LDAP server relay settings:

1 Click **LDAP Relay**.



RADIUS to LDAP Relay Settings

This SonicWall can operate as a RADIUS server for remote SonicWalls that do not support LDAP, acting as a gateway between RADIUS and LDAP, and relaying authentication requests from them to the LDAP server.

□ Enable RADIUS to LDAP Relay

Allow RADIUS clients to connect via:

□ Trusted Zones ☑ WAN Zone □ Public Zones □ Wireless Zones ☑ VPN Zone

RADIUS shared secret:

User group for legacy VPN users:

User group for legacy VPN client users:

User group for legacy L2TP users:

User group for legacy users with Internet access:

The RADIUS to LDAP Relay feature is designed for use in a topology where there is a central site with an LDAP/AD server and a central SonicWall with remote satellite sites connected into it through low-end Security Appliances that might not support LDAP. In that case the central SonicWall can operate as a RADIUS server for the remote SonicWalls, acting as a gateway between RADIUS and LDAP, and relaying authentication requests from them to the LDAP server.

2 Configure the following fields:

- **Enable RADIUS to LDAP Relay** – Enables this feature. This option is not selected by default.
- **Allow RADIUS clients to connect via** – Check the relevant checkboxes and policy rules are added to allow incoming RADIUS requests accordingly. **WAN Zone** and **VPN Zone** are selected by default.
- **RADIUS shared secret** – This is a shared secret common to all remote SonicWalls.
- **User groups for legacy VPN users** – Defines the user group that corresponds to the legacy 'Access to VPNs' privileges. When a user in this user group is authenticated, the remote SonicWall is notified to give the user the relevant privileges.
- **User groups for legacy VPN client users** – Defines the user group that corresponds to the legacy 'Access from VPN client with XAUTH' privileges. When a user in this user group is authenticated, the remote SonicWall is notified to give the user the relevant privileges.

- **User groups for legacy users with Internet access** – Defines the user group that corresponds to the legacy 'Allow Internet access (when access is restricted)' privileges. When a user in this user group is authenticated, the remote SonicWall is notified to give the user the relevant privileges.

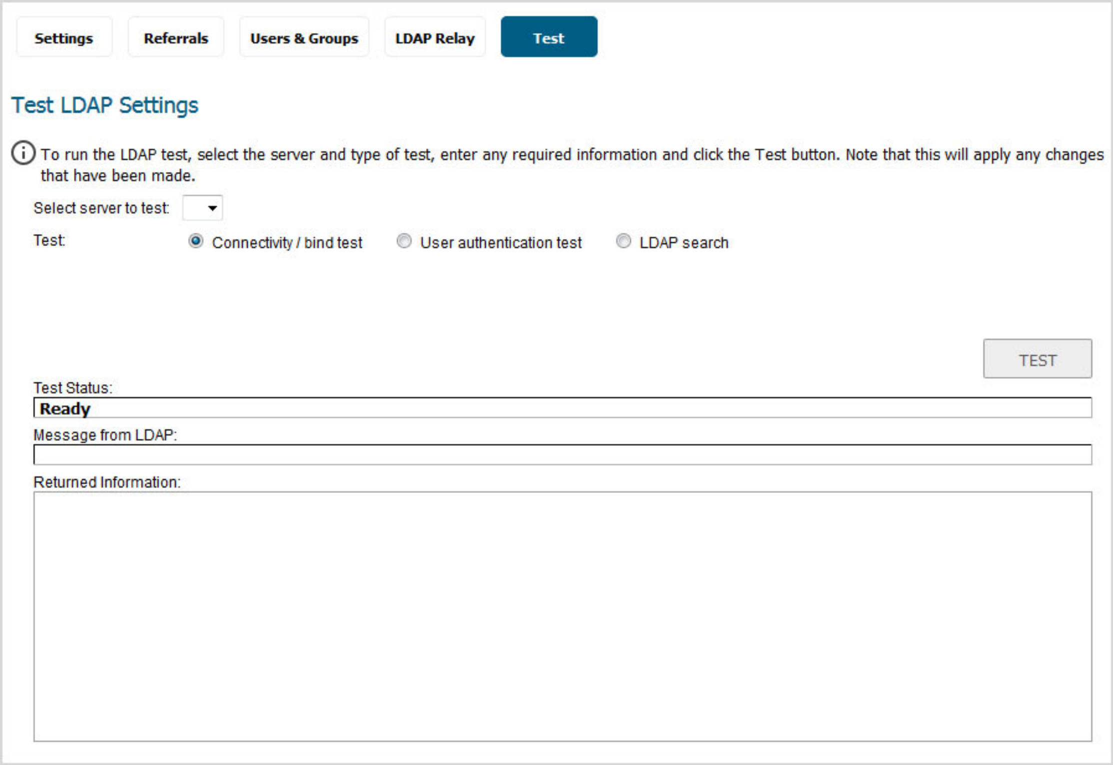
> **NOTE:** The 'Bypass filters' and 'Limited management capabilities' privileges are returned based on membership to user groups named 'Content Filtering Bypass' and 'Limited Administrators' – these are not configurable.

Test Page

> **IMPORTANT:** Testing the LDAP settings applies any changes you have made.

To configure the LDAP server test settings:

1 Select **Test** to test the configured LDAP settings:



Test LDAP Settings

To run the LDAP test, select the server and type of test, enter any required information and click the Test button. Note that this will apply any changes that have been made.

Select server to test:

Test: ● Connectivity / bind test ○ User authentication test ○ LDAP search

Test Status: Ready

Message from LDAP:

Returned Information:

The **Test LDAP Settings** page allows for the configured LDAP settings to be tested by attempting authentication with specified user and password credentials. Any user group memberships and/or framed IP address configured on the LDAP/AD server for the user are displayed.

About Extended Support for Multiple LDAP Servers

Multiple primary LDAP servers can be configured, one for each authentication partition, plus a list of additional servers for each. Each primary LDAP server is configured as per the current LDAP server. For the additional servers, configuration is minimal (common configuration from the primary server applies), but includes the login (bind) credentials and the sub-domain that the server controls.

> **NOTE:** Active Directory has a 1:1 mapping of LDAP server to domain, which might not be the case with other LDAP servers. When there is a 1:1 mapping, configuring a domain for each LDAP server makes selection of the server efficient, but if that is not the case, selection is just less efficient.

The settings that are configurable separately per-server are those currently in the **MANAGE | System Setup | Users > Settings > Configure LDAP** dialog in the Management Interface. For more information about configuring LDAP, see Configuring the SonicWall for LDAP on page 134.

ⓘ **IMPORTANT:** For correct operation, all the LDAP servers within a partition must be set to the same schema. If this is not the case, a warning is issued.

The **Referrals** settings are configured globally and are common across all the LDAP servers in all the authentication partitions.

ⓘ **NOTE:** Explicitly configuring the secondary servers is optional. Each primary and secondary server can be configured separately, or a primary can be configured with all the user/group trees that can be accessed through it through referrals.

Topics:

About Configuring Secondary Servers

Creating/configuring permanent secondary servers is the same as for the primary server, except for the primary/secondary setting. The only functional difference between them is that when a search is to be made and the location is not known from the configured user/group trees, then the search is sent to the primary server, with the primary server sending references/referrals when passing the search on to the secondary server(s) if needed.

About Dynamically Learned Secondary Servers

When a secondary server is accessed through a referral or reference for the first time, the Security Appliance binds to the secondary server after possibly trying multiple bind domain names [DNs) based on the various configured user trees. The Security Appliance internally creates a record for the secondary server in which the Security Appliance saves the bind information for future attempts. This process includes secondary servers that are not configured, thus creating a dynamic server object that is kept internally along with the server objects for the configured servers.

These dynamically learned server objects allow storing additional information as well as the current bind information, as per configured servers. The information includes the user/group trees that are learned by the server, plus statistics for the object.

ⓘ **NOTE:** This information is not persistent over reboot and is re-learned as necessary. The configuration of the user/group trees of dynamic secondary servers, however, are saved with the primary server.

About Backup Servers

Support for backup servers is provided with Active Directory, where backup is achieved through the DNS name system. An Active Directory domain controller is accessed through the DNS name of either the machine or the domain; in the latter case, the domain name resolves to a list of the IP addresses of all of the domain's controller replicas. When the LDAP server DNS name resolves to a list of IP addresses, the SonicWall Security Appliance tries each in turn until one responds. For this reason, configuring the LDAP server DNS name as the primary domain name rather than the domain controller machine name gives redundancy, with a backup server being used if the primary does not respond.

This mechanism also works in Active Directory for referrals and references because it returns the secondary domain's DNS name in a referral to the domain.

ⓘ **NOTE:** In Active Directory, backup servers are generally referred to as replica servers.

One or more backups can be configured for each configured primary or secondary LDAP server. This configuration enables recording status and statistics for each individual server and provides support for redundancy with backup servers in non-Active Directory installations where the above DNS name mechanism does not provide such support.

A backup server has only a subset of the configuration that is set for other servers, as most of the configuration is identical to the server for which it is a backup. By default, only the host name or IP address of the backup server is needed.

About Importing and Mirroring from LDAP

To create local user groups that mirror those in the LDAP directory when LDAP User Group Mirroring is enabled, the SonicWall Security Appliance periodically auto imports user groups and user group nestings (memberships where groups are members of other groups) from the LDAP server(s).

You can select mirror user groups anywhere you can select regular user groups, such as in access rules and CFS policies. Mirror user groups do have a few restrictions, however, such as they cannot have other user groups added as members locally on the SonicWall Security Appliance, although mirror user groups can be made members of other local user groups and local users can be made members of them. Users who are members of a user group on the LDAP server receive any access privileges set through its local mirror group automatically.

Topics:

- User Importation on page 147
- User Group Importation and Mirroring on page 148

User Importation

When user importation from LDAP is launched from the **LDAP Configuration** dialog or the **MANAGE | System Setup | Users > Local Users & Groups** page, there is an option to specify the LDAP server(s) from which to import:

- One specific LDAP server
- All the servers in an authentication partition (when the latter is enabled)
- All LDAP servers

To be able to distinguish users imported from different domains on different LDAP servers who might have the same usernames, there is also an option to create the local user object with one of a number of qualified username formats that include the domain. This option is in addition to using the simple username.

If a user account is imported with one of the qualified username formats, then:

- For web or client login using that account, the fully qualified username must be entered exactly as imported.
- When a user is identified through SSO, because the name formats can vary depending on the SSO source, the username and domain components are matched separately against those of the user object. For example, if a user is imported from LDAP as `jdoe@mydomain.com` and an SSO agent reports `MYDOMAIN/jdoe`, those match, and that user account is used to set additional group memberships for the user. Consequentially, for SSO, which qualified name format is selected does not really matter, and the choice comes down mainly to display preference.

  > ⓘ **NOTE:** This applies only if the **Use LDAP to retrieve user group information** or **Allow only users listed locally** option is set in **System Setup | Users > Settings**. For more information, see Configuring the SonicWall for LDAP on page 134 and Configuring SonicOS NS*v to Use the SonicWall SSO Agent* on page 150.

User Group Importation and Mirroring

When using authentication partitioning, the users in a partition must get access permissions set for user groups imported from that partition, but not the access permissions for user groups of the same name imported from other partitions.

For example, imported/mirrored user groups are used in policies to select the applicable user groups by matching the group names in the policy against the group names read from LDAP at login time for the users. Imported and mirrored user groups work a bit differently (mainly for historical reasons):

- When a user group is imported manually, the local user group object is created with the simple group name with no domain component. Then, when users' group memberships are matched against the local group name, just the simple group names are compared, and any domain component is ignored. So, where user groups exist with the same names in different domains, users from any domain would get memberships set for the local group.
- When LDAP user group mirroring mirrors a group, the local user group object is created with the name, `group-name@domain.com`, to distinguish groups mirrored from different domains. Then, when users' group memberships are read from LDAP, they are put into the same format, and the full group name, including the domain component, is compared. Where user groups exist with the same names in different domains, users from a domain only get memberships set for the groups mirrored from their own domain.

Manually imported user groups also have the option to import a qualified group name so they can be used as per mirrored groups above to set memberships separately for each domain's users. When importation of the groups is launched from the **MANAGE | System Setup | Users > Settings > Configure LDAP** dialog or the **Users > Local Users & Groups** page, the dialog has the same options as for users, except that the only choices for the format are **Simple name** or **name@domain** (the default).

ⓘ **NOTE:** No explicit authentication partition recording/checking is needed for imported/mirrored user groups because matching the domain component implicitly ensures that only the groups from the domains in a user's partition are selected.

For backwards compatibility and ease of setting common access for members of standard groups across different partitions, when a user group is imported from LDAP (or manually created) with a simple name, then the domain is ignored when matching against that; and so a simple name can be used to set access rights for users in any domain/partition.

For example, if you have:

- Partition A: `domain dom_a.com`
- Partition B: `domain dom_b.com`

and you then import the Administrators groups from both, selecting to import as **name@domain.com**, you import local user groups `Administrators@dom_a.com` and `Administrators@dom_b.com`. Users in each partition only receive access rights set for the relevant group; that is:

- When an administrative user from partition A logs in and an LDAP lookup finds that they are a member of the Administrators group in `dom_a.com`, they are given membership in `Administrators@dom_a.com`.
- Similarly, when an administrative user from partition B logs in, they receive membership in `Administrators@dom_b.com`.

If, however, you imported the Administrators group from either domain as a simple name, you would get a local user group named `Administrators` and administrative users in either partition would get any access rights set for that group.

Mirroring is enabled globally. When it is enabled, the user groups are mirrored from all configured and learned LDAP servers.

ⓘ **NOTE:** It is possible to use the exclude feature with wild cards to exclude all groups on a server.

About Enhanced LDAP Test

In the LDAP test, you can select the LDAP server to test, and you can add connectivity and search tests in addition to the current user authentication test. See LDAP Tests.

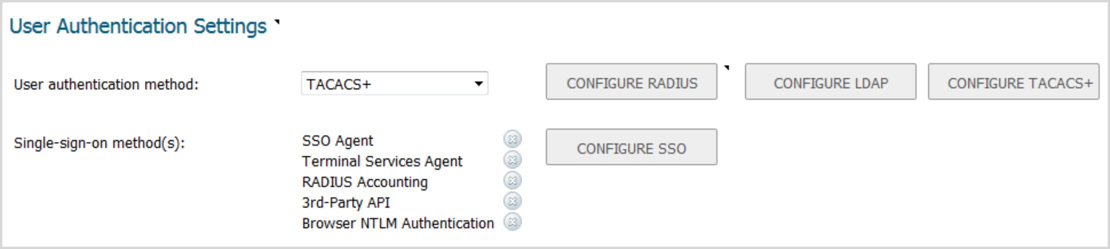
LDAP Tests

Test	Function
Connectivity/bind	Simply tries to bind to the LDAP server with the configured bind credentials.
User authentication	Tests that a given username and password can be sent to and authenticated by the LDAP server.
LDAP search	Has basic and advanced modes: **Basic mode** searches for a: • User with a given login name, qualified login name, or common name • User group with a given name or member **Advanced mode** allows: • An explicit search filter • Optionally, changing the search base and scope (the default is to search from the top of the domain sub-tree, with scope to search that entire sub-tree) • Searching for multiple objects • Limiting the information returned

Configuring TACACS + for Authentication

To configure TACACS+:

1 Navigate to **MANAGE | System Setup > Users > Settings**.



User Authentication Settings

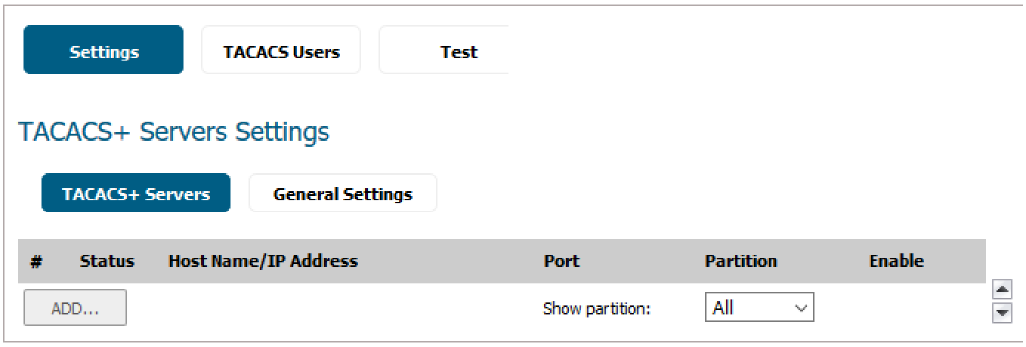
User authentication method: TACACS+

Single-sign-on method(s): SSO Agent, Terminal Services Agent, RADIUS Accounting, 3rd-Party API, Browser NTLM Authentication

2 From **User authentication method**, select either:

- **TACACS+**
- **TACACS+ + Local User**

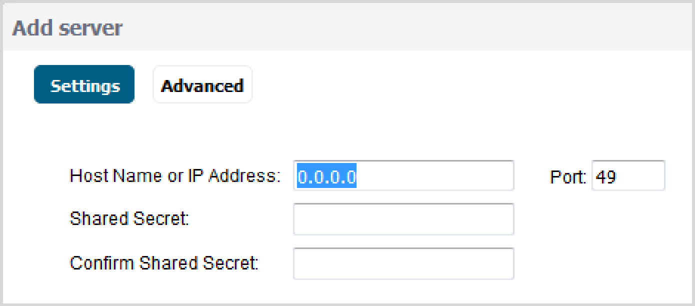
3 Click **CONFIGURE TACACS+**. The **TACACS+ Configuration** dialog displays.



#	Status	Host Name/IP Address	Port	Partition	Enable

Show partition: All

4 Under the **TACACS+ Servers** table, click **ADD**. The **Add Server** dialog displays.



Host Name or IP Address: 0.0.0.0 Port: 49

Shared Secret:

Confirm Shared Secret:

5 Enter the server's ID in the **Host Name or IP Address** field.

6 Enter the port number in the **Port** field. The default is **49**.

7 Enter the shared secret in the **Shared Secret** field.

8 Reenter the shared secret in the **Confirm Shared Secret** field.

9 Click **Save**. The server is added to the TACACS

10 Click **OK**.

Configuring SonicOS NS*v* to Use the SonicWall SSO Agent

To configure your Security Appliance to use the SonicWall SSO Agent:

1 Go to **MANAGE | System Setup > Users > Settings**.

2 In the **User Authentication Settings** section, for **Single-sign-on method(s)**, select **SSO Agent**. Use this choice to add and configure a TSA as well as an SSO Agent for the SSO method.

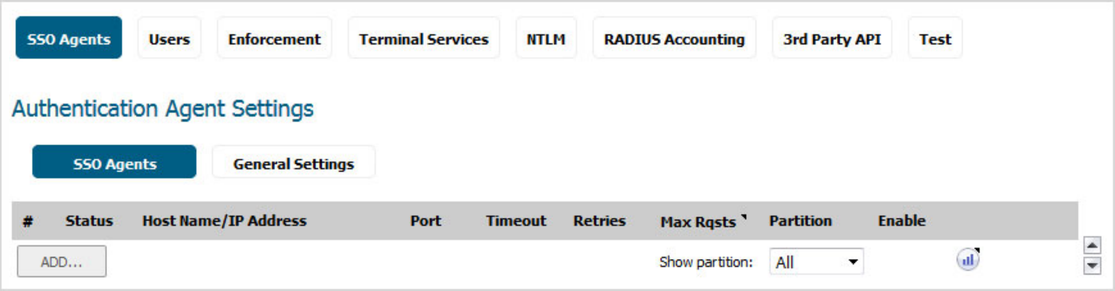
3 Click **CONFIGURE SSO**. The **SSO Authentication Configuration** dialog displays.

Topics:

- SSO Agents Page on page 151
- Users Page on page 153
- Enforcement Page on page 157
- Terminal Services Page on page 159

- NTLM Page on page 161
- RADIUS Accounting Page on page 163
- 3rd Party API Page on page 169
- Test Page on page 171

SSO Agents Page



On the **SSO Agents** page under **Authentication Agent Settings** you can view any SSO Agents already configured:

- The green LED next to the Agent's IP address indicates that the agent is currently up and running.
- A red LED would indicate that the agent is down.
- A grey LED shows that the agent is disabled.

The LEDs are dynamically updated using AJAX.

To configure an SSO agent:

TIP: As you type in values for the fields, the row at the top is updated in red to highlight the new information.

1. Click **ADD** to create an agent. The **Add Agent** dialog displays.
2. If you have partitions, choose which partition to add the agent.
3. Click **OK**.
4. Configure the SSO Settings options.
   - For **Host Name or IP Address**, enter the name or IP address of the workstation on which SonicWall SSO Agent is installed. By default, **0.0.0.0** is entered.
   - At **Port**, enter the port number that the SonicWall SSO Agent is using to communicate with the appliance. The default port is **2258**.

     NOTE: Agents at different IP addresses can have the same port number.
   - At **Shared Key**, enter the shared key that you created or generated in the SonicWall SSO Agent. The shared key must match exactly. Re-enter the shared key in the **Confirm Shared Key** field.
   - At **Timeout (seconds),** enter a number of seconds before the authentication attempt times out. This field is automatically populated with the default of **10** seconds.
   - At **Retries**, enter the number of authentication attempts. The default is **6**.
5. Click **Advanced**.
6. At **Maximum requests to send at a time**, enter the maximum number of simultaneous requests to send from the appliance to the agent at one time. The default is **32**.

The agent processes multiple requests concurrently, spawning a separate thread in the agent PC to handle each. The number of simultaneous requests that the authentication agent can handle depends on the performance level of the PC that it runs on and of the network. Increasing this setting could make SSO user authentication more efficient, but setting it too high could swamp the agent by sending too many requests at a time, thus overloading the PC and resulting in timeouts and authentication failures.

On the other hand, if the number of simultaneous requests sent from the appliance is too low, some requests have to wait, possibly causing ring buffer overflows. Too many requests waiting could lead to slow response times in Single Sign On authentication. If this setting cannot be increased high enough to avoid ring buffer warnings without getting a significant numbers of timeouts, then consider moving the agent to a higher-performance, dedicated machine, or possibly adding additional agents. For more information about checking for ring buffer overflows and related statistics in the SonicOS NSv TSR, see Single Sign-On Advanced Features on page 91.

ⓘ **TIP:** Look at the statistics in the **Single Sign On Authentication** section of the Tech Support Report. If significant numbers of timeouts are shown, then decreasing this value might help. If the **Maximum time spent on ring** approaches or exceeds the polling rate (configured on the **Users** tab) or if any ring buffer overflows are shown, then this value should probably be increased.

The page is updated to display a new row in the table at the top.

ⓘ **TIP:** You can modify any of the entries by clicking on it. The entry turns into an editable field.

7 Click **General Settings** under **Authentication Agent Settings**.

8 Configure the following options:

- Select the **Enable SSO agent authentication** checkbox to use the SSO Agent for user authentication. This setting is selected by default.
- Select the **Try next agent on getting no name from NetAPI/WMI** checkbox to force a retry of the authentication through a different SSO agent if there is no response or error from the first agent. This setting is not selected by default.

  ⓘ **NOTE:** This setting affects only agents using NetAPI/WMI, not any agents that use just the domain controller security log lookup mechanism.

  ⓘ **IMPORTANT:** See also the **Poll the same agent that authenticated the user** setting on the **Users** tab, which needs to be set if this setting is enabled.

  The NetAPI/WMI protocols used by the SSO agent for user identification are provided by Windows, and what they actually do is outside the control of the agent or appliance. When using NetAPI or WMI, should Windows respond with no user name and no error to a request from an agent, then by default, the appliance assumes that other agents get the same and does not retry the request through another agent (as it would do should it receive an error response).

  If you see authentication failures logged as `SSO agent returned no user name` when you think the users should have been identified, try enabling this setting. If this setting is enabled when the appliance receives a no-user-name response from an agent, the appliance treats the response as an error and retries the request through a different agent.

  Typically, enabling this setting is needed in a situation where only some of the agents can reach certain users; for example, if it is necessary to place an agent at a remote site to identify the users there because they cannot be reached easily by the agents at the central site.
- Select the **Don't block user traffic while waiting for SSO** checkbox to use the default policy while the user is being identified. This prevents browsing delays. This setting is not selected by default.

  When a user is being identified through SSO, traffic from the user is normally blocked until identification is complete so proper policies can be applied where applicable. Sometimes an SSO agent takes a significant time to identify a user, however, and that delay can result in users experiencing browsing delays.

This setting allows you to override that delay and instead allow users traffic through while waiting for SSO, with default policies applied until the user is identified.

You also can choose whether to allow through traffic when a user needs to be identified for an access rule that requires user authentication (that is, when a user would not otherwise be allowed any access if not identified).

△ **CAUTION: Take care with doing this as it can temporarily allow through a user who would not be allowed when identified. If you choose to do this for selected access rules, then a setting for it appears in the advanced settings of those rules that require user authentication.**

- Select the **Including for** checkbox and either the **All access rules** (default) or the **Selected access rules** radio button to allow traffic affected by access rules that require user authentication, while waiting for user identification.

△ **CAUTION: This can temporarily allow access that would not be allowed when the user is identified.**

- To have all the SSO agents synchronize their user databases, select either:
  - **Sync all agents** – To synchronize together no matter what identification mechanisms they use, thus giving a single, homogeneous user database duplicated on every agent.
  - **Sync those with the same user identification mechanisms** – To synchronize only those databases using the same identification mechanism; this is the default.

  Each SSO agent maintains its own database of the users that it has identified, and the agents can optionally be configured to synchronize those databases, thus giving a common user database duplicated on each agent. A common, synchronized user database makes user lookups more efficient and gives better redundancy. By specifying synchronicity here, the appliance can inform each agent of the other agents with which to synchronize, thereby avoiding the complexity of having to configure it in the agents.

  By default, the appliance has those agents configured to use the same user identification mechanisms synchronize together. For example, if some agents are reading domain controller logs while others use NetAPI, then two separate, external databases in the two groups of agents result, one database of those user found in the domain controller logs and a separate database of the users identified by NetAPI.

  ⓘ **NOTE:** This setting can be overridden by explicitly configuring in each SSO agent the list of other agents with which to synchronize.

- Configure the list of Windows service user names in the **User names used by Windows services** table. You can list up to 64 user names that might be used by services on the end-users' PCs; any log ins with these names are assumed to be service log ins and are ignored by the SSO agent(s).

  a) Click **ADD**. the **Service User name** dialog displays.

  b) Enter the service user name.

  c) Click **OK**.

  d) Repeat Step a through Step c for each user account.

  Windows services log on to the machine or domain using user accounts just as real users do. Some of the Windows' APIs used by the SSO agent do not provide for distinguishing these service log ins from real user log ins, which can lead to the SSO agent incorrectly reporting the user name used by a service instead of that of the actual user.

Users Page

1 Click **Users** to specify the following the **User Settings** options:

- Select the **Allow only users listed locally** checkbox to allow only users listed locally on the appliance to be authenticated. This setting is disabled by default.
- Select the **Allow limited access for non-domain users** checkbox to allow limited access to users who are logged in to a computer but not into a domain. These users are not given membership in the Trusted Users user group, even when set locally, and so do not get any access set for Trusted Users. They are given access through policies, and the like, which apply to everyone or that specifically list them as allowed users. This setting is disabled by default.

  These users are identified in logs as `computer-name/user-name`. When using the local user database to authenticate users and the **Simple user names in local database** option is disabled, user names must be configured in the local database using the full `computer-name/user-name` identification.

  ⓘ **NOTE:** This does not apply for users authenticated through NTLM. With NTLM, authentication non-domain users are given access only if the name/password matches a local user account created on the appliance.

- If your network includes non-Windows devices or Windows computers with personal Security Appliances running:

  a) Select the **Probe user for** checkbox.

  b) Choose one of the following, depending on which is configured for the SSO Agent:

  •NetAPI over NetBIOS

  •NetAPI over TCP

  •WMI

  ⓘ **TIP:** Hovering the mouse over these options displays a small tooltip contain the TCP port number.

  When the SSO agent attempts to identify a user in a Windows domain, if the agent uses NetAPI or WMI, then when the agent tries to communicate directly with the user’s computer from which the traffic is originating. This can cause problems:

  - When traffic is coming from non-Windows devices as such devices do not respond to, or might block, the Windows networking messages used by the SSO Agent to identify a user.
  - With Windows computers if personal Security Appliances on them are blocking them.

  The result can be that the agent might get overloaded with multiple threads waiting for requests that are not getting replies.

  To avoid these problems, enable this setting (it is disabled by default) and select the correct NetAPI/WMI protocol that the SSO agent is configured to use. Before sending a request to the agent to identify a user through NetAPI or WMI, the SonicWall appliance probes the machine from which the traffic originated to verify if it responds on the port used by the NetAPI or WMA protocol. If it does not, then the device fails SSO immediately without the agent getting involved.

  ⓘ **NOTE:** This setting does not affect an agent that reads user login information from the domain controller(s).

- If the **Probe users for** setting is enabled, it causes the Security Appliance to probe for a response on the NetAPI/WMI port before requesting that the SSO Agent identify a user. The **Probe timeout (seconds)** is set to **5** seconds by default.
- Select the **Probe test mode** checkbox to test that SSO probes are functioning correctly during SSO without interfering with user authentications. Probes are sent after initiating user authentication through the SSO agent. This setting is disabled by default.

  If this setting is enabled, the probes are sent after initiating user authentication through the SSO agent (normally, the latter is done if the probe is successful). Statistics for the probing are updated as normal, and if a probe fails for a user who is successfully authenticated by the agent, then that is reported through a message on the console port.

- For the **Mechanism for setting user group memberships**, choose either:
  - **Use LDAP to retrieve user group information** radio button to use LDAP to retrieve user information. This option is selected by default.
    - To configure the LDAP settings click **CONFIGURE**. The **LDAP Configuration** dialog displays. For configuration information for this dialog, refer to Advanced LDAP Configuration on page 172.
  - **Local configuration** radio button to use locally configured user group settings.
- In the **Polling rate (minutes)** field, enter a polling interval, in minutes (the default is **5**). After a user has been identified and logged in, the SonicWall polls the authentication agent at this rate to verify the user is still logged on.

  If you are using NTLM authentication, then in the NTLM settings you can selectively choose to have the appliance poll users by forcing them to re-authenticate through NTLM rather than polling through the agent.
- Select the **Poll the same agent that authenticated the user** checkbox if the network topology requires that particular agents be used depending on the location of users, rather than polling any agent to determine if the user is still logged in. This setting is disabled by default.

  ⓘ **IMPORTANT:** The **Try next agent on getting no name from NetAPI/WMI** setting on the **SSO Agents General Settings** tab also needs to be set if this is set.

  By default, the appliance assumes that any SSO agent can send NetAPI or WMI requests to any user, so when polling to check if users are still logged in, the appliance can choose any agent based on current loadings. If this is not the case, and the network topography requires particular agents be used depending on the location of the users, then enable this setting. When it is enabled, after a user is successfully identified by an agent, subsequent polling of the user is performed through that same agent.

  ⓘ **NOTE:** This setting affects only agents using NetAPI/WMI, not any agents that use just the domain controller security log lookup mechanism.
- In the **Hold time after (minutes)** field, enter a time, in minutes, that the Security Appliance waits before trying again to identify traffic after an initial failure to do so. This feature rate limits requests to the agent to avoid possibly flooding it with requests if further traffic continues to be received from sources that repeatedly fail SSO. The default is **1** minute.

  ⓘ **NOTE:** The times to hold off after getting errors from the SSO agent and after the agent reports that no user is logged in are set separately, so they are configured separately.
- In the **…after finding no user** field, enter the number of minutes that the appliance should wait before trying again if it gets errors from the SSO agent or when the agent reports that no user is logged in. The default is **1** minute.
- If **Ramp Up** is enabled, then the first retries after an SSO failure is quick, with the hold-off period growing exponentially on subsequent failures until it reaches configured rate. This can help avoid significant delays in identifying a user after a transient failure, which can happen, for example, if traffic emanates from their PC during boot-up. This option is selected by default.

  ⓘ **TIP:** If you encounter a problem that ramp-up does not help, then that might be because it ramps up too quickly before the problem has cleared, so try slowing down the ramp-up rate.
- Select the ramp-up rate:
  - **4 (fast ramp-up)** (default)
  - **3**

- **2**
- **1 (slow ramp-up)**

2 To give consistent naming for a domain in logging, select one of the following radio buttons for **When different SSO sources report different name variants for a user's domain**:

- **Use the domain name as received** (default)
- **Always use a consistent domain name**; go to Step a.

By default, a user identified through SSO is logged in on the SonicWall appliance with whatever domain name is reported to it by the external source that identified the user. A domain, however, typically has two or three different variants of its domain name (for example, a Windows domain has its DNS name, its NetBIOS name, and its Kerberos realm name), and different SSO sources might report different variants of these for a user in the same domain.

This difference can cause difficulty in tracking users by domain in logging, so you can instead select to make the names consistent by having the same domain name variant used for all the users in a domain, no matter which variant is reported to the SonicWall appliance.

a If you have selected **Always use a consistent domain name**, click **SELECT**. The **Select the name variant to use for each domain** pop-up dialog lists known domains from which you can select the names to use is displayed.

b Select the variant(s) to use. The initial default variant for each domain is **None**, which means that behavior of using whatever domain name is reported to the appliance through SSO does not change until **Always use a consistent domain name** is enabled and the domain name to use is selected here.

> ⓘ **NOTE:** If a domain is not shown in this list, wait until the SSO has identified some users in the domain, then repeat this step.

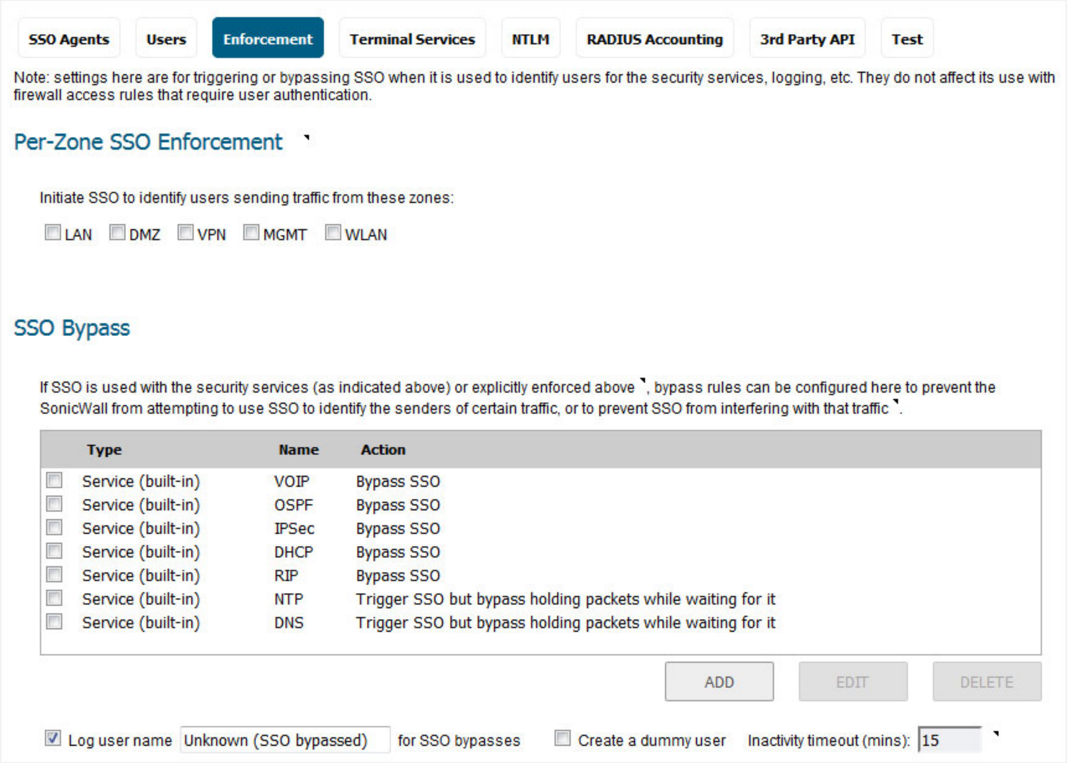
c Click **OK**.

If, when using Single Sign On, you see unexpected user names shown on the **MANAGE | System Setup > Users > Status** page, or logs of user login or user login failure with unexpected user names, those might be caused by Windows service logins and those user names should be configured here so that the SSO agent knows to ignore them.

In cases where there are multiple Security Appliances communicating with an SSO agent, the list of service account names should be configured on only one of them. The effect of configuring multiple lists on different appliances is undefined.

Enforcement Page

1 Click **Enforcement** if you want to either trigger SSO on traffic from a particular zone, or bypass SSO for traffic from non-user devices such as internal proxy web servers or IP phones.



Note: settings here are for triggering or bypassing SSO when it is used to identify users for the security services, logging, etc. They do not affect its use with firewall access rules that require user authentication.

Per-Zone SSO Enforcement

Initiate SSO to identify users sending traffic from these zones:

□ LAN □ DMZ □ VPN □ MGMT □ WLAN

SSO Bypass

If SSO is used with the security services (as indicated above) or explicitly enforced above, bypass rules can be configured here to prevent the SonicWall from attempting to use SSO to identify the senders of certain traffic, or to prevent SSO from interfering with that traffic.

	Type	Name	Action
□	Service (built-in)	VOIP	Bypass SSO
□	Service (built-in)	OSPF	Bypass SSO
□	Service (built-in)	IPSec	Bypass SSO
□	Service (built-in)	DHCP	Bypass SSO
□	Service (built-in)	RIP	Bypass SSO
□	Service (built-in)	NTP	Trigger SSO but bypass holding packets while waiting for it
□	Service (built-in)	DNS	Trigger SSO but bypass holding packets while waiting for it

☑ Log user name Unknown (SSO bypassed) for SSO bypasses □ Create a dummy user Inactivity timeout (mins): 15

2 Under **Per-Zone SSO Enforcement**, select the checkboxes for any zones on which you want to trigger SSO to identify users when traffic is sent:

- **LAN**
- **DMZ**
- **VPN**

If SSO is already required on a zone by Application Control or other policies, those checkboxes are pre-selected and cannot be cleared. If Guest Services is enabled on a zone, SSO cannot be enforced and you cannot select the checkbox. On zones where it is not otherwise initiated, SSO enforcement can be enabled by this option.

> **NOTE:** On zones where security services policies or access rules are set to require user authentication, SSO is always initiated for the affected traffic, and it is not necessary to also enable SSO enforcement here.

These per-zone SSO enforcement settings are useful for identifying and tracking users in event logging and AppFlow Monitor visualizations, even when SSO is not otherwise triggered by content filtering, IPS, or Application Control policies, or by access rules requiring user authentication.

3 To bypass SSO for traffic from certain services or locations and apply the default content filtering policy to the traffic, select the appropriate service or location from the list in the **SSO Bypass** table or add a new service or location to the table. The table displays the built-in services that bypass SSO; these services cannot be delete.

> **TIP:** You could create SSO bypass address and/or service group objects for this and reference those same ones both here and in those access rules.

NOTE: SSO bypass settings do not apply when SSO is triggered by access rules requiring user authentication. To configure this type of SSO bypass, add separate access rules that do not require user authentication for the affected traffic. For more information on configuring access rules, see *SonicOS NSv 6.5 Policies*.

By default, Linux and Mac users who are not authenticated by SSO through Samba are assigned the default content filtering policy. To redirect all such users who are not authenticated by SSO to manually enter their credentials, create an access rule from the **WAN** zone to the **LAN** zone for the **HTTP** service with **Users Allowed** set to **All**. Then configure the appropriate CFS policy for the users or user groups. For more information on configuring access rules, see *SonicOS NSv 6.5 Policies*.

SSO bypass might be necessary, for example, for:

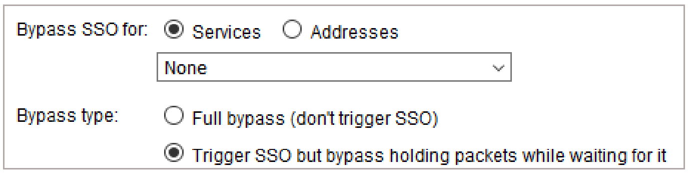
- Traffic emanating from a non-user device, such as an internal mail server or an IP phone.
- User traffic that does not need to be authenticated and might be adversely affected by delays waiting for SSO.

For traffic that bypasses SSO, the default content filtering policy is applied. If any APP rules or IPS/Anti-Spyware policies are set to include/exclude users, then that traffic is no included/excluded respectively with those.

The second setting is appropriate for user traffic that does not need to be authenticated, and triggering SSO might cause an unacceptable delay for the service.

4 Optionally, to add a service or location:

a Click **ADD**. The **Add an SSO bypass rule** dialog displays.



Bypass SSO for: ● Services ○ Addresses

None

Bypass type: ○ Full bypass (don't trigger SSO)

● Trigger SSO but bypass holding packets while waiting for it

b For **Bypass SSO for**, choose either **Services** or **Addresses**.

c Select a service or address from the drop-down menu.

d Choose the **Bypass type**:

- **Full bypass (don’t trigger SSO**
- **Trigger SSO but bypass holding packets while waiting for it** (default)

e Click **ADD**. The entry is added to the table

5 To select a SSO bypass user name for logging:

a Select **Log user name <*bypass name*> for SSO bypasses**.

b Specify a name for the SSO bypassed user. The default is **Unknown (SSO bypassed)**.

This setting is selected by default, and a default name of **SSO Bypass** is specified. When this setting is enabled, and when traffic bypasses SSO (as configured here), the traffic is shown in logs and AppFlow Monitor with the given user name rather than as from an unknown user, thus allowing it to be differentiated from traffic sent by users whom SSO could not identify.

TIP: You also can configure logging on the **Users > Settings** page under **User Session Settings**.

6 Optionally, **Create a dummy user**. This setting is not selected by default.

If this setting is enabled along with **Log user name <*bypass name*> for SSO bypasses**, on receiving SSO bypass traffic, a dummy user entry is created with the given user name for the originating IP address. Then, in addition to the name appearing in logs and the AppFlow Monitor, the dummy user entry displays on the **MANAGE | System Setup > Users > Status** page. The dummy name remains in existence until traffic from the IP address stops for the given inactivity time or, in the case of bypass services, until non-bypass traffic is received from it.

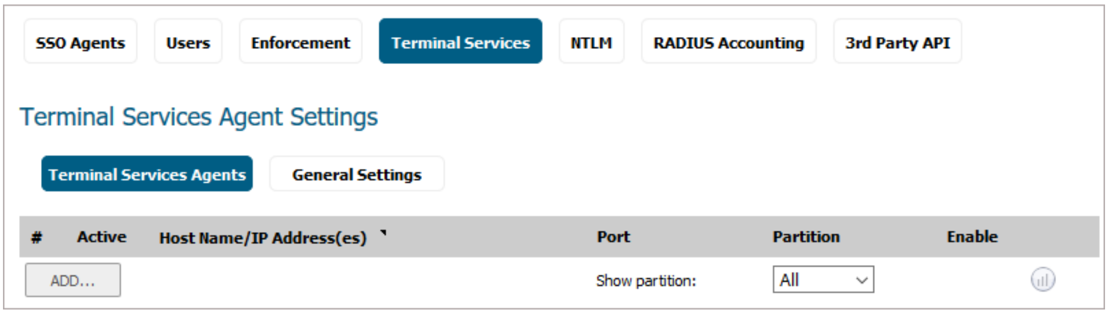
> ⓘ **NOTE:** This dummy user name applies only for bypass rules set for full SSO bypass. Any set to trigger SSO, but bypass holding packets while waiting for it results in the user being set according to the result of the triggered SSO identification.

> ⓘ **NOTE:** The logging part of this option also can be configured by the **For logging of connections on which the user is not identified** option in the **User Session Settings** section of the **Users > Settings** page.

a Optionally, specify an inactivity timeout, in minutes, in the **Inactivity timeout (mins)** field. The default is **15** minutes.

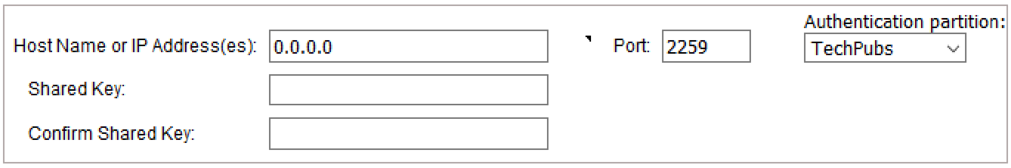
Terminal Services Page

1 Click **Terminal Services** to specify the following **Terminal Services Agent Settings** options.



#	Active	Host Name/IP Address(es)	Port	Partition	Enable
			Show partition:	All	

2 To add agents, click **ADD**. The **Add Terminal Services Agent** dialog displays.



Host Name or IP Address(es): 0.0.0.0

Port: 2259

Authentication partition: TechPubs

Shared Key:

Confirm Shared Key:

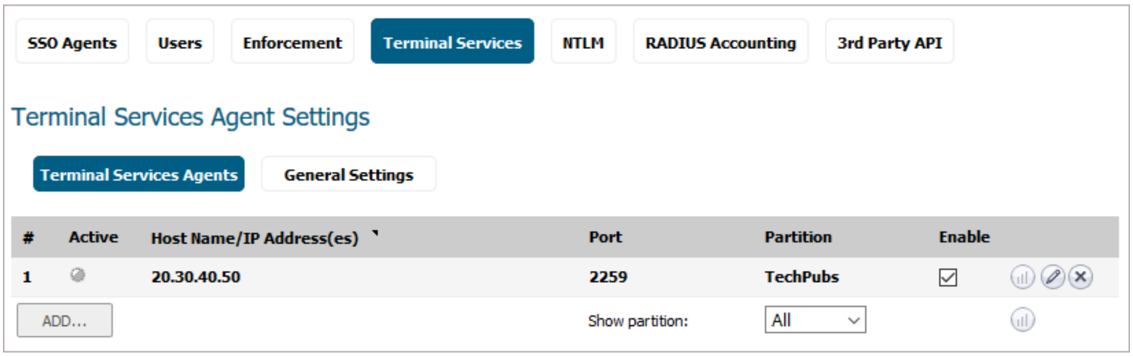
> ⓘ **TIP:** If partitioning is enabled, the **Select partition** dialog displays over the **Add Terminal Services Agent** dialog.
> 1 Choose the partition to which to add the new agent.
> 2 Click **OK**.

- In the **Host Name or IP Address(es)** field, enter the name or IP address of the terminal server on which SonicWall TSA is installed. If the terminal server is multi-homed (has multiple IP addresses) and you are identifying the host by IP address rather than DNS name, enter all the IP addresses as a comma-separated list.
- At **Port**, enter the port number that the SonicWall TSA is using to communicate with the appliance. The default port is **2259**.

  > ⓘ **NOTE:** Agents at different IP addresses can have the same port number.

- In the **Shared Key** field, enter the shared key that you created or generated in the SonicWall TSA. The shared key must match exactly. Re-enter the shared key in the **Confirm Shared Key** field.

  > ⓘ **TIP:** The shared key must be an even number of characters.



Terminal Services Agent Settings

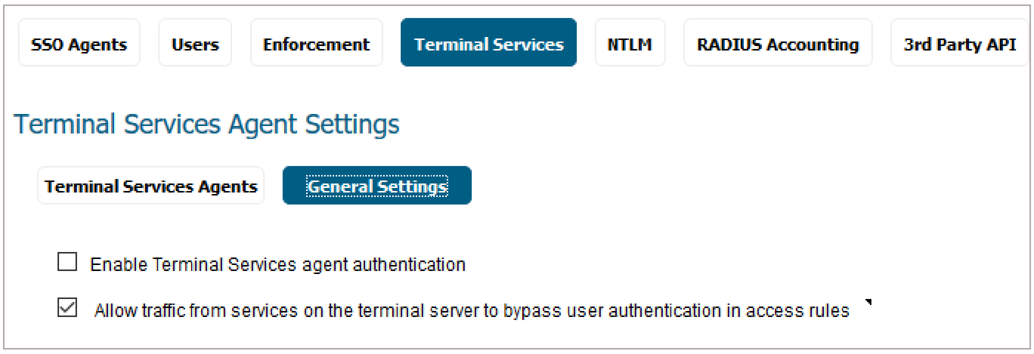
#	Active	Host Name/IP Address(es)	Port	Partition	Enable
1	●	20.30.40.50	2259	TechPubs	☑

The page is updated to display a new row in the table at the top and new input fields in the lower half of the page. For existing agents:

- Green LED-style icon next to an agent indicates that the agent is up and running.
- Red LED icon indicates that the agent is down.
- Yellow LED icon means that the TSA is idle and the firewall has not heard anything from it for five minutes or more.

Because TSA sends notifications to the appliance rather than the appliance sending requests to the agent, a lack of notifications could mean that there is a problem, but more likely means simply that no user on the terminal server is currently active.

3 Click **General Settings** under **Terminal Services Agent Settings** to configure the following options:



Terminal Services Agent Settings

□ Enable Terminal Services agent authentication

☑ Allow traffic from services on the terminal server to bypass user authentication in access rules

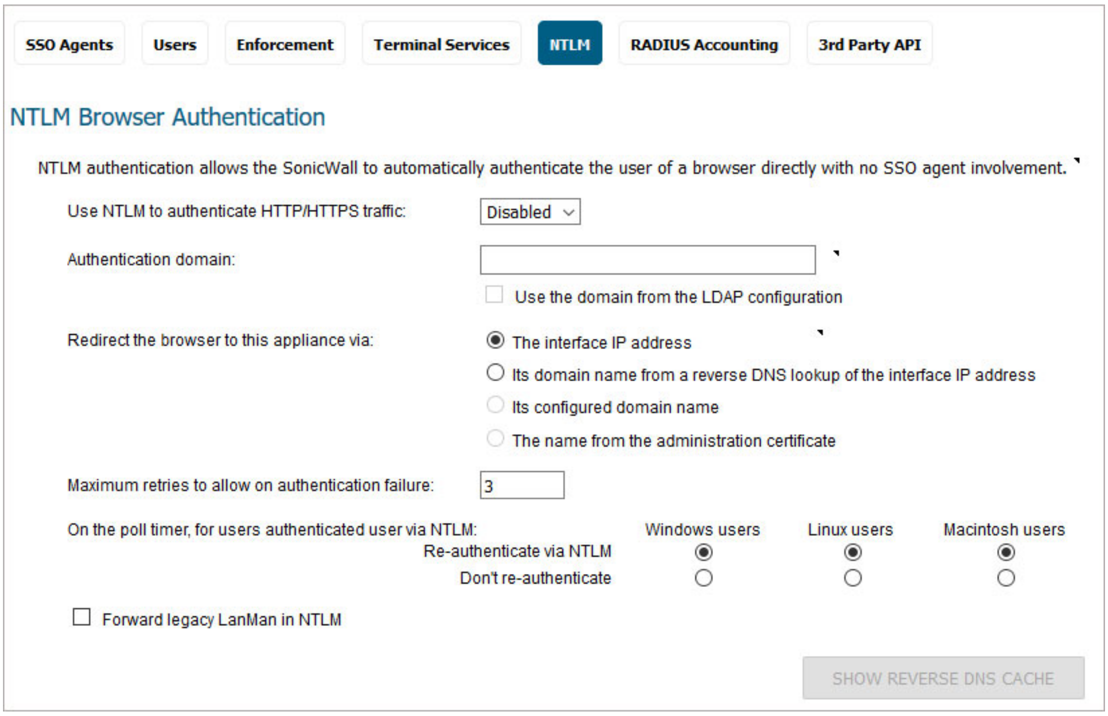
- Select **Enable Terminal Services agent authentication** to use the TSA for user authentication. This option is not selected by default.
- **Allow traffic from services on the terminal server to bypass user authentication in access rules** is selected by default. This allows service traffic, such as Windows updates or anti-virus updates not associated with any user login session, to pass without authentication. That traffic normally would be blocked if the applicable access rules are set to require user authentication.

  If you deselect this option, traffic from services can be blocked if access rules require user authentication. In this case, you can add rules to allow access for **All** to the services traffic destinations, or configure the destinations as HTTP URLs that can bypass user authentication in access rules.

NTLM Page

ⓘ **IMPORTANT:** RADIUS must be configured.

1 Click **NTLM**.



NTLM Browser Authentication

NTLM authentication allows the SonicWall to automatically authenticate the user of a browser directly with no SSO agent involvement.

Use NTLM to authenticate HTTP/HTTPS traffic: Disabled

Authentication domain:

□ Use the domain from the LDAP configuration

Redirect the browser to this appliance via:

● The interface IP address

○ Its domain name from a reverse DNS lookup of the interface IP address

○ Its configured domain name

○ The name from the administration certificate

Maximum retries to allow on authentication failure: 3

On the poll timer, for users authenticated user via NTLM:	Windows users	Linux users	Macintosh users
Re-authenticate via NTLM	●	●	●
Don't re-authenticate	○	○	○

□ Forward legacy LanMan in NTLM

NTLM authentication is supported by Mozilla-based browsers and can be used as a supplement to identifying users through an SSO agent or, with some limitations, on its own without the agent. The Security Appliance interacts directly with the browser to authenticate the user. Users logged in with domain credentials are authenticated transparently; in other cases the user might need to enter credentials to login to the appliance, but should only need to do so after the credentials are saved.

For more information about NTLM, see How Does Browser NTLM Authentication Work? on page 88.

2 Configure these settings:

- Select one of the following choices from **Use NTLM to authenticate HTTP traffic**:
  - **Disabled** – Never uses NTML authentication
  - **Enabled** – Try to authenticate users with NTLM before using the SonicWall SSO agent
- For **Authentication domain**, do one of the following:
  - Enter either:
    - The full DNS name of the domain in the form `www.somedomain.com`.
    - If using LDAP, the same domain that is entered in the LDAP configuration.

    In the NTLM protocol, the server (this firewall) might need to communicate its domain to the browser, and authentication might only be fully transparent to the user if the browser sees that as the local domain.

ⓘ **TIP:** In the NTLM protocol, the domain is something that might be requested/required by the browser in addition to the actual authentication of the name/password. Whether the domain affects the outcome of the authentication depends on the browser.

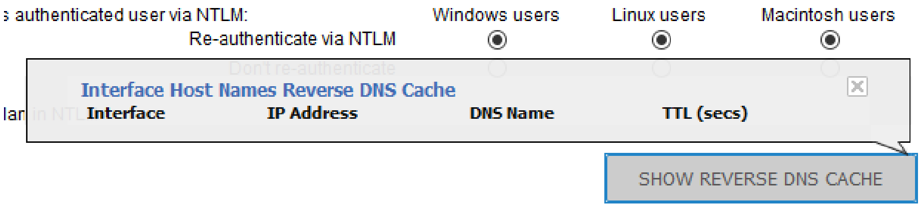
  - Select **Use the domain from the LDAP configuration** to use the same domain that is used in the LDAP configuration.

  Fully transparent authentication can only occur if the browser sees the appliance domain as the local domain.

- For **Redirect the browser to this appliance via**, select one of the following options to determine how a user's browser is initially redirected to the Security Appliance's own Web server:
  - **The interface IP address** – Select this to redirect the browser to the IP address of the appliance Web server interface. This option is selected by default.
  - **Its domain name from a reverse DNS lookup of the interface IP address** – Enables **Show Reverse DNS Cache** at the bottom of the window; when clicked, a popup displays the appliance Web server's Interface, IP Address, DNS Name, and TTL in seconds. Click the button to verify the domain name (DNS name) being used for redirecting the user's browser.
  - **Its configured domain name** – Use the Security Appliance's domain name as configured on the **System > Administration** page.
  - **The name from the administration certificate** – Use the imported certificate that is selected for HTTPS Web Management on the **Appliance > Base Settings > Appliance > Base Settings** page.
- Enter a number of retries in the **Maximum retries to allow on authentication failure**. The default is **3**, and the maximum is 99.
- To detect when users log out, select the polling method to be used by the appliance for Windows, Linux, and Macintosh users in the **On the poll timer, for users authenticated user via NTLM** options. Choose the option for users on each type of computer (**Windows users**, **Linux users**, **Macintosh users**):
  - **Re-authenticate via NTLM** – This method is transparent to the user if the browser is configured to store the domain credentials, or the user instructed the browser to save the credentials.
  - **Don't re-authenticate** – If you select this option, logout is not be detected other than through the inactivity timeout.

  NOTE: When multiple Content Filter policies are configured and NTLM is enabled for Single Sign-On enforcement, an HTTP/HTTPS access rule with Trusted Users as Users Allowed must be added to the LAN to WAN rules in the **MANAGE | Policies > Rules > Access Rules** page. This rule triggers an NTLM authentication request to the user. Without the access rule, restrictive CFS policies might block the user from Internet access and prevent authentication.

- If you are using older legacy servers that require legacy LAN Manager components to be included in NTLM messages, select the **Forward legacy LanMan in NTLM** checkbox. This might cause authentication to fail in newer Windows servers that do not allow LanMan in NTLM by default because it is not secure.
- If you chose Its domain name from a reverse DNS lookup of the interface IP address, click **SHOW REVERSE DNS CACHE**. A popup displays:



s authenticated user via NTLM:

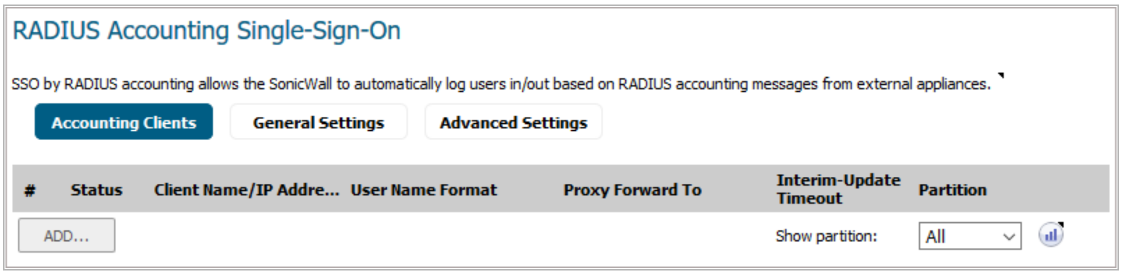
	Windows users	Linux users	Macintosh users
Re-authenticate via NTLM	●	●	●

Interface Host Names Reverse DNS Cache

Interface	IP Address	DNS Name	TTL (secs)

RADIUS Accounting Page

1 Click **RADIUS Accounting** to display **RADIUS Accounting Single-Sign-On**.



RADIUS Accounting Single-Sign-On

SSO by RADIUS accounting allows the SonicWall to automatically log users in/out based on RADIUS accounting messages from external appliances.

#	Status	Client Name/IP Addre...	User Name Format	Proxy Forward To	Interim-Update Timeout	Partition

Show partition: All

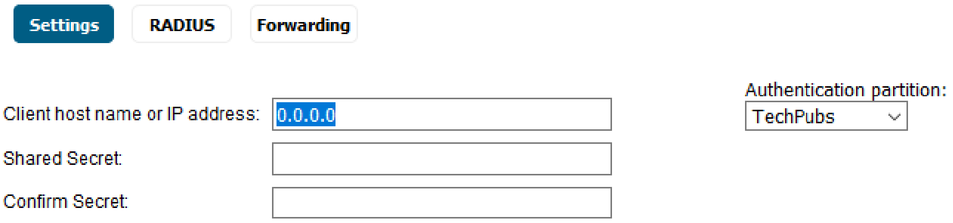
Single Sign-On by RADIUS accounting allows the appliance to act as a RADIUS accounting server for external third-party appliances, and to log users in or out based on the accounting messages from those devices. For third-party appliances that use RADIUS accounting for other purposes, SonicOS NS*v* can also forward the RADIUS accounting messages to another RADIUS accounting server.

The **Status** column shows the current status for each RADIUS accounting client listed in the panel:

- Green—the client is active
- Yellow—the client is idle
- Grey—the client is not detected

2 To add a new RADIUS client, click **ADD**. The **Add RADIUS Accounting Client** dialog displays..

> **NOTE:** Changes made in the dialog are instated directly into the highlighted entry in the **Accounting Clients** table as they are made. On completion, click anywhere outside of the pane to close it. Individual fields in the **Accounting Clients** table also can be updated by clicking on them directly in the table.



Client host name or IP address: 0.0.0.0

Shared Secret:

Confirm Secret:

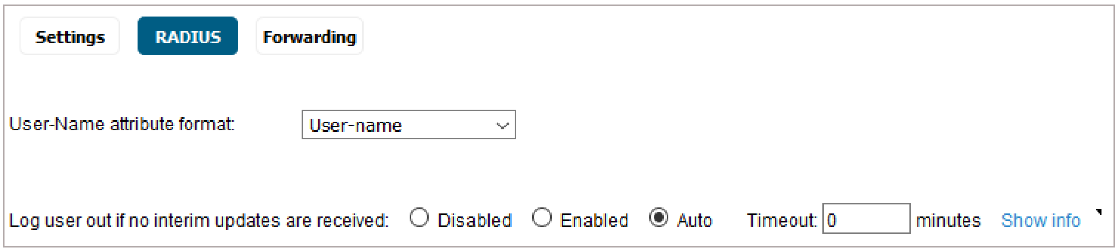
Authentication partition: TechPubs

> **TIP:** If partitioning is enabled, the **Select partition** dialog displays over the **Add RADIUS Accounting Client** dialog.
>
> 1 Choose the partition to which to add the new agent.
>
> 2 Click **OK**.

3 In the **Client host name or IP address** field, enter the name or the IP address for the RADIUS client host.

4 In the **Shared Secret** field and the **Confirm Secret** field, enter your shared secret for the client.

5 Click **RADIUS**.



User-Name attribute format: User-name

Log user out if no interim updates are received: ○ Disabled ○ Enabled ● Auto Timeout: 0 minutes

6 From **User-Name attribute format**, select the format for the user name login.

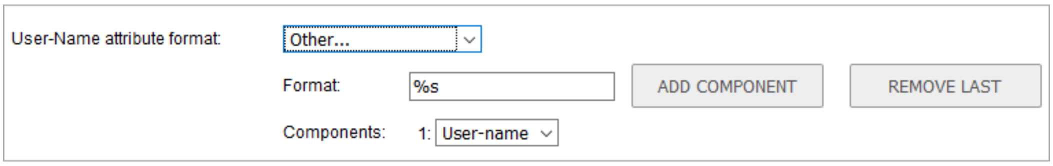
RADIUS Accounting does not specify the format of the content of the User-Name attribute passed in RADIUS Accounting messages. You need to enter, therefore, the format that is sent by the client. You can select from some common formats:

- **User-name**
- **Domain\User-name**
- **Domain/User-name**
- **User-name@Domain**
- **SonicWall SMA**
- **Other** – Non-standard format

> ⓘ **IMPORTANT:** The predefined formats are for common cases. If those do not match what your network access server sends, then you must select **Other** as the **User-Name** attribute format and then enter a customized format.

7 If you selected:

- A standard format, go to Step 8.
- If you select **Other**, more settings appear so you can configure the components to be found in the attribute:



User-Name attribute format: Other...

Format: %s

Components: 1: User-name

  - **Format**
  - **Components**
  - **ADD COMPONENT**
  - **REMOVE LAST**

a In the **Format** field, enter a limited scanf-style string, with either a `%s` or `%[…]` directive for each component. This directive tells the appliance what the network access device (NAS) sends in the **User-Name** attribute. This format is not specified by the RADIUS Accounting RFC. Devices are not constrained as to what they can send in this attribute, so, its content can be very variable. What you set here specifies how the appliance must decode the **User-Name** attribute to extract the user name, domain, and/or DN.

> ⓘ **TIP:** When you select **Other**, these fields are set to the format string and components of the previously selected format. So, first select the predefined format that most closely matches what your network access server sends. This gives you a good starting point for entering your customized format. Then, change to **Other**.

b From **Components**, select one of these

  - **Not used**
  - **User-Name** (default)
  - **Domain**
  - **DN**

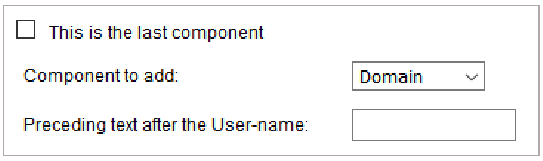
The components that you enter as a limited scanf-style string in the **Format** field consist of one or more of the following items:

- User-Name
- Domain
- Fully qualified distinguished name (DN)

> **NOTE:** You can double click **Components** to display a tooltip with instructions on how to enter the scanf-style format.

c Click **ADD COMPONENT**. The **Add a component to the User-Name attribute format** dialog displays.

> **NOTE:** If you understand the scanf-style format, you can edit the **Format** field directly instead of using **Add component**.
>
> **TIP:** Use %s for a component that is followed by white space or is at the end. For a component followed by some other character, use %[^x]x. For example, the **Format** string for the `name@domain` format would be `%[^@]@%s`, with the three components set to **User-Name**, **Domain**, and **Not used**.



☐ This is the last component

Component to add: Domain

Preceding text after the User-name:

d Select the type of component from **Component to add**:

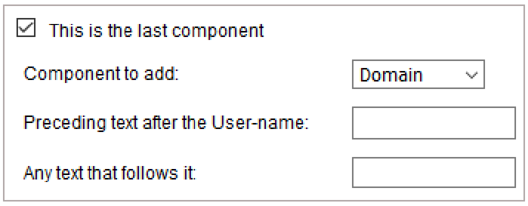
- **User-name**
- **Domain** (default)
- **DN**

e Enter text to separate entries in the **Preceding text after the User-name** field.

f Repeat Step c through Step e for each component.

To delete the last component you added, click **REMOVE LAST**.

g If this is the last user-name component, select **This is the last component**. Another option displays.



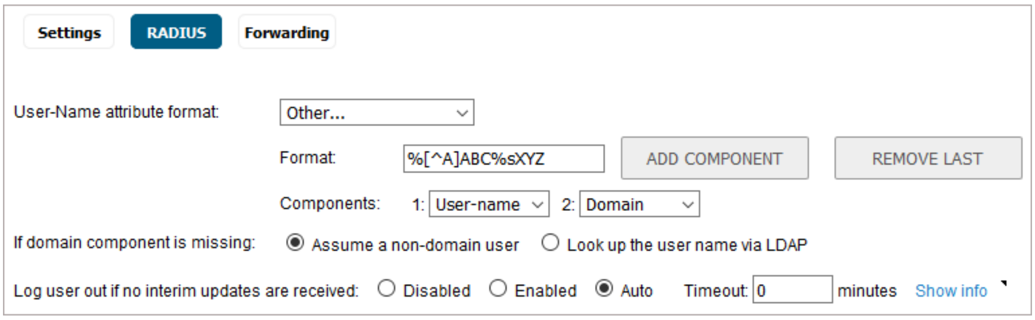
☑ This is the last component

Component to add: Domain

Preceding text after the User-name:

Any text that follows it:

h Click **ADD**. More options appear on the **Add a component to the User-Name attribute format** dialog.



User-Name attribute format: Other...

Format: %[^A]ABC%sXYZ

Components: 1: User-name 2: Domain

If domain component is missing: ● Assume a non-domain user ○ Look up the user name via LDAP

Log user out if no interim updates are received: ○ Disabled ○ Enabled ● Auto Timeout: 0 minutes i From **If domain component is missing**, choose:

- **Assume a non-domain user** – This option is selected by default.
- **Look up the user name via LDAP**.

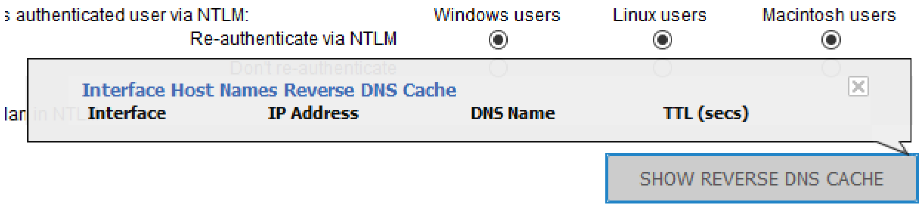
8 A RADIUS Accounting client can optionally send Interim Update messages periodically while a user is logged in. If the client does sends the messages at a reasonably constant interval, then the SonicWall appliance can monitor them and assume that the user has been logged out should the messages stop being sent. This process gives a fallback mechanism to guard against missing RADIUS Accounting Stop messages, which are sent on user log out.

Select a **Log user out if no accounting interim updates are received** option:

- **Disabled** – to not have messages sent.
- **Enabled** – to manually specify the **Timeout** interval. Set the timeout value greater than the period at which the RADIUS Accounting client sends the Interim-Update messages, and for dropped/missed Interim-Update messages, set the **Timeout** value at least two to three times greater than the period.
- **Auto** (This option is selected by default.) – to have the firewall detect automatically whether Interim-Update messages are being sent periodically and, if they are, to use them as specified under Enabled and setting automatically the timeout accordingly.

> **NOTE:** If, after some time, the timeout stays at 0 (zero) when the page is reloaded, then it has not detected them being sent and is not timing them out.
>
> It could take quite a considerable time to complete auto-detection, depending on how frequently the client sends them. For example, if the client sends them every 10 minutes, then it could take over 30 minutes before the measure timeout is shown here.

> **TIP:** You can click the **Show info** link to monitor progress in a popup dialog.



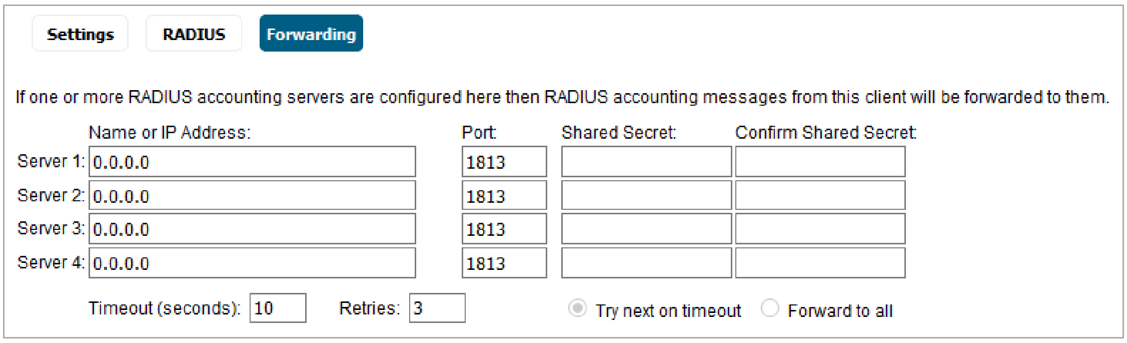
s authenticated user via NTLM:	Windows users	Linux users	Macintosh users
Re-authenticate via NTLM	●	●	●

Interface Host Names Reverse DNS Cache

Interface	IP Address	DNS Name	TTL (secs)

> **TIP:** To rerun auto-detection, change the setting to **Disabled** and then back to **Auto**, clicking **SAVE** after each change.

9 Click **Forwarding**.



If one or more RADIUS accounting servers are configured here then RADIUS accounting messages from this client will be forwarded to them.

	Name or IP Address:	Port:	Shared Secret:	Confirm Shared Secret:
Server 1:	0.0.0.0	1813		
Server 2:	0.0.0.0	1813		
Server 3:	0.0.0.0	1813		
Server 4:	0.0.0.0	1813		

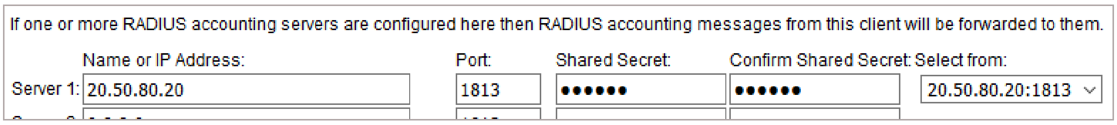
Timeout (seconds): 10 Retries: 3 ○ Try next on timeout ○ Forward to all

10 You can enter up to four RADIUS accounting servers in these fields:

- **Name or IP address**
- **Port** (default **1813**)

- **Shared Secret** for the RADIUS accounting servers to which you want the client to forward message
- **Confirm Shared Secret**

When you enter this information for a server, the **Select from** drop-down menu displays for each server.



If one or more RADIUS accounting servers are configured here then RADIUS accounting messages from this client will be forwarded to them.

	Name or IP Address:	Port:	Shared Secret:	Confirm Shared Secret:	Select from:
Server 1:	20.50.80.20	1813	●●●●●●	●●●●●●	20.50.80.20:1813

11 For each server, from **Select from**, select either:

- **No forwarding**
- IP address of the accounting server

If requests from more than one client are to be forwarded to the same accounting server, then after it has been configured for any one client, it can be selected from **Select from** for the others. All the information for the selected accounting server, including its shared secret, is copied and instated for this client.

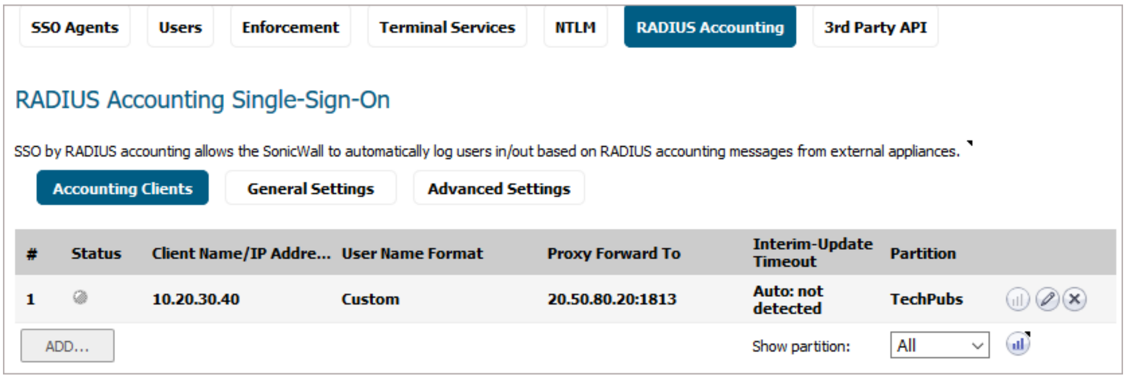
12 In the **Timeout (seconds)** field and **Retries** field, enter the timeout period in seconds and the number of retries. The default for **Timeout (seconds)** is **10** seconds, and the default for **Retries** is **3**.

To determine which users have logged out, the SonicWall Security Appliance polls the SSO Agent by sending requests to multiple logged-in users in a single request message to the SSO Agent. To configure the number of user requests the Security Appliance can send in a single request message to the Test tab

13 Select how the RADIUS accounting messages are forwarded from this client, either:

- **Try next on timeout**
- **Forward to all**

14 Click **SAVE**. The **Accounting Clients** table is updated.



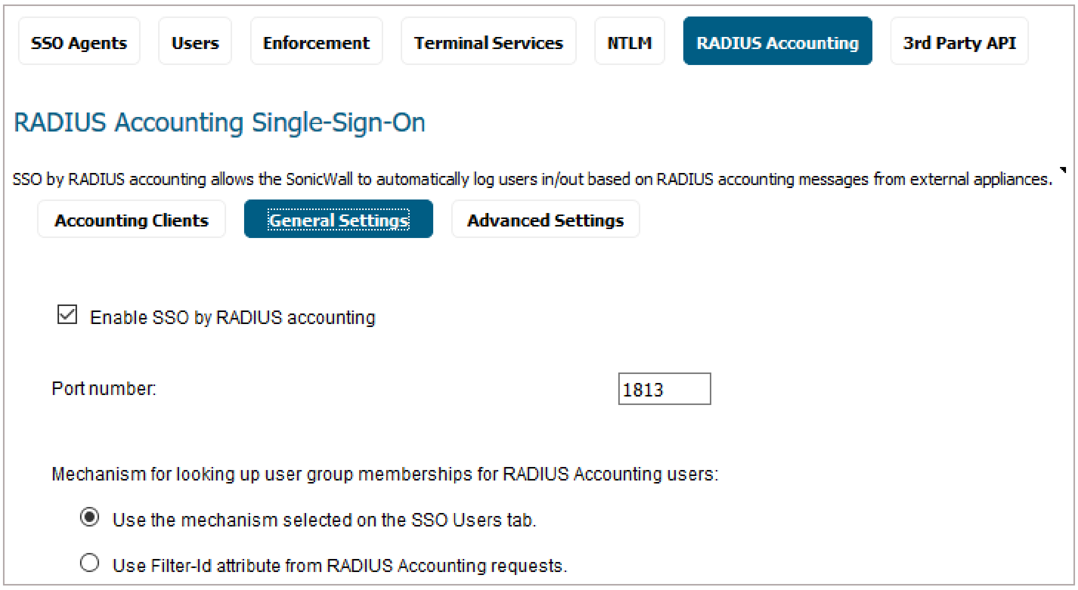
RADIUS Accounting Single-Sign-On

SSO by RADIUS accounting allows the SonicWall to automatically log users in/out based on RADIUS accounting messages from external appliances.

#	Status	Client Name/IP Addre...	User Name Format	Proxy Forward To	Interim-Update Timeout	Partition
1	●	10.20.30.40	Custom	20.50.80.20:1813	Auto: not detected	TechPubs

Show partition: All

15 Click **General Settings**.



RADIUS Accounting Single-Sign-On

SSO by RADIUS accounting allows the SonicWall to automatically log users in/out based on RADIUS accounting messages from external appliances.

☑ Enable SSO by RADIUS accounting

Port number: 1813

Mechanism for looking up user group memberships for RADIUS Accounting users:

● Use the mechanism selected on the SSO Users tab.

○ Use Filter-Id attribute from RADIUS Accounting requests.

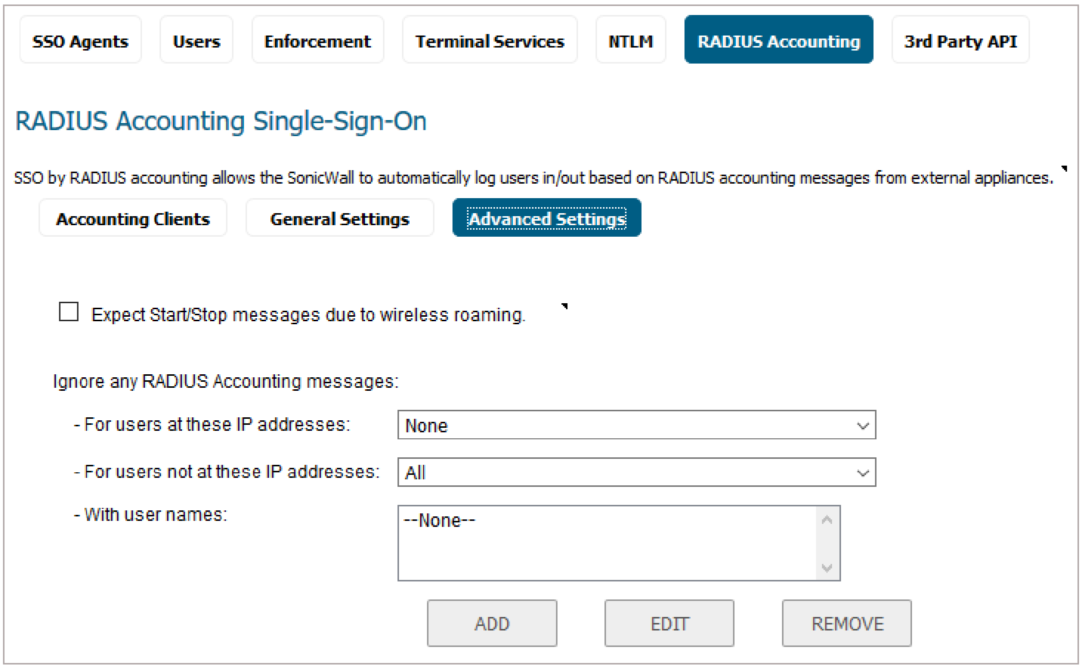
16 Enable SSO or RADIUS accounting by selecting the **Enable SSO or RADIUS accounting** checkbox. This option is selected by default.

17 Specify the port in the **Port number** field. The default port is **1813**.

18 For Mechanism for looking up user group memberships for RADIUS Accounting users, choose:

- **Use the mechanism selected on the SSO Users tab.** (default)
- **Use Filter-Id attribute from RADIUS Accounting requests.**

19 Click **Advanced Settings**.



RADIUS Accounting Single-Sign-On

SSO by RADIUS accounting allows the SonicWall to automatically log users in/out based on RADIUS accounting messages from external appliances.

□ Expect Start/Stop messages due to wireless roaming.

Ignore any RADIUS Accounting messages:

- For users at these IP addresses: None

- For users not at these IP addresses: All

- With user names: --None--

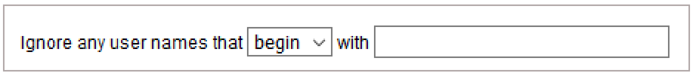
20 To have the appliance track RADIUS Accounting messages for Start/Stop messages, select the **Expect Start/Stop messages due to wireless roaming** checkbox. This option is not selected by default.

RADIUS Accounting clients send Start/Stop messages to notify the Security Appliance of users connecting/disconnecting. These roaming Start/Stop messages could interfere with the SSO authentication process, which normally processes Stop messages as notifications of user logout.

If this option is enabled, then the Security Appliance tracks the RADIUS Accounting messages to look for this Start/Stop sequence. If the sequence is found, then the Security Appliance considers the Stop messages as indications of roaming rather than as notifications of user logout.

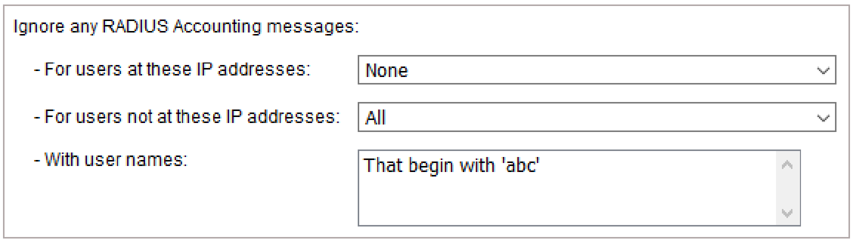
21 To have the Security Appliance ignore any RADIUS Accounting messages for users, under **Ignore any RADIUS Accounting messages**:

- At specific IP addresses, select an address object or address group from **For users at these IP addresses** or create a new address object or address group. The default is **None**.
- Not at specific IP addresses, select an address object or address group from **For users not at these IP addresses** or create a new address object or address group. The default is **All**.
- With specific user names:
  1) Click **ADD**. The **Add RADIUS Accounting User Name Exclusion** dialog displays.



Ignore any user names that begin with

  2) From the Ignore any user names that drop-down menu select:
     - **begin**
     - **end**
  3) Enter the user name in the **with** field.
  4) Click **APPLY**. The entry is added to the list.



Ignore any RADIUS Accounting messages:

- For users at these IP addresses: None

- For users not at these IP addresses: All

- With user names: That begin with 'abc'

To edit an entry, select it and then click **EDIT**.

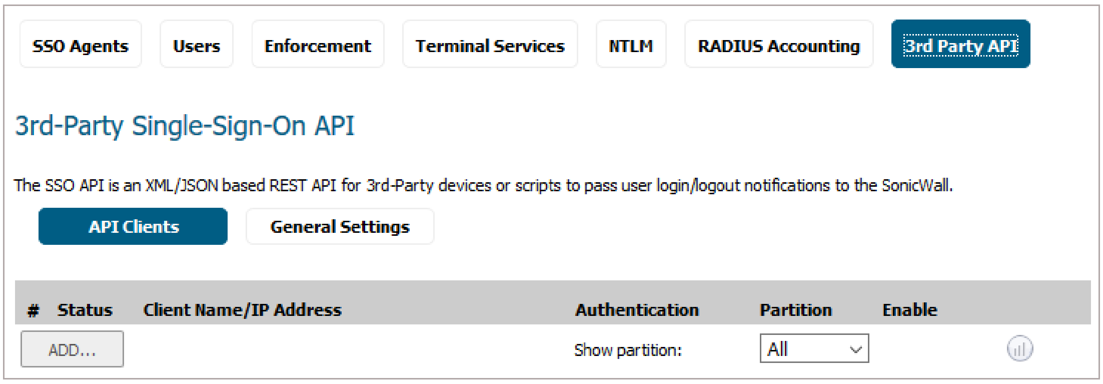
To remove an entry, select it and then click **REMOVE**.

3rd Party API Page

The SSO API is an XML-/JSON-based REST API for third-party devices or scripts to pass user login/logout notifications to the firewall.

To configure third-party API:

1 Click **3rd Party API**.

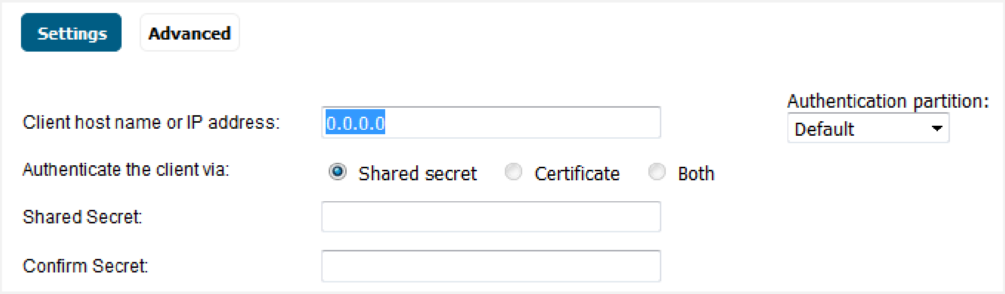


3rd-Party Single-Sign-On API

The SSO API is an XML/JSON based REST API for 3rd-Party devices or scripts to pass user login/logout notifications to the SonicWall.

#	Status	Client Name/IP Address	Authentication	Partition	Enable
			Show partition:	All	

2 Under the **API Clients** table, click **ADD**. The **Add API Client** dialog displays.



Client host name or IP address: 0.0.0.0

Authentication partition: Default

Authenticate the client via: ● Shared secret ○ Certificate ○ Both

Shared Secret:

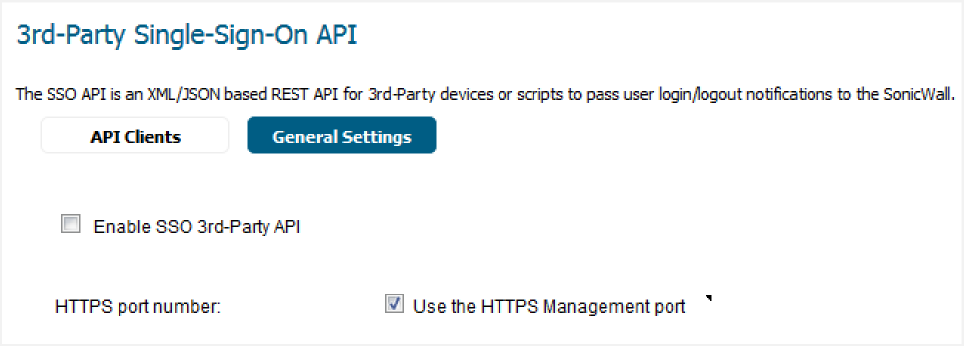
Confirm Secret:

> **TIP:** If partitioning is enabled, the **Select partition** dialog displays over the **Add RADIUS Accounting Client** dialog.
>
> 1 Choose the partition to which to add the new agent.
>
> 2 Click **OK**.

3 Configure the options.

4 Click **SAVE**. The client is added to the **API Clients** table.

5 Click **General Settings**.



3rd-Party Single-Sign-On API

The SSO API is an XML/JSON based REST API for 3rd-Party devices or scripts to pass user login/logout notifications to the SonicWall.

☐ Enable SSO 3rd-Party API

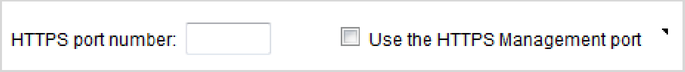
HTTPS port number: ☑ Use the HTTPS Management port

6 Select **Enable SSO 3rd-Party API**. This option is not selected by default.

7 To have user login/logout notifications on the API sent to:

- The same TCP port number used for HTTPS web management, select **Use the HTTPS Management port**. This option is selected by default.

- A separate, dedicated TCP port number, clear **Use the HTTPS Management port**; a field in which to enter the port number displays.



HTTPS port number: □ Use the HTTPS Management port

ⓘ **IMPORTANT:** You must use a separate port number if client certificates are used to authenticate API clients.

ⓘ **TIP:** A separate, dedicated TCP port number is recommended for larger installations to prevent a possible high rate of API requests from potentially adversely affecting web management.

8 Click **APPLY**.

Test Page

1 To test the agent settings you configured, click **TEST**.

ⓘ **IMPORTANT:** Performing tests on this page applies any changes that have been made.

You can test the connectivity between the appliance and an SSO agent or TSA. You can also test whether the SSO agent is properly configured to identify a user logged into a workstation.

2 If you have multiple agents configured, select the SSO agent or TSA to test from the **Select agent to test** drop-down menu. The drop-down menu includes SSO agents at the top, and TSA's at the end under the heading **--Terminal Server Agents--**.

3 Select the type of test to perform:

- **Check agent connectivity** radio button – Tests communication with the authentication agent. If the Security Appliance can connect to the SSO agent, the message **Agent is ready** displays. If testing a TSA, the **Test Status** field displays the message, and the version and server IP address are displayed in the **Information returned from the agent** field.
- For SSO agents only, select **Check user**, enter the IP address of a workstation in the **Workstation IP address** field. This tests if the SSO agent is properly configured to identify the user logged into a workstation.

ⓘ **TIP:** If the messages **Agent is not responding** or **Configuration error** display, check your settings and perform these tests again.

4 Click **TEST.**

5 When you are finished with all Authentication Agent configuration, click **OK**.

Configuring RADIUS Accounting for SSO

RADIUS accounting for Single Sign-On is configured on the **MANAGE | System Setup | Users > Settings** page.

To configure RADIUS accounting for SSO:

1 Display the **MANAGE | System Setup > Users > Settings** page.

2 Click **CONFIGURE SSO**. The **SSO Authentication Configuration** dialog appears.

3 Click the **RADIUS Accounting** tab. For the procedure to configure RADIUS Accounting, see RADIUS Accounting Page on page 163.

4 Click **APPLY**.

Advanced LDAP Configuration

If you selected **Use LDAP** to retrieve user group information on the **Users** page as described in Configuring SonicOS NS*v to Use the SonicWall SSO Agent* on page 150, you must configure your LDAP settings.

To configure LDAP to retrieve user group information:

1. Navigate to **MANAGE | System Setup > Users > Settings**.
2. Click **CONFIGURE SSO**. The **SSO Configuration Authentication** dialog displays.
3. Click **Users**.
4. Click **CONFIGURE** next to the **Use LDAP to retrieve user group information** option. The **LDAP Configuration** dialog displays.
5. For configuring LDAP, see Configuring the SonicWall for LDAP on page 134.

9

Managing Authentication Partitions

Topics:

About Authentication Partitioning

Topics:

About User Authentication Partitioning

ⓘ **NOTE:** For definitions of terms used in this section, see Terms and Acronyms.

SonicWall Security Appliances provide a mechanism for LDAP, RADIUS, and/or Single-Sign On (SSO) authentication in an environment where you manage multiple non-interconnected domains. Such an environment needs users in a particular domain to be authenticated through the specific:

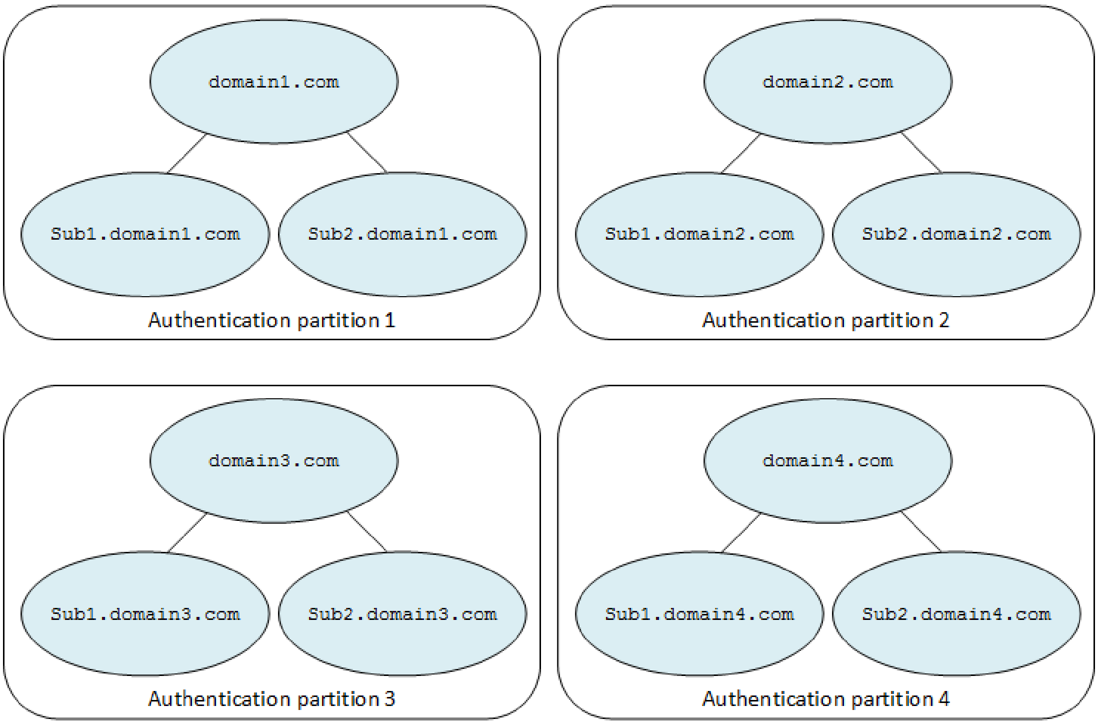
- LDAP/RADIUS server for that domain
- SSO agent(s) located in that domain

The mechanism for such environments is User Authentication Partitioning, which means:

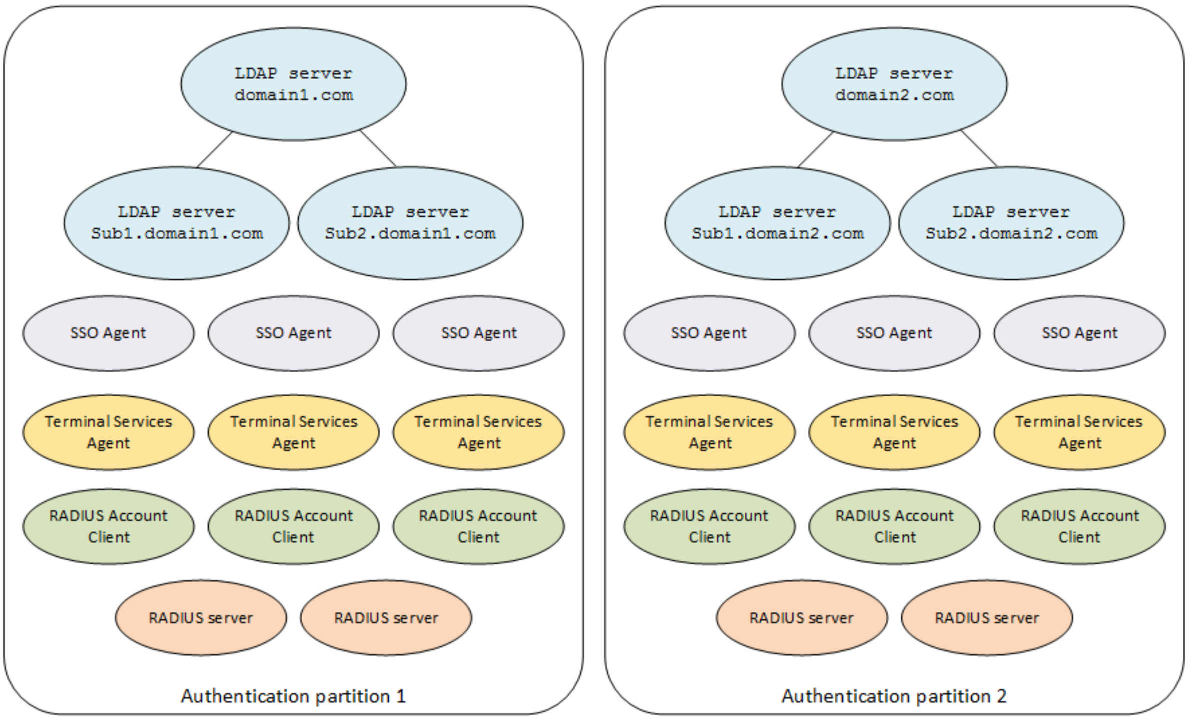
- First, partitioning your network(s) into separate partitions, each with its own authentication servers/agents/clients.
- Then, authenticating each user against the relevant authentication devices (servers/agents/clients) according to the authentication partition in which the user is located. The user's partition is selected by either:
  - Matching the user's domain names against those configured in the domains.
  - If the user's domain names are not available, basing their physical location as set by the partition-selection policies.

An authentication partition typically corresponds to one or more domains; for example, in a Windows domain, a partition usually corresponds to an Active Directory forest. Each partition has separate LDAP servers, RADIUS servers, SSO agents, and/or Terminal Service agents (TSAs). See Authentication Partitions and Installation with Central and Remote Sites.

Authentication Partitions



Partition Contents



Terms and Acronyms

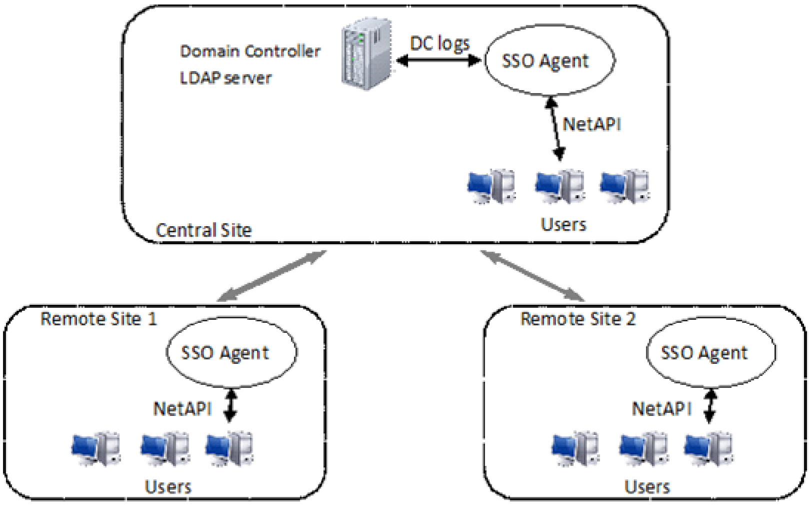
Authentication Partition	A part of a network with its own authentication servers/agents/clients, separate from those in other parts of the network
DC	Domain controller
LDAP	Lightweight Directory Access Protocol
RADIUS	Remote Authentication Dial In User Service
SSO	Single Sign On
TSA	Terminal Services Agent

About Subpartitions

Authentication partitions select the LDAP servers, RADIUS servers, SSO agents, and TSAs used to authenticate particular users. In addition to assigning the servers and agents to a partition, there can be instances where it is necessary to then further assign certain of them to different subsets of the users in the partition. Subpartitions allow assigning particular agents for certain subsets of a partition’s users if specific ones need to be used for them. If an authentication partition is set as a subpartition of another one, then agents specific to the top-level, or parent, authentication partition’s users can be assigned to the subpartition. The subpartition’s agents are used when relevant, but the servers and agents of the parent partition can be used as appropriate.

For example, an installation with central and remote sites has the domain controllers (DCs)/LDAP server located at the central site. Access policies, however, prevent an SSO agent located at the central site from accessing the remote user computers. For SSO with NetAPI or WMI to work in this topology, one or more SSO agents must be placed at each remote site in addition to those located at the central site; see Installation with Central and Remote Sites. For NetAPI/WMI, the SSO agent talks directly to the users' computers while user identification in the DC security log uses the SSO agent of the domain controller(s).

Installation with Central and Remote Sites



Subpartitioning of top-level partitions solves the problems of:

- Telling the appliance that the SSO agents at each individual site are used for NetAPI or WMI identification of the users located there.
- Using the SSO agents and LDAP servers at the central site for DC logs identification and user group lookups for all of the users across all the sites.

Each of the remote sites can be configured as a subpartition of the central site, with the SSO agent(s) at a remote site assigned to the subpartition. One or more partitions can be configured as subpartitions of a parent partition, with different selection policies defining the locations of the user subsets for each. In Installation with Central and Remote Sites, the entire installation is one partition, and the remote sites are each a subpartition within that partition. After selecting the relevant agent from the subpartition to identify a user at the remote site, the user's group memberships are subsequently looked up through the LDAP servers of the parent partition.

Some special cases for subpartitions are:

- LDAP servers cannot be assigned to a subpartition. If a subpartition corresponds to a sub-domain that has its own LDAP servers, those servers should be assigned to the parent partition. The LDAP server manages referring requests to the sub-domain.
- For RADIUS servers, a subpartition uses either servers assigned to it or those of the parent partition, but not both. If RADIUS servers are assigned to a subpartition, they are used for users located in it; otherwise, those of the parent partition are used.
- With SSO agents using NetAPI or WMI versus reading from domain controller logs, if there are agents in both a subpartition and its parent, then only the subpartition's own SSO agents are used for NetAPI/WMI identification of users located in the subpartition; the subpartition's SSO agents involve direct access to the user's computer. Domain controller log reading is done by SSO agents in the parent and/or subpartitions, if the subpartition's SSO agent's are configured for that.

Operation of Servers, Agents, and Clients with Subpartitions

Generally, any servers, agents, and/or clients assigned to a subpartition are used for the users located in it, but in addition, certain servers, agents, and/or clients of the parent partition are used; see Use of Servers, Agents, and Clients with Subpartitions.

Use of Servers, Agents, and Clients with Subpartitions

Server, agent, client	Use
LDAP servers	Only assignable to a top-level partition, not to a subpartition. If a subpartition corresponds to a sub-domain with its own LDAP server(s), those should be assigned to the parent partition, and the LDAP's referral/reference mechanism refers requests to the sub-domain's servers. Where a sub-partition corresponds to a sub-domain with its own LDAP server(s), however, you might find it more logical to assign those servers to the sub-partition, and that is allowed. Servers assigned to a sub-partition are linked internally into the parent partition.
RADIUS servers	A subpartition uses either the RADIUS servers assigned to it or those of the parent partition, but not both. If RADIUS servers are assigned to a subpartition, then they are used for users located in it; otherwise, those of the parent partition are used.
SSO agents	When using NetAPI or WMI, the agents need to be located where they can access the user PCs directly, and when reading from DC (domain controller) logs, they need to access the DCs. An SSO agent can be configured to do both activities. When using both DC logs and NetAPI/WMI, the SonicWall Security Appliance controls which are used and in what order. The Security Appliance: 1 Has the agents look for the user in the DC logs read from each DC. 2 If the user is not found in the logs, makes a separate follow-up request to try NetAPI/WMI. When using subpartitions, this mechanism operates as follows to identify a user located in a subpartition: 1 If any SSO agents assigned to the subpartition have DC logs enabled, then requests are sent to those SSO agents to look for the user in their DC logs. 2 If the user was not identified in Step 1, then if any SSO agents assigned to the parent partition have DC logs enabled, requests are sent to those SSO agents to look for the user in their DC logs. 3 If the user was not identified in Step 2, then if any SSO agents assigned to the subpartition have NetAPI or WMI enabled, requests are sent to one of those to identify the user. **NOTE:** NetAPI/WMI is not attempted through SSO agents in the parent partition for users located in a subpartition. If there are no agents assigned to the subpartition with NetAPI or WMI enabled, then authentication is not attempted.
TSAs and RADIUS accounting clients	The partition to which these agents/clients send user are assigned affects only the choice of LDAP server to use for user group lookups. As the LDAP servers of the parent partition are also used for all of its sub-partitions, the TSAs and RADIUS accounting clients can be assigned to either. The only difference would be which partition is displayed for their users, and the users are assigned to them based on their physical location. **NOTE:** This is applies only when a domain is not supplied.

About Inter-Partition User Roaming

Users who log into a domain in one partition are able to roam and connect from the physical network of a different partition if the network topology has been set up to allow them to access their own partition's domain server from the login partition. If an SSO agent is used in such a case, the appliance selects the SSO agent(s) of the local partition based on the user's physical location, not the agent(s) of their home partition.

The SSO agents of the local partition are not able to identify the roaming user from domain controller logs because the agents do not read from the correct domain controllers. The agents can identify the roaming user through NetAPI or WMI if they have the correct privileges, which requires Windows inter-domain trust. Thus, when the Security Appliance gets the username from an SSO agent, the Security Appliance checks the partition where the specified domain is located and allows that to override the partition initially selected based on the user's physical location.

The process to identify the roaming user and set their access permissions is:

1. A user who is logged in to domain-1 (in partition-1) connects from a subnet in partition-2; the user’s partition is initially recorded as partition-2.
2. If the partition-2 agents are reading domain controller logs, then requests are first sent to check those. These requests fail to find the user, who is not logged into partition-2's domain.
3. A request is sent to an SSO agent in partition-2 to try NetAPI. The agent does this, and identifies the user as one from domain-1.
4. The Security Appliance sees that domain-1 is in partition-1, and switches the user's partition to partition-1. The Security Appliance then looks up the user’s group memberships through the LDAP servers in partition-1.

About Authentication Partition Selection

Topics:

Selection Policies

Network topology can affect how SonicOS NS*v* locates authentication partition users on the network. SonicOS NS*v* provides several options for locating and selecting the user’s partition.

Selection Options

When Selected by	Each Authentication Partition
IP address	Corresponds to a set of IP addresses selected through an address object (network, range, or group) in its configuration.
Network interface	Corresponds to the networks that are accessed through one or more interfaces that are selected in its configuration.

Selection Options (Continued)

When Selected by	Each Authentication Partition
Network zone	Corresponds to one or more network zones that are selected in its configuration.
Username domain component	Is a member of one or more domains and is chosen by matching the domain name given at login time by the user. This option requires the user log in with a qualified name, for example, `domain\user` or `user@domain.com`. When a domain name is given, this option overrides the above location-based options. This option should be used for authenticating GVC and SSLVPN client users; see Remote Users on page 179. **NOTE:** For SSO agent authentication, one of the location-based options should be used because the SonicWall Security Appliance needs to derive the partition at the start of the process to select the SSO agent(s) to use, and at that point the Security Appliance does not yet have the user's login name; see About Inter-Partition User Roaming on page 177.

These options are configured as a set of separate selection policies, with one or more policies set per partition, to define how to select that partition. During user authentication, if no domain is given, then the partition is selected by matching the zone, interface, and IP address against the configured policies in a manner very similar to access rule matching. A default selection policy specifying the default partition is a catch-all for anything that does not match the explicitly configured policies. The default partition is initially named Default, but it can be renamed or the default selection policy can be set to another partition, after which the auto-created Default can be deleted.

Remote Users

Selection of the authentication partition to use for GVC clients and SSL VPN users is handled differently as these remote users are connecting into the authentication partition, not coming from it. The Security Appliance needs to know the authentication partition for these users to select the correct LDAP server to look up their user group memberships, and from that, the subnets they can access. There are two options for authenticating remote users:

- Use selection by username domain component and require that remote users give a qualified name including the domain.
- Have multiple WAN interfaces and/or WAN zones and have the users for each authentication partition connect to a different public IP address. The WAN interface or zone that a remote user is coming through is then used to select the authentication partition without requiring that the remote users give qualified usernames.

  ⓘ **NOTE:** For GVC users, having separate WAN zones allows different Group VPN policies for each zone, thereby potentially enforcing access more securely to the correct authentication zone.

When there are multiple WAN interfaces, it is possible to set partition-selection policies to select the partition for remote access through each WAN interface. If there is only one WAN interface, then it is possible to set a special selection policy to select the default partition for remote access when that cannot be derived from the supplied username.

ⓘ **NOTE:** If that selection policy is not set, then remote access users need to supply a qualified username unless the servers that authenticate them are assigned to the partition that is selected by default.

Appliance Notification of User Logins

If the SonicWall Security Appliance is notified of user logins by an agent/client, but does not send identification requests for them (for example, Terminal Services, RADIUS accounting, and login notifications from an SSO agent reading DC logs), the Security Appliance does not need to know the authentication partition for selection of the agent/client as it does for sending requests to SSO agents. To select the correct LDAP server to look up their user group memberships, however, the Security Appliance does need to know the authentication partition for these users. That selection is done from the username domain component, when present, or by manually assigning each such agent/client to an authentication partition.

Web User Login

When users log in through the SonicWall Security Appliance's web login portal, they could conceivably use any account name, no matter where they are coming from. Normally, the authentication partition is selected based on where users log in from (see Selection Policies on page 178), but if the user gives a username that includes the domain, then they are able to override that by logging in with a qualified username that includes the domain to select the authentication partition.

CLI Login

When a user logs in through CLI using the built-in admin account, partitioning is not relevant because that is always authenticated locally. But when additional administrator accounts that are authenticated through LDAP or RADIUS are used, then the partition does need to be known to select the server to authenticate it. There are three separate cases for this:

Login on the console port	There is no IP address from which to derive the partition, and so when that is needed, the user needs to log in with a qualified username.
Local SSH connection from inside the firewall	The authentication partition where the user is located is selected through the source IP address of the SSH connection, as per Selection Policies on page 178.
Remote SSH connection from outside the firewall	The partition selection is not based on the user's location, but it is optionally possible to have it selected according to the WAN interface to which they are connected, as per remote client users; see Selection Policies on page 178.

If selection by username domain component has been configured (see Selection Policies on page 178), then in all cases the user is able to override that by logging in with a qualified username that includes the domain from which the authentication partition is selected. It is also possible to set a special selection policy to select the default partition for console port login when that cannot be derived from the supplied username.

ⓘ **NOTE:** If the selection policy is not set, then users need to supply a qualified username to log in on the console port unless the servers that authenticate them are assigned to the partition that is selected by default.

Per-Partition User Authentication Settings

There can be in some cases a need to set certain settings governing user authentication differently in different partitions. For example if one partition has only RADIUS servers and another has only LDAP servers, then for user authentication RADIUS must be selection in the first partition and LDAP in the other.

By default, all such settings apply globally and are limited to the user authentication method and the single sign on methods. These settings are set only for top-level partitions; for sub-partitions, the authentication settings of their parent partitions apply.

About Extended Support for Multiple LDAP Servers

Partitioning requires multiple LDAP servers. Multiple primary LDAP servers can be configured, one for each authentication partition, plus a list of additional servers for each. For more information about multiple LDAP servers and how to configure them, see About Extended Support for Multiple LDAP Servers on page 145.

Per-Partition DNS Servers and Split DNS

With or without authentication partitions, it is usually necessary to use a domain's own DNS servers to resolve the names of devices in the domain, and occasionally there can also be a need to use different external DNS servers to resolve external host names. Multiple authentication partitions, however, usually require using different DNS servers to resolve the host names in the different partitions.

The DNS Proxy with Split DNS feature allows configuring different DNS servers associated with different domain names. The feature is separated from DNS Proxy so it can be used directly by the Security Appliance to resolve the names of devices in domains without needing to enable DNS Proxy, including for multiple, unrelated domains with authentication partitioning. For more information about Split DNS, see Managing Authentication Partitions on page 173.

About RADIUS Authentication

With RADIUS authentication there are some additional considerations as the SonicWall Security Appliance is not guaranteed a way to derive the user's domain, nor the domains of the user groups returned in RADIUS attributes, as it is with LDAP. So the Security Appliance can find the domains for selecting the correct domain user and user group objects, the Security Appliance tries the following to learn a user's domain with RADIUS authentication:

1. Have users give a qualified user name that includes the domain when they log in. If the RADIUS server returns the user groups in RADIUS attributes (Filter-ID or the SonicWall vendor-specific ones), then configure it to return them giving the fully qualified names of the groups, including their domain.
2. Use LDAP for the user group lookup after authenticating the user through RADIUS (which is the preferred method). Then, if the user does not give the domain with their user name it can be learned from the LDAP search to find their user groups.
3. Failing either of those, the domain can be looked up from the authentication partition when the user is logging in from an IP address physically located in it, but this can only definitively give the user's domain if there is only one domain per partition; consequentially, to use this method, it is necessary to have a separate sub-partition for every sub-domain.

   ⓘ **NOTE:** This does not work for cross-domain user group memberships.

In summary, the best option with RADIUS authentication is to use LDAP for the user group lookup. If that is not possible (no LDAP server), then the next best option is to have the RADIUS server return qualified user group names in RADIUS attributes.

If none of these can be used to derive the domains of user groups returned from RADIUS, then it is necessary to configure the user/user group objects to match in any domain.

Upgrading from a Non-Partitioned Configuration

When starting from an existing configuration without authentication partitioning, when partitioning is enabled:

- A single authentication partition named **Default** is created with all the existing servers, agents, and clients in it.
- A single default partition selection policy is configured to select the **Default** partition as the default partition for everything.

From that base, new partitions can be added, and the relevant servers, agents and clients easily moved to them from the default partition, or new ones added.

Configuring Authentication Partitions and Policies

The **MANAGE | System Setup | Users > Partitions** page enables you to create of a list of authentication partitions and of the policies to select them. For each partition, you can configure:

- A name for the authentication partition (for example, the name of the domain or forest to which it corresponds).
- The domains that the partition encompasses.
- How the authentication partition is to be selected for users (for example, configured as separate partition selection policies).

Before configuring the authentication partitions and partition selection policies, you can determine the users locations in the partitions from the **MONITOR | Current Status | User Sessions > Active Users** page.

When authentication partitions have been configured, a selection is added in the various server/agent/client configurations so the authentication partition can be selected when adding/editing a server, agent, or client. Configure the servers, agents, and clients from the **MANAGE | System Setup > Users > Settings** page.

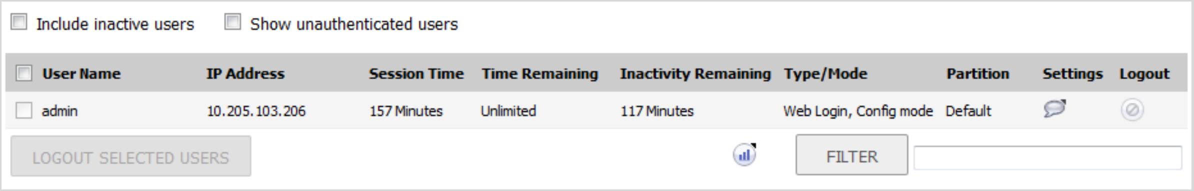
Topics:

- Displaying and Filtering Users/Partitions on page 182
- Configuring and Managing Partitions on page 184
- Configuring Partition Selection Policies on page 198
- Configuring Servers, Agents, and Clients for Authentication Partitioning on page 202

Displaying and Filtering Users/Partitions

The **MONITOR | Current Status | Users Sessions > Active User** page shows the partition where each user is located.

ⓘ **NOTE:** For more information about this page, see *SonicOS NSv 6.5 Monitoring* for your SonicWall Security Appliance.



□ Include inactive users □ Show unauthenticated users

□ User Name	IP Address	Session Time	Time Remaining	Inactivity Remaining	Type/Mode	Partition	Settings	Logout
□ admin	10.205.103.206	157 Minutes	Unlimited	117 Minutes	Web Login, Config mode	Default		

Topics:

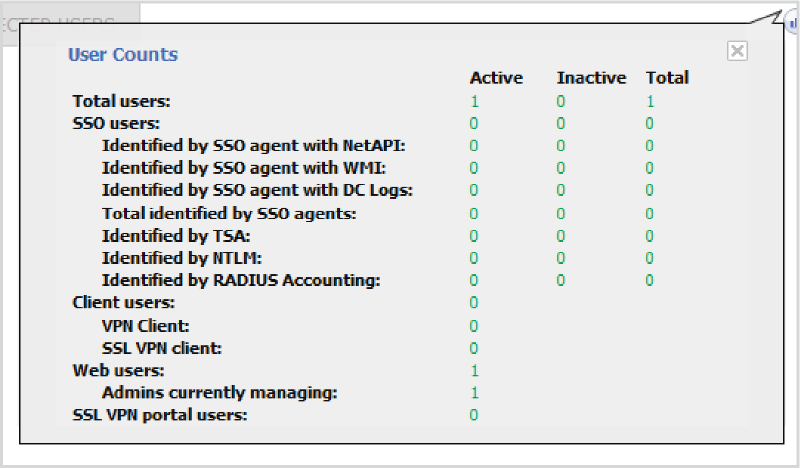
- Viewing User Information on page 183
- Filtering Users on page 183

Viewing User Information

You can view the number of users by various categories:

- Active/Inactive
- SSO users by how identified
- Client users by type of client
- Web users
- SSL VPN portal users

To view this information, click the **Statistics** icon beneath the **Active User Sessions** table. The **User Counts** popup dialog displays:



User Counts

	Active	Inactive	Total
Total users:	1	0	1
SSO users:	0	0	0
Identified by SSO agent with NetAPI:	0	0	0
Identified by SSO agent with WMI:	0	0	0
Identified by SSO agent with DC Logs:	0	0	0
Total identified by SSO agents:	0	0	0
Identified by TSA:	0	0	0
Identified by NTLM:	0	0	0
Identified by RADIUS Accounting:	0	0	0
Client users:	0		
VPN Client:	0		
SSL VPN client:	0		
Web users:	1		
Admins currently managing:	1		
SSL VPN portal users:	0		

Filtering Users

The **Filter** field allows filtering of a partition so that just the users in a selected partition can be shown. You search for users by specifying one or more full or partial usernames, domains, IP addresses, and/or type of user. You exclude users by prefixing entries with an exclamation point (!). When combining strings, to match:

- Any of the listed entries, separate the entries with a comma; that is, `a,b` includes users that match either a or b
- All of the listed entries, separate the entries with a semicolon (;); that is `a;b` includes users that match both a and b

To search for terminal server users, enter `user-num=`*`usernumber`*. The `type` filter matches text in the **Type/Mode** column, including any shown on mouse-over in that column. IPv6 addresses are supported, but only for full matching; for example, `ip=2012::1`, `!ip=2012::1`, or in combinations of other entries as shown in Filter Examples.

Filter Examples

`name=bob`	`name=bob,john,sue`	`domain=mydomain`
`ip=192.1.1.1`	`ip=192.1.1.1,192.1.1.2`	`ip=192.1.1.0/24`

Filter Examples (Continued)

```
type=config mode               type=sso,web                  type=sso;netapi
type=sso;from logs on domain controller 192.1.1.10
partition=somePartition        group=Trusted Users
name=bob;ip=192.1.1.1 (to match both name and IP address)
!name=bob !ip=192.1.1.1 (to exclude users)
```

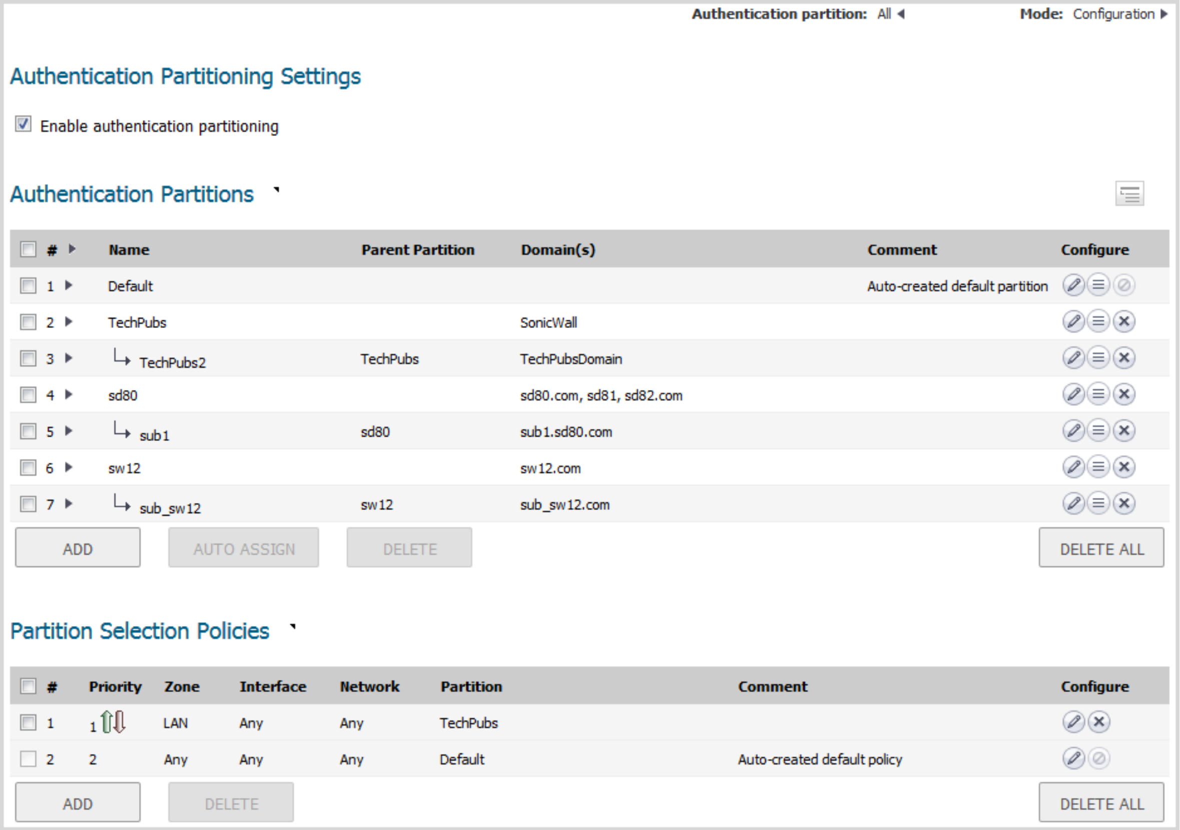
You also can use just simple strings; for example: `bob 192.1.1.1 mydomain`

Configuring and Managing Partitions

Topics:

- **Users > Partitions Page** on page 184
- Enabling/Disabling Authentication Partitioning on page 188
- Adding Partitions and Subpartitions on page 189
- Deleting Partitions and Subpartitions on page 191
- Assigning Servers, Agents, and Clients on page 192
- Editing Partitions on page 195

Users > Partitions Page



Authentication partition: All ◂ **Mode:** Configuration ▸

Authentication Partitioning Settings

☑ Enable authentication partitioning

Authentication Partitions

☐ #	Name	Parent Partition	Domain(s)	Comment	Configure
☐ 1	Default			Auto-created default partition	
☐ 2	TechPubs		SonicWall		
☐ 3	↳ TechPubs2	TechPubs	TechPubsDomain		
☐ 4	sd80		sd80.com, sd81, sd82.com		
☐ 5	↳ sub1	sd80	sub1.sd80.com		
☐ 6	sw12		sw12.com		
☐ 7	↳ sub_sw12	sw12	sub_sw12.com		

Partition Selection Policies

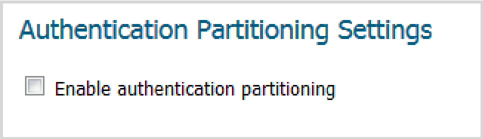
☐ #	Priority	Zone	Interface	Network	Partition	Comment	Configure
☐ 1	1	LAN	Any	Any	TechPubs		
☐ 2	2	Any	Any	Any	Default	Auto-created default policy	

The **MANAGE | System Setup > Users > Partitions** page has three sections:

- Authentication Partitioning Settings Section on page 185
- Authentication Partitions Section on page 185
- Partition Selection Policies Section on page 187

Authentication Partitioning Settings Section

This section enables/disables authentication partitioning. If authentication partitioning is disabled, the other sections do not display.

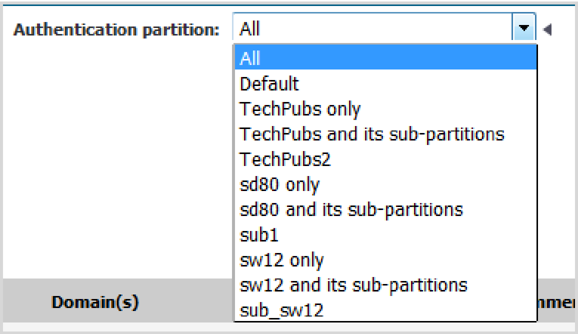


Authentication Partitioning Settings

□ Enable authentication partitioning

When authentication partitioning is enabled, the two sections, **Authentication Partitions** and **Authentication Selection Policies**, also display.

Also displayed when partitioning is enable is the **Authentication partitioning** drop-down menu at the top of the page from which you can select the partition to which the settings in the **MANAGE | System Setup > Users > Settings** and **MANAGE | System Setup > Users > Local Users & Groups** pages also apply. The default is **All**, that is, the settings apply to all partitions.



Authentication partition: All

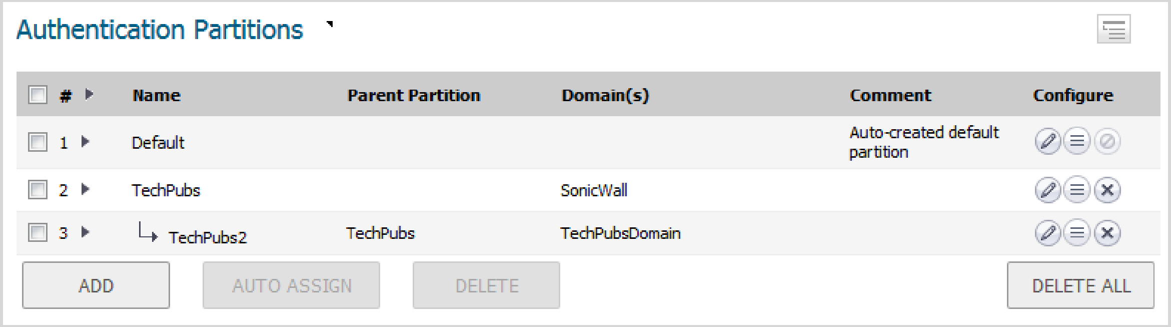
All
Default
TechPubs only
TechPubs and its sub-partitions
TechPubs2
sd80 only
sd80 and its sub-partitions
sub1
sw12 only
sw12 and its sub-partitions
sub_sw12
Domain(s)
nmei

Authentication Partitions Section

ⓘ | **NOTE:** This section displays only when authentication partitioning is enabled.

This section displays a table of authentication partitions and allows you to create, edit, delete, and manage the partitions. The partitions you configure here control which authentication servers are used for which users.

You can expand a partition's tree to show the servers, agents, and clients assigned to it.



Authentication Partitions

□	#	Name	Parent Partition	Domain(s)	Comment	Configure
□	1 ▸	Default			Auto-created default partition	
□	2 ▸	TechPubs		SonicWall		
□	3 ▸	└→ TechPubs2	TechPubs	TechPubsDomain		

Group subpartitions ☰ icon
Toggles between grouping subpartitions with their parent authentication partitions or ungrouping the subpartitions and sorting them with the top-level partitions.

NOTE: Grouped subpartitions are displayed immediately after their parent partition, with a **Link** ↳ icon denoting them as subpartitions.

Selection checkbox
Allows you to select one or more partitions and/or subpartitions in the table. Selecting the checkbox in the table heading selects all entries except the **Default** partition.

Name
Specifies the name of the authentication partition. Subpartitions are indicated by a **Link** ↳ icon in front of the name.

Parent Partition
Specifies the parent authentication partition for subpartitions. This column is blank for parent partitions.

Domain(s)
Specifies the domain(s) to which the partition or subpartition belongs. This column is blank for the **Default** partition.

Comment
Displays the comment included when the partition was added. The comment for the **Default** partition is **Auto-created default partition**.

Configure
Displays the **Edit**, **Selection** ☰, and **Delete** icons for the partition

NOTE: The **Edit** and **Delete** icons are dimmed for the **Default** partition.

Add
Displays the **Add an authentication partition** popup dialog for adding an authentication partition or subpartition.

Auto assign
Assigns any unassigned LDAP servers, RADIUS servers, SSO agents, TSAs, and RADIUS accounting clients to the relevant partitions automatically, based on their IP addresses or host names.

NOTE: Auto assign and **Delete** are dimmed unless at least one partition or subpartition has been selected.

Delete
Deletes the selected authentication partition(s) or subpartition(s).

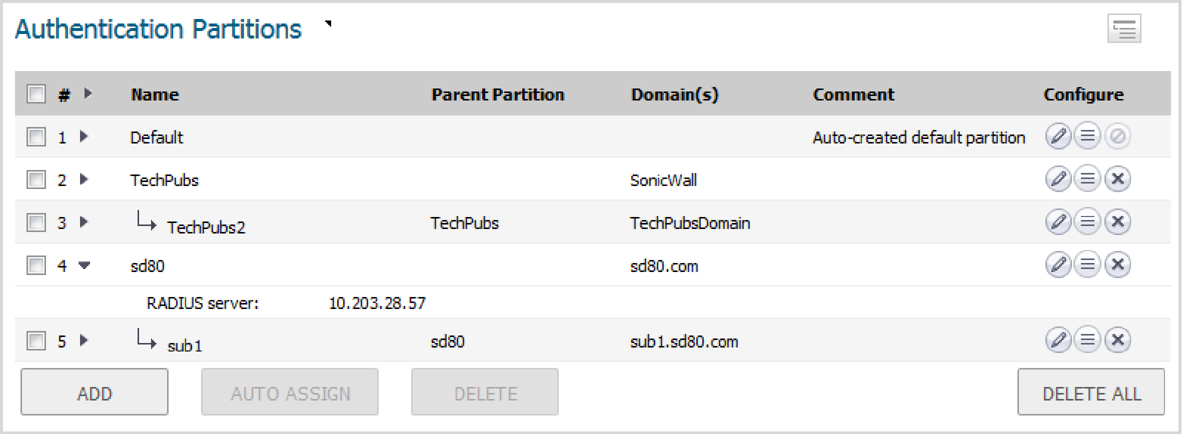
NOTE: You cannot delete the **Default** partition.

Delete All
Deletes all partitions and subpartitions from the table except the **Default** partition.

There is always one authentication partition in this table, the auto-created **Default** partition. You cannot delete this partition. You can, however, edit it and select servers, agents, and clients for it as well as subpartitions. If you disable authentication partitioning, all LDAP servers, SSO agents, TSAs, and RADIUS accounting clients are reassigned to the **Default** partition; when you re-enable authentication partitioning, you must reassign them. RADIUS servers are not affected and remain with their assigned partitions.

Expanding Trees

Expanding an authentication partition's tree shows the servers, clients, and agents assigned to the partition:



Authentication Partitions

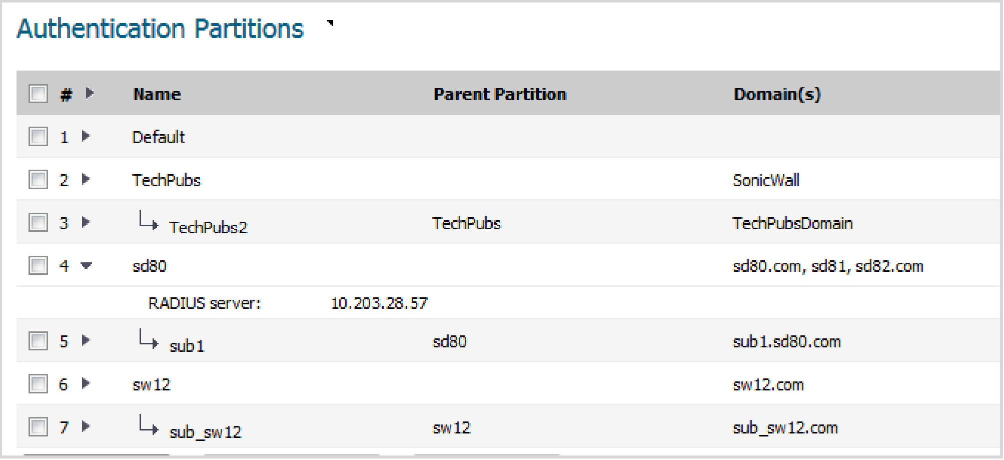
□	#	Name	Parent Partition	Domain(s)	Comment	Configure
□	1 ▸	Default			Auto-created default partition	✎ ☰ ⊘
□	2 ▸	TechPubs		SonicWall		✎ ☰ ⊗
□	3 ▸	↳ TechPubs2	TechPubs	TechPubsDomain		✎ ☰ ⊗
□	4 ▾	sd80		sd80.com		✎ ☰ ⊗
		RADIUS server:	10.203.28.57			
□	5 ▸	↳ sub1	sd80	sub1.sd80.com		✎ ☰ ⊗

You can expand the tree of:

- All table entries by clicking the triangle next to the checkbox in the heading.
- One or more table entries by clicking the **Expand** icon of each.

Showing Hierarchy

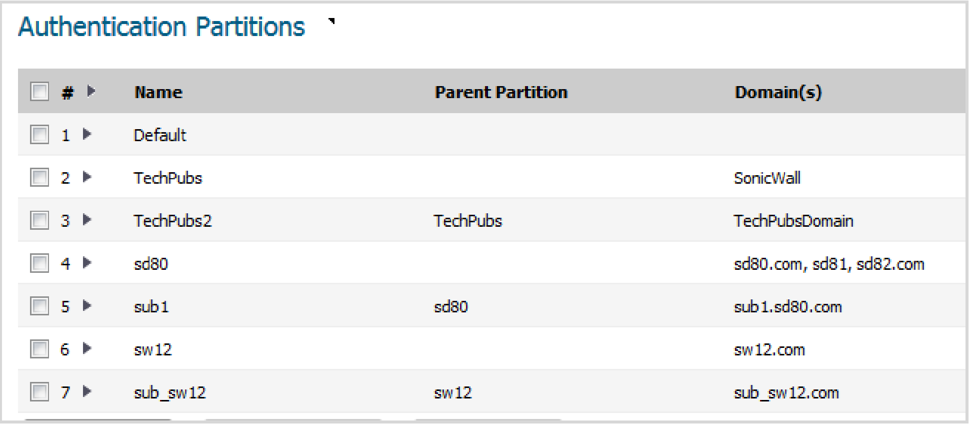
By default, subpartitions are shown below their parent partition with a **Link** icon before the subpartition's name



Authentication Partitions

□	#	▶	Name	Parent Partition	Domain(s)
□	1	▶	Default		
□	2	▶	TechPubs		SonicWall
□	3	▶	↳ TechPubs2	TechPubs	TechPubsDomain
□	4	▼	sd80		sd80.com, sd81, sd82.com
			RADIUS server:	10.203.28.57	
□	5	▶	↳ sub1	sd80	sub1.sd80.com
□	6	▶	sw12		sw12.com
□	7	▶	↳ sub_sw12	sw12	sub_sw12.com

You can show the subpartitions on the same level as their parent partition by clicking the **Group** ☰ icon.



Authentication Partitions

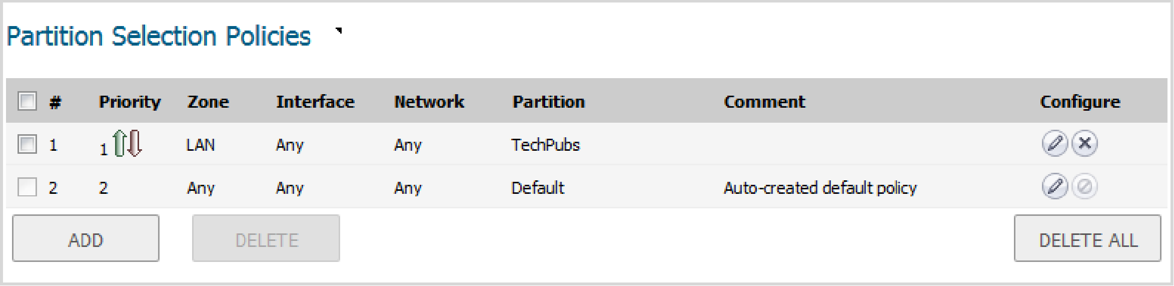
□	#	▶	Name	Parent Partition	Domain(s)
□	1	▶	Default		
□	2	▶	TechPubs		SonicWall
□	3	▶	TechPubs2	TechPubs	TechPubsDomain
□	4	▶	sd80		sd80.com, sd81, sd82.com
□	5	▶	sub1	sd80	sub1.sd80.com
□	6	▶	sw12		sw12.com
□	7	▶	sub_sw12	sw12	sub_sw12.com

Partition Selection Policies Section

ⓘ | **NOTE:** This section displays only when authentication partitioning is enabled.

This section displays a table of policies affecting the selection of authentication partitions and allows you to create, delete, and edit the policies and change the priority of any policy you create. These policies select the partitions in the **Authentication Partitions** table based on the physical locations of the users being authenticated. When authenticating users whose domain names are not available for matching against those in the selected partitions, the users' partitions are selected base on their physical locations set by these policies. These selection policies are also used for auto-assigning authentication devices to partitions based on the physical locations of those devices.

The Default selection policy for the Default partition cannot be deleted, nor can its priority be changed; it is always the lowest priority.



Partition Selection Policies

☐	#	Priority	Zone	Interface	Network	Partition	Comment	Configure
☐	1	1⇧⇩	LAN	Any	Any	TechPubs		✎ ☒
☐	2	2	Any	Any	Any	Default	Auto-created default policy	✎ ⊘

Selection checkbox Allows you to select one or more entries in the table. Selecting the checkbox in the table heading selects all entries except that of the **Default** selection policy.

Priority Orders the partition selection policies according to the priority you assign them. Clicking on the **Priority Arrows** 1⇧⇩ displays the **Change the selection policy priority** popup dialog. You cannot change the priority for the **Default** selection policy; it is always the lowest priority.

Zone Displays the zone assigned to the partition selection policy.

Interface Displays the interface assigned to the authentication partition selection policy.

Partition Displays the authentication partition to which the selection policy applies.

Comment Displays any comment you entered when creating or editing the selection policy. The selection policy for the **Default** partition has the comment **Auto-created default policy**.

Configure Displays the **Edit** and **Delete** icons, which are dimmed for the default policy.

Add Displays the **Add a partition selection policy** popup dialog for adding a selection policy for an authentication partition or subpartition.

Delete Deletes the selected policy or policies.

NOTE: You cannot delete the policy for the **Default** partition. **Delete** is dimmed unless at least one policy has been selected.

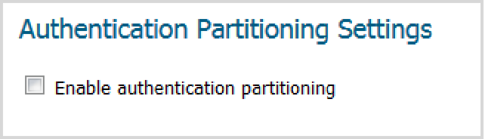
Delete All Deletes all policies from the table except the policy for the **Default** partition.

There is always one selection policy in this table, the auto-created default policy for the **Default** partition. You cannot select this policy, delete it, change its priority, or edit it, except for choosing the partition to which it applies.

Enabling/Disabling Authentication Partitioning

To enable partitioning:

1 Navigate to the **Users > Partitions** page.



Authentication Partitioning Settings

☐ Enable authentication partitioning

2 In the **Authentication Partitioning Setting**s section, select **Enable authentication partitioning**. The **Authentication Partitions** and **Partition Selection Policies** sections display.

To disable partitioning:

1 Navigate to the **MANAGE | System Setup | Users > Partitions** page.

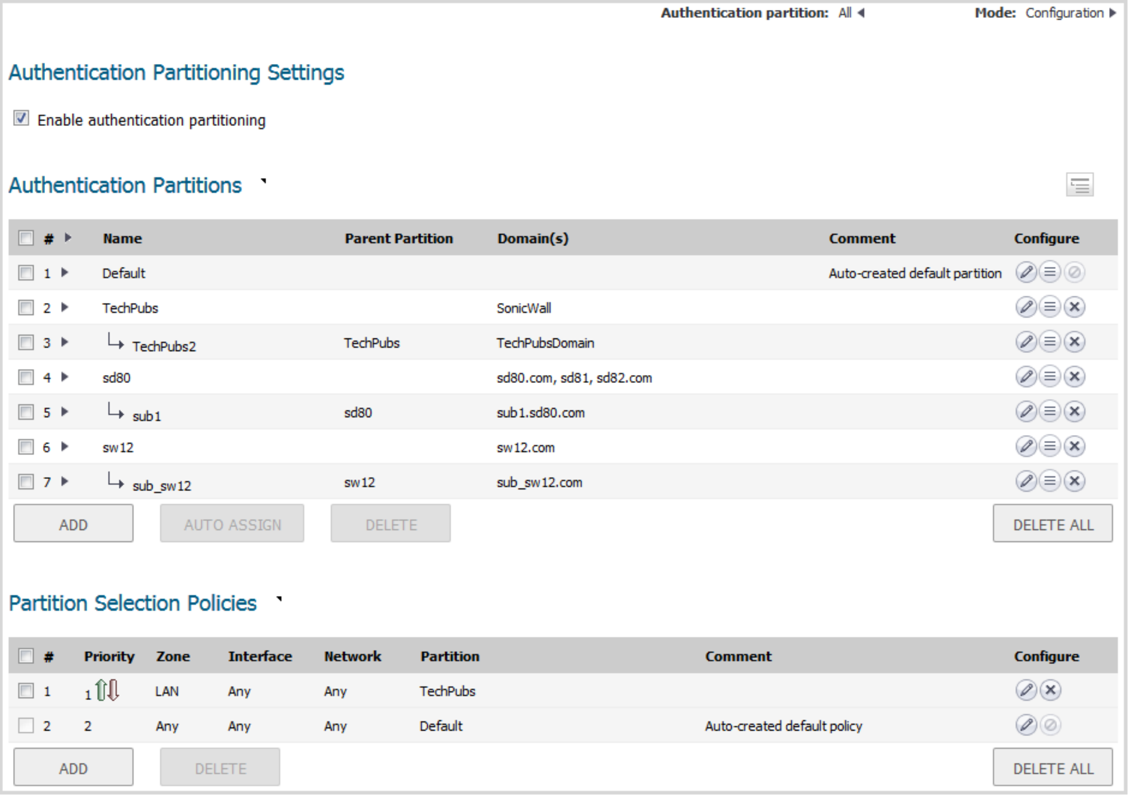
2 In the **Authentication Partitioning Setting**s section, deselect the **Enable authentication partitioning** checkbox. The **Authentication Partitions** and **Partition Selection Policies** sections no longer display.

> **IMPORTANT:** When you disable authentication partitioning, all partitioned LDAP servers, SSO agents, TSAs, and RADIUS accounting clients are moved to the **Default** authentication partition; RADIUS servers are not affected and remain in their configured authentication partitions. If you subsequently enable authentication partitioning, you need to reconfigure all other servers, agents, and clients.

Adding Partitions and Subpartitions

To add a partition:

1 Navigate to the **Users > Partitions** page.



Authentication partition: All ◂ **Mode:** Configuration ▸

Authentication Partitioning Settings

☑ Enable authentication partitioning

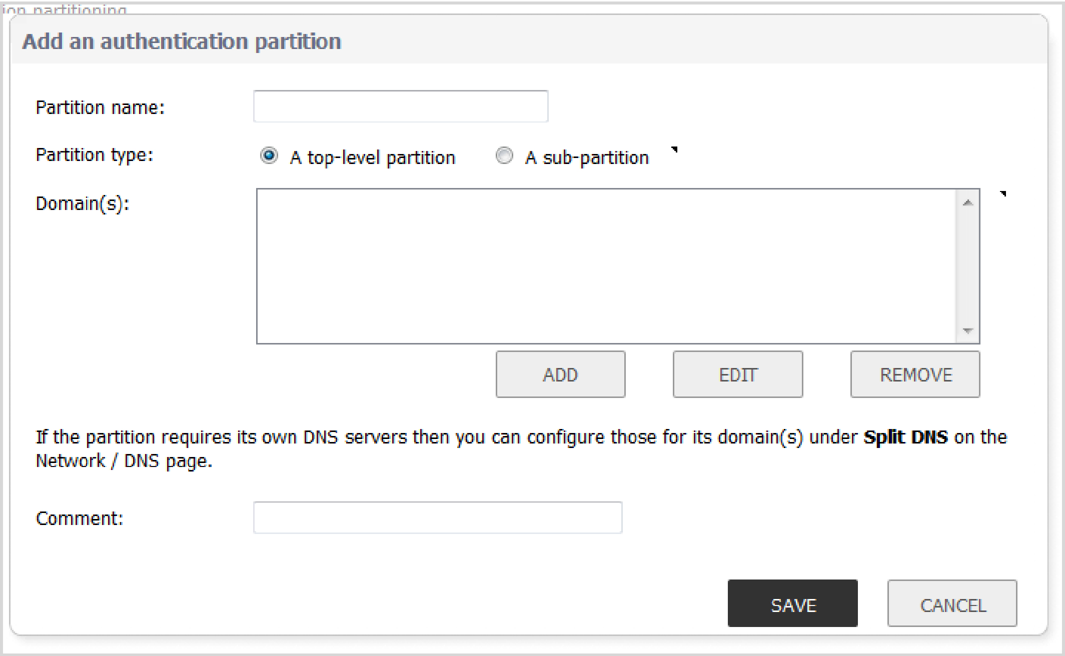
Authentication Partitions

☐	#	Name	Parent Partition	Domain(s)	Comment	Configure
☐	1 ▸	Default			Auto-created default partition	
☐	2 ▸	TechPubs		SonicWall		
☐	3 ▸	↳ TechPubs2	TechPubs	TechPubsDomain		
☐	4 ▸	sd80		sd80.com, sd81, sd82.com		
☐	5 ▸	↳ sub1	sd80	sub1.sd80.com		
☐	6 ▸	sw12		sw12.com		
☐	7 ▸	↳ sub_sw12	sw12	sub_sw12.com		

Partition Selection Policies

☐	#	Priority	Zone	Interface	Network	Partition	Comment	Configure
☐	1	1	LAN	Any	Any	TechPubs		
☐	2	2	Any	Any	Any	Default	Auto-created default policy	

2 In the **Authentication Partitions** section, click **Add**. The **Add an authentication partition** popup dialog displays.



Add an authentication partition

Partition name:

Partition type: ● A top-level partition ○ A sub-partition

Domain(s):

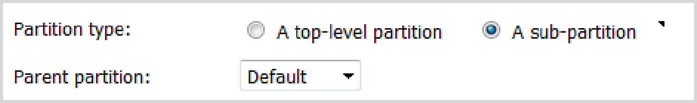
If the partition requires its own DNS servers then you can configure those for its domain(s) under **Split DNS** on the Network / DNS page.

Comment:

3 Enter a friendly, meaningful name in the **Partition name** field. The name can be from 1 to 32 alphanumeric characters.

4 For **Partition type**, choose whether the authentication partition is:

- **A top-level partition**; go to Step 6.
- **A sub-partition**; the **Parent partition** drop-down menu displays:



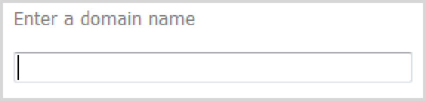
Partition type: ○ A top-level partition ● A sub-partition

Parent partition: Default

5 Select a parent partition from the drop-down menu. The default partition is **Default**.

ⓘ **TIP:** If your installation does not have multiple partitions, then create subpartitions as subpartitions of the **Default** partition.

6 Under the **Domain(s)** list, click **Add**. The **Add domain** popup dialog displays.



Enter a domain name

7 Enter a domain name.

8 Click **OK**.

9 Repeat Step 6 through Step 8 for each domain you want to add.

10 Optionally, enter a comment in the **Comment** field.

11 Click **Save**. The partitions and/or subpartitions are added to the **Authentication Partitions** table. Subpartitions are positioned immediately after their parent partitions, with a **Link** icon indicating they are subpartitions.

Deleting Partitions and Subpartitions

NOTE: In this section, partition refers to both partitions and subpartitions.

You can delete a single partition, multiple partitions, or all partitions. When you delete a single partition, the servers, agents, and clients are reassigned to the **Default** partition.

NOTE: You cannot delete the **Default** partition.

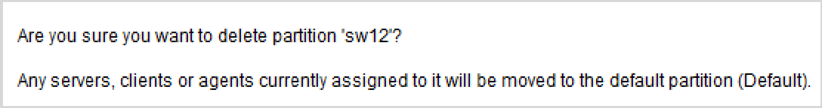
Topics:

- Deleting a Single Partition on page 191
- Deleting Multiple Partitions on page 191
- Deleting All Partitions (Except Default) on page 192

Deleting a Single Partition

To delete a single partition:

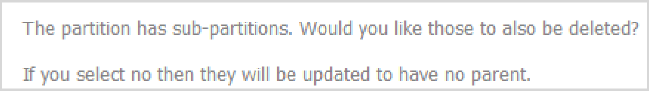
1. Navigate to **MANAGE | System Setup | Users > Partitions**.
2. Under the **Authentication Partitions** table, click the **Delete** icon in the **Configure** column for the partition to be deleted. A verification message displays:



Are you sure you want to delete partition 'sw12'?

Any servers, clients or agents currently assigned to it will be moved to the default partition (Default).

3. Click **OK**. If the partition:
   - Does not have subpartitions, the partition is deleted and the servers/agents/clients are reassigned to the **Default** partition.
   - Has subpartitions, this message displays:



The partition has sub-partitions. Would you like those to also be deleted?

If you select no then they will be updated to have no parent.

a) Do one of these:

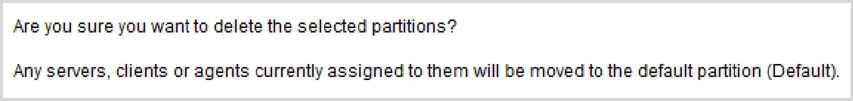
- To delete the subpartitions as well as the parent partition, click **Yes**. All servers/agents/clients are reassigned to the **Default** partition.
- To convert the subpartitions to top-level partitions while deleting the parent partition, click **No**. All servers/agents/clients are reassigned to the **Default** partition.
- To not delete the parent subpartition, click **Cancel**.

Deleting Multiple Partitions

To delete multiple partitions:

1. Navigate to **MANAGE | System Setup | Users > Partitions**.
2. In the **Authentication Partitions** table, click the checkbox(es) of the authentication partition(s) you want to delete. You can select multiple partitions.

3 Click **Delete**. A verification message displays:

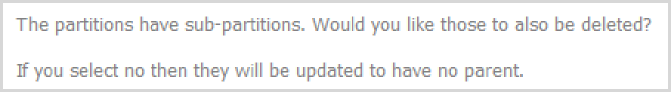


Are you sure you want to delete the selected partitions?

Any servers, clients or agents currently assigned to them will be moved to the default partition (Default).

4 Click **OK**. If any partition:

- Does not have subpartitions, the partition(s) is deleted and the servers/agents/clients are reassigned to the **Default** partition.
- Has subpartitions, this message displays:



The partitions have sub-partitions. Would you like those to also be deleted?

If you select no then they will be updated to have no parent.

a Do one of these:

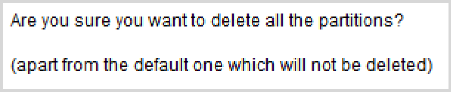
- To delete the subpartitions as well as the parent partition(s), click **Yes**. All servers/agents/clients are reassigned to the **Default** partition.
- To convert the subpartitions to top-level partitions while deleting the parent partition(s), click **No**. All servers/agents/clients are reassigned to the **Default** partition.
- To not delete the parent subpartition, click **Cancel**.

Deleting All Partitions (Except Default)

To delete all partitions (except Default)

1 Navigate to **Users > Partitions**.

2 In the **Authentication Partitions** table, click **Delete All**. A verification message displays:



Are you sure you want to delete all the partitions?

(apart from the default one which will not be deleted)

3 Click **OK**. All servers/agents/clients are reassigned to the **Default** partition.

Assigning Servers, Agents, and Clients

After you have added the authentication partitions, you assign servers, agents, and/or clients to the partitions. You also can assign them to the authentication partitions at any time by following the same procedure.

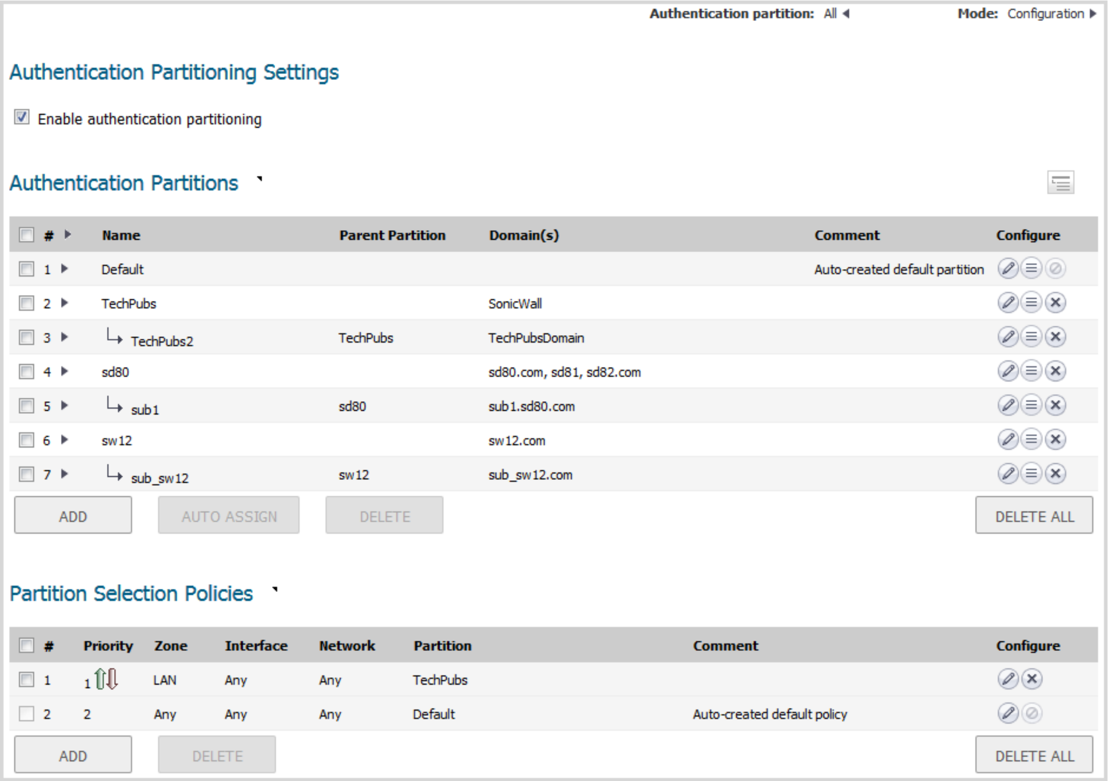
You can have unassigned servers, agents, and clients auto assigned to the partition.

Topics:

Assigning Manually

To assign servers, agents, and clients:

1 Navigate to **MANAGE | System Setup | Users > Partitions**.



Authentication partition: All ◄ Mode: Configuration ►

Authentication Partitioning Settings

☑ Enable authentication partitioning

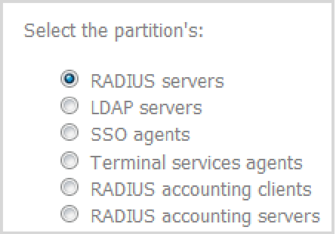
Authentication Partitions

□	#	Name	Parent Partition	Domain(s)	Comment	Configure
□	1	Default			Auto-created default partition	
□	2	TechPubs		SonicWall		
□	3	↳ TechPubs2	TechPubs	TechPubsDomain		
□	4	sd80		sd80.com, sd81, sd82.com		
□	5	↳ sub1	sd80	sub1.sd80.com		
□	6	sw12		sw12.com		
□	7	↳ sub_sw12	sw12	sub_sw12.com		

Partition Selection Policies

□	#	Priority	Zone	Interface	Network	Partition	Comment	Configure
□	1	1	LAN	Any	Any	TechPubs		
□	2	2	Any	Any	Any	Default	Auto-created default policy	

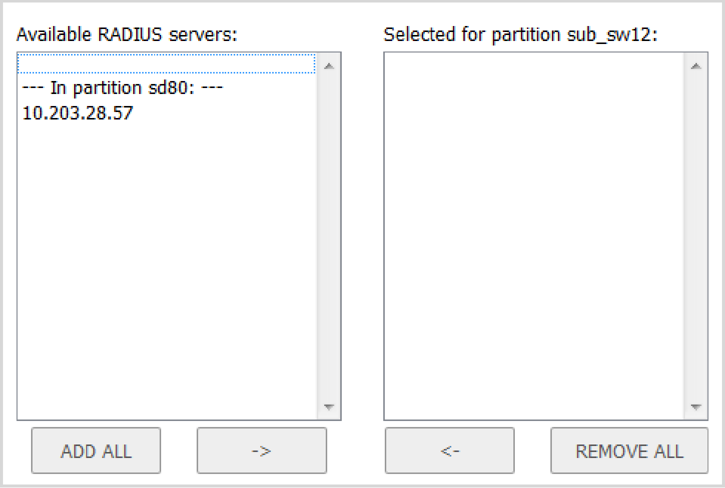
2 In the **Authentication Partition** table, click the partition's **Selection** icon in the **Configure** column. The **Select what?** popup dialog displays.



Select the partition's:

● RADIUS servers
○ LDAP servers
○ SSO agents
○ Terminal services agents
○ RADIUS accounting clients
○ RADIUS accounting servers

3 Select the type of server, agent, or client to assign. The appropriate **Select the *server/agent/client* for partition *partitionName*** popup menu displays with a list of available servers, agents, or clients.


Available RADIUS servers:
--- In partition sd80: ---
10.203.28.57
Selected for partition sub_sw12:
ADD ALL
->
<-
REMOVE ALL

4 Do one of the following:

- Select a server/agent/client from the **Available** list and click the **Right-arrow**.
- Select multiple items from the **Available** list by pressing the **Ctrl** key while selecting each item and then click the **Right-arrow**.
- Select all items by clicking **Add All**.

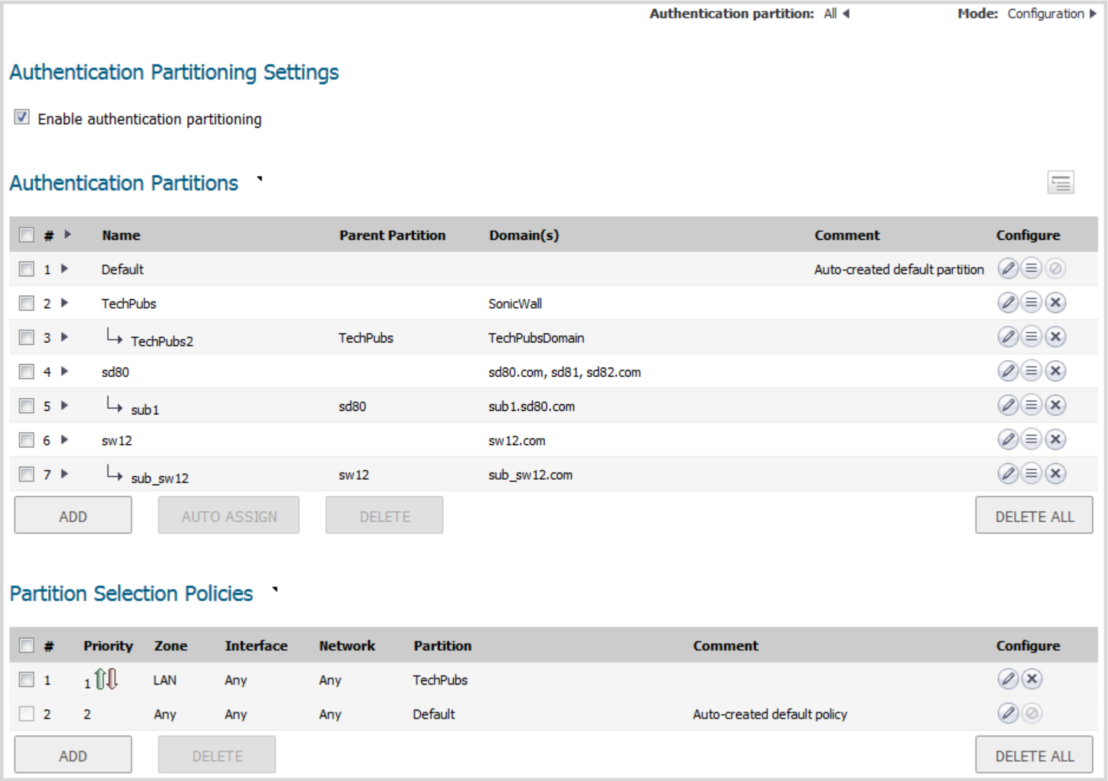
5 Click **SAVE**.

Auto Assigning

There is **Auto Assign** for assigning any unassigned servers, agents, and clients, based on their IP addresses or host names, to the relevant partitions automatically.

To auto assign servers, agents, and clients:

1 Navigate to **MANAGE | System Setup | Users > Partitions**.



Authentication partition: All ◂ **Mode:** Configuration ▸

Authentication Partitioning Settings

☑ Enable authentication partitioning

Authentication Partitions

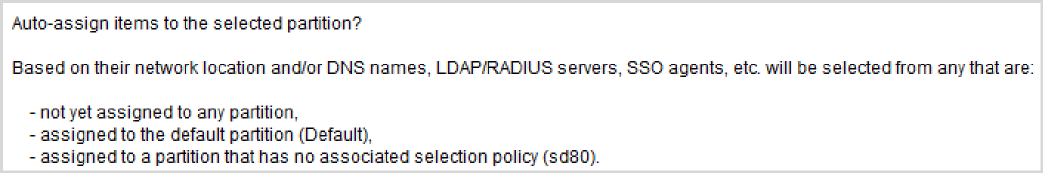
□ #	Name	Parent Partition	Domain(s)	Comment	Configure
□ 1 ▸	Default			Auto-created default partition	
□ 2 ▸	TechPubs		SonicWall		
□ 3 ▸	↳ TechPubs2	TechPubs	TechPubsDomain		
□ 4 ▸	sd80		sd80.com, sd81, sd82.com		
□ 5 ▸	↳ sub1	sd80	sub1.sd80.com		
□ 6 ▸	sw12		sw12.com		
□ 7 ▸	↳ sub_sw12	sw12	sub_sw12.com		

Partition Selection Policies

□ #	Priority	Zone	Interface	Network	Partition	Comment	Configure
□ 1	1	LAN	Any	Any	TechPubs		
□ 2	2	Any	Any	Any	Default	Auto-created default policy	

2 In the **Authentication Partitions** table, click the checkbox(es) of the authentication partition(s) to which you want to assign unassigned servers, agents, and/or clients. You can select more than one partition. **AUTO ASSIGN** becomes active.

3 Click **AUTO ASSIGN**. The auto-assign message appears.



Auto-assign items to the selected partition?

Based on their network location and/or DNS names, LDAP/RADIUS servers, SSO agents, etc. will be selected from any that are:

- not yet assigned to any partition,
- assigned to the default partition (Default),
- assigned to a partition that has no associated selection policy (sd80).

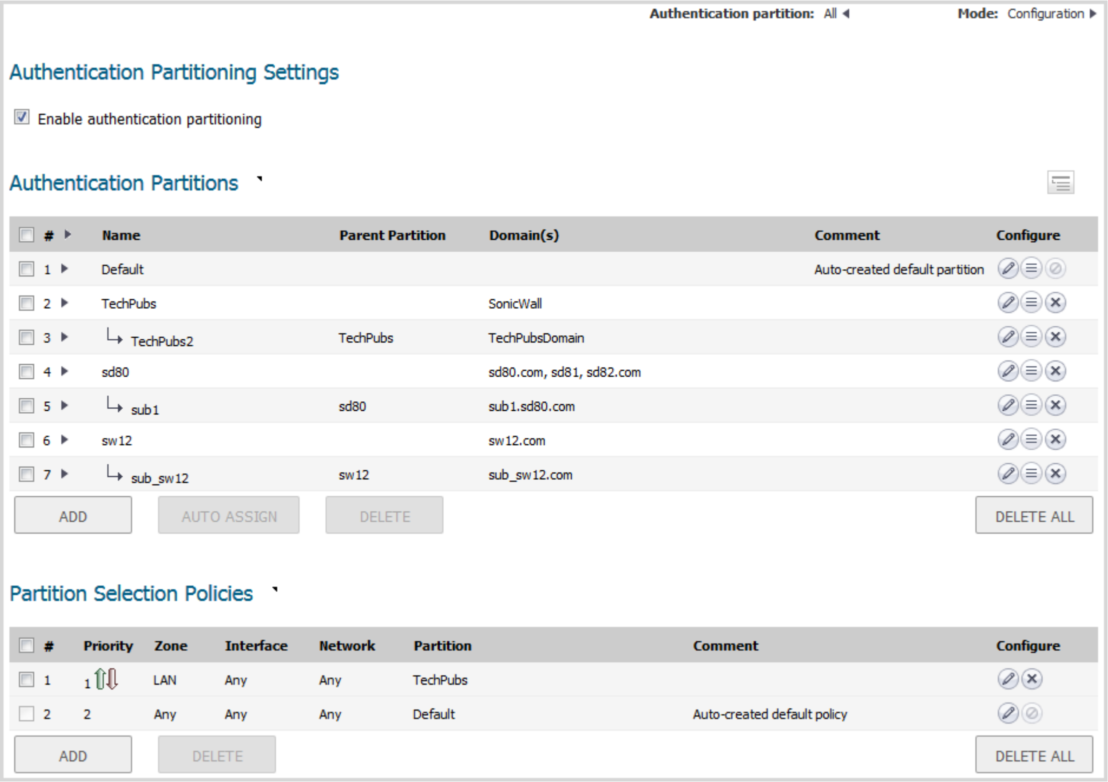
4 Click **OK**.

Editing Partitions

You can edit all partitions including the **Default** partition.

To edit a partition:

1 Navigate to **MANAGE | System Setup > Users > Partitions**.



Authentication partition: All ◂ Mode: Configuration ▸

Authentication Partitioning Settings

☑ Enable authentication partitioning

Authentication Partitions

☐	#	Name	Parent Partition	Domain(s)	Comment	Configure
☐	1	Default			Auto-created default partition	✎ ≡ ⊘
☐	2	TechPubs		SonicWall		✎ ≡ ⊗
☐	3	↳ TechPubs2	TechPubs	TechPubsDomain		✎ ≡ ⊗
☐	4	sd80		sd80.com, sd81, sd82.com		✎ ≡ ⊗
☐	5	↳ sub1	sd80	sub1.sd80.com		✎ ≡ ⊗
☐	6	sw12		sw12.com		✎ ≡ ⊗
☐	7	↳ sub_sw12	sw12	sub_sw12.com		✎ ≡ ⊗

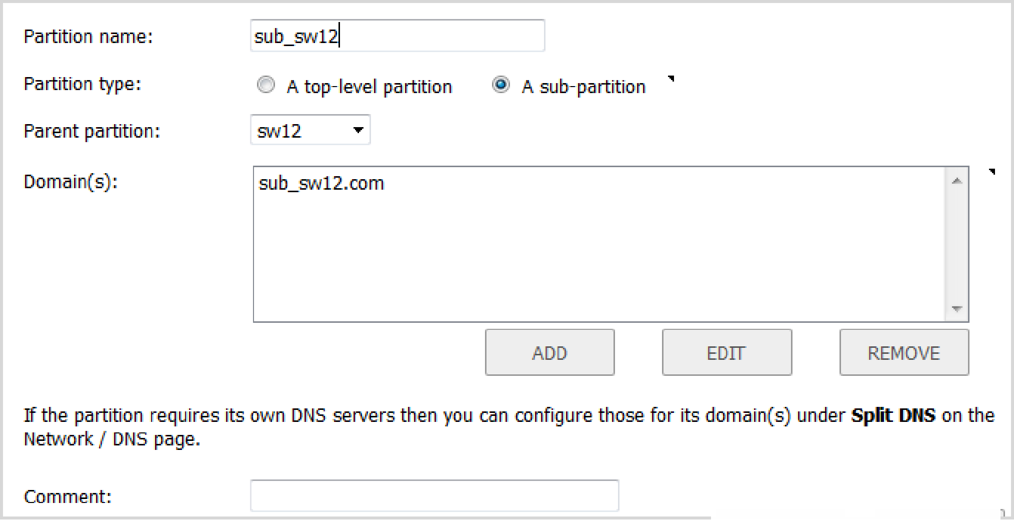
ADD AUTO ASSIGN DELETE DELETE ALL

Partition Selection Policies

☐	#	Priority	Zone	Interface	Network	Partition	Comment	Configure
☐	1	1 ⇅	LAN	Any	Any	TechPubs		✎ ⊗
☐	2	2	Any	Any	Any	Default	Auto-created default policy	✎ ⊘

ADD DELETE DELETE ALL

2 In the **Authentication Partitions** table, click the **Edit** icon in the **Configuration** column of the authentication partition you want to modify. The **Edit authentication partition** popup displays.



Partition name: sub_sw12

Partition type: ○ A top-level partition ● A sub-partition

Parent partition: sw12

Domain(s): sub_sw12.com

ADD EDIT REMOVE

If the partition requires its own DNS servers then you can configure those for its domain(s) under **Split DNS** on the Network / DNS page.

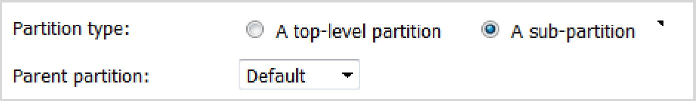
Comment:

3 You can change the partition’s name in the **Partition name** field. The name can be from 1 to 32 alphanumeric characters.

4 You can change a partition from a top-level partition to a subpartition or from a subpartition to a top-level partition by changing the **Partition type**; choose whether the authentication partition is now to be:

> ⓘ **NOTE:** A top-level partition that has subpartitions cannot be changed to a subpartition unless you first delete the subpartitions, reallocate them to a different top-level partition, or make them top-level partitions.

- **A top-level partition**, go to Step 6.
- **A sub-partition**; the **Parent partition** drop-down menu displays:



Partition type: ○ A top-level partition ● A sub-partition

Parent partition: Default

5 Select a parent partition from the **Parent partition** drop-down menu. The default partition is **Default**.

6 To:

- Edit a domain, go to Step 10.
- Delete a domain, go to Step 15.
- Add a domain, under the **Domain(s)** list, click **Add**. The **Add domain** popup dialog displays.

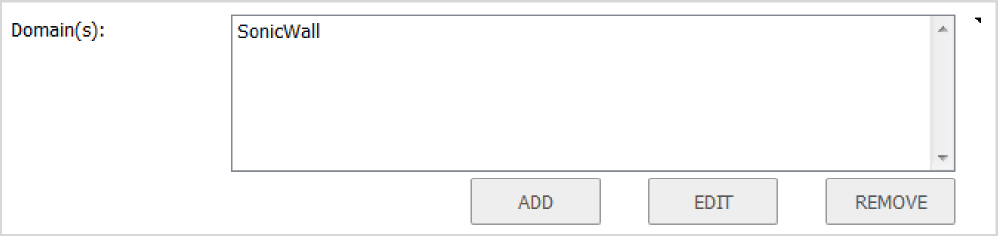
Enter a domain name

7 Enter a domain name, which can be from 1 to 32 alphanumeric characters.

8 Click **OK**.

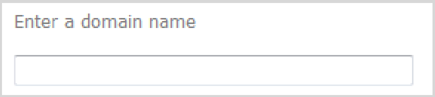
9 Go to Step 17.

10 Select a domain to edit by clicking on it.



Domain(s): SonicWall

11 Click **Edit**. The **Edit domain** dialog displays.



Enter a domain name

12 Change the domain name.

13 Click **OK**.

14 Go to Step 17

15 Select a domain to delete.

16 Click **Remove**.

17 Repeat Step 6 for each domain you want to add, edit, or delete.

18 To change the servers used for looking up names in the partition, for **To look up names in the partition**, select either:

- **Use the default DNS servers**; go to Step 20.
- **Use the partition's DNS servers**; the **DNS Server 1**/-**2**/-**3** fields become active.

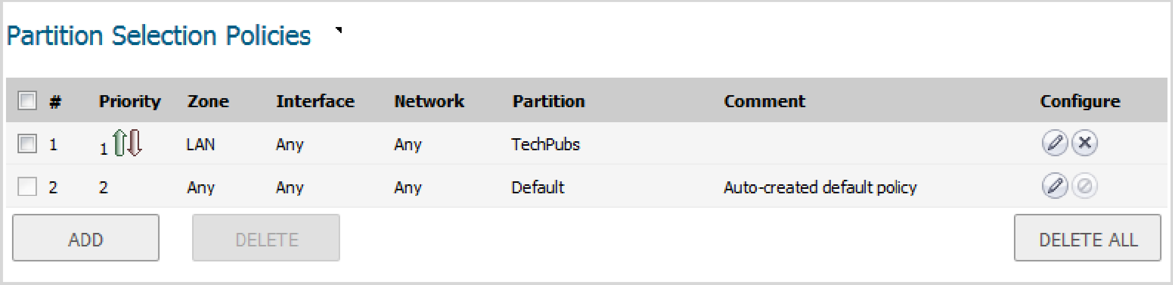
19 Enter up to three DNS servers in the **DNS Server 1**/-**2**/-**3** fields.

20 Optionally, enter a comment in the **Comment** field.

21 Click **SAVE**.

Configuring Partition Selection Policies

A partition selection policy specifies how an authentication partition is selected for a user. You add, edit, and manage authentication partition selection policies in the **Partition Selection Policies** section of the **MANAGE | System Setup > Users > Partitions** page. For a complete description of partition selection policies, see About Authentication Partition Selection on page 178.



Partition Selection Policies

□	#	Priority	Zone	Interface	Network	Partition	Comment	Configure
□	1	1 ⇧⇩	LAN	Any	Any	TechPubs		✎ ✖
□	2	2	Any	Any	Any	Default	Auto-created default policy	✎ ⊘

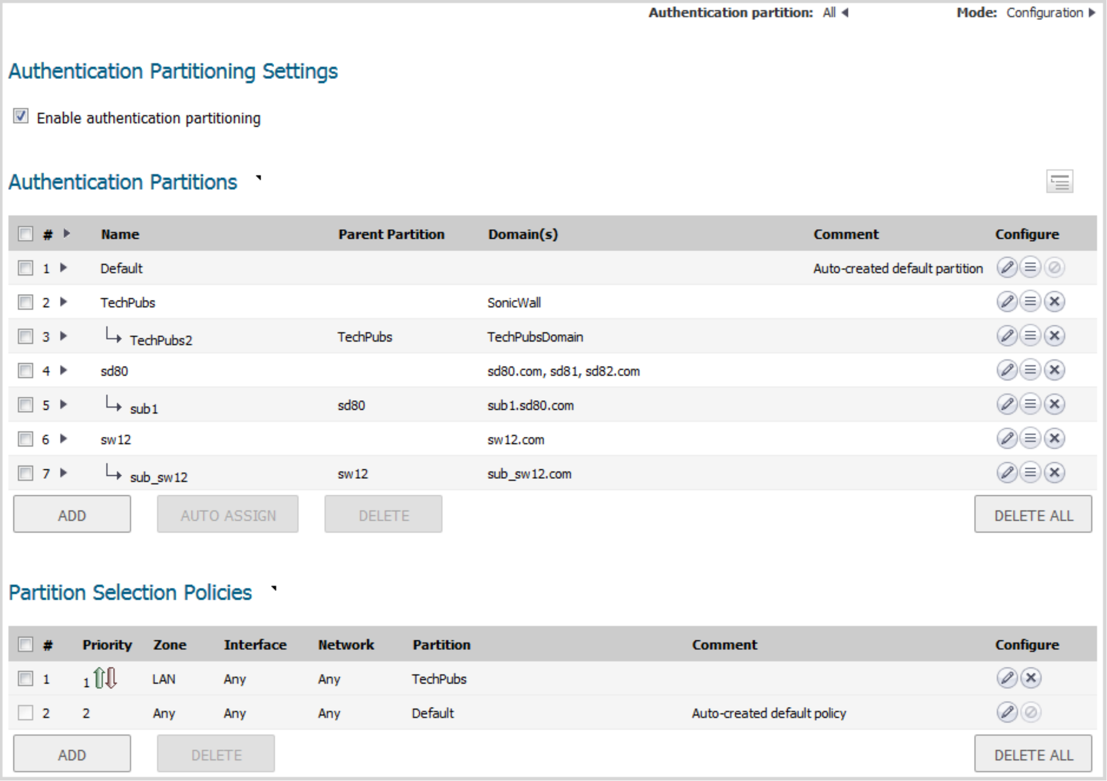
Topics:

- Adding Authentication Partition Selection Policies on page 199
- Changing Priority of a Selection Policy on page 200
- Modifying a Selection Policy on page 201
- Deleting Partition Selection Policies on page 201

Adding Authentication Partition Selection Policies

To add a partition select policy:

1 Navigate to the **MANAGE | System Setup > Users > Partitions** page.



Authentication partition: All ◂ **Mode:** Configuration ▸

Authentication Partitioning Settings

☑ Enable authentication partitioning

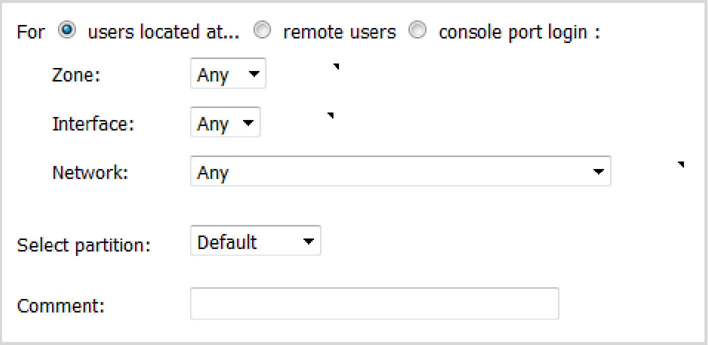
Authentication Partitions

☐	#	Name	Parent Partition	Domain(s)	Comment	Configure
☐	1 ▸	Default			Auto-created default partition	
☐	2 ▸	TechPubs		SonicWall		
☐	3 ▸	↳ TechPubs2	TechPubs	TechPubsDomain		
☐	4 ▸	sd80		sd80.com, sd81, sd82.com		
☐	5 ▸	↳ sub1	sd80	sub1.sd80.com		
☐	6 ▸	sw12		sw12.com		
☐	7 ▸	↳ sub_sw12	sw12	sub_sw12.com		

Partition Selection Policies

☐	#	Priority	Zone	Interface	Network	Partition	Comment	Configure
☐	1	1	LAN	Any	Any	TechPubs		
☐	2	2	Any	Any	Any	Default	Auto-created default policy	

2 In the **Partition Selection Policies** section, click **Add**. The **Add a partition selection policy** popup dialog displays.



For ● users located at... ○ remote users ○ console port login :

Zone: Any

Interface: Any

Network: Any

Select partition: Default

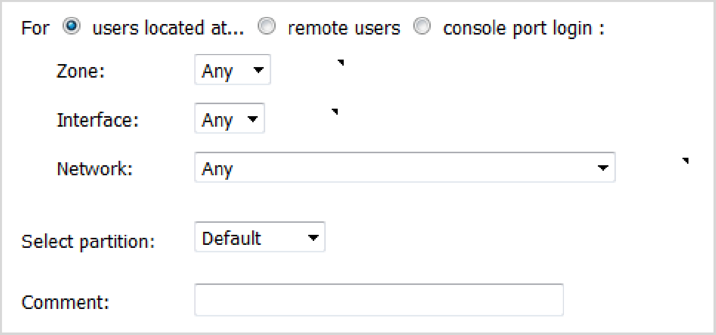
Comment:

3 Choose the users' login location; what displays depends on your choice:

For this choice	Go to
users located at...	Step 4; this is the default
remote users	Step 7
console port login	Step 9

4 If you selected **users located at...**, select where the partitions are located from the **Zone**, **Interface**, and **Network** drop-down menus:

> **NOTE:** To select the partition it is typically not necessary to specify the zone, interface, and network. For optimum efficiency, it is best to give the minimum necessary.
>
> For example, if a partition is located through a specific interface, then just select that interface and leave the **Zone** as the default, **Any**. If a partition is located in a specific subnet, then just select that subnet as the **Network** and leave the **Zone** and **Interface** both set to the default, **Any**.



For ● users located at... ○ remote users ○ console port login :

Zone: Any

Interface: Any

Network: Any

Select partition: Default

Comment:

> **NOTE:** The choices provided in each drop-down menu vary by site.

- **Zone** – default is **Any**
- **Interface** – default is **Any**
- **Network** – default is **Any**; there are options to create a new Address Object and/or Address Group

5 Select a partition or subpartition from the **Select partition** drop-down menu. The default partition is **Default**.

6 Go to Step 10.

7 If you selected remote users, the options change; select a partition or subpartition from the **Select partition** drop-down menu. The default partition is **Default**.

8 Go to Step 10.

9 If you selected console port login, the options change; select a partition or subpartition from the **Select partition** drop-down menu. The default partition is **Default**.

10 Optionally, enter a comment in the **Comment** field.

11 Click **SAVE**.

Changing Priority of a Selection Policy

When determining an authentication partition to use, SonicOS NS*v* searches the **Partition Selection Policies** table sequentially from top (1) to bottom (*n*). As you create selection policies, they are prioritized as follows:

1 Zone, with **Any** listed last in the group

2 Interface, with **Any** listed last in the group

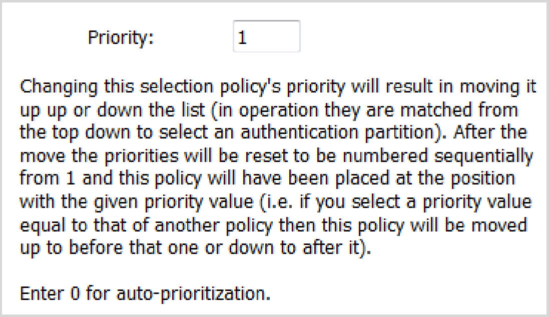
3 Network, with **Any** listed last in the group

You can change the priority of any policy except the **Default** partition selection policy, which is always the lowest priority.

Changing the priority of a selection policy moves the policy up or down the priority list. After the move, the priorities are reset to match the new ordering.

To change the priority of a policy:

1 In the **Partition Selection Policy** table, click the **Priority** 1⇅ icon for the selection policy. The **Change selection policy priority** popup dialog displays.



Priority: 1

Changing this selection policy's priority will result in moving it up up or down the list (in operation they are matched from the top down to select an authentication partition). After the move the priorities will be reset to be numbered sequentially from 1 and this policy will have been placed at the position with the given priority value (i.e. if you select a priority value equal to that of another policy then this policy will be moved up to before that one or down to after it).

Enter 0 for auto-prioritization.

2 In the **Priority** field, enter the desired priority.

ⓘ | **NOTE:** Enter 0 for auto prioritization.

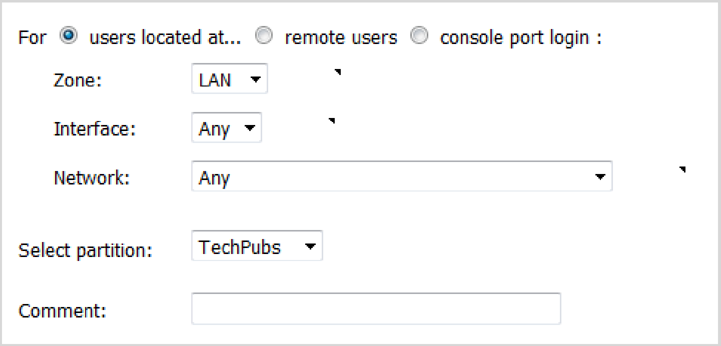
3 Click **OK**. The **Partition Selection Policies** table is updated to reflect the new ordering, including the reordering of other policies.

Modifying a Selection Policy

You can modify any partition selection policy except the auto-created **Default** policy. For the Default policy, you can only change the **Selected partition**.

To change a partition selection policy:

1 In the **Partition Selection Policies** table, click the **Edit** icon in the **Configure** column for the selection policy. The **Edit partition selection policy** popup dialog displays



For ● users located at... ○ remote users ○ console port login :

Zone: LAN

Interface: Any

Network: Any

Select partition: TechPubs

Comment:

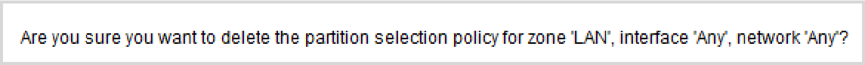
2 This is the same dialog as the Add partition selection policy; for information about the dialog, see Adding Authentication Partition Selection Policies on page 199.

Deleting Partition Selection Policies

You can delete any partition selection policy except the auto-created **Default** policy for the **Default** authentication partition. You can delete a single policy, multiple policies, or all policies you created.

To delete a policy:

1 In the **Partition Selection Policies** section of the **MANAGE | System Setup | Users > Partitions** page, click the **Delete** icon in the **Configure** column for the policy to be deleted. A verification message displays:



Are you sure you want to delete the partition selection policy for zone 'LAN', interface 'Any', network 'Any'?

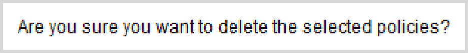
2 Click **OK**.

To delete multiple policies:

ⓘ | **NOTE:** The default partition selection policy cannot be deleted.

1 In the **Partition Selection Policies** section of the **MANAGE | System Setup | Users > Partitions** page, select one or more policies to be deleted by clicking their checkboxes. **Delete** becomes active.

2 Click **Delete**. A verification message displays:

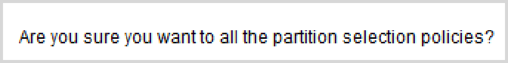


Are you sure you want to delete the selected policies?

3 Click **OK**.

To delete all policies:

1 In the **Partition Selection Policies** section of the **MANAGE | System Setup | Users > Partitions** page, click **Delete All**. A verification message displays:



Are you sure you want to all the partition selection policies?

2 Click **OK**.

Configuring Servers, Agents, and Clients for Authentication Partitioning

For each partition, you can configure:

User authentication method	Local Users
	RADIUS
	RADIUS + Local Users
	LDAP
	LDAP + Local Users
Single-sign-on method	SSO Agent
	Terminal Services Agent (TSA)
	RADIUS Accounting
	Browser NTLM Authentication

Authentication partitioning of all of the servers, agents, and clients is configured from the **MANAGE | System Setup | Users > Settings** page; for a complete description of how to configure these entities and of the **MANAGE | System Setup | User > Settings** page, see Configuring Settings for Managing Users on page 102. For a description of how partitioning affects the configuration of servers and agents, see Configuring Servers and Agents.

ⓘ **NOTE:** Operation of servers, agents, and clients is further described in Operation of Servers, Agents, and Clients with Subpartitions on page 176.

Configuring Servers and Agents

Server/Agent	Partitioning Configuration
RADIUS servers	A maximum of two RADIUS servers are configured as a primary/secondary redundant pair. You can configure multiple RADIUS server pairs, one primary/secondary pair per authentication partition.
LDAP servers	A number of primary LDAP servers can be configured, one for each authentication partition, plus a list of secondary servers for each (see About Extended Support for Multiple LDAP Servers on page 145). Typically, the LDAP servers for a domain or a group of inter-connected domains (forest in Active Directory terms) are allocated to each authentication partition.
SSO agents	Multiple SSO agents, in addition to supporting both load-sharing and redundancy, also support allocating agents to authentication partitions. A group of one or more agents are allocated to each authentication partition, and load-sharing and redundancy happens within each group.
TS agents	Partitioning of TSAs is required only for LDAP server selection for user group membership lookup. Configuration is optional as the TSA always supplies the full Windows NetBIOS domain name with the username. Thus, in most cases, it is possible to derive the authentication partition from the username.
RADIUS Accounting clients	Partitioning of SSO RADIUS Accounting clients is required only for LDAP server selection for user group membership lookup. Configuration is optional as some, but not all, RADIUS Accounting clients supply the domain name with the username in their accounting messages. Thus, in some cases, it is possible to derive the authentication partition from the username.

10

Configuring Local Users and Groups

Topics:

About Authentication and Passwords

Topics:

Using Two-Factor Authentication

Many user login authentication require one-time passwords (OTP). SonicOS NS*v* provides an additional method of OTP through email: Time-Based One-Time Password (TOTP) authentication with two-factor authentication.

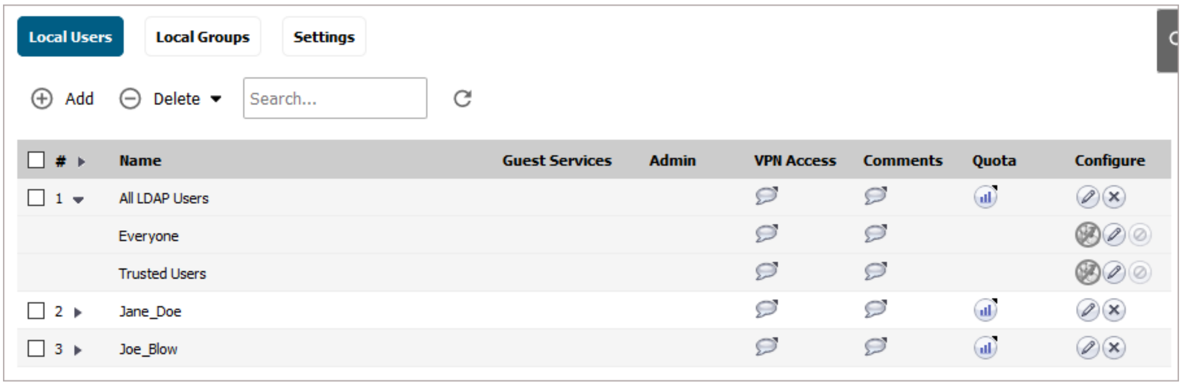
To use this feature, you must download a TOTP client application (such as Google Authentication, DUO, or Microsoft Authentication) onto your smart phone. Select TOTP on the **Add/Edit User** dialog.

Enforcing First Login Password Change

Previously, when you created a user, you could allow users to change their passwords after first logging in. SonicOS NS*v* allows you to force users to change their password before their first login when you create or edit a local user. You can specify the login change for users or for groups.

Configuring Local Users

Local users are users stored and managed on the SonicWall Security Appliance's local database. In **MANAGE | System Setup > Users > Local Users & Groups**, you can view and manage all local users, add new local users, and edit existing local users. You can also import users from your LDAP server.



☐	#	▸	Name	Guest Services	Admin	VPN Access	Comments	Quota	Configure
☐	1	▾	All LDAP Users			💬	💬	📊	✎ ✕
			Everyone			💬	💬		⚙ ✎ ⊘
			Trusted Users			💬	💬		⚙ ✎ ⊘
☐	2	▸	Jane_Doe			💬	💬	📊	✎ ✕
☐	3	▸	Joe_Blow			💬	💬	📊	✎ ✕

Checkbox Used to select individual local users.

Expand/Collapse icons By default, only the local user's username is listed. Clicking the Expand icon displays the groups to which the local user belongs.

Name Lists the username of the local user; when expanded lists the name(s) of the groups to which the local user belongs.

Guest Services Indicates with a green checkmark icon whether guest services is active for the local user.

Admin Displays the type of administration capabilities available to the local user.

VPN Access Displays a **Comment** icon for each local user and each group to which the local user is a member. Mousing over the icon displays the status of the local group's VPN access and that of each member of the group.

Comments Displays a **Comment** icon for each local user and each group to which the local user is a member. Mousing over the icon displays the comment entered when the local user or group was configured or edited.

Quota For each local user, displays a **Statistics** icon. Mousing over the icon displays any usage quota for the local user.

Configure Displays the **Edit** and **Delete** icons for each local user. If an icon is dimmed or otherwise disabled, that function is not available for that local user or local group.

For information about authentication and two-factor passwords, see About Authentication and Passwords on page 204.

Topics:

- Quota Control for all Users on page 206

Quota Control for all Users

The quota control for users feature provides quota control based on the user's account. The quota can be specified as a session lifetime, or a transmit and/or receive traffic limit. With a cyclic quota, a user cannot access the Internet upon meeting the account quota until the next cycle (day, week, or month) begins. If the quota cycle is Non Cyclic, the user is unable to access the Internet upon meeting the quota.

Previously, the quota control was supported only for guest users. Quota control is now specified for all local users as well.

Viewing Local Users

You can view all the groups to which a user belongs on **MANAGE | System Setup | Users > Local Users & Groups**. Click the **Expand** icon next to a user to view the group memberships for that user.

The columns to the right of the user's name list the privileges that the user has. In the expanded view, it displays which group the user gets each privilege from.

To:

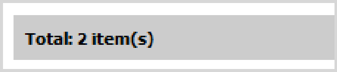
- View the network resources to which the user has VPN access, hover the mouse pointer over the **Comment** icon in the user's **VPN Access** column.
- View the quota for the user, hover the mouse over the **Statistics** icon in the **Quota** column
- Remove the user from a group, in the expanded view, click the **Remove** icon in the user's **Configure** column.

  ⓘ | **NOTE:** If the user cannot be deleted from a group, the icon is dimmed.

- Edit the user, click the **Edit** icon in the user's **Configure** column. See Editing Local Users on page 213.
- Delete the user or group in that row, click the **Delete** icon in the user's **Configure** column.

  ⓘ | **NOTE:** If the local user cannot be deleted from a group, the icon is dimmed.

The bottom of the **Users > Local Users & Groups** page displays the total number of local users:



Total: 2 item(s)

Adding Local Users

You can add local users to the internal database on the Security Appliance from the **MANAGE | System Setup | Users > Local Users & Groups** page.

ⓘ **NOTE:** For the procedure for creating a user for an SSL VPN client, see *SonicOS NSv 6.5 Connectivity*.

To add local users to the database:

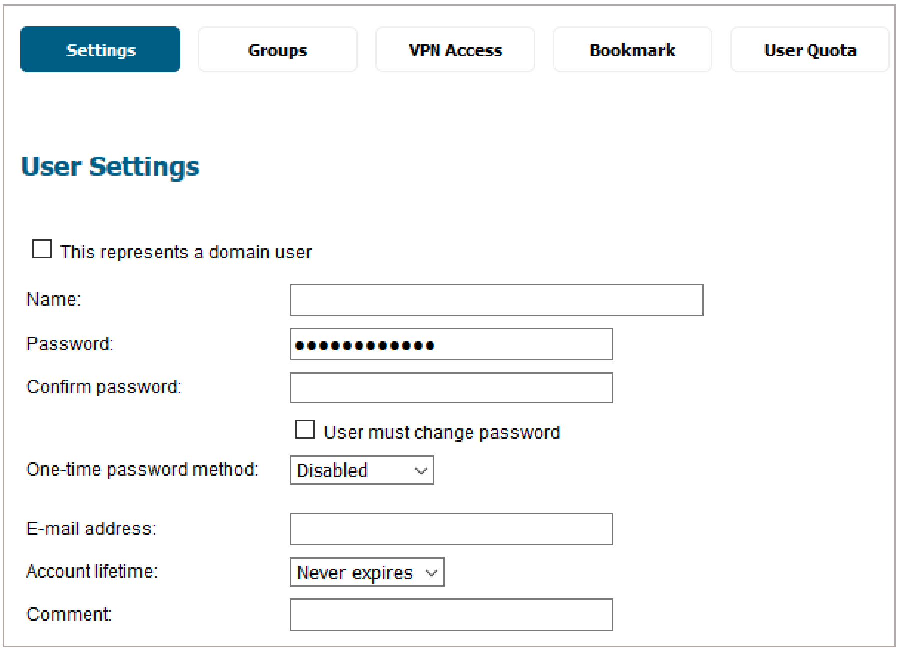
1 Navigate to **MANAGE | System Setup > Users > Local Users & Groups**.

2 If partitioning is:

- Not enabled, go to Step 3.
- Enabled, select the partition to which the settings apply from the **Authentication partitioning** drop-down menu. The default is **All**.

ⓘ **TIP:** This menu displays only if partitioning is enabled.

3 Click the **Add** icon. The **Add User** dialog displays.



User Settings

□ This represents a domain user

Name:

Password: ●●●●●●●●●●●●

Confirm password:

□ User must change password

One-time password method: Disabled

E-mail address:

Account lifetime: Never expires

Comment:

4 In **Settings**, indicate whether the group memberships, access rights, and other attributes apply to any domain user logging in using the registered domain account by selecting **This represents a domain user**. This option is not selected by default. When selected, other options display.

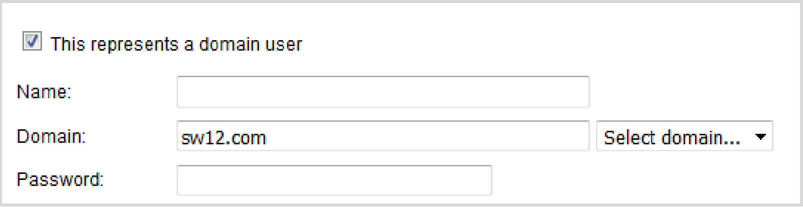
If **This represents a domain user** is:

- Selected, then any attributes, such as group membership and access rights, set apply for users who log in using the named domain account (authenticated through RADIUS or LDAP) or who are identified as hat domain user by SSO. You can have this attribute apply for the named user account in a specific domain or for a user with the given name in any domain.
- Not selected, the local user is a local account and anything this is set applies only for users who log in using the account and authenticated locally, in which case the password must be set in Step 8.

5 Type the user name into the **Name** field.

6 If the local user:

- Represents a domain user, the options change; go to Step 7.

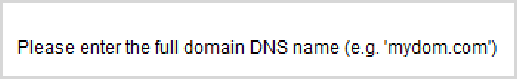


☑ This represents a domain user

Name:		
Domain:	sw12.com	Select domain... ▾
Password:		

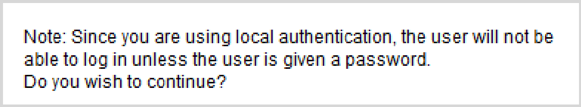
- Does not represent a domain user, go to Step 8.

7 Enter the domain name in the **Domain** field. You can select the **Domain** dome from the drop-down menu. If you enter a domain name that is not listed, you must enter the full domain name or a message is displayed:



Please enter the full domain DNS name (e.g. 'mydom.com')

If the domain is local, you must enter a password. If you do not, a message displays:



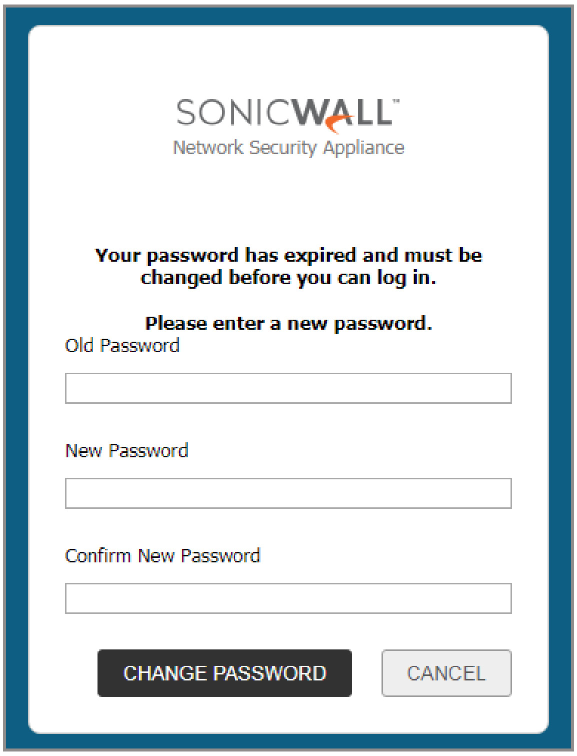
Note: Since you are using local authentication, the user will not be able to log in unless the user is given a password.
Do you wish to continue?

8 In the **Password** field, type a password for the user. Passwords are case-sensitive and should consist of a combination of 32 alphanumeric and special characters rather than names of family, friends, or pets. The length and type of characters are configured on **MANAGE | Appliance > Base Settings > Login Security**.

ⓘ | **NOTE:** If **This represents a domain user** was not selected, you must enter a password.

9 Confirm the password by retyping it in the **Confirm Password** field.

10 Optionally, select **User must change password** to force users to change their passwords the first time they login. This option is not selected by default. If **User must change password** is selected, this dialog displays at the first login attempt:



SONICWALL
Network Security Appliance

Your password has expired and must be changed before you can log in.

Please enter a new password.

Old Password

New Password

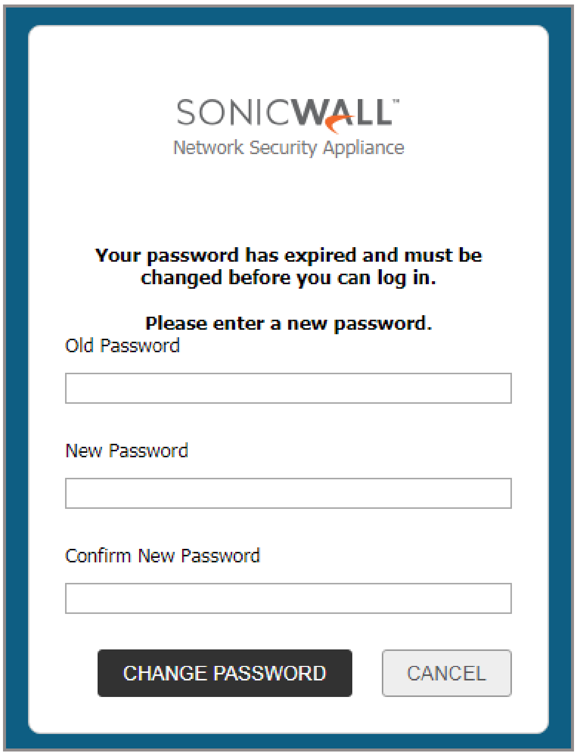
Confirm New Password

11 From **One-time password method**, select the method to require SSL VPN users to submit a system-generated password for two-factor authentication.

> ⓘ **TIP:** If a Local User does not have one-time password enabled, while a group it belongs to does, ensure the user's email address is configured, otherwise this user cannot login.

> ⓘ **TIP:** To avoid another password change request for this user, the option applies only to the first login.

- **Disabled** (default) – If **User must change password** is selected this dialog displays at the first login attempt:

  Your password has expired and must be changed before you can log in.

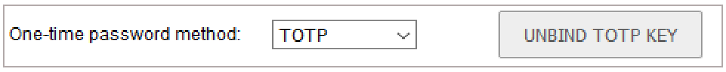
  Please enter a new password.

  Go to Step 13.

- **OTP via Mail** – Users receive a temporary password by email after they enter their user name and first password. After receiving the password-containing email, they can enter the second password to complete the login process. Go to Step 12.

- **TOTP** – Users receive a temporary password by email after they input their user name and first password, but to use this feature, users must download a TOTP client application (such as Google Authentication, DUO, or Microsoft Authentication) on their smart phone.

  The **UNBIND TOTP KEY** displays.

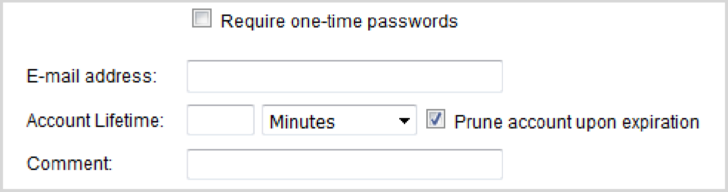
  One-time password method: TOTP

12 Enter the user's email address so they can receive one-time passwords.

13 From **Account Lifetime**, select the duration a user account exists before it is ether deleted or disabled. Depending on your selection, more options display:

- **Never expires** makes the account permanent. This is the default. Go to Step 16.

- **Minutes**, **Hours**, or **Days** specify a lifetime after which the user account is either deleted or disabled. If you choose a limited lifetime, the option changes:

  □ Require one-time passwords

  E-mail address:

  Account Lifetime: Minutes ☑ Prune account upon expiration

  Comment:

14 Enter the lifetime in the **Account Lifetime** field. You can specify up to 9999 hours, minutes, or days.

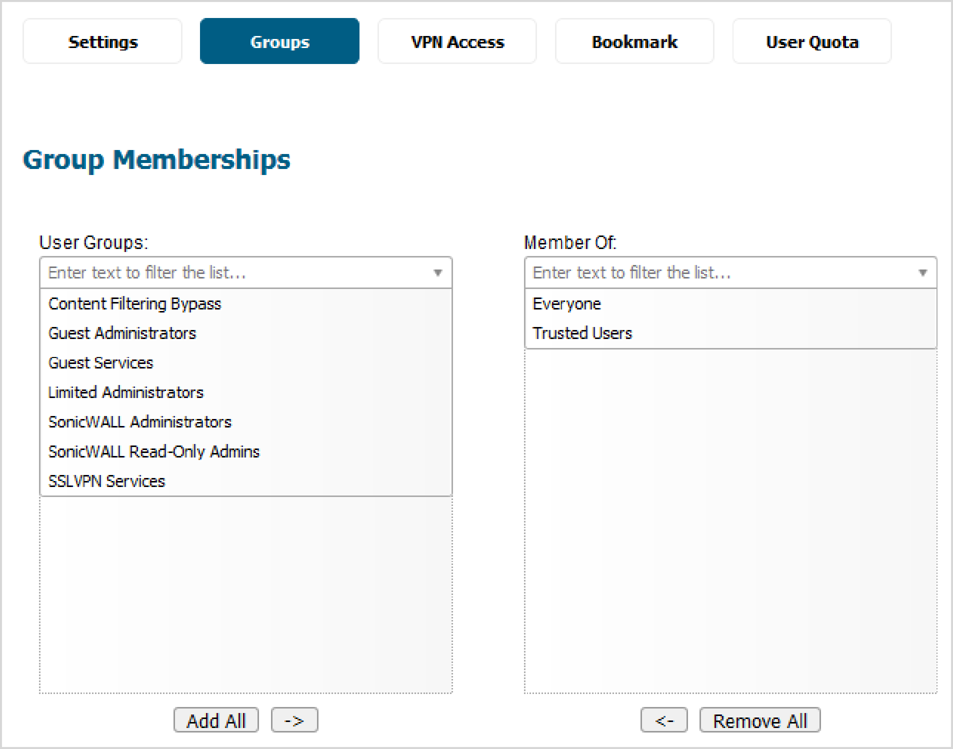
15 To

- Have the user account deleted after the lifetime expires, select **Prune account upon expiration**. This option is selected by default.
- Have the account simply be disabled after the lifetime expires, disable this option. You can then re-enable the account by resetting the account lifetime.

16 Optionally, enter a comment in the **Comment** field.

17 Click **Groups**.

Groups



Group Memberships

User Groups:

Enter text to filter the list...

- Content Filtering Bypass
- Guest Administrators
- Guest Services
- Limited Administrators
- SonicWALL Administrators
- SonicWALL Read-Only Admins
- SSLVPN Services

Member Of:

Enter text to filter the list...

- Everyone
- Trusted Users

1 From **User Groups**:

a Select one or more groups to which the user belongs.

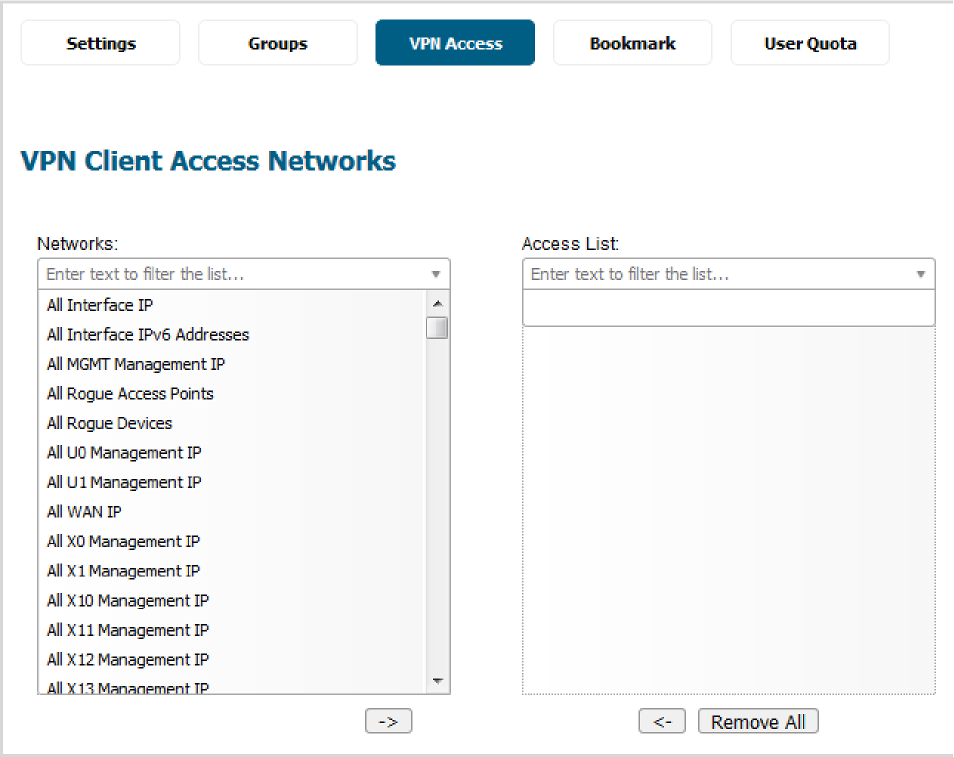
b Either:

- Click the **Right Arrow ->** to move the group name(s) into the **Member of** list. The user is a member of the selected groups.
- Click **Add All**.

> **NOTE:** To remove the user from a group:
> 1 Select the group from the **Member of** list
> 2 Either:
> - Click the **Left Arrow <-**.
> - Click **Remove All**.
>
> **NOTE:** You cannot delete **Everyone** and **Trusted Users** from **Member Of**.

2 To configure which network resources VPN users (either GVC, NetExtender, or Virtual Office bookmarks) can access, click **VPN Access**.

VPN Access



VPN Client Access Networks

Networks:

Enter text to filter the list...

All Interface IP
All Interface IPv6 Addresses
All MGMT Management IP
All Rogue Access Points
All Rogue Devices
All U0 Management IP
All U1 Management IP
All WAN IP
All X0 Management IP
All X1 Management IP
All X10 Management IP
All X11 Management IP
All X12 Management IP
All X13 Management IP

Access List:

Enter text to filter the list...

1 Select one or more networks from **Networks**.

2 Click **Right Arrow** to move them to **Access List**.

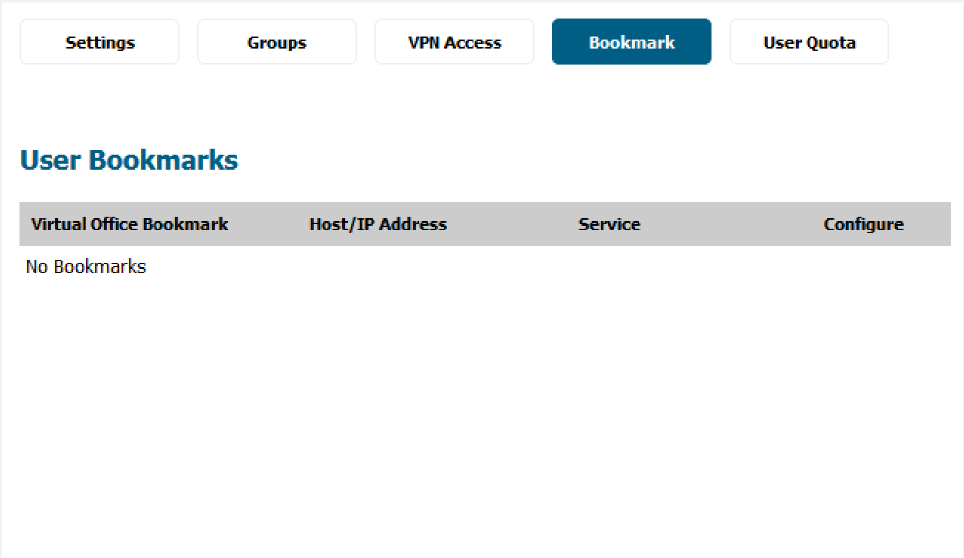
> ⓘ **NOTE:** **VPN Access** affects the ability of remote clients using GVC, NetExtender, and Virtual Office bookmarks to access network resources. To allow these users to access a network resource, the network address objects or groups must be added to the **Access List**.

To remove the user’s access to a network:

- Select the network(s) from the **Access List**, and then click **Left Arrow**.
- Click **Remove All**.

3 To add, edit, or delete Virtual Office bookmarks for each user who is a member of a related group, click **Bookmark**.

Bookmark



User Bookmarks

Virtual Office Bookmark	Host/IP Address	Service	Configure
No Bookmarks			

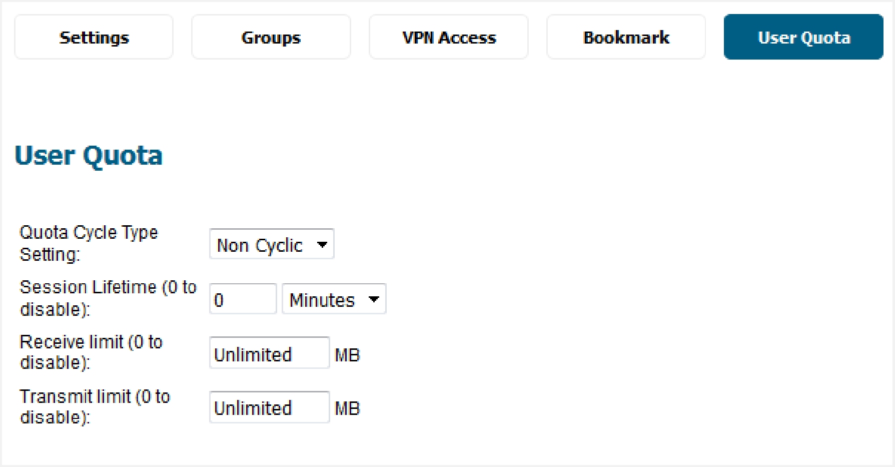
4 To add a bookmark, click **Add Bookmark**. For information on configuring SSL VPN bookmarks, see *SonicOS NSv 6.5 Policies*.

> ⓘ **NOTE:** Users must be members of the SSL VPN Services group before you can configure Bookmarks for them. If the users are not members, you must add them to the SSL VPN Service group and submit the change to enable bookmarks.

5 Click **User Quota**.

User Quota

1 Click **User Quota**.



User Quota

Quota Cycle Type Setting: Non Cyclic

Session Lifetime (0 to disable): 0 Minutes

Receive limit (0 to disable): Unlimited MB

Transmit limit (0 to disable): Unlimited MB

2 Configure the options.

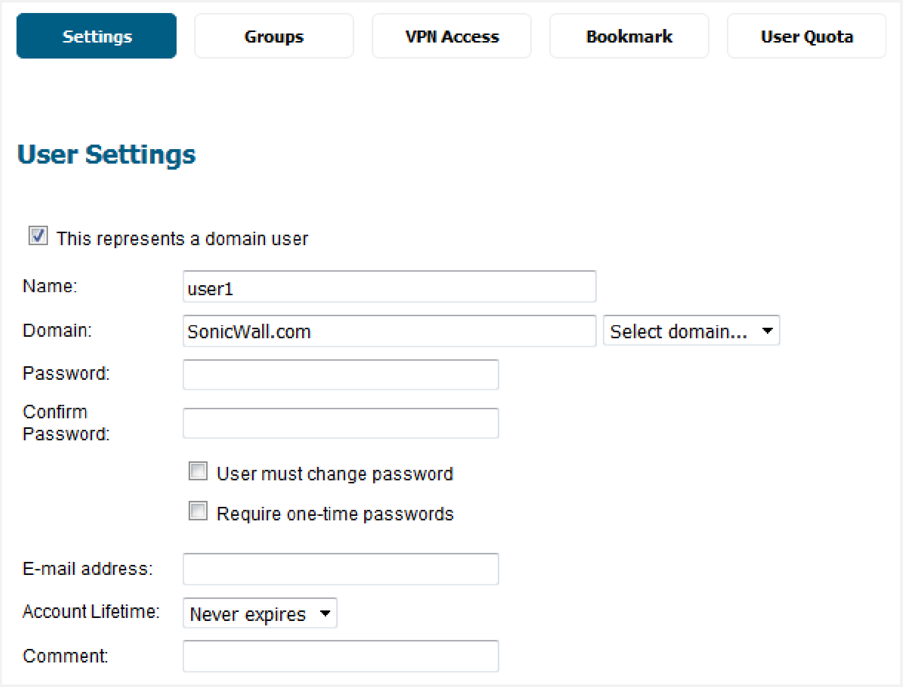
3 Click **OK** to complete the user configuration.

Editing Local Users

You can edit local users from the **Users > Local Users & Groups** page.

To edit a local user:

1 In the **Local Users** table, click the user’s **Edit** icon under **Configure**. The **Edit User** dialog displays.



User Settings

☑ This represents a domain user

Name: user1

Domain: SonicWall.com Select domain...

Password:

Confirm Password:

□ User must change password

□ Require one-time passwords

E-mail address:

Account Lifetime: Never expires

Comment:

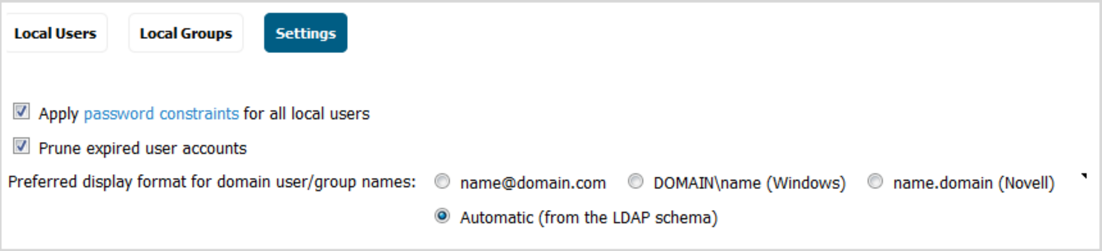
2 Configure the **Settings**, **Groups**, **VPN Access, Bookmark,** and **User Quota** options exactly as when adding a new user. See Adding Local Users on page 207.

Configuring Global Settings

To configure settings for all users:

1 Navigate to **MANAGE | System Setup** > **Users > Local Users & Groups**.

2 Click Settings.



☑ Apply password constraints for all local users

☑ Prune expired user accounts

Preferred display format for domain user/group names: ○ name@domain.com ○ DOMAIN\name (Windows) ○ name.domain (Novell) ● Automatic (from the LDAP schema)

3 Select **Apply password constraints to all local users**. This option is selected by default.

4 Select **Prune expired user accounts**. This option is selected by default.

5 To choose the display format in the management interface, chose a format from **Preferred display format for domain user/group names**:

> ⓘ **TIP:** This option affects only how the names are displayed and not how they are processed by the firewall. For example, choosing Windows format displays `user1@mydomain.com` displays as `MYDOMAIN\user1`, but the user object is processed as `user1@mydomain.com`. Also, the display is affected only for those users and user group objects that have explicit domains; those for which any domain selected is not affected.

- **name@domain.com**
- **DOMAIN\name (Windows)**
- **name.domain (Novell)**
- **Automatic (from the LDAP schema)** (default)

  > ⓘ **NOTE:** If Automatic is chosen, the format is selected based on the schema of the LDAP server. LDAP, therefore, must be enabled; otherwise, the default format of `name@domain.com` is used.
  >
  > If partitioning is enabled, then the display format is chosen based on the LDAP schema for the partition that hosts the domain. This allows for different display formats in partitions that have different domain types.

6 Click **ACCEPT**.

Importing Local Users from LDAP

You can configure local users on the firewall by retrieving the user names from your LDAP server. Having users on the firewall with the same name as existing LDAP/AD users allows SonicWall user privileges to be granted upon successful LDAP authentication.

The list of users read from the LDAP server can be quite long, and you probably only want to import a small number of them. **Remove from list** is provided, along with several methods of selecting unwanted users. You can use these options to reduce the list to a manageable size and then select the users to import. for information about how to import users from an LDAP server, see About Importing and Mirroring from LDAP on page 147.

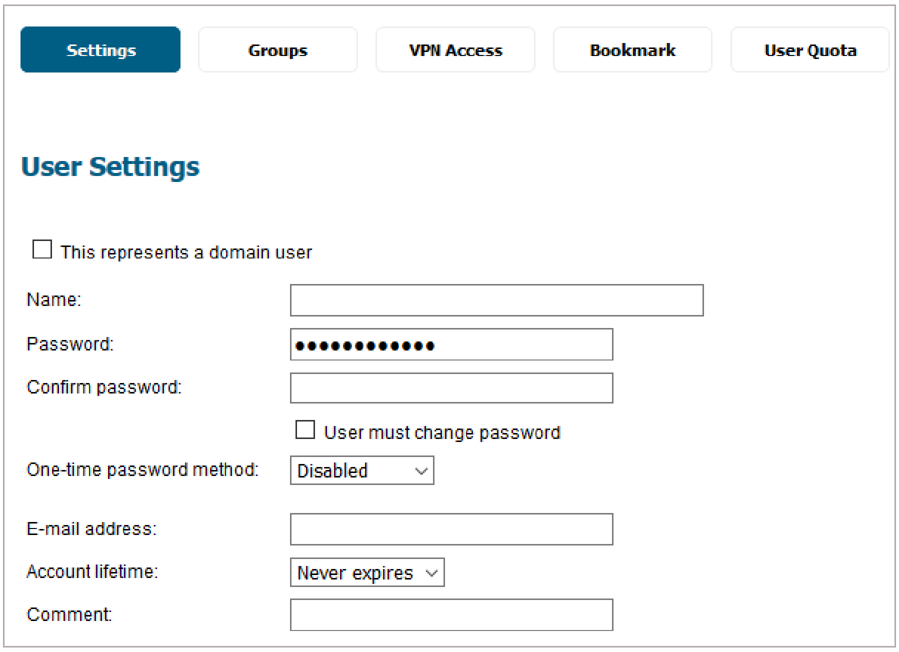
Configuring a Guest Administrator

A Guest Administrator privileges group is available to provide administrator access only to manage guest accounts and sessions.

To configure a Guest Administrator account:

1 Navigate to **MANAGE | System Setup | Users > Local Users & Groups**.

2 Click **Add**. The **Add User** dialog displays.



User Settings

□ This represents a domain user

Name:

Password: ●●●●●●●●●●●●

Confirm password:

□ User must change password

One-time password method: Disabled

E-mail address:

Account lifetime: Never expires

Comment:

3 Give the user a name in the **Name** field.

4 Click **Groups**.

5 Select **Guest Administrators** in the **User Groups** list.

6 Click Right Arrow to move **Guest Administrators** to the **Member Of** list.

7 Click **OK**.

8 Navigate to **MANAGE | System Setup | Network > Interfaces**.

9 Click the **Edit** icon for the LAN interface. The **Edit Interface** dialog displays.

10 To allow the Guest Administrator account to login to the Security Appliance from the LAN, under **User Login** select both **HTTP** and **HTTPS**.

11 Click **OK**.

Logging on as Guest Administrator

To log on as Guest Administrator:

1 Log on to the Security Appliance as the Guest Administrator. The dialog showing access to privileged services displays.

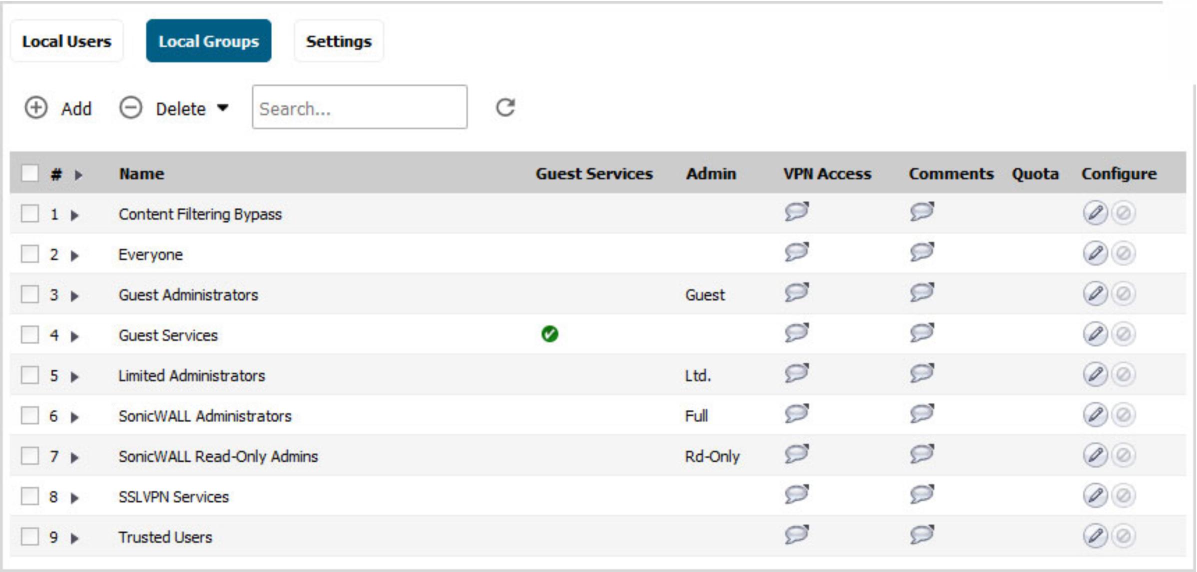
2 Click **MANAGE**.

After logging in, the Guest Administrator can:

- View all the guest accounts and sessions through the **MONITOR | Current Status | User Sessions > Active Guest Users** page.
- Manage the guest users (create, delete, update) on these management interface pages:
  - **MANAGE | System Setup > Users > Guest Accounts**
  - **MANAGE | System Setup > Users > Guest Services**

Configuring Local Groups

Local groups are displayed in the **Local Groups** table. Certain local groups are default groups that can be modified, but not deleted.



Local Users | Local Groups | Settings

⊕ Add ⊖ Delete ▾ Search... ↻

□	#	Name	Guest Services	Admin	VPN Access	Comments	Quota	Configure
□	1 ▸	Content Filtering Bypass			💬	💬		✎ ⊘
□	2 ▸	Everyone			💬	💬		✎ ⊘
□	3 ▸	Guest Administrators		Guest	💬	💬		✎ ⊘
□	4 ▸	Guest Services	✓		💬	💬		✎ ⊘
□	5 ▸	Limited Administrators		Ltd.	💬	💬		✎ ⊘
□	6 ▸	SonicWALL Administrators		Full	💬	💬		✎ ⊘
□	7 ▸	SonicWALL Read-Only Admins		Rd-Only	💬	💬		✎ ⊘
□	8 ▸	SSLVPN Services			💬	💬		✎ ⊘
□	9 ▸	Trusted Users			💬	💬		✎ ⊘

Checkbox Used to select individual local groups. Default local groups cannot be changed, and, therefore, their checkboxes are dimmed.

Expand/Collapse icons By default, only the local group's name is listed.

Name Lists both the default and configured local groups by name.

If the **Enable Multiple Administrator Role** option has been enabled on the **System > Administration** page, the **MANAGE | System Setup | Users > Local Groups** page lists these default role-based administrator groups:

- System Administrators
- Cryptographic Administrators
- Audit Administrators

Guest Services Indicates with a green checkmark icon whether guest services is active for the local group.

Admin Displays the type of administration capabilities available to the local group. Mousing over the icon displays a tooltip regarding the listed capability.

VPN Access Displays a **Comment** icon for each group and each member of the group. Mousing over the icon displays the status of the local group's VPN access and that of each member of the group.

Comments Lists any comment provided for the local group.

Quota Lists any usage quota for the local group.

Configure Displays the **Edit** and **Delete** icons for each local group and group member, and for group members, a **Remove** icon. If an icon is dimmed, that function is not available for that local group or group member.

For information about authentication and two-factor passwords, see About Authentication and Passwords on page 204.

Topics:

- Creating or Editing a Local Group on page 218
- Importing Local Groups from LDAP on page 224

Creating or Editing a Local Group

This section describes how to create a local group, but also applies to editing existing local groups. When adding or editing a local group, you can add other local groups as members of the group.

Topics:

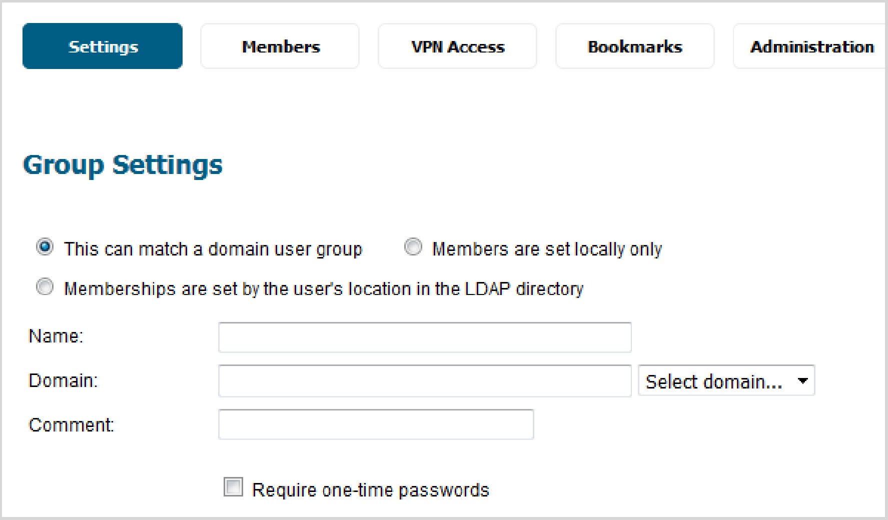
- Adding a Local Group on page 218
- Editing a Local Group on page 224

Adding a Local Group

To add a local group:

1 Navigate to **MANAGE | System Setup | Users > Local Users & Groups**.

2 Click **Add**. The **Add Group** dialog displays.



Group Settings

● This can match a domain user group ○ Members are set locally only

○ Memberships are set by the user's location in the LDAP directory

Name:

Domain: Select domain...

Comment:

□ Require one-time passwords

Topics:

- Settings on page 219
- Members on page 221
- VPN Access on page 222
- Bookmarks on page 223
- Administration on page 223

Settings

1 Choose how to set the ways that users are given membership to this group when they log in or are identified through SSO:

> **NOTE:** Users who are given membership in this user group are given any privileges and access rights that are given to the group.

This can match a domain user group (default)	Any users who are members of a domain user group with the same name as this one are given membership to this group. You can choose to have membership: • Only for members of the domain user group in a specific domain. • For users who are members of the named group in any domain. **NOTE:** The options change when this is selected.
Members are set locally only	Local users are the only users given membership in the group. This option is not selected by default.
Memberships are set by the user's location in the LDAP directory	When users log in or are identified through SSO, if their user object on the LDAP server is at the location specified in **LDAP Location** (or under it if appropriate), they are given membership to this user group for the session. This setting is disabled by default. **NOTE:** There is no corresponding user group on the LDAP server and membership to the group is not related to any memberships set in domain user groups there. **NOTE:** The options change when this is selected.

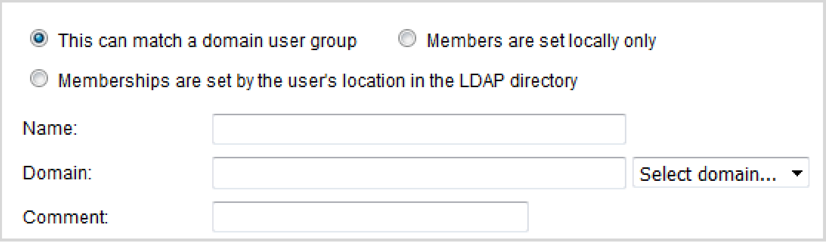
> **NOTE:** In all cases, local users (including those representing domain users) and other user groups also can be made members of the group on the **Members** page of this dialog.

2 Enter a name for the local group in the **Name** field.

> **NOTE:** The name of a predefined user or group cannot be edited and the field is dimmed.

3 If you selected:

- **This can match a domain user group**, the options change. go to Step 4.



● This can match a domain user group ○ Members are set locally only

○ Memberships are set by the user's location in the LDAP directory

Name:

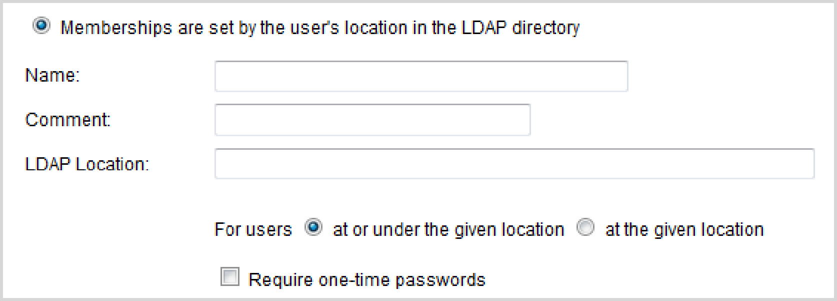
Domain: Select domain...

Comment:

- **Members are set locally only**, go to Step 5.

- **Memberships are set by user’s location in the LDAP directory**, the options change. go to Step 5.

  ⓘ **TIP:** Local users and other groups also can be made members of the group on the **Members** tab.



● Memberships are set by the user's location in the LDAP directory

Name:

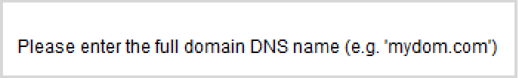
Comment:

LDAP Location:

For users ● at or under the given location ○ at the given location

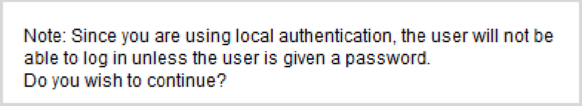
□ Require one-time passwords

4 Enter the domain name in the **Domain** field. You can select the **Domain** dome from the drop-down menu. If you enter a domain name that is not listed, you must enter the full domain name or a message is displayed:



Please enter the full domain DNS name (e.g. 'mydom.com')

If the domain is local, you must enter a password. If you do not, a message displays:



Note: Since you are using local authentication, the user will not be able to log in unless the user is given a password.
Do you wish to continue?

5 Optionally, enter a descriptive comment in the **Comment** field.

6 If you selected either **This can match a domain user group** or **Members are set locally only**, go to Step 9.

7 In the **LDAP Location** field, enter the location in the LDAP directory tree. The location can be given as a path (for example, `domain.com/users`) or as an LDAP distinguished name.

ⓘ **NOTE:** If LDAP user group mirroring is enabled, then for mirror user groups this field is read-only and displays the location in the LDAP directory of the mirrored group.

8 Choose where the location is from the **For Users** options:

- **at or under the given location** (default)
- **at the given location**

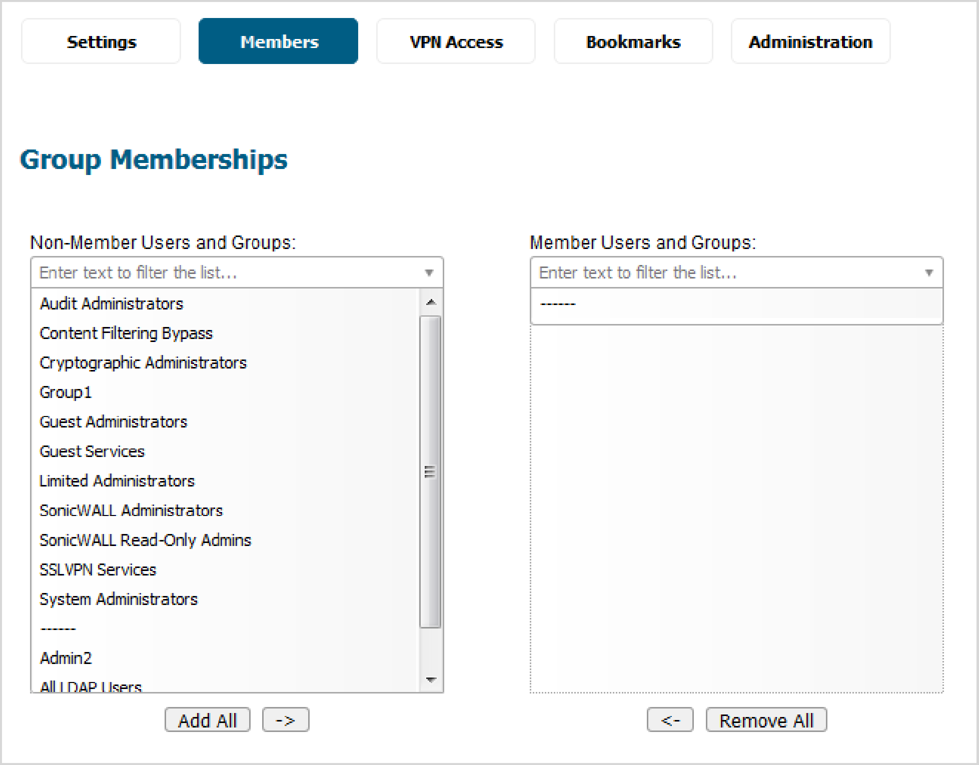
9 Optionally, to require one-time passwords for the group, select the **Require one-time passwords** checkbox. If you enable this setting, users must have their email addresses set.

10 To:

- Finish adding the group, click **OK**.
- Add members, go to Members on page 221.

Members

1 Click **Members**.



Group Memberships

Non-Member Users and Groups:

Enter text to filter the list...

Audit Administrators
Content Filtering Bypass
Cryptographic Administrators
Group1
Guest Administrators
Guest Services
Limited Administrators
SonicWALL Administrators
SonicWALL Read-Only Admins
SSLVPN Services
System Administrators

Admin2
All LDAP Users

Member Users and Groups:

Enter text to filter the list...

------

2 From the **Non-Member Users and Groups** list, select the user(s) and/or group(s) you want to add.

3 To add:

- User(s) and/or group(s) to the **Member Users and Groups** list:

  a) Select the user(s) and/or group(s) from the **Non-Member Users and Groups** list.

  b) Click the **Right Arrow ->**.

- All users and groups, click **Add All**.

ⓘ **NOTE:** You can add any group as a member of another group except **Everybody** and **All LDAP Users**. Be aware of the membership of the groups you add as members of another group.

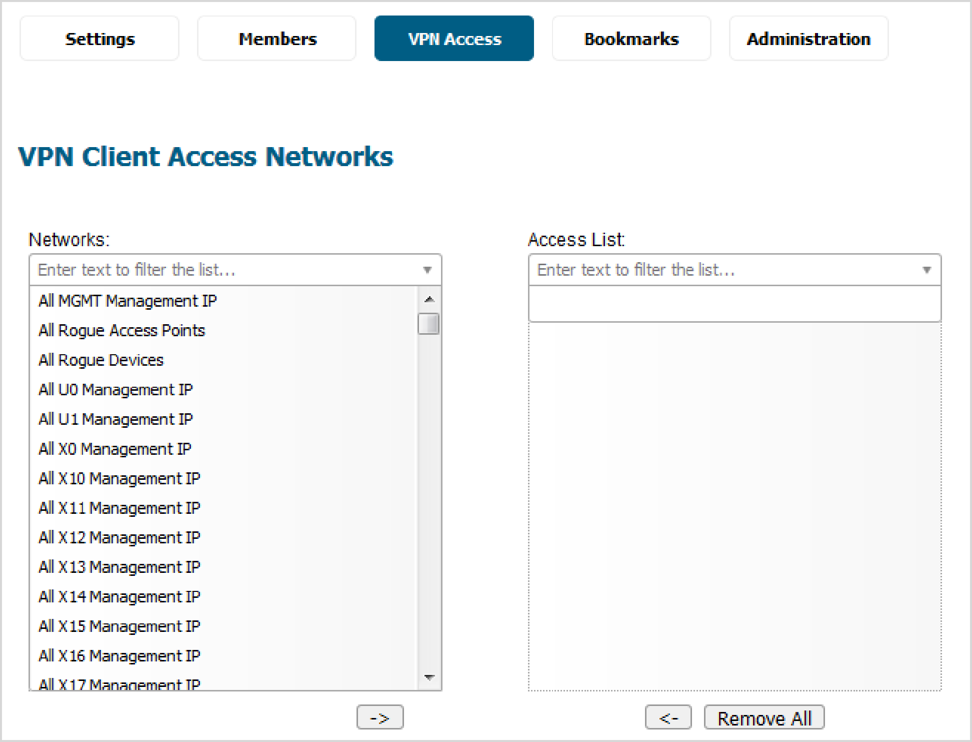
To remove users and/or groups, from the **Member Users and Groups** list, select the user(s) and/or group(s) and click the **Left Arrow <-**. To remove all users and groups, click **Remove All**.

4 To:

- Finish adding the group, click **OK**.
- Specify VPN access, go to VPN Access on page 222.

VPN Access

1 Click **VPN Access**.



VPN Client Access Networks

Networks:

Enter text to filter the list...

All MGMT Management IP
All Rogue Access Points
All Rogue Devices
All U0 Management IP
All U1 Management IP
All X0 Management IP
All X10 Management IP
All X11 Management IP
All X12 Management IP
All X13 Management IP
All X14 Management IP
All X15 Management IP
All X16 Management IP
All X17 Management IP

Access List:

Enter text to filter the list...

2 From the **Networks** list, select the network resource(s) to which this group has VPN Access by default.

> **NOTE:** Group VPN access settings affect remote clients and SSL VPN Virtual Office bookmarks.

3 Click the **Right Arrow ->** to add the resource(s) to **Access List**.

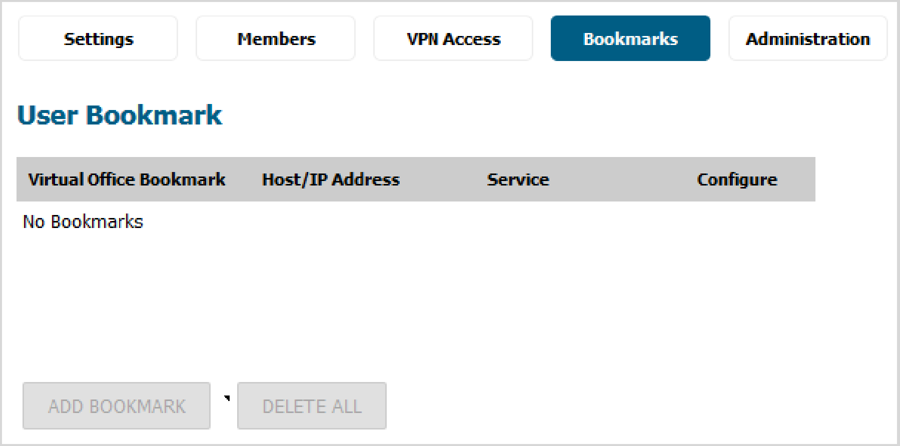
To remove resource(s), from **Access List**, select the resource(s) and click the **Left Arrow <-**. To remove resources, click **Remove All**.

4 To:

- Finish adding the group, click **OK**.
- Specify bookmarks, go to Bookmarks on page 223.

Bookmarks

1 Click **Bookmarks**.



User Bookmark

Virtual Office Bookmark	Host/IP Address	Service	Configure
No Bookmarks			

2 You can add, edit, or delete Virtual Office bookmarks for each user who is a member of a related group. For information on configuring SSL VPN bookmarks, see the *SonicOS NSv 6.5 Connectivity*.

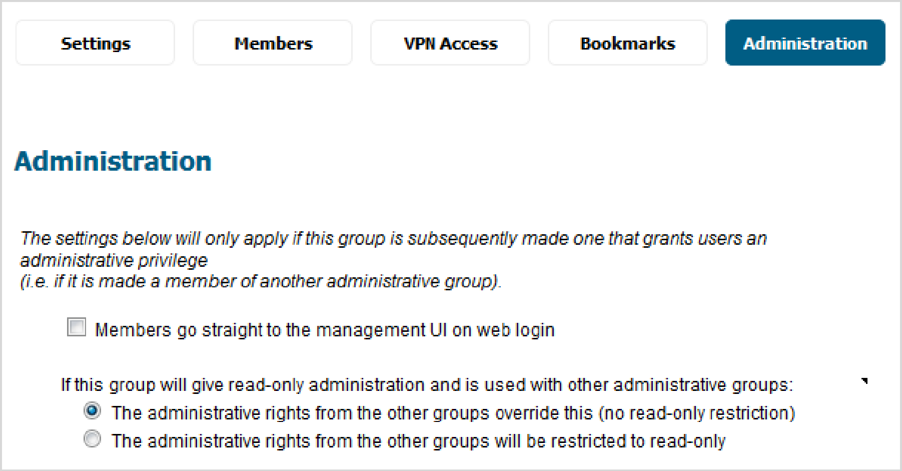
> **NOTE:** Users must be members of the SSLVPN Services group before you can configure Bookmarks for them.

3 To:

- Finish adding the group, click **OK**.
- Specify whether the group has administration privileges, go to Administration on page 223.

Administration

1 Click **Administration**.



Administration

The settings below will only apply if this group is subsequently made one that grants users an administrative privilege
(i.e. if it is made a member of another administrative group).

□ Members go straight to the management UI on web login

If this group will give read-only administration and is used with other administrative groups:

● The administrative rights from the other groups override this (no read-only restriction)

○ The administrative rights from the other groups will be restricted to read-only

2 If the new group is to be made an administrative group by giving it membership in another administrative group, select **Members go straight to the management UI on web login**. This option is not selected by default.

3 The **If this read-only admin group is used with other administrative groups** options control what happens when users start with membership in a user group that gives read-only administration (that is, the SonicWall Read-Only Admins group or one with membership in it) and then are added to other administrative user groups. To give the user the:

- Admin rights set by their other administrative groups with no read-only restriction, choose **The administrative rights from the other groups override this (no read-only restriction)**. This setting allows the read-only admin group to be the default for a set of users, but then overrides the default for selected users by making them members of other administrative groups so they can do configuration. This option is selected by default. In the **Local Users** table, the **Admin** column for the user displays the other group's designation, such as *Ltd* or *"Full."*
- To give member users the administration level set by their other groups, but restrict them to read only access, select **The administrative rights from the other groups will be restricted to read-only**. In the **Local Users** table, the **Admin** column for the user displays the dual designation, such as *Rd-Only Ltd*.

  ⓘ **TIP:** To do a mix of both, select the first option for SonicWall Read-Only Admins, and then create another group that is a member of this group, but that has the second option selected (but not *vice versa*).

  ⓘ **NOTE:** If a user is a member of a read-only admin group and has membership in no other administrative groups, then that member gets full level access (as per SonicWall Administrators) restricted to read-only.

4 Click **OK** to complete the configuration.

Editing a Local Group

To edit a local group:

1 Click the **Edit** icon of the group that you want to edit. The Edit Group dialog displays, and is the same as the Add Group

2 Follow the steps in Adding a Local Group on page 218.

Importing Local Groups from LDAP

Having user groups in SonicOS NS*v* with the same name as existing LDAP/AD user groups allows SonicWall group memberships and privileges to be granted upon successful LDAP authentication. You can configure local user groups in SonicOS NS*v* by retrieving the user group names from your LDAP server. For further information about importing local groups, see Users & Groups Page on page 142.

Setting User Membership by LDAP Location

You can set LDAP rules and policies for users located in certain Organizational Units (OUs) on the LDAP server. For more information about the LDAP Group Membership by Organizational Unit feature, see LDAP Group Membership by Organizational Unit on page 80. For the full procedure for creating new members, see Creating a New User Group for RADIUS Users on page 132.

11

Managing Guest Services

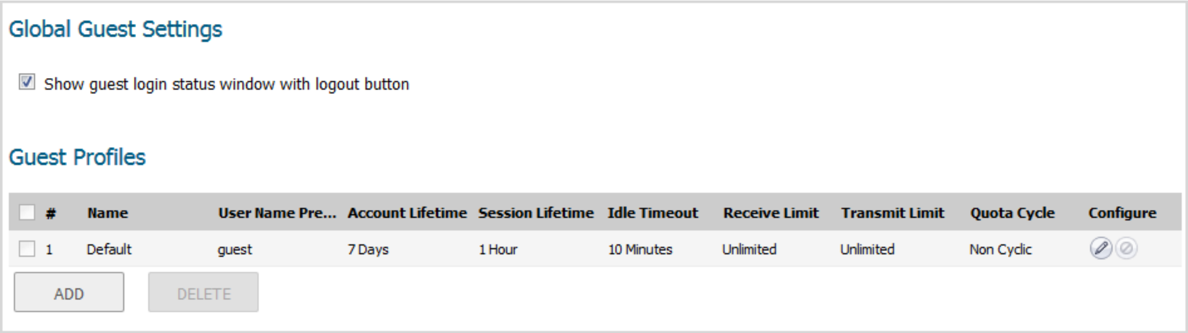
Topics:

- **Users > Guest Services** on page 225
  - Global Guest Settings on page 226
  - Guest Profiles on page 226

Users > Guest Services

Guest accounts are temporary accounts set up for users to log into your network. You can create these accounts manually, as needed or generate them in batches. SonicOS NS*v* includes profiles you can configure in advance to automate configuring guest accounts when you generate them. Guest accounts are typically limited to a pre-determined life-span. After their life span, by default, the accounts are removed.

Guest Services determine the limits and configuration of the guest accounts. **MANAGE | System Setup > Users > Guest Services** page displays a list of Guest Profiles. Guest profiles determine the configuration of guest accounts when they are generated. In **MANAGE | System Setup | Users > Guest Services**, you can add, delete, and configure Guest Profiles. In addition, you can determine if all users who log in to the Security Appliance see a user login window that displays the amount of time remaining in their current login session.



Global Guest Settings

☑ Show guest login status window with logout button

Guest Profiles

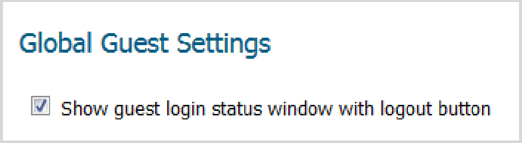
□	#	Name	User Name Pre...	Account Lifetime	Session Lifetime	Idle Timeout	Receive Limit	Transmit Limit	Quota Cycle	Configure
□	1	Default	guest	7 Days	1 Hour	10 Minutes	Unlimited	Unlimited	Non Cyclic	✎ ⊘

Topics:

- Global Guest Settings on page 226
- Guest Profiles on page 226

Global Guest Settings

The Global Guest Settings section provides an option for displaying the guest login status window. The window displays the time remaining in their current session. Users must keep this window open during their login session and can log out by clicking **Logout** in the login status window.



Global Guest Settings

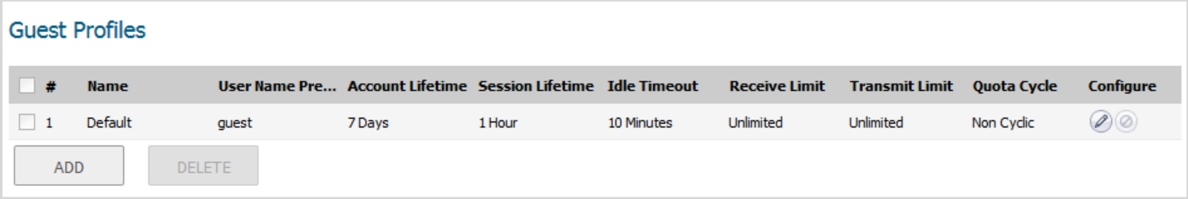
☑ Show guest login status window with logout button

To configure the guest login status window:

1. Select **Show guest login status window with logout** to display **Logout** on the user's login window whenever the user is logged in. This option is selected by default.
2. Click **ACCEPT**.

Guest Profiles

The **Guest Profiles** table lists the profiles you have created and enables you to add, edit, and delete these profiles. There is always one guest profile, **Default**, which is generated by SonicOS NS*v* and cannot be deleted, although you can edit it.



Guest Profiles

□	#	Name	User Name Pre...	Account Lifetime	Session Lifetime	Idle Timeout	Receive Limit	Transmit Limit	Quota Cycle	Configure
□	1	Default	guest	7 Days	1 Hour	10 Minutes	Unlimited	Unlimited	Non Cyclic	✎ ⊘

Topics:

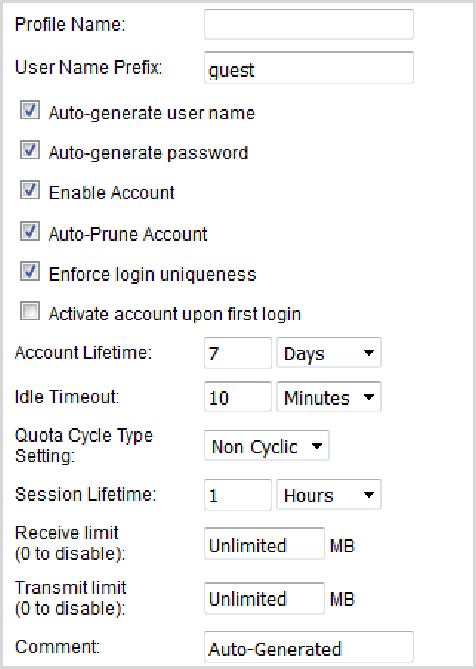
- Adding a Guest Profile on page 226
- Editing Guest Profiles on page 228
- Deleting Guest Profiles on page 228

Adding a Guest Profile

To add a profile:

1. Navigate to **MANAGE | System Setup > Users > Guest Services**.

2 Click **ADD** below the **Guest Profile** table. The **Add Guest Profile** dialog displays.



Profile Name:	
User Name Prefix:	guest
☑ Auto-generate user name	
☑ Auto-generate password	
☑ Enable Account	
☑ Auto-Prune Account	
☑ Enforce login uniqueness	
□ Activate account upon first login	
Account Lifetime:	7 Days ▾
Idle Timeout:	10 Minutes ▾
Quota Cycle Type Setting:	Non Cyclic ▾
Session Lifetime:	1 Hours ▾
Receive limit (0 to disable):	Unlimited MB
Transmit limit (0 to disable):	Unlimited MB
Comment:	Auto-Generated

3 In the **Profile Name** field, enter the name of the profile.

4 In the **User Name Prefix** field, enter the first part of every user account name generated from this profile. To allow guest accounts generated from this profile to have an automatically generated user name, select **Auto-generate user name**. The user name is usually the prefix plus a two- or three-digit number. This option is selected by default.

5 To allow guest accounts generated from this profile to have an automatically generated password, select **Auto-generate password**. The generated password is an eight-character, unique alphabetic string. This option is selected by default.

6 For all guest accounts generated from this profile to be enabled upon creation, select **Enable Account**. This option is selected by default.

7 To have the account removed from the database after its lifetime expires, select **Auto-Prune Account**. This option is selected by default.

8 To allow only a single instance of an account to be used at any one time, select **Enforce login uniqueness**. By default, this feature is enabled when creating a new guest account. If you want to allow multiple users to login with a single account, disable this enforcement by clearing **Enforce login uniqueness**.

9 To delay the Account Expiration timer until a user logs into the account for the first time, select **Activate Account Upon First Login**. This option is not selected by default.

10 To define how long an account remains on the Security Appliance before the account expires, enter the duration in **Account Lifetime**. You can specify from 1 to 9999 in the **Account Lifetime** field and select the type of duration from the drop-down menu:

- **Minutes**
- **Hours**
- **Days**

The default is **7 Days**.

11 To define the maximum period of time when no traffic is passed on an activated guest services session, enter the time-out duration in **Idle Timeout**:. Exceeding the period defined by this setting expires the

session, but the account itself remains active as long as the **Account Lifetime** hasn't expired. The **Idle Timeout** cannot exceed the value set in the **Session Lifetime**.

You can specify from 1 to 9999 in the **Account Lifetime** field and select the type of duration from the drop-down menu:

- **Minutes**
- **Hours**
- **Days**

The default is **10 Minutes**.

12 To specify the quota cycle type, select from the **Quota Cycle Type Setting** drop-down menu:

- **Non Cyclic** (default)
- **Per Day**
- **Per Week**
- **Per Month**

13 To define how long a guest login session remains active after it has been activated, specify the duration in **Session Lifetime**. By default, activation occurs the first time a guest user logs into an account. The **Session Lifetime** cannot exceed the value set in the **Account Lifetime**.

You can specify from 1 to 9999 in the **Session Lifetime** field and select the type of duration from the drop-down menu:

- **Minutes**
- **Hours**
- **Days**

The default is **1 Hours**.

14 To limit the amount of data the user can receive, enter the amount, in MB, in **Receive limit (0 to disable)** field. The range is from 0 (no data can be received) to 999999999 MB to **Unlimited** (default).

15 To limit the amount of data the user can send, enter the amount, in MB, in **Transmit limit (0 to disable)** field. The range is from 0 (no data can be received) to 999999999 MB to **Unlimited** (default).

16 Optionally, enter a descriptive comment in the **Comment** field. The default is **Auto-Generated**.

17 Click **OK**.

Editing Guest Profiles

To edit guest profiles:

1 Click the **Edit** icon in the **Configure** column for the profile.

2 Follow the steps in Adding a Guest Profile on page 226.

> ⓘ **NOTE:** When editing the **Default** profile, you can edit all options except **Profile Name** and **User Name Prefix**; these options are dimmed.

Deleting Guest Profiles

You can delete all guest profiles except the **Default** profile.

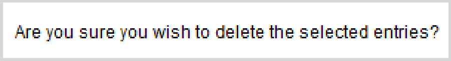
To delete guest profiles:

1 Select either:

   - The checkbox(es) of the guest profile(s) to be deleted.
   - The checkbox in the **Guest Profiles** table. All checkboxes (except for the **Default** profile) become selected.

   DELETE becomes active.

2 Click **DELETE**. A confirmation message displays:



Are you sure you wish to delete the selected entries?

3 Click **OK**.

12

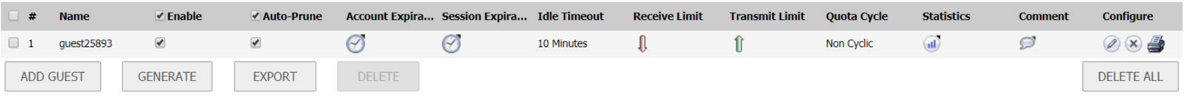
Managing Guest Accounts

Topics:

- **Users > Guest Accounts** on page 230
  - Viewing Guest Account Statistics on page 230
  - Adding Guest Accounts on page 232
  - Enabling Guest Accounts on page 238
  - Enabling Auto-Prune for Guest Accounts on page 238
  - Printing Account Details on page 239

Users > Guest Accounts

MANAGE | System Setup | Users > Guest Accounts lists the guest services accounts on the SonicWall Security Appliance. You can enable or disable individual accounts, groups of accounts, or all accounts, you can set the Auto-Prune feature for accounts, set an Account or Session Expiration date or time, and you can add, edit, delete, and print accounts.



□	#	Name	☑ Enable	☑ Auto-Prune	Account Expira...	Session Expira...	Idle Timeout	Receive Limit	Transmit Limit	Quota Cycle	Statistics	Comment	Configure
□	1	guest25893	☑	☑	⏲	⏲	10 Minutes	⇩	⇧	Non Cyclic	📊	💬	✎ ⊗ 🖶

Topics:

- Viewing Guest Account Statistics on page 230
- Adding Guest Accounts on page 232
- Enabling Guest Accounts on page 238
- Enabling Auto-Prune for Guest Accounts on page 238
- Printing Account Details on page 239

Viewing Guest Account Statistics

The **Guest Account** table displays statistics about the guest accounts.

Topics:

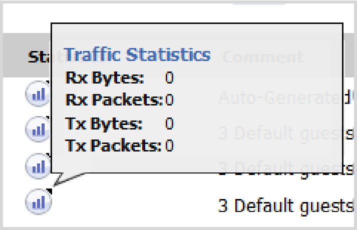
- Viewing Traffic Statistics on page 231
- Viewing Account Expiration on page 231
- Viewing Session Expiration on page 231

- Viewing Receive and Transmit Limit Statistics on page 232
- Exporting Guest Accounts on page 232

Viewing Traffic Statistics

To view traffic statistics on a guest account:

1 Hover your mouse over the **Statistics** icon in the **Statistics** column for the guest account. The **Traffic Statistics** popup displays the cumulative total bytes and packets sent and received for all completed sessions. Currently active sessions are not added to the statistics until the guest user logs out.

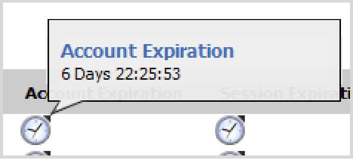


Traffic Statistics
Rx Bytes: 0
Rx Packets: 0
Tx Bytes: 0
Tx Packets: 0

Viewing Account Expiration

To view the time remaining until the account expires:

1 Hover your mouse over the **Clock** icon in the **Account Expiration** column for the guest account. The **Account Expiration** popup displays the remaining time for the guest account.

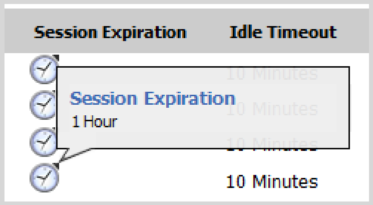


Account Expiration
6 Days 22:25:53

Viewing Session Expiration

To view the time remaining until the session expires:

1 Hover your mouse over the **Clock** icon in the **Account Expiration** column for the guest account. The **Account Expiration** popup displays the remaining time for the guest account.



Session Expiration	Idle Timeout
	10 Minutes
	10 Minutes
	10 Minutes
	10 Minutes

Session Expiration
1 Hour

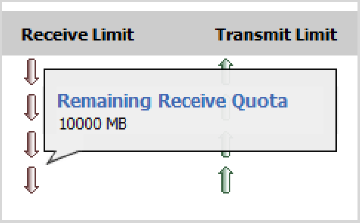
ⓘ **NOTE:** If the user’s session has not started, the **Session Expiration** popup reads `Unused`.

Viewing Receive and Transmit Limit Statistics

For each user account in the table, the **Receive Limit** column contains a red down arrow icon, and the **Transmit Limit** column contains a green up arrow icon.

To view the receive/transmit limit statistics:

1. Hover your mouse over the **Arrow** icon in the **Receive Limit/Transmit Limit** column for the guest account. The **Remaining Receive/Transmit Quota** popup displays the remaining amount of data the guest user can download or send.

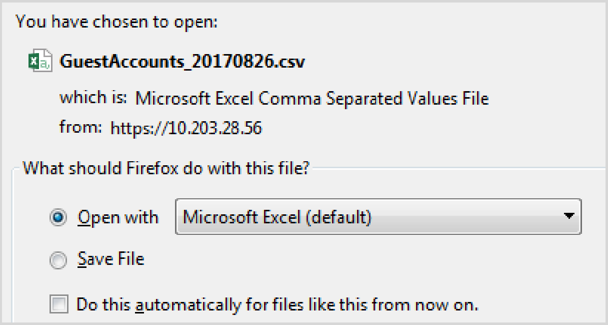


Exporting Guest Accounts

You can export the **Guest Accounts** table as a `.CSV` file. This file contains not only all the displayed data, but the limit and remaining receive and transmitted data statistics.

To export the guest accounts as a .CSV file:

1. Under the **Guest Accounts** table, click **Export**. The **Opening *guestaccounts_nnn*.csv** dialog displays.



You have chosen to open:

GuestAccounts_20170826.csv

which is: Microsoft Excel Comma Separated Values File

from: https://10.203.28.56

What should Firefox do with this file?

● Open with Microsoft Excel (default)

○ Save File

□ Do this automatically for files like this from now on.

2. You can:
   - Open the file to view it.
   - Save the file for later.
3. Click **OK**.

Adding Guest Accounts

You can add guest accounts individually or generate multiple guest accounts automatically.

Topics:

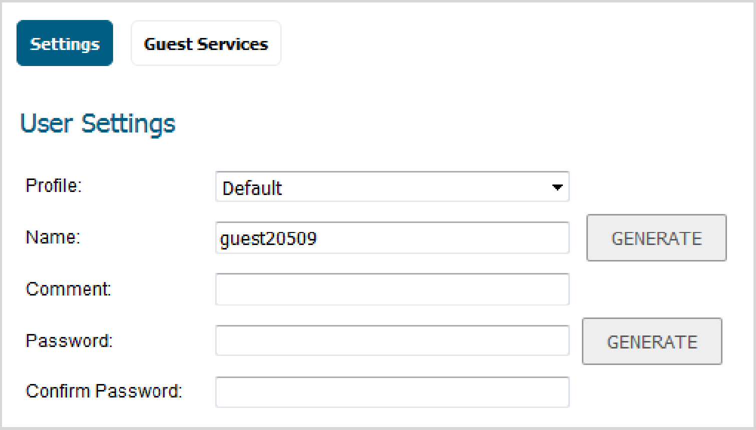
- Adding a Guest Account on page 233
- Generating Multiple Guest Accounts on page 235

Adding a Guest Account

To add an individual account:

1 Navigate to **MANAGE | System Setup | Users > Guest Accounts**.

2 Under the **Guest Accounts** table, click **Add Guest**. The **Add Guest** dialog displays.



User Settings

Profile: Default

Name: guest20509

Comment:

Password:

Confirm Password:

3 From **Profile**, select the Guest Profile from which to generate this account. The default profile is **Default**.

4 Name the guest account by either:

- Entering a name for the account in the **Name** field.
- Clicking **Generate** to have SonicOS NS*v* generate the name. The generated name is the first name of the profile, the word guest, and a random two- to five-digit number. For example:
  - guest1235 (for the Default profile)
  - TechPubs guest51026 (for the TechPubs Guest profile)

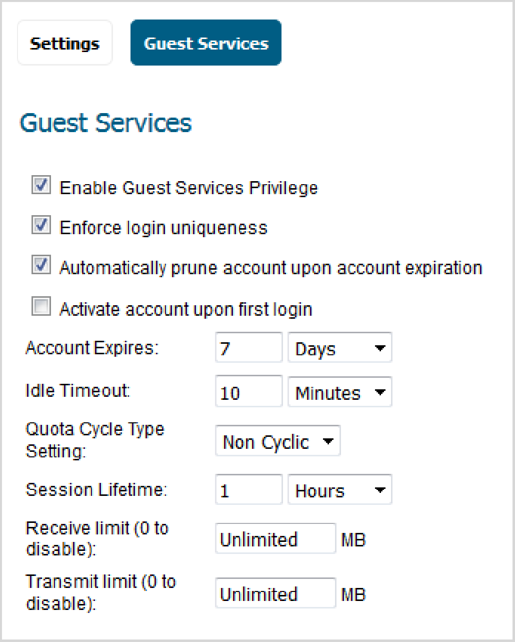
5 Enter a descriptive comment in the **Comment** field. The default comment is **Auto-Generated**.

6 Create a user account password by either:

- Entering the password in the **Password** field and the Confirm field. The password can be up to 32 alphanumeric characters.
- Clicking **Generate**. The generated password is a random string of eight alphabetic characters.

  ⓘ **TIP:** Make a note of the password. Otherwise, you have to reset it.

7 Click **Guest Services**.



Guest Services

☑ Enable Guest Services Privilege

☑ Enforce login uniqueness

☑ Automatically prune account upon account expiration

□ Activate account upon first login

Account Expires:	7 Days
Idle Timeout:	10 Minutes
Quota Cycle Type Setting:	Non Cyclic
Session Lifetime:	1 Hours
Receive limit (0 to disable):	Unlimited MB
Transmit limit (0 to disable):	Unlimited MB

8 For the account to be enabled upon creation, select **Enable Guest Services Privilege**. This option is selected by default.

9 To allow only one instance of this account to log into the Security Appliance at one time, select **Enforce login uniqueness**. Clear it to allow multiple users to use this account simultaneously. This option is selected by default.

10 To have the account removed from the database after its lifetime expires, select **Automatically prune account upon account expiration**. This option is selected by default.

11 To begin the timing for the account expiration, select **Activate account upon first login**.

12 To define how long an account remains on the Security Appliance before the account expires, enter the expiration date in **Account Expires**. You can specify from 1 to 9999 in the **Account Expires** field and select the type of duration from the drop-down menu:

- **Minutes**
- **Hours**
- **Days**

The default is **7 Days**.

If **Automatically prune account upon account expiration** is:

- Enabled, the account is deleted when it expires.
- Disabled, the account remains in the **Guest Accounts** table with an **Expired** status to allow easy reactivation.

  ⓘ **NOTE:** This setting overrides the account lifetime set in Guest Profiles on page 226.

13 To define the maximum period of time when no traffic is passed on an activated guest services session, enter the timeout duration in **Idle Timeout**:. Exceeding the period defined by this setting expires the session, but the account itself remains active as long as the **Account Lifetime** hasn't expired. The **Idle Timeout** cannot exceed the value set in the **Session Lifetime**.

ⓘ **NOTE:** This setting overrides the idle timeout setting in the profile.

You can specify from 1 to 9999 in the **Account Lifetime** field and select the type of duration from the drop-down menu:

- **Minutes**
- **Hours**
- **Days**

The default is **10 Minutes**.

14 To specify the quota cycle type, select from the **Quota Cycle Type Setting** drop-down menu:

- **Non Cyclic** (default)
- **Per Day**
- **Per Week**
- **Per Month**

15 To define how long a guest login session remains active after it has been activated, specify the duration in **Session Lifetime**. By default, activation occurs the first time a guest user logs into an account. The **Session Lifetime** cannot exceed the value set in the **Account Lifetime**.

ⓘ | **NOTE:** This setting overrides the session lifetime setting in the profile.

You can specify from 1 to 9999 in the **Session Lifetime** field and select the type of duration from the drop-down menu:

- **Minutes**
- **Hours**
- **Days**

The default is **1 Hours**.

16 **Receive limit (0 to disabled)**: Enter the number of megabytes the user is allowed to receive. The minimum number is 0, which disables the limit; the maximum is **Unlimited**, the default.

17 **Transmit limit (0 to disabled)**: Enter the number of megabytes the user is allowed to transmit. The minimum number is 0, which disables the limit; the maximum is **Unlimited**, the default.

18 To limit the amount of data the user can receive, enter the amount, in MB, in **Receive limit (0 to disable)** field. The range is from 0 (no data can be received) to 999999999 MB to **Unlimited** (default).

19 To limit the amount of data the user can send, enter the amount, in MB, in **Transmit limit (0 to disable)** field. The range is from 0 (no data can be received) to 999999999 MB to **Unlimited** (default).

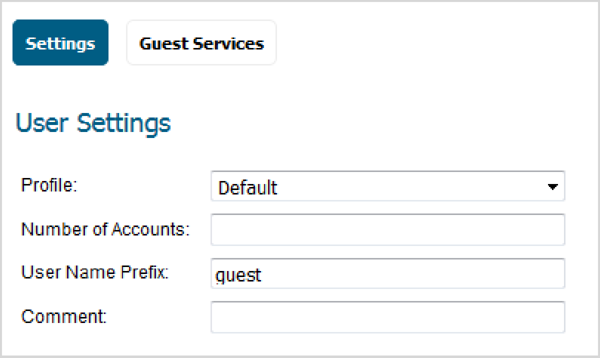
20 Click **OK** to generate the account.

Generating Multiple Guest Accounts

To generate multiple accounts:

1 Navigate to **MANAGE | System Setup | Users > Guest Accounts**.

2 Under the **Guest Accounts** table, click **Generate**. The **Generate Guest Accounts** dialog displays.



User Settings

Profile: Default

Number of Accounts:

User Name Prefix: guest

Comment:

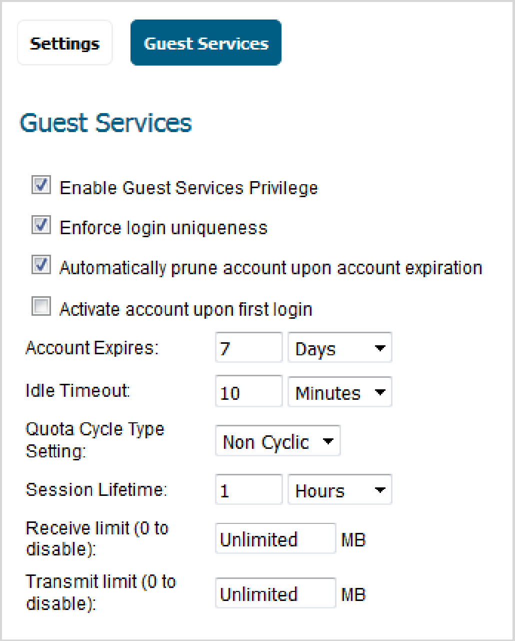
3 From **Profile**, select the Guest Profile from which to generate the accounts from. The default is **Default**.

4 Enter the number of accounts to generate in the **Number of Accounts** field. You can create from 1 to 6000 accounts

5 Enter the prefix from which account names are generated in the **User Name Prefix** field. For example, if you enter **Guest**, the generated accounts have names like `Guest123` and `Guest234`. The default prefix is **guest**.

6 Enter a descriptive comment of up to 16 alphanumeric characters in the **Comment** field.

7 Click **Guest Services**.



Guest Services

☑ Enable Guest Services Privilege

☑ Enforce login uniqueness

☑ Automatically prune account upon account expiration

☐ Activate account upon first login

Account Expires: 7 Days

Idle Timeout: 10 Minutes

Quota Cycle Type Setting: Non Cyclic

Session Lifetime: 1 Hours

Receive limit (0 to disable): Unlimited MB

Transmit limit (0 to disable): Unlimited MB

8 For the account to be enabled upon creation, select **Enable Guest Services Privilege**. This option is selected by default.

9 To allow only one instance of this account to log into the Security Appliance at one time, select **Enforce login uniqueness**. Clear it to allow multiple users to use this account simultaneously. This option is selected by default.

10 To have the account removed from the database after its lifetime expires, select **Automatically prune account upon account expiration**. This option is selected by default.

ⓘ **NOTE:** This setting overrides the Auto-Prune setting in the guest profile, if they differ.

11 To begin the timing for the account expiration, select **Activate account upon first login**.

12 To define how long an account remains on the Security Appliance before the account expires, enter the expiration date in **Account Expires**. You can specify from 1 to 9999 in the **Account Expires** field and select the type of duration from the drop-down menu:

- **Minutes**
- **Hours**
- **Days**

The default is **7 Days**.

If **Automatically prune account upon account expiration** is:

- Enabled, the account is deleted when it expires.
- Disabled, the account remains in the **Guest Accounts** table with an **Expired** status to allow easy reactivation.

ⓘ **NOTE:** This setting overrides the account lifetime set in Guest Profiles on page 226.

13 To define the maximum period of time when no traffic is passed on an activated guest services session, enter the timeout duration in **Idle Timeout**:. Exceeding the period defined by this setting expires the session, but the account itself remains active as long as the **Account Lifetime** has not expired. The **Idle Timeout** cannot exceed the value set in the **Session Lifetime**.

ⓘ **NOTE:** This setting overrides the idle timeout setting in the profile.

You can specify from 1 to 9999 in the **Account Lifetime** field and select the type of duration from the drop-down menu:

- **Minutes**
- **Hours**
- **Days**

The default is **10 Minutes**.

14 To specify the quota cycle type, select from the **Quota Cycle Type Setting** drop-down menu:

- **Non Cyclic** (default)
- **Per Day**
- **Per Week**
- **Per Month**

15 To define how long a guest login session remains active after it has been activated, specify the duration in **Session Lifetime**. By default, activation occurs the first time a guest user logs into an account. The **Session Lifetime** cannot exceed the value set in the **Account Lifetime**.

ⓘ **NOTE:** This setting overrides the session lifetime setting in the profile.

You can specify from 1 to 9999 in the **Session Lifetime** field and select the type of duration from the drop-down menu:

- **Minutes**
- **Hours**
- **Days**

The default is **1 Hours**.

16 **Receive limit (0 to disabled)**: Enter the number of megabytes the user is allowed to receive. The minimum number is 0, which disables the limit; the maximum is **Unlimited**, the default.

17 **Transmit limit (0 to disabled)**: Enter the number of megabytes the user is allowed to transmit. The minimum number is 0, which disables the limit; the maximum is **Unlimited**, the default.

18 To limit the amount of data the user can receive, enter the amount, in MB, in **Receive limit (0 to disable)** field. The range is from 0 (no data can be received) to 999999999 MB to **Unlimited** (default).

19 To limit the amount of data the user can send, enter the amount, in MB, in **Transmit limit (0 to disable)** field. The range is from 0 (no data can be received) to 999999999 MB to **Unlimited** (default).

20 Click **OK** to generate the accounts.

Enabling Guest Accounts

You can enable or disable any number of accounts at one time.

To enable one or more guest accounts:

1 Select the checkbox(es) in the **Enable** column next to the name(s) of the account(s) you want to enable. To enable all accounts, select the **Enable** checkbox in the table heading.

2 Click **Accept**.

Enabling Auto-Prune for Guest Accounts

You can enable or disable auto-prune for any number of accounts at one time. When auto-prune is enabled, the account is deleted after it expires.

ⓘ **NOTE:** This overrides the Auto-Prune option set when configuring the user profile or the guest account.

To enable auto-prune:

1 Select the checkbox(es) in the **Auto-Prune** column next to the name(s) of the account(s). To enable it on all accounts, select the **Auto-Prune** checkbox in the table heading.

2 Click **Accept**.

Editing Guest Accounts

To edit guest accounts:

1 Click the **Edit** icon in the **Configure** column for the profile.

2 Follow the steps in Adding a Guest Profile on page 226.

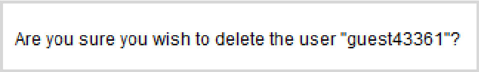
ⓘ **NOTE:** When editing the **Default** profile, you can edit all options except **Profile Name** and **User Name Prefix**; these options are dimmed.

Deleting Guest Accounts

You can delete all guest profiles except the **Default** profile.

To delete a guest account

1 Click the **Delete** icon for the guest account. A confirmation message displays:



Are you sure you wish to delete the user "guest43361"?

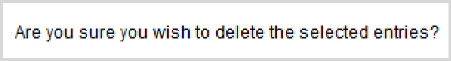
2 Click **OK**.

To delete one or more guest accounts:

1 Navigate to **MANAGE | System Setup | Users > Local Users & Groups**.

2 Select the checkbox(es) of the guest profile(s) to be deleted. **Delete** becomes active.

3 Click **DELETE**. A confirmation message displays:



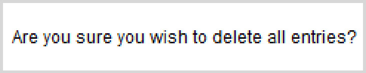
Are you sure you wish to delete the selected entries?

4 Click **OK**.

To delete all guest accounts:

1 Select the checkbox in header of the **Guest Accounts** table. All checkboxes (except for the **Default** profile) become selected. **DELETE ALL** becomes available.

2 Click **DELETE ALL**. A confirmation message displays:



Are you sure you wish to delete all entries?

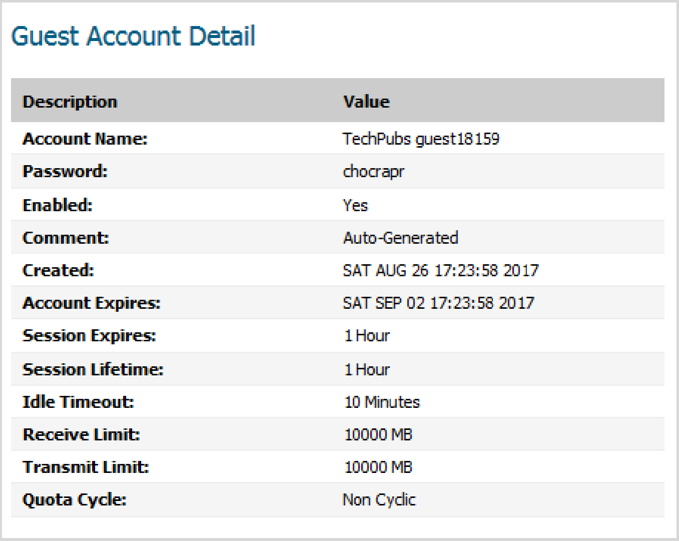
3 Click **OK**.

Printing Account Details

You can print a summary of a guest account.

To print details of a guest account.

1 Click the **Print** icon to display a summary account report and a **Print** dialog.



Guest Account Detail

Description	Value
Account Name:	TechPubs guest18159
Password:	chocrapr
Enabled:	Yes
Comment:	Auto-Generated
Created:	SAT AUG 26 17:23:58 2017
Account Expires:	SAT SEP 02 17:23:58 2017
Session Expires:	1 Hour
Session Lifetime:	1 Hour
Idle Timeout:	10 Minutes
Receive Limit:	10000 MB
Transmit Limit:	10000 MB
Quota Cycle:	Non Cyclic

2 Click **OK** to send the summary to a printer.

Part 4

SYSTEM SETUP | Network

13

Configuring Interfaces

Topics:

About Interfaces

Physical and Virtual Interfaces

Interfaces in SonicOS NS*v* can be:

- **Physical interfaces** – Physical interfaces are bound to a single port
- **Virtual interfaces** – Virtual interfaces are assigned as subinterfaces to a physical interface and allow the physical interface to carry traffic assigned to multiple interfaces.

Topics:

Physical Interfaces

The front panel of a SonicWall Security Appliance has a number of physical interfaces. The number and type of interfaces depend on the model and version (for more information about the interfaces on your appliance, see the relevant *Getting Started Guide*):

Physical interfaces must be assigned to a zone to allow for configuration of Access Rules to govern inbound and outbound traffic. Security zones are bound to each physical interface where it acts as a conduit for inbound and outbound traffic. If there is no interface, traffic cannot access the zone or exit the zone.

For more information on zones, see About Zones on page 283.

Virtual Interfaces (VLAN)

Supported on SonicWall Security Appliances, virtual Interfaces are subinterfaces assigned to a physical interface. Virtual interfaces allow you to have more than one interface on one physical connection.

Virtual interfaces provide many of the same features as physical interfaces, including zone assignment, DHCP Server, and NAT and Access Rule controls.

Virtual Local Area Networks (VLANs) can be described as a “tag-based LAN multiplexing technology” because through the use of IP header tagging, VLANs can simulate multiple LAN’s within a single physical LAN. Just as two physically distinct, disconnected LAN’s are wholly separate from one another, so too are two different VLANs; however, the two VLANs can exist on the very same wire. VLANs require VLAN aware networking devices to offer this kind of virtualization — routers and firewalls, that have the ability to recognize, process, remove and insert VLAN tags (IDs) in accordance with the network’s design and security policies.

VLANs are useful for a number of different reasons, most of which are predicated on the VLANs ability to provide logical rather than physical broadcast domain, or LAN boundaries. This works both to segment larger physical LAN’s into smaller virtual LAN’s, as well as to bring physically disparate LAN’s together into a logically contiguous virtual LAN. The benefits of this include:

- **Increased performance** – Creating smaller, logically partitioned broadcast domains decreases overall network utilization, sending broadcasts only where they need to be sent, thereby leaving more available bandwidth for application traffic.
- **Decreased costs** – Historically, broadcast segmentation was performed with routers, requiring additional hardware and configuration. With VLANs, the functional role of the router is reversed – rather than being used for the purposes of inhibiting communications, it is used to facilitate communications between separate VLANs as needed.
- **Virtual workgroups** – Workgroups are logical units that commonly share information, such as a Marketing department or an Engineering department. For reasons of efficiency, broadcast domain

boundaries should be created such that they align with these functional workgroups, but that is not always possible: Engineering and Marketing users might be commingled, sharing the same floor (and the same workgroup switch) in a building, or just the opposite – the Engineering team might be spread across an entire campus. Attempting to solve this with complex feats of wiring can be expensive and impossible to maintain with constant adds and moves. VLANs allow for switches to be quickly reconfigured so that logical network alignment can remain consistent with workgroup requirements.

- **Security** – Hosts on one VLAN cannot communicate with hosts on another VLAN unless some networking device facilitates communication between them.

Subinterfaces

VLAN support on SonicOS NS*v* is achieved by means of subinterfaces, which are logical interfaces nested beneath a physical interface. Every unique (tag) requires its own subinterface. For reasons of security and control, SonicOS NS*v* does not participate in any VLAN trunking protocols, but instead requires that each VLAN that is to be supported be configured and assigned appropriate security characteristics.

ⓘ **NOTE:** VLAN IDs range from 0 – 4094, with these restrictions: VLAN 0 is reserved for QoS and VLAN 1 is reserved by some switches for native VLAN designation.

ⓘ **NOTE:** Dynamic VLAN Trunking protocols, such as VTP (VLAN Trunking Protocol) or GVRP (Generic VLAN Registration Protocol), should not be used on trunk links from other devices connected to the firewall.

Trunk links from VLAN capable switches are supported by declaring the relevant VLAN ID’s as a subinterface on the firewall, and configuring them in much the same way that a physical interface would be configured. In other words, only those VLANs which are defined as subinterfaces are handled by the firewall, the rest are discarded as uninteresting. This method also allows the parent physical interface on the firewall to which a trunk link is connected to operate as a conventional interface, providing support for any native (untagged) VLAN traffic that might also exist on the same link. Alternatively, the parent interface could remain in an ‘unassigned’ state.

VLAN subinterfaces have most of the capabilities and characteristics of a physical interface, including zone assignability, security services, GroupVPN, DHCP server, IP Helper, routing, and full NAT policy and Access Rule controls. Multicast support is excluded from VLAN subinterfaces at this time.

SonicOS NSv Secure Objects

The SonicOS NS*v* scheme of interface addressing works in conjunction with address objects, service objects, and network zones. This structure is based on secure objects, which are utilized by rules and policies within SonicOS NS*v*.

Secured objects include interface objects that are directly linked to physical interfaces and managed in the **MANAGE | System Setup | Network > Interfaces** page. Address and Service Objects are defined in **MANAGE | Policies > Objects > Address Objects** and **MANAGE | Policies > Objects > Service Objects** respectively; for more information about address and service objects, see *SonicOS NSv 6.5 Policies*.

Zones are the hierarchical apex of SonicOS NS*v*’s secure objects architecture. SonicOS NS*v* includes predefined zones as well as allow you to define your own zones. Predefined zones include LAN, DMZ, WAN, and Custom. For more information about zones, see Configuring Network Zones on page 283.

Zones can include multiple interfaces; the WAN zone, however, is restricted to a maximum of the total number of interfaces minus one. Within the WAN zone, either one or more WAN interfaces can be actively passing traffic depending on the WAN Failover and Load Balancing configuration on **MANAGE | System Setup | Network > Failover & Load Balancing**. For more information on WAN Failover and Load Balancing on the SonicWall Security Appliance, see **MANAGE | System Setup | Network > Failover & Load Balancing** on page 272.

At the zone configuration level of **MANAGE | System Setup | Zones**, the **Allow Interface Trust** setting for zones automates the processes involved in creating a permissive intra-zone Access Rule. It creates a comprehensive

Address Object for the entire zone and a inclusively permissive Access Rule from zone address to zone addresses.

Firewall Sandwich

You can deploy and configure a SonicWall Firewall Sandwich to improve availability, scalability, and manageability across the IT infrastructure. Deployment of the Firewall Sandwich provides the following features:

- Scalability - add more capacity as you go, reusing existing equipment
- Redundancy and resiliency – primary and secondary components
- Inline upgrades – upgrade firewalls without shutting down the system
- Single point of management - manage policies for multiple firewall clusters and blades
- Full security services - including DPI-SSL capability

Firewall Sandwich deployment and configuration can be implemented using these equipment and services:

- SonicWall services, such as GAV, IPS, ASPR, DPI-SSL, and CFS in conjunction with Single Sign-On All in Wire Mode.

HTTP/HTTPS Redirection

When the Security Appliance configuration requires user authentication, HTTP/HTTPS traffic from an unauthenticated source is redirected to the SonicOS NS*v* login screen for the user to enter their credentials. A problem occurs when HTTP and HTTPS traffic arrive from sources from which users do not log in, and one or more such sources repeatedly try to open new connections, which keeps triggering this redirection. These could be non-user devices that are validly trying to get access or could be malicious code attempting a Denial of Service (DoS) attack. The effect that it has on the Security Appliance is to cause high CPU load in the CP, both in the data plane task initiating the redirections and in the web server thread tasks that are serving up the target redirect pages.

To minimize this effect, ensure the **Add rule to enable redirect from HTTP to HTTPS** option is selected when adding or editing an interface. Enabling this option causes SonicOS NS*v* to add an access rule that allows HTTP to the interface; a side effect of this rule is that it also allows SonicOS NS*v* to be able to redirect HTTPS to HTTP in certain cases without security issues. One such case is the first step of redirecting traffic that needs to be authenticated, at which point there is no sensitive data that needs to be hidden. Then HTTP processing can occur on the data plane (DP) rather than on the CP.

HTTP/HTTPS Redirection with DP Offload

This feature improves handling of HTTP/HTTPS redirection requests that occur when user authentication is required for users to get access through the Security Appliance. HTTP/HTTPS requests received from sources that are not authenticated users are redirected to the Security Appliance’s login page, which is served up by its built-in web server. This redirection happens if Single Sign-On (SSO) cannot identify the user or if SSO is not in use.

This feature improves efficiencies in both the web server and the HTTP/HTTPS redirection processes, and offloads most of the redirection processes to the Data Plane (DP) where the processing can be spread across multiple cores.

> ⓘ **NOTE:** Elements of this feature can be controlled by internal User Authentication Settings options. This includes an option to globally enable/disable redirection processing in the DP, a flush option to clear the redirect files cache, and an option to specify the internal NAT port number used for the web server. Contact SonicWall Technical Support for information about internal settings.

Enabling DNS Proxy on an Interface

When DNS Proxy is enabled globally, you can enable it on individual interfaces. This allows you to enable the feature for different network segments independently. For how to enable DNS Proxy on an interface, see Enabling DNS Proxy on page 324.

LAN Bypass

The hardware (LAN) bypass mode is enabled in Wire Mode. The main functionality of the LAN Bypass feature, when enabled:

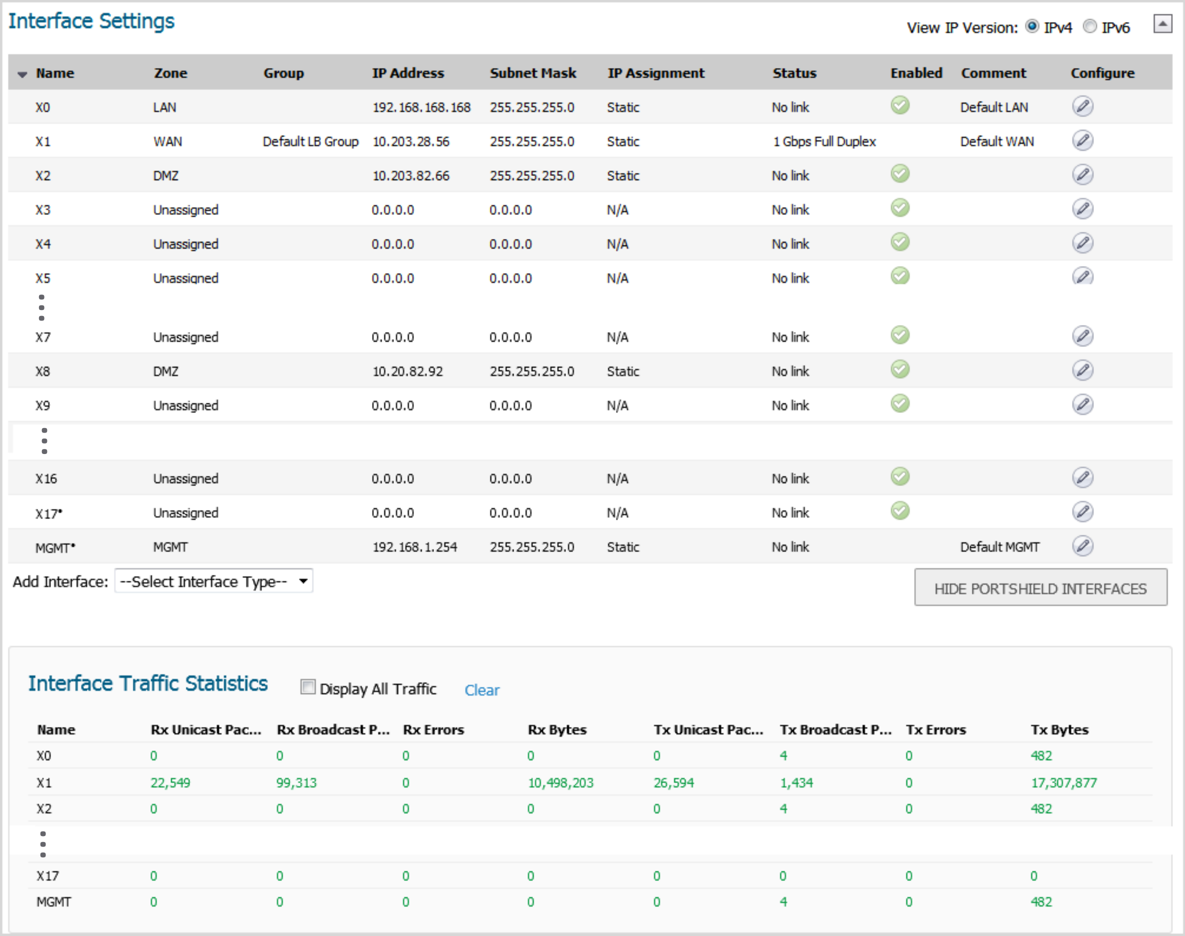
- Pass traffic in between the LBP-capable interfaces while rebooting.
- Even when the firewall is powered off, pass traffic in between those LBP-capable Interfaces.

The LAN Bypass feature is available between interfaces X26 and X27.

Network > Interfaces

The **MANAGE | System Setup | Network > Interfaces** page includes interface objects that are directly linked to physical interfaces. The SonicOS NS*v* scheme of interface addressing works in conjunction with network zones and address objects.

Security Appliance Interface



Interface Settings

View IP Version: ● IPv4 ○ IPv6

Name	Zone	Group	IP Address	Subnet Mask	IP Assignment	Status	Enabled	Comment	Configure
X0	LAN		192.168.168.168	255.255.255.0	Static	No link	✓	Default LAN	✎
X1	WAN	Default LB Group	10.203.28.56	255.255.255.0	Static	1 Gbps Full Duplex		Default WAN	✎
X2	DMZ		10.203.82.66	255.255.255.0	Static	No link	✓		✎
X3	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X4	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X5	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
⋮									
X7	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X8	DMZ		10.20.82.92	255.255.255.0	Static	No link	✓		✎
X9	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
⋮									
X16	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X17*	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
MGMT*	MGMT		192.168.1.254	255.255.255.0	Static	No link		Default MGMT	✎

Add Interface: --Select Interface Type--

Interface Traffic Statistics

□ Display All Traffic

Name	Rx Unicast Pac...	Rx Broadcast P...	Rx Errors	Rx Bytes	Tx Unicast Pac...	Tx Broadcast P...	Tx Errors	Tx Bytes
X0	0	0	0	0	0	4	0	482
X1	22,549	99,313	0	10,498,203	26,594	1,434	0	17,307,877
X2	0	0	0	0	0	4	0	482
⋮								
X17	0	0	0	0	0	0	0	0
MGMT	0	0	0	0	0	4	0	482

Topics:

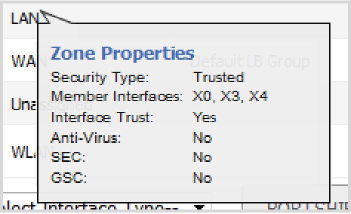
- Interface Settings on page 247
- Interface Traffic Statistics on page 248
- Physical and Virtual Interfaces on page 243
- SonicOS NSv Secure Objects on page 244
- Firewall Sandwich on page 245
- Configuring Interfaces on page 249
- Configuring Security Services (Unified Threat Management) on page 264
- Configuring Interfaces for IPv6 on page 269
- 31-Bit Network on page 269

Interface Settings

The **Interface Settings** table lists this information for each interface:

- **Name** - The name of the interface.

- **Zone** - LAN and WAN are listed by default as is DMZ when applicable. As zones are configured, the names are listed in this column. Non-configured zones are designated **Unassigned**. Mousing over the zone displays zone properties:



LAN
WA
Una
WL

Zone Properties

Security Type:	Trusted
Member Interfaces:	X0, X3, X4
Interface Trust:	Yes
Anti-Virus:	No
SEC:	No
GSC:	No

Security Type Displays security type selected for the zone when it was configured.

Member Interfaces Lists interfaces assigned to this zone.

Interface Trust Indicates whether **Allow Interface Trust** is enabled for this zone.

Anti-Virus Indicates whether **Enable Client AV Enforcement Service** and/or **Enable Gateway Anti-Virus Service** is enabled for this zone.

SEC

GSC Indicates whether **Enforce Global Security Clients** (GSC) protection is enabled for this zone. For more information, see Enabling SonicWall Security Services on Zones on page 286.

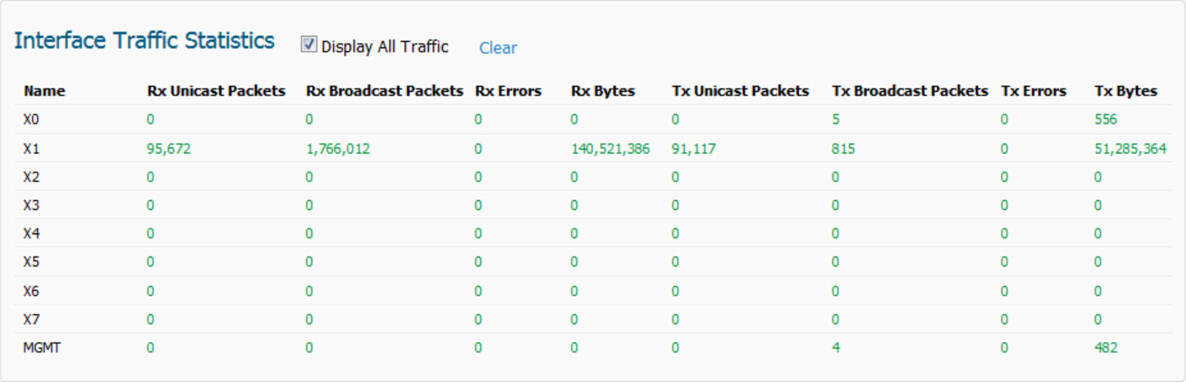
- **Group** - If the interface is assigned to a Load Balancing group, it is displayed in this column.
- **IP Address** - IP address assigned to the interface.
- **Subnet Mask** - The network mask assigned to the subnet.
- **IP Assignment** - The available methods of IP assignment depend on the zone to which the interface is assigned:

LAN	**Static IP Mode** (default), **Wire Mode (2-Port Wire)**
WAN	**Static** (default), **DHCP**, **Wire Mode, (2-Port Wire)**
DMZ	**Static IP Mode** (default), **Wire Mode (2-Port Wire)**

- **Status** - The link status and speed.
- **Enabled** - Indicates ports that can be enabled/disabled through **Network > Interfaces**. Ports that are enabled are indicated by an **Enabled** icon, those that are disabled by a **Disabled** icon. Clicking on the icon displays a message verifying you want the port enabled/disabled. Click **OK**. The port is enabled/disabled, and the icon changes.
- **Comment** - Any user-defined comments.
- **Configure** - Click the **Edit** icon to display the **Edit Interface** dialog, which allows you to configure the settings for the specified interface. For information about configuring interfaces, see Configuring Interfaces on page 249.

Interface Traffic Statistics

The **Interface Traffic Statistics** table lists, for each interface, received and transmitted information for all configured interfaces, including VLAN sub-interfaces:



Interface Traffic Statistics ☑ Display All Traffic Clear

Name	Rx Unicast Packets	Rx Broadcast Packets	Rx Errors	Rx Bytes	Tx Unicast Packets	Tx Broadcast Packets	Tx Errors	Tx Bytes
X0	0	0	0	0	0	5	0	556
X1	95,672	1,766,012	0	140,521,386	91,117	815	0	51,285,364
X2	0	0	0	0	0	0	0	0
X3	0	0	0	0	0	0	0	0
X4	0	0	0	0	0	0	0	0
X5	0	0	0	0	0	0	0	0
X6	0	0	0	0	0	0	0	0
X7	0	0	0	0	0	0	0	0
MGMT	0	0	0	0	0	4	0	482

Name Name of the interface.

Rx Unicast Packets Number of point-to-point communications received by the interface.

Rx Broadcast Packets or Rx Multicast Packets Number of multipoint communications received by the interface.

RX Errors Number of errors received by the interface.

RX Bytes Volume of data, in bytes, received by the interface.

Tx Unicast Packets Number of point-to-point communications transmitted by the interface.

Tx Broadcast Bytes Number of mutlipoint communications received by the interface.

TX Errors Number of errors transmitted b the interface.

Tx Bytes Volume of data, in bytes, transmitted by the interface.

To clear the current statistics, click **Clear** at the top of the **Interface Traffic Statistics** table.

Configuring Interfaces

Topics:

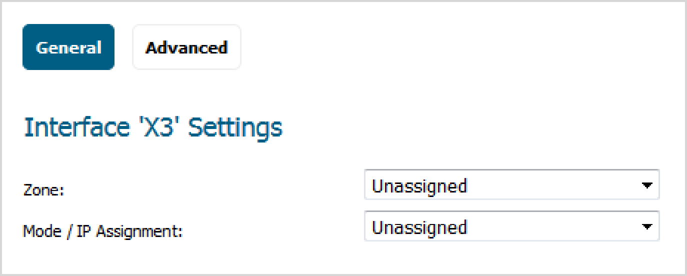
Configuring a Static Interface

For general information on interfaces, see Physical and Virtual Interfaces on page 243.

Static means that you assign a fixed IP address to the interface.

To configure a static interface:

1. Navigate to **MANAGE | System Setup | Network > Interfaces**.
2. In the **Interface Settings** table, click the **Edit** icon for the interface you want to configure. The **Edit Interface** dialog displays.



Interface 'X3' Settings

Zone: Unassigned

Mode / IP Assignment: Unassigned

3. Select a zone to assign to the interface from **Zone**:
   - **LAN**
   - **WAN**
   - **DMZ**
   - Custom zone
   - **Create new zone**. The **Add Zone** dialog is displayed. See About Zones on page 283 for instructions on adding a zone.

   ⓘ **NOTE:** The options displayed change, depending on the **Zone** you select.

4. From **IP Assignment** select:
   - **Static** (default for WAN)
   - **Static IP Mode** (default for LAN)
5. Enter the IP address and subnet mask for the interface into the **IP Address** and **Subnet Mask** fields.

   ⓘ **NOTE:** You cannot enter an IP address that is in the same subnet as another zone.

6. If configuring a:
   - WAN zone interface or the MGMT interface, enter the IP address of the gateway device into the **Default Gateway** field.

     ⓘ **NOTE:** A default gateway IP is required on the WAN interface if any destination is required to be reached through the WAN interface that is not part of the WAN subnet IP address space, regardless whether a default route is received dynamically from a routing protocol of a peer device on the WAN subnet. A default gateway IP is optional on a LAN interface.

   - LAN zone interface or a DMZ zone interface, optionally enter the IP address of the gateway device into the **Default Gateway (Optional)** field.

   The gateway device provides access between this interface and the external network, whether it is the Internet or a private network.

7 If configuring a:

- LAN zone interface, go to Step 8.
- WAN zone interface, enter the IP addresses of up to three DNS servers into the **DNS Server** fields. These can be public or private DNS servers. For more information, see Configuring a WAN Interface on page 258.

8 Enter any optional comment text in the **Comment** field. This text is displayed in the **Comment** column of the **Interface Settings** table.

9 If you want to enable remote management of the Security Appliance from this interface, choose the supported **Management** protocol(s): **HTTPS**, **Ping**, **SNMP**, and/or **SSH**. If **HTTPS** is chosen, **Add rule to enable redirect from HTTP to HTTPS** becomes available and selected; selecting **HTTP**, disables **Add rule to enable redirect from HTTP to HTTPS**, and it becomes dimmed.

> ⓘ **NOTE:** Elements of this feature can be controlled by internal User Authentication Settings options. For more information, see HTTP/HTTPS Redirection with DP Offload on page 245.

To allow access to the WAN interface for management from another zone on the same Security Appliance, access rules must be created. For more information about allowing WAN primary IP access from the LAN zone, see *SonicOS NSv 6.5 Policies*.

10 If you want to allow selected users with limited management rights to log in to the Security Appliance, choose **HTTP** and/or **HTTPS** in **User Login**. If **HTTPS** is chosen, **Add rule to enable redirect from HTTP to HTTPS** becomes available and selected; selecting **HTTP**, disables **Add rule to enable redirect from HTTP to HTTPS**, and it becomes dimmed.

11 Either:

- Configure **Advanced Settings**; go to Configuring Advanced Settings for a Static Interface on page 252.
- Click **OK**.

> ⓘ **NOTE:** The administrator password is required to regenerate encryption keys after changing the Security Appliance’s address.

Configuring Advanced Settings for a Static Interface

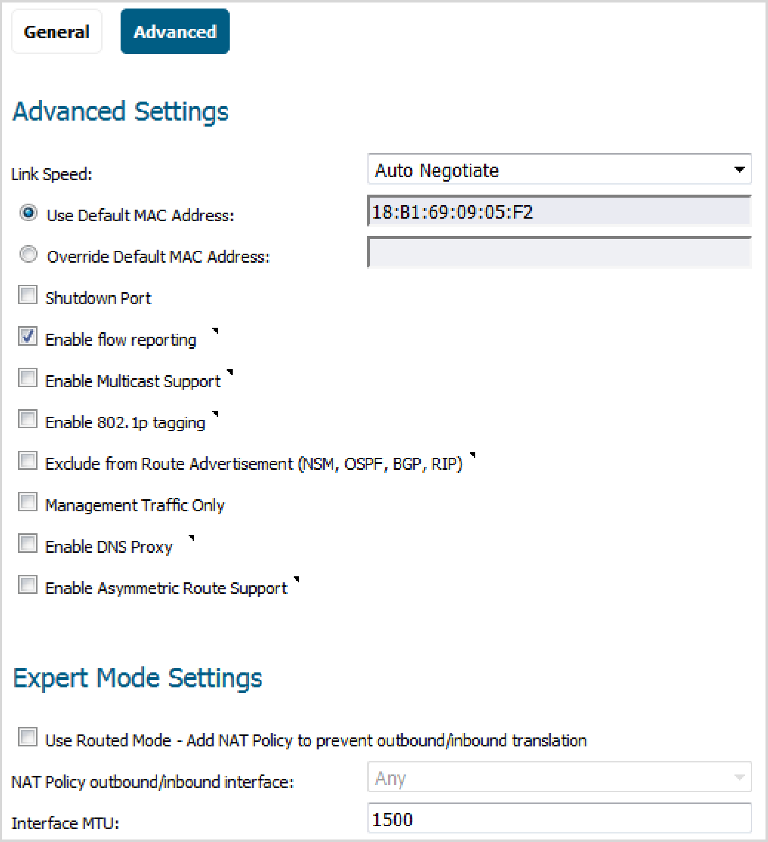
To configure advanced settings for a static interface.

1 In the **Edit Interface** dialog, click **Advanced**.

ⓘ **NOTE:** The options available in **Advanced** for a static interface vary depending on the selected zone and the platform:

- Edit Interface Advanced settings—LAN/DMZ on page 252
- Edit Interface Advanced settings—WAN on page 253

Edit Interface Advanced settings—LAN/DMZ



Advanced Settings

Link Speed: Auto Negotiate

● Use Default MAC Address: 18:B1:69:09:05:F2

○ Override Default MAC Address:

□ Shutdown Port

☑ Enable flow reporting

□ Enable Multicast Support

□ Enable 802.1p tagging

□ Exclude from Route Advertisement (NSM, OSPF, BGP, RIP)

□ Management Traffic Only

□ Enable DNS Proxy

□ Enable Asymmetric Route Support

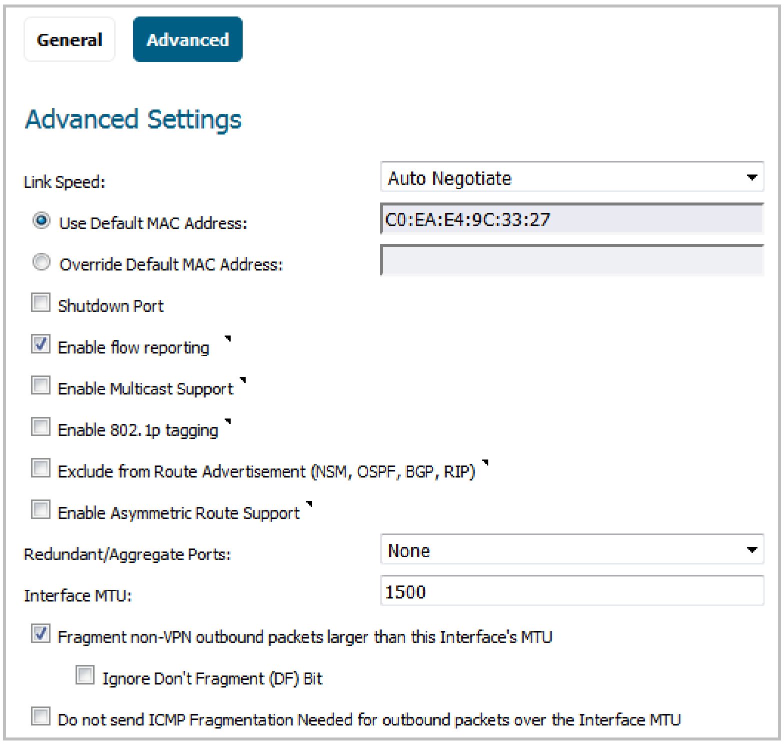
Expert Mode Settings

□ Use Routed Mode - Add NAT Policy to prevent outbound/inbound translation

NAT Policy outbound/inbound interface: Any

Interface MTU: 1500

Edit Interface Advanced settings—WAN



General | Advanced

Advanced Settings

Link Speed: Auto Negotiate

● Use Default MAC Address: C0:EA:E4:9C:33:27

○ Override Default MAC Address:

□ Shutdown Port

☑ Enable flow reporting

□ Enable Multicast Support

□ Enable 802.1p tagging

□ Exclude from Route Advertisement (NSM, OSPF, BGP, RIP)

□ Enable Asymmetric Route Support

Redundant/Aggregate Ports: None

Interface MTU: 1500

☑ Fragment non-VPN outbound packets larger than this Interface's MTU

□ Ignore Don't Fragment (DF) Bit

□ Do not send ICMP Fragmentation Needed for outbound packets over the Interface MTU

2 For **Link Speed**, **Auto Negotiate** is selected by default, which causes the connected devices to negotiate the speed and duplex mode of the Ethernet connection automatically. To force Ethernet speed and duplex, select one of the following options from **Link Speed**:

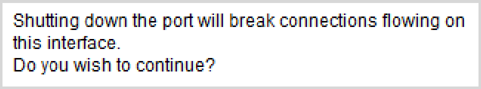
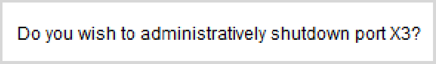
For 1 Gbps Interfaces	For 10 Gbps Interfaces
1 Gbps - Full Duplex	**10 Gbps - Full Duplex**
100 Mbps - Full Duplex	
100 Mbps - Half Duplex	
10 Mbps - Full Duplex	
10 Mbps - Half Duplex	

△ CAUTION: **If you select a specific Ethernet speed and duplex, you must force the connection speed and duplex from the Ethernet card to the Security Appliance as well.**

3 **Use Default MAC Address** is selected by default. You override **Use Default MAC Address** for the Interface by choosing **Override Default MAC Address** and entering the MAC address in the field.

4 Select **Shutdown Port** to temporarily take this interface offline for maintenance or other reasons. If connected, the link goes down. This option is not selected by default.

Clear the option to activate the interface and allow the link to come back up.

> ⓘ **IMPORTANT:** You cannot shut down the management interface or the interface you are currently using.
>
> If you select this option, a confirmation message displays:
>
> 
>
> Shutting down the port will break connections flowing on this interface.
> Do you wish to continue?
>
> Click **OK** to shut down the port.
>
> **TIP:** You can shut down the interface by clicking the **Enabled** icon in the **Enabled** column for the interface. A confirmation message displays:
>
> 
>
> Do you wish to administratively shutdown port X3?
>
> If you click **OK**, the **Enabled** icon turns to a **Disabled** icon. To enable the interface, click the **Disabled** icon. A confirmation message displays:
>
>
>
> Do you wish to administratively enable port X2?
>
> If you click **OK**, the **Disabled** icon turns to an **Enabled** icon.

5 For the AppFlow feature, select **Enable flow reporting** to allow flow reporting on flows created for this interface. This option is selected by default.

6 Optionally, select **Enable Multicast Support** to allow multicast reception on this interface. This option is not selected by default.

7 Optionally, select **Enable Default 802.1p CoS** to tag information passing through this interface with 802.1p priority information for Quality of Service (QoS) management. This option is not selected by default.

> ⓘ **NOTE:** This option is available only for VLAN interfaces.

Packets sent through this interface are tagged with VLAN id=0 and carry 802.1p priority information. To make use of this priority information, devices connected to this interface should support priority frames. QoS management is controlled by access rules on **MANAGE | Policies | Rules > Access Rules**. For information on QoS and bandwidth management, see SonicOS NS*v* *Policies*.

8 Optionally, to exclude the interface from Route Advertisement, select **Exclude from Route Advertisement (NSM, OSPF, BGP, RIP)** This option is not selected by default.

9 Optionally, select **Management Traffic Only** to restrict traffic to only SonicWall management traffic and routing protocols. This option is not selected by default.

10 Optionally, if you have enabled DNS Proxy, the **Enable DNS Proxy** option for displays for LAN or DMZ interfaces. To enable DNS Proxy on the interface, select the option. This option is not selected by default.

11 Optionally, enable Asymmetric Route Support on the interface by selecting **Enable Asymmetric Route Support**. If enabled, the traffic initialized from this interface supports asymmetric routes, that is, the initial packet or response packet can pass through from other interfaces. This option is not selected by default.

12 If configuring a Security Appliance for a:

- LAN/DMZ interface, go to Configuring Routed Mode on page 255.
- WAN interface, go to Step 13.

13 To specify the largest packet size (MTU – maximum transmission unit) that a WAN interface can forward without fragmenting the packet, enter the size of the packets that the port receives and transmits in the **Interface MTU** field:

Standard packets (default)	1500
Jumbo frame packets	9000

ⓘ **NOTE:** Jumbo frame support must be enabled before a port can process jumbo frames, as explained in *SonicOS NSv 6.5 Policies*. Because of jumbo frame packet buffer size requirements, jumbo frames increase memory requirements by a factor of four.

14 Optionally, to fragment non-VPN outbound packets larger than the interface's MTU, select **Fragment non-VPN outbound packets larger than this Interface's MTU**. This option is selected by default. When selected, the following option becomes available.

ⓘ **IMPORTANT:** You specify fragmentation of outbound VPN traffic in **MANAGE | Connectivity | Advanced Settings**. For more information, see *SonicOS NSv Connectivity*.

a Optionally, to override the Do-not-fragment packet bit, select **Ignore Don't Fragment (DF) bit**. This option is not selected by default.

15 To block notification that the WAN interface can receive fragmented packets, select **Do not send ICMP Fragmentation Needed for outbound packets over the Interface MTU**. This option is not selected by default.

16 If configuring bandwidth management for this interface, go to Enabling Bandwidth Management on an Interface on page 256.

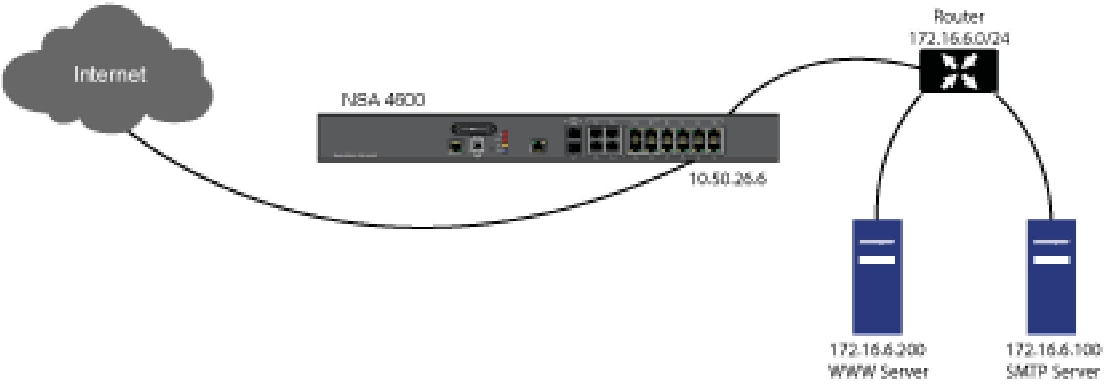
17 Click **OK**.

Configuring Routed Mode

Routed Mode provides an alternative for NAT for routing traffic between separate public IP address ranges. Consider the topology in Routed Mode Configuration, where the Security Appliance is routing traffic across two public IP address ranges:

- `10.50.26.0/24`
- `172.16.6.0/24`

Routed Mode Configuration

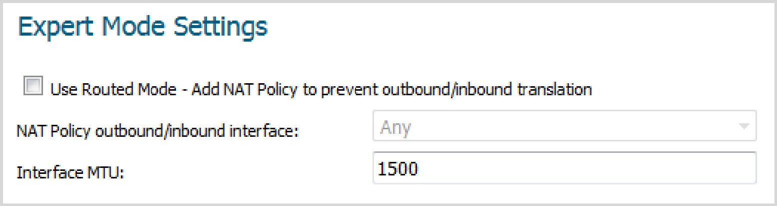


By enabling Routed Mode on the interface for the `172.16.6.0` network, NAT translations are automatically disabled for the interface, and all inbound and outbound traffic is routed to the WAN interface configured for the `10.50.26.0` network.

> ⓘ **NOTE:** Routed Mode is available when using Static IP Mode for interfaces in the LAN and DMZ zones. For DMZ, it is also available when using Layer 2 Bridged Mode. Routed mode is not available for WAN mode.

To configure Routed Mode:

1. Navigate to **MANAGE | System Setup** > **Network > Interfaces**.
2. Click on the **Configure** icon for the appropriate interface. The **Edit Interface** dialog displays.
3. Click **Advanced**.
4. Scroll to the **Expert Mode Settings** section.



Expert Mode Settings

□ Use Routed Mode - Add NAT Policy to prevent outbound/inbound translation

NAT Policy outbound/inbound interface: Any

Interface MTU: 1500

5. To enable Routed Mode for the interface, select **Use Routed Mode - Add NAT Policy to prevent outbound\inbound translation**. This option is not selected by default. When you select it, the next Expert Mode setting become available.
6. From **NAT Policy outbound/inbound interface**, select the WAN interface that is to be used to route traffic for the interface. The default is **Any**.
7. To specify the largest packet size (MTU – maximum transmission unit) that the interface can forward without fragmenting the packet, enter the size of the packets that the port receives and transmits in the **Interface MTU** field:

Standard packets (default)	1500
Jumbo frame packets	9000

> ⓘ **NOTE:** Jumbo frame support must be enabled before a port can process jumbo frames, as explained in *SonicOS NSv 6.5 Policies*. Because of jumbo frame packet buffer size requirements, jumbo frames increase memory requirements by a factor of four.

8. If Bandwidth Management has been enabled on the Security Appliance, the Bandwidth Management section displays. To configure BWM for this interface, go to Enabling Bandwidth Management on an Interface on page 256.
9. Click **OK**.

> ⓘ **IMPORTANT:** The Security Appliance creates “no-NAT” policies for both the configured interface and the selected WAN interface. These policies override any more general M21 NAT policies that might be configured for the interfaces.

Enabling Bandwidth Management on an Interface

Bandwidth Management (BWM) allows you to guarantee minimum bandwidth and prioritize traffic. BWM is enabled in **MANAGE | Security Configuration | Firewall Settings > Bandwidth Management**; for information about Bandwidth Management (BWM), see *SonicOS NSv 6.5 Security Configuration*. By controlling the amount of bandwidth to an application or user, you can prevent a small number of applications or users from consuming all available bandwidth. Balancing the bandwidth allocated to different network traffic and then assigning priorities to traffic improves network performance.

Various types of bandwidth management can be enabled:

- **Advanced**—Enables you to configure maximum egress and ingress bandwidth limitations per interface, by configuring bandwidth objects, access rules, and application policies.
- **Global**—Allows you to enable BWM settings globally and apply them to any interfaces.
- **None** (default)—Disables BWM.

For information on configuring bandwidth management and the effect of the various BWM types, see *SonicOS NSv 6.5 Security Configuration*.

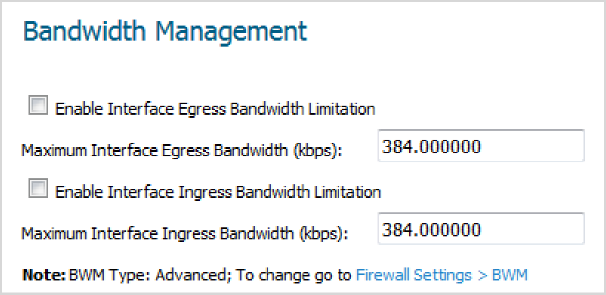
SonicOS NSv can apply bandwidth management to both egress (outbound) and ingress (inbound) traffic on any interfaces. Outbound bandwidth management is done using Class-based Queuing. Inbound Bandwidth Management is done by implementing an ACK delay algorithm that uses TCP's intrinsic behavior to control the traffic.

Class-based Queuing (CBQ) provides guaranteed and maximum bandwidth Quality of Service (QoS) for the firewall. Every packet destined to the interface is queued in the corresponding priority queue. The scheduler then dequeues the packets and transmits them on the link depending on the guaranteed bandwidth for the flow and the available link bandwidth.

Enabling BWM

To enable or disable ingress and egress BWM:

1. Navigate to **MANAGE | System Setup > Network > Interfaces**.
2. Click the **Edit** icon of an interface. The **Add/Edit Interface** dialog displays.
3. If this is an unassigned interface, configure the interface according to the sections contained in Configuring Interfaces on page 249.
4. Click **Advanced**.
5. Scroll to **Bandwidth Management**.



Bandwidth Management

□ Enable Interface Egress Bandwidth Limitation

Maximum Interface Egress Bandwidth (kbps): 384.000000

□ Enable Interface Ingress Bandwidth Limitation

Maximum Interface Ingress Bandwidth (kbps): 384.000000

Note: BWM Type: Advanced; To change go to Firewall Settings > BWM

> **NOTE: Advanced Settings** might differ, depending on the Security Appliance model and the type of zone selected.

6. Enable Bandwidth Management for this interface. For more information about Bandwidth Management, see *SonicOS NSv 6.5 Security Configuration*.
   a. To limit outgoing traffic to a maximum bandwidth on the interface, select **Enable Interface Egress Bandwidth Limitation**. This option is not selected by default.
      - Specify the maximum bandwidth, in kbps, in the **Maximum Interface Egress Bandwidth** field. The minimum is 20 Kbps, the maximum is 1000000, and the default is **384.000000**.

b To limit incoming traffic to a maximum bandwidth on the interface, select **Enable Interface Ingress Bandwidth Limitation**. This option is not selected by default.

- Specify the maximum bandwidth, in kbps, in the **Maximum Interface Egress Bandwidth** field. The minimum is 20 Kbps, the maximum is 1000000, and the default is **384.000000**.

When either of these options is:

- Selected, the maximum available egress BWM is defined, but as advanced BWM is policy-based, the limitation is not enforced unless there is a corresponding Access Rule or App Rule.
- Not selected, no bandwidth limitation is set at the interface level, but traffic can still be shaped using other options.

7 Click **OK**.

Configuring a WAN Interface

ⓘ **NOTE:** A default gateway IP is required on the WAN interface if any destination is required to be reached through the WAN interface that is not part of the WAN subnet IP address space, regardless whether we receive a default route dynamically from a routing protocol of a peer device on the WAN subnet.

Configuring a WAN interface enables Internet connectivity. You can configure up to *N minus 2* WAN interfaces on the SonicWall Security Appliance, where *N* is the number of interfaces defined on the unit (both physical and VLAN). Only the X0 and MGMT interfaces cannot be configured as WAN interfaces.

To configure your WAN interface:

1 Navigate to **MANAGE | System Setup | Network > Interfaces**.

2 Click on the **Edit** icon in the **Configure** column for the Interface you want to configure. The **Edit Interface** dialog displays.

3 If you are configuring an unassigned Interface, select **WAN** from the **Zone** menu. If you selected the **Default WAN** interface, **WAN** is already selected in the **Zone** menu.

4 Select one of the following WAN Network Addressing Modes from **IP Assignment**.

ⓘ **NOTE:** Depending on the option you choose from the IP Assignment drop-down menu, the options available change. Complete the corresponding fields that are displayed after selecting the option.

- **Static** - configures the Security Appliance for a network that uses static IP addresses.
- **DHCP** - configures the Security Appliance to request IP settings from a DHCP server on the Internet. NAT with DHCP Client is a typical network addressing mode for cable and DSL customers.
- **Wire Mode (2-Port Wire)** - allows insertion of the Security Appliance into a network, in Bypass, Inspect, or Secure mode. For detailed information, see Configuring Wire Mode on page 265.

5 If using **DHCP**, optionally enter a descriptive name in the **Host Name** field and any desired comments in the **Comment** field.

6 If you want to enable remote management of the Security Appliance from this interface, select the supported management protocol(s): **HTTPS**, **Ping**, **SNMP**, and/or **SSH**.

To allow access to the WAN interface for management from another zone on the same Security Appliance, access rules must be created. For information about creating access rules, see SonicOS NS*v* *Policies*.

7 If using DHCP, optionally choose:

- **Request renew of previous IP on startup** to request the same IP address for the WAN interface that was previously provided by the DHCP server.

- **Renew DHCP lease on any link up occurrence** to send a lease renewal request to the DHCP server every time this WAN interface reconnects after being disconnected.

The fields displayed below these options are provisioned by the DHCP server. After provisioning, these buttons are available; choose:

- **Renew** to restart the DHCP lease duration for the currently assigned IP address.
- **Release** to cancel the DHCP lease for the current IP address. The connection is dropped. You need to obtain a new IP address from the DHCP server to reestablish connectivity.
- **Refresh** to obtain a new IP address from the DHCP server.

8 To allow selected users with limited management rights to log directly into the Security Appliance from this interface, select **HTTP** and/or **HTTPS** in **User Login**.

9 Check **Add rule to enable redirect from HTTP to HTTPS**, if you want an HTTP connection automatically redirected to a secure HTTPS connection to the Security Appliance. For more information about this option, see HTTP/HTTPS Redirection on page 245.

10 Continue the configuration on the **Advanced** and **Protocol** tabs (if displayed) as described in Configuring Advanced Settings for a WAN Interface on page 259.

11 To continue with advanced settings; go to Configuring Advanced Settings for a WAN Interface on page 259.

12 Click **OK.**

Configuring Advanced Settings for a WAN Interface

To configure advanced settings for a WAN interface:

1 In the **Edit Interface** dialog, click **Advanced**.

2 For **Link Speed, Auto Negotiate** is selected by default, which causes the connected devices to automatically negotiate the speed and duplex mode of the Ethernet connection. If you want to specify the forced Ethernet speed and duplex, select one of the following options from the **Link Speed** menu:

- For 1 Gbps interfaces, select:
  - **1 Gbps - Full Duplex**
  - **100 Mbps - Full Duplex**
  - **100 Mbps - Half Duplex**
  - **10 Mbps - Full Duplex**
  - **10 Mbps - Half Duplex**
- For 10 Gbps interfaces, the only selection is **10 Gbps - Full Duplex**.

> ⓘ **IMPORTANT:** If you select a specific Ethernet speed and duplex, you must force the connection speed and duplex from the Ethernet card to the firewall as well.

3 You can choose to override the **Use Default MAC Address** for the Interface by selecting **Override Default MAC Address** and entering the MAC address in the field.

4 Select the **Shutdown Port** checkbox to temporarily take this interface off line for maintenance or other reasons. If connected, the link goes down. Clear the checkbox to activate the interface and allow the link to come back up.

5 For the AppFlow feature, select the **Enable flow reporting** checkbox to allow flow reporting on flows created for this interface.

6 Select the **Enable Multicast Support** checkbox to allow multicast reception on this interface.

7 **Interface MTU** - Specifies the largest packet size that the interface can forward without fragmenting the packet. Identify the size of the packets that the port receives and transmits:

Standard packets (default)	1500
Jumbo frame packets	9000

ⓘ **NOTE:** Jumbo frame support must be enabled before a port can process jumbo frames. For more information about jumbo frames, see *SonicOS NSv Security Configuration*. Because of jumbo frame packet buffer size requirements, jumbo frames increase memory requirements by a factor of four.

- **Fragment non-VPN outbound packets larger than this Interface's MTU** - Specifies all non-VPN outbound packets larger than this Interface's MTU be fragmented. Specifying the fragmenting of VPN outbound packets is set in **MANAGE | Connectivity | VPN**; for further information about VPN traffic, see *SonicOS NSv Connectivity*.
- **Ignore Don't Fragment (DF) Bit** - Overrides DF bits in packets.
- **Suppress ICMP Fragmentation Needed message generation -** blocks notification that this interface can receive fragmented packets.

8 If using DHCP, the following options are displayed:

- Select **Initiate renewals with a Discover when using DHCP** if the server might change.
- Select **Use an interval of _ seconds between DHCP Discovers** during lease acquisition and adjust the number of seconds for the interval if the DHCP server might not respond immediately.

9 Optionally enable Bandwidth Management for this interface. For more information about Bandwidth Management, see Enabling Bandwidth Management on an Interface on page 256.

Configuring Tunnel Interfaces

You can configure several types of tunnel interfaces in SonicOS NSv:

- Numbered and unnumbered tunnel interfaces and IPv6 6to4 tunnel interfaces are configured on **MANAGE | System Setup | Network > Interfaces**.
- Drop tunnel interfaces and VPN tunnel interfaces are configured from **MANAGE | Network > Routing**; for more information, see Configuring Route Advertisements and Route Policies on page 335.
- Unnumbered tunnel interfaces are configured as part of a VPN policy from **MANAGE | Connectivity > VPN**; for information about VPN policies, see *SonicOS NSv Connectivity*.

Numbered and unnumbered tunnel interfaces are used with VPNs. A numbered tunnel interface is assigned its own IP address, but an unnumbered tunnel interface borrows an IP address from an existing physical or virtual (VLAN) interface.

Both numbered and unnumbered tunnel interface types support static routing and dynamic routing with RIP and OSPF, while numbered tunnel interfaces can also be used with BGP.

Also, both numbered VPN and unnumbered tunnel interfaces can support advanced routing, and unnumbered tunnel interfaces have no restrictions.

See these sections for configuring the various types of tunnel interfaces:

- Numbered Tunnel Interfaces; see Configuring VPN Tunnel Interfaces on page 261
- Unnumbered Tunnel Interfaces; see *SonicOS NSv Connectivity*.
- Drop Tunnel Interfaces; see Drop Tunnel Interface on page 348
- IPv6 6to4 Tunnel Interfaces; see Configuring the 6to4 Auto Tunnel on page 675

Configuring VPN Tunnel Interfaces

You can create a numbered tunnel interface by selecting **VPN Tunnel Interface** from the **Add Interface** drop-down list. VPN tunnel interfaces are added to the **Interface Settings** table and then can be used with dynamic routing, including RIP, OSPF, and BGP, or a static route policy can use the VPN tunnel interface as the interface in a configuration for a static route-based VPN.

A VPN Tunnel Interface (TI) can be configured like a standard interface, including options to enable appliance management or user login using HTTP, HTTPS, Ping, or SSH in addition to multicast, flow reporting, asymmetric routing, fragmented packet handling, and Don't Fragment (DF) Bit settings.

> **NOTE:** A similar VPN policy and numbered tunnel interface must be configured on the remote gateway. The IP addresses assigned to the numbered tunnel interfaces (on the local gateway and the remote gateways) must be on the same subnet.

VPN Tunnel Interface Deployment lists how a VPN Tunnel Interface can be deployed.

VPN Tunnel Interface Deployment

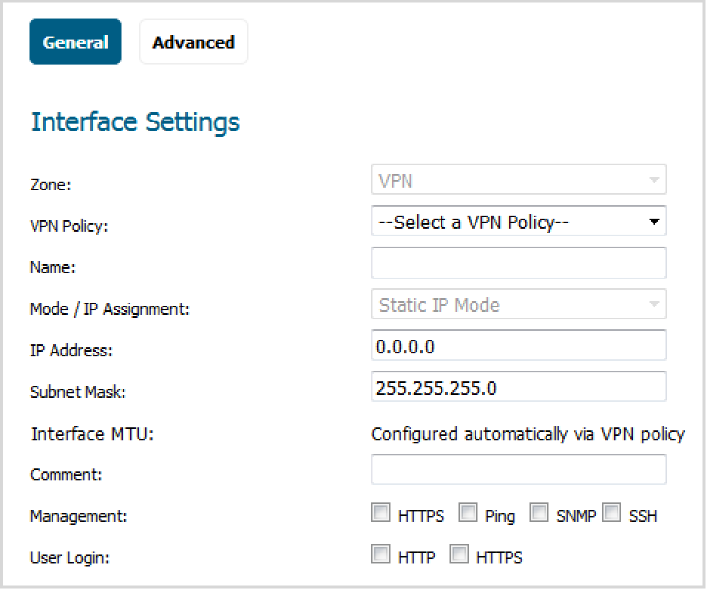
TI can be configured as an interface in	TI cannot be configured as
Static Route	Static ARP entries interface
NAT	HA interface
ACL Control List	WLB (WAN Load Balancing) interface
	Static NDP (Neighbor Discovery Protocol) entries interface
OSPF	OSPFv3/RIPnG: currently not supported for IPv6 advanced routing
RIP	MAC_IP Anti-spoof interface
BGP	DHCP server interface

For all platforms, the maximum supported number of VPN Tunnel Interfaces (numbered tunnel interfaces) is 64. The maximum number of unnumbered tunnel interfaces differs by platform and directly corresponds to the maximum number of VPN policies supported on each platform.

To configure a VPN Tunnel Interface:

1 Navigate to **MANAGE | System Setup > Network > Interfaces**.

2 From **Add Interface** under the **Interface Settings** table, select **VPN Tunnel Interface**. The **Add Tunnel Interface** dialog displays.



Interface Settings

Zone:	VPN
VPN Policy:	--Select a VPN Policy--
Name:	
Mode / IP Assignment:	Static IP Mode
IP Address:	0.0.0.0
Subnet Mask:	255.255.255.0
Interface MTU:	Configured automatically via VPN policy
Comment:	
Management:	□ HTTPS □ Ping □ SNMP □ SSH
User Login:	□ HTTP □ HTTPS

The zone is defined as VPN and cannot be changed.

3 From **VPN Policy**, select a VPN policy.

4 In the **Name** field, enter a friendly name for this interface. The name can contain alphanumeric characters, periods (dots), or underscores; it cannot contain spaces or hyphens.

5 Enter an IP address in the **IP Address** field. The default is `0.0.0.0`, but you need to enter an explicit IP address or an error message displays.

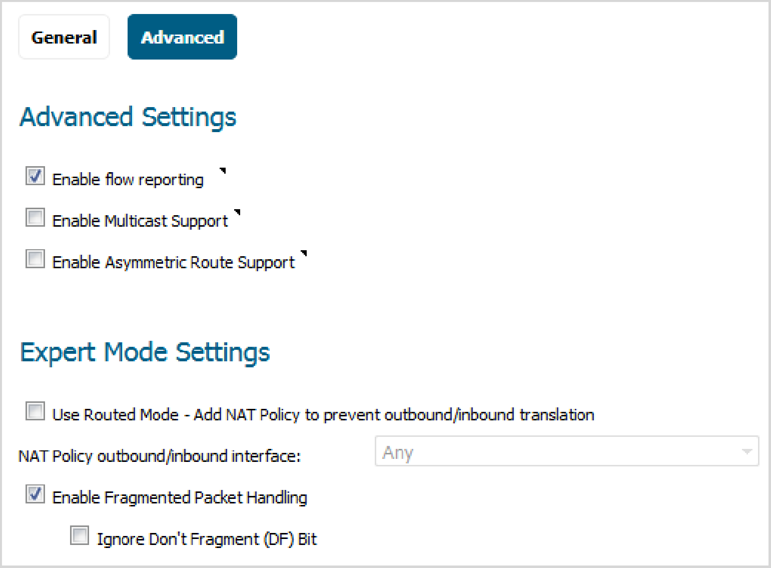
6 In the **Subnet Mask** field, enter the subnet mask. The default is `255.255.255.0`.

7 Optionally, add a comment in the **Comment** field.

8 Optionally, specify the **Management** protocol(s) allowed on this interface: **HTTPS**, **Ping**, **SNMP**, and/or **SSH**.

9 Optionally, specify the **User Login** protocol(s) allowed on this interface: **HTTP** and/or **HTTPS**.

10 Click **Advanced**.



Advanced Settings

☑ Enable flow reporting

□ Enable Multicast Support

□ Enable Asymmetric Route Support

Expert Mode Settings

□ Use Routed Mode - Add NAT Policy to prevent outbound/inbound translation

NAT Policy outbound/inbound interface: Any

☑ Enable Fragmented Packet Handling

□ Ignore Don't Fragment (DF) Bit

11 To enable flow reporting on flows created for the tunnel interface, select **Enable flow reporting**. This option is selected by default.

12 Optionally, enable multicast reception on the interface by selecting **Enable Multicast Support**. This option is not selected by default.

13 Optionally, enable Asymmetric Route Support on the tunnel interface by selecting **Enable Asymmetric Route Support**. This option is not selected by default.

14 To use Routed Mode and add a NAT policy o prevent outbound/inbound translation, select **User Routed Mode – Add NAT Policy to prevent outbound/inbound translation**. When selected, the following option becomes available. This option is not selected by default.

15 If Routed Mode is selected, to specify an interface for the NAT policy, select an interface from **NAT Policy outbound/inbound interface**. The available interfaces depend on your Security Appliance. The default is **ANY**.

16 To enable fragmented packet handling on this interface, select **Enable Fragmented Packet Handling**. If this option is not selected, fragmented packets are dropped and the VPN log report shows the log message `Fragmented IPsec packet dropped`. This option is selected by default.

If this option is selected, the **Ignore Don’t Fragment (DF) Bit** option is available.

17 Select **Ignore Don't Fragment (DF) Bit** to ignore the DF bit in the packet header. Some applications can explicitly set the Don’t Fragment option in a packet, which tells all Security Appliances to not fragment the packet. This option, when enabled, causes the Security Appliance to ignore the DF bit and fragment the packet regardless.

18 Click **OK**. The numbered VPN tunnel interface is added to the **Interface Settings** table.

Configuring Virtual Interfaces (VLAN Subinterfaces)

When you add a VLAN subinterface, you need to assign it to a zone, assign it a VLAN Tag, and assign it to a physical interface. Based on your zone assignment, you configure the VLAN subinterface the same way you configure a physical interface for the same zone.

To add a virtual interface:

1 Navigate to **MANAGE | System Setup** | **Network > Interfaces**.

2 At the bottom of the **Interface Settings** table, select **Virtual Interface** from **Add Interface**. The **Add Interface** dialog displays.

3 Select a zone to assign to the interface. You can select LAN, WAN, DMZ, or a custom zone. The zone assignment does not have to be the same as the parent (physical) interface. In fact, the parent interface can even remain **Unassigned**.

4 Assign a VLAN tag (ID) to the subinterface in the **VLAN Tag** field. Valid VLAN IDs are **0** (default) to 4094, although some switches reserve VLAN 1 for native VLAN designation, and VLAN 0 is reserved for QoS. You need to create a VLAN subinterface with a corresponding VLAN ID for each VLAN you wish to secure with your Security Appliance.

5 Select the parent (physical) interface to which this subinterface belongs from **Parent Interface**. There is no per-interface limit to the number of subinterfaces you can assign – you might assign subinterfaces up to the system limit.

6 Configure the subinterface network settings based on the zone you selected. See the interface configuration instructions:

   - Configuring a Static Interface on page 250
   - Configuring Advanced Settings for a Static Interface on page 252
   - Configuring a WAN Interface on page 258

7 Select the management and user-login methods for the subinterface.

8 Click **OK**.

Configuring Security Services (Unified Threat Management)

The settings that you enable in this section control what type of malicious traffic you detect in IPS Sniffer Mode. Typically, you want to enable Intrusion Prevention, but you might also want to enable other Security Services, such as Gateway Anti-Virus or Anti-Spyware.

To enable Security Services, your SonicWall Security Appliance must be licensed for them and the signatures must be downloaded from the SonicWall Data Center. For complete instructions on enabling and configuring IPS, GAV, and Anti-Spyware, see SonicOS NS*v* *Security Configuration*.

Topics:

- Configuring Logging on page 264
- Connecting and Configuring the WAN Interface to the Data Center on page 265

Configuring Logging

You can configure logging on the **Log Settings > Base Setup** page to record entries for attacks that are detected by the firewall. For how to enable logging, see SonicOS NS*v* *Logs and Reporting*.

Connecting and Configuring the WAN Interface to the Data Center

Connect the WAN port on the Security Appliance, typically port X1, to your gateway or to a device with access to the gateway. The Security Appliance communicates with the SonicWall Data Center automatically. For detailed instructions on configuring the WAN interface, see Configuring a WAN Interface on page 258.

Configuring Wire Mode

SonicOS NS*v* supports Wire Mode, which provide methods of non-disruptive, incremental insertion into networks. Wire Mode Settings describes the wire modes.

Wire Mode Settings

Wire Mode Setting	Description
Bypass Mode	Bypass Mode allows for the quick and relatively non-interruptive introduction of Security Appliance hardware into a network. Upon selecting a point of insertion into a network (for example, between a core switch and a perimeter Security Appliance, in front of a VM server farm, at a transition point between data classification domains), the Security Appliance is inserted into the physical data path, requiring a very short maintenance window. One or more pairs of switch ports on the Security Appliance are used to forward all packets across segments at full line rates, with all the packets remaining on the Security Appliance's 240Gbps switch fabric rather than getting passed up to the multi-core inspection and enforcement path. While Bypass Mode does not offer any inspection or firewalling, this mode allows you to physically introduce the Security Appliance into the network with a minimum of downtime and risk, and to obtain a level of comfort with the newly inserted component of the networking and security infrastructure. You can then transition from Bypass Mode to Inspect or Secure Mode instantaneously through a simple user-interface driven reconfiguration.
Inspect Mode	Inspect Mode extends Bypass Mode without functionally altering the low-risk, zero-latency packet path. Packets continue to pass through the Security Appliance's switch fabric, but they are also mirrored to the multi-core RF-DPI engine for the purposes of passive inspection, classification, and flow reporting. This reveals the Security Appliance's Application Intelligence and threat detection capabilities without any actual intermediate processing.
Secure Mode	Secure Mode is the progression of Inspect Mode, actively interposing the Security Appliance's multi-core processors into the packet processing path. This unleashes the inspection and policy engines' full-set of capabilities, including Application Intelligence and Control, Intrusion Prevention Services, Gateway and Cloud-based Anti-Virus, Anti-Spyware, and Content Filtering. Secure Mode affords the same level of visibility and enforcement as conventional NAT or L2 Bridged Mode deployments, but without any L3/L4 transformations, and with no alterations of ARP or routing behavior. Secure Mode thus provides an incrementally attainable NGFW deployment requiring no logical and only minimal physical changes to existing network designs. Secure mode should be used when creating wire-mode pairs for VLAN translation.

Wire Modes: Functional Differences summarizes the key functional differences between modes of interface configuration:

Wire Modes: Functional Differences

Interface Configuration	Bypass Mode	Inspect Mode	Secure Mode
Application Control	No	No	Yes
Application Visibility	No	Yes	Yes
ARP/Routing/NAT[1]	No	No	No
Comprehensive Anti-Spam Service[2]	No	No	No
Content Filtering	No	No	Yes
DHCP Server[1]	No	No	No
DPI Detection	No	Yes	Yes
DPI Prevention	No	No	Yes
DPI-SSL[1]	No	No	Yes
High-Availability	Yes	Yes	Yes
Link-State Propagation[3]	Yes	Yes	Yes
Stateful Packet Inspection	No	Yes	Yes
TCP Handshake Enforcement[4]	No	No	No
Virtual Groups[1]	No	No	No
VLAN Translation[5]	No	No	Yes

1. **Link State Propagation** is a feature whereby interfaces in a Wire Mode pair mirror the link-state triggered by transitions of their partners. This is essential to proper operations in redundant path networks. Link State Propagation is not supported in Wire Mode over VLAN interfaces.
2. **Link State Propagation** is a feature whereby interfaces in a Wire Mode pair mirror the link-state triggered by transitions of their partners. This is essential to proper operations in redundant path networks. Link State Propagation is not supported in Wire Mode over VLAN interfaces.
3. **Link State Propagation** is a feature whereby interfaces in a Wire Mode pair mirror the link-state triggered by transitions of their partners. This is essential to proper operations in redundant path networks. Link State Propagation is not supported in Wire Mode over VLAN interfaces.
4. Disabled by design in Wire Mode to allow for failover events occurring elsewhere on the network to be supported when multiple Wire Mode paths, or when multiple Security Appliance units are in use along redundant or asymmetric paths.
5. VLAN Translation is not supported in Wire Mode over VLAN interfaces.

ⓘ **NOTE:** When operating in Wire Mode, the firewall’s dedicated Management interface is used for local management. To enable remote management and dynamic security services and application intelligence updates, a WAN interface (separate from the Wire Mode interfaces) must be configured for Internet connectivity. This is easily done given that SonicOS NS*v* supports interfaces in mixed-modes of almost any combination.

Configuring an Interface for Wire Mode

Wire Mode can be configured on WAN, LAN, DMZ, and custom zones. Wire Mode is configured as a pair of interfaces. In Wire Mode, the destination zone is the **Paired Interface Zone**. Access rules are applied to the Wire Mode pair based on the direction of traffic between the source **Zone** and its **Paired Interface Zone**. For example, if the source **Zone** is **WAN** and the **Paired Interface Zone** is **LAN**, then WAN to LAN and LAN to WAN rules are applied, depending on the direction of the traffic.

In Wire Mode, you can enable **Link State Propagation**, which propagates the link status of an interface to its paired interface. If an interface goes down, its paired interface is forced down to mirror the link status of the first interface. Both interfaces in a Wire Mode pair always have the same link status.

In Wire Mode, you can **Disable Stateful Inspection**. When **Disable Stateful Inspection** is selected, Stateful Packet Inspection is turned off. When **Disable Stateful Inspection** is *not* selected, new connections can be established without enforcing a 3-way TCP handshake. **Disable Stateful Inspection** must be selected if asymmetrical routes are deployed.

To configure an interface for Wire Mode:

1. Navigate to **MANAGE | System Setup | Network > Interfaces**,
2. Click the **Configure** icon for the interface you want to configure for Wire Mode. The **Edit Interface** dialog displays.
3. From **Zone**, select any zone type.
4. From **Mode / IP Assignment**, to configure the Interface for:
   - Wire Mode, select **Wire Mode (2-Port Wire)**.
5. From **Wire Mode Type**, select the appropriate mode:
   - **Bypass (via Internal Relay)**
   - **Inspect (Passive DPI of Mirrored Traffic)**
   - **Secure (Active DPI of Inline Traffic)**
6. From **Paired Interface**, select the interface that connects to the upstream Security Appliance. The paired interfaces must be of the same type (two 1 GB interfaces or two 10 GB interfaces).

   NOTE: Only unassigned interfaces are available from **Paired Interface**. To make an interface unassigned, click its **Configure**, and from **Zone**, select **Unassigned**.
7. Click **OK**.

Configuring Wire Mode for a WAN/LAN Zone Pair

The following configuration is an example of how Wire Mode can be configured. This example is for a WAN zone paired with a LAN zone. Wire Mode can also be configured for DMZ and custom zones.

To configure Wire Mode for a WAN/LAN Zone Pair:

1. Navigate to **MANAGE | System Setup | Network > Interfaces**.
2. Click one of these:
   - **Add Interface**.
   - **Configure** icon for the interface you want to configure.

   The **Add/Edit Interface** dialog displays.
3. From **IP Assignment**, select **Wire Mode (2-Port Wire**).
4. From **Zone**, select **WAN**.
5. From **Paired Interface Zone**, select **LAN**.
6. Select the **Disable Stateful Inspection** option.

7 Select the **Enable Link State Propagation** option.

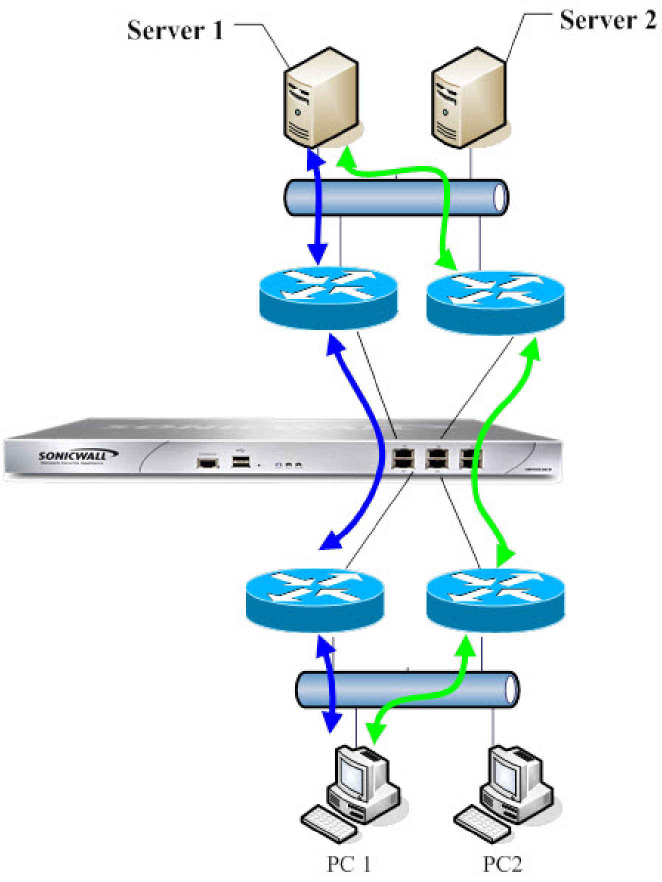
8 Click **OK**. The **Interface Settings** table is updated:

Asymmetric Routing

SonicOS NS*v* supports asymmetric routing. Asymmetric routing is when the flow of packets in one direction passes through a different interface than that used for the return path. This can occur when traffic flows across different layer 2 bridged pair interfaces on the Security Appliance or when it flows across different Security Appliances in a high availability cluster.

Any Security Appliance that performs deep packet inspection or stateful firewall activity must “see” all packets associated with a packet flow. This is in contrast to traditional IP routing in which each packet in a flow might technically be forwarded along a different path as long as it arrives at its intended destination — the intervening routers do not have to see every packet. Today’s routers do attempt to forward packets with a consistent next-hop for each packet flow, but this applies only to packets forwarded in one direction. Routers make no attempt to direct return traffic to the originating router. This IP routing behavior presents problems for a Security Appliance cluster that does not support asymmetric routing because the set of Cluster Nodes all provide a path to the same networks. Routers forwarding packets to networks through the cluster might choose any of the Cluster Nodes as the next-hop. The result is asymmetric routing, in which the flow of packets in one direction go through a node different than that used for the return path. This difference in flow causes traffic to be dropped by one or both Cluster Nodes as neither is “seeing” all of the traffic from the flow. See Asymmetric Routing.

Asymmetric Routing



Asymmetric Routing Traffic

In Asymmetric Routing, PC1 communicates with Server1, two-way traffic passes through different routers, that is, some packets of same connection go through blue path, some go through green path. On such deployment, the routers might run some redundancy route protocol or a load balancing protocol. For example, Cisco HSRP protocol.

SonicOS NS*v* uses stateful inspection. All connections passing through the Security Appliance are bound to interfaces. With support for asymmetric routing, however, SonicOS NS*v* tracks ingress and egress traffic, even when the flows go across different interfaces, and provides stateful, deep packet inspection.

NOTE: Asymmetric routing is not the same as one-way connections without reply, that is, TCP State Bypass.

Configuring Interfaces for IPv6

For a complete description of configuring IPv6 interfaces, see IPv6 Interface Configuration on page 665.

31-Bit Network

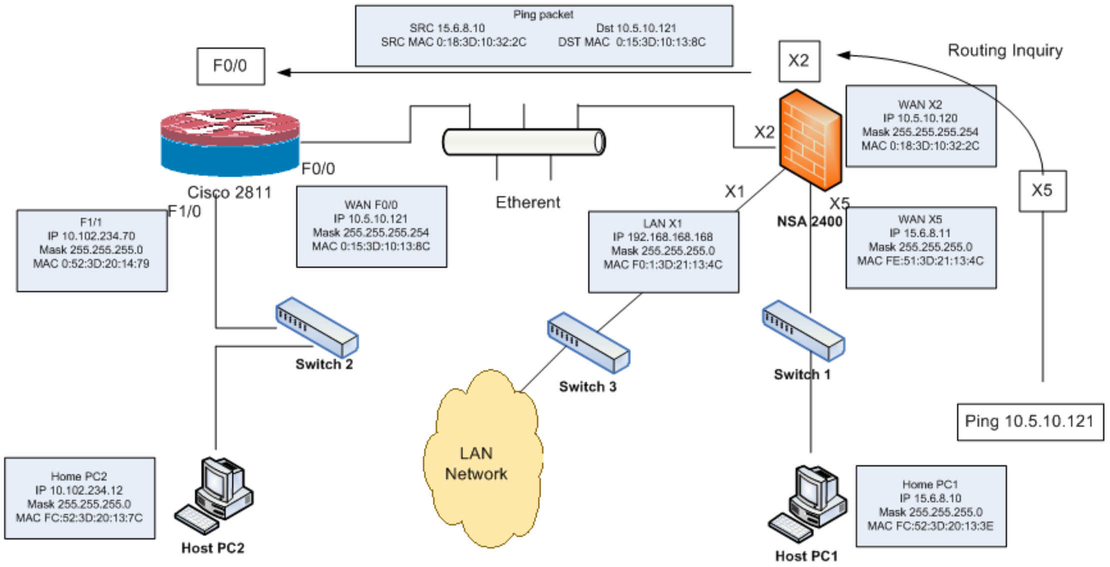
SonicOS NS*v* introduces support for RFC 3021, which defines the use of a 31-bit subnet mask. This mask allows only two host addresses in the subnet, with no network or gateway address and no broadcast address. Such a configuration can be used within a larger network to connect two hosts with a point-to-point link. The savings in address space resulting from this change is easily seen as each point-to-point link in a large network would consume two addresses instead of four.

In this context, the point-to-point link is not equivalent to PPP (point to point protocol). A point-to-point link using a 31-bit mask can use or not use the PPP protocol. 31-bit prefixed IPv4 addresses on a point-to-point link can also be used in the Ethernet network.

Topics:

- Example Network Environment on page 270
- Configuring SonicOS NS*v* on page 271

Example Network Environment



In this network environment, Host PC1 and Host PC2 can visit each other, while hosts in the LAN network can visit Host PC2.

To configure settings for this environment:

1. For Host PC1, add two route entries:
   - `Route add 10.5.10.0 mask 255.255.255.0  15.6.8.10`
   - `Route add 10.102.234.0 mask 255.255.255.0  15.6.8.10`
2. For Host PC2, add two route entries:
   - `Route add 10.5.10.0 mask 255.255.255.0  10.102.234.70`
   - `Route add 15.6.8.0 mask 255.255.255.0  10.102.234.70`
3. On the Cisco router (F0/0):
   - `interface fastEthernet 0/0`
   - `ip address 10.5.10.120 255.255.255.254`
4. On the Cisco 2811, add one route entry:

   ```
   !
   ip route 15.6.8.0 255.255.255.0 10.5.10.120
   !
   ```

5 On the firewall, add one route entry to enable the WAN zone data flow from X2 to X5, and X5 to X2:

```
Any    10.102.234.0    Any    X2 Default Gateway    X2
```

Configuring SonicOS NS*v*

To configure an interface for a 31-bit subnet:

1 Navigate to **MANAGE | System Setup | Network > Interfaces**.

2 Edit the desired interface.

3 Set the **Subnet Mask** to `255.255.255.254`.

4 Enter one host IP address into the **IP Address** field.

5 Enter the other host IP address into the **Default Gateway** field.

6 Set the other fields according to your network, as needed.

7 Click **OK**.

14

Setting Up Failover and Load Balancing

Topics:

Network > Failover & Load Balancing

Topics:

About Failover and Load Balancing

Failover and Load Balancing (LB) (together, FLB) is a mechanism that actively monitors WAN connections and acts accordingly on failure/recovery of the WAN interface(s). The overall effect is a system-wide response to failure/recovery of WAN connections. Even if you only have one WAN, you still benefit because of faster recovery procedures performed on that one WAN as normal part of FLB (for more information about FLB with one WAN, see Knowledge Base article, SW13851, *Can I disable global Load Balancing if only one WAN is used on the firewall?*). In essence, FLB provides a highly-available system.

For FLB, multiple WAN members are supported (*N*–1), where *N* is the total number of interfaces on a hardware platform). For example:

- Primary WAN Ethernet Interface
- Alternate WAN #1

- Alternate WAN #2
- Alternate WAN #<*n–1*> ...

> ⓘ **IMPORTANT:** It is recommended that Load Balancing be enabled at all times, even if there is only one WAN. For more information, see *Can I disable global Load Balancing if only one WAN is used on the firewall?* (SW13851).

The **Primary WAN Ethernet Interface** has the same meaning as the previous concept of "Primary WAN." It is the highest ranked WAN interface in the LB group. The **Alternate WAN #1** corresponds to "Secondary WAN," it has a lower rank than the Primary WAN, but a higher rank than the next two alternates. The others, **Alternate WAN #2** and **Alternate WAN #<*n–1*>**, are new, with **Alternate WAN #<*n–1*>** being the lowest ranked among the four WAN members of the LB group.

How Failover and Load Balancing Work

Topics:

WAN Interface Failure

This is what FLB does when a WAN interface failure had been detected (linkDown or probing-failure or no-IP-settings):

1. Graceful shutdown of the interface (call the stop API, if one is provided; for example, dialup-stop).
2. Trigger the disabling of routes associated with the failed interface (except for the ones marked `do not disable on link down`).
3. Flush the cache entries using the failed interface as the outbound interface.
4. Update the WAN default route to point to an alternate WAN, if available. Update status data (this is part of recovery procedure).
   - Address Objects used by other apps such as CASS gets updated as well.
   - Security Services depend on this for failover capability.
5. Notify interested parties (VPN, BWM, CASS, DDNS, DNS).
6. Actively monitor status of failed interface, attempt recovery such as restarting WAN connection (call the start API, if provided; for example, dial-start).

WAN Interface Recovery

This is what FLB does when a WAN interface recovery had been detected (linkUp or probing-success or IP-change):

1. On linkUp, jump-start the interface connection (call the start API, if provided; for example, dial-start). In most cases, this would be in a connected state already, but if it is not, FLB attempts to push it to start. It might do a graceful shutdown and restart if a hung condition is detected (timer-based).
2. When connectivity is confirmed (simple linkUp or probing), trigger enabling of routes associated with the interface.
3. Add ARP entries (if any are needed).

- Send out unsolicited ARP response (for interface) to update neighboring devices.

4 If needed, update the WAN default route (for example, preempt) to use the best available WAN. Update status data.

- Address Objects used by other apps such as CASS gets updated as well.
- Security Services depend on this for failover capability.

5 Notify interested parties (VPN, BWM, CASS, DDNS, DNS).

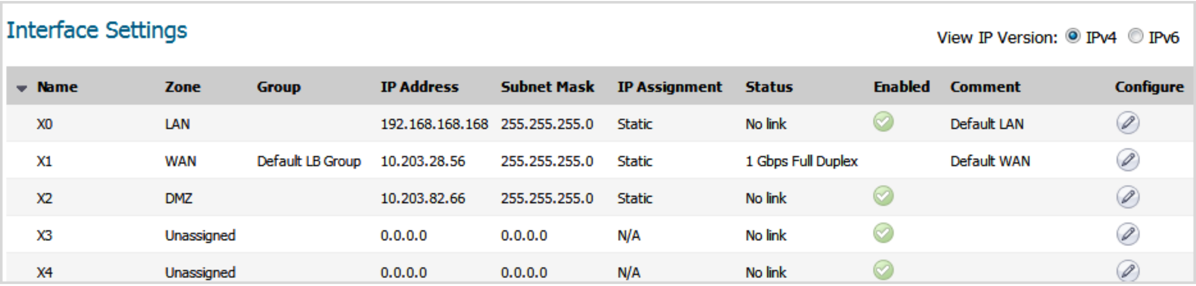
6 Continue monitoring status of interface.

Multiple WAN (MWAN)

The Multiple WAN (MWAN) feature allows you to configure all but one of the appliance's interfaces for WAN network routing (one interface must remain configured for the LAN zone for local administration). All of the WAN interfaces can be probed using the SNWL Global Responder host.

Network Interfaces

MANAGE | System Setup | Network > Interfaces allows more than two WAN interfaces to be configured for routing. It is possible to configure WAN interfaces in **MANAGE | System Setup | Network > Interfaces**, but not include them in **MANAGE | System Setup | Network > Failover & Load Balancing**. Only the Primary WAN Ethernet Interface is required to be part of the LB group whenever LB has been enabled. Any WAN interface that does not belong to the LB group is not included in the LB function, but performs normal WAN routing functions.



Interface Settings

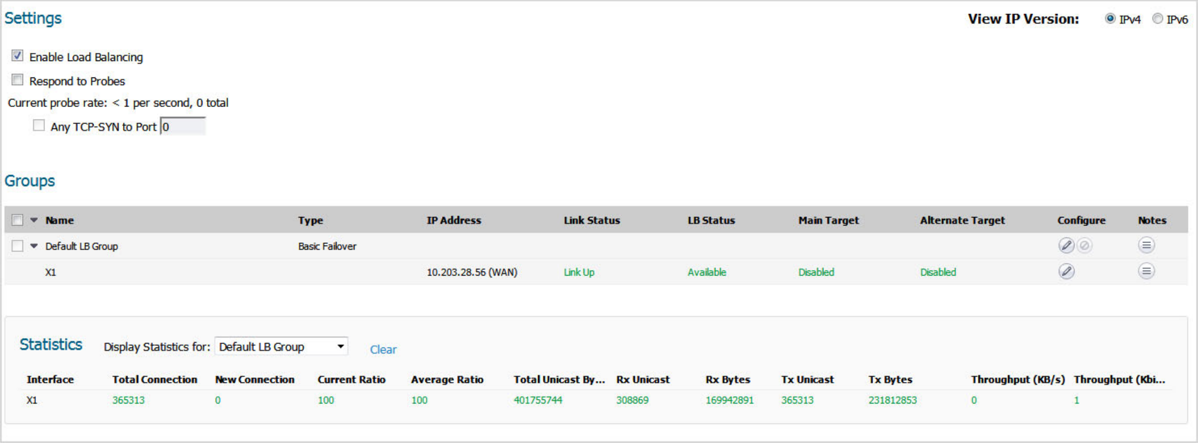
View IP Version: ● IPv4 ○ IPv6

Name	Zone	Group	IP Address	Subnet Mask	IP Assignment	Status	Enabled	Comment	Configure
X0	LAN		192.168.168.168	255.255.255.0	Static	No link	✓	Default LAN	✎
X1	WAN	Default LB Group	10.203.28.56	255.255.255.0	Static	1 Gbps Full Duplex		Default WAN	✎
X2	DMZ		10.203.82.66	255.255.255.0	Static	No link	✓		✎
X3	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X4	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎

NOTE: A virtual WAN interface might belong to the LB group. However, prior to using within the LB group, ensure that the virtual WAN network is fully routable like that of a physical WAN.

A default gateway IP is required on the WAN interface if any destination is required to be reached through the WAN interface that is not part of the WAN subnet IP address space, regardless whether a default route is received dynamically from a routing protocol of a peer device on the WAN subnet.

Network > Failover & Load Balancing



Settings

View IP Version: ● IPv4 ○ IPv6

☑ Enable Load Balancing

□ Respond to Probes

Current probe rate: < 1 per second, 0 total

□ Any TCP-SYN to Port 0

Groups

□ Name	Type	IP Address	Link Status	LB Status	Main Target	Alternate Target	Configure	Notes
□ Default LB Group	Basic Failover							
X1		10.203.28.56 (WAN)	Link Up	Available	Disabled	Disabled		

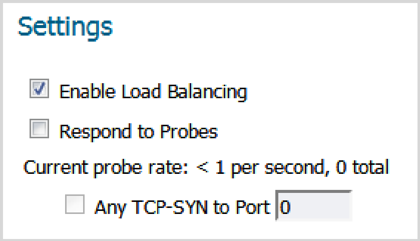
Statistics Display Statistics for: Default LB Group Clear

Interface	Total Connection	New Connection	Current Ratio	Average Ratio	Total Unicast By...	Rx Unicast	Rx Bytes	Tx Unicast	Tx Bytes	Throughput (KB/s)	Throughput (Kbi...
X1	365313	0	100	100	401755744	308869	169942891	365313	231812853	0	1

Topics:

- Settings on page 275
- Groups on page 276
- Statistics on page 277

Settings



Settings

☑ Enable Load Balancing

□ Respond to Probes

Current probe rate: < 1 per second, 0 total

□ Any TCP-SYN to Port 0

- **Enable Load Balancing**—This option must be enabled for the user to access the LB Groups and LB Statistics sections of the Failover & Load Balancing configuration. If disabled, no options for Failover & Load Balancing are available to be configured. This option is enabled by default.

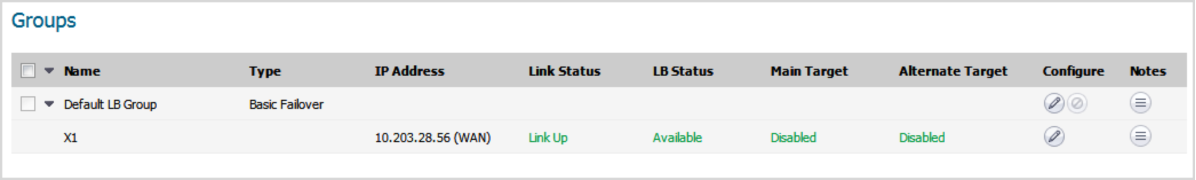
  > **IMPORTANT:** It is recommended that Load Balancing be enabled at all times, even if there is only one WAN. For more information, see *Can I disable global Load Balancing if only one WAN is used on the firewall?* (SW13851).

- **Respond to Probes**—When enabled, the appliance can reply to probe request packets that arrive on any of the appliance's interfaces. This option is not selected by default.

  The current probe rate and total number of probes are displayed.

  - **Any TCP-SYN to Port**—This option is available when the **Respond to Probes** option is enabled. When selected, the appliance only responds to TCP probe request packets having the same packet destination address TCP port number as the configured value. This option is not selected by default.

Groups



Groups

□	▾ Name	Type	IP Address	Link Status	LB Status	Main Target	Alternate Target	Configure	Notes
□	▾ Default LB Group	Basic Failover							
	X1		10.203.28.56 (WAN)	Link Up	Available	Disabled	Disabled		

LB Members added to a LB Group take on certain "roles." A member can only work in one of the following roles:

- **Primary**—Only one member can be the Primary per Group. This member always appears first or at the top of the member list.

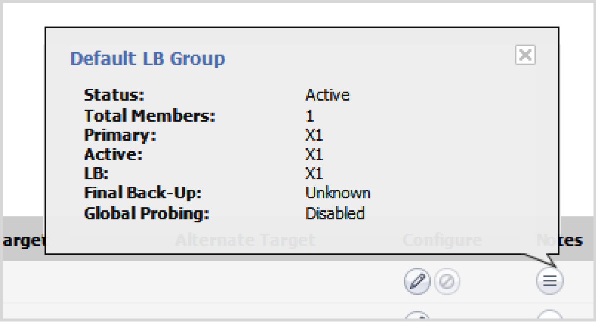
  > **NOTE:** Although a group can be configured with an empty member list, it is impossible to have members without a Primary.

- **Alternate**—More than one member can be an Alternate; however, it is not possible to have a Group of only Alternate members.
- **Last-Resort**—Only one member can be designed as Last-Resort. Last-Resort can only be configured with other group members.

Each member in a group has a rank. Members are displayed in descending order of rank. The rank is determined by the order of interfaces as they appear in the Member List for the group. The order is important in determining the usage preferences of the Interfaces, as well as the level of precedence within the group. Thus, no two interfaces within a group have the same or equal rank; each Interface has a distinct rank.

Groups Table

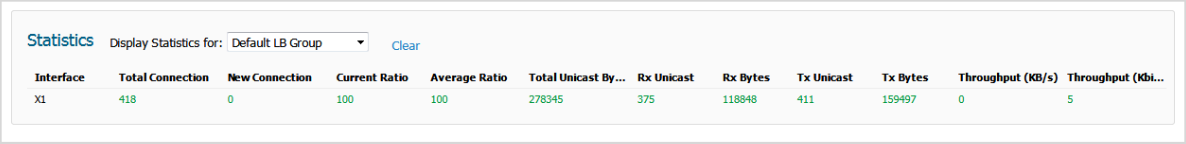
- **Expand/Collapse** icon – Click to expand or collapse the group to show the members.
- **Checkbox** – Used to select a group; the default group cannot be selected.
- **Type** – The type of failover; only for groups, not members.
- **IP Address** – The IP address of the group member.
- **Link Status** – Displays whether the link is Link Up or Link Down.
- **LB Status** – Displays the status of load balancing.
- **Main Target** – Displays whether probing is performed on the main target.
- **Alternate Target** – Displays whether probing is performed on the alternate target.
- **Configure** – Displays the **Edit** icon and, for groups, the **Delete** icon (the default group cannot be deleted, so the **Delete** icon is dimmed).
- **Notes** – Displays the **Notes** icon, which, when moused over, displays a popup balloon with status about the group.



Default LB Group

Status:	Active
Total Members:	1
Primary:	X1
Active:	X1
LB:	X1
Final Back-Up:	Unknown
Global Probing:	Disabled

Statistics



Statistics Display Statistics for: Default LB Group Clear

Interface	Total Connection	New Connection	Current Ratio	Average Ratio	Total Unicast By...	Rx Unicast	Rx Bytes	Tx Unicast	Tx Bytes	Throughput (KB/s)	Throughput (Kbi...
X1	418	0	100	100	278345	375	118848	411	159497	0	5

From the **Display Statistics for** drop-down menu, select the LB group for which you want to view statistics.

The Load Balancing **Statistics** table displays the following LB group statistics for the firewall:

- Interface –
- Total Connections –
- New Connection –
- Current Ratio –
- Average Ratio –
- Total Unicast Bytes –
- Rx Unicast –
- Rx Bytes –
- Tx Unicast –
- Tx Bytes –
- Throughput (KB/s) –
- Throughput (Kbits/s) –

Click **Clear** on the top right of the **Statistics** table to clear its information.

Configuring Failover and LB Groups

Topics:

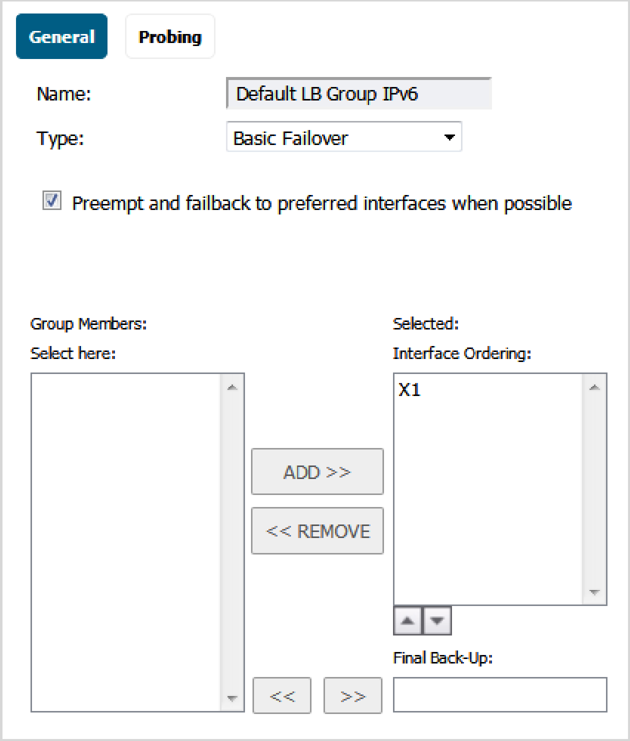
- General Settings on page 278
- Probing Settings on page 280

General Settings

To configure the Group settings:

1 Navigate to **MANAGE | System Setup | Network > Failover & Load Balancing**.

2 Click the **Configure** icon of the Group you wish to configure. The **Edit LB Group** dialog displays.



Name: Default LB Group IPv6

Type: Basic Failover

☑ Preempt and failback to preferred interfaces when possible

Group Members:

Select here:

Selected:

Interface Ordering: X1

Final Back-Up:

3 Edit the display name of the Group in the **Name** field. The name of the default group cannot be changed and the field is dimmed.

4 From the **Type** drop-down menu, choose the type (or method) of LB; options change depending on the type selected:

- **Basic Failover**—The four WAN interfaces use rank to determine the order of preemption when the **Preempt** checkbox has been enabled. Only a higher-ranked interface can preempt an Active WAN interface. This is selected by default.
- **Round Robin**—This option now allows you to re-order the WAN interfaces for Round Robin selection. The default order is:
    - Primary WAN
    - Alternate WAN #1
    - Alternate WAN #2
    - Alternate WAN #3

  The Round Robin then returns to the Primary WAN to continue the order.
- **Spill-over**—The bandwidth threshold applies to the Primary WAN. When the threshold is exceeded, new traffic flows are allocated to the Alternates in a Round Robin manner. If the

Primary WAN bandwidth goes below the configured threshold, Round Robin stops, and outbound new flows are again sent out only through the Primary WAN.

> ⓘ **NOTE:** Existing flows remain associated with the Alternates (as they are already cached) until they time out normally.

- **Ratio**—A percentages can be set for each WAN in the LB group. To avoid problems associated with configuration errors, ensure that the percentage corresponds correctly to the WAN interface it indicates.

5 Depending on what you selected from the **Type** drop-down menu, one of these options display:

Type selection	Option
Basic Failover	**Preempt and failback to preferred interfaces when possible** Select to enable rank to determine the order of preemption. Selected by default.
Spill-over	**When bandwidth exceeds *BandwidthLimit* Kbit/s on *PrimaryInterface*, new flows will go to the alternate group members in Round Robin manner** Specify the bandwidth for the Primary in the field. If this value is exceeded, new flows are then sent to alternate group members according to the order listed in the **Selected** column. The default value is **0**.
Round Robin, **Spill-over**, and **Ratio**	**Use Source and Destination IP Address binding** The option is especially useful when using HTTP/HTTPS redirection or in a similar situation. For example, connection A and connection B need to be on the same WAN interface, the source and destination IP addresses in Connection A are the same as those for connection B, but a different service is being used. In this case, source and destination IP address binding is required to keep both the connections on the same WAN interface so that the transactions do not fail. This option is not selected by default.

6 Add, delete, and order member interfaces in the **Group Members: Select here:/Selected** lists. The use of the selected members in the **Selected** list depends on the **Type** selected:

- **Basic Failover: Interface Ordering:**
- **Round Robin: Interface Pool:**
- **Spill-over: Primary/Alt. Pool:**
- **Ratio: Interface Distribution:**

7 Add members by selecting a displayed interface from the **Group Members:** column, and then clicking **Add>>**.

8 You can order the entries in the **Selected** column by:

a Selecting an entry.

b Clicking **Up/Down**.

9 If you selected **Ratio**, instead of ordering the entries, you can specify the ratio of bandwidth for each interface. See Configuring Bandwidth as a Ratio on page 280.

> ⓘ **IMPORTANT:** To avoid problems associated with configuration errors, ensure that the percentage corresponds correctly to the WAN interface it indicates.

10 Enter a percentage of bandwidth to be assigned to an interface in the percent (**%**) field. The total bandwidth for all interfaces should add up to 100 percent. The total percentage of bandwidth allocated is displayed.

11 You can modify the ratio by clicking **Modify Ratio** or have the ratios adjusted automatically by clicking **Auto Adjust**.

12 You can delete members from the **Selected** column by:

a Selecting the displayed interface.

b Clicking **<<Remove**.

ⓘ **NOTE:** The interface at the top of the list is the Primary.

The Interface Rank does not specify the operation performed on the individual member. The operation that is performed is specified by the Group Type.

13 Optionally, enter this setting:

- **Final Back-Up**—An entry in this setting is an interface of "last resort," that is, an interface that is used only when all other interfaces in the **Selected**: group are either unavailable or unusable. To specify a Final Back-Up interface, select an entry in the Group Members list, and then click the double right arrow. To remove a **Final Back-Up** interface, click the double left arrow.

14 Click **OK**.

Configuring Bandwidth as a Ratio

If **Ratio** is selected, **Add >>** is replaced by a percent **(%)** field and **Double Right Arrow** and **Up/Down Arrow** are replaced with **Auto Adjust**.

Enter a percentage of bandwidth to be assigned to the interface. The total percentage of bandwidth allocated is displayed.

ⓘ **IMPORTANT:** To avoid problems associated with configuration errors, ensure that the percentage corresponds correctly to the WAN interface it indicates.

If multiple interfaces are selected, you can either:

- Click **Auto Adjust** to distribute the bandwidth equally among the interfaces.
- Enter a percentage of bandwidth to be assigned to each interface.

To modify the bandwidth percentage for an interface:

1 Select the interface in the **Selected** column.

2 Click **Modify Ratio**.

3 Enter a new percentage in the percent **(%)** field.

4 Click **Modify Ratio** again. The percentage for the bandwidth and the total bandwidth allocated are updated.

Probing Settings

When Logical probing is enabled, test packets can be sent to remote probe targets to verify WAN path availability. A new option has been provided to allow probing through the additional WAN interfaces: Alternate WAN #3 and Alternate WAN #4.

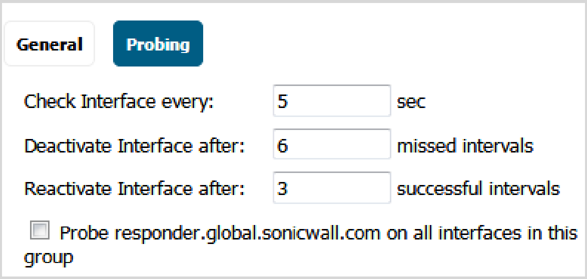
ⓘ **NOTE:** VLANs for alternate WANs do not support QoS or VPN termination.

To configure the probing options for a specific Group:

1 Navigate to **MANAGE | Network > Failover & Load Balancing**.

2 Click the **Configure** icon of the Group you wish to configure. The **Edit LB Group** dialog displays.

3 Click **Probing**.



Check Interface every: 5 sec

Deactivate Interface after: 6 missed intervals

Reactivate Interface after: 3 successful intervals

□ Probe responder.global.sonicwall.com on all interfaces in this group

4 Modify the following settings:

- **Check Interface every:** *n* **sec** —The interval of health checks in units of seconds. The default value is **5** seconds.
- **Deactivate Interface after:** *n* **missed intervals**—The number of failed health checks after which the interface sets to Failover. The default value is **6** seconds.
- **Reactivate Interface after:** *n* **successful intervals**—The number of successful health checks after which the interface sets to Available. The default value is **3** seconds.
- **Probe responder.global.SonicWall.com on all interfaces in this group**—Enable this checkbox to automatically set Logical/Probe Monitoring on all interfaces in the Group. When enabled, TCP probe packets are sent to the global SNWL host that responds to SNWL TCP packets, `responder.global.SonicWall.com`, using a target probe destination address of `204.212.170.23:50000`. When this checkbox is selected, the rest of the probe configuration enables built-in settings automatically. The same probe is applied to all four WAN Ethernet interfaces.

  ⓘ **NOTE:** The Dialup WAN probe setting also defaults to the built-in settings.

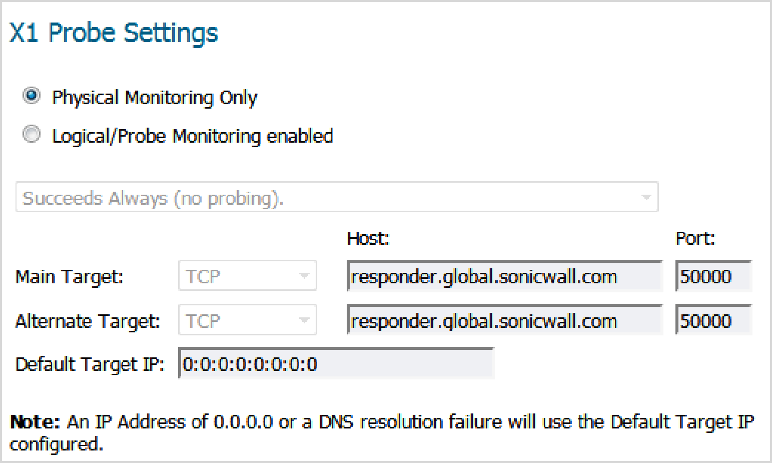
5 Click **OK**.

Configuring Probe Settings for Group Members

To configure the Group Member probe settings:

1 Navigate to **MANAGE | System Setup | Network > Failover & Load Balancing**.

2 Click the **Configure** icon of the Group member you wish to configure. The **Probe Settings** dialog displays.



X1 Probe Settings

● Physical Monitoring Only

○ Logical/Probe Monitoring enabled

Succeeds Always (no probing).

		Host:	Port:
Main Target:	TCP	responder.global.sonicwall.com	50000
Alternate Target:	TCP	responder.global.sonicwall.com	50000
Default Target IP:	0:0:0:0:0:0:0:0		

Note: An IP Address of 0.0.0.0 or a DNS resolution failure will use the Default Target IP configured.

3 Choose the type of probing to be done:

- **Physical Monitoring Only** (default; all other options are dimmed). Go to Step 9.
- **Logical/Probe Monitoring enabled** – all other options become available.

4 From **Logical/Probe Monitoring**, select when the probe succeeds:

- **Probe succeeds when either Main Target or Alternate Target responds.**
- **Probe succeeds when both Main Target and Alternate Target respond.**
- **Probe succeeds when Main Target responds.**
- **Succeeds Always (no probing)**. – Default; all other options are dimmed. Go to Step 9.

5 From **Main Target**, select:

- **Ping (ICMP)**
- **TCP** (default)

a In the **Main Target Host** field, enter the host name. The default is **responder.global.SonicWall.com**.

b In the **Main Target Port** field, enter the applicable port. The default is **50000**.

6 If Probe succeeds when Main Target Responds was selected, go to Step 8.

7 From the **Alternate Target** drop-down menu, select:

> ⓘ **NOTE:** The **Alternate Target** options are available only when **Probe succeeds when either Main Target or Alternate Target responds** or **Probe succeeds when both Main Target and Alternate Target respond** is selected for **Logical/Probe Monitoring** enabled.

- **Ping (ICMP)**
- **TCP** (default)

a In the **Alternate Target Host** field, enter the host name. The default is **responder.global.SonicWall.com**.

b In the **Alternate Target Port** field, enter the applicable port. The default is **50000**.

8 In the **Default Target IP** field, enter the IP address of the default target.

> ⓘ **NOTE:** This option is dimmed if S**ucceeds Always (no probing)** is selected for **Logical/Probe Monitoring enabled**.
>
> An IP Address of `0.0.0.0` or a DNS resolution failure uses the configured Default Target IP.

9 Click **OK**.

15

Configuring Network Zones

About Zones

A zone is a logical grouping of one or more interfaces designed to make management, such as the definition and application of Access Rules, a simpler and more intuitive process than following strict physical interface scheme. Zone-based security is a powerful and flexible method of managing both internal and external network segments, allowing the administrator to separate and protect critical internal network resources from unapproved access or attack.

A network security zone is simply a logical method of grouping one or more interfaces with friendly, user-configurable names, and applying security rules as traffic passes from one zone to another zone. Security zones provide an additional, more flexible, layer of security for the firewall. With the zone-based security, the administrator can group similar interfaces and apply the same policies to them, instead of having to write the same policy for each interface. For more information on configuring interfaces, see **Network > Interfaces** on page 246.

SonicOS NS*v* zones allows you to apply security policies to the inside of the network. This allows you to do this by organizing network resources to different zones, and allowing or restricting traffic between those zones. This way, access to critical internal resources, such as payroll servers or engineering code servers, can be strictly controlled.

Zones also allow full exposure of the NAT table to allow you control over the traffic across the interfaces by controlling the source and destination addresses as traffic crosses from one zone to another. This means that NAT can be applied internally, or across VPN tunnels, which is a feature that users have long requested. Firewalls can also drive VPN traffic through the NAT policy and zone policy, because VPNs are now logically grouped into their own VPN zone.

Topics:

How Zones Work

An easy way to visualize how security zones work is to imagine a large new building, with several rooms inside the building, and a group of new employees that do not know their way around the building. This building has one or more exits, which can be thought of as the WAN interfaces. The rooms within the building have one or more doors, which can be thought of as interfaces. These rooms can be thought of as zones inside each room are a number of people. The people are categorized and assigned to separate rooms within the building. People in each room going to another room or leaving the building, must talk to a door person on the way out of each room. This door person is the inter-zone/intra-zone security policy, and the door person's job to consult a list and make sure that the person is allowed to go to the other room, or to leave the building. If the person is allowed (for example, the security policy allows them in), they can leave the room through the door (the interface).

Upon entering the hallway, the person needs to consult with the hallway monitor to find out where the room is, or where the door out of the building is located. This hallway monitor provides the routing process because the monitor knows where all the rooms are located, and how to get in and out of the building. The monitor also knows the addresses of any of the remote offices, which can be considered the VPNs. If the building has more than one entrance/exit (WAN interfaces), the hallway monitor can direct people to use the secondary entrance/exit, depending upon how they have been told to do so (for example, only in an emergency, or to distribute the traffic in and out of the entrance/exits). This function can be thought of as WAN Load Balancing.

There are times that the rooms inside the building have more than one door, and times when there are groups of people in the room who are not familiar with one another. In this example, one group of people uses only one door, and another group uses the other door, even though groups are all in the same room. Because they also do not recognize each other, in order to speak with someone in another group, the users must ask the door person (the security policy) to point out which person in the other group is the one with whom they wish to speak. The door person has the option to not let one group of people talk to the other groups in the room. This is an example of when zones have more than one interface bound to them, and when intra-zone traffic is not allowed.

Sometimes, people want to visit remote offices, and people might arrive from remote offices to visit people in specific rooms in the building. These are the VPN tunnels. The hallway and doorway monitors check to see if this is allowed or not, and allow traffic through. The door person can also elect to force people to put on a costume before traveling to another room, or to exit, or to another remote office. This hides the true identity of the person, masquerading the person as someone else. This process can be thought of as the NAT policy.

Predefined Zones

The predefined zones on your firewall depend on the device. The predefined security zones on the SonicWall Security Appliance are not modifiable:

This zone	Has this function
DMZ	Normally used for publicly accessible servers and can consist of one to four interfaces, depending on your network design.
LAN	Cn consist of multiple interfaces, depending on your network design. Even though each interface has a different network subnet attached to it, when grouped together, they can be managed as a single entity.
MULTICAST	Provides support for IP multicasting, which is a method for sending IN packets from a single source simultaneously to multiple hosts.
SSLVPN	Used for secure remote access using the SonicWall NetExtender client.
VPN	A virtual zone used for simplifying secure, remote connectivity.
WAN:	Can consist of multiple interfaces. If you are using the Security Appliance's WAN failover capability, you need to add the second Internet interface to the WAN zone.

ⓘ **NOTE:** Even though you can group interfaces together into one security zone, this does not preclude you from addressing a single interface within the zone.

Security Types

Each zone has a security type, which defines the level of trust given to that zone:

Trusted	Provides the highest level of trust—meaning that the least amount of scrutiny is applied to traffic coming from trusted zones. Trusted security can be thought of as being on the LAN (protected) side of the Security Appliance. The LAN zone is always Trusted.
Encrypted	Used exclusively by the VPN and SSLVPN zones. All traffic to and from an Encrypted zone is encrypted.
Public	Offers a higher level of trust than an Untrusted zone, but a lower level of trust than a Trusted zone. Public zones can be thought of as being a secure area between the LAN (protected) side of the Security Appliance and the WAN (unprotected) side. The DMZ, for example, is a Public zone because traffic flows from it to both the LAN and the WAN. By default, traffic from DMZ to LAN is denied, but traffic from LAN to ANY is allowed. This means only LAN-initiated connections have traffic between DMZ and LAN. The DMZ only has default access to the WAN, not the LAN.
Untrusted	Represents the lowest level of trust. It is used by both the WAN and the virtual Multicast zone. An Untrusted zone can be thought of as being on the WAN (unprotected) side of the Security Appliance. By default, traffic from Untrusted zones is not permitted to enter any other zone type without explicit rules, but traffic from every other zone type is permitted to Untrusted zones.

Allow Interface Trust

The **Allow Interface Trust** setting in the **Add Zone** dialog automates the creation of Access Rules to allow traffic to flow between the interface of a zone instance. For example, if the LAN zone has both the **LAN** and **X3** interfaces assigned to it, checking **Allow Interface Trust** on the LAN zone creates the necessary Access Rules to allow hosts on these interfaces to communicate with each other.

Enabling SonicWall Security Services on Zones

You can enable SonicWall Security Services for traffic across zones. For example, you can enable SonicWall Intrusion Prevention Service for incoming and outgoing traffic on the zone to add more security for internal network traffic. You can enable these SonicWall Security Services on zones:

Enable Gateway Anti-Virus Service Enforces gateway anti-virus protection on multiple interfaces in the same Trusted and Public security types for zones.

Enable IPS Enforces intrusion detection and prevention on multiple interfaces in the same Trusted and Public security types for zones.

Enable App Control Service Enforces application control policy services on multiple interfaces in the same Trusted and Public security types for zones.

Enable Anti-Spyware Service Enforces anti-spyware detection and prevention on multiple interfaces in the same Trusted and Public security types for zones.

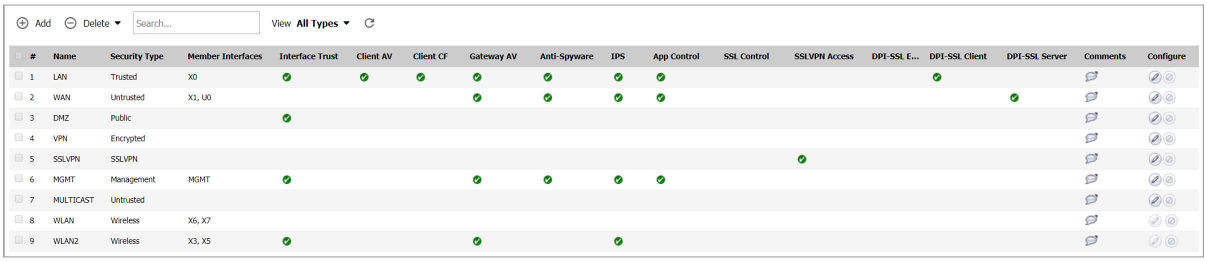
Enforce Global Security Clients Enforces Global Security Client (GSC) protection on multiple interfaces in the same Trusted and Public security types for zones.

Create Group VPN Creates a GroupVPN policy for the zone, which is displayed in the VPN Policies table on **MANAGE | Connectivity > VPN > Base Settings**. You can customize the GroupVPN policy on **VPN > Base Settings**. If you clear **Create Group VPN**, the GroupVPN policy is removed from **VPN > Base Settings**. For more information about creating VPN policies, see *SonicOS NSv 6.5 Connectivity*.

Enable SSL Control Enables SSL Control on the zone. All new SSL connections initiated from that zone are now subject to inspection. SSL Control must first be enabled globally on **MANAGE | Firewall Settings | SSL Control**. For more information about SSL Control, see *SonicOS NSv 6.5 Security Configuration*.

Enable SSLVPN Access Enables SSLVPN secure remote access on the zone.

Network > Zones



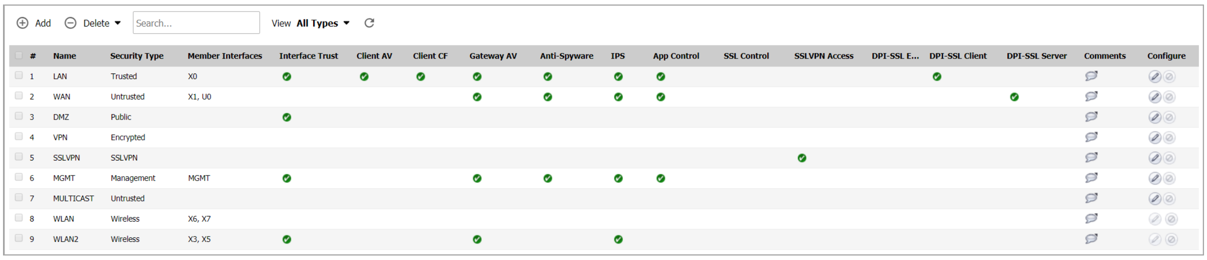
□	#	Name	Security Type	Member Interfaces	Interface Trust	Client AV	Client CF	Gateway AV	Anti-Spyware	IPS	App Control	SSL Control	SSLVPN Access	DPI-SSL E...	DPI-SSL Client	DPI-SSL Server	Comments	Configure
□	1	LAN	Trusted	X0	✓	✓	✓	✓	✓	✓	✓				✓		💬	✎ ⊘
□	2	WAN	Untrusted	X1, U0				✓	✓	✓	✓					✓	💬	✎ ⊘
□	3	DMZ	Public		✓												💬	✎ ⊘
□	4	VPN	Encrypted														💬	✎ ⊘
□	5	SSLVPN	SSLVPN										✓				💬	✎ ⊘
□	6	MGMT	Management	MGMT	✓			✓	✓	✓	✓						💬	✎ ⊘
□	7	MULTICAST	Untrusted														💬	✎ ⊘
□	8	WLAN	Wireless	X6, X7													💬	✎ ⊘
□	9	WLAN2	Wireless	X3, X5	✓			✓		✓							💬	✎ ⊘

- The Zone Settings Table on page 287
- Adding a New Zone on page 288
- Configuring a Zone for Guest Access on page 290
- Configuring a Zone for Open Authentication and Social Login on page 293
- Configuring a Zone for a Customized Policy Message on page 294
- Configuring a Zone for a Customized Login Page on page 295
- Configuring DPI-SSL Granular Control per Zone on page 296

- Enabling Automatic Redirection to the User-Policy Page on page 296
- Deleting a Zone on page 297

The Zone Settings Table

The **Zone Settings** table displays a listing of all the SonicWall Security Appliance’s default predefined zones as well as any zones you create. The table displays the following status information about each zone configuration:



#	Name	Security Type	Member Interfaces	Interface Trust	Client AV	Client CF	Gateway AV	Anti-Spyware	IPS	App Control	SSL Control	SSLVPN Access	DPI-SSL E...	DPI-SSL Client	DPI-SSL Server	Comments	Configure
1	LAN	Trusted	X0	✓	✓	✓	✓	✓	✓	✓				✓			
2	WAN	Untrusted	X1, U0				✓	✓	✓	✓					✓		
3	DMZ	Public		✓													
4	VPN	Encrypted															
5	SSLVPN	SSLVPN										✓					
6	MGMT	Management	MGMT	✓			✓	✓	✓	✓							
7	MULTICAST	Untrusted															
8	WLAN	Wireless	X6, X7														
9	WLAN2	Wireless	X3, X5	✓			✓		✓								

Name Name of the zone. The predefined **LAN**, **WAN**, **DMZ**, **VPN**, **SSLVPN**, **MULTICAST**, and **Encrypted** zone names cannot be changed.

Security Type Security type: **Trusted**, **Untrusted**, **Public**, **SSLVPN**, or **Encrypted**.

Member Interfaces Interfaces that are members of the zone.

Interface Trust Check mark indicates the **Allow Interface Trust** setting is enabled for the zone.

Client AV Check mark indicates SonicWall Client Anti-Virus is enabled for traffic coming in and going out of the zone. SonicWall Client Anti-Virus manages an anti-virus client application on all clients on the zone.

Client CF Check mark indicates Client Content Filtering services are enabled.

Gateway AV Check mark indicates SonicWall Gateway Anti-Virus is enabled for traffic coming in and going out of the zone. SonicWall Gateway Anti-Virus manages the anti-virus service on the firewall.

Anti-Spyware Check mark indicates SonicWall Anti-Spyware detection and prevention is enabled for traffic through interfaces in the zone.

IPS Check mark indicates SonicWall Intrusion Prevention Service is enabled for traffic coming in and going out of the zone.

App Control Check mark indicates App Control Service is enabled for traffic coming in and going out the zone.

SSL Control Check mark indicates SSL Control is enabled for traffic coming in and going out the zone. All new SSL connections initiated from that zone is now subject to inspection.

SSL VPN Access Check mark indicates SSL VPN secure remote access is enabled for traffic coming in and going out the zone.

DPI-SSL Enforcement Check mark indicates granular DPI-SSL enforcement on a per-zone basis rather than a global basis.

DPI-SSL Client Check mark indicates granular DPI-SSL on a per-zone basis rather than a global basis for DPI-SSL clients.

DPI-SSL Server Check mark indicates granular DPI-SSL on a per-zone basis rather than global basis for DPI-SSL servers.

Comments Mousing over the **Comment** icon displays the comment entered when the Zone was configured.

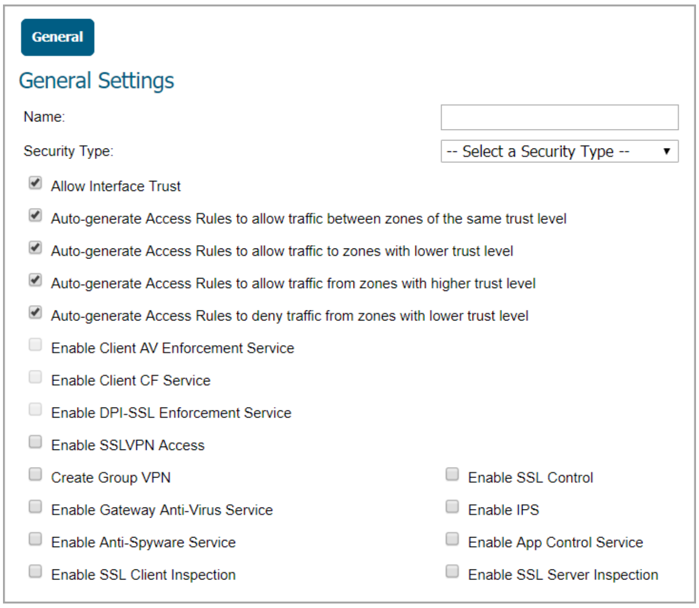
Configure Clicking the **Edit** icon displays the **Edit Zone** dialog. Clicking the **Delete** icon deletes the zone. The delete icon is dimmed for the predefined zones; you cannot delete these zones.

Adding a New Zone

To add a new zone:

1 Navigate to **MANAGE | System Setup > Network > Zones**.

2 Click the **Add** icon. The **Add Zone** dialog displays.



General

General Settings

Name:

Security Type: -- Select a Security Type --

☑ Allow Interface Trust

☑ Auto-generate Access Rules to allow traffic between zones of the same trust level

☑ Auto-generate Access Rules to allow traffic to zones with lower trust level

☑ Auto-generate Access Rules to allow traffic from zones with higher trust level

☑ Auto-generate Access Rules to deny traffic from zones with lower trust level

□ Enable Client AV Enforcement Service

□ Enable Client CF Service

□ Enable DPI-SSL Enforcement Service

□ Enable SSLVPN Access

□ Create Group VPN □ Enable SSL Control

□ Enable Gateway Anti-Virus Service □ Enable IPS

□ Enable Anti-Spyware Service □ Enable App Control Service

□ Enable SSL Client Inspection □ Enable SSL Server Inspection

3 Type a name for the new zone in the **Name** field.

4 From **Security Type**, select:

Trusted Zones with the highest level of trust, such as internal LAN segments.

Public Zones with a lower level of trust requirements, such as a DMZ interface.

SSLVPN Interfaces on which Content Filtering, Client AV enforcement, and Client CF services are enabled.

NOTE: Selecting this security type disables the **Enable SSLVPN Access** and **Create Group VPN** options on this dialog.

5 To allow intra-zone communications, select **Allow Interface Trust**. An Access Rule allowing traffic to flow between the interfaces of a Zone instance is created automatically. This option is selected by default.

6 To have SonicOS NS*v* automatically generate access rules to allow traffic between this zone and other zones of equal trust, select **Auto-generate Access Rules to allow traffic between zones of the same trust level**. For example, `CUSTOM_LAN -> CUSTOM _LAN` or `CUSTOM_LAN -> LAN`. This option is selected by default.

NOTE: For this option and the following Access Rules options, see *SonicOS NSv 6.5 Policies* for information about Access Rules.

7 To have SonicOS NSv automatically generate access rules to allow traffic between this zone and other zones of lower trust, select **Auto-generate Access Rules to allow traffic to zones with lower trust level**. For example, `CUSTOM_LAN -> WAN` or `CUSTOM_LAN -> DMZ`. This option is selected by default.

8 To have SonicOS NSv automatically generate access rules to allow traffic between this zone and other zones of higher trust, select **Auto-generate Access Rules to allow traffic from zones with higher trust level**. For example, `LAN -> CUSTOM_DMZ` or `CUSTOM_LAN -> CUSTOM_DMZ`. This option is selected by default.

9 To have SonicOS NSv automatically generate access rules to deny traffic between this zone and zones of lower trust, select **Auto-generate Access Rules to deny traffic from zones with lower trust level**. For example, `WAN -> CUSTOM_LAN` or `DMZ -> CUSTOM_LAN`. This option is selected by default.

10 To enforce managed Client Anti-Virus protection on clients connected to multiple interfaces in the same Trusted or Public zones using the Client Anti-Virus client on your network hosts, select **Enable Client AV Enforcement Service**. This option is not selected by default.

ⓘ **NOTE:** This option is dimmed and unavailable until you select a security type from **Security Type**.

ⓘ **NOTE:** For this option and the following Security Services options, see SonicOS NSv *6.5 Security Configuration* for more information about these services.

11 To enforce managed Client Content Filtering on clients connected to multiple interfaces in the same Trusted or Public zones using the Client CF client on your network hosts, select **Enable Client CF Service**. This option is not selected by default.

ⓘ **NOTE:** This option is dimmed and unavailable until you select a security type from **Security Type**.

12 To enforce enhanced NGAV (Next Generation AV) such as DPI-SSL Enforcement or SentinelOne AV enforcement, select **Enable DPI-SSL Enforcement Service**. This option is not selected by default. For more information about NGAV, see SonicOS NSv *6.5 Security Configuration*.

13 To enable SSLVPN secure remote access on the zone, select **Enable SSLVPN Access**. This option is not selected by default.

ⓘ **NOTE:** This option is dimmed if **SSLVPN** is selected for **Security Type**.

14 To create a SonicWall Group VPN Policy for this zone automatically, select **Create Group VPN**. You can customize the GroupVPN Policy in **MANAGE | Connectivity > VPN > Base Settings**. This option is not selected by default. This option is available UNTIL **SSLVPN** is selected for **Security Type**, but after the Security Type is changed to one of the other types, it remains dimmed and unavailable.

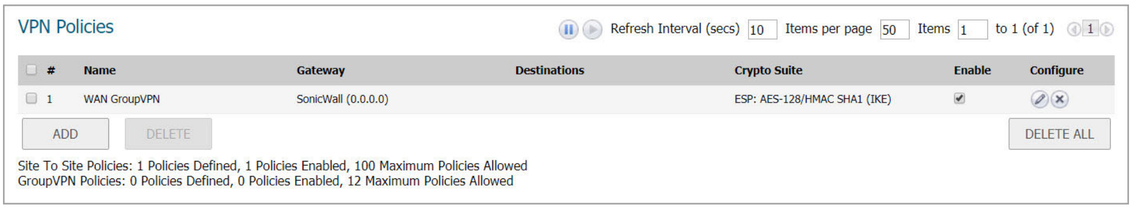
△ **CAUTION: Disabling Create Group VPN removes any corresponding Group VPN policy.**

ⓘ **NOTE:** This option is dimmed if **SSLVPN** is selected for **Security Type**.

For this and other connectivity options, see SonicOS NSv *6.5 Connectivity* for more information.

Disabling Group VPN for WAN VPN policies, deletes all VPN policies. Re-enabling the **Create Group VPN** option automatically creates a new, enabled VPN policy. Disabling VPN policies globally does not also delete auto-rules. If you do not want to VPN polices at all, globally disable VPN, and then delete all policies that correlate with VPN.

GroupVPN policies appear in the **VPN Policies** table located in **MANAGE | Connectivity | VPN > Base Settings**. WAN GroupVPN policies are disabled by default when the firewall is booted with the factory default.



Refresh Interval (secs) 10 Items per page 50 Items 1 to 1 (of 1)

☐	#	Name	Gateway	Destinations	Crypto Suite	Enable	Configure
☐	1	WAN GroupVPN	SonicWall (0.0.0.0)		ESP: AES-128/HMAC SHA1 (IKE)	☑	

Site To Site Policies: 1 Policies Defined, 1 Policies Enabled, 100 Maximum Policies Allowed
GroupVPN Policies: 0 Policies Defined, 0 Policies Enabled, 12 Maximum Policies Allowed

15 To enable SSL Control on the zone, select **Enable SSL Control**. All new SSL connections initiated from that zone are now subject to inspection. This option is not selected by default.

> **NOTE:** SSL Control must first be enabled globally on **MANAGE | Security Configuration > Firewall > SSL Control**.

16 To enforce gateway anti-virus protection on your Security Appliance for all clients connecting to this zone, select **Enable Gateway Anti-Virus Service**. SonicWall Gateway Anti-Virus manages the anti-virus service on the Security Appliance. This option is not selected by default.

17 To enforce intrusion detection and prevention on multiple interfaces in the same Trusted or Public zones. select **Enable IPS**. This option is not selected by default.

18 To enforce anti-spyware detection and prevention on multiple interfaces in the same Trusted or Public security type zones, select **Enable Anti-Spyware Service**. This option is not selected by default.

19 To enforce application control policy services on multiple interfaces in the same Trusted or Public security type for zones, select **Enable App Control Service**. This option is not selected by default. For more information about App Control, see SonicOS NS*v* *6.5 Policies*.

20 To enable granular DPI-SSL on a per-zone basis rather than globally for DPI-SSL clients, select **Enable SSL Client Inspection**. This option is not selected by default.

21 To enable granular DPI-SSL on a per-zone basis rather than globally for DPI-SSL servers, select **Enable SSL Server Inspection**. This option is not selected by default.

22 Click **OK**. The new zone is now added to the Security Appliance.

Configuring a Zone for Guest Access

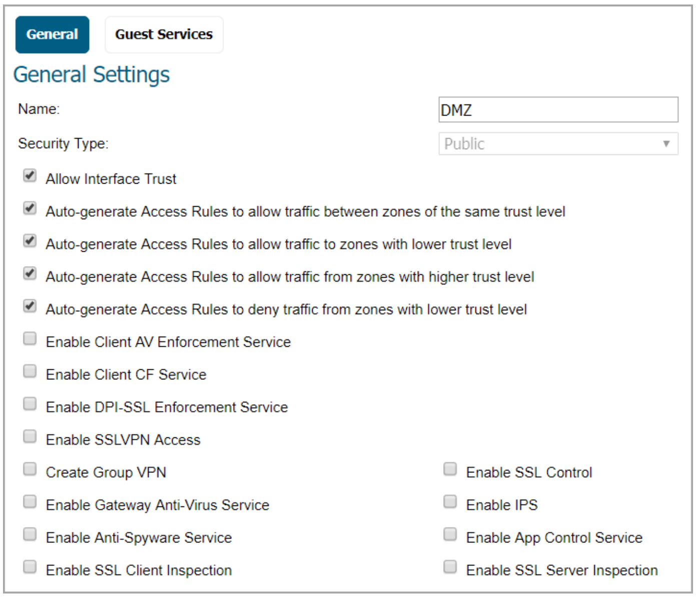
> **IMPORTANT:** You cannot configure an Untrusted, Encrypted, or SSLVPN zone for guest access.

SonicWall User Guest Services provides an easy solution for creating guest passes and/or locked-down Internet-only network access for visitors or untrusted network nodes. This functionality can be extended to users on the LAN, DMZ, or public/semi-public zones of your choice.

To configure Guest Services feature:

1 Navigate to **MANAGE | System Setup > Network > Zones**.

2 Click **Edit** for the zone you wish to add Guest Services to. The **Edit Zone** dialog displays.



General Settings

Name: DMZ

Security Type: Public

☑ Allow Interface Trust

☑ Auto-generate Access Rules to allow traffic between zones of the same trust level

☑ Auto-generate Access Rules to allow traffic to zones with lower trust level

☑ Auto-generate Access Rules to allow traffic from zones with higher trust level

☑ Auto-generate Access Rules to deny traffic from zones with lower trust level

□ Enable Client AV Enforcement Service

□ Enable Client CF Service

□ Enable DPI-SSL Enforcement Service

□ Enable SSLVPN Access

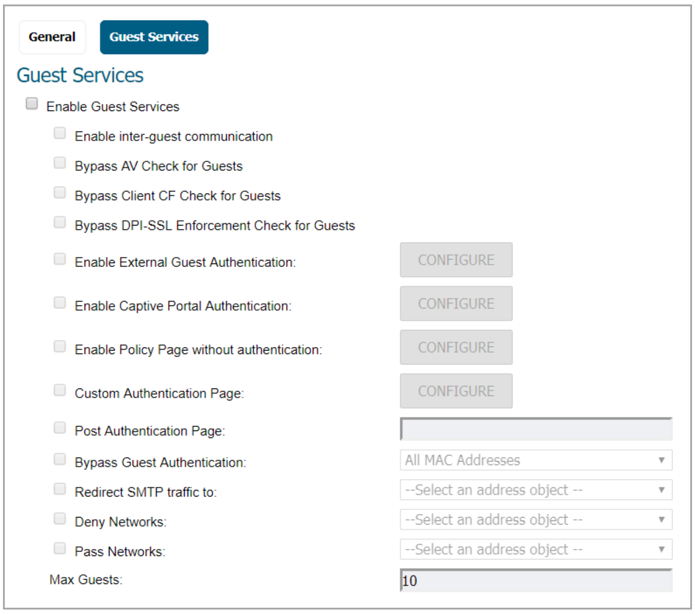
□ Create Group VPN □ Enable SSL Control

□ Enable Gateway Anti-Virus Service □ Enable IPS

□ Enable Anti-Spyware Service □ Enable App Control Service

□ Enable SSL Client Inspection □ Enable SSL Server Inspection

3 Click **Guest Services**. Only the **Enable Guest Services** option is available.



Guest Services

□ Enable Guest Services

□ Enable inter-guest communication

□ Bypass AV Check for Guests

□ Bypass Client CF Check for Guests

□ Bypass DPI-SSL Enforcement Check for Guests

□ Enable External Guest Authentication:

□ Enable Captive Portal Authentication:

□ Enable Policy Page without authentication:

□ Custom Authentication Page:

□ Post Authentication Page:

□ Bypass Guest Authentication: All MAC Addresses

□ Redirect SMTP traffic to: --Select an address object --

□ Deny Networks: --Select an address object --

□ Pass Networks: --Select an address object --

Max Guests: 10

4 Click **Enable Guest Services**. All other options become available, but are not selected by default.

5 Select from the following configuration options for Guest Services:

Enable inter-guest communication	Allows guests to communicate directly with other users who are connected to this zone.
Bypass AV Check for Guests	Allows guest traffic to bypass Anti-Virus protection.
Bypass Client CF Check for Guests	Allows guest traffic to bypass Client CF enforcement.
Bypass DPI-SSL Enforcement Check for Guests	Allows guest traffic to bypass DPI-SSL enforcement.

Enable External Guest Authentication

Requires guests connecting from the device or network you select to authenticate before gaining access. Selecting this option makes **CONFIGURE** available. Clicking **CONFIGURE** displays the **External Guest Authentication** dialog. For information about configuring this option, see Configuring Social Login in SonicOS NS*v* on page 530.

NOTE: When this option is selected, the following three options become dimmed and unavailable.

Enable Policy Page without authentication

Guest users are authenticated by accepting the policy instead of providing a user name and password. Selecting this option makes **CONFIGURE** available. To set up an HTML customizable policy usage page, click **CONFIGURE**. The **Customize Policy Message** dialog displays. For information about configuring this option, see Configuring a Zone for a Customized Policy Message on page 294.

Custom Authentication Page

Redirects users to a custom authentication page when they first connect to the network. Selecting this option makes **CONFIGURE** available. To set up the custom authentication page, click **CONFIGURE** to display the **Customize Login Page** dialog. For information about configuring this option, see Configuring a Zone for a Customized Login Page on page 295.

Post Authentication Page

Directs users to the specified page immediately after successful authentication. Selecting this option makes its field available. Enter a URL for the post-authentication page in the field.

Bypass Guest Authentication

Allows the Guest Services feature to integrate into environments already using some form of user-level authentication. This feature automates the authentication process. When selected, this option’s drop-down menu becomes available; select:

- **All MAC Addresses** (default)
- An Address Object
- An Address Group
- **Create new MAC object** – Displays the **Add Address Object** dialog.[1]

NOTE: This feature should only be used when unrestricted Guest Service access is desired, or when another device upstream is enforcing authentication.

Redirect SMTP traffic to

Redirects SMTP traffic incoming on this zone to an SMTP server you specify. When selected, this option’s drop-down menu becomes available; select:

- An Address Object
- **Create new address object** – Displays the **Add Address Object** dialog.[1]

Deny Networks

Blocks traffic to the networks you name. When selected, this option’s drop-down menu becomes available; select:

- An Address Object
- An Address Object group
- **Create new address object**[1]
- **Create new address object group**[1]

Pass Networks	Allows traffic through the Guest Service-enabled zone to the selected networks automatically. When selected, this option's drop-down menu becomes available; select: • An Address Object • An Address Object group • **Create new address object**[1] • **Create new address object group**[1] **NOTE:** Displays the **Add Address Object** dialog.
Max Guests	Specifies the maximum number of guest users allowed to connect to this zone. The minimum number is 1, the maximum number is 4500, and the default setting is **10**.

[1] For information about creating Address Objects and Address Object Groups, see SonicOS NS*v* *Policies*.

6 Click **OK** to apply these settings to this zone.

Configuring a Zone for Open Authentication and Social Login

SonicOS NS*v* supports Open Authentication (OAuth) and Social Login:

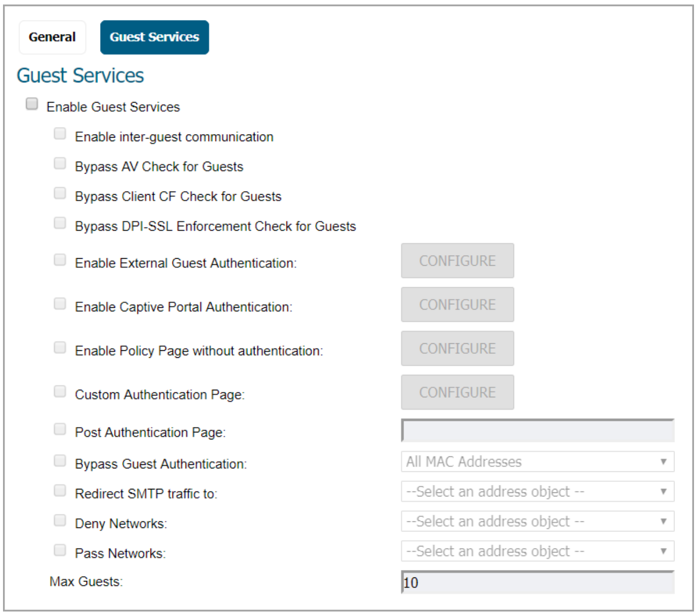
- Oauth assists users in sharing data between applications
- Social Login simplifies the login process for various social media

To use these features, you create a zone, as described in the Configuring Open Authentication, Social Login, and LHM on page 523.

Configuring a Zone for a Customized Policy Message

To configure a customized policy message:

1 On the **Add/Edit Zone** dialog, click **Guest Services**.



General | Guest Services

Guest Services

□ Enable Guest Services

□ Enable inter-guest communication

□ Bypass AV Check for Guests

□ Bypass Client CF Check for Guests

□ Bypass DPI-SSL Enforcement Check for Guests

□ Enable External Guest Authentication: CONFIGURE

□ Enable Captive Portal Authentication: CONFIGURE

□ Enable Policy Page without authentication: CONFIGURE

□ Custom Authentication Page: CONFIGURE

□ Post Authentication Page:

□ Bypass Guest Authentication: All MAC Addresses

□ Redirect SMTP traffic to: --Select an address object --

□ Deny Networks: --Select an address object --

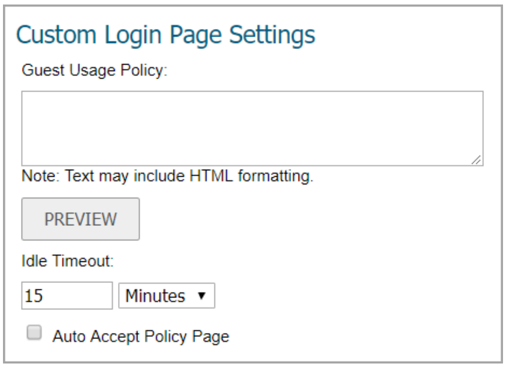
□ Pass Networks: --Select an address object --

Max Guests: 10

2 Select **Enable Guest Services**. The options become available.

3 Select **Enable Policy Page without authentication**. **CONFIGURE** becomes available.

4 Click **CONFIGURE**. The **Customize Login Page** dialog displays.



Custom Login Page Settings

Guest Usage Policy:

Note: Text may include HTML formatting.

PREVIEW

Idle Timeout:

15 Minutes

□ Auto Accept Policy Page

5 Enter your policy for guest usage in the **Guest Usage Policy** field. The text might include HTML formatting.

6 To preview your policy message, click **PREVIEW**.

7 To specify an idle timeout, enter the timeout value in the **Idle Timeout** field.

8 Select the type of timeout:

- **Seconds**
- **Minutes** (default)
- **Hours**

- **Days**

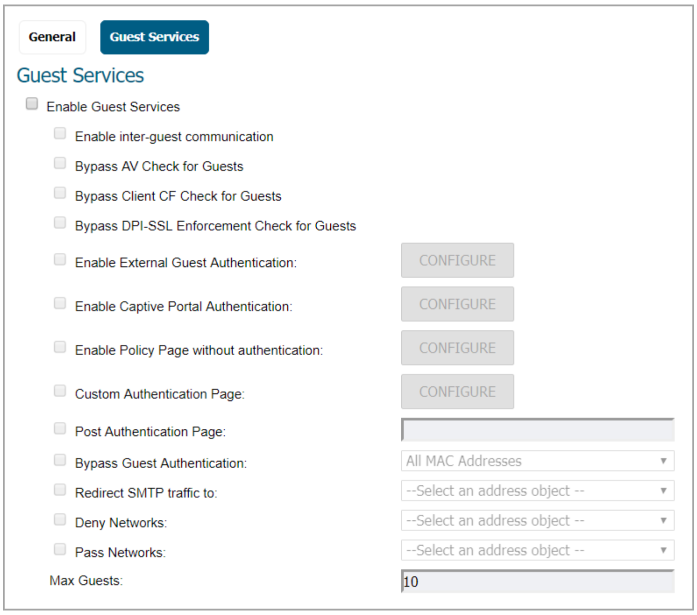
9 Select **Auto Accept Policy Page**. This option is not selected by default.

10 Click **OK**.

Configuring a Zone for a Customized Login Page

To configure a customized login page:

1 On the **Add/Edit Zone** dialog, click **Guest Services**.



Guest Services

☐ Enable Guest Services

☐ Enable inter-guest communication

☐ Bypass AV Check for Guests

☐ Bypass Client CF Check for Guests

☐ Bypass DPI-SSL Enforcement Check for Guests

☐ Enable External Guest Authentication: CONFIGURE

☐ Enable Captive Portal Authentication: CONFIGURE

☐ Enable Policy Page without authentication: CONFIGURE

☐ Custom Authentication Page: CONFIGURE

☐ Post Authentication Page:

☐ Bypass Guest Authentication: All MAC Addresses

☐ Redirect SMTP traffic to: --Select an address object --

☐ Deny Networks: --Select an address object --

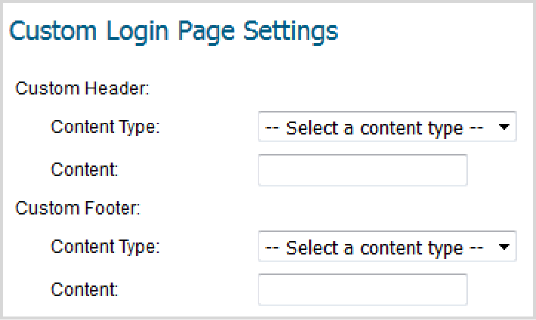
☐ Pass Networks: --Select an address object --

Max Guests: 10

2 Select **Enable Guest Services**. The options become available.

3 Select **Custom Authentication Page**. **CONFIGURE** becomes available.

4 Click **CONFIGURE**. The **Customize Login Page** dialog displays.



Custom Login Page Settings

Custom Header:

Content Type: -- Select a content type --

Content:

Custom Footer:

Content Type: -- Select a content type --

Content:

5 For **Custom Header**, select from **Content Type**:

- **URL**
- **Text**

6 Enter the URL or text in the **Content** field.

7 For **Custom Footer**, select from **Content Type**:

- **URL**

- **Text**

8 Enter the URL or text in the **Content** field.

9 Click **OK**.

Configuring DPI-SSL Granular Control per Zone

DPI-SSL granular control allows you to enable DPI-SSL on a per-zone basis rather than globally. You can enable both DPI-SSL Client and DPI-SSL Server per zone. For further information, see *SonicOS NSv 6.5 Security Configuration*.

Enabling Automatic Redirection to the User-Policy Page

SonicOS NSv allows you to redirect a guest automatically to your guest-user policy page. If you enable this feature, also known as the zero-touch policy page redirection, the guest user is redirected automatically to your guest-user policy page. If you disable the feature, the guest must click **ACCEPT**.

To enable automatic redirection to the user-policy page:

1 Navigate to **MANAGE | System Setup > Network > Zones**.

2 Click either the:

- **Add** icon to add a new zone.
- **Edit** icon of an existing zone.

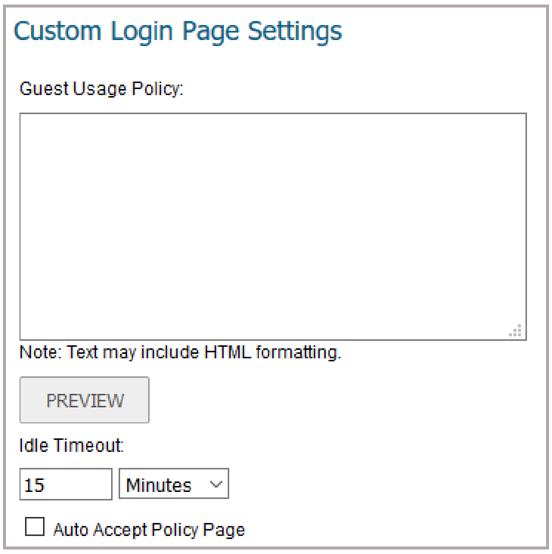
The **Add Zone/Edit Zone** dialog displays.

3 Click **Guest Services**.

4 Click **Enable Guest Services**.

5 Click **Enable Policy Page without authentication**.

6 Click **CONFIGURE**. The **Custom Policy Message** dialog displays.



Custom Login Page Settings

Guest Usage Policy:

Note: Text may include HTML formatting.

Idle Timeout: 15 Minutes

□ Auto Accept Policy Page

7 Select **Auto Accept Policy Page**. This option is not selected by default.

8 Click **OK**.

9 Finish configuring the zone.

10 Click **OK**.

Deleting a Zone

To delete a user-created zone:

1 Navigate to **MANAGE | System Setup | Network > Zones**.

> ⓘ **NOTE:** The **Delete** icon is unavailable for predefined zones. You cannot delete these zones. Any zones that you create can be deleted.

2 Clicking the **Delete** icon in the zone's **Configure** column.

To delete one or more user-created zones:

1 Navigate to **MANAGE | System Setup | Network > Zones**.

> ⓘ **NOTE:** The checkboxes are unavailable for predefined zones. You cannot delete these zones. Any zones that you create can be deleted.

2 Select the zones to delete.

3 From **Delete**, select which zones to delete:

- **Delete Selected**
- **Delete All**

16

Configuring Wire Mode VLAN Translation

Topics:

- **Network > VLAN Translation** on page 298
  - About VLAN Translation on page 298
  - Creating and Managing VLAN Maps on page 300

Network > VLAN Translation

ⓘ **NOTE:** VLAN Translation is available on all platforms that support Wire Mode.

ⓘ **NOTE:** VLAN Translation and Wire Mode over VLAN interfaces cannot be enabled at the same time.

- About VLAN Translation on page 298
- Creating and Managing VLAN Maps on page 300

About VLAN Translation

The VLAN Translation (mapping) feature allows traffic arriving on a VLAN to a Wire Mode interface operating in Secure mode to be mapped to a different VLAN on the outgoing paired interface. Re-routing some of the traffic coming into the SonicWall Security Appliance onto different VLANS allows you to perform further analysis, processing, or merely remapping traffic. This feature is supported on all Wire Mode-capable devices.

An advantage of Wire Mode, that is, you can pre-provision the VLAN mapping. This allows you to have the mapping in place before the interface receives traffic. You also can add and delete mapping on an active Wire Mode interface.

Topics:

- Mapping Modes on page 298
- Mapping Persistence on page 299
- Map Multiple Interface Pairs on page 299

Mapping Modes

You can create a VLAN mapping in these modes:

- Unidirectional mapping – For example, use to:
  - Secure printing from a less-secure network to a high-secure network

    - Transfer application and operating system updates from a less-secure network to a high-secure network
    - Monitor multiple networks in a SOC (security operations center)
    - Provide time synchronization in high-secure networks
    - Transfer files
    - Provide a “you have mail” alert to a high-secure network from a less-secure network
- Bidirectional mapping – For example, use to setup a two-way connection to and from devices through the Security Appliance, for example, TCP.

Mapping Persistence

The VLAN map created for a pair of interfaces is persistent over reload and is stored as part of the configuration. If the wire-mode pair (secure mode) have mapping associated with them, the wire mode cannot be changed unless the mapping policy is deleted.

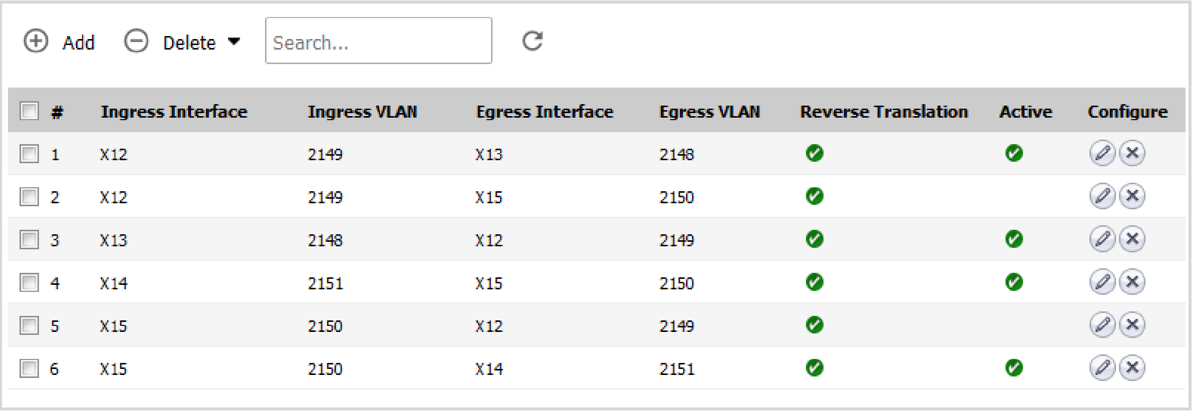
Map Multiple Interface Pairs

You can create VLAN mapping for multiple pairs of interfaces at the same time. These interfaces must form part of an existing Secure Wire Mode pair at the time of the VLAN mapping creation. You can also create mappings for an interface with multiple interfaces, but only the mappings for the current active Wire Mode pair are in use at any given time.

If the paired interface is changed, the message, `Cannot change wire-mode pair interface when WireMode VLAN entries exist for the interface`, displays.

Example

Multiple interface pairs mapping



□ #	Ingress Interface	Ingress VLAN	Egress Interface	Egress VLAN	Reverse Translation	Active	Configure
□ 1	X12	2149	X13	2148	✓	✓	✎ ✖
□ 2	X12	2149	X15	2150	✓		✎ ✖
□ 3	X13	2148	X12	2149	✓	✓	✎ ✖
□ 4	X14	2151	X15	2150	✓	✓	✎ ✖
□ 5	X15	2150	X12	2149	✓		✎ ✖
□ 6	X15	2150	X14	2151	✓	✓	✎ ✖

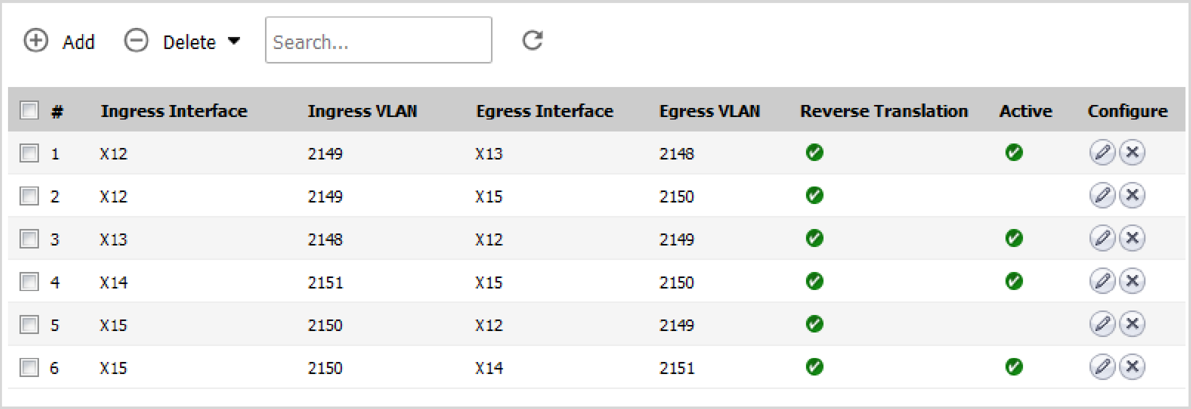
In Multiple interface pairs mapping, a mapping exists for X12 to X13 (policy 1) as well as X12 to X15 (policy 2).

As only X12 and X13 (policies 1 and 3) and X14 and X15 (policies 4 and 6) are currently forming a Wire Mode pair, only policies 1, 3, 4, and 6 are active as indicated by the green checkmark in the active column.

ⓘ **NOTE:** The wire-mode pair interfaces cannot change if Wire Mode VLAN entries exist for the interface.

Creating and Managing VLAN Maps

Network > VLAN Translation allows you to create and manage the VLAN mapping of interfaces.



□	#	Ingress Interface	Ingress VLAN	Egress Interface	Egress VLAN	Reverse Translation	Active	Configure
□	1	X12	2149	X13	2148	✓	✓	✎ ⊗
□	2	X12	2149	X15	2150	✓		✎ ⊗
□	3	X13	2148	X12	2149	✓	✓	✎ ⊗
□	4	X14	2151	X15	2150	✓	✓	✎ ⊗
□	5	X15	2150	X12	2149	✓		✎ ⊗
□	6	X15	2150	X14	2151	✓	✓	✎ ⊗

Add icon — Displays the **Add VLAN Translation** dialog.

Delete icon — Displays the **Delete** drop-down menu:

- **Delete Selected**
- **Delete All**

Search field — Allows you to display only those VLAN translations of interest.

Refresh icon — Refreshes the VLAN Translation table.

Policy number and checkbox — Number of the policy and its associated checkbox.

Ingress Interface — Name of the incoming interface.

Ingress VLAN — VLAN tag of the incoming interface.

Egress Interface — Name of the interface to which traffic is mapped.

Egress VLAN — VLAN tag of the interface to which traffic is mapped.

Reverse Translation — Indicates whether the mapping is unidirectional or bidirectional:

- **Disabled** – Unidirectional; column blank.
- **Enabled** – Bidirectional; green checkmark.

Active — Status of the mapped pair:

- **Active** – The Wire Mode pair is mapped and active; green checkmark.
- **Inactive** – The Wire Mode pair is mapped but not active (pre-provisioned); column blank.

Configure — Displays **Edit** and **Delete** icons for a mapped pair.

Topics:

- Creating a VLAN Map on page 300
- Managing VLAN Mappings on page 304

Creating a VLAN Map

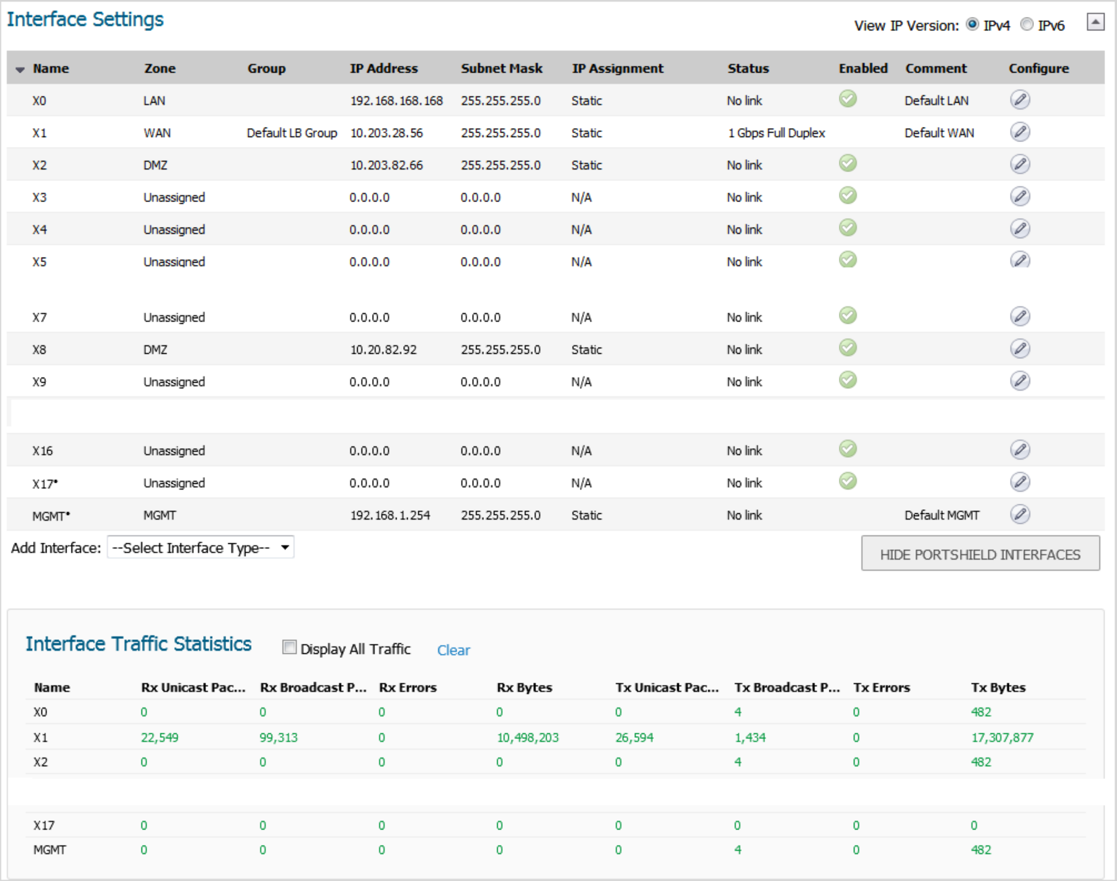
You can create a unidirectional VLAN map before or after a Wire Mode pair. Creating a VLAN map is a two-step process:

1. Creating a Wire Mode Pair in Secure Mode on page 301
2. Creating the VLAN Mapping on page 303

Creating a Wire Mode Pair in Secure Mode

To create a Wire Mode pair in secure mode:

1 Navigate to **MANAGE | System Setup | Network > Interfaces**.



Interface Settings

View IP Version: ● IPv4 ○ IPv6

Name	Zone	Group	IP Address	Subnet Mask	IP Assignment	Status	Enabled	Comment	Configure
X0	LAN		192.168.168.168	255.255.255.0	Static	No link	✓	Default LAN	✎
X1	WAN	Default LB Group	10.203.28.56	255.255.255.0	Static	1 Gbps Full Duplex		Default WAN	✎
X2	DMZ		10.203.82.66	255.255.255.0	Static	No link	✓		✎
X3	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X4	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X5	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X7	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X8	DMZ		10.20.82.92	255.255.255.0	Static	No link	✓		✎
X9	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X16	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X17*	Unassigned		0.0.0.0	0.0.0.0	N/A	No link	✓		✎
MGMT*	MGMT		192.168.1.254	255.255.255.0	Static	No link		Default MGMT	✎

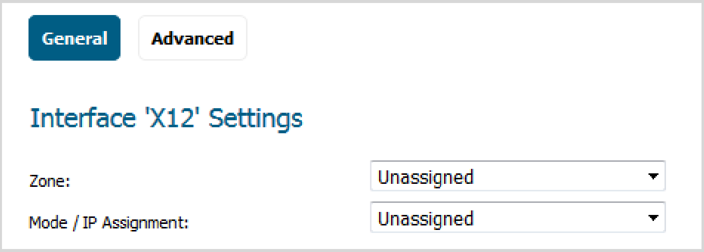
Add Interface: --Select Interface Type--

Interface Traffic Statistics

□ Display All Traffic

Name	Rx Unicast Pac...	Rx Broadcast P...	Rx Errors	Rx Bytes	Tx Unicast Pac...	Tx Broadcast P...	Tx Errors	Tx Bytes
X0	0	0	0	0	0	4	0	482
X1	22,549	99,313	0	10,498,203	26,594	1,434	0	17,307,877
X2	0	0	0	0	0	4	0	482
X17	0	0	0	0	0	0	0	0
MGMT	0	0	0	0	0	4	0	482

2 Click the **Edit** icon for the interface to be part of the Wire Mode pair. The **Edit Interface** dialog displays.

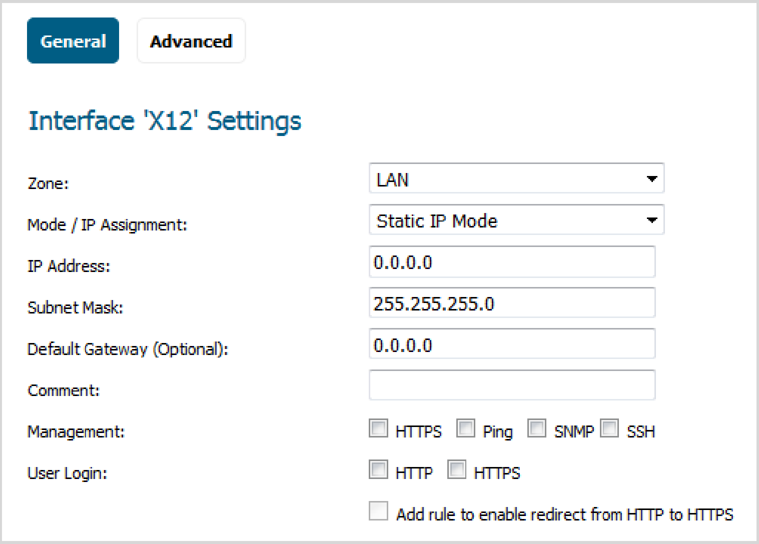


Interface 'X12' Settings

Zone: Unassigned

Mode / IP Assignment: Unassigned

3 Select the zone for the Wire Mode pair from **Zone**. The options change.



Interface 'X12' Settings

Zone: LAN

Mode / IP Assignment: Static IP Mode

IP Address: 0.0.0.0

Subnet Mask: 255.255.255.0

Default Gateway (Optional): 0.0.0.0

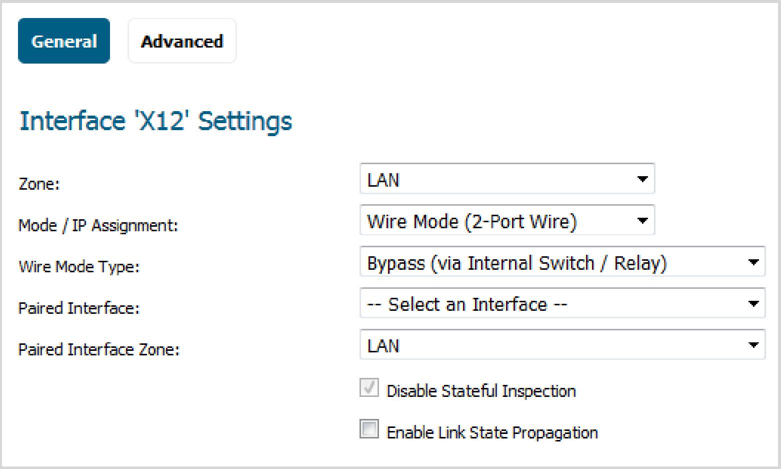
Comment:

Management: □ HTTPS □ Ping □ SNMP □ SSH

User Login: □ HTTP □ HTTPS

□ Add rule to enable redirect from HTTP to HTTPS

4 Select **Wire Mode (2-Port Wire)** from **Mode / IP Assignment**. The options change again.



Interface 'X12' Settings

Zone: LAN

Mode / IP Assignment: Wire Mode (2-Port Wire)

Wire Mode Type: Bypass (via Internal Switch / Relay)

Paired Interface: -- Select an Interface --

Paired Interface Zone: LAN

☑ Disable Stateful Inspection

□ Enable Link State Propagation

5 Select **Secure (Active DPI of Inline Traffic)** from **Wire Mode Type**.

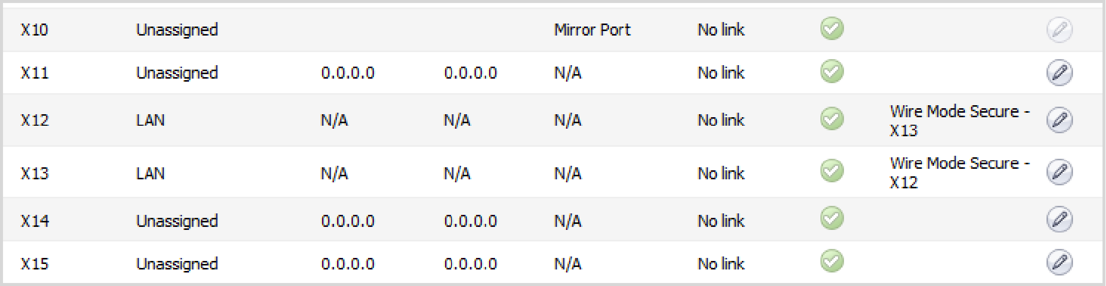
6 Select the interface to pair with the current interface from the **Paired Interface** drop-down menu.

ⓘ | **TIP:** Ensure the interface you pair with is unassigned.

7 Select the zone for the paired interface from **Paired Interface Zone**. The default is **LAN**.

8 Configure the other options as if configuring a regular Wire Mode pair as described in Configuring Wire Mode on page 265 and Configuring Wire Mode on page 265.

9 Click **OK**. The **Network > Interfaces** page is updated.

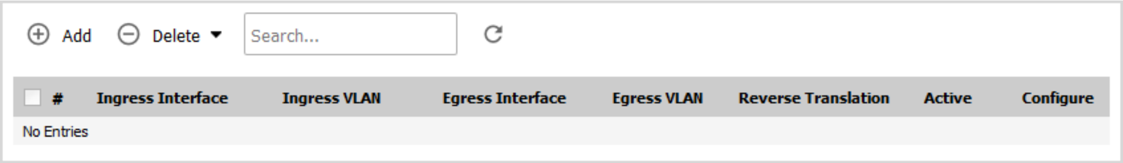


X10	Unassigned			Mirror Port	No link	✓		✎
X11	Unassigned	0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X12	LAN	N/A	N/A	N/A	No link	✓	Wire Mode Secure - X13	✎
X13	LAN	N/A	N/A	N/A	No link	✓	Wire Mode Secure - X12	✎
X14	Unassigned	0.0.0.0	0.0.0.0	N/A	No link	✓		✎
X15	Unassigned	0.0.0.0	0.0.0.0	N/A	No link	✓		✎

Creating the VLAN Mapping

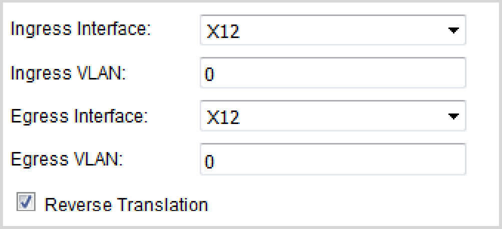
To create a VLAN mapping:

1 Navigate to **Network > VLAN Translation**.



□	#	Ingress Interface	Ingress VLAN	Egress Interface	Egress VLAN	Reverse Translation	Active	Configure
No Entries								

2 Click the **Add** icon. The **Add VLAN Translation** dialog displays.



Ingress Interface: X12

Ingress VLAN: 0

Egress Interface: X12

Egress VLAN: 0

☑ Reverse Translation

3 Select the Wire Mode interface in the pair on which you expect to receive traffic from **Ingress Interface**.

4 Set **Ingress VLAN** to the VLAN on which you expect to receive traffic for mapping.

5 Select the Wire Mode interface in the pair on which you want to map traffic to the **Egress Interface** drop-down menu.

6 Set **Egress VLAN** to the VLAN to which you expect to map traffic.

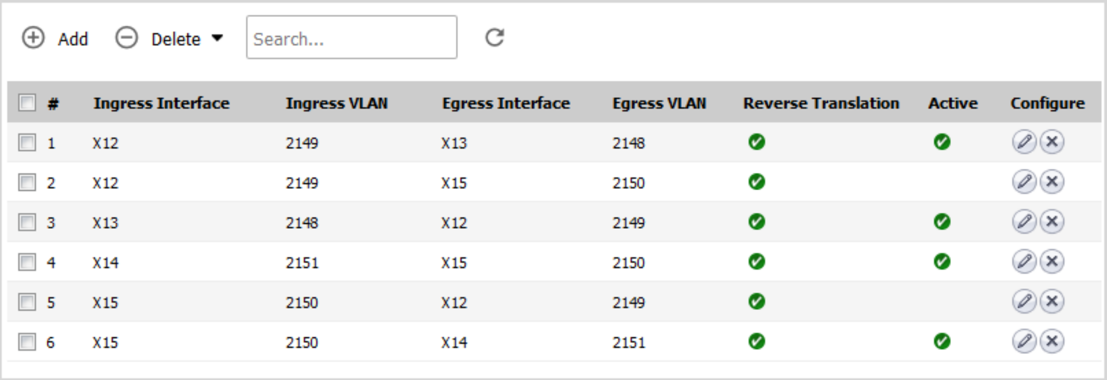
7 To create a:

- Unidirectional mapping, ensure the **Reverse Translation** checkbox is not selected. For example, to map VLAN X on interface A to VLAN Y on interface B.

  ⓘ **NOTE:** This option is selected by default.

- Bidirectional mapping, select the **Reverse Translation** checkbox. For example, to map VLAN Y on interface B to VLAN X on interface A as well as map VLAN X on interface A to VLAN Y on interface B.

8 Click **Add**. The **Wiremode VLAN Translation** table is updated.



☐	#	Ingress Interface	Ingress VLAN	Egress Interface	Egress VLAN	Reverse Translation	Active	Configure
☐	1	X12	2149	X13	2148	✓	✓	✎ ⊗
☐	2	X12	2149	X15	2150	✓		✎ ⊗
☐	3	X13	2148	X12	2149	✓	✓	✎ ⊗
☐	4	X14	2151	X15	2150	✓	✓	✎ ⊗
☐	5	X15	2150	X12	2149	✓		✎ ⊗
☐	6	X15	2150	X14	2151	✓	✓	✎ ⊗

Managing VLAN Mappings

Topics:

- Editing Mappings on page 304
- Filtering Mappings on page 304
- Deleting Mappings on page 304

Editing Mappings

To edit a mapping, click its **Edit** icon in the **Configuration** column. The **Edit VLAN Translation** dialog displays. You can change any of the mappings except the **Reverse Translation** setting.

Filtering Mappings

If you have a lot of VLAN mappings, you can display only those of interest by:

1 Entering an interface name or VLAN tag in the **Search** field.

2 Pressing **Enter**.

Only those mappings meeting the search criterion are displayed.

To redisplay all the mappings:

1 Delete the criterion from the **Search** field.

2 Press **Enter**.

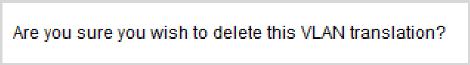
Deleting Mappings

To delete mappings:

1 To delete:

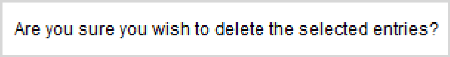
- A single mapping by:
  - Clicking i**ts Delete icon in the Configuration column.**

    A confirmation message displays:


Are you sure you wish to delete this VLAN translation?

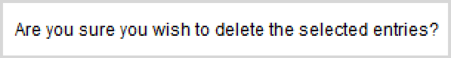
  - **Clicking its Selection** checkbox and then selecting **Delete Selected** from the **Delete** drop-down menu.

    A confirmation message displays:

    
    Are you sure you wish to delete the selected entries?

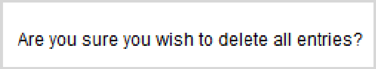
- Multiple mappings by clicking their **Selection** checkboxes and then selecting **Delete Selected** from the **Delete** drop-down menu.

  A confirmation message displays:

  
  Are you sure you wish to delete the selected entries?

- All mappings by selecting **Delete Selected** from the **Delete All** drop-down menu.

  A confirmation message displays:

  
  Are you sure you wish to delete all entries?

2 Click **OK**.

If a policy is bidirectional, then both directions are deleted if one is deleted.

17

Configuring DNS Settings

Topics:

Network > DNS

The Domain Name System (DNS) is a distributed, hierarchical system that provides a method for identifying hosts on the Internet using alphanumeric names called fully qualified domain names (FQDNs) instead of using difficult to remember numeric IP addresses. **MANAGE | System Setup | Network > DNS** allows you to manually configure your DNS settings, if necessary.

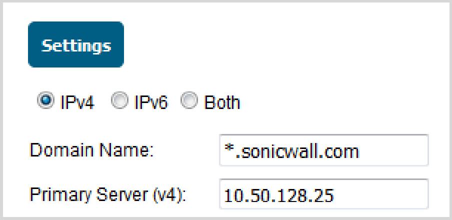
ⓘ | **NOTE:** For complete information on the SonicOS NS*v* implementation of IPv6, see IPv6 on page 659.

Topics:

About Split DNS

Split DNS is an enhancement that allows you to configure a set of servers and associate them to a given domain name (which can be a wildcard). When SonicOS NS*v* DNS Proxy receives a query that matches the domain name, the name is transmitted to the designated DNS server. Split DNS Example shows how this works:

Split DNS Example



● IPv4 ○ IPv6 ○ Both

Domain Name: *.sonicwall.com

Primary Server (v4): 10.50.128.25

- This topology has two firewalls with network connectivity:
  - One firewall is connected to the Internet.
  - Another is a VPN tunnel connected to the corporation network.

- Default DNS queries go to the public ISP DNS Server.
- All queries to `*.SonicWall.com` go to the DNS server located behind the VPN tunnel.

For viewing and configuring split DNS entries, see Configuring Domain-Specific DNS Servers for Split DNS on page 311.

By adding a split DNS entry, all queries to `SonicWall.com` are sent to the specific server (see Configuring Domain-Specific DNS Servers for Split DNS on page 311).

Multiple DNS servers could be configured to handle queries to `SonicWall.com` as well.

About Per-Partition DNS Servers and Split DNS

With or without authentication partitions, it is usually necessary to use a domain's own DNS servers to resolve the names of devices in the domain, and occasionally there can also be a need to use different external DNS servers to resolve external host names. Now, with multiple authentication partitions, this situation is exacerbated as those partitions usually require using different DNS servers to resolve the host names in the different partitions.

> ⓘ **NOTE:** Use of a domain’s own DNS servers can be required unexpectedly because LDAP referrals usually give the referred server by DNS name, even when the LDAP servers are configured by IP address.
>
> An example where different external DNS servers to resolve external host names was required involved external-using cloud services that could not be resolved by the internal domain's DNS servers.

The Split DNS feature is used directly by the SonicWall Security Appliance to resolve the names of devices in domains without the need to enable DNS Proxy, including for multiple unrelated domains with authentication partitioning.

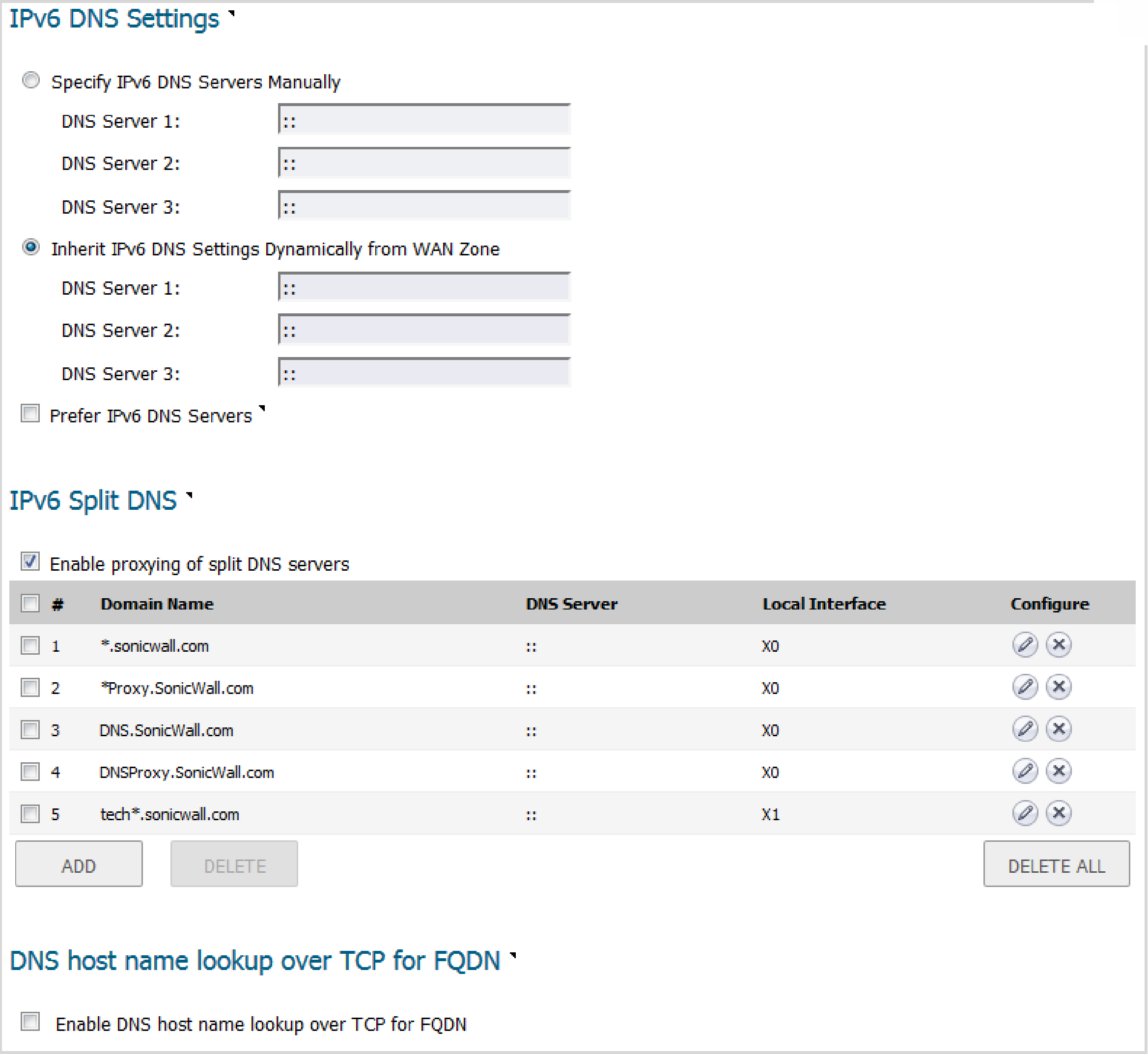
DNS servers configured in Split DNS are used directly for DNS lookups of host names in internal domains as follows:

- This applies for anything that has entries in the Security Appliance's main DNS Cache:
  - SMTP servers
  - SYSLOG servers
  - Web Proxy servers and User (internal) Proxy servers
  - GMS and GMS standby
  - POP servers
  - RADIUS authentication and accounting servers
  - LDAP servers
  - SSO/Terminal Services agents and RADIUS accounting clients
- If partitioning is enabled and a partition has one domain or one tree of parent/sub-domains (AKA one AD Forest), then if Split DNS servers are configured for the partition’s top-level domain, then those are copied into the internal partition structure. Those DNS servers are then used to resolve the names of agents, servers, and clients in the partition.
- If partitioning is enabled and a partition is configured with multiple separate domains (which is allowed but is not common), then no DNS servers are copied into the partition structure, relying instead on the mechanism described below.
- If partitioning is disabled or a partition has no DNS servers set, or for resolving items not associated with a partition, the DNS servers to use are selected per-request through the API provided by Split DNS.

Managing DNS Servers

The options on **Network > DNS** change depending on whether you specify IPv6 or IPv4; see: **IPv6 Network > DNS** and **IPv4 Network > DNS**.

IPv6 Network > DNS



IPv6 DNS Settings

○ Specify IPv6 DNS Servers Manually

DNS Server 1: ::

DNS Server 2: ::

DNS Server 3: ::

● Inherit IPv6 DNS Settings Dynamically from WAN Zone

DNS Server 1: ::

DNS Server 2: ::

DNS Server 3: ::

□ Prefer IPv6 DNS Servers

IPv6 Split DNS

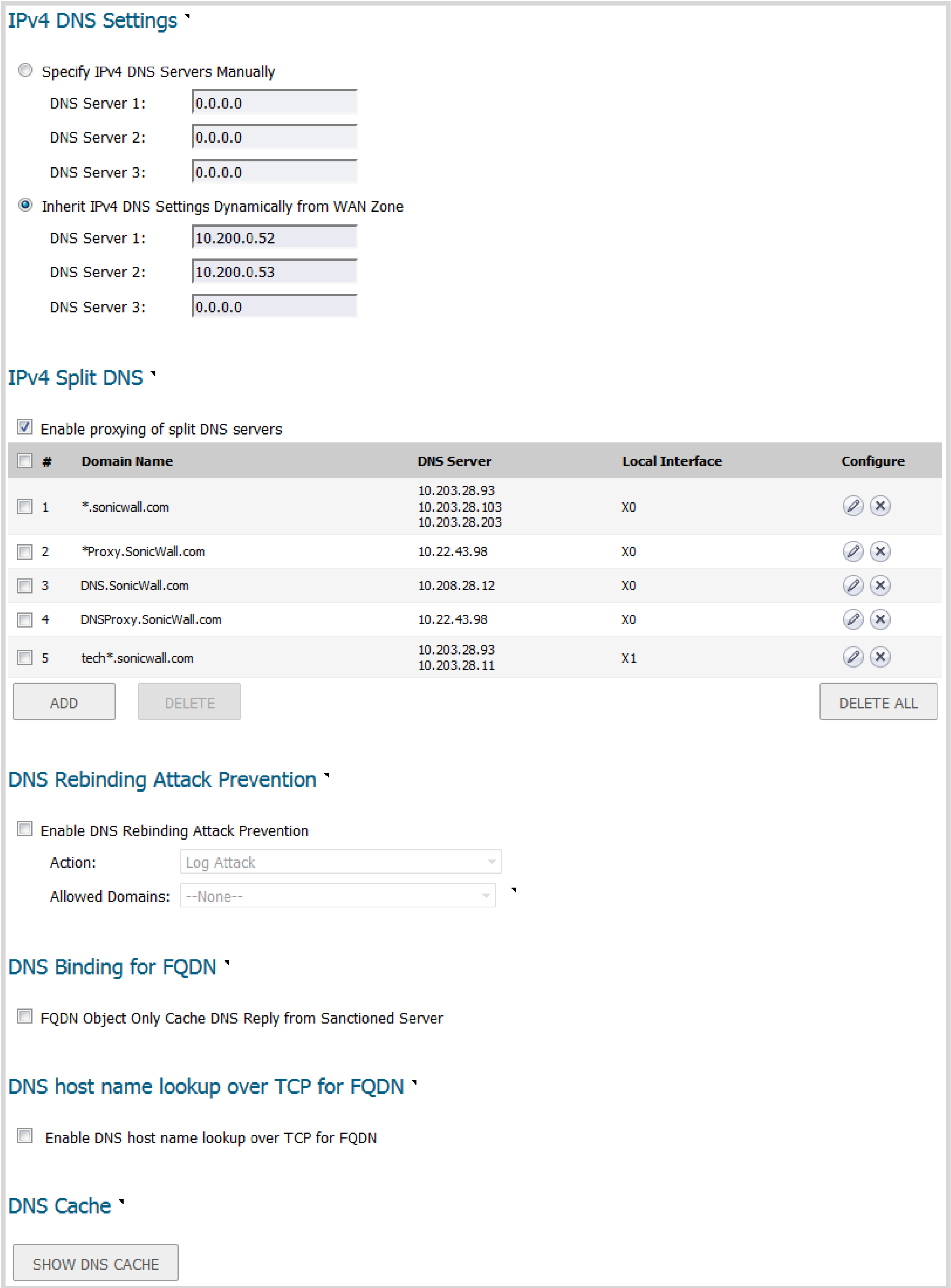
☑ Enable proxying of split DNS servers

□ #	Domain Name	DNS Server	Local Interface	Configure
□ 1	*.sonicwall.com	::	X0	✎ ✖
□ 2	*Proxy.SonicWall.com	::	X0	✎ ✖
□ 3	DNS.SonicWall.com	::	X0	✎ ✖
□ 4	DNSProxy.SonicWall.com	::	X0	✎ ✖
□ 5	tech*.sonicwall.com	::	X1	✎ ✖

DNS host name lookup over TCP for FQDN

□ Enable DNS host name lookup over TCP for FQDN

IPv4 Network > DNS



IPv4 DNS Settings

○ Specify IPv4 DNS Servers Manually

DNS Server 1: 0.0.0.0

DNS Server 2: 0.0.0.0

DNS Server 3: 0.0.0.0

● Inherit IPv4 DNS Settings Dynamically from WAN Zone

DNS Server 1: 10.200.0.52

DNS Server 2: 10.200.0.53

DNS Server 3: 0.0.0.0

IPv4 Split DNS

☑ Enable proxying of split DNS servers

□	#	Domain Name	DNS Server	Local Interface	Configure
□	1	*.sonicwall.com	10.203.28.93 10.203.28.103 10.203.28.203	X0	✎ ⊗
□	2	*Proxy.SonicWall.com	10.22.43.98	X0	✎ ⊗
□	3	DNS.SonicWall.com	10.208.28.12	X0	✎ ⊗
□	4	DNSProxy.SonicWall.com	10.22.43.98	X0	✎ ⊗
□	5	tech*.sonicwall.com	10.203.28.93 10.203.28.11	X1	✎ ⊗

DNS Rebinding Attack Prevention

□ Enable DNS Rebinding Attack Prevention

Action: Log Attack

Allowed Domains: --None--

DNS Binding for FQDN

□ FQDN Object Only Cache DNS Reply from Sanctioned Server

DNS host name lookup over TCP for FQDN

□ Enable DNS host name lookup over TCP for FQDN

DNS Cache

The two versions of the management interface page have the **DNS Settings**, **Split DNS**, and **DNS host name lookup over TCP for FQDN** sections in common and are described together.

Topics:

- Selecting IP Version on page 310
- Specifying which DNS Servers are Used on page 310
- Configuring Domain-Specific DNS Servers for Split DNS on page 311
- Enabling DNS Host Name Lookup over TCP for FQDN on page 315

Selecting IP Version

To select the IP version:

1 Navigate to **MANAGE | System Setup > Network > DNS**.

2 From **View IP Version** at the top right of the page, choose:

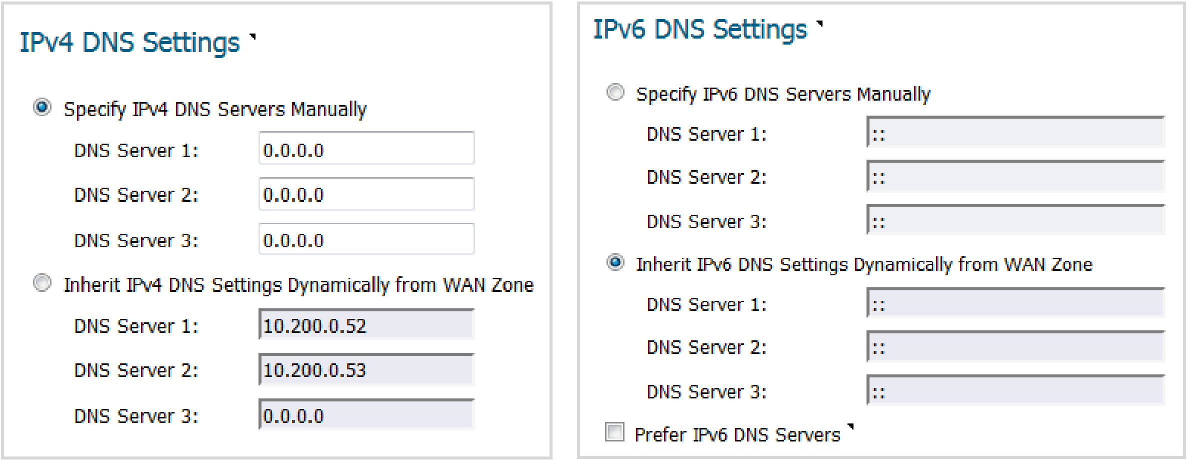
  - **IPv4**
  - **IPv6**

The options on **Network > DNS** change depending on whether you specify IPv6 or IPv4; see **IPv6 Network > DNS** and **IPv4 Network > DNS**.

Specifying which DNS Servers are Used

Regardless of the IP version, you can specify how SonicOS NS*v* selects the DNS servers. The method is the same for both IP versions.

IPv4 DNS Settings/IPv6 DNS Settings Section



IPv4 DNS Settings

● Specify IPv4 DNS Servers Manually

DNS Server 1: 0.0.0.0

DNS Server 2: 0.0.0.0

DNS Server 3: 0.0.0.0

○ Inherit IPv4 DNS Settings Dynamically from WAN Zone

DNS Server 1: 10.200.0.52

DNS Server 2: 10.200.0.53

DNS Server 3: 0.0.0.0

IPv6 DNS Settings

○ Specify IPv6 DNS Servers Manually

DNS Server 1: ::

DNS Server 2: ::

DNS Server 3: ::

● Inherit IPv6 DNS Settings Dynamically from WAN Zone

DNS Server 1: ::

DNS Server 2: ::

DNS Server 3: ::

□ Prefer IPv6 DNS Servers

To specify which DNS servers are used:

1 Navigate to **Network > DNS**.

2 In the **IPv4/IPv6 DNS Settings** section, select one of the following:

  - To manually specify the DNS servers.

    a) Select **Specify IPv4/IPv6 DNS Servers Manually**.

    b) Enter up to three IP addresses into the **DNS Server** fields.

    c) If you are using:

        - IPv4 go to Step 4.
        - IPv6, go to Step 3.
    - To use the DNS Settings configured for the WAN zone:
        a) Select **Inherit IPv4/IPv6 DNS Settings Dynamically from WAN Zone**. This is the default. The IP address(es) are populated into the **DNS Server** fields automatically.

        b) For IPv4, go to Step 4.

3 To use only IPv6 servers, select **Prefer IPv6 DNS Servers**. This option is not selected by default.

SonicOS NS*v* DNS supports these server types:

- DNS_SYSTEM_BEHAVIOR – the system default behavior, which depends on the setting of this option.
- DNS_PREFER_V4_DNSSERVER – IPv4 DNS servers preferred unless there is a failure, then IPv6 DNS servers are requested.
- DNS_PREFER_V6_DNSSERVER: – IPv6 DNS servers preferred unless there is a failure, then IPv4 DNS servers are requested.

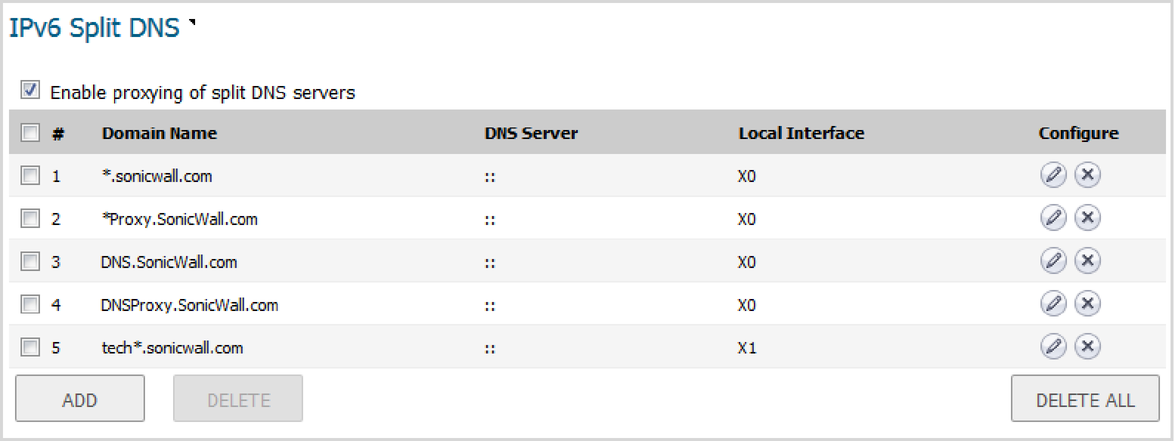
△ CAUTION: **Select this option only if you have configured the IPv6 DNS server correctly.**

4 Click **Accept** to save your changes.

Configuring Domain-Specific DNS Servers for Split DNS

You can optionally configure separate domain-specific DNS servers to use with either IPv6 or IPv4. The method is the same for both IP versions. Any differences are noted.

IPv6 Split DNS Section

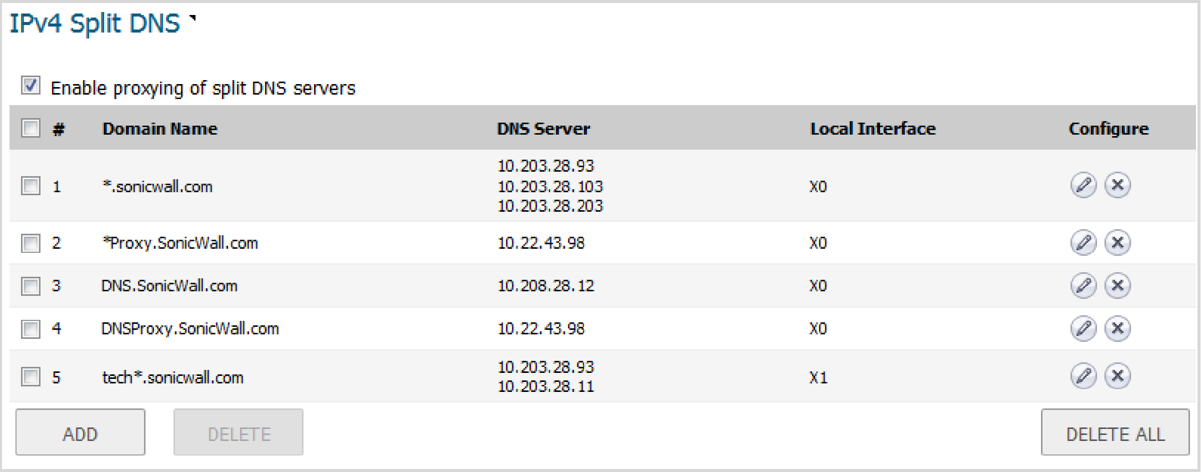


IPv6 Split DNS

☑ Enable proxying of split DNS servers

□	#	Domain Name	DNS Server	Local Interface	Configure
□	1	*.sonicwall.com	::	X0	✎ ✖
□	2	*Proxy.SonicWall.com	::	X0	✎ ✖
□	3	DNS.SonicWall.com	::	X0	✎ ✖
□	4	DNSProxy.SonicWall.com	::	X0	✎ ✖
□	5	tech*.sonicwall.com	::	X1	✎ ✖

IPv4 Split DNS Section



IPv4 Split DNS

☑ Enable proxying of split DNS servers

□	#	Domain Name	DNS Server	Local Interface	Configure
□	1	*.sonicwall.com	10.203.28.93 10.203.28.103 10.203.28.203	X0	✎ ⊗
□	2	*Proxy.SonicWall.com	10.22.43.98	X0	✎ ⊗
□	3	DNS.SonicWall.com	10.208.28.12	X0	✎ ⊗
□	4	DNSProxy.SonicWall.com	10.22.43.98	X0	✎ ⊗
□	5	tech*.sonicwall.com	10.203.28.93 10.203.28.11	X1	✎ ⊗

Domain Name Name of the DNS Server.

DNS Server IPv4/IPv6 IP address of the DNS Server.

NOTE: The status of the DNS servers are displayed on the **Network > DNS Proxy** page.

Local Interface Interface assigned to the DNS Server.

Configure Contains **Edit** and **Delete** icons for each server.

Topics:

- Adding a DNS Server on page 312
- Editing Split DNS Entries on page 315
- Deleting Split DNS Entries on page 315

Adding a DNS Server

To add domain-specific DNS servers and associate them to a given domain name:

ⓘ **IMPORTANT:** The maximum number of entries for Split DNS is 32. If the list is full, new entries cannot be added.

1 Navigate to **MANAGE | System Setup > Network > DNS**.

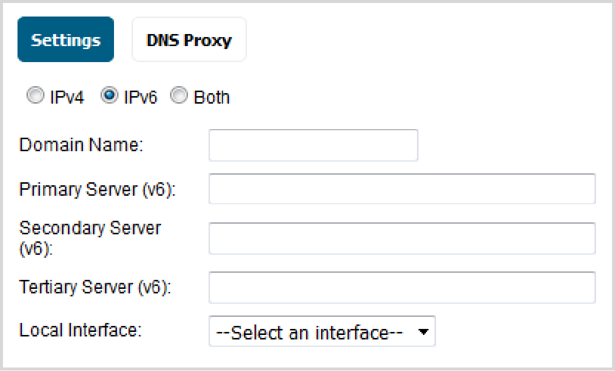
2 Choose the IP version from **View IP Version**.

3 To enable proxying of split DNS servers, select **Enable proxying of split DNS servers**. This option is selected by default.

4 Under the **Split DNS** table, click **Add**. The **Add Split DNS Entry** dialog displays.

ⓘ **TIP:** If you selected DNS Proxy, a page for it, **DNS Proxy**, also displays on the **Add Split DNS Entry** dialog.

IPv6 Add Split DNS Entry—DNS Proxy Enabled



○ IPv4 ● IPv6 ○ Both

Domain Name:

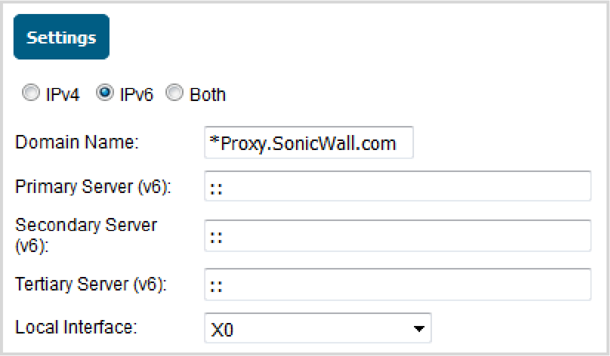
Primary Server (v6):

Secondary Server (v6):

Tertiary Server (v6):

Local Interface: --Select an interface--

IPv6 Add Split DNS Entry—DNS Proxy Disabled



○ IPv4 ● IPv6 ○ Both

Domain Name: *Proxy.SonicWall.com

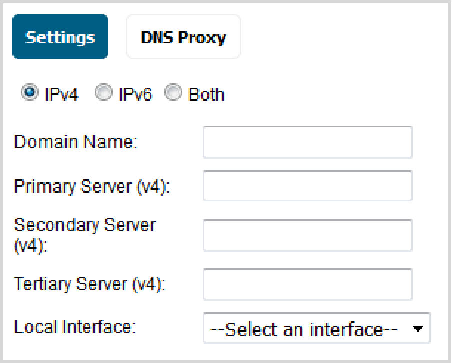
Primary Server (v6): ::

Secondary Server (v6): ::

Tertiary Server (v6): ::

Local Interface: X0

IPv4 Add Split DNS Entry



● IPv4 ○ IPv6 ○ Both

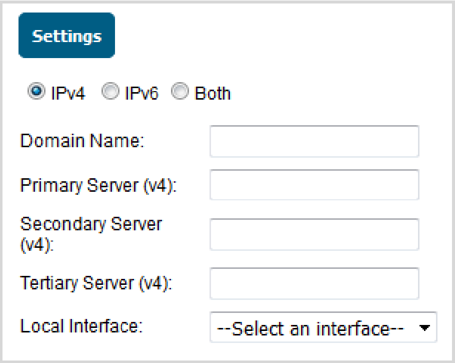
Domain Name:

Primary Server (v4):

Secondary Server (v4):

Tertiary Server (v4):

Local Interface: --Select an interface--



● IPv4 ○ IPv6 ○ Both

Domain Name:

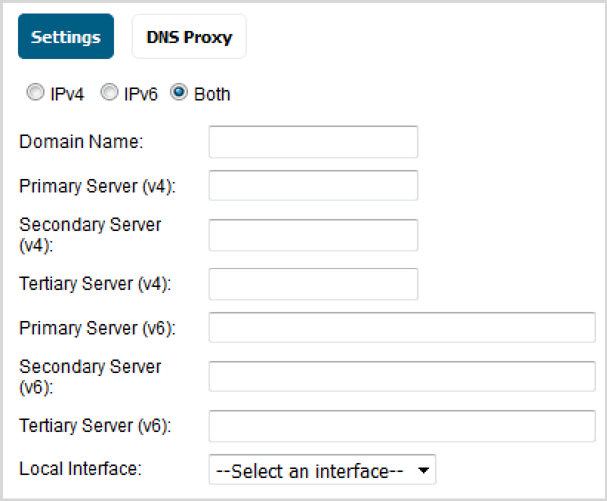
Primary Server (v4):

Secondary Server (v4):

Tertiary Server (v4):

Local Interface: --Select an interface--

IPv6 and IPv4 Add Split DNS Entry—DNS Proxy Enabled



○ IPv4 ○ IPv6 ● Both

Domain Name:

Primary Server (v4):

Secondary Server (v4):

Tertiary Server (v4):

Primary Server (v6):

Secondary Server (v6):

Tertiary Server (v6):

Local Interface: --Select an interface--

5 Choose the IP version:

- **IPv4**
- **IPv6**
- **Both**

6 Enter the domain name in the **Domain Name** field. The name can contain a wildcard (`*`; for example, `*.SonicWall.com`).

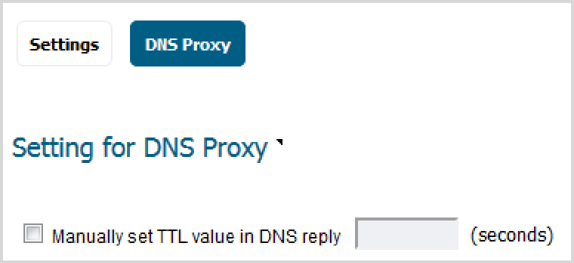
7 To configure one or more IPv4/IPv6 Split DNS Servers for this domain, enter the IP addresses in the appropriate fields:

- **Primary Server (v4/v6)**
- **Secondary Server (v4/v6)** (optional)
- **Tertiary Server (v4/v6)** (optional)

8 Select an interface from **Local interface**.

9 If you have not enabled DNS Proxy, go to Step 13.

10 Click **DNS Proxy**.



Setting for DNS Proxy

□ Manually set TTL value in DNS reply (seconds)

11 To specify a Time to Live, select **Manually set TTL value in DNS reply**. This option is not selected by default. If this option is not selected, the TTL value is the same as that from the DNS response; if it is set, the TTL value is the same as the setting.

NOTE: This option applies only when Split DNS is used by DNS Proxy.

12 Enter the maximum time for the cache entry to exist. The minimum is 1 second, the maximum is 9999999999999999 seconds.

13 Click **OK**.

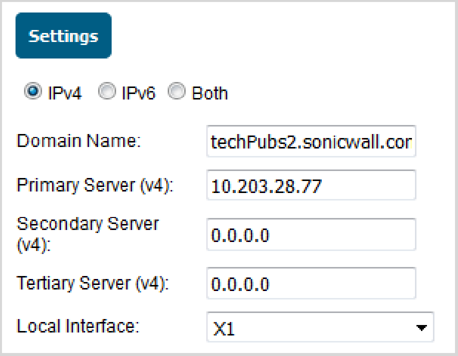
> ⓘ **TIP:** The DNS servers display in the **Split DNS** table of both IP versions regardless of which IP version was chosen when configuring them.

Editing Split DNS Entries

To edit a Split DNS entry.

1 Navigate to **MANAGE | System Setup > Network > DNS**.

2 In the **Split DNS** table, click the entry's **Edit** icon. The **Edit Split DNS Entry** dialog displays.



● IPv4 ○ IPv6 ○ Both

Domain Name:	techPubs2.sonicwall.cor
Primary Server (v4):	10.203.28.77
Secondary Server (v4):	0.0.0.0
Tertiary Server (v4):	0.0.0.0
Local Interface:	X1

3 Make the changes.

4 Click **OK**.

Deleting Split DNS Entries

To delete a Split DNS entry:

1 Click the entry's **Delete** icon.

To delete two or more Split DNS entries:

1 Select the checkboxes of the entries to be deleted. **Delete** becomes available.

2 Click **Delete**.

To delete all Split DNS entries:

1 Click **Delete All**.

Enabling DNS Host Name Lookup over TCP for FQDN

By default, DNS queries are sent over UDP. The DNS response can include a Truncated flag if the response length exceeds the maximum allowed by UDP.

When the **Enable DNS host name lookup over TCP for FQDN** option is:

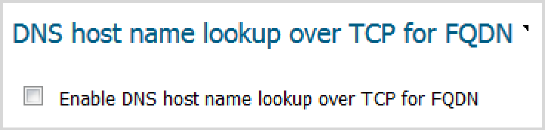
- Enabled and the Truncated flag is set in the DNS response, SonicOS NS*v* sends an additional DNS query over TCP to determine the full DNS response for multiple IP addresses.
- Disabled, DNS queries are sent over UDP, and SonicOS NS*v* only processes the IP addresses in the DNS response packet, although the Truncated flag is set in the response.

The DNS query times out after one second if no DNS response over TCP is received from the DNS server.

This option is used to gain more IP addresses when sending DNS queries from FQDN over TCP while the Security Appliance receives DNS responses over UDP.

To enable DNS host name lookup over TCP for FQDN:

1. Navigate to **MANAGE | System Setup** > **Network > DNS**.
2. Scroll to the **DNS host name lookup over TCP for FQDN** section.

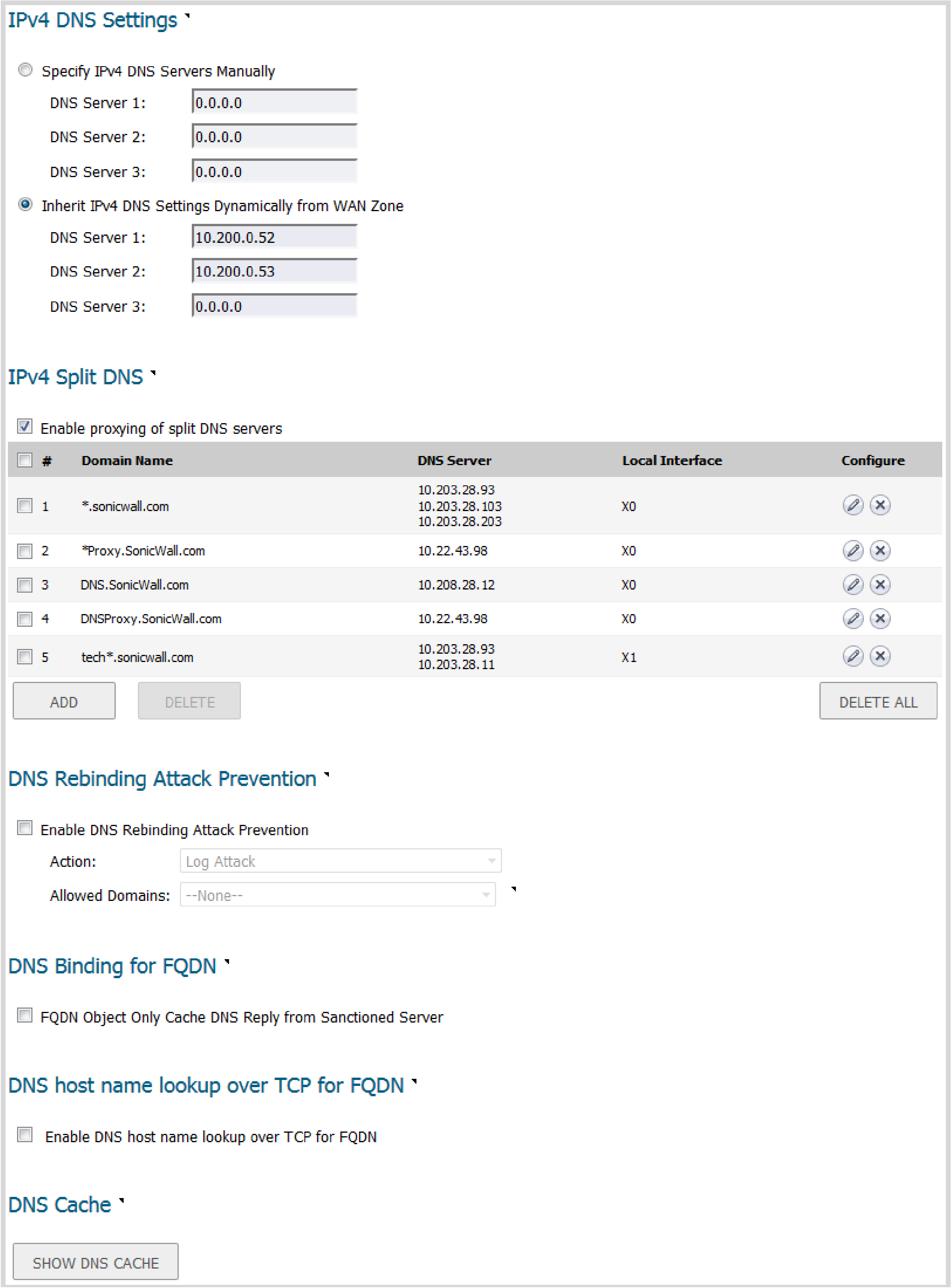


DNS host name lookup over TCP for FQDN

☐ Enable DNS host name lookup over TCP for FQDN

3. Select **Enable DNS host name lookup over TCP for FQDN**. This option is not selected by default.
4. Click **Accept**.

DNS and IPv4



IPv4 DNS Settings

○ Specify IPv4 DNS Servers Manually

DNS Server 1: 0.0.0.0

DNS Server 2: 0.0.0.0

DNS Server 3: 0.0.0.0

● Inherit IPv4 DNS Settings Dynamically from WAN Zone

DNS Server 1: 10.200.0.52

DNS Server 2: 10.200.0.53

DNS Server 3: 0.0.0.0

IPv4 Split DNS

☑ Enable proxying of split DNS servers

☐	#	Domain Name	DNS Server	Local Interface	Configure
☐	1	*.sonicwall.com	10.203.28.93 10.203.28.103 10.203.28.203	X0	✎ ✕
☐	2	*Proxy.SonicWall.com	10.22.43.98	X0	✎ ✕
☐	3	DNS.SonicWall.com	10.208.28.12	X0	✎ ✕
☐	4	DNSProxy.SonicWall.com	10.22.43.98	X0	✎ ✕
☐	5	tech*.sonicwall.com	10.203.28.93 10.203.28.11	X1	✎ ✕

DNS Rebinding Attack Prevention

☐ Enable DNS Rebinding Attack Prevention

Action: Log Attack

Allowed Domains: --None--

DNS Binding for FQDN

☐ FQDN Object Only Cache DNS Reply from Sanctioned Server

DNS host name lookup over TCP for FQDN

☐ Enable DNS host name lookup over TCP for FQDN

DNS Cache

The IPv4 **Network > DNS** page has these sections in addition to those in common with the IPv6 **Network > DNS** page:

DNS Rebinding Attack Prevention

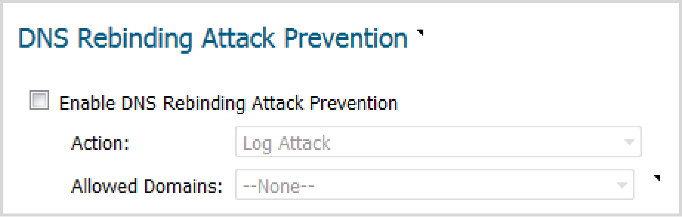
DNS rebinding is a DNS-based attack on code embedded in web pages. Normally requests from code embedded in web pages (JavaScript, Java, and Flash) are bound to the web-site they are originating from (see **Same Origin Policy**). A DNS rebinding attack can be used to improve the ability of JavaScript-based malware to penetrate private networks, and subvert the browser's same-origin policy.

DNS rebinding attackers register a domain that is delegated to a DNS server they control. The server is configured to respond with a very short Time to Live (TTL) parameter, which prevents the result from being cached. The first response contains the IP address of the server hosting the malicious code. Any subsequent requests contain IP addresses from private (RFC 1918) network, presumably behind a firewall, being target of the attacker. Because both are fully valid DNS responses, they authorize the sandbox script to access hosts in a private network. By iterating addresses in these short-term but still valid DNS replies, the script is able to scan the network and perform other malicious activities.

To configure DNS rebinding attack prevention:

1 Navigate to **Network > DNS**.

2 Scroll to the **DNS Rebinding Attack Prevention** section.



DNS Rebinding Attack Prevention

☐ Enable DNS Rebinding Attack Prevention

Action: Log Attack

Allowed Domains: --None--

3 Select **Enable DNS Rebinding Attack Prevention**. This option is not selected by default. The two options become available.

4 From **Action**, select an action to perform when a DNS rebinding attack is detected:

- **Log Attack** (default)
- **Log Attack & Return a Query Refused Reply**
- **Log Attack & Drop DNS Reply**

5 From **Allowed Domains**, select an allowed domain FQDN Address Object or FQDN Address Object Group containing allowed domain-names (such as, `*.SonicWall.com`) for which locally connected/routed subnets should be considered legal responses.

You can also create new FQDN address objects or FQDN address object groups by selecting **Create new FQDN Address Object...** or **FQDN Address Object Group...**.

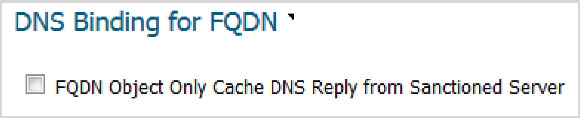
6 Click **Accept**.

DNS Binding for FQDN

To enable DNS binding for FQDN:

1 Navigate to **Network > DNS**.

2 Scroll to the **DNS Binding for FQDN** section.



DNS Binding for FQDN

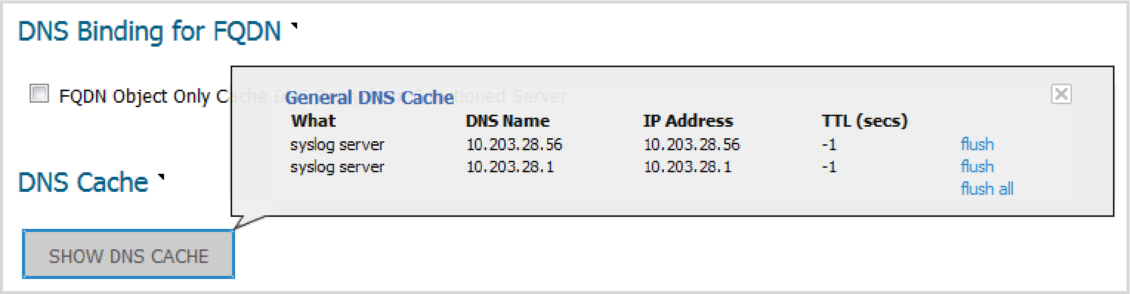
□ FQDN Object Only Cache DNS Reply from Sanctioned Server

3 Select **FQDN Object Only Cache DNS Reply from Sanctioned Server**. This option is not selected by default.

4 Click **Accept**.

DNS Cache

To show the contents of the general DNS cache, click **Show DNS Cache**. A popup displays the cache contents:



DNS Binding for FQDN

□ FQDN Object Only C

DNS Cache

SHOW DNS CACHE

General DNS Cache

What	DNS Name	IP Address	TTL (secs)	
syslog server	10.203.28.56	10.203.28.56	-1	flush
syslog server	10.203.28.1	10.203.28.1	-1	flush
				flush all

What DNS Server name:

- Forward DNS cache, the host name.
- Reverse DNS cache, a string representation of the IP address.

DNS Name Domain name, such as `www.SonicWall.com`, or IP address.

IP Address Resolved IP address.

TTL (secs) Time to Live; the TTL value from the DNS response.

flush Clicking this flushes the server’s DNS cache entry

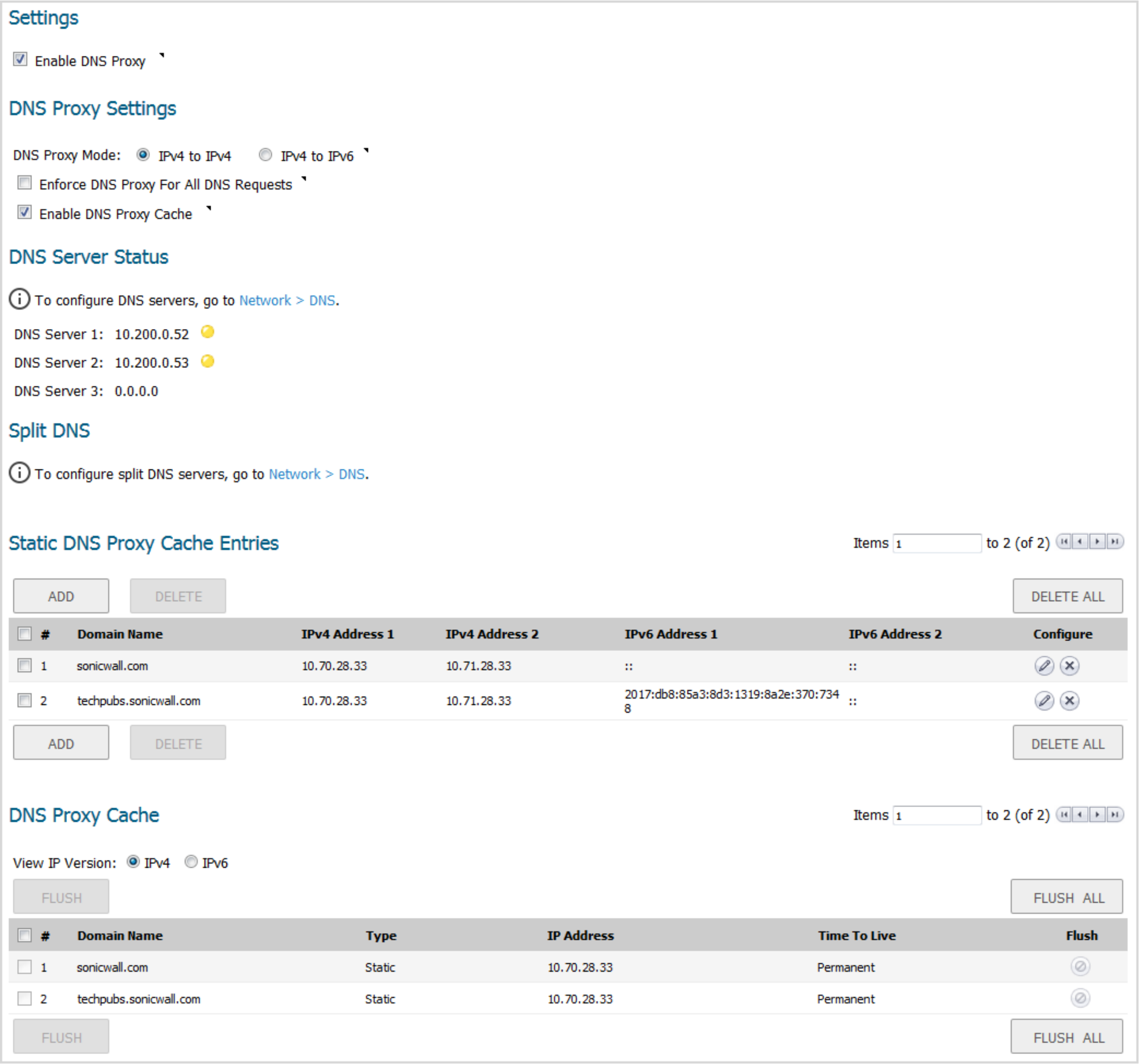
flush all Clicking this flushes all DNS cache entry of all listed servers

18

Configuring DNS Proxy Settings

Topics:

Network > DNS Proxy



Settings

☑ Enable DNS Proxy

DNS Proxy Settings

DNS Proxy Mode: ● IPv4 to IPv4 ○ IPv4 to IPv6

□ Enforce DNS Proxy For All DNS Requests

☑ Enable DNS Proxy Cache

DNS Server Status

ⓘ To configure DNS servers, go to Network > DNS.

DNS Server 1: 10.200.0.52 ●

DNS Server 2: 10.200.0.53 ●

DNS Server 3: 0.0.0.0

Split DNS

ⓘ To configure split DNS servers, go to Network > DNS.

Static DNS Proxy Cache Entries

Items 1 to 2 (of 2)

□	#	Domain Name	IPv4 Address 1	IPv4 Address 2	IPv6 Address 1	IPv6 Address 2	Configure
□	1	sonicwall.com	10.70.28.33	10.71.28.33	::	::	
□	2	techpubs.sonicwall.com	10.70.28.33	10.71.28.33	2017:db8:85a3:8d3:1319:8a2e:370:7348	::	

DNS Proxy Cache

Items 1 to 2 (of 2)

View IP Version: ● IPv4 ○ IPv6

□	#	Domain Name	Type	IP Address	Time To Live	Flush
□	1	sonicwall.com	Static	10.70.28.33	Permanent	
□	2	techpubs.sonicwall.com	Static	10.70.28.33	Permanent	

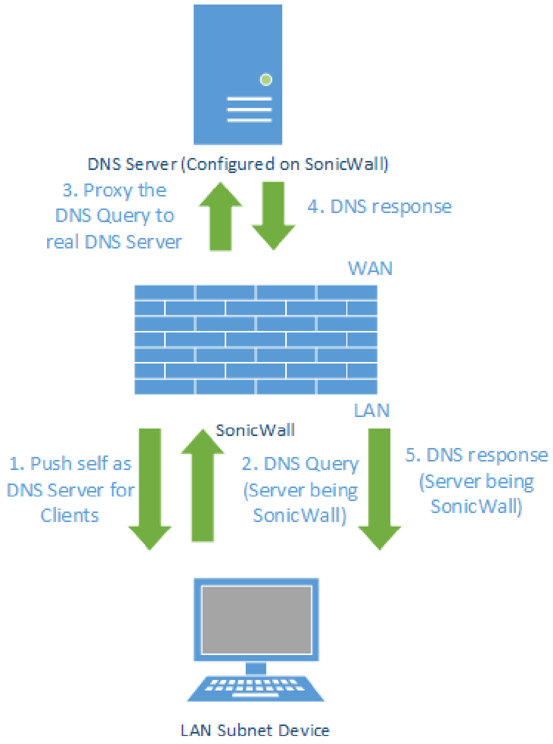
Topics:

- About DNS Proxy on page 322
- Enabling DNS Proxy on page 324
- Configuring DNS Proxy Settings on page 325
- Monitoring DNS Server Status on page 326
- Monitoring Split DNS Server Status on page 326
- Viewing DNS Proxy Cache Entries on page 328
- Viewing and Managing Static DNS Cache Entries on page 327

About DNS Proxy

An IPv4 interface can do name resolution on an IPv4 Internet, and an IPv6 interface can only do name resolution on an IPv6 Internet through DNS proxy. To allow IPv4 clients to access DNS services in a network with mixed IPv4 and IPv6 interfaces, SonicOS NS*v* supports DNS proxy; see DNS Proxy.

DNS Proxy


DNS Server (Configured on SonicWall)
3. Proxy the DNS Query to real DNS Server
4. DNS response
WAN
LAN
SonicWall
1. Push self as DNS Server for Clients
2. DNS Query (Server being SonicWall)
5. DNS response (Server being SonicWall)
LAN Subnet Device

The DNS proxy feature provides a transparent mechanism that allows devices to proxy hostname resolution requests on behalf of clients. The proxy can use existing DNS cache, which is either statically configured by you or learned dynamically, to respond to the queries directly.

The proxy can redirect the DNS queries selectively to specific DNS servers, according to partial or complete domain specifications. This is useful when VPN tunnels provide multiple network connectivity, and it is necessary to direct some DNS queries to one network, and other queries to another network

With DNS Proxy, LAN Subnet devices use the SonicWall Security Appliance as the DNS Server and send DNS queries to the Security Appliance. The Security Appliance proxies the DNS queries to the real DNS Server. In this way, the Security Appliance is the central management point for the network DNS traffic, providing the ability to manage the DNS queries of the network at a single point.

ⓘ | **NOTE:** To maintain security, an incoming DNS Query is proxied only after Access Rule and DPI checking.

When DNS proxy is enabled on an interface, one Allow Rule is auto-added by SonicOS NS*v*. For the Access Rules associated with the interface, see *SonicOS NSv Policies*.

When **DNS Proxy over TCP** is enabled, another Allow Rule is auto-added.

Topics:

- Supported Interfaces on page 323
- DNS Server Liveness Detection and Failover on page 323

- DNS Cache on page 323
- DHCP Server on page 324
- Enabling Log Settings on page 324
- Monitoring Packets on page 324

Supported Interfaces

The DNS proxy feature is supported on physical interfaces, VLAN interfaces, or VLAN trunk interfaces. The zone for each interface should only be LAN or DMZ.

DNS Server Liveness Detection and Failover

When multiple DNS servers are configured, to determine the “best” server, SonicOS NS*v* considers these factors:

- DNS server priority.
- DNS server status (up, down, unknown).
- Time duration after failover.

DNS Cache

In DNS Proxy, a DNS cache memory saves the most commonly used domains and host addresses, and when it receives the DNS query that match the domain in DNS cache, the Security Appliance directly responds to clients by using the cache records, without processing DNS query and reply proxy.

There are two kinds of DNS Cache:

Static	Manually configured by you.
Dynamic	Auto-learned by SonicOS NS*v*. For each DNS Query, SonicOS NS*v* DNS Proxy does the deep inspection on the URI and records the valid response to the caches.

When a DNS query matches an existing cache entry, SonicOS NS*v* DNS Proxy responds directly with the cached URI. This usually decreases the network traffic and, thus, improves overall network performance.

Maximum DNS Proxy Cache Size

Static DNS Proxy Cache Size

Static DNS proxy cache entry size is always 256 regardless of platform. The static DNS cache is never deleted unless it is done manually.

If the maximum DNS proxy cache size has been reached when the Security Appliance attempts to add an entry to the proxy cache, the Security Appliance:

1. Deletes the DNS proxy ache entry with the earliest expire time.
2. Adds the new DNS proxy cache entry.

High Availability Stateful Synchronization of DNS Cache

DNS proxy supports stateful synchronization of DNS proxy cache. When the DNS proxy cache is added, deleted, or updated dynamically, it synchronizes to the idle Security Appliance.

DHCP Server

When DNS Proxy is enabled on an interface, the device needs to push the interface IP as a DNS server address to clients, so the DHCP server must be configured manually, using the interface address as the **DNS Server 1** address in the **DHCP Server** settings on the **DNS/WINS** tab. The **Interface Pre-Populate** option in the **Dynamic Range Configuration** dialog makes this easy to configure; if the selected interface has enabled DNS Proxy, the DNS server IP is added automatically into the DNS/WINS page. For how to configure a DHCP server statically, see Configuring Static DHCP Entries on page 418.

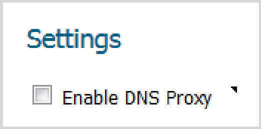
Enabling Log Settings

Several events logs are related to DNS Proxy and need to be configured as described in SonicOS NSv *Investigate*.

Monitoring Packets

The process of DNS Proxy is monitored with **Dashboard > Packet Monitor**. For information about the Packet Monitor, see SonicOS NSv *Investigate*.

Enabling DNS Proxy



Settings

□ Enable DNS Proxy

Enabling DNS Proxy must be done first globally on the **MANAGE | System Setup | Network > DNS Proxy** page and then on each interface. This provides a gradual control to enable the feature for different network segments independently.

To enable DNS Proxy:

1 Navigate to **MANAGE | System Setup | Network > DNS Proxy**.

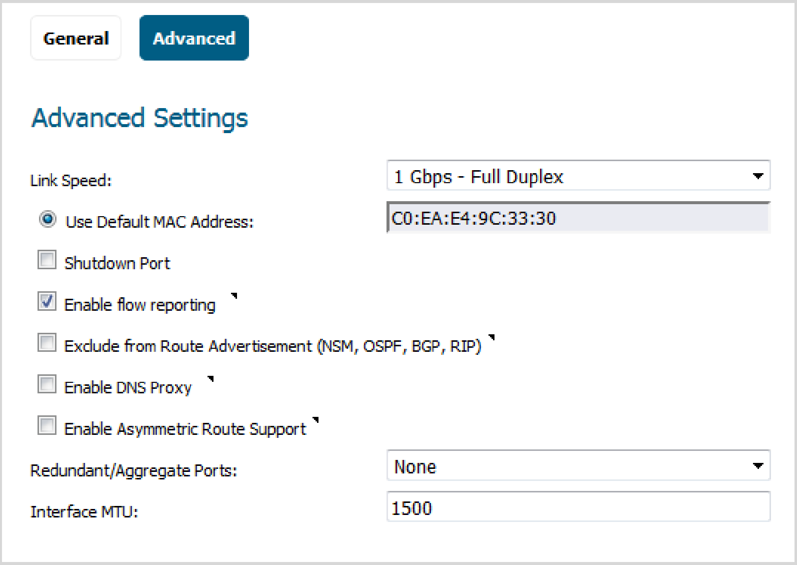
2 Select **Enable DNS Proxy**. This option is not selected by default.

3 Click **Accept**.

4 Navigate to **MANAGE | System Setup | Network > Interfaces**.

5 Click the **Edit** icon for the interface on which to enable DNS Proxy. The **Edit Interface** dialog displays.

6 Click **Advanced**.



Advanced Settings

Link Speed: 1 Gbps - Full Duplex

● Use Default MAC Address: C0:EA:E4:9C:33:30

□ Shutdown Port

☑ Enable flow reporting

□ Exclude from Route Advertisement (NSM, OSPF, BGP, RIP)

□ Enable DNS Proxy

□ Enable Asymmetric Route Support

Redundant/Aggregate Ports: None

Interface MTU: 1500

7 Select **Enable DNS Proxy**. This option displays only when DNS Proxy is enabled globally.

8 Click **OK**.

9 Repeat Step 5 through Step 8 for each interface on which to enable DNS Proxy.

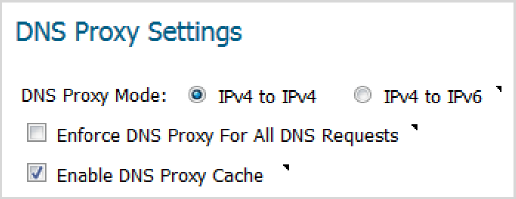
10 Click **Accept**.

For the Access Rules associated with the interface, see the SonicOS NS*v* *Policies Guide*.

Configuring DNS Proxy Settings

To configure DNS Proxy:

1 Navigate to **MANAGE | System Setup | Network > DNS Proxy | DNS Proxy Settings**.



DNS Proxy Settings

DNS Proxy Mode: ● IPv4 to IPv4 ○ IPv4 to IPv6

□ Enforce DNS Proxy For All DNS Requests

☑ Enable DNS Proxy Cache

2 From **DNS Proxy Mode**, choose the IP version for sending/receiving DNS proxy packets between the Security Appliance and the DNS servers:

- **IPv4 to IPv4** (default)
- **IPv4 to IPv6**

3 To allow all types of DNS requests, including stack DNS packets sent by SonicOS NS*v*, to be processed by DNS Proxy, including the forwarding of DNS queries with a destination address of outside DNS servers, select **Enforce DNS Proxy for All DNS Requests**. If this option is disabled, only those requests destined for SonicWall Security Appliances are processed. This option is not selected by default.

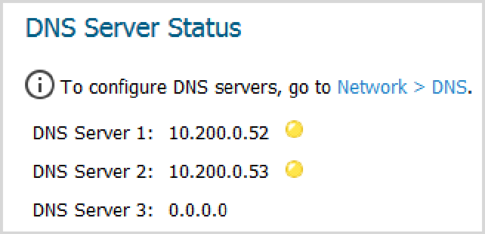
ⓘ **NOTE:** This option affects only DNS over UDP. If this option is not selected, only DNS proxy requests destined for a SonicWall Security Appliance are enabled.

4 For DNS over UDP requests only, select **Enable DNS Cache**. This option is selected by default.

5 Click **Accept**.

ⓘ **NOTE:** There are several advanced settings, such as DNS Proxy protocol, that can be configured. For more information about these settings, contact Technical Support.

Monitoring DNS Server Status



DNS Server Status

ⓘ To configure DNS servers, go to Network > DNS.

DNS Server 1: 10.200.0.52 ●

DNS Server 2: 10.200.0.53 ●

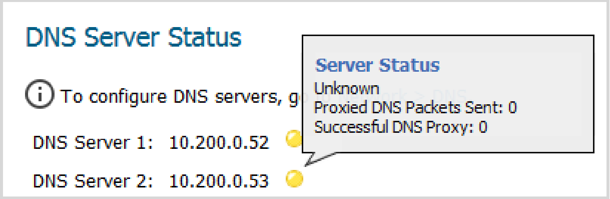
DNS Server 3: 0.0.0.0

ⓘ **NOTE:** A configured DNS Server has its IP address displayed. If a server is not configured, the IP address is `0.0.0.0`. To configure a server, click the link to **Network > DNS**; see Configuring DNS Settings on page 306.

You monitor the status of each configured upstream DNS Servers in the **DNS Server Status** section. The server status is decided by DNS reply from the server:

Up (green LED)	The reply was successful.
Unknown (yellow LED)	A DNS reply has not been received by the server.
Down (red LED)	The failure count exceeded the limit of 20. The status remains down until the next successful DNS query.

Moving the mouse over the LED displays a popup with further information about the number of proxied DNS packets sent and the number of successful DNS Proxy queries:



DNS Server Status

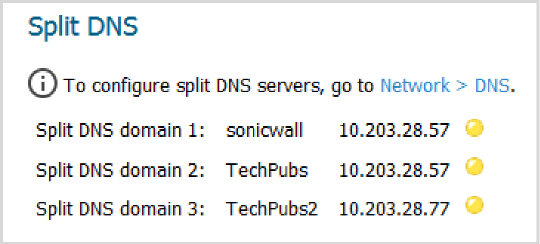
ⓘ To configure DNS servers, g

DNS Server 1: 10.200.0.52 ●

DNS Server 2: 10.200.0.53 ●

Server Status
Unknown
Proxied DNS Packets Sent: 0
Successful DNS Proxy: 0

Monitoring Split DNS Server Status



Split DNS

ⓘ To configure split DNS servers, go to Network > DNS.

Split DNS domain 1:	sonicwall	10.203.28.57	●
Split DNS domain 2:	TechPubs	10.203.28.57	●
Split DNS domain 3:	TechPubs2	10.203.28.77	●

ⓘ **NOTE:** A configured split DNS server has its IP address displayed. To configure a split server, click the link to **Network > DNS**; see Configuring DNS Settings on page 306.

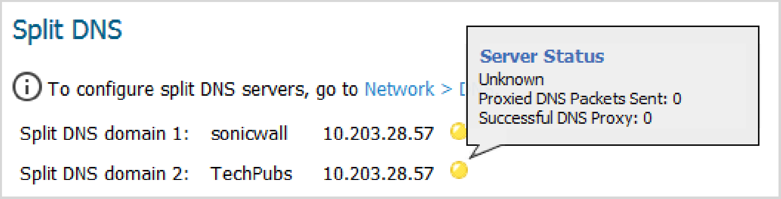
You monitor the status of each configured upstream DNS Servers in the **Split DNS** section. The server status is decided by DNS reply from the server:

Up (green LED) The reply was successful.

Unknown (yellow LED) A DNS reply has not been received by the server.

Down (red LED) The failure count exceeded the limit of 20. The status remains down until the next successful DNS query.

Moving the mouse over the LED displays a popup with further information about the number of proxied DNS packets sent and the number of successful DNS Proxy queries:



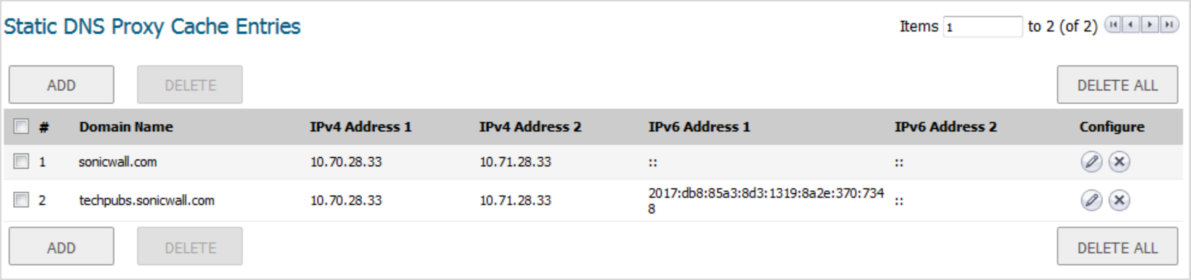
Split DNS

ⓘ To configure split DNS servers, go to Network > [

Split DNS domain 1:	sonicwall	10.203.28.57	●
Split DNS domain 2:	TechPubs	10.203.28.57	●

Server Status
Unknown
Proxied DNS Packets Sent: 0
Successful DNS Proxy: 0

Viewing and Managing Static DNS Cache Entries



Static DNS Proxy Cache Entries

□	#	Domain Name	IPv4 Address 1	IPv4 Address 2	IPv6 Address 1	IPv6 Address 2	Configure
□	1	sonicwall.com	10.70.28.33	10.71.28.33	::	::	✎ ⊗
□	2	techpubs.sonicwall.com	10.70.28.33	10.71.28.33	2017:db8:85a3:8d3:1319:8a2e:370:7348	::	✎ ⊗

Domain Name Name of the domain.

IPv4 Address 1 Primary IPv4 address of Static DNA cache. `0.0.0.0` if not specified.

IP4 Address 2 Secondary IPv4 address of Static DNA cache. `0.0.0.0` if not specified.

IPv6 Address 1 Primary IPv6 address of Static DNA cache. `::` if not specified.

IPv6 Address 2 Secondary IPv6 address of Static DNA cache. `::` if not specified.

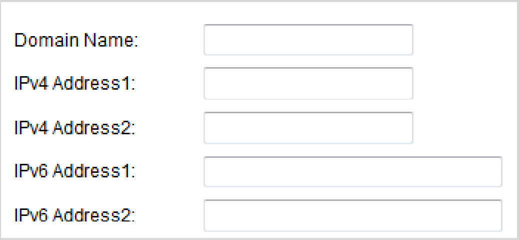
Configure Contains the **Edit** and **Delete** icons for each entry.

To add static DNS cache entries:

1 Navigate to **MANAGE | System Setup | Network > DNS Proxy**.

2 Scroll to **Static DNS Proxy Cache Entries**.

3 Click **Add** either above or below the table. The **Add Static DNS Cache** dialog displays.



Domain Name:	
IPv4 Address1:	
IPv4 Address2:	
IPv6 Address1:	
IPv6 Address2:	

4 Enter a name in the **Domain Name** field.

5 For IPv4 static DNS cache, enter the primary IPv4 address in the **IPv4 Address 1** field.

6 Optionally, for IPv4 static DNS cache, enter the secondary IPv4 address in the **IPv4 Address 2** field.

7 For IPv6 static DNS cache, enter the primary IPv6 address in the **IPv6 Address 1** field.

8 Optionally, for IPv6 static DNS cache, enter the secondary IPv6 address in the **IPv4 Address 2** field.

9 Click **OK**.

10 To add another static DNS cache entry, repeat Step 4 through Step 9.

11 Click **Cancel**.

Deleting Static DNS Cache Entries

To delete a static DNS cache entry:

1 Click the entry's **Delete** icon.

To delete two or more static DNS cache entries:

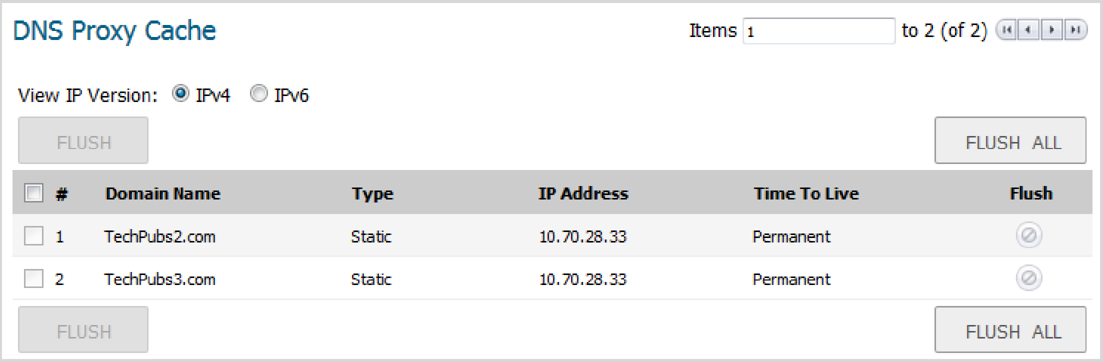
1 Select the checkboxes of the entries to be deleted. **Delete** becomes available.

2 Click **Delete**.

To delete all static DNS cache entries:

1 Click **Delete All**.

Viewing DNS Proxy Cache Entries



DNS Proxy Cache

Items 1 to 2 (of 2)

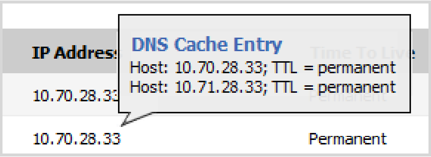
View IP Version: ● IPv4 ○ IPv6

□	#	Domain Name	Type	IP Address	Time To Live	Flush
□	1	TechPubs2.com	Static	10.70.28.33	Permanent	⊘
□	2	TechPubs3.com	Static	10.70.28.33	Permanent	⊘

View IP Version	Select either **IPv4** or **IPv6**.
Domain Name	Name of the DNS Server.
Type	**Dynamic** **Static**

IP Address

IPv4 or IPv6 address of the DNS Server. Mousing over an entry displays **Host** and Time to Live (**TTL**) information for the entry:



DNS Cache Entry
Host: 10.70.28.33; TTL = permanent
Host: 10.71.28.33; TTL = permanent

10.70.28.33

10.70.28.33 Permanent

Time to Live

Either:

- **Expires in *n minutes x seconds*** (Dynamic DNS)
- **Expired** (Dynamic DNS)
- **Permanent** (Static DNS)

Flush

Flush icon for each entry.

Dynamic DNS cache is added automatically during the DNS Proxy process; static DNS cache is added when you configure it. Dynamic DNS cache has a TTL value and can be flushed. Static DNS cache must be deleted; see Deleting Static DNS Cache Entries on page 328

Flushing Dynamic DNS Cache Entries

To flush a dynamic DNS cache entry:

1 Click the entry’s **Flush** icon.

To flush two or more dynamic DNS cache entries:

1 Select the checkboxes of the entries to be deleted. **Flush** become available.

2 Click **Flush**.

To flush all dynamic DNS cache entries:

1 Click **Flush All**.

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Configuring DNS Security

Topics:

About Sinkholes

A DNS sinkhole, also known as a sinkhole server, Internet sinkhole, or BlackholeDNS, is a DNS server that gives out false information to prevent the use of the domain names it represents. DNS sinkholes are effective at detecting and blocking malicious traffic, and used to combat bots and other unwanted traffic.

SonicOS NS*v* now provides the ability to configure a sinkhole with black and white lists.

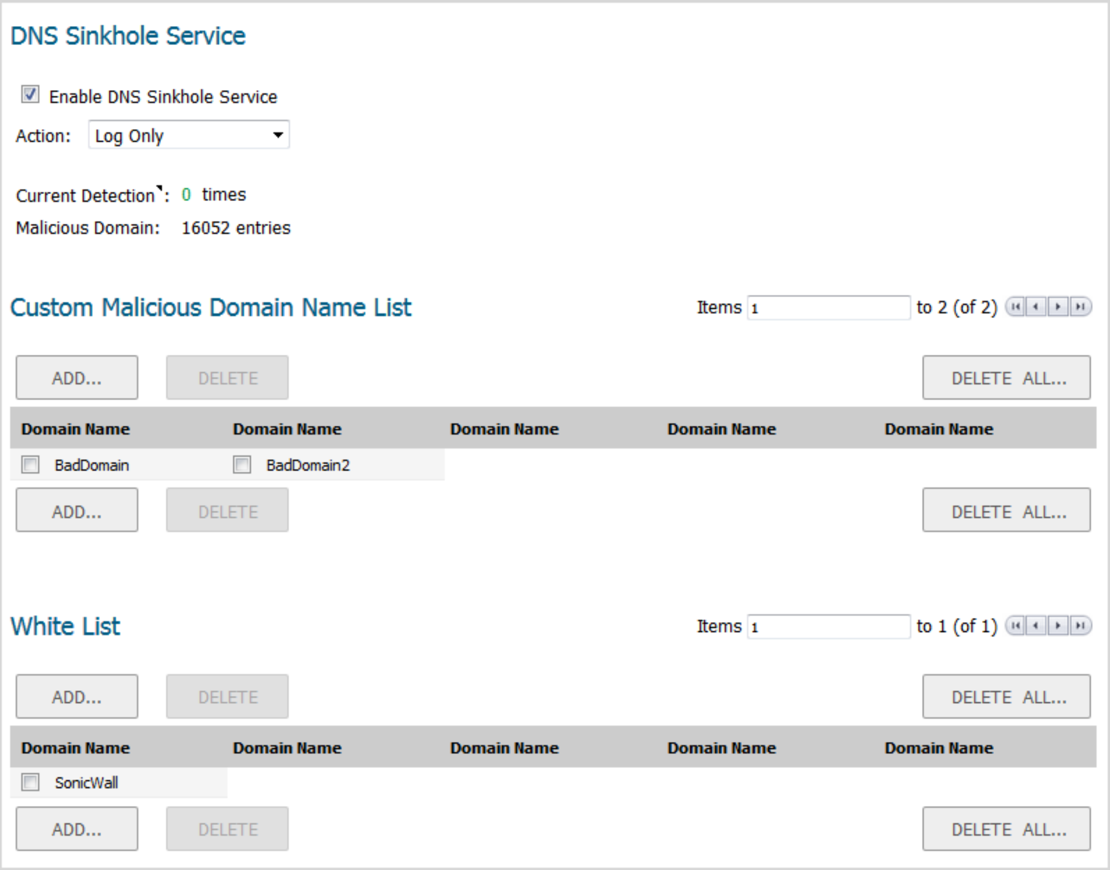
Network > DNS Security

MANAGE | System Setup > **Network** > **DNS Security** allows you to manually configure your DNS security settings.

Configuring DNS Security Settings

To configure DNS Security settings:

1 Navigate to **MANAGE | System Setup > Network > DNS Security**.



DNS Sinkhole Service

☑ Enable DNS Sinkhole Service

Action: Log Only

Current Detection: 0 times

Malicious Domain: 16052 entries

Custom Malicious Domain Name List

Items 1 to 2 (of 2)

Domain Name	Domain Name	Domain Name	Domain Name	Domain Name
□ BadDomain	□ BadDomain2			

White List

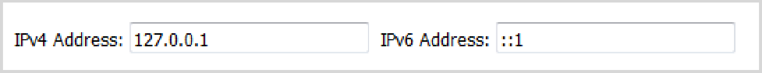
Items 1 to 1 (of 1)

Domain Name	Domain Name	Domain Name	Domain Name	Domain Name
□ SonicWall				

2 Select **Enable DNS Sinkhole Service**. This option is selected by default.

3 Select what the service is to do from **Action**:

- **Log Only**
- **Negative Reply**
- **Reply with Forged IP** – Two fields display:

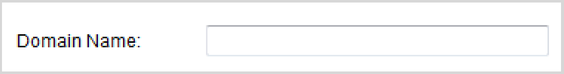


IPv4 Address: 127.0.0.1 IPv6 Address: ::1

a) Enter the IPv4 and IPv6 addresses in the fields.

4 Scroll to **Custom Malicious Domain Name List**.

5 CLICK **ADD**. THE **ADD ONE DOMAIN** NAME DIALOG DISPLAYS.



Domain Name:

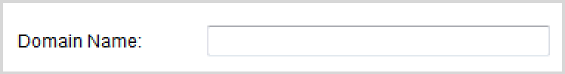
6 Click **OK**.

7 Enter the malicious domain name in the **Domain Name** field.

8 Repeat Step 5 through Step 7 for each domain name.

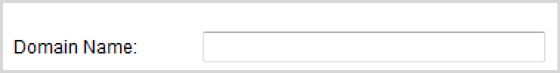
9 Scroll to **White List**.

10 CLICK **ADD**. THE **ADD ONE WHITE ENTRY** DIALOG DISPLAYS.



Domain Name:

11 Enter the white list domain name in the **Domain Name** field.



Domain Name:

12 Click **OK**.

13 Repeat Step 10 through Step 7 for each domain name.

14 Click **ACCEPT** to save your changes.

Deleting Entries in the Lists

To delete a list's entries.

1 Navigate to **MANAGE | System Setup > Network > DNS Security**.

2 Select the entry to delete. **DELETE** and **DELETE ALL** become available.

3 Click the appropriate button.

About DNS Tunneling Detection

DNS tunneling is a method of bypassing security controls and exfiltrating data from a targeted organization. A DNS tunnel can be used as a full remote-control channel for a compromised internal host. Capabilities include Operating System (OS) commands, file transfers or even a full IP tunnel.

SonicOS NS*v* provides the ability to detect DNS tunneling attacks, displays suspicious clients, and allows you to create white lists for DNS tunnel detection.

When DNS tunneling detection is enabled, SonicOS NS*v* logs whenever suspicious DNS packets are dropped.

Topics:

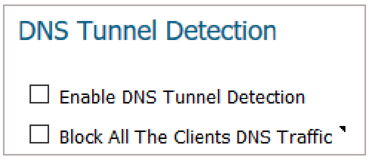
- Enabling DNS Tunneling Detection on page 332
- Viewing Detected Suspicious Clients on page 333
- Creating DNS Tunnel Detection White Lists on page 333
- Deleting DNS Tunnel Detection White List Entries on page 334

Enabling DNS Tunneling Detection

To configure DNS tunneling detection:

1 Navigate to **MANAGE | System Setup > Network > DNS Security**.

2 Scroll to the **DNS Tunnel Detection** section.



DNS Tunnel Detection

☐ Enable DNS Tunnel Detection

☐ Block All The Clients DNS Traffic

3 To enable DNS tunnel detection, select **Enable DNS Tunnel Detection**.

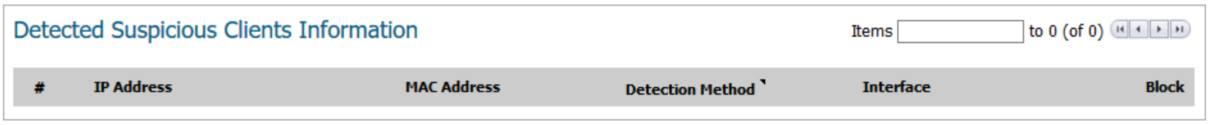
4 To block all the detected clients' DNS traffic, select **Block All The Clients DNS Traffic**.

5 Click **ACCEPT**.

Viewing Detected Suspicious Clients

SonicOS NS*v* displays information about all hosts that have established a DNS tunnel in the **Detected Suspicious Clients Information** table.

TIP: This table is populated only if DNS tunnel detection is enabled. Hosts are dropped only if blocking clients DNS traffic is enabled. See Enabling DNS Tunneling Detection on page 332.



Detected Suspicious Clients Information

#	IP Address	MAC Address	Detection Method	Interface	Block

IP Address IP address of the suspicious client

MAC Address MAC address of the suspicious client

Detection Method DNS type used to detect suspicious clients:

- **Normal DNS Type**: A, AAAA, CNAME
- **Corner DNS Type**: such as TXT, NULL, SRV, PRIVATE, MX

Interface Interface on which the host establishing the DNS tunnel was detected

Block Indicates whether the host was blocked

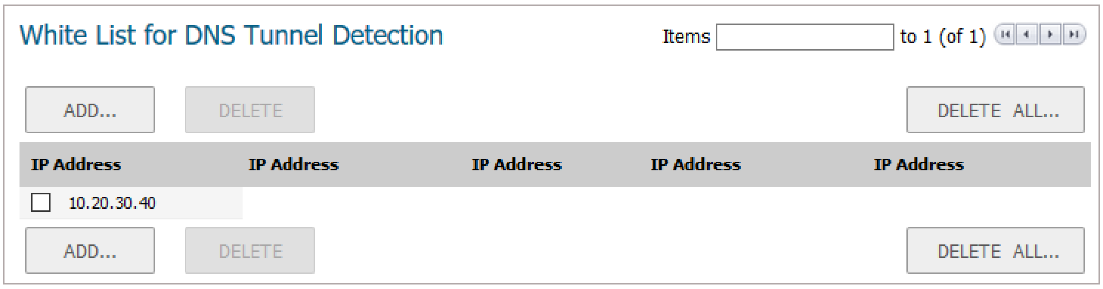
Creating DNS Tunnel Detection White Lists

You can create white lists for IP address you consider safe. If a detected DNS tunnel IP address matches an address in the white list, DNS tunnel detection is bypassed.

To create a DNS

1 Navigate to **MANAGE | System Setup > Network > DNS Security**.

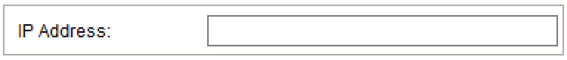
2 Scroll to **White List for DNS Tunnel Detection**.



White List for DNS Tunnel Detection

IP Address	IP Address	IP Address	IP Address	IP Address
☐ 10.20.30.40				

3 Click **ADD**. The **Add One White List Entry** dialog displays.



IP Address:

4 Click **OK**.

5 Repeat Step 3 and Step 4 for each white list entry.

Deleting DNS Tunnel Detection White List Entries

To delete all DNS tunnel detection white list entries:

1 Navigate to **MANAGE | System Setup > Network > DNS Security**.

2 Scroll to **White List for DNS Tunnel Detection**.

3 Click **DELETE ALL**.

To delete one or more DNS tunnel detection white list entries:

1 Navigate to **MANAGE | System Setup > Network > DNS Security**.

2 Scroll to **White List for DNS Tunnel Detection**.

3 Select one or more DNS tunnel detection white list entries. **DELETE** becomes available.

4 Click **DELETE**.

20

Configuring Route Advertisements and Route Policies

ⓘ **IMPORTANT:** For SD-WAN routing and route policies, see Configuring SD-WAN Route Policies on page 475.

Topics:

About Routing

SonicWall Security Appliances support these routing protocols:

- RIPv1 (Routing Information Protocol)
- RIPv2
- OSPFv2 (Open Shortest Path First)
- OSPFv3
- PBR (Policy-Based Routing)

Topics:

About Metrics and Administrative Distance

Metrics and administrative distance affect network performance, reliability, and circuit selection.

About Metrics

A *metric* is a weighted cost assigned to static and dynamic routes. Metrics determine the best route among several, usually the gateway with the lowest metric. This gateway is usually the default gateway.

Metrics have a value between 1 and 254; see Metric Value Descriptions. Lower metrics are considered better and take precedence over higher costs. SonicOS NS*v* adheres to Cisco-defined metric values for directly connected interfaces, statically encoded routes, and all dynamic IP routing protocols.

Metric Value Descriptions

Metric Value	Description
1	Static Route
5	EIGRP Summary
20	External BGP
90	EIGRP
100	IGRP
110	OSPF
115	IS-IS
120	RIP
140	EGP

Metric Value Descriptions (Continued)

Metric Value	Description
170	External EIGRP
200	Internal BGP

About Administrative Distance

Administrative distance (admin distance) is a value that influences which source of routes should be used for two identical routes from different sources. The lower the administrative distance value, the more trusted the route.

The admin distance, when set, is only used by the ZebOS components when choosing which routes to:

- Populate into PBR
- Redistribute to other routing protocols when a static route competes with a route received from a particular routing protocol.

The admin distance is not used for prioritizing routes within PBR itself, so unless dynamic routing is in use, the admin distance set for a static route has no effect. When dynamic routing is being used, the admin distance provides a mechanism by which static routes defined in PBR can be compared to otherwise equivalent dynamic routes possibly received from protocols such as OSPF, RIP, or BGP. By default, the admin distance of a PBR static route inserted into the network services module (NSM) is equal to the metric defined for the PBR route. The admin distance of each static route might optionally be set to a different value when a custom value is entered for Admin Distance.

For example, if a simple (destination only) static route (for example, destination = `14.1.1.0/24`) is defined with a metric of 10 and the admin distance set to its default of **Auto**, that route is populated into NSM with an admin distance and metric of 10.

Now assume the same `14.1.1.0/24` route is received from both RIP and OSPF. RIP routes have a default admin distance of 120 and OSPF routes 110, so the static route, with a default admin distance (== the metric) of 10 would be preferred over both routes, and NSM would not populate either the OSPF or RIP route into PBR. If the admin distance of the static route had been set to 115 (keeping the metric at 10), however, then the OSPF route (at 110) would be preferred over the static route, but the RIP route would not. If the OSPF route disappeared, NSM would withdraw the OSPF route and would not populate the RIP route as its 120 AD is greater than the static route's 115 AD.

In either of the above cases, the static route is still preferred in PBR because all non-default routes populated into PBR from NSM are added with a 110 metric, which is greater than the metric of 10 for the static route.

If an admin distance of 110 and a metric > 110 are used for the static routes, the metric value passed to NSM would be used by OSPF when it compares the metric of the static route to the OSPF metric (or cost) of any competing OSPF route.

Route Advertisement

SonicWall Security Appliances use RIPv1 or RIPv2 to advertise its static and dynamic routes to other routers on the network. Changes in the status of VPN tunnels between the Security Appliance and remote VPN gateways are also reflected in the RIPv2 advertisements. Based on your router’s capabilities or configuration, choose between:

- RIPv1, which is an earlier version of the protocol, has fewer features, and sends packets through broadcast instead of multicast.
- RIPv2, which is a later version of the protocol, includes subnet information when multicasting the routing table to adjacent routers and route tags for learning routes. RIPv2 packets are backwards compatible and

can be accepted by some RIPv1 implementations that provide an option of listening for multicast packets. The RIPv2 Enabled (broadcast) selection, which broadcasts packets instead of multicasting them, is for heterogeneous networks with a mixture of RIPv1 and RIPv2 routers.

ECMP Routing

SonicOS NSv supports equal-cost multi-path (ECMP) routing, a technique for routing packets along multiple paths of equal cost. The forwarding engine identifies paths by next-hop. When forwarding a packet, the router must decide which next-hop (path) to use. Multi-path routing can be used in conjunction with most routing protocols.

In SonicOS NSv, you can use ECMP routing to specify multiple next hops for a given route's destination. In environments with substantial requirements, there are several reasons for doing this. A router could just use one ISP most of the time, and switch to the other when the first one fails for some reason. Another application of multi-path is to keep a path on standby and enable it only when bandwidth requirements surpass a predefined threshold. SonicOS NSv supports up to four next-hop paths.

Various routing protocols, including Open Shortest Path First (OSPF) and Intermediate System to Intermediate System (ISIS), explicitly allow ECMP routing. Some router implementations also allow equal-cost multi-path usage with RIP and other routing protocols.

Policy-based Routing

A simple static routing entry specifies how to handle traffic that matches specific criteria, such as destination address, destination mask, gateway to forward traffic, the interface that gateway is located, and the route metric. This method of static routing satisfies most static requirements, but is limited to forwarding based only on destination addressing.

Policy-based Routing (PBR) allows you to create extended static routes to provide more flexible and granular traffic handling capabilities. SonicOS NSv PBR allows for matching based upon source address, source netmask, destination address, destination netmask, service, interface, and metric. This method of routing allows for full control of forwarding based upon a large number of user defined variables.

A FQDN cannot be used as the source or destination of the PBR entry.

Policy-based TOS Routing

SonicOS NSv supports policy-based TOS (type of service) routing when defining policy-based routing (PBR) policies by Type of Service (TOS) and TOS mask values. When defined, the TOS and mask values are compared against the associated IP packet's TOS/DSCP field in the IP header when finding a route match.

The TOS value is compared to an 8-bit field in the IP packet header (for information about this header, see *RFC 2474, Differentiated Services*, and *RFC 2168, Explicit Congestion Notification*). The TOS value can be used to define services relating to quantitative performance requirements (for example, peak bandwidth) and those based on relative performance (for example, class differentiation).

TOS routing differs from existing SonicOS NSv QoS marking, which does not affect the routing of a packet and cannot forward packets differently based on an inbound packet's TOS field. TOS Routing provides this capability by allowing policy routes to define a TOS Value/TOS Mask pair to be compared to inbound packets for differential forwarding. TOS routing only applies to packets as they enter the Security Appliance.

With TOS routing, it is possible to define multiple policy routes with identical source IP, destination IP, and service values, but differing TOS/TOS mask values. This allows packets with marked TOS fields to be forwarded differently based on the value of the TOS field in the inbound packet.

Any PBR policy routes defined before SonicOS NS*v* 6.5 have no values defined for the TOS/TOS mask. Likewise, the default values for TOS/TOS mask fields are zero (no values defined).

Policy routes with a TOS value other than zero are prioritized before all simple destination-only routes, but below any policy routes that define a source or service. When comparing two TOS Policy routes, and assuming both have the same set of source, destination, and service values either defined or not defined, the TOS route with the greater number of TOS mask bits set to 1 is prioritized before TOS routes with fewer TOS mask bits set.

The general prioritization (high to low) of PBR routes is as follows, based on the policy fields defined as anything other than **Any** or zero for TOS:

Destination, Source, Service, TOS

Destination, Source, Service

Destination, Source, TOS

Destination, Source

Destination, Service, TOS

Destination, Service

Destination, TOS

Destination

Source, Service, TOS

Source, Service

Source, TOS

Source

Service, TOS

Service

TOS

PBR Metric-based Priority

SonicOS NS*v* supports a metric weighted cost assigned to a route policy for policy-based routing (PBR) that allows the configured metric to take precedence in route prioritization over the route specificity that used by default. Metrics have a value between 0 and 255. Lower metrics are considered better and take precedence over higher ones.

The general prioritization (high to low) of PBR routes is as follows, based on the policy fields defined as anything other than **Any**, or zero for TOS:

Destination, Source, Service, TOS

Destination, Source, Service

Destination, Source, TOS

Destination, Source

Destination, Service, TOS

Destination, Service

Destination, TOS

Destination

Source, Service, TOS

Source, Service

Source, TOS

Source

Service, TOS

Service

TOS

Within these 15 classifications, routes are further prioritized based on the cumulative specificity of the defined route entries. For the source and destination fields, specificity is measured by counting the number of IP addresses represented in the address object. For example, the network address object, `10.0.0.0/24`, would include 256 IP addresses, while the network address object, `10.0.0.0/20`, would represent 4096. The longer `/24` (24 bit) network prefix represents fewer host IP addresses and is more specific.

The new metric-weighted option allows the configured metric to take precedence in prioritization over the route specificity. With the option enabled, the precedence used during prioritization is as follows (high to low):

1. Route class (determined by the combination of source, destination, service, and TOS fields with values other than Any or zero)
2. The value of the Metric
3. The cumulative specificity of the source, destination, service, and TOS fields

Policy-based Routing and IPv6

For complete information on the SonicOS NS*v* implementation of IPv6, see IPv6 on page 659.

Policy-based Routing is fully supported for IPv6 by selecting IPv6 address objects and gateways for route policies on **Network > Routing**. You can switch the entries in the **Route Policies** table between **IPv4** and **IPv6**.

Routing Information Protocol next generation (RIPng) is an information routing protocol for IPv6, which allows routers to exchange information for computing routes through an IPv6-based network.

For information on route advertisement, see Route Advertisement on page 337. For information on setting up Route Policies, see Route Advertisement on page 337.

OSPF and RIP Advanced Routing Services

In addition to Policy-based Routing and RIP advertising, SonicOS NS*v* offers the option of enabling Advanced Routing Services (ARS). Advanced Routing Services provides full advertising and listening support for the Routing Information Protocol (RIPv1 - RFC1058) and (RIPv2 - RFC2453), and Open Shortest Path First (OSPFv2 – RFC2328). Advanced Routing Service should only be enabled by those environments requiring support for either or both of these dynamic routing protocols.

RIP and OSPF are Interior Gateway Protocols (IGP) that are both widely used by networks of various sizes to automate the process of route distribution. RIP is commonly used within smaller networks, while OSPF is used by larger networks, although network size should not be the only factor used to determine the appropriateness of one protocol over the other – network speed, interoperability requirements, and relative overall complexity, for example, should also be considered. RIPv1 and RIPv2 are both supported by ARS, the largest differences between the two being that RIPv2 supports VLSM (Variable Length Subnet Masks), authentication, and routing updates. Routing Information Protocol Differences illustrates the major differences between RIPv1, RIPv2, and OSPFv2/OSPFv3:

Routing Information Protocol Differences

	RIPv1	RIPv2	OSPFv2/OSPFv3
Protocol metrics	Distance Vector	Distance Vector	Link State
Maximum Hops	15	15	Unlimited
Routing table updates	Full table broadcast periodically, slower convergence	Full table broadcast or multicast periodically, slower convergence	Link state advertisement multicasts, triggered by changes, fast convergence
Subnet Sizes Supported	Only class-based (a/b/c) subnets support	Class-based only	VLSM
Autonomous system topology	Indivisible and flat	Indivisible and flat	Area-based, allowing for segmentation and aggregation

Topics:

- About Routing Services on page 341
- OSPF Terms on page 344

About Routing Services

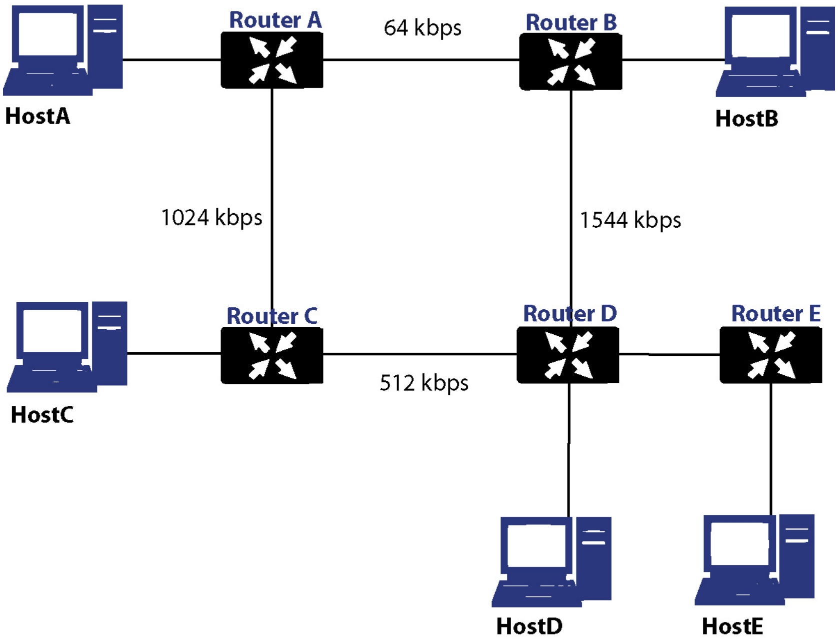
Topics:

- Protocol Type on page 341
- Maximum Hops on page 342
- Split-Horizon on page 343
- Poison Reverse on page 343
- Routing Table Updates on page 343
- Subnet Sizes Supported on page 343
- Autonomous System Topologies on page 344

Protocol Type

Distance Vector protocols such as RIP base routing metrics exclusively on hop counts, while Link state protocols such as OSPF consider the state of the link when determining metrics. For example, OSPF determines interface metrics by dividing its reference bandwidth (100mbits by default) by the interface speed – the faster the link, the lower the cost and the more preferable the path. Consider the example network shown in Example Network for Determining Lowest Cost Route:

Example Network for Determining Lowest Cost Route



In the sample network shown in Example Network for Determining Lowest Cost Route, if Host A wanted to reach Host B, with RIP, the lowest cost route would be from Router A to Router B, across the relatively slow 64kbps link. With OSPF, the cost from Router A to Router B would be 1562, while the cost from Router A to Router C to Router D to Router B would be 364, making it the preferred route.

Maximum Hops

RIP imposes a hop count of 15 to help prevent routing loops which can occur when bad (for example, stale) routing information is broadcast and propagated through a network either because of misconfiguration, or slow convergence. Consider if the link between Router D and Router E failed in the example in Example Network for Determining Lowest Cost Route, and there were no safeguards in place:

- Router A’s routing information states that it can reach Network E through Router B or Router C with a metric of 3.
- When the link between Router D and Router E fail, and Router A broadcasts its routing information, Router B and Router C determine that they can reach Network E through Router A with a metric of 4.
- Router B and Router C broadcast this information, and it is received by Router D which then determines it can reach Network E through Router B or Router C with a metric of 5.
- This loop continues until the hop count of 16 (infinity) is reached.

Other measures against this sort of situation are also commonly employed by RIP, including:

- Split-Horizon on page 343
- Poison Reverse on page 343
- Routing Table Updates on page 343
- Subnet Sizes Supported on page 343
- Autonomous System Topologies on page 344

Split-Horizon

A preventative mechanism where routing information learned through an interface is not sent back out the same interface. This generally works well on broadcast links, but not on non-broadcast links such as Frame Relay, where a single link can commonly be used to reach two separate autonomous systems.

Poison Reverse

Also known as route poisoning, an extension of split-horizon where a network is advertised with a metric of 16 (unreachable), helping to ensure that incorrect alternative routes are not propagated.

OSPF does not have to impose a hop count limit because it does not advertise entire routing tables, rather it generally only sends link state updates when changes occur. This is a significant advantage in larger networks in that it converges more quickly, produces less update traffic, and supports an unlimited number of hops.

Routing Table Updates

As mentioned above, the practice of sending an entire routing table introduces the problems of slower convergences, higher bandwidth utilization, and increased potential for stale routing information. RIPv1 broadcasts its entire routing table at a prescribed interval (usually every 30 seconds), RIPv2 can either broadcast or multicast, and OSPF multicasts only link state updates whenever a change to the network fabric occurs. OSPF has a further advantage of using designated routers (DR) in forming adjacencies in multiple-access networks (more on these concepts later) so that updates do not have to be sent to the entire network.

Subnet Sizes Supported

RIPv1 was first implemented when networks were strictly class A, class B, and class C (and later D and E):

Class A `1.0.0.0` to `126.0.0.0` (`0.0.0.0` and `127.0.0.0` are reserved)

- Left most bit 0; 7 network bits; 24 host bits
- 0nnnnnnn hhhhhhhh hhhhhhhh hhhhhhhh (8-bit classful netmask)
- 126 Class A networks, 16,777,214 hosts each

Class B `128.0.0.0` to `191.255.0.0`

- Left most bits 10; 14 network bits; 16 host bits
- `10nnnnnn nnnnnnnn hhhhhhhh hhhhhhhh` (16-bit classful netmask)
- 16,384 Class B networks, 65,532 hosts each

Class C `192.0.0.0` to `223.255.255.0`

- Left most bits 110; 21 network bits; 8 host bits
- 110nnnnn nnnnnnnn nnnnnnnn hhhhhhhh (24-bit classful netmask)
- 2,097,152 Class Cs networks, 254 hosts each

Class D `225.0.0.0` to `239.255.255.255` (multicast)

- Left most bits 1110; 28 multicast address bits
- 1110mmmm mmmmmmmm mmmmmmmm mmmmmmmm

Class E `240.0.0.0` to `255.255.255.255` (reserved)

- Left most bits 1111; 28 reserved address bits
- 1111rrrr rrrrrrrr rrrrrrrr rrrrrrrr

This method of address allocation proved to be very inefficient because it provided no flexibility, neither in the way of segmentation (subnetting) or aggregation (supernetting, or CIDR – classless inter-domain routing) by means of VLSM – variable length subnet masks.

VLSM, supported by RIPv2 and OSPF, allows for classless representation of networks to break larger networks into smaller networks:

> For example, take the classful `10.0.0.0/8` network, and assign it a `/24` netmask. This subnetting allocates an additional 16-bits from the host range to the network range (24-8=16). To calculate the number of additional networks this subnetting provides, raise 2 to the number of additional bits: 2^16=65,536. Thus, rather than having a single network with 16.7 million hosts (usually more than most LAN's require) it is possible to have 65,536 networks, each with 254 usable hosts.

VLSM also allows for route aggregation (CIDR):

> For example, if you had 8 class C networks: `192.168.0.0/24` through `192.168.7.0/24`, rather than having to have a separate route statement to each of them, it would be possible to provide a single route to `192.168.0.0/21` which would encompass them all.

This ability, in addition to providing more efficient and flexible allocation of IP address space, also allows routing tables and routing updates to be kept smaller.

Autonomous System Topologies

An autonomous system (AS) is a collection of routers that are under common administrative control and that share the same routing characteristics. When a group of autonomous systems share routing information, they are commonly referred to as a confederation of autonomous systems. (RFC1930 and RFC975 address these concepts in much greater detail). In simple terms, an AS is a logical distinction that encompasses physical network elements based on the commonness of their configurations.

With regard to RIP and OSPF, RIP autonomous systems cannot be segmented, and all routing information must be advertised (broadcast) through the entire AS. This can become difficult to manage and can result in excessive routing information traffic. OSPF, on the other hand, employs the concept of Areas, and allows for logically, manageable segmentation to control the sharing of information within an AS. An Area ID is an administrative identifier. OSPF areas begin with the backbone area (area 0 or `0.0.0.0`), and all other areas must connect to this backbone area (although there are exceptions). This ability to segment the routing AS helps to ensure that it never becomes too large to manage, or too computationally intensive for the routers to handle.

OSPF Terms

OSPF is substantially more complicated to configure and maintain than RIP. The following concepts are critical to understanding an OSPF routing environment:

- **Link state** – As it pertains to OSPF, a link is an egress interface on a router, and the state describes characteristics of that interface, such as its cost. Link states are sent in the form of Link State Advertisements (*LSA*) which are contained within Link State Update (*LSU*) packets, one of five types of OSPF packets.
- **Cost** – A quantification of the overhead required to send a packet along a particular link. Cost is calculated by dividing a reference bandwidth (usually 100mbit, or 10^8 bit) by an interface's speed. The lower the cost, the more preferable the link. Some common path costs are shown in Cost Calculation for Different Interfaces.

Cost Calculation for Different Interfaces

Interface	Divided by 10^8 (100mbit) = OSPF Cost
Fast Ethernet	1
Ethernet	10
T1 (1.544mbit)	64
DSL (1mbit)	100
DSL (512kbps)	200

Cost Calculation for Different Interfaces (Continued)

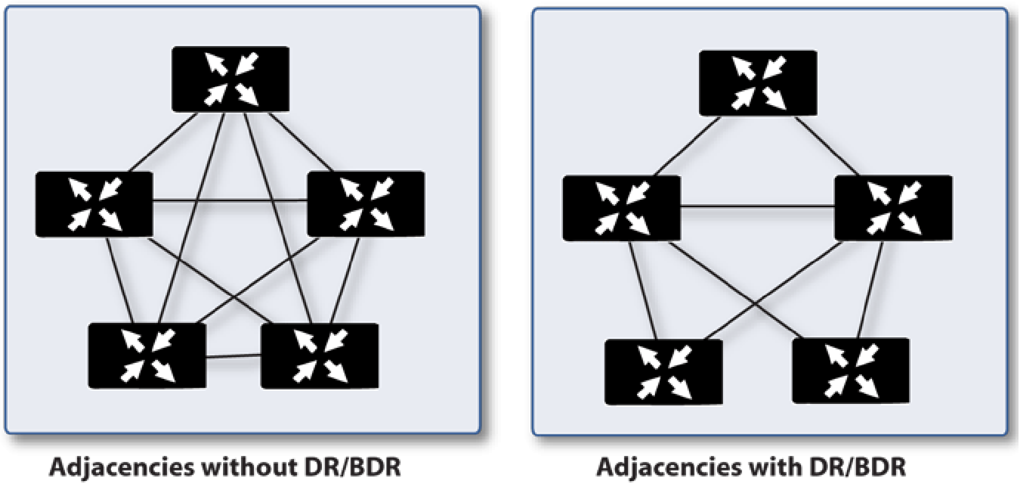
Interface	Divided by 10^8 (100mbit) = OSPF Cost
64kbps	1562
56kbps	1785

- **Area** – The network comprising the group of OSPF routers intended to share a common Link State Database. OSPF networks are built around the backbone area (area 0, or `0.0.0.0`) and all other areas must connect to the backbone area (unless virtual links are used, which is generally discouraged). Area assignment is interface specific on an OSPF router; in other words, a router with multiple interfaces can have those interfaces configured for the same or different areas.
- **Neighbors** – OSPF routers on a common network segment have the potential to become neighbors by means of sending Hello packets. Hello packets act as a form of advertisement and identification, and if two OSPF routers share a common set of certain characteristics, they become neighbors upon seeing their own router ID in the other router's Hello packet. Hello packets are also used in the *DR* (Designated Router) and *BDR* (Backup Designated Router) election process. For two routers to become neighbors, the characteristics that they must have in common are:
    - **Area-ID** – An area ID identifies an OSPF *area* with a 32-bit value, and is generally represented in an IP address format. OSPF requires at a minimum the backbone area, area 0 (or `0.0.0.0`) for operation.
    - **Authentication** – Authentication types can generally be set to none, simple text, or MD5. When using simple text, authentication should be used only for identification, as it is sent in the clear. For security, MD5 should be used.
    - **Timer intervals** – Hello and Dead intervals must be the same. The Hello interval specifies the number of seconds between Hello packets (as a Keepalive function), and the Dead interval specifies the number of seconds after which a router is considered unavailable if a Hello is not received.
    - **Stub area flag** – A *Stub area* is an area that only requires a single point of egress, and therefore does not require a full list of external link advertisements. The stub area flag on two potential neighbors must be the same to avoid inappropriate link state exchanges. Another factor that affects neighboring is the kind of network. OSPF recognizes three network types:
        - **Broadcast** – For example, Ethernet. In broadcast networks, neighboring can be established with all other routers in the broadcast domain.
        - **Point to Point** – For example, serial links. In point to point (or point to multipoint) networks, neighboring can be established with the router at the other end of the link.
        - **NBMA** (non-broadcast multiple access) – For example, frame relay. In NBMA networks, neighbors must be explicitly declared.
- **Link State Database** – The Link State Database is composed of the LSA's sent and received by *neighboring* OSPF routers that have created *adjacencies* within an *area*. The database, after complete, contains all the link state information for a given area, at which time the Shortest Path First (SPF) algorithm is applied to determine the optimal route to all connected networks based on cost. The SPF algorithm employs the Dijkstra pathfinding algorithm, which essentially regards all routers as vertices in a graph, and computes the cost between each vertex.
- **Adjacencies** – OSPF routers exchange LSA's with adjacent routers to create the LSDB. Adjacencies are created in different fashions depending on the network type (see *Neighbors* above). Generally, the network type is broadcast (for example, Ethernet) so adjacencies are formed by the exchanging OSPF packets in a handshake-like fashion (see OSPF Packet types below). To minimize the amount of information exchanged between adjacent routers, segments (broadcast domains) with multiple OSPF routers elect a Designated Router (DR) and a Backup Designated Router (BDR) using Hello packets.

- **DR** (Designated Router) – On multi-access segments, OSPF routers elect a DR and a BDR, and all other routers on the segment create adjacencies with the DR and the BDR. DR election is based on a router's OSPF Priority, which is a configurable value from 0 (not eligible for DR) to 255. The router with the highest priority becomes the DR. In the event of a priority tie, the router with the highest Router ID (based on interface addressing) wins. When a router is the DR, its role is uncontested until it becomes unavailable.

  LSA's are then exchanged within LSUs across these adjacencies rather than between each possible pairing combination of routers on the segment; see Routing Adjacencies: Designated Router (DR). Link state updates are sent by non-DR routers to the multicast address `225.0.0.6`, the RFC1583 assigned 'OSPFIGP Designated Routers' address. They are also flooded by DR routers to the multicast address `225.0.0.5` 'OSPFIGP All Routers' for all routers to receives the LSA's.

  Routing Adjacencies: Designated Router (DR)



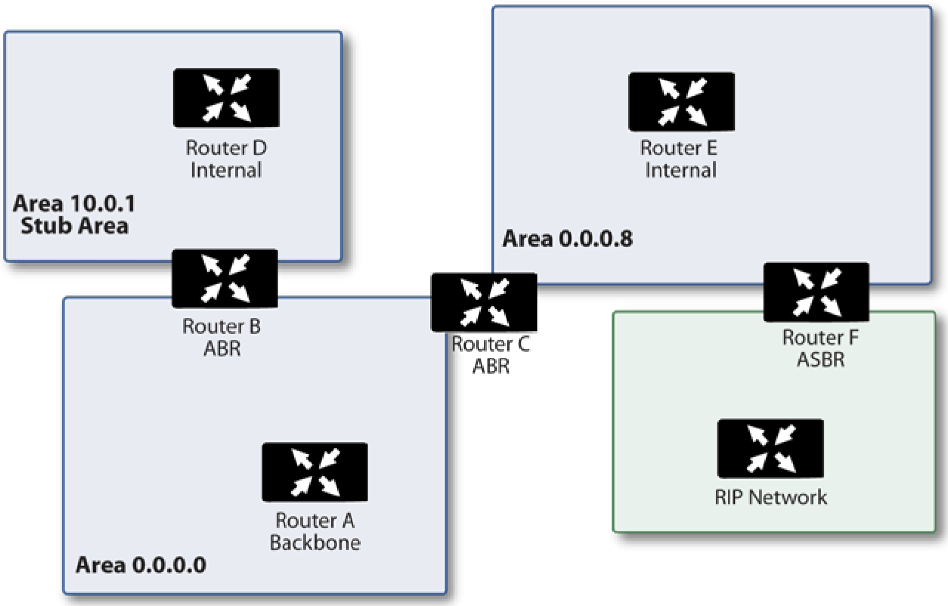
- **OSPF Packet types** – The five types of OSPF packets are:
  - **Hello** (OSPF type 1) – Sent at a certain interval to establish and maintain relationships with neighboring OSPF routers, and elect Designated Routers. (*Sent during the initialization and the 2-WAY phases on LSDB synchronization*).
  - **Database Description** (OSPF type 2) – Sent between OSPF routers during the creation of an adjacency. *During the Exstart phase of LSDB synchronization*, DD packets establish an ISN (initial sequence number) used to track LSA's, and they establish a master/slave relationship between neighboring OSPF routers. *In the Exchange phase of LSDB synchronization*, they contain short versions of Link State Advertisements. Because DD exchanges can span multiple packets, they are exchanged in a poll (master) and response (slave) fashion to ensure completeness.
  - **Link State Request** (OSPF type 3) – *During the Loading phase of LSDB synchronization*, LSR packets are sent to request database updates from a neighbor. This is the final step in the establishment of an adjacency.
  - **Link State Update** (OSPF type 4) – Sent in response to Link State Requests, LSU packets flood adjacencies with Link State Advertisements to achieve LSDB synchronization.
  - **Link State Acknowledgement** (OSPF type 5) – To ensure reliability of LSA flooding, all updates are acknowledged.
- **Link State Advertisements** (**LSA**) – There are 7 types of LSA's:
  - Type 1 (Router Link Advertisements) - Sent by an OSPF router to describe the links to each area to which it belongs. Type 1 LSA's are only flooded into a router's area.
  - **Type 2** (Network Links Advertisements) – Sent by the DR for an area describing the set of routers within the network. Type 2 LSA's are only flooded into a router's area.

    - **Type 3** (Summary Link Advertisements) – Sent across areas by ABRs (Area Border Routers) to describe the networks within an area. Type 3 LSA’s are also used for route aggregation purposes, and are not sent to Totally Stubby Areas.
    - **Type 4** (AS Summary Link Advertisements) – Sent across areas by ABRs to describe networks within a different AS. Type 4 LSA’s are not sent to Stub Areas.
    - **Type 5** (AS External Link Advertisements) – Sent by ASBR (Autonomous System Boundary Routers) to describe routes to networks in a different AS. Type 5 LSA’s are net sent to Stub Areas. There are two types of External Link Advertisements:
        - **External Type 1** - Type 1 packets add the internal link cost to the external link cost when calculating a link’s metric. A Type 1 route is always preferred over a Type 2 route to the same destination.
        - **External Type 2** - Type 2 packets only use the external link cost to determine the metric. Type 2 is generally used when there is only one path to an external AS.
    - **Type 6** (Multicast OSPF or MOSPF) - Called source/destination routing, this is in contrast to most unicast datagram forwarding algorithms (like OSPF) that route based solely on destination. For more information about MOSPF, see *RFC1584 – Multicast Extensions to OSPF*.
    - **Type 7** (NSSA AS External Link Advertisements) – Sent by ASBRs that are part of an NSSA (see ‘Stub Area’).
- **Stub Area** – A stub area is an area that only requires one path, rather than an optimal path. This can be an area with only a single point of egress, or it can be an area where SPF optimization is not necessary. All routers in a stub area must be configured as stub routers, and rather than receiving the full state database, and computing the SPF tree, they receive only summary link information.

  There are different type of stub area:

    - **Stub area** – The standard stub area receives all LSA’s except for LSA type 5 (AS External Link advertisement). This helps to keep the LSDB smaller, and reduces the computational overhead on the router.
    - **Totally Stubby Area** – A special type of stub area into which LSA types 3 (Summary Links), 4 (AS Summary Links) and 5 are not passed. Only intra-area routes, and a default route are advertised into totally stubby areas.
    - **NSSA** (Not So Stubby Area) – Described by RFC3101, NSSA is a hybrid stub area that allows external routes to be flooded within the NSSA area using type 7 LSA’s (NSSA AS External Routes), but does not accept type 5 LSA’s from other areas. NSSAs are useful when connecting a remote site running a different IGP (such as RIP) to an OSPF site, where the remote site’s routes do not need to be distributed back to the main OSPF site. An NSSA *ABR* (Area Border Router) also has the ability to translate type 7 to type 5 LSA’s (this is possible only from the SonicOS CLI).
- **Router Types** – OSPF recognizes 4 types of routers, based on their roles; see OSPF-recognized Router Types Example.

OSPF-recognized Router Types Example



- **IR** (Internal Router) - A router whose interfaces are all contained within the same area. An internal router's LSDB only contains information about its own area.
- **ABR** (Area Border Router) – A router with interfaces in multiple areas. An ABR maintains LSDBs for each area to which it is connected, one of which is typically the backbone.
- **Backbone Router** – A router with an interface connected to area 0, the backbone.
- **ASBR** (Autonomous System Boundary Router) – A router with an interface connected to a non-OSPF AS (such as a RIP network) which advertises external routing information from that AS into the OSPF AS.

Drop Tunnel Interface

A drop tunnel interface prevents traffic from being sent out using an incorrect route when the configured route is down. Traffic sent to a drop tunnel interface does not leave the Security Appliance, but is ostensibly dropped.

A drop tunnel interface should be used in conjunction with a VPN tunnel interface, although a drop tunnel interface can be used standalone. If a static route is bound to a tunnel interface, SonicWall recommends configuring a static route bound to a drop tunnel interface for the same network traffic. That way, if the tunnel interface goes down, the second static route is used and the traffic is effectively dropped. This prevents the data from being forwarded in the clear over another route.

When configuring a route over a VPN tunnel interface, if the tunnel is temporarily down, the corresponding route entry is disabled as well. SonicOS NS*v* looks up a new route entry for the connections destined for the VPN protected network. In deployments that do not have a backup link for a remote VPN network, no other correct route entry is available. Traffic is sent to a wrong route entry, generally the default route, which causes security issues such as internal data sent without encryption.

For deployments without a backup link, consider configuring the route table as in this example:

```
route n:   local VPN network(source), remote VPN network(destination), VPN TI(egress_if)
route n+1: local VPN network(source), remote VPN network(destination), Drop If(egress_if)
```

When the VPN tunnel interface configured as in this example, the traffic matches the drop interface and is not sent out. When the VPN tunnel interface resumes, traffic resumes also.

App-based Routing

App-based Routing is a kind of PBF (policy-based forwarding) rule that allows traffic to take an alternative path from the next hop specified in the route table and is typically used to specify an egress interface for security or performance reasons.

When an App-based Route entry is created, at the beginning the Security Appliance does not have enough information to identify the application and, therefore, cannot enforce the route entry. As more packets arrive, the Security Appliance determines the application and creates an internal entry in the App-ID cache, which is retained for the session. When a new session is created with the same destination IP address, destination port, and protocol ID, the Security Appliance could identify the application as the same from the initial session and apply the App-based Route. Therefore, a session that is not an exact match and is not the same application, cannot be forwarded based on the App-Based Route.

This feature is available only when Gateway AV/Anti-Spyware/Intrusion Prevention/App Control/App Visualization is licensed and App Control is enabled in **MANAGE | Policies > Rules > App Control**.

Network > Routing

If you have routers on your interfaces, you configure static routes on the SonicWall Security Appliance on the **MANAGE | System Setup > Network > Routing** page. You can create static routing policies that create static routing entries that make decisions based upon source address, source netmask, destination address, destination netmask, service, interface, gateway and metric. This feature allows for full control of forwarding based upon a large number of user-defined variables.

Topics:

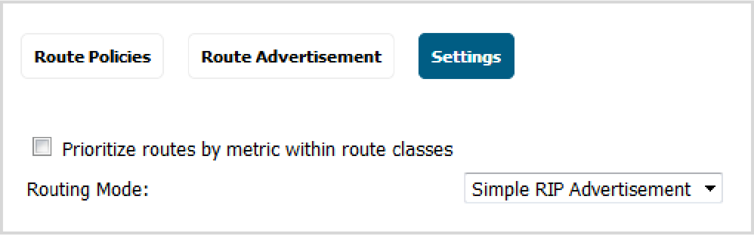
- **Network > Routing > Settings** on page 349

Network > Routing > Settings

The look of **MANAGE | System Setup > Network > Routing > Settings** changes depending on the routing mode you select:

- **Simple RIP Advertisement**
- **Advanced Routing**

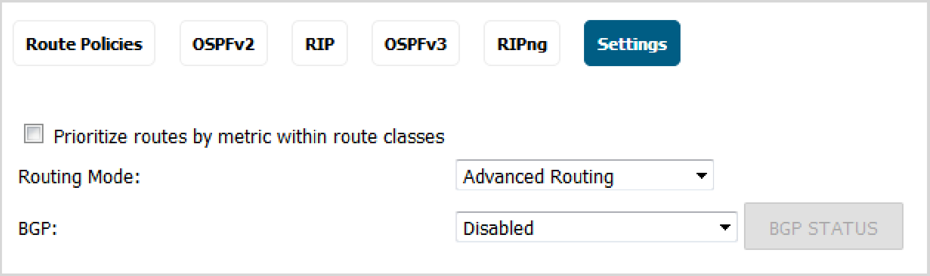
Simple RIP Advertisement



☐ Prioritize routes by metric within route classes

Routing Mode: Simple RIP Advertisement

Advanced Routing



□ Prioritize routes by metric within route classes

Routing Mode: Advanced Routing

BGP: Disabled

Network > Routing > Route Policies

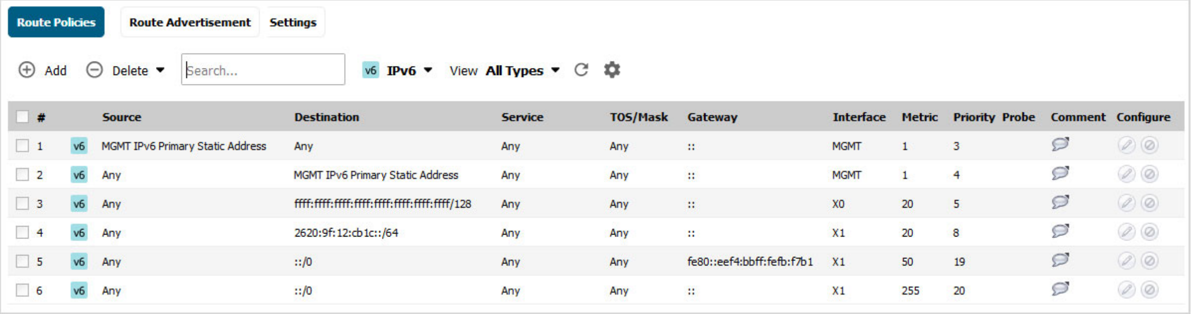
Network > Routing > Route Policies displays all the default and/or custom routes for either IPv4 or IPv6. The display is the same for either IP version except the IPv6 display shows the IPv6 link-local address instead of the IP address.

You can change the view of the route policies in the **Route Policies** table by selecting:

- **IPv4** or **IPv6**
- One of the view settings in **View**:

All Types	All routing policies including **Custom Policies** and **Default Policies**. Initially, only **Default Policies** are displayed in the **Route Policies** table when you select **All Types**.
Custom Polices	Ones you created.
Default Policies	Ones created by SonicOS NS*v*.

You can filter the display by entering the source, destination, or interface in the **Search** field.



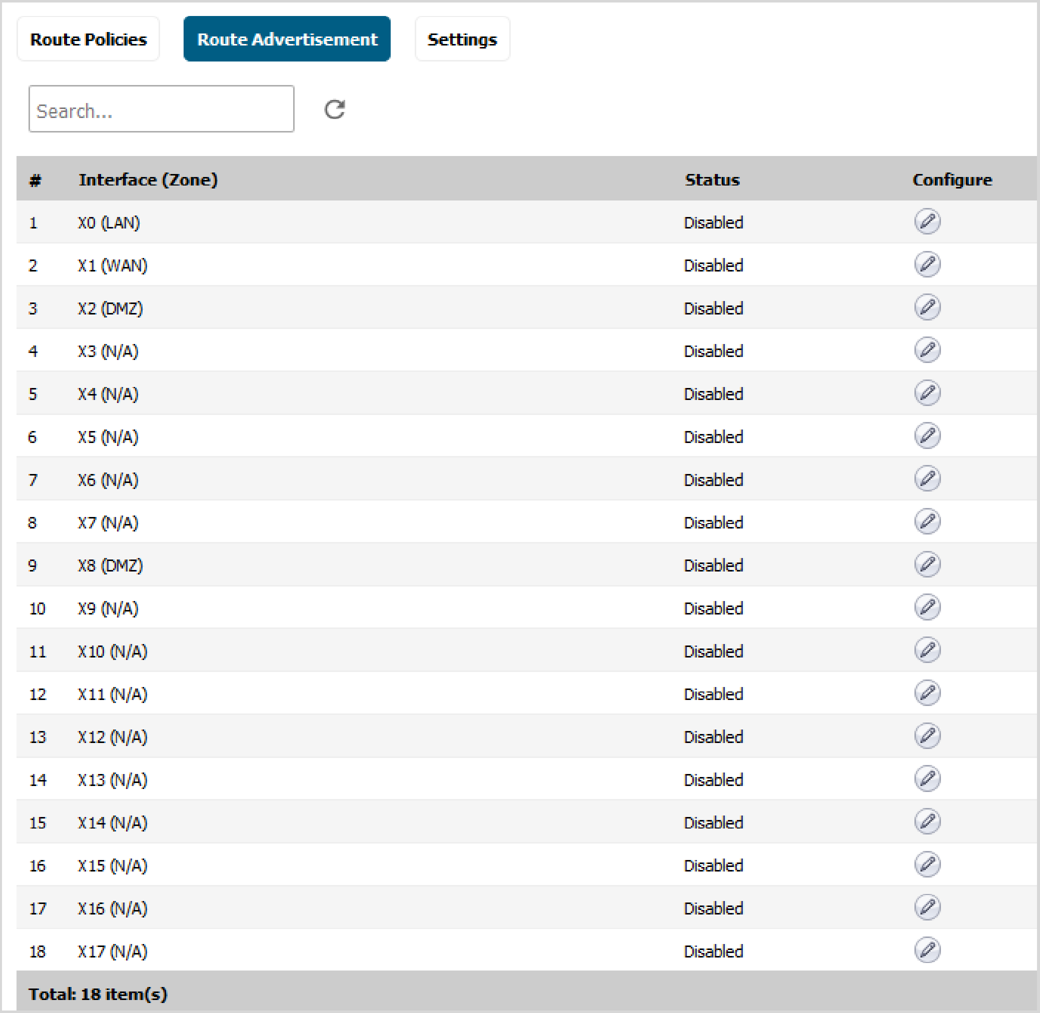
□ #		Source	Destination	Service	TOS/Mask	Gateway	Interface	Metric	Priority	Probe	Comment	Configure
□ 1	v6	MGMT IPv6 Primary Static Address	Any	Any	Any	::	MGMT	1	3		💬	✎ ⊘
□ 2	v6	Any	MGMT IPv6 Primary Static Address	Any	Any	::	MGMT	1	4		💬	✎ ⊘
□ 3	v6	Any	ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff/128	Any	Any	::	X0	20	5		💬	✎ ⊘
□ 4	v6	Any	2620:9f:12:cb1c::/64	Any	Any	::	X1	20	8		💬	✎ ⊘
□ 5	v6	Any	::/0	Any	Any	fe80::eef4:bbff:fefb:f7b1	X1	50	19		💬	✎ ⊘
□ 6	v6	Any	::/0	Any	Any	::	X1	255	20		💬	✎ ⊘

Column	Route Policy Configuration
Source	IP version icon and name for the source.
Destination	Destination IP address (IPv4) or MAC address (IPv6).
Service	Service object configured for the route policy.
TOS/Mask	TOS and TOS Mask configured for the route.
Gateway	Gateway IP address (IPv4) or MAC address (IPv6).
Interface	Interface configured for the route policy.
Metric	Metric configured for route priority.
Priority	Priority of the route policy.
Probe	Whether probe is configured.

Column	Route Policy Configuration (Continued)
Comment	**Comment** icon containing the comment entered when the custom route was configured; `Auto-added Route Policy` for default policies.
Configure	**Edit** and **Delete** icons; icons for default policies are dimmed.

Network > Routing > Route Advertisement

Network > Routing > Route Advertisement displays only when **Simple RIP Advertisement** is chosen for **Routing Mode**.



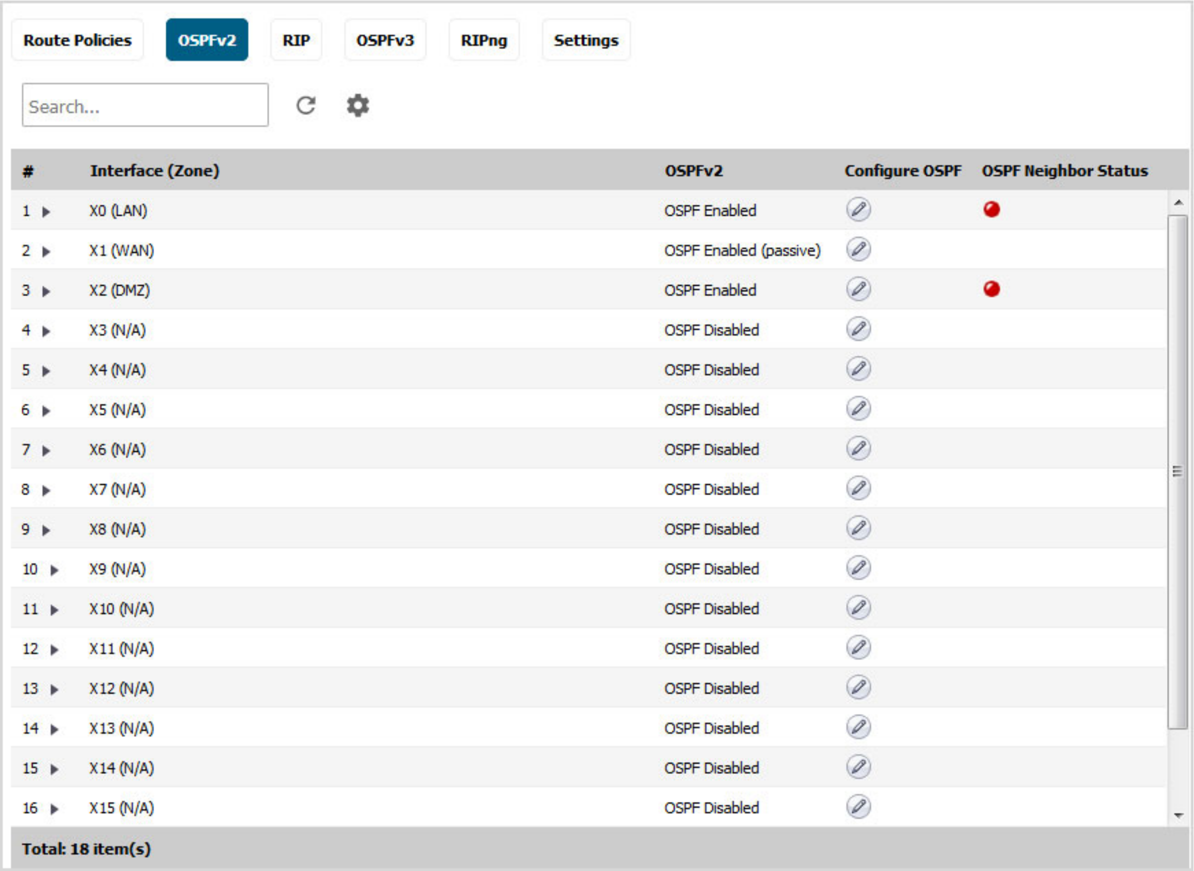
#	Interface (Zone)	Status	Configure
1	X0 (LAN)	Disabled	✎
2	X1 (WAN)	Disabled	✎
3	X2 (DMZ)	Disabled	✎
4	X3 (N/A)	Disabled	✎
5	X4 (N/A)	Disabled	✎
6	X5 (N/A)	Disabled	✎
7	X6 (N/A)	Disabled	✎
8	X7 (N/A)	Disabled	✎
9	X8 (DMZ)	Disabled	✎
10	X9 (N/A)	Disabled	✎
11	X10 (N/A)	Disabled	✎
12	X11 (N/A)	Disabled	✎
13	X12 (N/A)	Disabled	✎
14	X13 (N/A)	Disabled	✎
15	X14 (N/A)	Disabled	✎
16	X15 (N/A)	Disabled	✎
17	X16 (N/A)	Disabled	✎
18	X17 (N/A)	Disabled	✎

Total: 18 item(s)

Interface (Zone)	Interfaces configured for route advertisement. If a zone has not been configured for an interface, the **(Zone)** designation is **(N/A)**.
Status	Either **Enabled** or **Disabled**.
Configure	Contains the **Edit** icon.

Network > Routing > OSPFv2

Network > Routing > OSPFv2, which displays only when **Advanced Routing** is chosen for **Routing Mode**, shows the status of OSPFv2 and allows you to configure OSPFv2 for an interface.



#	Interface (Zone)	OSPFv2	Configure OSPF	OSPF Neighbor Status
1 ▸	X0 (LAN)	OSPF Enabled	✎	●
2 ▸	X1 (WAN)	OSPF Enabled (passive)	✎	
3 ▸	X2 (DMZ)	OSPF Enabled	✎	●
4 ▸	X3 (N/A)	OSPF Disabled	✎	
5 ▸	X4 (N/A)	OSPF Disabled	✎	
6 ▸	X5 (N/A)	OSPF Disabled	✎	
7 ▸	X6 (N/A)	OSPF Disabled	✎	
8 ▸	X7 (N/A)	OSPF Disabled	✎	
9 ▸	X8 (N/A)	OSPF Disabled	✎	
10 ▸	X9 (N/A)	OSPF Disabled	✎	
11 ▸	X10 (N/A)	OSPF Disabled	✎	
12 ▸	X11 (N/A)	OSPF Disabled	✎	
13 ▸	X12 (N/A)	OSPF Disabled	✎	
14 ▸	X13 (N/A)	OSPF Disabled	✎	
15 ▸	X14 (N/A)	OSPF Disabled	✎	
16 ▸	X15 (N/A)	OSPF Disabled	✎	

Total: 18 item(s)

Settings Icon that displays the **Settings** popup for configuring the metrics for default routes.

Interface (Zone) Interfaces and their zone configured for OSPFv2. If a zone has not been configured for an interface, the **(Zone)** designation is **(N/A)**.

OSPFv2 Indicates whether OSPF is enabled on an interface:

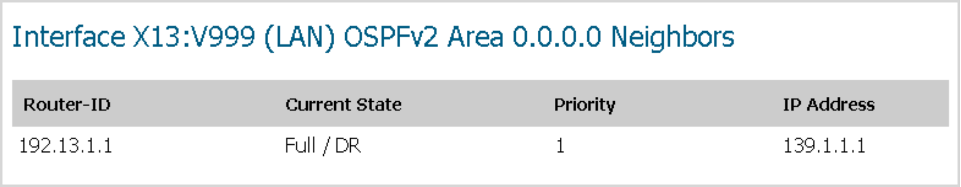
- **OSPF Enabled**
- **OSPF Enabled (passive)**
- **OSPF Disabled**

Configure OSPF Displays the **Edit** icon for the interface.

OSPF Neighbor Status Displays the **Status** icon, which indicates whether there are active or inactive neighbors; clicking the icon displays the **Interface OSPFv2 Neighbors** popup for more detail about the interface’s neighbors. See **Network > Routing > OSPFv2 > Interface OSPFv2 Neighbors** on page 353.

Network > Routing > OSPFv2 > Interface OSPFv2 Neighbors

Display this popup by clicking the **Status** icon for the interface.



Interface X13:V999 (LAN) OSPFv2 Area 0.0.0.0 Neighbors

Router-ID	Current State	Priority	IP Address
192.13.1.1	Full / DR	1	139.1.1.1

Router ID Neighbor’s router ID.

Current State State of the OSPFv2 neighborhood when it is established:

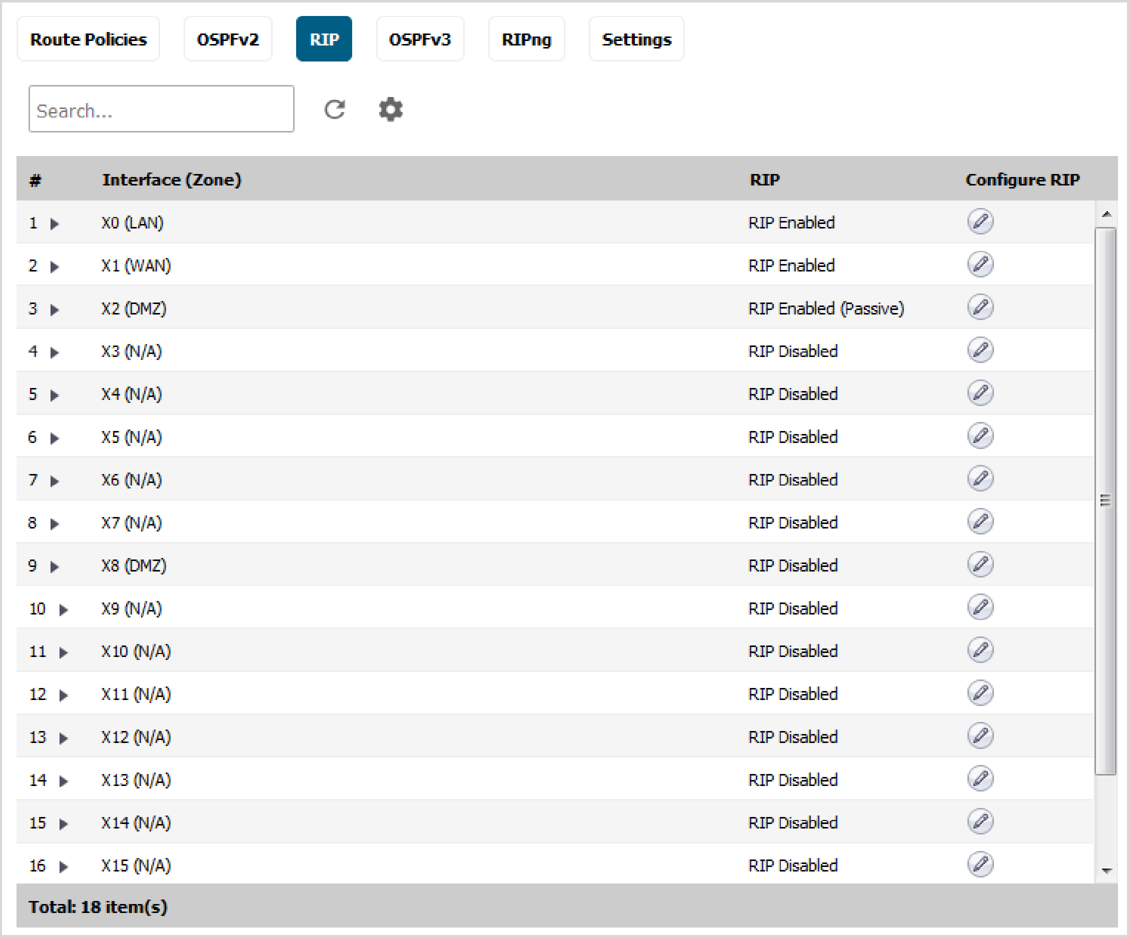
- **Init**
- **2-way**
- **ExStart**
- **Exchange**
- **Loading**
- **Full**

Priority Neighbor’s router’s priority.

IP Address IP address of neighbor’s router.

Network > Routing > RIP

Network > Routing > RIP, which displays only when **Advanced Routing** is chosen for **Routing Mode**, shows the status of RIP and allows you to configure RIP for an interface.



#	Interface (Zone)	RIP	Configure RIP
1	X0 (LAN)	RIP Enabled	
2	X1 (WAN)	RIP Enabled	
3	X2 (DMZ)	RIP Enabled (Passive)	
4	X3 (N/A)	RIP Disabled	
5	X4 (N/A)	RIP Disabled	
6	X5 (N/A)	RIP Disabled	
7	X6 (N/A)	RIP Disabled	
8	X7 (N/A)	RIP Disabled	
9	X8 (DMZ)	RIP Disabled	
10	X9 (N/A)	RIP Disabled	
11	X10 (N/A)	RIP Disabled	
12	X11 (N/A)	RIP Disabled	
13	X12 (N/A)	RIP Disabled	
14	X13 (N/A)	RIP Disabled	
15	X14 (N/A)	RIP Disabled	
16	X15 (N/A)	RIP Disabled	

Total: 18 item(s)

Settings Icon that displays the **Settings** popup for configuring the metrics for default routes.

Interface (Zone) Interfaces and their zone configured for RIP. If a zone has not been configured for an interface, the **(Zone)** designation is **(N/A)**.

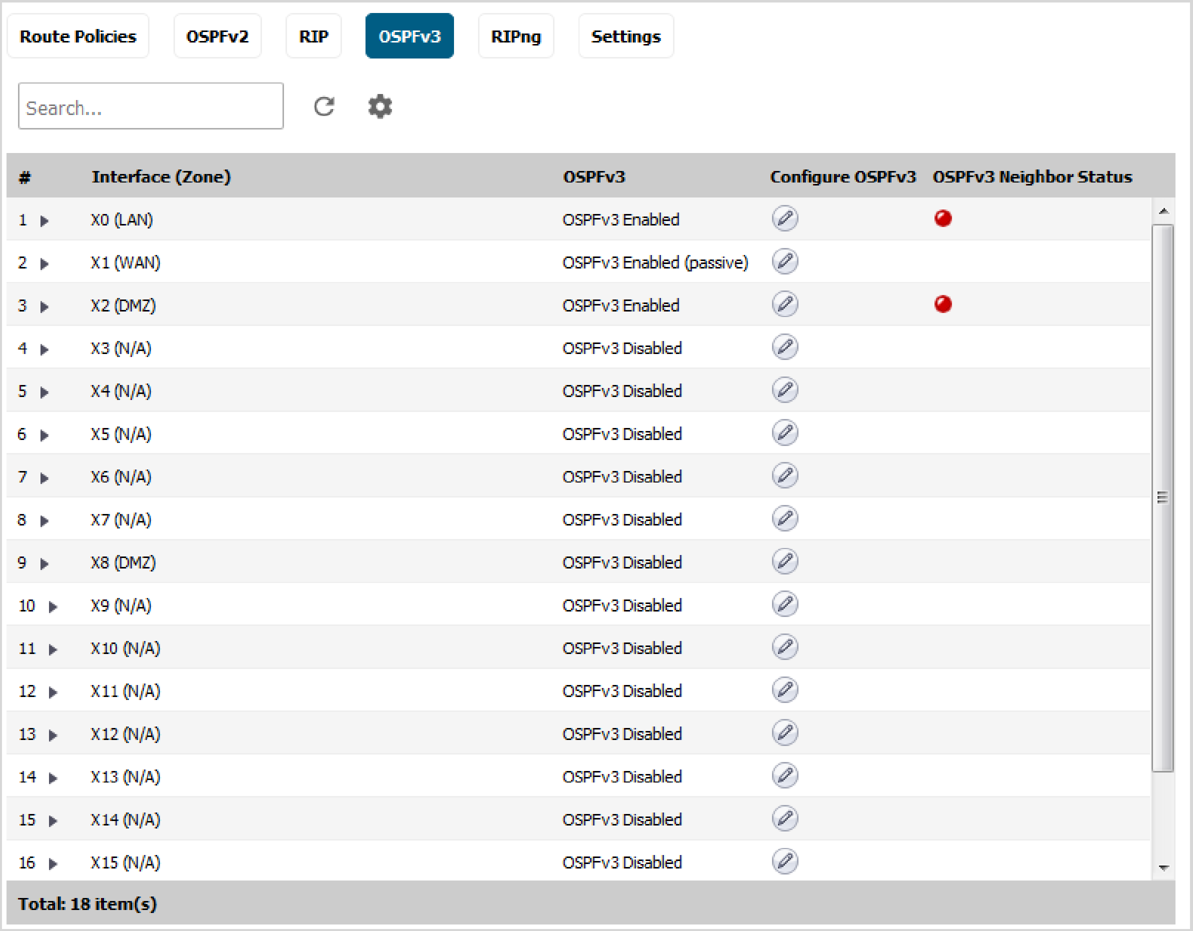
RIP Indicates whether RIP is enabled on an interface:

- **RIP Enabled**
- **RIP Enabled (passive)**
- **RIP Disabled**

Configure RIP Displays the **Edit** icon for the interface.

Network > Routing > OSPFv3

Network > Routing > OSPFv3, which displays only when **Advanced Routing** is chosen for **Routing Mode**, shows the status of OSPFv3 and allows you to configure OSPFv3 for an interface.



#	Interface (Zone)	OSPFv3	Configure OSPFv3	OSPFv3 Neighbor Status
1 ▸	X0 (LAN)	OSPFv3 Enabled	✎	●
2 ▸	X1 (WAN)	OSPFv3 Enabled (passive)	✎	
3 ▸	X2 (DMZ)	OSPFv3 Enabled	✎	●
4 ▸	X3 (N/A)	OSPFv3 Disabled	✎	
5 ▸	X4 (N/A)	OSPFv3 Disabled	✎	
6 ▸	X5 (N/A)	OSPFv3 Disabled	✎	
7 ▸	X6 (N/A)	OSPFv3 Disabled	✎	
8 ▸	X7 (N/A)	OSPFv3 Disabled	✎	
9 ▸	X8 (DMZ)	OSPFv3 Disabled	✎	
10 ▸	X9 (N/A)	OSPFv3 Disabled	✎	
11 ▸	X10 (N/A)	OSPFv3 Disabled	✎	
12 ▸	X11 (N/A)	OSPFv3 Disabled	✎	
13 ▸	X12 (N/A)	OSPFv3 Disabled	✎	
14 ▸	X13 (N/A)	OSPFv3 Disabled	✎	
15 ▸	X14 (N/A)	OSPFv3 Disabled	✎	
16 ▸	X15 (N/A)	OSPFv3 Disabled	✎	

Total: 18 item(s)

Settings Icon that displays the **Settings** popup for configuring the metrics for default routes.

Interface (Zone) Interfaces and their zone configured for OSPFv3. If a zone has not been configured for an interface, the **(Zone)** designation is **(N/A)**.

OSPFv3 Indicates whether OSPF is enabled on an interface:

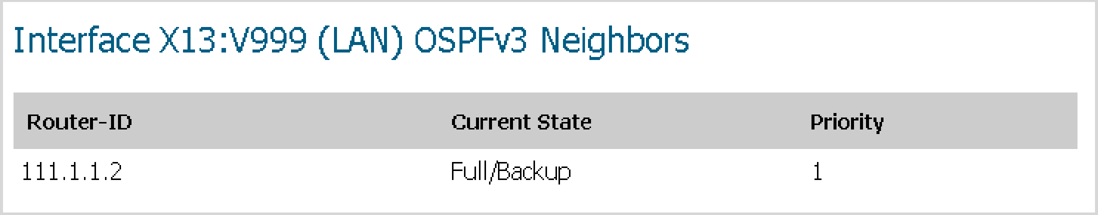
- **OSPFv3 Enabled**
- **OSPFv3 Enabled (passive)**
- **OSPFv3 Disabled**

Configure OSPFv3 Displays the **Edit** icon for the interface.

OSPFv3 Neighbor Status Displays the **Status** icon, which indicates whether there are active or inactive neighbors; clicking the icon displays the **Interface OSPFv3 Neighbors** popup for more detail about the interface's neighbors. See **Network > Routing > OSPFv3 > Interface OSPFv3 Neighbors** on page 356.

Network > Routing > OSPFv3 > Interface OSPFv3 Neighbors

Display this popup by clicking the **Status** icon for the interface.



Interface X13:V999 (LAN) OSPFv3 Neighbors

Router-ID	Current State	Priority
111.1.1.2	Full/Backup	1

Router ID Neighbor’s router’ ID.

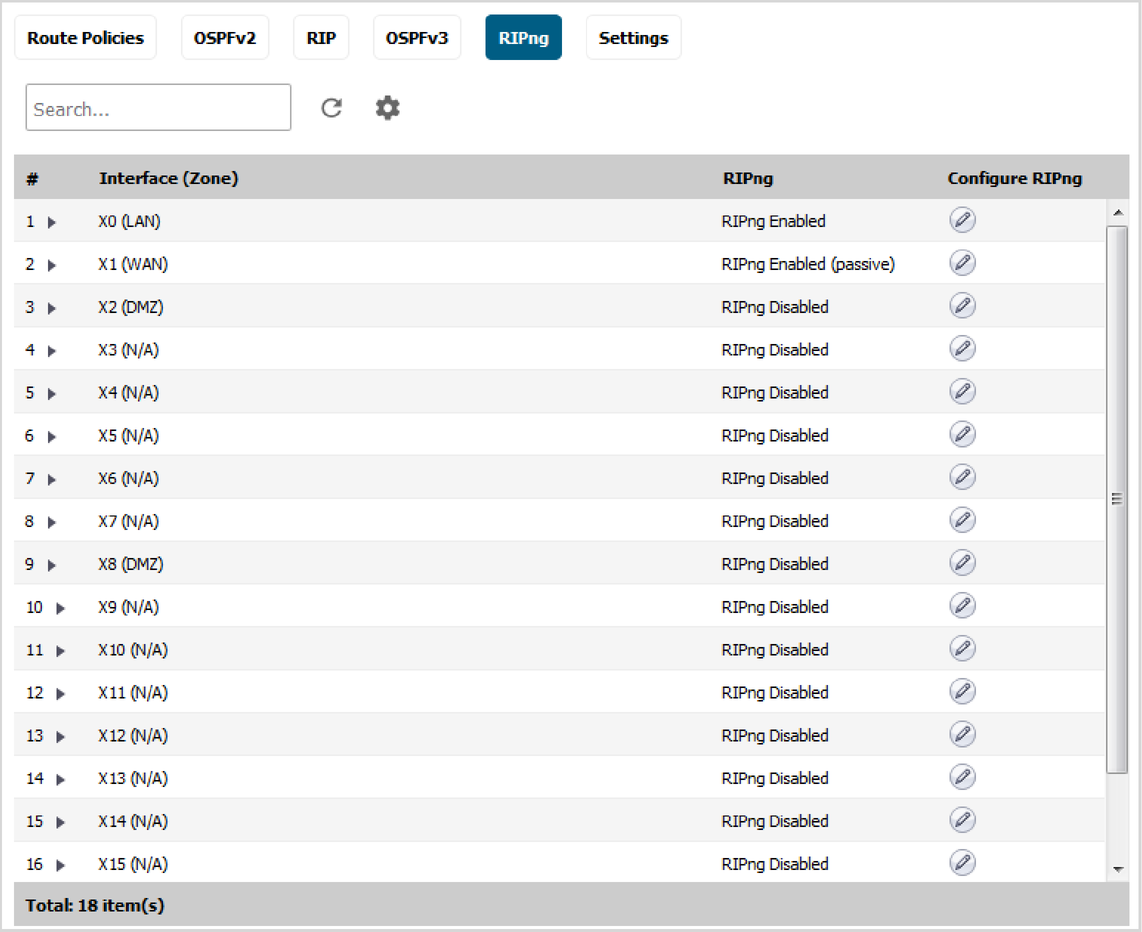
Current State State of the OSPFv3 neighborhood when it is established:

- **Init**
- **2-way**
- **ExStart**
- **Exchange**
- **Loading**
- **Full**

Priority Neighbor’s router’s priority.

Network > Routing > RIPng

Network > Routing > RIPng, which displays only when **Advanced Routing** is chosen for **Routing Mode**, shows the status of RIPng and allows you to configure RIPng for an interface.



#	Interface (Zone)	RIPng	Configure RIPng
1 ▸	X0 (LAN)	RIPng Enabled	✎
2 ▸	X1 (WAN)	RIPng Enabled (passive)	✎
3 ▸	X2 (DMZ)	RIPng Disabled	✎
4 ▸	X3 (N/A)	RIPng Disabled	✎
5 ▸	X4 (N/A)	RIPng Disabled	✎
6 ▸	X5 (N/A)	RIPng Disabled	✎
7 ▸	X6 (N/A)	RIPng Disabled	✎
8 ▸	X7 (N/A)	RIPng Disabled	✎
9 ▸	X8 (DMZ)	RIPng Disabled	✎
10 ▸	X9 (N/A)	RIPng Disabled	✎
11 ▸	X10 (N/A)	RIPng Disabled	✎
12 ▸	X11 (N/A)	RIPng Disabled	✎
13 ▸	X12 (N/A)	RIPng Disabled	✎
14 ▸	X13 (N/A)	RIPng Disabled	✎
15 ▸	X14 (N/A)	RIPng Disabled	✎
16 ▸	X15 (N/A)	RIPng Disabled	✎

Total: 18 item(s)

Settings Icon that displays the **Settings** popup for configuring the metrics for default routes.

Interface (Zone) Interfaces and their zone configured for RIPng. If a zone has not been configured for an interface, the **(Zone)** designation is **(N/A)**.

RIPng Indicates whether RIPng is enabled on an interface:

- **RIP Enabled**
- **RIP Enabled (passive)**
- **RIP Disabled**

Configure RIPng Displays the **Edit** icon for the interface.

Configuring Routing

Topics:

- Prioritizing Routes by Metric on page 358
- Configuring Metrics for Default Routes Learned through Router Advertisement on page 358

- Configuring Static and Policy-based Routes on page 360
- Configuring a Static Route for a Drop Tunnel Interface on page 364
- Configuring OSPF and RIP Advanced Routing Services on page 366
- Configuring BGP Advanced Routing on page 375

Prioritizing Routes by Metric

IMPORTANT: Changing to metric-weighted route prioritization requires restarting the SonicWall Security Appliance.

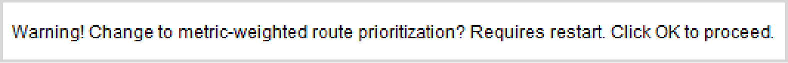
The Metric-Weighted option allows the metric to take precedence in prioritization over route specificity. The precedence (high to low) used during prioritization when the metric option is:

- Not selected (default):
  a Route class (determined by the combination of source, destination, service, and TOS fields with values other than **ANY**.
  b The cumulative specificity of the source, destination, service, and TOS fields.
  c The metric.
- Selected:
  a Route class.
  b The metric.
  c The cumulative specificity of the source, destination, service, and TOS fields

To change to metric-weighted route prioritization:

1 Navigate to **MANAGE | System Setup > Network > Routing > Settings**.

2 Select **Prioritize routes by metric within route classes**. A confirmation message displays.



Warning! Change to metric-weighted route prioritization? Requires restart. Click OK to proceed.

3 Click **OK**.

4 Navigate to **MANAGE | Updates > Restart** to manually restart SonicOS NS*v*.

Configuring Metrics for Default Routes Learned through Router Advertisement

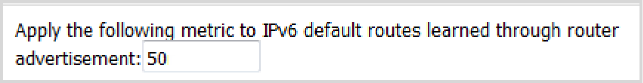
NOTE: This setting takes effect only on IPv6 default routes learned from Router Advertisement.

To configure metrics for default routes learned through router advertisement:

1 Navigate to **MANAGE | System Setup | Network > Routing**.

2 Click **Route Policies**.

3 Click the **Settings** icon. The **Settings** dialog displays.



Apply the following metric to IPv6 default routes learned through router advertisement: 50

4 This route metric applies to default routes learned through router advertisement. Enter the metric in the **Apply the following metric to IPv6 default routes learned through router advertisement** field. The minimum is 1, the maximum is 255, and the default is **50**.

ⓘ | **TIP:** Lower metrics are considered better and take precedence over higher ones.

5 Click **ACCEPT**.

Configuring Route Advertisement

To enable Route Advertisement for a network interface:

1 Navigate to **MANAGE | System Setup | Network > Routing**.

2 Click **Route Advertisement**.

3 Click the **Edit** icon in the **Configure** column for the interface. The **Interface Route Advertisement Configuration** dialog displays.

4 Select one of the following types from the **RIP Advertisements** drop-down menu:

- **Disabled** (default) - Disables RIP advertisements.
- **RIPv1 Enabled** - RIPv1 is the first version of Routing Information Protocol.
- **RIPv2 Enabled (multicast)** - To send route advertisements using multicasting (a single data packet to specific notes on the network).
- **RIPv2 Enabled (broadcast)** - To send route advertisements using broadcasting (a single data packet to all nodes on the network).

By selecting a type other than **Disable**, the other options become available.

5 From the **Advertise Default Route drop-down** menu, select:

- **Never** (default)
- **When WAN is up** (not available for a WAN interface)
- **Always**

6 Enable **Advertise Static Routes** if you have static routes configured on the Security Appliance, enable this feature to exclude them from Route Advertisement.

7 Enable **Advertise Remote VPN Networks** if you want to advertise VPN networks.

8 Enter a value in seconds between advertisements broadcast over a network in the **Route Change Damp Time (seconds)** field. The default value is **30** seconds, the minimum is 1 second, and the maximum is 99 seconds. A lower value corresponds with a higher volume of broadcast traffic over the network. The **Route Change Damp Time (seconds)** setting defines the delay between the time a VPN tunnel changes state (up or down) and the time the change is advertised with RIP. The delay, in seconds, prevents ambiguous route advertisements sent as a result of a temporary change in the VPN tunnel status.

9 Enter the number of advertisements that a deleted route broadcasts until it stops in the **Deleted Route Advertisements (0-99)** field. The default value is **1**.

10 Enter a value from **1** (default) to 15 in the **Route Metric (1-15)** field. This is the number of times a packet touches a router from the source IP address to the destination IP address.

> ⓘ **NOTE:** The following options are available only if a RIPv2 advertisement option is selected in the **RIP Advertisements** drop-down menu. If you selected **RIPv1 Enabled**, go to Step 13.

11 You can enter a value for the route tag in the **RIPv2 Route Tag (4 HEX Digits)** field. This value is implementation-dependent and provides a mechanism for routers to classify the originators of RIPv2 advertisements. The default value is **0**.

12 If you want to enable RIPv2 authentication, select one of the following options from the **RIPv2 Authentication** drop-down menu (the default is **Disabled**):

- **User defined** - Two fields display:
  - **Authentication Type (4 Hex Digits)** – Enter 4 hex digits in the field. The default is **0**.
  - **Authentication Data (32 Hex Digits)** – Enter 32 hex digits in the field.
- **Cleartext Password** - The **Authentication Password** field displays. Enter a password of up to 16 characters in the field.
- **MD5 Digest** - Enter a numerical value from 0-255 in the Authentication **Key-Id (0-255)** field. Enter a 32 hex digit value for the **Authentication Key (32 hex digits)** field, or use the generated key.
  - **Authentication Key-Id (0-255)** – Enter up to 255 characters in the field. The default is **1**.
  - **Authentication Key** – Enter up to 32 characters in the field.

13 Click **OK**.

Configuring Static and Policy-based Routes

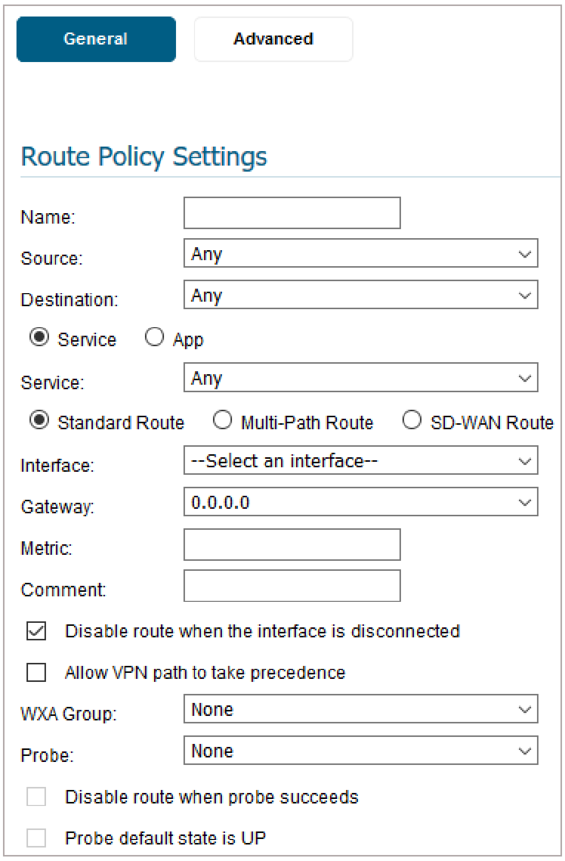
In SonicOS NS*v*, a static route is configured through a basic route policy. For the maximum number of routes per Security Appliance, see the description of configuring route policies in *SonicOS NSv 6.5 Policies*.

When configuring a static route, you can optionally configure a Network Monitor policy for the route. When a Network Monitor policy is used, the static route is dynamically disabled or enabled, based on the state of the probe for the policy.

To configure a static or policy-based route:

1 Navigate to **MANAGE | System Setup > Network > Routing > Route Policies**.

2 Click the **Add** icon. The **Add Route Policy** dialog displays.



Route Policy Settings

Name:

Source: Any

Destination: Any

● Service ○ App

Service: Any

● Standard Route ○ Multi-Path Route ○ SD-WAN Route

Interface: --Select an interface--

Gateway: 0.0.0.0

Metric:

Comment:

☑ Disable route when the interface is disconnected

□ Allow VPN path to take precedence

WXA Group: None

Probe: None

□ Disable route when probe succeeds

□ Probe default state is UP

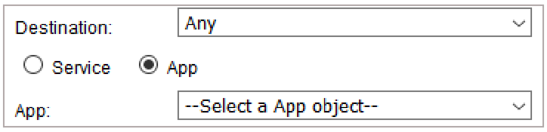
3 Enter a meaningful name in the **Name** field.

4 From **Source**, select the source address object for the static route or select **Create new address object** to dynamically create a new address object. The default is **Any**.

5 From **Destination**, select the destination address object or select **Create new address object** to dynamically create a new address object. The default is **Any**.

6 Choose the type of route policy:

- **Service** (default)
- **App** – Service changes to **App**:



Destination: Any

○ Service ● App

App: --Select a App object--

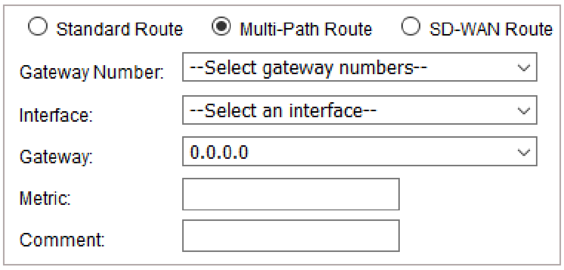
7 From **Service**, select a service object. For a generic static route that allows all traffic types, simply select **Any** (the default).

8 Go to Step 14.

9 From **App**, select an App Object.

10 Choose the type of route to use:

- **Standard Route** (the default) – Go to Step 14.
- **Multi-Path Route** – The **Gateway Number** option displays:



○ Standard Route ● Multi-Path Route ○ SD-WAN Route

Gateway Number: --Select gateway numbers--

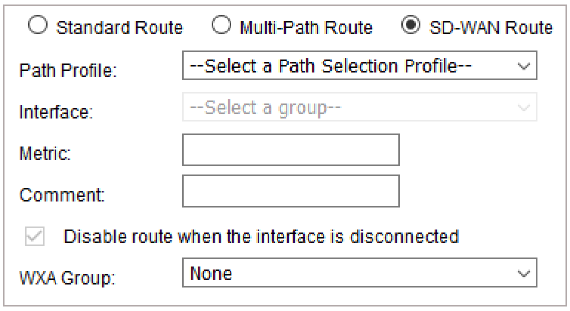
Interface: --Select an interface--

Gateway: 0.0.0.0

Metric:

Comment:

- **SD-WAN Route** – The options change:



○ Standard Route ○ Multi-Path Route ● SD-WAN Route

Path Profile: --Select a Path Selection Profile--

Interface: --Select a group--

Metric:

Comment:

☑ Disable route when the interface is disconnected

WXA Group: None

> **NOTE:** The **Interface** and **Disable route when the interface is disconnected** options are dimmed because these options cannot be edited in SD-WAN policies. The **Interface** option is populated with the SD-WAN group name in the associated Path Selection Profile (PSP) and cannot be changed. The interface for the SD-WAN route is selected from the SD-WAN group that is part of the PSP associated with the SD-WAN route and, therefore, cannot be configured.

Go to Step 13.

11 From **Gateway Number**, select the maximum number of gateways:

- **2**
- **3**
- **4**

12 Go to Step 16.

13 From **Path Profile**, select a Path Selection Profile.

14 From **Interface**, select the interface to be used for the route or select **Create VPN Tunnel interface** to dynamically create a new VPN policy. For information about creating a VPN policy, see SonicOS NS*v* *6.5 Connectivity*.

15 From **Gateway**, select the gateway address object to be used for the route or select **Create new address object** to dynamically create a new address object. The default is **0.0.0.0**. For information about creating address objects, see SonicOS NS*v* *6.5 Policies*.

16 Enter the **Metric** (weighted cost) for the route. The minimum is 1, and the maximum is 254. The default metric for:

- Static routes is **1**
- Dynamic routes learned from:
  - RIP/RIPng is **120**
  - OSPFv2/OSPFv3 is **110**
  - BGP is **20**

For more information on metrics, see About Metrics and Administrative Distance on page 336 and Policy-based Routing on page 338.

> ⓘ **TIP:** Lower metrics are considered better and take precedence over higher metrics (costs). SonicOS NS*v* adheres to Cisco-defined metric values for directly connected interfaces, statically encoded routes, and all dynamic IP routing protocols.

17 Optionally, enter a **Comment** for the route. This field allows you to enter a descriptive comment for the new static route policy.

18 To have the route automatically disabled when the interface is disconnected, select **Disable route when the interface is disconnected**. This option is selected by default.

> ⓘ **NOTE:** If you are configuring a SD-WAN route, this option is both selected and dimmed; you cannot change it.

19 If you are configuring an SD-WAN route, go to Step 21.

20 Optionally, to create a backup route for a VPN tunnel, select **Allow VPN path to take precedence**. This option is not selected by default.

By default, a user-configured VPN tunnel static route has a metric of 1 and takes precedence over VPN traffic. The **Allow VPN path to take precedence** option gives precedence over the static route to VPN traffic to the same destination address object. This results in the following behavior when a VPN tunnel:

- **Is active**: Static routes matching the destination address object of the VPN tunnel are automatically disabled if the **Allow VPN path to take precedence** option is enabled. All traffic is routed over the VPN tunnel to the destination address object.
- **Goes down**: Static routes matching the destination address object of the VPN tunnel are automatically enabled. All traffic to the destination address object is routed over the static routes.

21 If WXA is licensed, select the WXA group from **WXA Group**. The default is **None**.

22 If you are configuring an SD-WAN route, go to Step 28.

23 To:

- Use probe-enabled, policy-based routing, go to Step 24.
- Ignore probe-enabled routing and configure TOS and administration distance values, go to Step 28.
- Apply the configuration, go to Step 32.

24 From **Probe**, select:

- **None** (default). Go to Step 27.
- A Network Monitor object; the following two options become available for configuring Probe-Enabled Policy-based Routing.
- **Create new Network Monitor object**. The **Add Policy** dialog displays. For how to create a Network Monitor object, see the procedure in *SonicOS NSv 6.5 Investigate*.

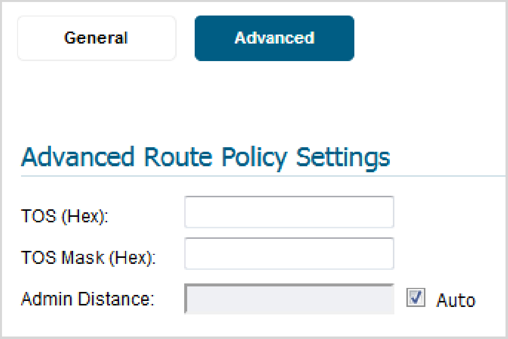
25 To have the route disabled when a probe succeeds, select **Disable route when probe succeeds**. This option is not selected by default.

> ⓘ **IMPORTANT:** Typical configurations do not check the **Disable route when probe succeeds** checkbox, because typically administrators want to disable a route when a probe to the route’s destination fails. This option gives you added flexibility for defining routes and probes.

26 To have the route consider the probe to be successful (that is, in the UP state) when the attached Network Monitor policy is in the UNKNOWN state, select the **Probe default state is UP**. This is useful to control the probe-based behavior when a unit of a High Availability pair transitions from IDLE to ACTIVE, because this transition sets all Network Monitor policy states to UNKNOWN.

27 To use default TOS and admin distance values, go to Step 32.

28 Click **Advanced**.



Advanced Route Policy Settings

TOS (Hex):

TOS Mask (Hex):

Admin Distance: ☑ Auto

29 Enter a TOS value in the **TOS (Hex)** field. The maximum value is FF. If the **TOS** and **TOS Mask** fields are not configured, a value of 0 is used. For further information about TOS and TOS Mask values, see Policy-based TOS Routing on page 338.

30 Enter the same value in the **TOS Mask (Hex)** field.

31 To manually specify an administration distance:

a Deselect **Auto**. The **Admin Distance** field becomes available. This option is selected by default. For information about administration distance, see About Metrics and Administrative Distance on page 336.

b Enter the administration distance in the **Admin Distance** field.

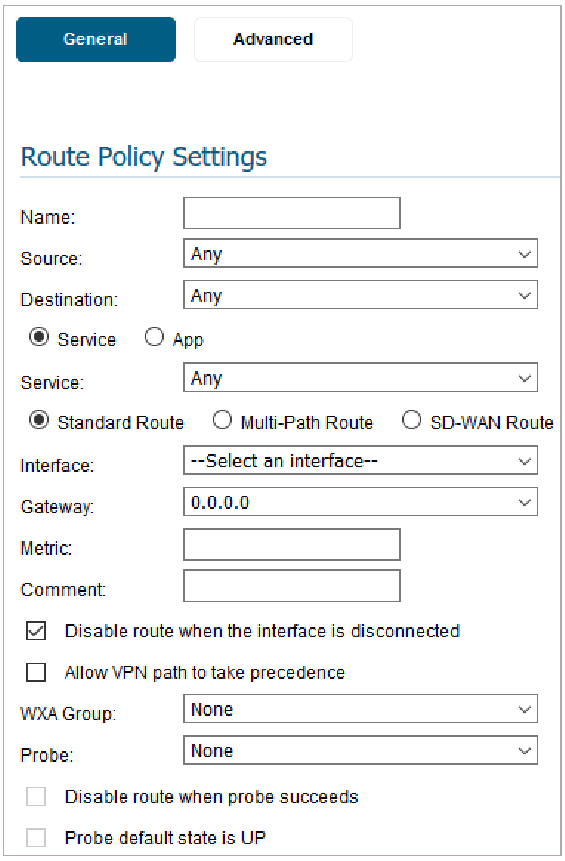
32 Click **OK**.

Configuring a Static Route for a Drop Tunnel Interface

To add a static route for a drop tunnel interface:

1 Navigate to **MANAGE | System Setup | Network > Routing > Route Policies**.

2 Click the **Add** icon. The **Add Route Policy** dialog displays.



Route Policy Settings

Name:	
Source:	Any
Destination:	Any

● Service ○ App

Service:	Any

● Standard Route ○ Multi-Path Route ○ SD-WAN Route

Interface:	--Select an interface--
Gateway:	0.0.0.0
Metric:	
Comment:	

☑ Disable route when the interface is disconnected

□ Allow VPN path to take precedence

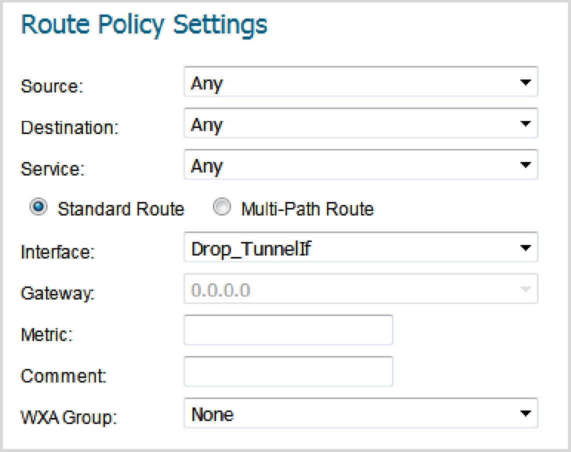
WXA Group:	None
Probe:	None

□ Disable route when probe succeeds

□ Probe default state is UP

3 Configure the values for **Source**, **Destination**, **Service** and **Route** options as described in Configuring Static and Policy-based Routes on page 360.

4 For **Interface**, select **Drop_TunnelIf**. The options change.



Route Policy Settings

Source:	Any
Destination:	Any
Service:	Any

● Standard Route ○ Multi-Path Route

Interface:	Drop_TunnelIf
Gateway:	0.0.0.0
Metric:	
Comment:	
WXA Group:	None

5 Finish configuring the options as in Configuring Static and Policy-based Routes on page 360.

6 Click **OK**. The route is enabled and displayed in the **Route Polices** table.

Configuring OSPF and RIP Advanced Routing Services

NOTE: ARS is a fully featured multi-protocol routing suite. The sheer number of configurable options and parameters provided is incongruous with the simplicity of a graphical user interface. Rather than limiting the functionality of ARS, an abbreviated representation of its capabilities has been rendered in the SonicOS web management interface, providing control over the most germane routing features, while the full command suite is available through the CLI. The ARS CLI can be accessed from an authenticated CLI session and contains 3 modules:

- **route ars-nsm** – The Advanced Routing Services Network Services Module. This component provides control over core router functionality, such as interface bindings and redistributable routes.
- **route ars-rip** – The RIP module. Provides control over the RIP router.
- **route ars-ospf** – The OSPF module. Provides control over the OSPF router.

In general, all of the functionality needed to integrate the Security Appliance into most RIP and OSPF environments is available through SonicOS web management. The additional capabilities of the CLI make more advanced configurations possible.

By default, Advanced Routing Services are disabled, and must be enabled to be made available.

The operation of the RIP and OSPF routing protocols is interface dependent. Each interface and virtual subinterface can have RIP and OSPF settings configured separately, and each interface can run both RIP and OSPF routers.

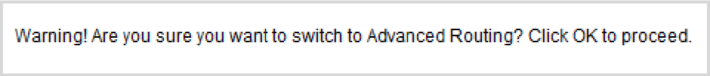
Topics:

- Enabling Advanced Routing Services and BGP on page 366
- Configuring OSPF on page 367
- Configuring RIP and RIPng on page 371
- Configuring Advanced Routing for Tunnel Interfaces on page 374

Enabling Advanced Routing Services and BGP

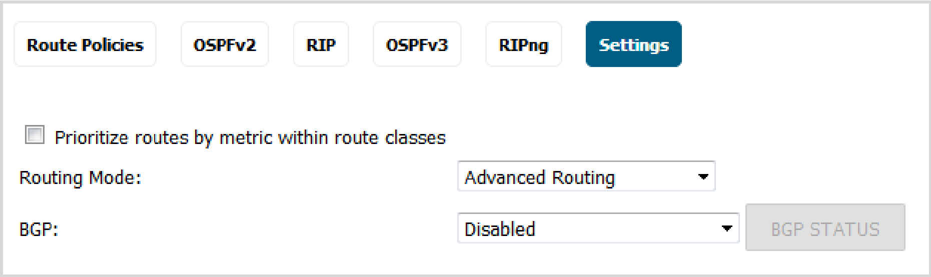
To enable advanced routing services:

1. Navigate to **MANAGE | System Setup | Network > Routing > Settings**.
2. From **Routing mode**, select **Advanced Routing**. A confirmation message displays.



Warning! Are you sure you want to switch to Advanced Routing? Click OK to proceed.

3. Click **OK**. The options on **Network > Routing** change:

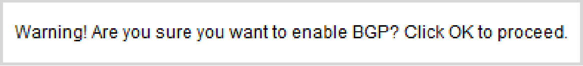


☐ Prioritize routes by metric within route classes

Routing Mode: Advanced Routing

BGP: Disabled

4 To enable BGP, select **Enabled (Configure with CLI)** from **BGP**. The default is **Disabled**. A confirmation message displays.



Warning! Are you sure you want to enable BGP? Click OK to proceed.

5 Click **OK**. **BGP STATUS** becomes available.

Configuring OSPF

ⓘ **NOTE:** OSPF design concepts are beyond the scope of this document. This section describes how to configure a SonicWall Security Appliance to integrate into an OSPF network, be it existing or newly implemented, but it does not offer design guidelines. For terms used throughout this section, refer to OSPF Terms on page 344.

Topics:

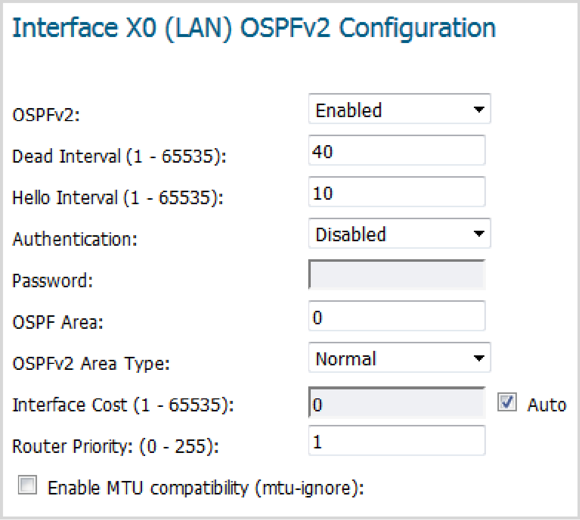
- Configuring OSPFv2 on page 367
- Configuring OSPFv3 on page 369

Configuring OSPFv2

To configure an interface for OSPFv2:

1 Navigate to **MANAGE | System Setup | Network > Routing > OSPFv2**.

2 Click the **Edit** icon for the interface. The **Interface OSPFv2 Configuration** dialog displays.



Interface X0 (LAN) OSPFv2 Configuration

OSPFv2:	Enabled
Dead Interval (1 - 65535):	40
Hello Interval (1 - 65535):	10
Authentication:	Disabled
Password:	
OSPF Area:	0
OSPFv2 Area Type:	Normal
Interface Cost (1 - 65535):	0 ☑ Auto
Router Priority: (0 - 255):	1

□ Enable MTU compatibility (mtu-ignore):

3 From **OSPFv2**, select:

Disabled (default) OSPF Router is disabled on this interface. Go to Step 13.

Enabled OSPF Router is enabled on this interface.

Passive The OSPF router is enabled on this interface, but only advertises connected networks using type 1 LSAs (Router Link Advertisements) into the local area. All the options except **OSPF Area** are dimmed; go to Step 9.

4 To specify the period after which an entry in the LSDB is removed if Hello is not received, enter the time, in seconds, in the **Dead Interval (1 - 65535)** field. The default is **40** seconds, with a minimum of 1 and a maximum on 65,535.

> **IMPORTANT:** Be sure this value agrees with the other OSPF routers on the segment for successful neighbor establishment.

5 To specify the period of time between Hello packets, enter the time, in seconds, in the **Hello Interval (1 - 65535)** field. The default is **10** seconds, with a minimum of 1 and a maximum on 65,535.

> **IMPORTANT:** Be sure this value agrees with the other OSPF routers on the segment for successful neighbor establishment.

6 From **Authentication**, select the type of authentication used on this interface:

Disabled	No authentication is used; go to Step 8.
Simple Password	A plain-text password is used for identification purposes by the OSPF router.
Message Digest	An MD5 hash is used to securely identify the OSPF route.

> **IMPORTANT:** Be sure this setting agrees with the other OSPF routers on the segment for successful neighbor establishment.

7 If you specified:

Simple Password	Enter a 1- to 15-character alphanumeric password.
Message Digest	Enter a 1- to 15-character alphanumeric password.

8 Enter the Area ID in the **OSPF Area** field. The OSPF Area can be represented in either IP or decimal notation. For example, the area connected to `X4:100` as either `100.100.100.100` or `1684300900`. The default is **0**.

9 Select the OSPFv2 area type from **OSPFv2 Area Type** (for a detailed description of these settings, see OSPF Terms on page 344):

Normal	Default; receives and sends all applicable LSA types.
Stub Area	Does not receive type 5 LSAs (AS External Link Advertisements).
Totally Stubby Area	Does not receive LSA types 3, 4, or 5.
Not So Stubby Area	Receives type 7 LSAs (NSSA AS External Routes).
Totally Stubby NSSA	Receives type 1 and 2 LSAs.

10 To:

- Specify the overhead of sending packets across this interface, enter the overhead in the **Interface Cost (1 - 65535)** field. The default value is **0**, generally used to indicate an Ethernet interface. The minimum and default value is 0 (for example, Fast Ethernet) and the maximum value is 65,535 (for example, pudding).
- Have the cost determined automatically, select **Auto**, which dims the **Interface Cost** field. This option is selected by default.

11 To specify the router priority value is used in determining the Designated Router (DR) for a segment, enter the value in the **Router Priority (0-255)** field. The higher the value, the higher the priority. For a priority tie, the Router ID acts as the tie-breaker. Setting a value of 0 makes the OSPF router on this interface ineligible for DR status. The default value is **1**, and the maximum value is 255.

12 To enable MTU compatibility, select **Enable MTU compatibility (mtu-ignore)**. This option is not selected by default.

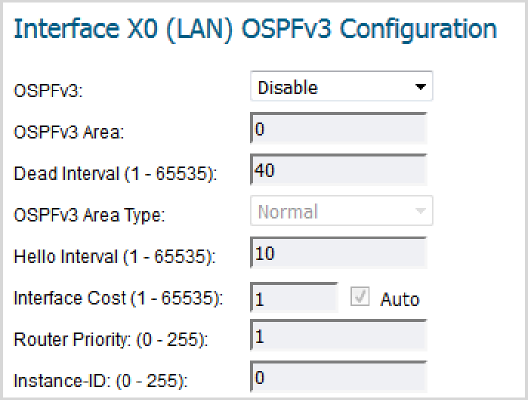
13 Click **OK**.

Configuring OSPFv3

To configure an interface for OSPFv3:

1 Navigate to **MANAGE | System Setup | Network > Routing > OSPFv3**.

2 Click the **Edit** icon for the interface. The **Interface OSPFv3 Configuration** dialog displays.



Interface X0 (LAN) OSPFv3 Configuration

OSPFv3:	Disable
OSPFv3 Area:	0
Dead Interval (1 - 65535):	40
OSPFv3 Area Type:	Normal
Hello Interval (1 - 65535):	10
Interface Cost (1 - 65535):	1 ☑ Auto
Router Priority: (0 - 255):	1
Instance-ID: (0 - 255):	0

3 From **OSPFv3**, select:

Disabled (default)	OSPF Router is disabled on this interface. Go to Step 12.
Enabled	OSPF Router is enabled on this interface.
Passive	The OSPF router is enabled on this interface, but only advertises connected networks using type 1 LSAs (Router Link Advertisements) into the local area. All the options except **OSPFv3 Area** are dimmed.

4 Enter the Area ID in the **OSPF Area** field. The OSPF Area can be represented in either IP or decimal notation. For example, the area connected to `X4:100` as either `100.100.100.100` or `1684300900`. The default is **0**.

5 If you selected **Passive** for **OSPFv3**, go to Step 12.

6 To specify the period after which an entry in the LSDB is removed if Hello is not received, enter the time, in seconds, in the **Dead Interval (1 - 65535)** field. The default is **40** seconds, with a minimum of 1 and a maximum on 65,535.

ⓘ **IMPORTANT:** Be sure this value agrees with the other OSPF routers on the segment for successful neighbor establishment.

7 Select the OSPFv3 area type from **OSPFv3 Area Type** (for a detailed description of these settings, see OSPF Terms on page 344):

Normal	Default; receives and sends all applicable LSA types.
Stub Area	Does not receive type 5 LSAs (AS External Link Advertisements).
Totally Stubby Area	Does not receive LSA types 3, 4, or 5.

8 To specify the period of time between Hello packets, enter the time, in seconds, in the **Hello Interval (1 - 65535)** field. The default is **10** seconds, with a minimum of 1 and a maximum on 65,535.

ⓘ **IMPORTANT:** Be sure this value agrees with the other OSPF routers on the segment for successful neighbor establishment.

9 To:

- Specify the overhead of sending packets across this interface, enter the overhead in the **Interface Cost (1 - 65535)** field. The default value is **0**, generally used to indicate an Ethernet interface. The minimum and default value is 0 (for example, Fast Ethernet) and the maximum value is 65,535 (for example, pudding).
- Have the cost determined automatically, select **Auto**, which dims the **Interface Cost** field. This option is selected by default.

10 To specify the router priority value is used in determining the Designated Router (DR) for a segment, enter the value in the **Router Priority (0-255)** field. The higher the value, the higher the priority. For a priority tie, the Router ID acts as the tie-breaker. Setting a value of 0 makes the OSPF router on this interface ineligible for DR status. The default value is **1**, and the maximum value is 255.

11 To configure the instance ID for the interface, enter a value in the **Instance-ID (0 - 255)** field. The minimum and default is 0, and the maximum is 255. This option is not selected by default.

> ⓘ **IMPORTANT:** This option is normally dimmed and should be set only through the SonicOS command line interface.

12 Click **OK**.

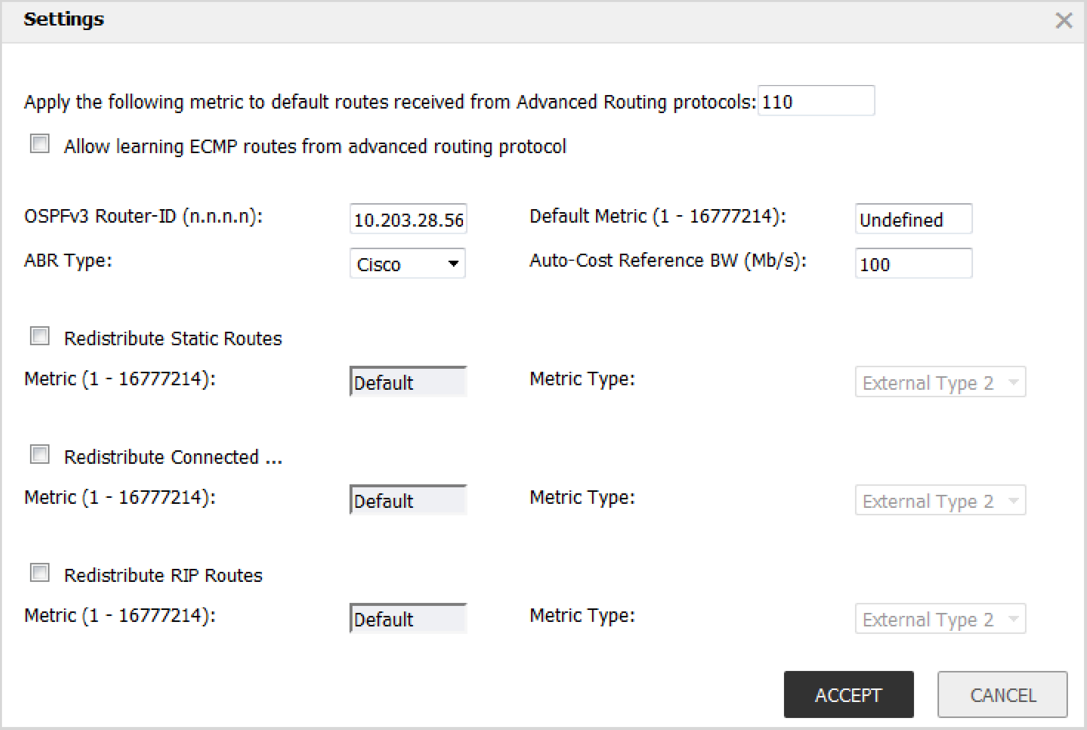
Global OSPFv3 Configuration

To configure global OSPFv3:

1 Navigate to **MANAGE | System Setup | Network > Routing**.

2 Click **OSPFv3**.

3 Click the **Setting** icon. The **Settings** popup dialog displays:



Settings

Apply the following metric to default routes received from Advanced Routing protocols: 110

□ Allow learning ECMP routes from advanced routing protocol

OSPFv3 Router-ID (n.n.n.n):	10.203.28.56	Default Metric (1 - 16777214):	Undefined
ABR Type:	Cisco	Auto-Cost Reference BW (Mb/s):	100

□ Redistribute Static Routes

Metric (1 - 16777214): Default Metric Type: External Type 2

□ Redistribute Connected ...

Metric (1 - 16777214): Default Metric Type: External Type 2

□ Redistribute RIP Routes

Metric (1 - 16777214): Default Metric Type: External Type 2

4 Configure these options:

- **OSPFv3 Router ID (n.n.n.n)** – The Router ID can be any value, represented in IP address notation. It is unrelated to the any of the IP addresses on the Security Appliance, and can be set to any *unique* value within your OSPF network.
- **ABR Type** – Allows for the specification of the topology with which this OSPF router is participating, for the sake of compatibility. The options are:
  - **Standard** – Full RFC2328 compliant ABR OSPF operation.
  - **Cisco** – For interoperating with Cisco's ABR behavior, which expects the backbone to be configured and active before setting the ABR flag.
  - **IBM** – For interoperating with IBM's ABR behavior, which expects the backbone to be configured before settings the ABR flag.
  - **Shortcut** – A shortcut area enables traffic to go through the non-backbone area with a lower metric whether or not the ABR router is attached to area 0.
- **Default Metric (1-16777214)** – Specifies the metric used when redistributing routes from other (Default, Static, Connected, RIP, or VPN) routing information sources. The default value (**Undefined**) is **1**, and the maximum is 16,777,214.
- **Auto-Cost Reference B@ (Mb/s)** – The default is 100.
- **Redistribute Static Routes** – Enables or disables the advertising of static (Policy-based Routing) routes into the OSPF system. This option is not selected by default.

> ⓘ **NOTE:** The following applies to all Redistributed routes:
>
> - **Metric** – Can be explicitly set for this redistribution, or it can use the value (**Default**) specified in the **Default Metric** option.
> - **Metric Type** – The redistributed route advertisement i an LSA Type 5, and the type might be selected as either **External Type 1** (adds the internal link cost) or **External Type 2** (only uses the external link cost).
>
> **NOTE:** These fields are dimmed unless the Redistributed route option is selected.

- **Redistribute Connected Networks** - Enables or disables the advertising of locally connected networks into the OSPF system. This option is not selected by default.
- **Redistribute RIP Routes** - Enables or disables the advertising of routes learned through RIP into the OSPF system. This option is not selected by default.

5 Click **ACCEPT**.

The **Routing Protocols** section shows the status of all active OSPF routers by interface.

The **Routing Policies** section shows routes learned by OSPF as **OSPF** or **RIP Routes**.

Status becomes available.

Configuring RIP and RIPng

Topics:

- Configuring RIP on page 371

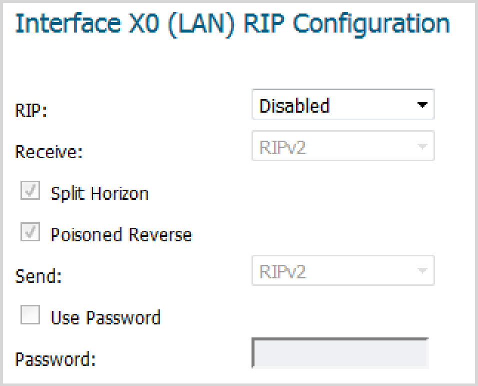
Configuring RIP

To configure RIP routing on an interface:

1 Navigate to **MANAGE | System Setup | Network > Routing**.

2 Click **RIP**.

3 Click the **Edit** icon for the interface. The **Interface RIP Configuration** dialog displays.



Interface X0 (LAN) RIP Configuration

RIP: Disabled

Receive: RIPv2

☑ Split Horizon

☑ Poisoned Reverse

Send: RIPv2

□ Use Password

Password:

4 From **RIP**, select a mode:

Disabled (default)	RIP is disabled on this interface; go to Step 12.
Send and Receive	The RIP router on this interface sends updates and processes received updates.
Send Only	The RIP router on this interface only sends updates and does not process received updates. This is similar to the basic routing implementation.
Receive Only	The RIP router on this interface only processes received updates.
Passive	The RIP router on this interface does not process received updates and only sends updates to neighboring RIP routers specified with the CLI `neighbor` command. **IMPORTANT:** This mode should be used only when configuring advanced RIP options from the ARS-RIP CLI. When selected, all other options are dimmed.

5 If you specified:

- **Send Only**, go to Step 8.
- **Passive**, go to Step 12.

6 From **Receive**, select the RIP version for receiving RIP packets:

RIPv1	Receive only *broadcast* RIPv1 packets.
RIPv2 (default)	Receive only *multicast* RIPv2 packets. RIPv2 packets are sent by multicast, although some implementations of RIP routers (including basic routing on SonicWall devices) have the ability to send RIPv2 in either broadcast or multicast formats. **IMPORTANT:** Be sure the device sending RIPv2 updates uses multicast mode, or the updates are not processed by the ars-rip router.

7 If you selected **Receive Only** for **RIP**, go to Step 11.

8 To suppress the inclusion of routes sent in updates to routers from which they were learned, select **Split Horizon**. This is a common RIP mechanism for preventing routing loops; see Maximum Hops on page 342. This option is selected by default.

9 To specify an optional mode of Split Horizon operation, select **Poisoned Reverse**. Rather than suppressing the inclusion of learned routes, the routes are sent with a metric of infinity (16), thus indicating that they are unreachable; see Maximum Hops on page 342. This option is selected by default.

10 From **Send**, select the RIP version for sending packets:

RIPv1	Send *broadcast* RIPv1 packets.

RIPv2 - v1 compatible Send *multicast* RIPv2 packets that are compatible with RIPv1.

RIPv2 (default) Send *multicast* RIPv2 packets.

11 To enforce use of a password, select **Use Password**. The **Password** field becomes available. This option is not selected by default.

a Enter the password in the **Password** field.

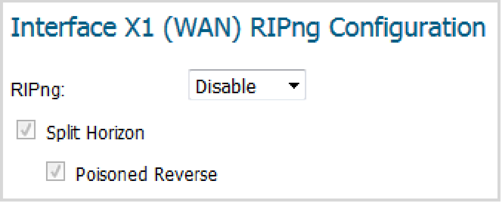
12 Click **OK**.

Configuring RIPng

To configure RIPng routing on an interface:

1 Navigate to **MANAGE | System Setup | Network > Routing > RIPng**.

2 Click the **Edit** icon for the interface. The **Interface RIPng Configuration** dialog displays.



Interface X1 (WAN) RIPng Configuration

RIPng: Disable

☑ Split Horizon

☑ Poisoned Reverse

3 From **RIPng**, select a mode:

Disabled (default) RIPng is disabled on this interface; go to Step 6.

Enable The RIPng router on this interface sends updates and processes received updates.

Passive The RIPng router on this interface does not process received updates and only sends updates to neighboring RIPng routers specified with the CLI `neighbor` command.

IMPORTANT: This mode should be used only when configuring advanced RIPng options from the ARS-RIP CLI.

4 To suppress the inclusion of routes sent in updates to routers from which they were learned, select **Split Horizon**. This is a common RIP mechanism for preventing routing loops; see Maximum Hops on page 342. This option is selected by default.

5 To specify an optional mode of Split Horizon operation, select **Poisoned Reverse**. Rather than suppressing the inclusion of learned routes, the routes are sent with a metric of infinity (16), thus indicating that they are unreachable; see Maximum Hops on page 342. This option is selected by default.

6 Click **OK**.

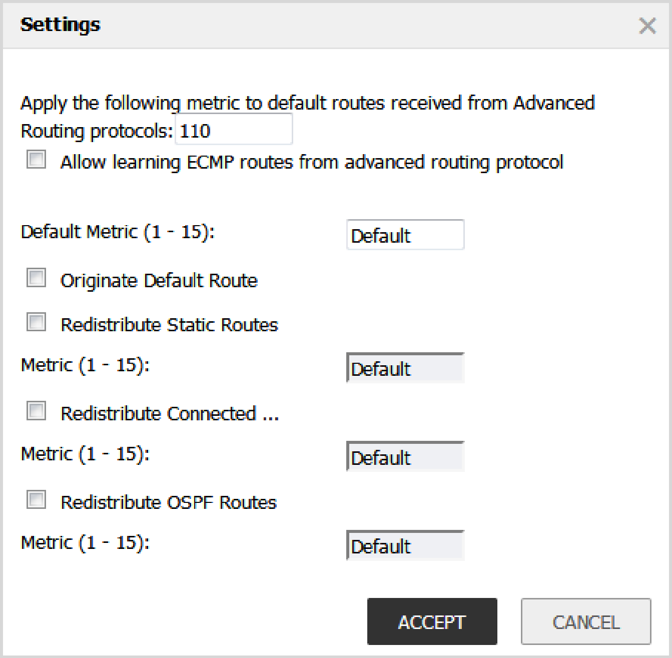
Global RIPng Configuration

To configure global OSPFv3:

1 Navigate to **MANAGE | System Setup | Network > Routing**.

2 Click **OSPFv3**.

3 Click the **Setting** icon. The **Settings** popup dialog displays:



Settings

Apply the following metric to default routes received from Advanced Routing protocols: 110

□ Allow learning ECMP routes from advanced routing protocol

Default Metric (1 - 15): Default

□ Originate Default Route

□ Redistribute Static Routes

Metric (1 - 15): Default

□ Redistribute Connected ...

Metric (1 - 15): Default

□ Redistribute OSPF Routes

Metric (1 - 15): Default

4 Configure these options:

- **Default Metric** – Used to specify the metric that is used when redistributing routes from other (Default, Static, Connected, OSPF, or VPN) routing information sources. The default value (undefined) is **1** and the maximum is 15.
- **Originate Default Route** – This checkbox enables or disables the advertising of the Security Appliance's default route into the RIP system.
- **Redistribute Static Routes** – Enables or disables the advertising of static (Policy-based Routing) routes into the RIP system. The metric can be explicitly set for this redistribution, or it can use the value (default) specified in the **Default Metric** setting.
- **Redistribute Connected Networks** - Enables or disables the advertising of locally connected networks into the RIP system. The metric can be explicitly set for this redistribution, or it can use the value (default) specified in the **Default Metric** setting.
- **Redistribute OSPF Routes** - Enables or disables the advertising of routes learned through OSPF into the RIP system. The metric can be explicitly set for this redistribution, or it can use the value (default) specified in the **Default Metric** setting.

5 Click **ACCEPT**.

Configuring Advanced Routing for Tunnel Interfaces

VPN Tunnel Interfaces can be configured for advanced routing. To do so, you must enable advanced routing for the tunnel interface on the **Advanced** tab of its configuration.

After you have enabled advanced routing for a Tunnel Interface, it is displayed in the tables with the other interfaces in the various views on **MANAGE | System Setup | Network > Routing**.

To configure Advanced Routing options:

1 Click the **Edit** icon in the **Configure RIP/RIPng** or **Configure OSPF/OSPFv3** column for the Tunnel Interface you wish to configure. The RIP and OSPF configurations for Tunnel Interfaces are very similar to the configurations for traditional interfaces.

Global Unnumbered Configuration

Because unnumbered Tunnel Interfaces are not physical interfaces and have no inherent IP address, they must "borrow" the IP address of another interface. Therefore, the advanced routing configuration for a Tunnel Interface includes the following options for specifying the source and destination IP addresses for the tunnel:

- **IP Address Borrowed From** - The interface whose IP address is used as the source IP address for the Tunnel Interface.

  ⓘ **NOTE:** The borrowed IP address must be a static IP address.

- **Remote IP Address** - The IP address of the remote peer to which the Tunnel Interface is connected. In the case of a SonicWall-to-SonicWall configuration with another Tunnel Interface, this should be the IP address of the borrowed interface of the Tunnel Interface on the remote peer.

Guidelines for Configuring Tunnel Interfaces for Advanced Routing

The following guidelines ensure success when configuring Tunnel Interfaces for advanced routing:

- The borrowed interface must have a static IP address assignment.
- The borrowed interface cannot have RIP or OSPF enabled on its configuration.

  ⓘ **TIP:** SonicWall recommends creating a VLAN interface that is dedicated solely for use as the borrowed interface. This avoids conflicts when using wired connected interfaces.

- The IP address of the borrowed interface should be from a private address space, and should have a unique IP address in respect to any remote Tunnel Interface endpoints.
- The Remote IP Address of the endpoint of the Tunnel Interface should be in the same network subnet as the borrowed interface.
- The same borrowed interface might be used for multiple Tunnel Interfaces, provided that the Tunnel interfaces are all connected to different remote devices.
- When more than one Tunnel Interface on an appliance is connected to the same remote device, each Tunnel Interface must use a unique borrowed interface.

Depending on the specific circumstances of your network configuration, these guidelines might not be essential to ensure that the Tunnel Interface functions properly. But these guidelines are SonicWall best practices that avoid potential network connectivity issues.

Configuring BGP Advanced Routing

Border Gateway protocol (BGP) is a large-scale routing protocol used to communicate routing information between Autonomous Systems (ASs), which are well-defined, separately administered network domains. BGP support allows for Security Appliances to replace a traditional BGP router on the edge of a network's AS. The current SonicWall implementation of BGP is most appropriate for single-provider/single-homed environments, where the network uses one ISP as their Internet provider and has a single connection to that provider. SonicWall BGP is also capable of supporting single-provider/multi-homed environments, where the network uses a single ISP but has a small number of separate routes to the provider. BGP is enabled on the **MANAGE | System Setup | Network > Routing** page of the SonicOS web management interface, and then it is fully configured through the SonicOS command line interface.

For complete information on SonicWall's implementation of BGP, see BGP Advanced Routing on page 687.

Configuring an IPsec Tunnel for BGP Sessions

BGP transmits packets in the clear. For strong security, therefore, SonicWall recommends configuring an IPsec tunnel to use for BGP sessions. For how to configure an IPsec Tunnel for BGP and to enable BGP, see BGP Advanced Routing on page 687.

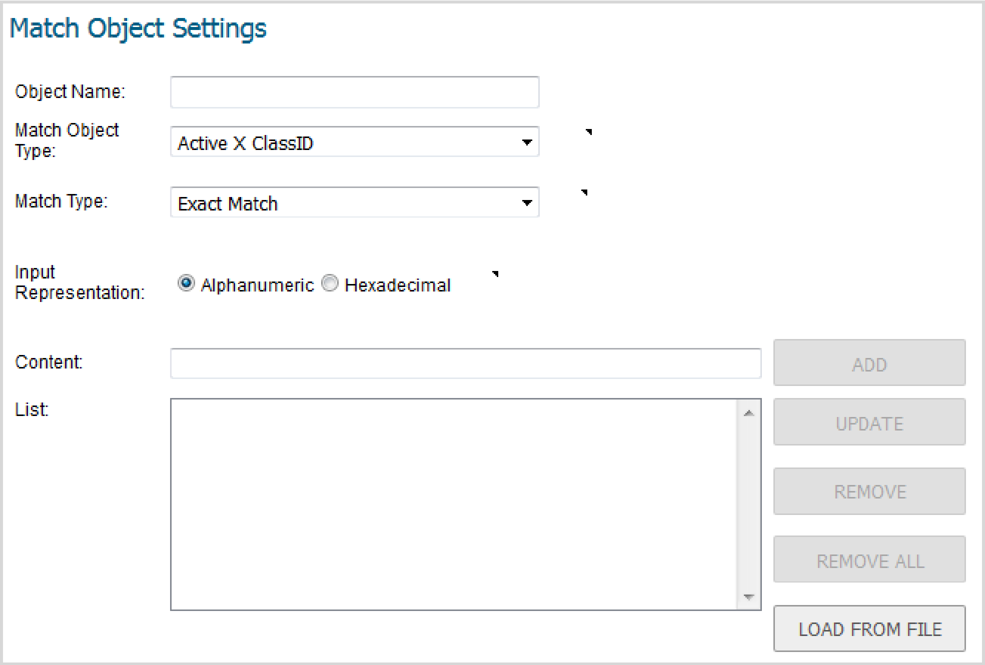
After BGP has been enabled through the Management Interface, the specifics of the BGP configuration are performed using the SonicOS command line interface (CLI). For complete information on the implementation of BGP on a SonicWall Security Appliance, see BGP Advanced Routing on page 687.

Configuring App-based Routes

To configure an app-based route entry:

1 Navigate to **MANAGE | Policies > Objects > Match Objects**.

2 From **Add**, select **Match Object**. The **Create Match Object** dialog displays.



Match Object Settings

Object Name:

Match Object Type: Active X ClassID

Match Type: Exact Match

Input Representation: ● Alphanumeric ○ Hexadecimal

Content:

List:

3 From **Match Object Type**, select

- **Application Category List**
- **Application List**

4 Complete the configuration of the match object.

5 Click **OK**.

6 Navigate to **MANAGE | System Setup > Network > Routing**.

7 Create a route policy.

8 Click **OK**.

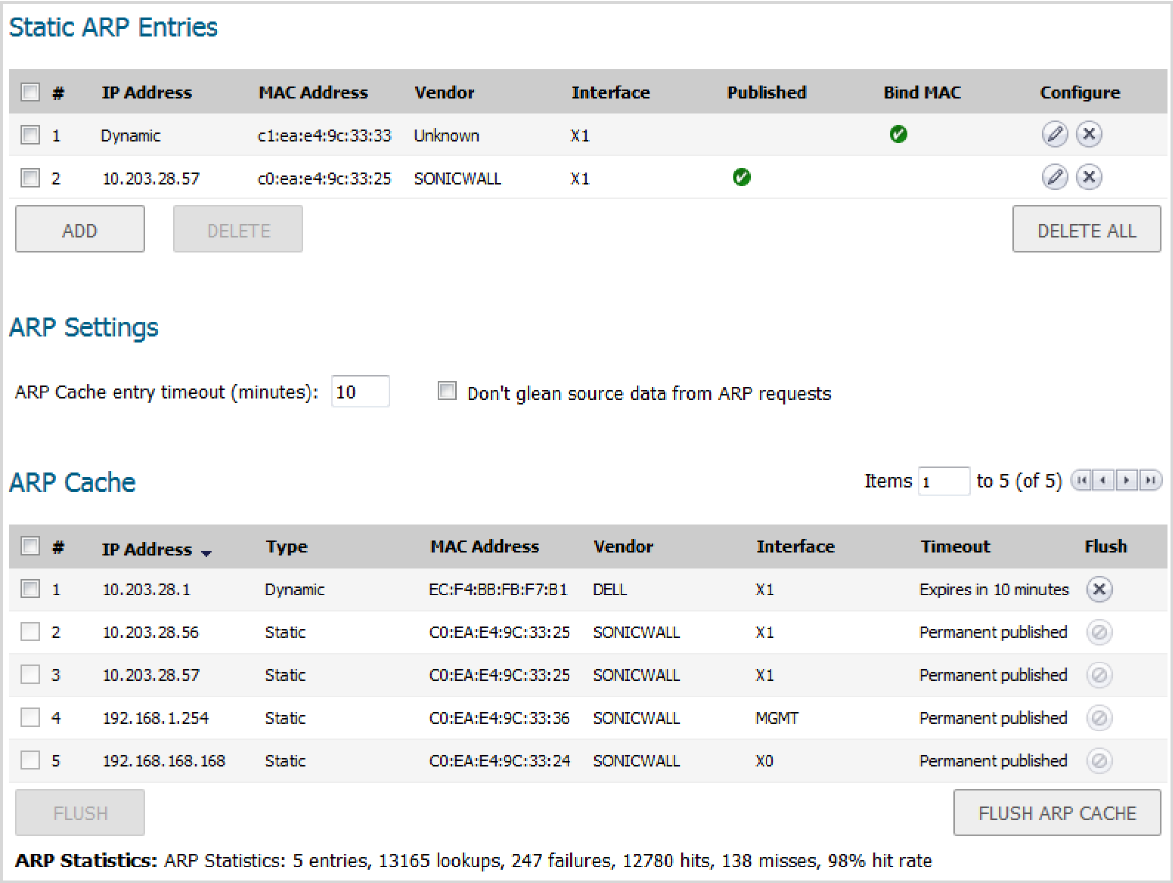
21

Managing ARP Traffic

Topics:

- **Network > ARP** on page 377
  - Static ARP Entries on page 378
  - ARP Settings on page 381
  - ARP Cache on page 381

Network > ARP



Static ARP Entries

□	#	IP Address	MAC Address	Vendor	Interface	Published	Bind MAC	Configure
□	1	Dynamic	c1:ea:e4:9c:33:33	Unknown	X1		✓	
□	2	10.203.28.57	c0:ea:e4:9c:33:25	SONICWALL	X1	✓		

ARP Settings

ARP Cache entry timeout (minutes): 10

□ Don't glean source data from ARP requests

ARP Cache

Items 1 to 5 (of 5)

□	#	IP Address	Type	MAC Address	Vendor	Interface	Timeout	Flush
□	1	10.203.28.1	Dynamic	EC:F4:BB:FB:F7:B1	DELL	X1	Expires in 10 minutes	☒
□	2	10.203.28.56	Static	C0:EA:E4:9C:33:25	SONICWALL	X1	Permanent published	⊘
□	3	10.203.28.57	Static	C0:EA:E4:9C:33:25	SONICWALL	X1	Permanent published	⊘
□	4	192.168.1.254	Static	C0:EA:E4:9C:33:36	SONICWALL	MGMT	Permanent published	⊘
□	5	192.168.168.168	Static	C0:EA:E4:9C:33:24	SONICWALL	X0	Permanent published	⊘

ARP Statistics: ARP Statistics: 5 entries, 13165 lookups, 247 failures, 12780 hits, 138 misses, 98% hit rate

ARP (Address Resolution Protocol) maps layer 3 (IP addresses) to layer 2 (physical or MAC addresses) to enable communications between hosts residing on the same subnet. ARP is a broadcast protocol that can create excessive amounts of network traffic on your network. To minimize the broadcast traffic, an ARP cache is maintained to store and reuse previously learned ARP information.

Topics:

- Static ARP Entries on page 378
- ARP Settings on page 381
- ARP Cache on page 381

Static ARP Entries

The Static ARP feature allows for static mappings to be created between layer 2 MAC addresses and layer 3 IP addresses.

Topics:

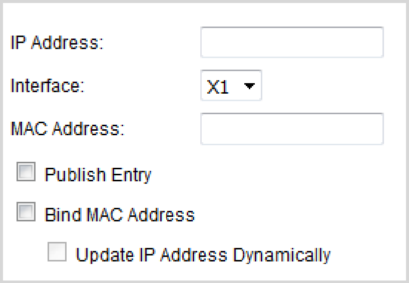
- Configuring a Static ARP on page 378
- Editing a Static ARP Entry on page 379
- Secondary Subnets with Static ARP on page 379
- Viewing Static ARP Entries on page 381

Configuring a Static ARP

To configure a Static ARP:

1 Navigate to **Network > ARP**.

2 Under the **Static ARP Entries** table, click **Add**. The **Add Static ARP** dialog displays.



IP Address:

Interface: X1

MAC Address:

□ Publish Entry

□ Bind MAC Address

□ Update IP Address Dynamically

3 In the **IP Address** field, enter the IP address of the SonicWall Security Appliance.

4 From **Interface**, select the LAN interface on the Security Appliance to be associated with this static ARP entry.

5 In the **MAC Address** field, enter the MAC address of the Security Appliance.

6 To cause the Security Appliance to respond to ARP queries for the specified IP address with the specified MAC address, select the **Publish Entry** option. This option is not selected by default.

This option can be used, for example, to have the Security Appliance reply for a secondary IP address on a particular interface by adding the MAC address of the Security Appliance. See Secondary Subnets with Static ARP on page 379. Selecting this option dims the **MAC Address** field and **Bind MAC Address** option.

7 If you selected **Publish Entry**, go to Step 10.

8 To bind the MAC address specified to the designated IP address and interface, select **Bind MAC Address**. This option is not selected by default.

This option ensures that a particular workstation (as recognized by the network card's unique MAC address) can only the used on a specified interface on the Security Appliance. After the MAC address is bound to an interface, the Security Appliance:

- Does not respond to that MAC address on any other interface.
- Removes any dynamically cached references to that MAC address that might have been present.
- Prohibits additional (non-unique) static mappings of that MAC address.

When Bind MAC Address is selected, **Update IP Address Dynamically** becomes available.

9 To allow a MAC address to be bound to an interface when DHCP is being used to dynamically allocate IP addressing, select **Update IP Address Dynamically**, which is a sub-feature of the **Bind MAC Address** option.

Enabling this option dims the **IP Address** field and sets it to `0.0.0.0`, makes the **MAC Address** field available, and populates the ARP Cache with the IP address allocated by either the Security Appliance's internal DHCP server or, if IP Helper is in use, by the external DHCP server.

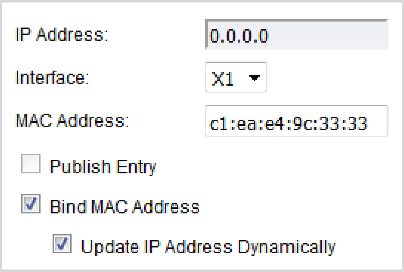
10 Click **OK**.

Editing a Static ARP Entry

To edit a Static ARP entry:

1 Navigate to **MANAGE | System Setup | Network > ARP**.

2 In the **Static ARP Entries** table, click the entry’s **Edit** icon in the **Configure** column. The **Edit Static ARP** dialog displays.



IP Address: 0.0.0.0

Interface: X1

MAC Address: c1:ea:e4:9c:33:33

□ Publish Entry

☑ Bind MAC Address

☑ Update IP Address Dynamically

3 Make the changes.

4 Click **OK**. The entry is updated.

Secondary Subnets with Static ARP

The Static ARP feature allows for secondary subnets to be added on other interfaces without the addition of automatic NAT rules.

Topics:

- Adding a Secondary Subnet on page 380
- An Example on page 380

Adding a Secondary Subnet

To add a Secondary Subnet using the Static ARP Method:

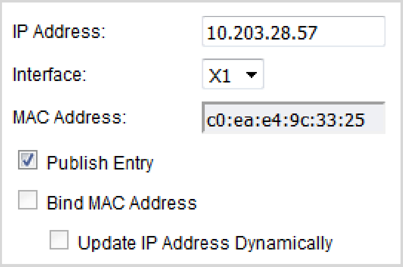
1. Add a 'published' static ARP entry for the gateway address that is used for the secondary subnet, assigning it the MAC address of the Security Appliance interface to which it is connected.
2. Add a static route for that subnet, so that the Security Appliance regards it as valid traffic, and knows to which interface to route that subnet's traffic.
3. Add Access Rules to allow traffic destined for that subnet to traverse the correct network interface.
4. Optional: Add a static route on upstream device(s) so that they know which gateway IP to use to reach the secondary subnet.

An Example

Consider the following network example (see Adding a Secondary Subnet on page 380).

To support the added configuration:

1. Create a published static ARP entry for `192.168.50.1`, the address that serves as the gateway for the secondary subnet.
2. Associate it with the appropriate LAN interface. From **MANAGE | System Setup | Network > ARP**, click **Add** under the **Static ARP Entries** table.
3. Add this entry:



IP Address: 10.203.28.57

Interface: X1

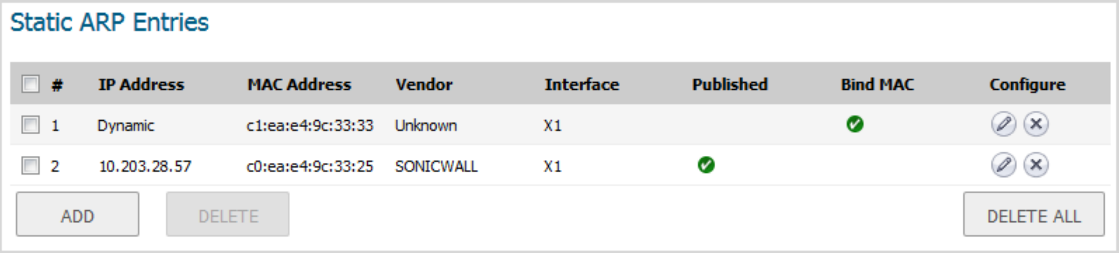
MAC Address: c0:ea:e4:9c:33:25

☑ Publish Entry

□ Bind MAC Address

□ Update IP Address Dynamically

4. Click **OK**. The entry appears in the **Static ARP Entries** table.

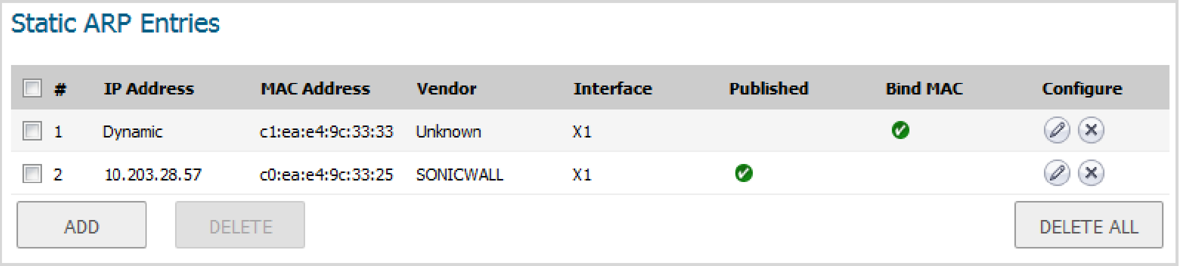


Static ARP Entries

□	#	IP Address	MAC Address	Vendor	Interface	Published	Bind MAC	Configure
□	1	Dynamic	c1:ea:e4:9c:33:33	Unknown	X1		✓	✎ ✕
□	2	10.203.28.57	c0:ea:e4:9c:33:25	SONICWALL	X1	✓		✎ ✕

5. Navigate to **Network > Routing**.
6. Add a static route for the `192.168.50.0/24` network, with the `255.255.255.0` subnet mask on the X3 Interface. For information about adding static routes, see Configuring Route Advertisements and Route Policies on page 335.
7. To allow traffic to reach the `192.168.50.0/24` subnet and to allow the `192.168.50.0/24` subnet to reach the hosts on the LAN, navigate to **MANAGE | Policies | Rules > Access Rules** page.
8. Add appropriate Access Rules to allow traffic to pass. For information about adding Access Rules, see *SonicOS NSv Polices*.

Viewing Static ARP Entries



Static ARP Entries

□	#	IP Address	MAC Address	Vendor	Interface	Published	Bind MAC	Configure
□	1	Dynamic	c1:ea:e4:9c:33:33	Unknown	X1		✓	✎ ✕
□	2	10.203.28.57	c0:ea:e4:9c:33:25	SONICWALL	X1	✓		✎ ✕

IP Address IP address of the Security Appliance serving as the gateway.

MAC Address MAC address of the Security Appliance serving as the gateway.

Vendor Name of the Security Appliance’s manufacturer.

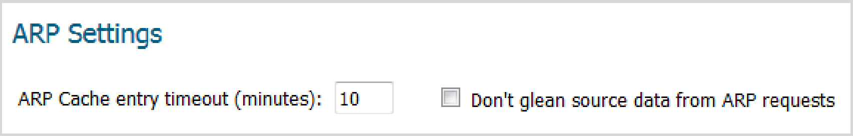
Interface LAN interface associated with this entry.

Published Indicates with a green checkmark whether the Security Appliance responds to ARP queries for the specified IP address with the specified MAC address.

Bind MAC Indicates with a green checkmark whether the MAC address is bound to the designated IP address and interface.

Configure Displays the **Edit** and **Delete** icons for the entry.

ARP Settings



ARP Settings

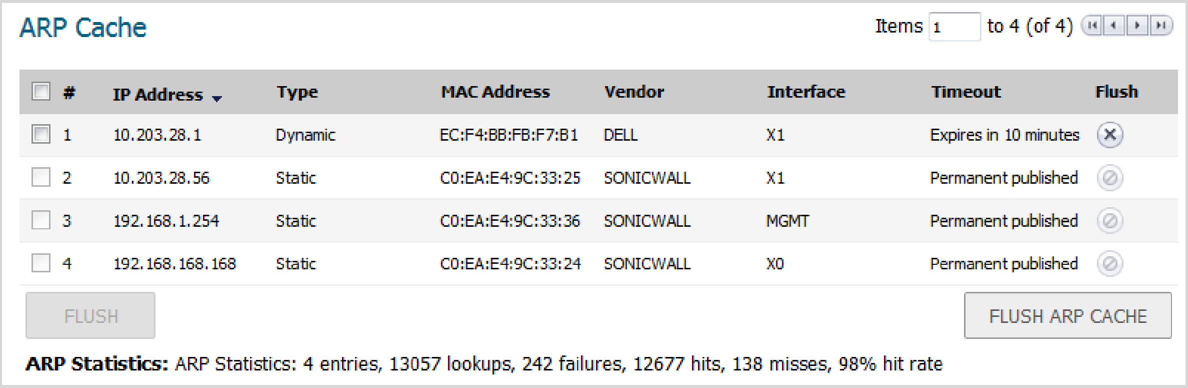
ARP Cache entry timeout (minutes): 10

□ Don't glean source data from ARP requests

ARP Cache entry timeout (minutes) Specify a length of time for the entries to time out and be flushed from the cache. The minimum time is two minutes, the maximum is 600 minutes (10 hours), and the default is **10** minutes.

Don’t glean source data from ARP requests Select to prevent source data from being obtained from ARP requests. This option is not selected by default.

ARP Cache



ARP Cache

Items 1 to 4 (of 4)

□	#	IP Address	Type	MAC Address	Vendor	Interface	Timeout	Flush
□	1	10.203.28.1	Dynamic	EC:F4:BB:FB:F7:B1	DELL	X1	Expires in 10 minutes	✕
□	2	10.203.28.56	Static	C0:EA:E4:9C:33:25	SONICWALL	X1	Permanent published	⊘
□	3	192.168.1.254	Static	C0:EA:E4:9C:33:36	SONICWALL	MGMT	Permanent published	⊘
□	4	192.168.168.168	Static	C0:EA:E4:9C:33:24	SONICWALL	X0	Permanent published	⊘

ARP Statistics: ARP Statistics: 4 entries, 13057 lookups, 242 failures, 12677 hits, 138 misses, 98% hit rate

IP Address IP Address of the Security Appliance.

Type Indicates whether the ARP is **Static** or **Dynamic**.

MAC Address MAC address associated with the IP Address.

Vendor Name of the Security Appliance’s manufacturer.

Interface LAN interface associated with this ARP entry.

Timeout Indicates the time left in cache for this entry. If the entry was published when configured, **Timeout** displays `Permanent published`.

Flush Displays the **Delete** icon for flushing the entry from ARP cache.

NOTE: Only **Dynamic** entries have the **Delete** icon.

Flushing the ARP Cache

It is sometimes necessary to flush the ARP cache if the IP address has changed for a device on the network. As the IP address is linked to a physical address, the IP address can change, but still be associated with the physical address in the ARP Cache. Flushing the ARP Cache allows new information to be gathered and stored in the ARP Cache.

ⓘ **TIP:** To configure a specific length of time for an entry to time out, enter a value in minutes in the **ARP Cache entry time out (minutes)** field; see ARP Settings on page 381.

To flush a dynamic entry in the ARP Cache table:

1 Click its **Delete** icon in the **Flush** column.

To flush one or more dynamic entries in the ARP Cache table:

1 Select the checkbox(es) of one or more entries to be flushed. **Flush** becomes active.

2 Click **Flush**.

To flush all the dynamic entries in the ARP Cache table:

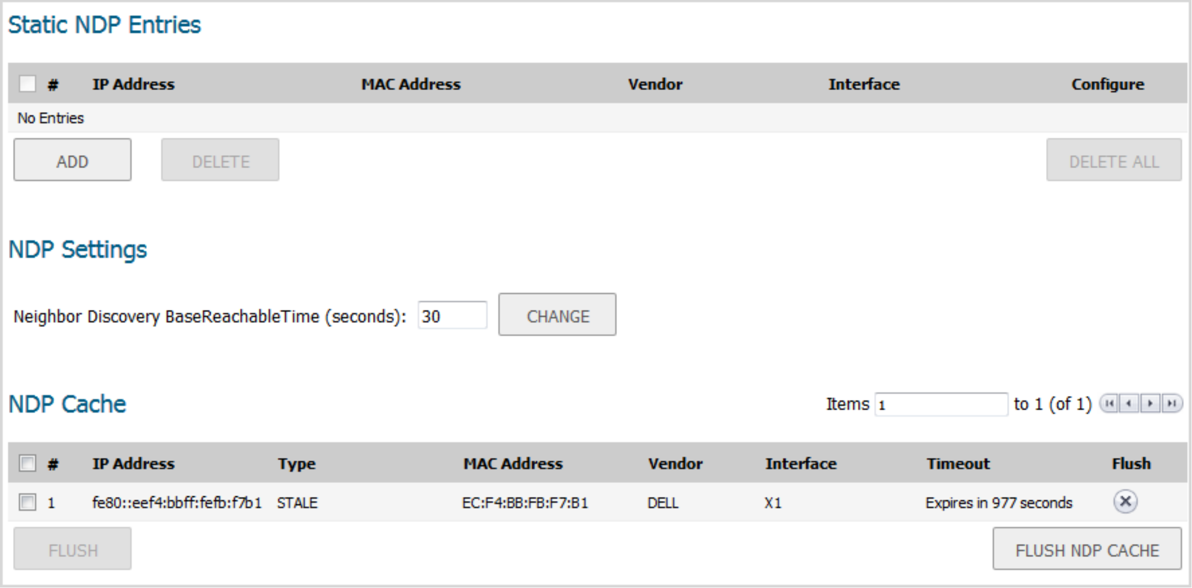
1 Click **Flush ARP Cache**.

22

Configuring Neighbor Discovery Protocol

Topics:

Network > Neighbor Discovery (IPv6 Only)



Static NDP Entries

□	#	IP Address	MAC Address	Vendor	Interface	Configure
No Entries						

NDP Settings

Neighbor Discovery BaseReachableTime (seconds): 30

NDP Cache

Items 1 to 1 (of 1)

□	#	IP Address	Type	MAC Address	Vendor	Interface	Timeout	Flush
□	1	fe80::eef4:bbff:fefb:f7b1	STALE	EC:F4:BB:FB:F7:B1	DELL	X1	Expires in 977 seconds	⊗

The Neighbor Discovery Protocol (NDP) is a new messaging protocol that was created as part of IPv6 to perform a number of the tasks that ICMP and ARP accomplish in IPv4. Just like ARP, Neighbor Discovery builds a cache of dynamic entries, and you can configure static Neighbor Discovery entries. IPv4/IPv6 Neighbor Messages and Functions shows the IPv6 neighbor messages and functions that are analogous to the traditional IPv4 neighbor messages.

IPv4/IPv6 Neighbor Messages and Functions

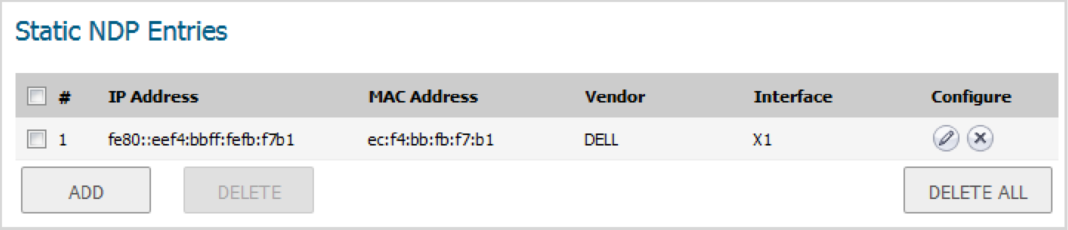
IPv4 Neighbor Message	IPv6 Neighbor Message
ARP request message	Neighbor solicitation message
ARP reply message	Neighbor advertisement message
ARP cache	Neighbor cache
Gratuitous ARP	Duplicate address detection
Router solicitation message (optional)	Router solicitation (required)
Router advertisement message (optional)	Router advertisement (required)
Redirect message	Redirect Message

The Static NDP feature allows for static mappings to be created between a Layer 3 IPv6 address and a Layer 2 MAC address.

Topics:

- Static NDP Entries on page 384
- NDP Settings on page 385
- NDP Cache on page 385
- Configuring a Static NDP Entry on page 386
- Editing a Static NDP Entry on page 386
- Flushing the NDP Cache on page 387

Static NDP Entries



Static NDP Entries

□	#	IP Address	MAC Address	Vendor	Interface	Configure
□	1	fe80::eef4:bbff:fefb:f7b1	ec:f4:bb:fb:f7:b1	DELL	X1	✎ ⊗

IP Address IPv6 IP address for the remote device.

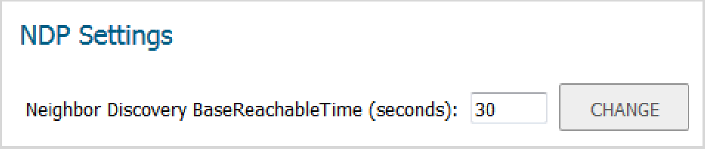
MAC Address MAC address for the remote device.

Vendor Name of the remote device’s manufacturer.

Interface Interface associated with the remote device.

Configure Contains the **Edit** and **Delete** icons for the entry.

NDP Settings



NDP Settings

Neighbor Discovery BaseReachableTime (seconds): 30 CHANGE

Specify the maximum time to reach a neighbor in **NDP Settings**.

> **NOTE:** For IPv6, this value also can be set for each interface on the **MANAGE | System Setup | Network > Interfaces > Edit Interface > Advanced** dialog. If Router Advertisement is enabled on an interface, the value set for the interface is used for that interface only. For more information, see Configuring Interfaces on page 249.

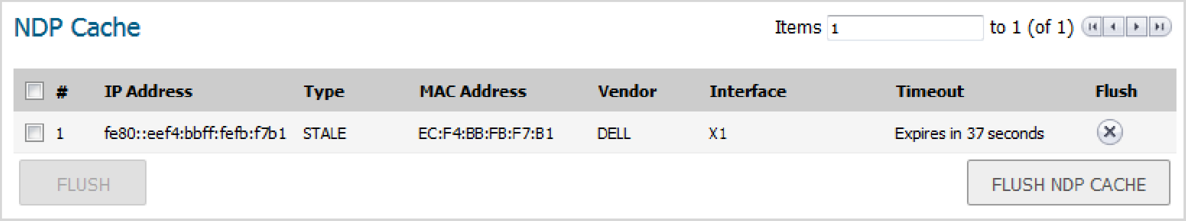
To specify the maximum time:

1 Enter a number in the **Neighbor Discover BaseReachableTime (seconds)** field. The minimum is 0 seconds, the maximum is 3600 seconds, and the default is **20** seconds.

> **TIP:** When this option's value is set to 0, the global value of NDP settings is used.

2 Click **Change**.

NDP Cache



NDP Cache

Items 1 to 1 (of 1)

□	#	IP Address	Type	MAC Address	Vendor	Interface	Timeout	Flush
□	1	fe80::eef4:bbff:fefb:f7b1	STALE	EC:F4:BB:FB:F7:B1	DELL	X1	Expires in 37 seconds	⊗

FLUSH FLUSH NDP CACHE

The **NDP Cache** table displays all current IPv6 neighbors.

IP Address IPv6 IP Address of the neighbor device.

Type Type of neighbor:

- **REACHABLE** - The neighbor is known to have been reachable within 30 seconds.
- **STALE** - The neighbor is no longer known to be reachable, and traffic has been sent to the neighbor within 1200 seconds.
- **STATIC** - The neighbor was manually configured as a static neighbor.,

MAC Address IPv6 MAC Address of the neighbor device.

Vendor Name of the neighbor device’s manufacturer.

Interface Interface associated with this neighbor device.

Timeout The length of inactivity time until the user times out.

Flush Contains the **Delete** icon for the entry.

These types of neighbors are displayed:

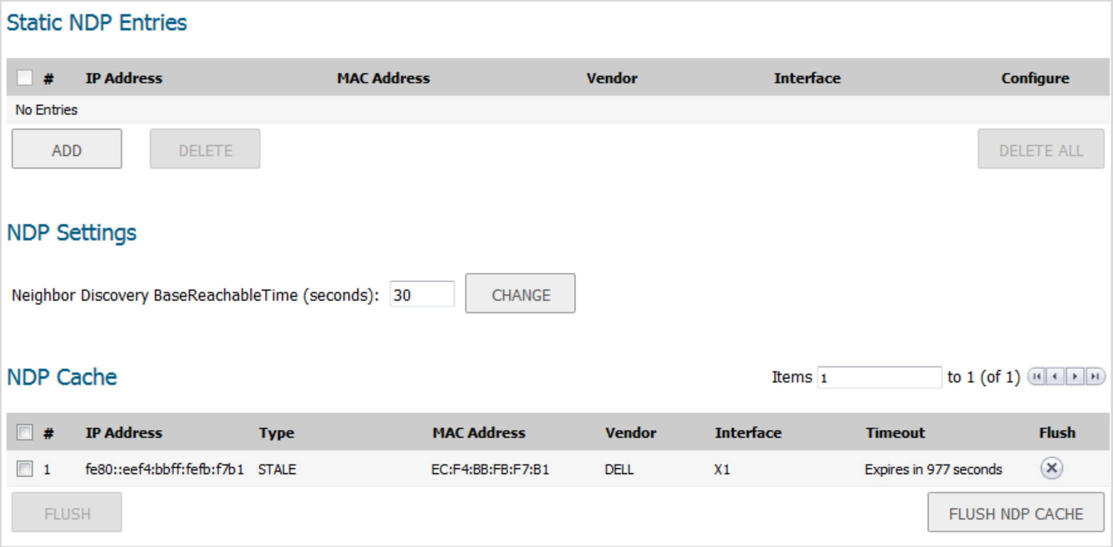
- **REACHABLE** - The neighbor is known to have been reachable within 30 seconds.
- **STALE** - The neighbor is no longer known to be reachable, and traffic has been sent to the neighbor within 1200 seconds.

- **STATIC** - The neighbor was manually configured as a static neighbor.

Configuring a Static NDP Entry

To configure a Static NDP entry:

1 Navigate to the **MANAGE | System Setup | Network > Neighbor Discovery** page.



Static NDP Entries

□	#	IP Address	MAC Address	Vendor	Interface	Configure
No Entries						

NDP Settings

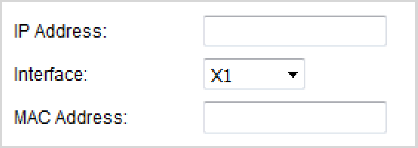
Neighbor Discovery BaseReachableTime (seconds): 30

NDP Cache

Items 1 to 1 (of 1)

□	#	IP Address	Type	MAC Address	Vendor	Interface	Timeout	Flush
□	1	fe80::eef4:bbff:fefb:f7b1	STALE	EC:F4:BB:FB:F7:B1	DELL	X1	Expires in 977 seconds	⊗

2 Under the **Static NDP Entries** table, click **Add**. The **Add Static NDP** dialog displays.



IP Address:	
Interface:	X1
MAC Address:	

3 In the **IP Address** field, enter the IPv6 address for the remote device.

4 From **Interface**, select the interface on the SonicWall Security Appliance that is used for the entry.

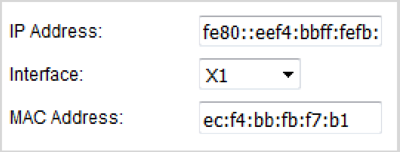
5 In the **MAC Address** field, enter the MAC address of the remote device.

6 Click **OK**. The static NDP entry is added.

Editing a Static NDP Entry

To edit a Static NDP entry:

1 In the **Static NDP Entries** table, click the entry's **Edit** icon in the **Configure** column. The **Edit Static NDP** dialog displays.



IP Address:	fe80::eef4:bbff:fefb:
Interface:	X1
MAC Address:	ec:f4:bb:fb:f7:b1

2 Make the changes.

3 Click **OK**. The entry is updated.

Flushing the NDP Cache

It is sometimes necessary to flush the NDP cache if the IP address has changed for a device on the network. As the IP address is linked to a physical address, the IP address can change, but still be associated with the physical address in the NDP Cache. Flushing the NDP Cache allows new information to be gathered and stored in the NDP Cache.

ⓘ **TIP:** To configure a specific length of time for an entry to time out, enter a value in minutes in the **NDP Cache entry time out (minutes)** field; see NDP Settings on page 385.

To flush an entry in the NDP Cache table:

1 Click its **Delete** icon in the **Flush** column.

To flush one or more entries in the NDP Cache table:

1 Select the checkbox of one or more entries to be flushed. The two flush buttons become active.

2 Click either **Flush** or **Flush NDP Cache**.

To flush all the entries in the NDP Cache table:

1 Select the checkbox in the **NDP Cache** table header. The two flush buttons become active.

2 Click either **Flush** or **Flush NDP Cache**.

23

Configuring MAC-IP Anti-spoof

Topics:

About MAC-IP Anti-spoof Protection

MAC and IP address-based attacks are increasingly common in today's network security environment. These types of attacks often target a Local Area Network (LAN) and can originate from either outside or inside a network. In fact, anywhere internal LANs are somewhat exposed, such as in office conference rooms, schools, or libraries, could provide an opening to these types of attacks. These attacks also go by various names: man-in-the-middle attacks, ARP poisoning, SPITS. The MAC-IP Anti-spoof feature lowers the risk of these attacks by providing you with different ways to control access to a network and by eliminating spoofing attacks at OSI Layer 2/3.

The effectiveness of the MAC-IP Anti-spoof feature focuses on two areas:

- Admission control, which gives you the ability to select which devices gain access to the network.
- Elimination of spoofing attacks, such as denial-of-service attacks, at Layer 2.

To achieve these goals, two caches of information must be built: the MAC-IP Anti-spoof Cache, and the ARP Cache.

The MAC-IP Anti-spoof cache validates incoming packets and determines whether they are to be allowed inside the network. An incoming packet's source MAC and IP addresses are looked up in this cache. If they are found, the packet is allowed through. The MAC-IP Anti-spoof cache is built through one or more of these sub-systems:

- DHCP Server-based leases (SonicWall's - DHCP Server; IPv4 only)

- DHCP relay-based leases (SonicWall’s - IP Helper; IPv4 only)
- Static ARP entries; IPv4 only
- User-created static entries

The ARP Cache is built through these subsystems:

- ARP packets; both ARP requests and responses; IPv4 only
- Static ARP entries from user-created entries; IPv4 only
- MAC-IP Anti-spoof Cache

The MAC-IP Anti-spoof subsystem achieves egress control by locking the ARP cache, so egress packets (those exiting the network) are not spoofed by a bad device or by unwanted ARP packets. This prevents a SonicWall Security Appliance from routing a packet to the unintended device, based on mapping. This also prevents man-in-the-middle attacks by refreshing a client’s own MAC address inside its ARP cache.

Extension to IP Helper

To support leases from the DHCP relay subsystem of IP Helper (**MANAGE | System Setup | Network > IP Helper**):

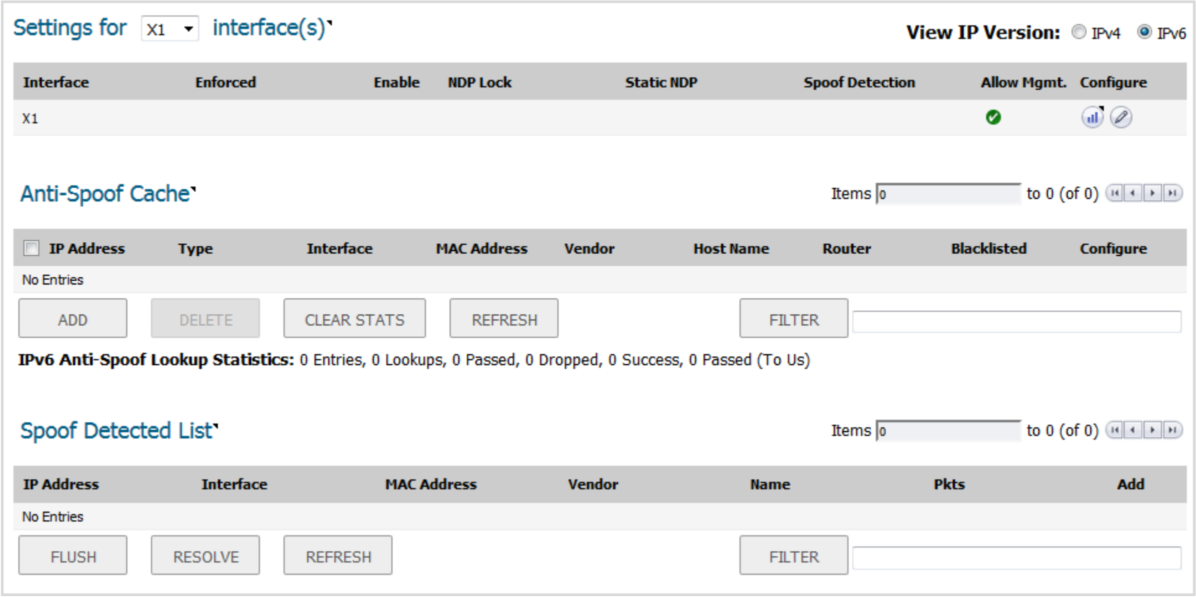
- As part of the DHCP relay logic, IP Helper learns leases exchanged between clients and the DHCP server, then saves them into flash memory.
- These learned leases are synchronized to the idle SonicWall Security Appliance, as part of the IP Helper state sync messages.

MAC and IP address bindings from the leases are transferred into the MAC-IP Anti-spoof cache.

For more information about IP Helper, see Using IP Helper on page 429.

Network > MAC-IP Anti-spoof

IPv6



Settings for X1 interface(s)

View IP Version: ○ IPv4 ● IPv6

Interface	Enforced	Enable	NDP Lock	Static NDP	Spoof Detection	Allow Mgmt.	Configure
X1						✓	

Anti-Spoof Cache

Items 0 to 0 (of 0)

□ IP Address	Type	Interface	MAC Address	Vendor	Host Name	Router	Blacklisted	Configure
No Entries								

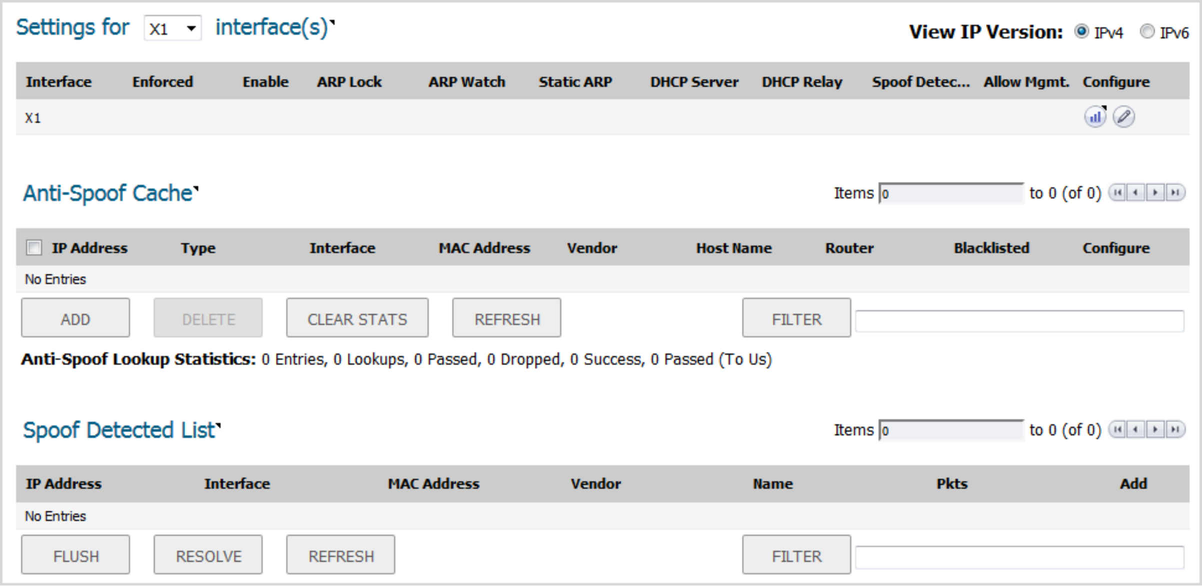
IPv6 Anti-Spoof Lookup Statistics: 0 Entries, 0 Lookups, 0 Passed, 0 Dropped, 0 Success, 0 Passed (To Us)

Spoof Detected List

Items 0 to 0 (of 0)

IP Address	Interface	MAC Address	Vendor	Name	Pkts	Add
No Entries						

IPv4



Settings for X1 interface(s)

View IP Version: ● IPv4 ○ IPv6

Interface	Enforced	Enable	ARP Lock	ARP Watch	Static ARP	DHCP Server	DHCP Relay	Spoof Detec...	Allow Mgmt.	Configure
X1										

Anti-Spoof Cache

Items 0 to 0 (of 0)

□ IP Address	Type	Interface	MAC Address	Vendor	Host Name	Router	Blacklisted	Configure
No Entries								

ADD DELETE CLEAR STATS REFRESH FILTER

Anti-Spoof Lookup Statistics: 0 Entries, 0 Lookups, 0 Passed, 0 Dropped, 0 Success, 0 Passed (To Us)

Spoof Detected List

Items 0 to 0 (of 0)

IP Address	Interface	MAC Address	Vendor	Name	Pkts	Add
No Entries						

FLUSH RESOLVE REFRESH FILTER

This section describes how to plan, design, and implement MAC-IP Anti-spoof protection in SonicWall SonicOS NS*v*.

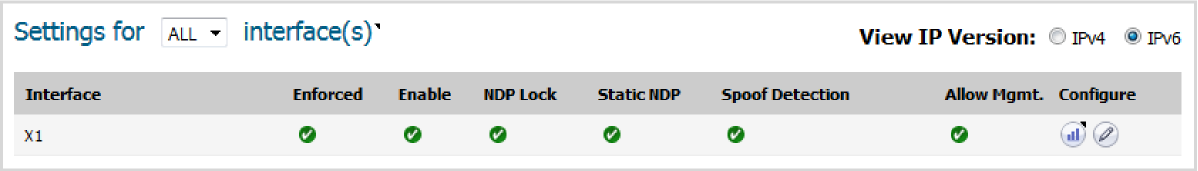
Topics:

- Settings for Interface(s) on page 390
- Anti-Spoof Cache on page 392
- Spoof Detected List on page 393

Settings for Interface(s)

NOTE: The green checkmark icons denote which settings have been enabled.

IPv6



Settings for ALL interface(s)

View IP Version: ○ IPv4 ● IPv6

Interface	Enforced	Enable	NDP Lock	Static NDP	Spoof Detection	Allow Mgmt.	Configure
X1	✓	✓	✓	✓	✓	✓	

Settings for interface(s) Lists all interfaces on which MAC-IP Anti-spoof settings can be applied. The default for display is **All**.

Interface Interface selected from **Settings for interface(s)**.

Enforced Indicates whether ingress anti-spoof is enforced on this interface.

Enable Indicates whether MAC-IP Anti-spoof is enabled on this interface. b

NDP Lock Indicates whether MAC-IP Anti-spoof check is enabled for every transmit packet on this interface.

Static NDP Indicates whether a corresponding MAC-IP Anti-spoof table entry is created for every static NDP entry.

Spoof Detection Indicates whether a MAC-IP Anti-spoof-detected list is created for packets failing to match the anti-spoof cache.

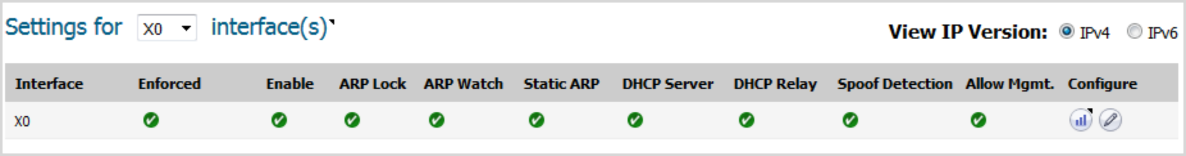
NOTE: These interfaces are excluded from the MAC-IP Anti-spoof list:

- Non-ethernet interfaces
- Port-shield member interfaces
- Layer 2 bridge pair interfaces
- High availability interfaces
- High availability data interfaces

Allow Mgmt. Indicates whether all traffic destined to the Security Appliance is allowed without a valid MAC-IP Anti-spoof cache.

Configure Contains the **Statistics** and **Edit** icons for the entry.

IPv4



Settings for X0 ▾ interface(s)

View IP Version: ● IPv4 ○ IPv6

Interface	Enforced	Enable	ARP Lock	ARP Watch	Static ARP	DHCP Server	DHCP Relay	Spoof Detection	Allow Mgmt.	Configure
X0	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Settings for interface(s) Lists all interfaces on which MAC-IP Anti-spoof settings can be applied. The default for display is **All**.

Interface Interface selected from **Settings for interface(s)**.

Enforced Indicates whether ingress anti-spoof is enforced on this interface.

Enable Indicates whether MAC-IP Anti-spoof is enabled on this interface. b

ARP Lock Indicates whether MAC-IP Anti-spoof check is enabled for every transmit packet on this interface.

ARP Watch Indicates whether prevention of ARP poisoning of connected machines is enabled.

Static ARP Indicates whether a corresponding MAC-IP Anti-spoof table entry is created for every static ARP entry.

DHCP Server Indicates whether the MAC-IP Anti-spoof entry is populated from the DHCP Lease (SonicWall’s DHCP server).

DHCP Relay Indicates whether the MAC-IP Anti-spoof entry is populated from the DHCP Lease (DHCP relay - IP Helper).

Spoof Detection Indicates whether a MAC-IP Anti-spoof-detected list is created for packets failing to match the anti-spoof cache.

NOTE: These interfaces are excluded from the MAC-IP Anti-spoof list:

- Non-ethernet interfaces
- Port-shield member interfaces
- Layer 2 bridge pair interfaces
- High availability interfaces
- High availability data interfaces

Allow Management Indicates whether all traffic destined to the firewall is allowed without a valid MAC-IP Anti-spoof cache.

Configure Contains the **Statistics** and **Edit** icons for the entry.

Anti-Spoof Cache

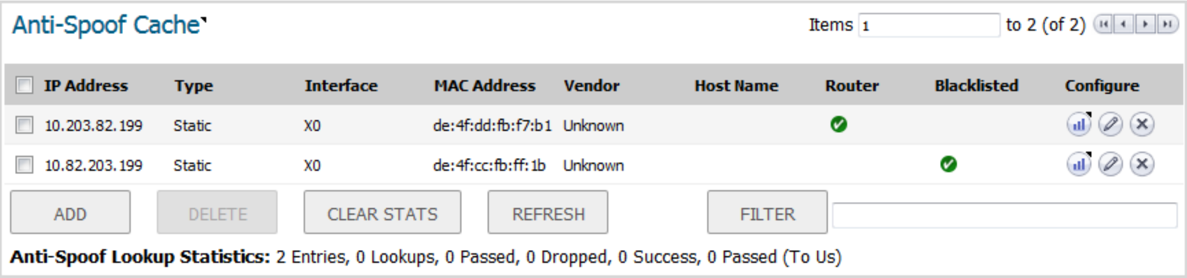
MAC-IP Anti-spoof Cache lists all MAC address-to-IP address bindings, which can include all the devices presently:

- Listed as “authorized” to access the network.
- Marked as a device that acts like a router with a network behind it.
- Marked as “blacklisted” (denied access) from the network.

Some packet types are bypassed even though the MAC-IP Anti-spoof feature is enabled:

- Non-IP packets.
- DHCP packets with source IP as 0.
- Packets from a VPN tunnel.
- Packets with invalid unicast IPs as their source IPs.
- Packets from interfaces where the Management status is not enabled under anti-spoof settings.

Anti-spoof lookup statistics are displayed at the bottom of the table.



□ IP Address	Type	Interface	MAC Address	Vendor	Host Name	Router	Blacklisted	Configure
□ 10.203.82.199	Static	X0	de:4f:dd:fb:f7:b1	Unknown		✓		
□ 10.82.203.199	Static	X0	de:4f:cc:fb:ff:1b	Unknown			✓	

Anti-Spoof Lookup Statistics: 2 Entries, 0 Lookups, 0 Passed, 0 Dropped, 0 Success, 0 Passed (To Us)

IP Address	IP address of the device
Type	Type of entry: **Static** or **Lease**
Interface	Interface receiving incoming traffic
MAC Address	MAC address of the device
Vendor	Manufacturer of the device, if known
Host Name	Device’s host name, if known
Router	Device was designated as a possible router when configured
Blacklisted	Device was designated blacklisted when configured
Configure	Displays the **Statistics**, **Edit**, and **Delete** icons for each entry

To clear cache statistics on one or more devices:

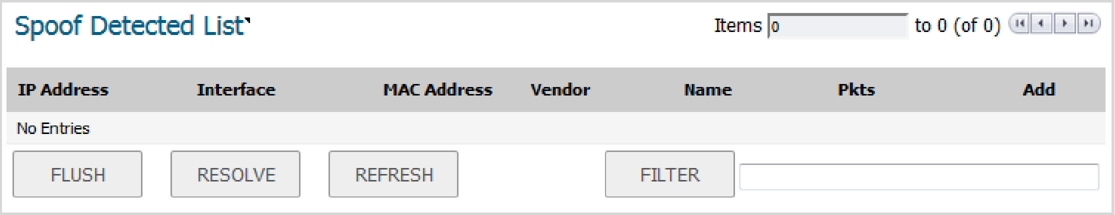
1. Navigate to **MANAGE | System Setup | Network > MAC-IP Anti-spoof**.
2. Select one or more devices.
3. Click **CLEAR STATS**.

To view the most recent available cache information:

1. Navigate to **MANAGE | System Setup | Network > MAC-IP Anti-spoof**.
2. Click **REFRESH** at the bottom of the **Anti-Spoof Cache** table.

Spoof Detected List

The **Spoof Detected List** displays devices that failed to pass the ingress anti-spoof cache check. Entries on this list can be added as a static anti-spoof entry in the **Anti-Spoof Cache** table.



Spoof Detected List

Items 0 to 0 (of 0)

IP Address	Interface	MAC Address	Vendor	Name	Pkts	Add
No Entries						

IP Address	IP address of the device.
Interface	Interface receiving incoming traffic.
MAC Address	MAC address of the device.
Vendor	Manufacturer of the device, if known.
Name	Name of the device.
Pkts	Number of packets received.
Add	Displays the **Edit** icon.

To flush entries from the spoof-detected list:

1 Click **FLUSH**.

To resolve the name of each device using NetBios:

1 Click **RESOLVE**.

To view the most recent available cache information:

1 Click **REFRESH** at the bottom of the **Spoof Detected List** table.

Configuring MAC-IP Anti-spoof Protection

Topics:

- Displaying Traffic Statistics on page 394
- Editing MAC-IP Anti-spoof Settings for an IPv6 Interface on page 394
- Editing MAC-IP Anti-spoof Settings for an IPv4 Interface on page 395
- Adding Devices to Anti-Spoof Cache on page 397
- Deleting Anti-Spoof Cache Entries on page 397
- Filtering What Is Displayed on page 398
- Adding Static Entries from Spoof Detected List on page 398

Displaying Traffic Statistics

To display traffic statistics for an interface in the Settings or Anti-Spoof Cache tables:

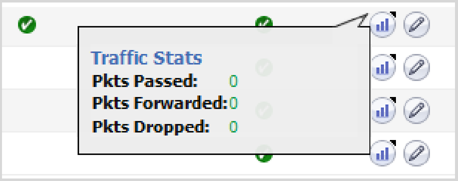
1 Navigate to **MANAGE | System Setup | Network > MAC-IP Anti-spoof**.

2 To display traffic statistics for an interface in the **Settings** table, select an interface to display from **Settings for interface(s)**; the default is **All**.

3 Mouse over the **Statistics** icon for the interface.

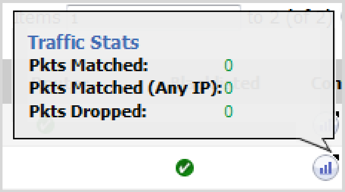
4 The **Traffic Stats** popup displays:

Settings table



Traffic Stats
Pkts Passed: 0
Pkts Forwarded: 0
Pkts Dropped: 0

Anti-Spoof Cache table



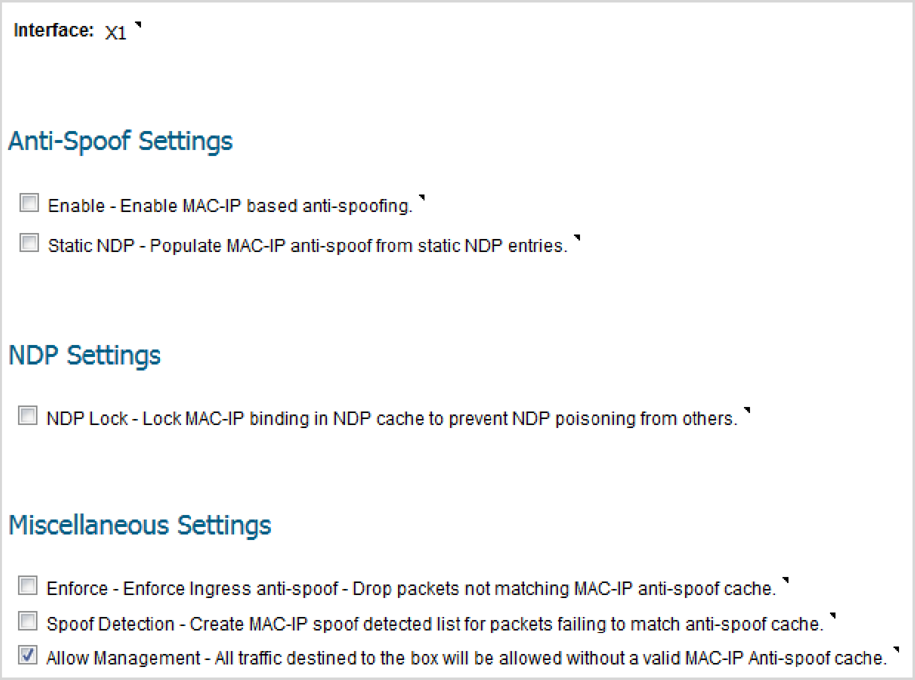
Traffic Stats
Pkts Matched: 0
Pkts Matched (Any IP): 0
Pkts Dropped: 0

Editing MAC-IP Anti-spoof Settings for an IPv6 Interface

To configure MAC-IP Anti-spoof settings for a particular interface:

1 Navigate to **MANAGE | System Setup | Network > MAC-IP Anti-spoof**.

2 In the **Settings for Interface(s)** table, click the **Configure** icon for the desired interface. The **Edit MAC-IP Anti-spoof Settings** dialog displays.



Interface: X1

Anti-Spoof Settings

□ Enable - Enable MAC-IP based anti-spoofing.

□ Static NDP - Populate MAC-IP anti-spoof from static NDP entries.

NDP Settings

□ NDP Lock - Lock MAC-IP binding in NDP cache to prevent NDP poisoning from others.

Miscellaneous Settings

□ Enforce - Enforce Ingress anti-spoof - Drop packets not matching MAC-IP anti-spoof cache.

□ Spoof Detection - Create MAC-IP spoof detected list for packets failing to match anti-spoof cache.

☑ Allow Management - All traffic destined to the box will be allowed without a valid MAC-IP Anti-spoof cache.

3 To enable MAC address and IP address traffic based on Anti-spoofing through this interface, select **Enable – Enable MAC-IP-based anti-spoofing** in the **Anti-Spoof Settings** section. This option is not selected by default.

4 To create for every static NDP entry a corresponding entry in the MAC-IP Anti-spoof table, select **Static NDP – Populate MAC-IP anti-spoof from static NDP entries**. This option is not selected by default.

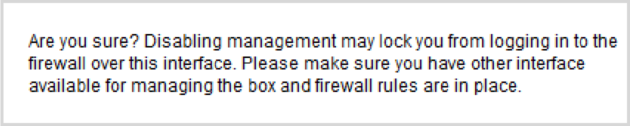
5 To add an NDP cache entry for every MAC-IP binding inside the anti-spoof cache, select **NDP Lock – Lock MAC-IP binding in NDP cache to prevent NDP poisoning from others** in the **NDP Settings** section. This option is not selected by default.

6 To enable a MAC-IP anti-spoof check for every transit packet, select **Enforce – Enforce Ingress anti-spoof - Drop packets not matching MAC-IP anti-spoof cache** in the **Miscellaneous Settings** section. This option is not selected by default.

7 To create a spoof-detected list for every device that fails a MAC-IP Anti-spoof cache check, select **Spoof Detection – Create MAC-IP spoof detected list for packets failing to match anti-spoof cache**. This option is not selected by default.

8 To allow all traffic destined to the Security Appliance, including without a valid MAC-IP Anti-spoof cache, select **Allow Management – All traffic destined to the box will be allowed without a valid MAC-IP Anti-spoof cache**. This option is selected by default.

> **CAUTION: If you disable this option, you could be prevented from logging in to the SonicWall Security Appliance over this interface. Ensure you have other interfaces available for managing the Security Appliance and that proper rules and policies are in place. A warning message displays when you disable the option:**



Are you sure? Disabling management may lock you from logging in to the firewall over this interface. Please make sure you have other interface available for managing the box and firewall rules are in place.

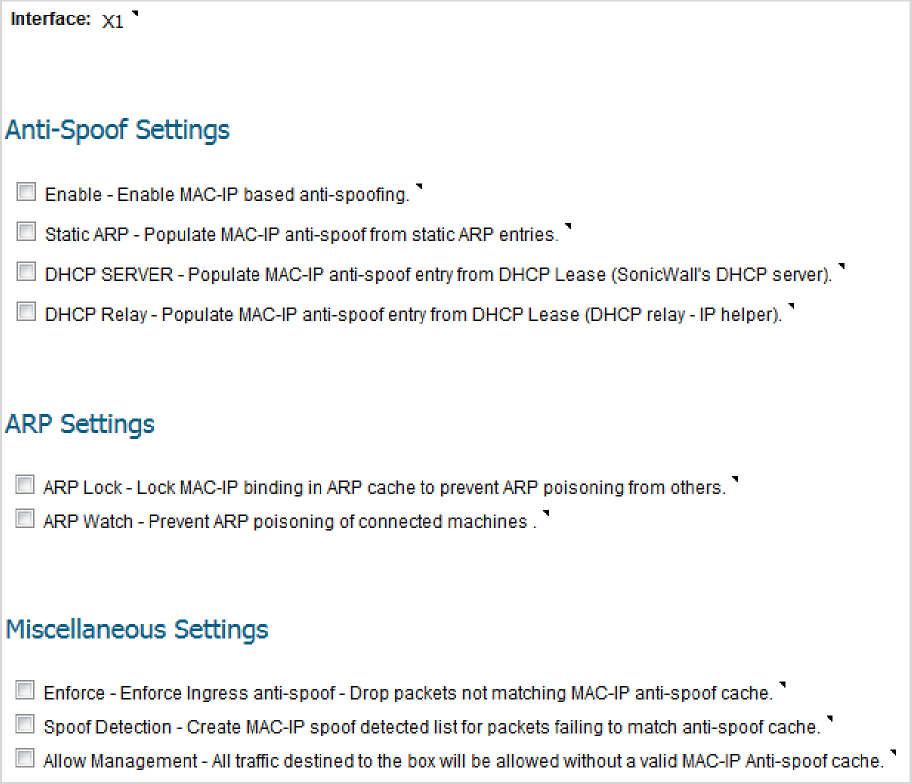
9 Click **OK**.

Editing MAC-IP Anti-spoof Settings for an IPv4 Interface

To configure MAC-IP Anti-spoof settings for a particular interface:

1 Navigate to **MANAGE | System Setup | Network > MAC-IP Anti-spoof**.

2 In the **Settings for Interface(s)** table, click the **Configure** icon for the desired interface. The **Edit MAC-IP Anti-spoof Settings** dialog displays.



Interface: X1

Anti-Spoof Settings

□ Enable - Enable MAC-IP based anti-spoofing.

□ Static ARP - Populate MAC-IP anti-spoof from static ARP entries.

□ DHCP SERVER - Populate MAC-IP anti-spoof entry from DHCP Lease (SonicWall's DHCP server).

□ DHCP Relay - Populate MAC-IP anti-spoof entry from DHCP Lease (DHCP relay - IP helper).

ARP Settings

□ ARP Lock - Lock MAC-IP binding in ARP cache to prevent ARP poisoning from others.

□ ARP Watch - Prevent ARP poisoning of connected machines .

Miscellaneous Settings

□ Enforce - Enforce Ingress anti-spoof - Drop packets not matching MAC-IP anti-spoof cache.

□ Spoof Detection - Create MAC-IP spoof detected list for packets failing to match anti-spoof cache.

□ Allow Management - All traffic destined to the box will be allowed without a valid MAC-IP Anti-spoof cache.

3 To enable MAC address and IP address traffic based on Anti-spoofing through this interface, select **Enable – Enable MAC-IP-based anti-spoofing** in the **Anti-Spoof Settings** section. This option is not selected by default.

4 To create for every static ARP entry a corresponding entry in the MAC-IP anti-spoof table, select **Static ARP – Populate MAC-IP anti-spoof from static ARP entries**. This option is not selected by default.

5 To create for every DHCP Lease allocated by a DHCP server a corresponding entry in the MAC-IP Anti-spoof table, select **DHCP SERVER – Populate MAC-IP anti-spoof entry from DHCP Lease (SonicWall's DHCP server)**. This option is not selected by default.

6 To create for every DHCP Lease allocated by a remote DHCP server a corresponding entry in the MAC-IP Anti-spoof table based on the DHCP relay configuration, select **DHCP Relay – Populate MAC-IP anti-spoof entry from DHCP Lease (DHCP relay - IP helper)**. This option is not selected by default.

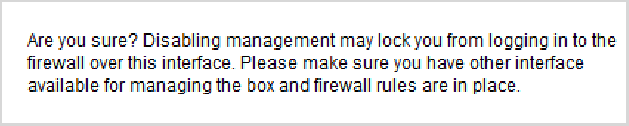
7 To add an ARP cache entry for every MAC-IP binding inside the anti-spoof cache, select **ARP Lock – Lock MAC-IP binding in ARP cache to prevent ARP poisoning from others** in the **ARP Settings** section. This option is not selected by default.

8 To prevent ARP poisoning of connected appliances and protect all client PCs from man-in-the-middle attacks, select **ARP Watch – Prevent ARP poisoning of connected machines**. This option is not selected by default.

9 To enable a MAC-IP anti-spoof check for every transit packet, select **Enforce – Enforce Ingress anti-spoof - Drop packets not matching MAC-IP anti-spoof cache** in the **Miscellaneous Settings** section. This option is not selected by default.

10 To create a spoof-detected list for every device that fails a MAC-IP Anti-spoof cache check, select **Spoof Detection – Create MAC-IP spoof detected list for packets failing to match anti-spoof cache**. This option is not selected by default.

11 To allow all traffic destined to the Security Appliance, including without a valid MAC-IP Anti-spoof cache, select **Allow Management – All traffic destined to the box is allowed without a valid MAC-IP Anti-spoof cache**. This option is selected by default.

> **CAUTION: If you disable this option, you could be prevented from logging in to the SonicWall Security Appliance over this interface. Ensure you have other interfaces available for managing the Security Appliance and that proper rules and policies are in place. A warning message displays when you disable the option:**
>
> 
>
> Are you sure? Disabling management may lock you from logging in to the firewall over this interface. Please make sure you have other interface available for managing the box and firewall rules are in place.

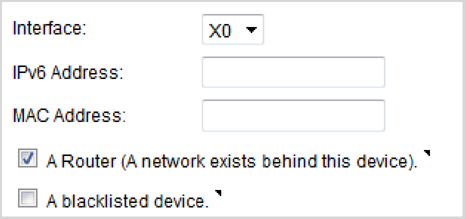
12 Click **OK**.

Adding Devices to Anti-Spoof Cache

To add a device to Anti-Spoof Cache:

1 Navigate to **MANAGE | System Setup | Network > MAC-IP Anti-spoof**.

2 Click **ADD** below the **Anti-Spoof Cache** table. The **Add Static MAC-IP Anti-spoof** dialog displays.



Interface: X0

IPv6 Address:

MAC Address:

☑ A Router (A network exists behind this device).

□ A blacklisted device.

3 From **Interface**, select the interface on which traffic from the device arrives.

4 In the **IP Address** field, type in the IP address of the device.

5 In the **MAC Address** field, type in the MAC address of the device.

6 To designate the device as a router that might have a network behind it, select **A Router**. This option is selected by default.

7 To put this device on the blacklist and block traffic from it, select **A blacklisted device**. This option is not selected by default.

Blacklisting the device causes packets to be blocked from this device regardless of its IP address.

8 Click **OK**.

Deleting Anti-Spoof Cache Entries

To delete a single static anti-spoof cache entry:

1 Navigate to **MANAGE | System Setup | Network > MAC-IP Anti-spoof**.

2 Click the **Delete** icon of the entry.

To delete one or more static anti-spoof cache entries:

1 Navigate to **MANAGE | System Setup | Network > MAC-IP Anti-spoof**.

2 Select the entries to be deleted. **DELETE** becomes active.

3 Click **DELETE**.

To delete all static anti-spoof cache entries

1 Navigate to **MANAGE | System Setup | Network > MAC-IP Anti-spoof**.

2 Select the checkbox in the Anti-Spoof Cache table header. **DELETE** becomes active.

3 Click **DELETE**.

Filtering What Is Displayed

You can display only a specific device(s) in the **Anti-Spoof Cache** and **Spoof Detected List** tables by using the **Filter** function.

To filter the table display:

1 Navigate to **MANAGE | System Setup | Network > MAC-IP Anti-spoof**.

2 In the Filter field below the table to be filtered, specify either the device's IP address, interface, MAC address, host name, or name. The field must be filled using the appropriate syntax for operators shown in Filter Operator Syntax Options.

Filter Operator Syntax Options

Operator	Syntax Options
Value with a type	• Ip=1.1.1.1 or ip=1.1.1.0/24 • Mac=00:01:02:03:04:05 • Iface=x1
String	• X1 • 00:01 • Tst-mc • 1.1.
AND	• Ip=1.1.1.1;iface=x1 • Ip=1.1.1.0/24;iface=x1;just-string
OR	• Ip=1.1.1.1,2.2.2.2,3.3.3.0/24 • Iface=x1,x2,x3
Negative	• !ip=1.1.1.1;!just-string • !iface=x1,x2
Mixed	• Ip=1.1.1.1,2.2.2.2;mac=00:01:02:03:04:05;just-string;!iface=x1,x2

Adding Static Entries from Spoof Detected List

To add a static entry from the Spoof Detected List:

1 Navigate to **MANAGE | System Setup | Network > MAC-IP Anti-spoof**.

2 In the **Spoof Detected List** table, click the **Edit** icon under the **Add** column for the desired device. An alert message displays, asking if you wish to add this static entry.

3 Click **OK**.

Setting Up the DHCP Server

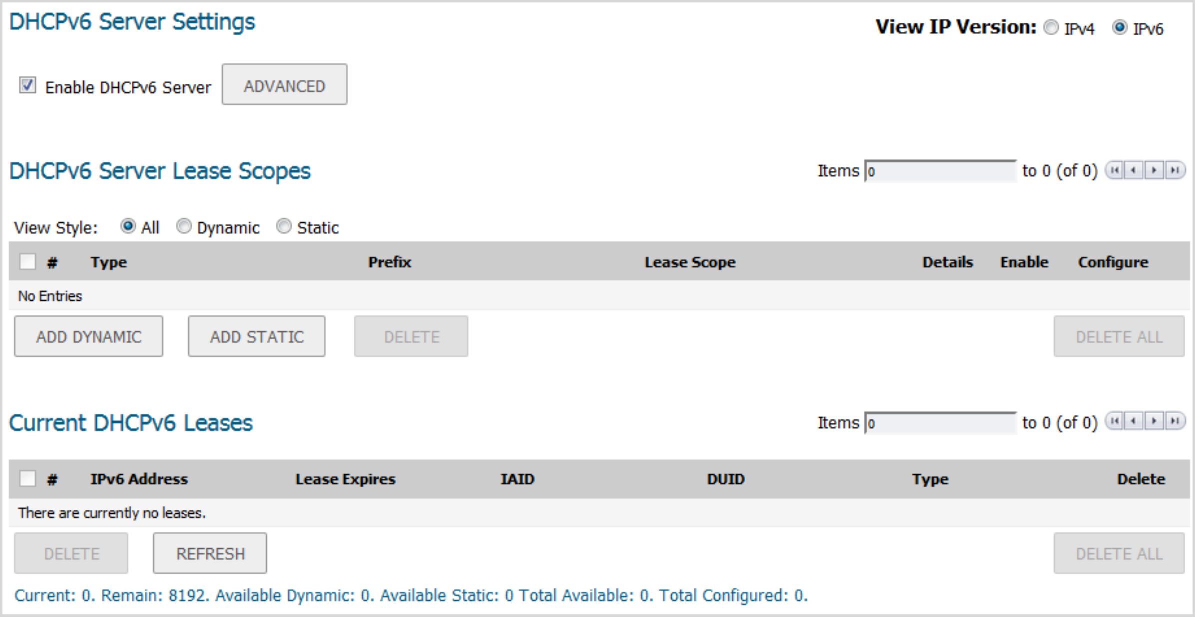
Topics:

ⓘ **IMPORTANT:** DHCP server functionality by the NS*v* is not supported in public cloud environments such as AWS or Azure.

Network > DHCP Server

There are only minor differences between the IPv6 (IPv6 **Network > DHCP Server**) and IPv4 versions (IPv4 **Network > DHCP Server**) of **MANAGE | System Setup | Network > DHCP Server**. Differences are noted within procedures.

IPv6 Network > DHCP Server



DHCPv6 Server Settings

View IP Version: ○ IPv4 ● IPv6

☑ Enable DHCPv6 Server

DHCPv6 Server Lease Scopes

Items 0 to 0 (of 0)

View Style: ● All ○ Dynamic ○ Static

□	#	Type	Prefix	Lease Scope	Details	Enable	Configure
No Entries							

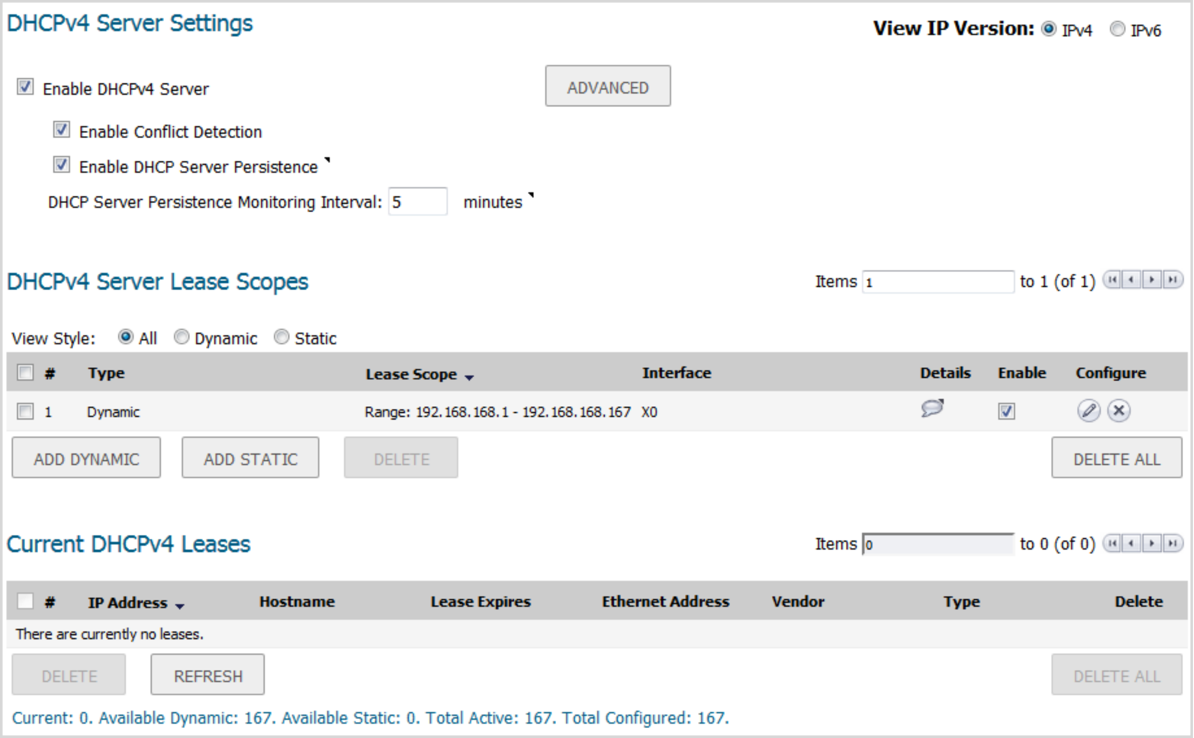
Current DHCPv6 Leases

Items 0 to 0 (of 0)

□	#	IPv6 Address	Lease Expires	IAID	DUID	Type	Delete
There are currently no leases.							

Current: 0. Remain: 8192. Available Dynamic: 0. Available Static: 0 Total Available: 0. Total Configured: 0.

IPv4 Network > DHCP Server



DHCPv4 Server Settings

View IP Version: ● IPv4 ○ IPv6

☑ Enable DHCPv4 Server

☑ Enable Conflict Detection

☑ Enable DHCP Server Persistence

DHCP Server Persistence Monitoring Interval: 5 minutes

DHCPv4 Server Lease Scopes

Items 1 to 1 (of 1)

View Style: ● All ○ Dynamic ○ Static

□	#	Type	Lease Scope	Interface	Details	Enable	Configure
□	1	Dynamic	Range: 192.168.168.1 - 192.168.168.167	X0		☑	

Current DHCPv4 Leases

Items 0 to 0 (of 0)

□	#	IP Address	Hostname	Lease Expires	Ethernet Address	Vendor	Type	Delete
There are currently no leases.								

Current: 0. Available Dynamic: 167. Available Static: 0. Total Active: 167. Total Configured: 167.

The SonicWall Security Appliance includes a DHCP (Dynamic Host Configuration Protocol) server to distribute IP addresses, subnet masks, gateway addresses, and DNS server addresses to your network clients. **MANAGE | System Setup | Network > DHCP Server** includes settings for configuring the Security Appliance's DHCP server.

IMPORTANT: You can use the Security Appliance's DHCP server or use existing DHCP servers on your network. If your network uses its own DHCP servers, make sure **Enable DHCP Server** is cleared. DHCP server functionality by the NS*v* is not supported on public cloud platforms such as Azure and AWS.

The number of address ranges and IP addresses that the firewall's DHCP server can assign depends on the model, operating system, and licenses of the Security Appliance.

- DHCP Server Options Feature on page 401
- Multiple DHCP Scopes per Interface on page 402
- About DHCP Server Persistence on page 403
- Configuring the DHCP Server on page 404
- DHCP Server Lease Scopes on page 405
- Current DHCP Leases on page 406
- Configuring Advanced Options on page 407
- Configuring DHCP Server for Dynamic Ranges on page 412
- Configuring Static DHCP Entries on page 418
- Configuring DHCP Generic Options for DHCP Lease Scopes on page 420
- RFC-defined DHCP Option Numbers on page 420
- DHCP and IPv6 on page 424

DHCP Server Options Feature

The SonicWall DHCP server options feature provides support for DHCP options, also known as vendor extensions, as defined primarily in RFCs 2131 and 2132. DHCP options allow users to specify additional DHCP parameters in the form of predefined, vendor-specific information that is stored in the options field of a DHCP message. When the DHCP message is sent to clients on the network, it provides vendor-specific configuration and service information. The section RFC-defined DHCP Option Numbers on page 420 lists DHCP options by RFC-assigned option number.

Topics:

- Benefits on page 401
- How the DHCP Server Options Feature Works on page 401
- Supported Standards on page 402

Benefits

The SonicWall DHCP server options feature provides a simple interface for selecting DHCP options by number or name, making the DHCP configuration process quick, easy, and compliant with RFC-defined DHCP standards.

How the DHCP Server Options Feature Works

The DHCP server options feature allows definition of DHCP options using a drop-down menu based on RFC-defined option numbers, allowing administrators to easily create DHCP objects and object groups, and configure DHCP generic options for dynamic and static DHCP lease scopes. After being defined, the DHCP option is included in the options field of the DHCP message, which is then passed to DHCP clients on the network, describing the network configuration and service(s) available.

Supported Standards

The DHCP server options feature supports the following standards:

- RFC 2131 - Dynamic Host Configuration Protocol
- RFC 2132 - DHCP Options and BOOTP Vendor Extensions

Multiple DHCP Scopes per Interface

Topics:

What are Multiple DHCP Scopes per Interface?

Often, DHCP clients and server(s) reside on the same IP network or subnet, but sometimes DHCP clients and their associated DHCP server(s) do not reside on the same subnet. The Multiple DHCP Scopes per Interface feature allows one DHCP server to manage different scopes for clients spanning multiple subnets.

Benefits of Multiple DHCP Scopes

Efficiency	A single DHCP server can provide IP addresses for clients spanning multiple subnets.
Compatible with DHCP over VPN	The processing of relayed DHCP messages is handled uniformly, regardless of whether it comes from a VPN tunnel or a DHCP relay agent.
Multiple Scopes for Site-to-Site VPN	When using an internal DHCP server, a remote subnet could be configured using scope ranges that differ from the LAN/DMZ subnet. The scope range for the remote subnet is decided by the “Relay IP Address” set in the remote gateway.
Multiple Scopes for Group VPN	When using an internal DHCP server, a SonicWall GVC client could be configured using scope ranges that differ from the LAN/DMZ subnet. The scope range for GVC client is decided by the Relay IP Address (Optional) option set in the central gateway.
Compatible with Conflict Detection	Currently, DHCP server performs server-side conflict detection when this feature is enabled. The advantage of server-side conflict detection is that it detects conflicts even when the DHCP client does not run client-side conflict detection. However, if there are a lot of DHCP clients on the network, server-side conflict detection can result in longer waits for a full IP address allocation to complete. Conflict Detection (and Network Pre-Discovery) are not performed for an IP address which belongs to a “relayed” subnet scope. The DHCP server only performs a conflict detection ICMP check for a subnet range attached to its interface.

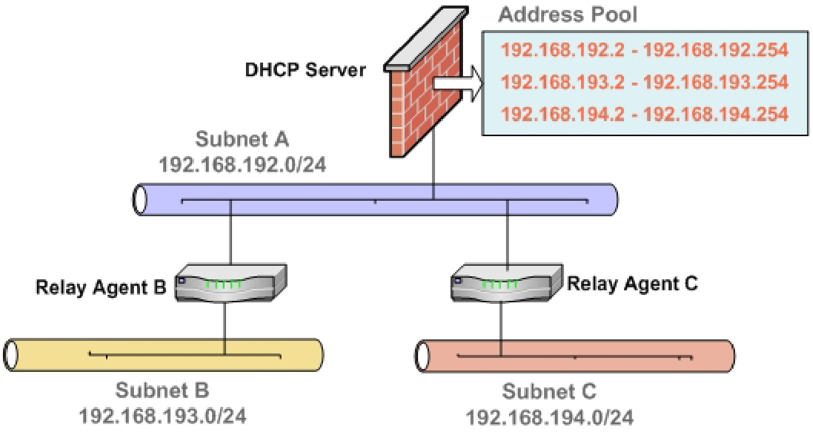
How Do Multiple DHCP Scopes per Interface Work?

Normally, a DHCP client initiates an address allocating procedure by sending a Broadcast DHCP Discovery message. As most routes do not forward broadcast packets, this method requires DHCP clients and server(s) to reside on the same IP network or subnet.

When DHCP clients and their associated DHCP server are not on the same subnet, some type of third-party agent (such as BOOTP relay agent, IP Helper) is required to transfer DHCP messages between clients and server;

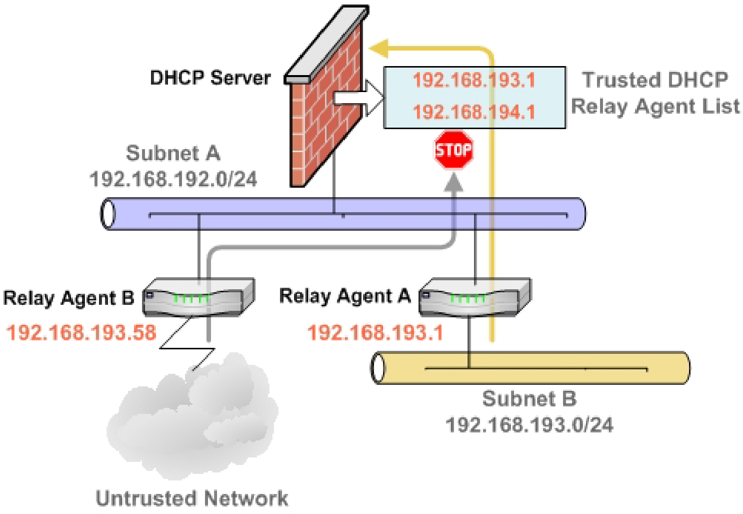
see Multiple Subnets Sharing One DHCP Server. The DHCP relay agent populates the giaddr field with its ingress interface IP address and then forwards it to the configured DHCP server. When the DHCP server receives the message, it examines the giaddr field to determine if it has a DHCP scope that could be used to supply an IP address lease to the client.

Multiple Subnets Sharing One DHCP Server



The Multiple DHCP Scopes per Interface feature provides security enhancements to protect against potential vulnerabilities inherent in allowing wider access to the DHCP server. The **DHCP Advanced Setting** dialog provides security with a tab for Trusted Agents for specifying trusted DHCP relay agents; see Trusted DHCP Relay Agents. The DHCP server discards any messages relayed by agents which are not in the list.

Trusted DHCP Relay Agents



About DHCP Server Persistence

DHCP server persistence is the ability of the Security Appliance save DHCP lease information and to provide the client with a predictable IP address that does not conflict with another user on the network, even after a client reboot.

DHCP server persistence works by storing DHCP lease information periodically to flash memory. This ensures that users have predicable IP addresses and minimizes the risk of IP addressing conflicts after a reboot.

DHCP server persistence provides a seamless experience when a user reboots a workstation. The DHCP lease information is saved, and the user retains the same workstation IP address. When a firewall is restarted, usually because of maintenance or an upgrade, DHCP server persistence provides these benefits:

- IP address uniqueness: Lease information is stored in flash memory, so the risk of assigning the same IP address to multiple users is nullified.
- Ease of use: By saving the lease information in the flash memory, the user's connections are automatically restored.

Configuring the DHCP Server

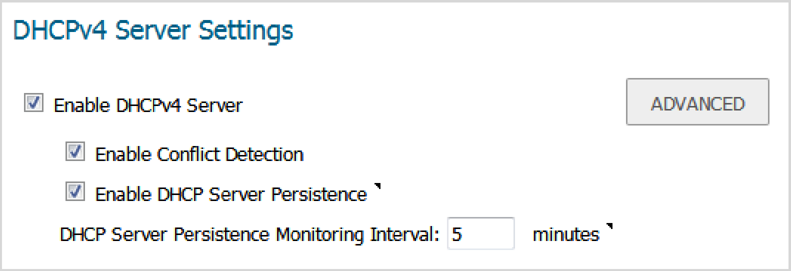
ⓘ **NOTE:** When deployed on public clouds such as AWS and Azure, NS*v* appliances do not support DHCP functionality.

To use the SonicWall Security Appliance's DHCP server:

1 Navigate to **MANAGE | System Setup | Network > DHCP Server**.

2 Choose which IP version to use from **View IP Version**:

- **IPv4**



DHCPv4 Server Settings

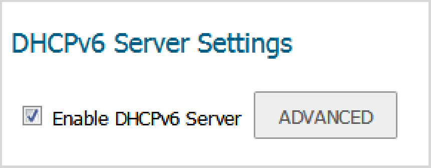
☑ Enable DHCPv4 Server

☑ Enable Conflict Detection

☑ Enable DHCP Server Persistence

DHCP Server Persistence Monitoring Interval: 5 minutes

- **IPv6**



DHCPv6 Server Settings

☑ Enable DHCPv6 Server

3 To distribute IP addresses, subnet masks, gateway addresses, and DNS server addresses to your network clients, select **Enable DHCPv4/6 Server**. This option is selected by default. **ADVANCED** and, for IPv4, the server settings options become available.

4 For configuring DHCPv6, go to Step 7.

5 To turn on automatic DHCP scope conflict detection on each zone when another DHCP server is present, select **Enable Conflict Detection**. This option is selected by default.

Currently, DHCP server performs server-side conflict detection when this feature is enabled. The advantage of server-side conflict detection is that it detects conflicts even when the DHCP client does not run client-side conflict detection. However, if there are a lot of DHCP clients on the network, server-side conflict detection can result in longer waits for a full IP address allocation to complete.

ⓘ **NOTE:** Conflict detection is not performed for an IP address that belongs to a "relayed" subnet scope. The DHCP server only performs a conflict detection ICMP check for a subnet range attached to its interface.

6 To allow the current state of the DHCP leases in the network to be periodically written to Flash, select **Enable DHCP Server Persistence**. At reboot, the system restores the previous DHCP server network DHCP allocation knowledge based on the IP. Lease times stored in Flash. This option is selected by default. When this option is selected, the **DHCP Server Persistence Monitoring Interval** option is available.

- To control how often changes in the network are examined and, if necessary, written to Flash, enter the time, in minutes, in **DHCP Server Persistence Monitoring Interval**. The default is **5** minutes, the minimum is five minutes, and the maximum is 1440 minutes (24 hours).

7 To configure **Option Objects**, **Option Groups**, and **Trusted Agents**, click **ADVANCED**. For detailed information on configuring these features, see Configuring Advanced Options on page 407.

8 Click **ACCEPT**.

Topics:

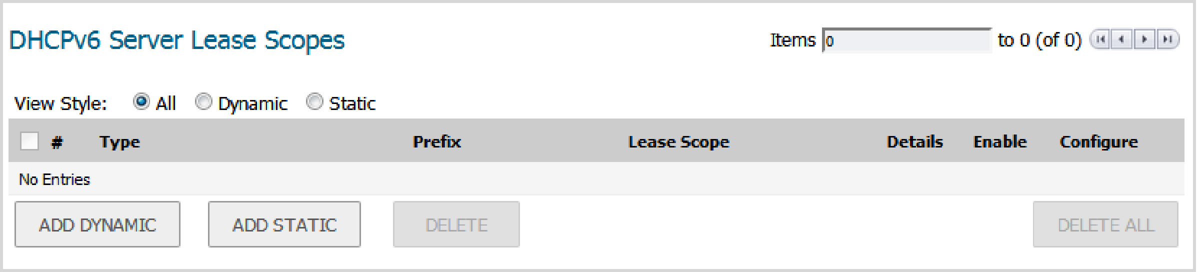
- Configuring the DHCP Server for DNS Proxy on page 405
- Current DHCPv4 Leases on page 407

Configuring the DHCP Server for DNS Proxy

When DNS proxy is enabled on an interface, the device needs to push the interface IP as DNS server address to clients, so the you need to configure the DHCP server manually; use the interface address as the **DNS Server 1** address in the DHCP server settings on the **DNS/WINS** tab. The I**nterface Pre-populate** checkbox in the DHCP page makes this easy to configure; if the selected interface has enabled DNS proxy, the DNS server IP is auto-added into the **DNS/WINS** page.

DHCP Server Lease Scopes

DHCPv6 Server Lease Scopes



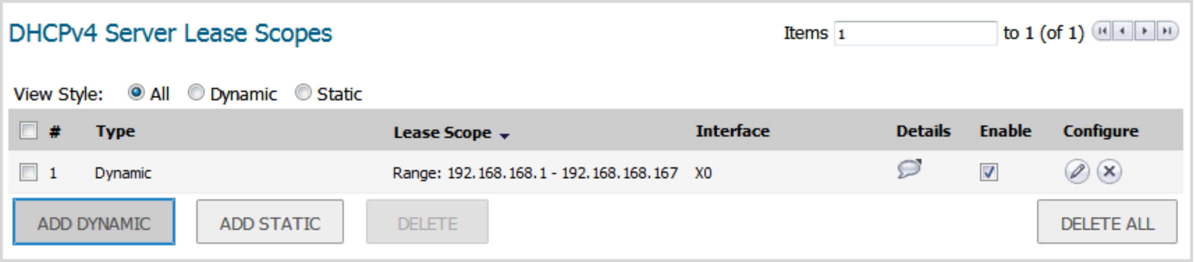
DHCPv6 Server Lease Scopes

Items 0 to 0 (of 0)

View Style: ● All ○ Dynamic ○ Static

□	#	Type	Prefix	Lease Scope	Details	Enable	Configure
No Entries							

DHCPv4 Server Lease Scopes



DHCPv4 Server Lease Scopes

Items 1 to 1 (of 1)

View Style: ● All ○ Dynamic ○ Static

□	#	Type	Lease Scope	Interface	Details	Enable	Configure
□	1	Dynamic	Range: 192.168.168.1 - 192.168.168.167	X0	💬	☑	✎ ⊗

The **DHCP Server Lease Scopes** table displays the currently configured DHCP IP ranges:

Type **Dynamic** or **Static**.

Prefix IPv6 only.

Lease Scope The IP address range, for example, `172.16.31.2-172.16.31.254`.

Interface IPv4 only. The Interface the range is assigned to.

Details Detailed information about the lease, displayed as a tool tip when you hover the mouse pointer over the **Comment** icon.

Enable Select the checkbox to enable the DHCP range. Clear it to disable the range.

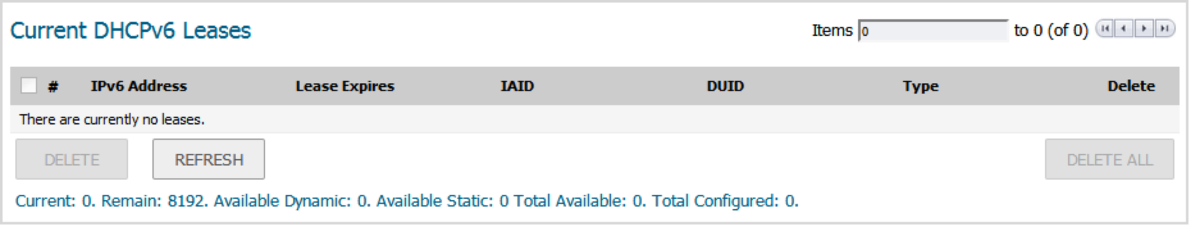
Configure Contains the **Configure** and **Delete** icons for the table entry.

Current DHCP Leases

Topics:

- Current DHCPv6 Leases on page 406
- Current DHCPv4 Leases on page 407

Current DHCPv6 Leases



Current DHCPv6 Leases

Items 0 to 0 (of 0)

□	#	IPv6 Address	Lease Expires	IAID	DUID	Type	Delete
There are currently no leases.							

Current: 0. Remain: 8192. Available Dynamic: 0. Available Static: 0 Total Available: 0. Total Configured: 0.

The current DHCP lease information is displayed in the **Current DHCP Leases** table. Each binding entry displays the:

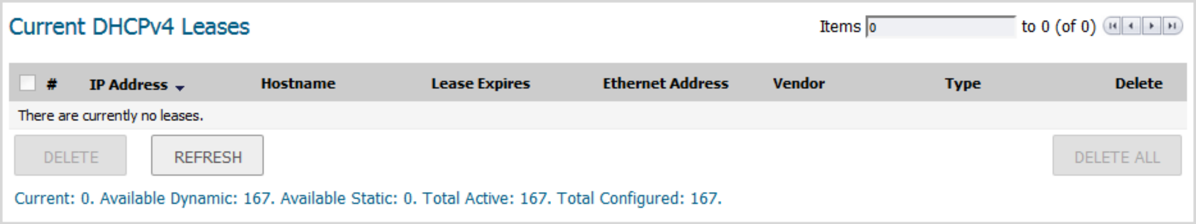
- **IPv6 Address**
- **Lease Expires**
- **IAID**
- **DUID**
- **Type** of binding (**Dynamic**, **Dynamic BOOTP**, or **Static BOOTP**)
- **Delete** icon

To delete a binding, which frees the IP address on the DHCP server:

1 Click the **Delete** icon next for the entry. For example, use the **Delete** icon to remove a host when it has been removed from the network and you need to reuse its IP address.

2 Click **Accept**.

Current DHCPv4 Leases



Current DHCPv4 Leases

Items 0 to 0 (of 0)

□	#	IP Address	Hostname	Lease Expires	Ethernet Address	Vendor	Type	Delete
There are currently no leases.								

Current: 0. Available Dynamic: 167. Available Static: 0. Total Active: 167. Total Configured: 167.

The current DHCP lease information is displayed in the **Current DHCP Leases** table. Each binding entry displays the:

- **IP Address**
- **Hostname**
- **Lease Expires**
- **Ethernet Address**
- **Vendor**
- **Type** of binding (**Dynamic**, **Dynamic BOOTP**, or **Static BOOTP**)
- **Delete** icon

To delete a binding, which frees the IP address on the DHCP server:

1. Click the **Delete** icon next for the entry. For example, use the **Delete** icon to remove a host when it has been removed from the network and you need to reuse its IP address.
2. Click **Accept**.

DHCPv6 Relay

SonicOS NS*v* supports DHCPv6 Relay. For information about DHCPv6 relay in SonicOS NS*v*, see DHCPv6 Relay on page 431.

Configuring Advanced Options

ⓘ **NOTE:** Configuring DHCP server options is essentially the same for both IPv4 and IPv6. Exceptions are noted in the procedures.

ⓘ **IMPORTANT:** DHCP server functionality by the NS*v* is not supported in public cloud environments such as AWS or Azure.

Topics:

- Configuring DHCP Option Objects on page 408
- Configuring DHCP Option Groups on page 409
- Configuring a Trusted DHCP Relay Agent Address Group (IPv4 Only) on page 411
- Enabling Trusted DHCP Relay Agents on page 411

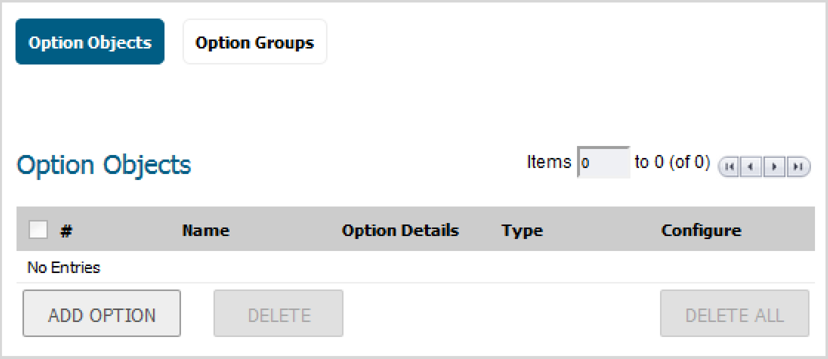
The RFC-defined DHCP Option Numbers on page 420 provides a list of DHCP options by RFC-assigned option number.

Configuring DHCP Option Objects

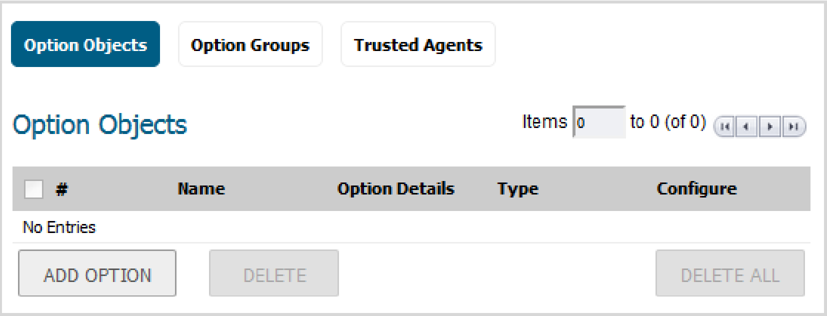
To configure DHCP option objects:

1. Navigate to **MANAGE | System Setup | Network > DHCP Server**.
2. Under **DHCPv4/6 Server Settings**, click **Advanced**. The **DHCP Advanced Settings** dialog displays. The dialogs for IPv4 and IPv6 are slightly different; see IPv6 DHCP Advanced Settings and IPv4 DHCP Advanced Settings.

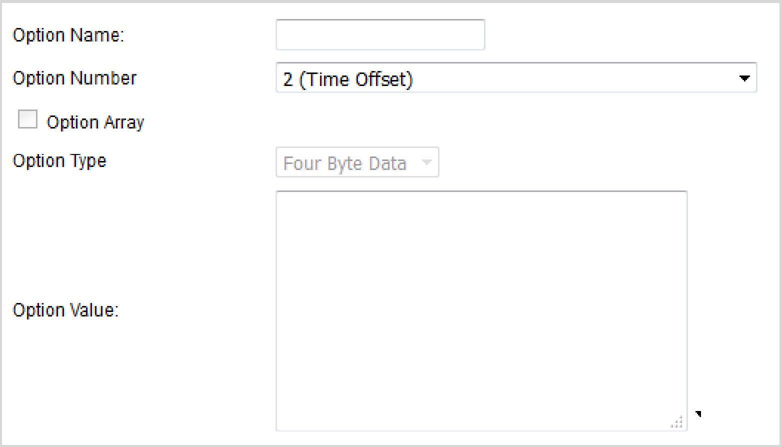
IPv6 DHCP Advanced Settings



IPv4 DHCP Advanced Settings



3. Click **Add Option**. The **Add DHCP Option Objects** dialog displays.



Option Name:

Option Number 2 (Time Offset)

□ Option Array

Option Type Four Byte Data

Option Value:

4. Type a name for the option in the **Option Name** field.

5 From **Option Number**, select the option number that corresponds to your DHCP option. For a list of option numbers, names, and descriptions, refer to RFC-defined DHCP Option Numbers on page 420.

ⓘ **NOTE:** Available options differ depending on whether you are configuring an IPv4 or IPv6 option.

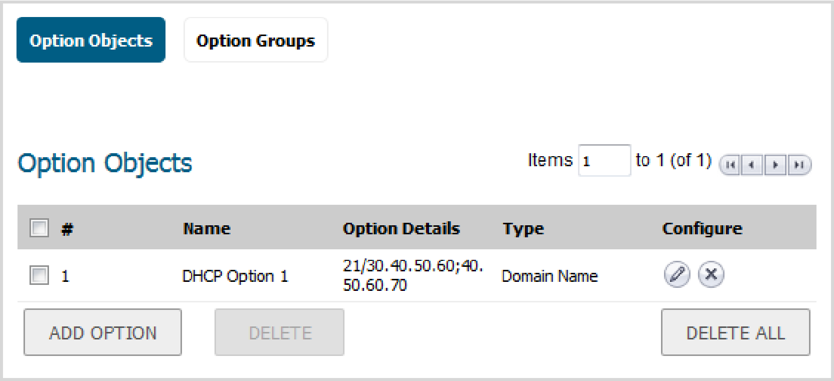
6 If:

- Only one option type is available, for example, for **Option Number 2 (Time Offset)**, **Option Array** is dimmed. Go to Step 7.
- There are multiple option types available, for example, for **77 (User Class Information)**, **Option Type** becomes available and lists allowable types of the option, such as **IP Address**, **Two-Byte Data**, **String**, or **Boolean**. Select the option type.

7 Type the option value, for example, an IP address, in the **Option Value** field. If **Option Array** is checked, multiple values might be entered, separated by a semi-colon (;).

8 Click **OK**. The object displays in the **Option Objects** table (see DHCPv6 Option Objects Table and DHCPv4 Option Objects Table).

DHCPv6 Option Objects Table

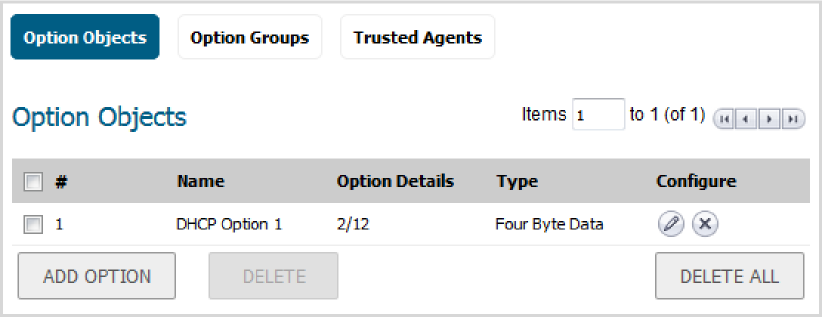


Option Objects

Items 1 to 1 (of 1)

□ #	Name	Option Details	Type	Configure
□ 1	DHCP Option 1	21/30.40.50.60;40.50.60.70	Domain Name	

DHCPv4 Option Objects Table



Option Objects

Items 1 to 1 (of 1)

□ #	Name	Option Details	Type	Configure
□ 1	DHCP Option 1	2/12	Four Byte Data	

Configuring DHCP Option Groups

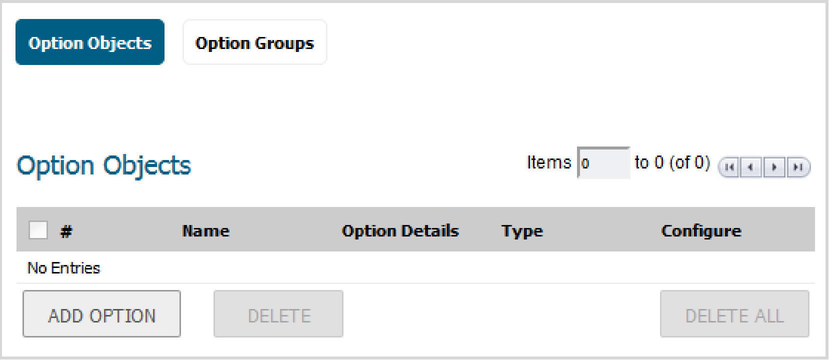
To configure DHCP option groups:

1 Navigate to **MANAGE | System Setup | Network > DHCP Server**.

2 Under **DHCPv4/6 Server Settings**, click **Advanced**. The **DHCP Advanced Settings** dialog displays.

ⓘ **NOTE:** Available options differ depending on whether you are configuring an IPv4 or IPv6 option (see IPv6 DHCP Advanced Settings or IPv4 DHCP Advanced Settings).

IPv6 DHCP Advanced Settings

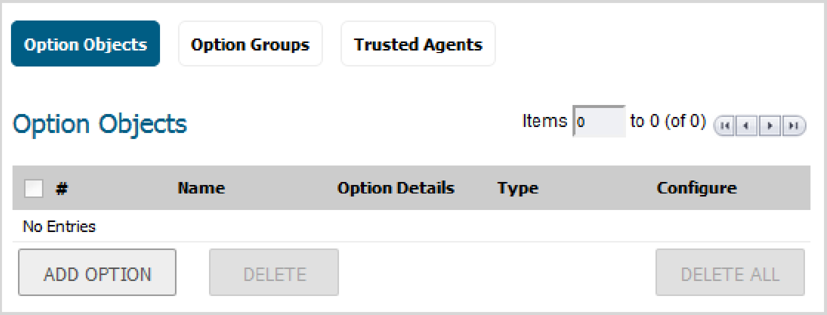


Option Objects

Items 0 to 0 (of 0)

□ #	Name	Option Details	Type	Configure
No Entries				

IPv4 DHCP Advanced Settings

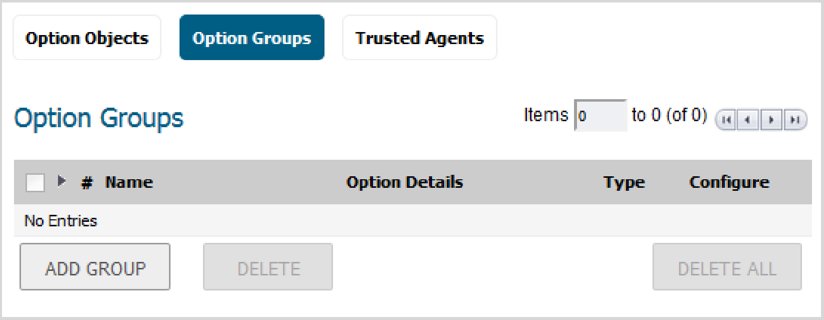


Option Objects

Items 0 to 0 (of 0)

□ #	Name	Option Details	Type	Configure
No Entries				

3 Click **Option Groups**.

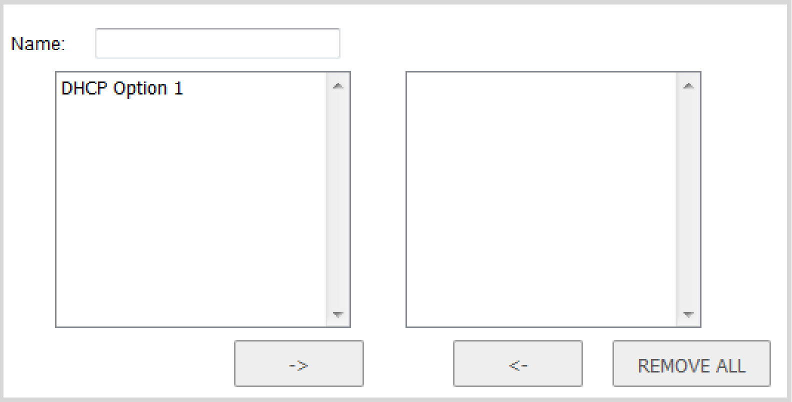


Option Groups

Items 0 to 0 (of 0)

□ ▸ # Name	Option Details	Type	Configure
No Entries			

4 Click **Add Group**. The **Add DHCP/v6 Option Group** dialog displays.


Name:

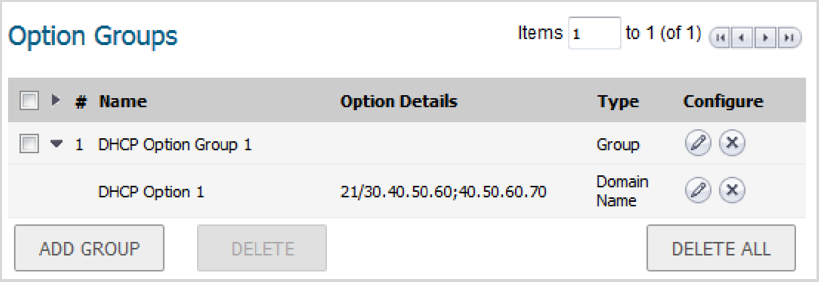
DHCP Option 1

5 Enter a name for the group in the **Name** field.

6 Select an option object from the left column and click **Right Arrow** to add the option object to the group. To select multiple option objects at the same time, hold the **Ctrl** key while selecting the option objects.

7 Click **OK**. The group displays in the **Option Groups** table.

DHCPv6 Option Groups Table

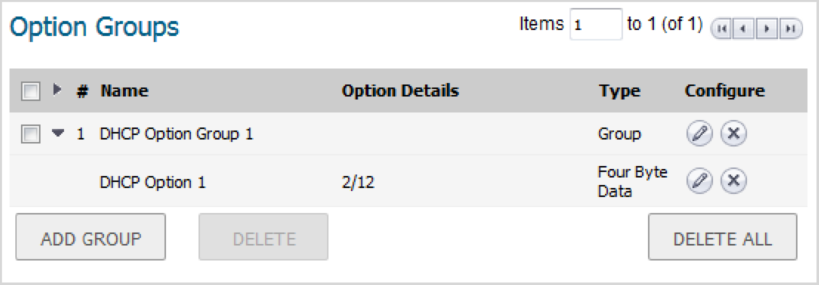


Option Groups

Items 1 to 1 (of 1)

□	#	Name	Option Details	Type	Configure
□	1	DHCP Option Group 1		Group	
		DHCP Option 1	21/30.40.50.60;40.50.60.70	Domain Name	

DHCPv4 Option Groups Table



Option Groups

Items 1 to 1 (of 1)

□	#	Name	Option Details	Type	Configure
□	1	DHCP Option Group 1		Group	
		DHCP Option 1	2/12	Four Byte Data	

Configuring a Trusted DHCP Relay Agent Address Group (IPv4 Only)

To configure the **Default Trusted Relay Agent List** Address Group, you must first configure an Address Object for each trusted relay agent, then add these Address Objects to the **Default Trusted Relay Agent List** Address Group or to a custom Address Group.

Address Objects and Address Groups are configured on **MANAGE | Policies | Objects > Address Objects**. For information on how to configure Address Objects and Address Groups, see SonicOS NS*v* *6.5 Policies*.

Enabling Trusted DHCP Relay Agents

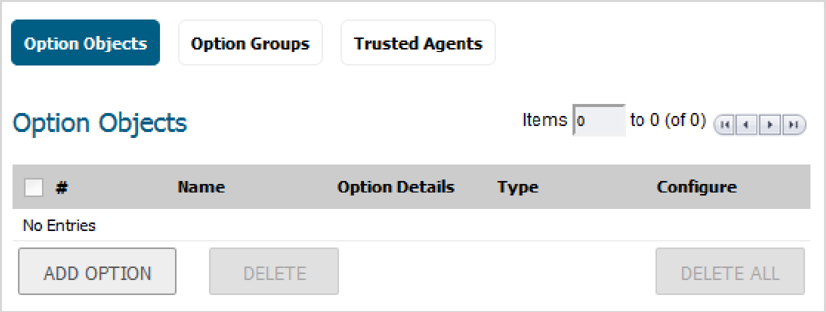
In the **DHCP Advanced Settings** dialog, you can enable the **Trusted Relay Agent List** option using the **Default Trusted Relay Agent List** Address Group or create another Address Group using existing Address Objects.

ⓘ **NOTE:** When a server is assigned as the internal DHCP server for DHCP over VPN Central Gateway, DHCP messages that come from the VPN tunnel are always bypassed.

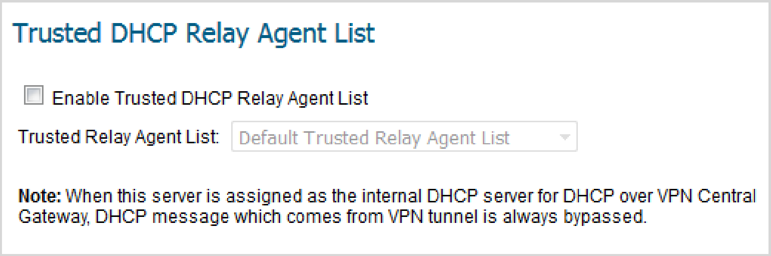
To enable the Trusted Relay Agent List option and select the desired Address Group:

1 Navigate to **MANAGE | System Setup | Network > DHCP Server**.

2 Under **DHCPv4 Settings**, click **ADVANCED**. The **DHCP Advanced Settings** dialog displays.



3 Click **Trusted Agents**.

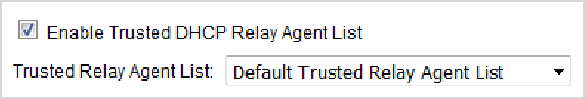

Trusted DHCP Relay Agent List

□ Enable Trusted DHCP Relay Agent List

Trusted Relay Agent List: Default Trusted Relay Agent List

Note: When this server is assigned as the internal DHCP server for DHCP over VPN Central Gateway, DHCP message which comes from VPN tunnel is always bypassed.

4 Select **Enable Trusted DHCP Relay Agent List**. This option is not selected by default. **Trusted Relay Agent List** becomes available.


☑ Enable Trusted DHCP Relay Agent List

Trusted Relay Agent List: Default Trusted Relay Agent List

5 Select the Address Group from **Default Trusted Relay Agent List**. This option includes all existing address groups as well as the **Create new Address Object Group** option.

> **NOTE:** To create a custom Address Group for this option, select **Create new Address Object Group**. The **Add Address Object Group** dialog displays. For information on how to configure Address Groups, see *SonicOS NSv 6.5 Policies*.

6 Click **OK** to enable the **Trusted Relay Agent List** option with the selected Address Group.

Configuring DHCP Server for Dynamic Ranges

Because SonicOS NSv allows multiple DHCP scopes per interface, there is no requirement that the subnet range is attached to the interface when configuring DHCP scopes.

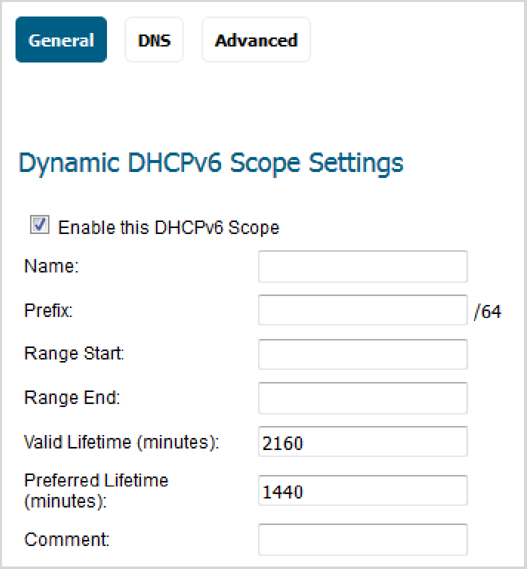
To configure DHCP server for dynamic IP address ranges:

1 Navigate to **MANAGE | System Setup | Network > DHCP Server**.

2 Under **DHCPv4/6 Server Lease Scopes** table, click **ADD DYNAMIC**. For:

- IPv6, the **Add DHCPv6 Dynamic Scope** dialog displays. Go to Add DHCPv6 Dynamic Scope on page 413.
- IPv4, the **Dynamic Ranges Configuration** dialog displays. Go to Dynamic Range Configuration on page 414.

Add DHCPv6 Dynamic Scope



Dynamic DHCPv6 Scope Settings

☑ Enable this DHCPv6 Scope

Name:

Prefix: /64

Range Start:

Range End:

Valid Lifetime (minutes): 2160

Preferred Lifetime (minutes): 1440

Comment:

To add a dynamic scope:

1 To enable this scope, ensure **Enable this DHCP Scope** is selected. This option is selected by default.

2 Enter a name for the scope in the **Name** field.

3 Enter the prefix the scope uses to distribute IPv6 addresses in the **Prefix** field.

4 Enter the range start and range end in the **Range Start** and **Range End** fields, respectively. Both addresses must fall within the scope of the prefix.

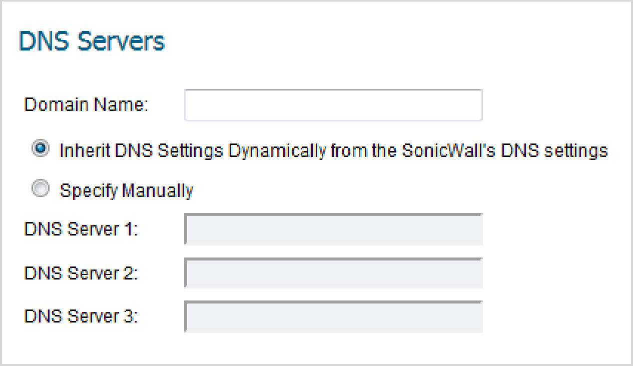
5 Enter the valid lifetime of an IPv6 address leased by the scope, in minutes, in the **Valid Lifetime** field. The minimum is 0, the maximum is 71582789, and the default is **2160**.

6 Enter the preferred lifetime of an IPv6 address leased by the scope, in minutes, in the **Preferred Lifetime** field. The minimum is 0, the maximum is 71582789, and the default is **1440**.

7 Optionally, enter a comment in the **Comment** field.

8 Click **DNS**.

DNS



DNS Servers

Domain Name:

● Inherit DNS Settings Dynamically from the SonicWall's DNS settings

○ Specify Manually

DNS Server 1:

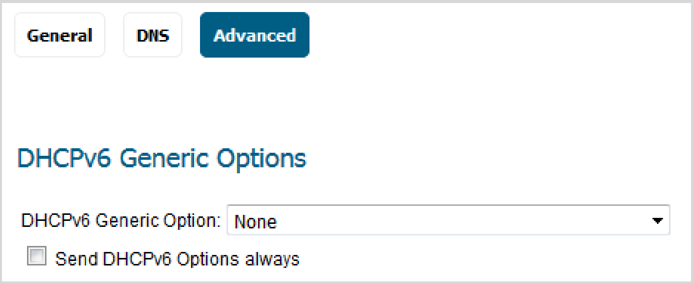
DNS Server 2:

DNS Server 3:

To add a DNS server:

1. Enter a domain name in the **Domain Name** field.
2. Choose whether to:
   - **Inherit DNS Settings Dynamically from the SonicWall's DNS settings**; go to Step 4.
   - **Specify Manually**. The **DNS Server 1/2/3** fields become available.
3. Enter the IP address(es) of the DNS server(s) in the respective **DNS Server 1/2/3** field(s).
4. Click **Advanced**.

Advanced



DHCPv6 Generic Options

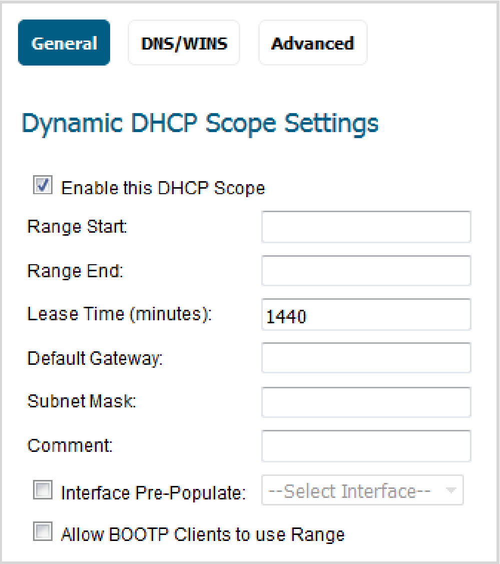
DHCPv6 Generic Option: None

□ Send DHCPv6 Options always

To configure generic DHCP options:

1. Select a DHCP Option Object or Group from **DHCPv6 Generic Option**. The default is **None**. To configure a new DHCPv6 Option or Group, see Configuring DHCP Option Objects on page 408 and/or Configuring DHCP Option Groups on page 409.
2. To send all configured DHCPv6 options for this scope regardless of the Option Request Option contained in the message from the DHCPv6 client, select **Send DHCPv6 Options always**. This option is not selected by default.
3. Click **OK**.

Dynamic Range Configuration



Dynamic DHCP Scope Settings

☑ Enable this DHCP Scope

Range Start:

Range End:

Lease Time (minutes): 1440

Default Gateway:

Subnet Mask:

Comment:

□ Interface Pre-Populate: --Select Interface--

□ Allow BOOTP Clients to use Range

To configure a dynamic range:

1 To enable this scope, ensure **Enable this DHCP Scope** is selected. This option is selected by default.

2 To populate the **Range Start**, **Range End**, **Default Gateway**, and **Subnet Mask** fields:

a With default values for a certain interface:

1) Select **Interface Pre-Populate** near the bottom of the dialog. The selections become available. This option is not selected by default.

2) Select the interface. The populated IP addresses are in the same private subnet as the selected interface.

> ⓘ **IMPORTANT:** To select an interface from **Interface Pre-Populate**, the interface must first be fully configured and it must be either:
>
> - Of the zone type LAN or DMZ.
> - A VLAN sub-interface.

3) Go to Step 3.

b Manually:

1) Type in your own IP address range.

2) Enter the number of minutes an IP address is leased by the scope before it is issued another IP address in the **Lease Time (minutes)** field. The minimum is 0, the maximum is 71582789, and **1440** minutes (24 hours) is the default.

3) Enter the IP address of the gateway into the **Default Gateway** field.

4) Enter the gateway subnet mask into the **Subnet Mask** field.

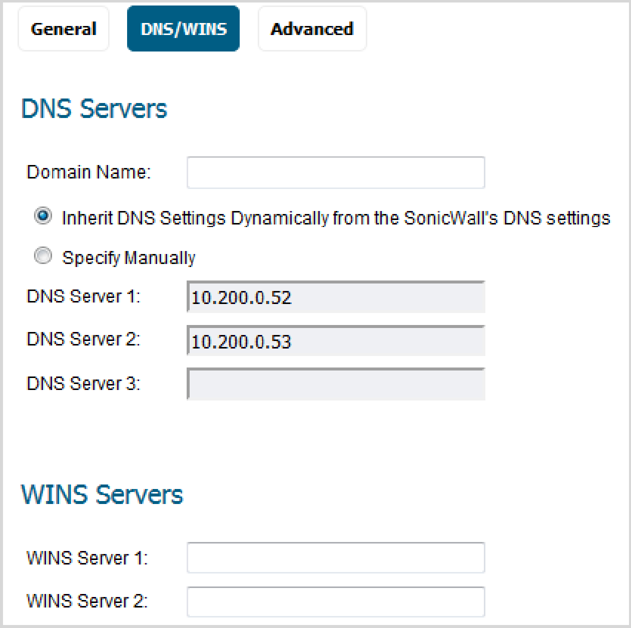
3 Optionally, enter a comment in the **Comment** field.

4 Select **Allow BOOTP Clients to use Range** if you have BOOTP Clients on your network. This option is not selected by default.

BOOTP stands for bootstrap protocol, which is a TCP/IP protocol and service that allows diskless workstations to obtain their IP address, other TCP/IP configuration information, and their boot image file from a BOOTP server.

5 Click **DNS/WINS** to continue configuring the DHCP Server feature.

DNS/WINS



DNS Servers

Domain Name:

● Inherit DNS Settings Dynamically from the SonicWall's DNS settings

○ Specify Manually

DNS Server 1: 10.200.0.52

DNS Server 2: 10.200.0.53

DNS Server 3:

WINS Servers

WINS Server 1:

WINS Server 2:

To configure DNS/WINS servers:

1 If you have a domain name for the DNS server, enter it in the **Domain Name** field.

2 Choose whether to:

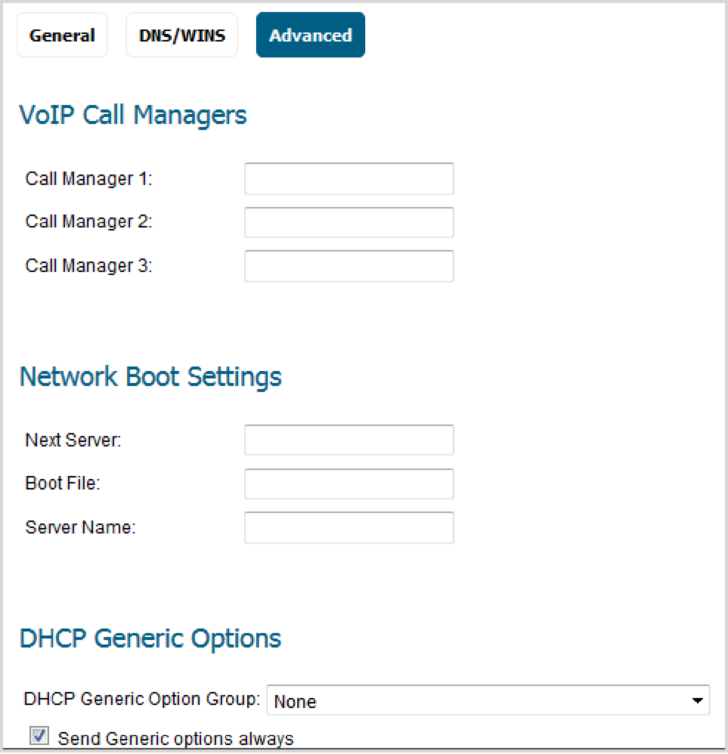
- **Inherit DNS Settings Dynamically from the SonicWall's DNS settings**; go to Step 4.
- **Specify Manually**. The **DNS Server 1/2/3** fields become available.

3 Enter the IP address(es) of the DNS server(s) in the respective **DNS Server 1/2/3** field(s).

4 If you have WINS running on your network, type the WINS server IP address in the **WINS Server 1** field. You can add an additional WINS server.

5 Click **Advanced**. The **Advanced** options allow you to configure DHCP server to send Cisco Call Manager information to VoIP clients on the network.

Advanced



VoIP Call Managers

Call Manager 1:

Call Manager 2:

Call Manager 3:

Network Boot Settings

Next Server:

Boot File:

Server Name:

DHCP Generic Options

DHCP Generic Option Group: None

☑ Send Generic options always

To configure advanced settings:

1 Under **VoIP Call Managers**, enter the IP address or FQDN of your VoIP Call Manager in the **Call Manager 1** field. You can add two additional VoIP Call Manager addresses.

2 Under **Network Boot Settings**, in the **Next Server** field, enter the IP address of the PXE boot server (TFTP server) that a PXE client uses during the next stage of the boot process.

> ⓘ **IMPORTANT:** The fields under **Network Boot Settings** are used in a Pre-boot Execution Environment (PXE), in which the client boots up using files obtained over a network interface. The PXE client obtains the IP address and name of the PXE boot server, and the boot file name, from the DHCP server.
>
> When using these options, select **PXE** under **DHCP Generic Options**.

3 In the **Boot File** field, enter the name of the boot file that the PXE client can get over TFTP from the PXE boot server.

4 In the **Server Name** field, enter the DNS host name of the PXE boot server (TFTP server).

5 For information on configuring DHCP Generic Options see Configuring DHCP Generic Options for DHCP Lease Scopes on page 420.

6 Click **OK**.

7 Click **Accept** for the settings to take effect on the firewall.

For more information on VoIP support features on the SonicWall Security Appliance, see About VoIP on page 506.

Configuring Static DHCP Entries

Static entries are IP addresses assigned to servers requiring permanent IP settings. Because SonicOS NS*v* allows multiple DHCP scopes per interface, there is no requirement that the subnet range is attached to the interface when configuring DHCP scopes.

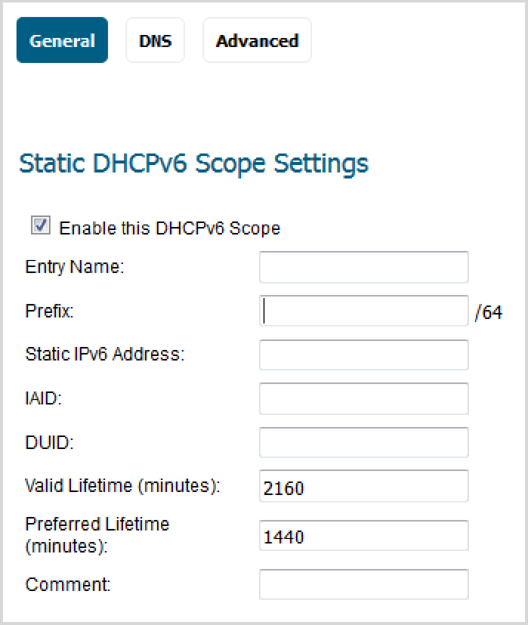
To configure static entries:

1 Navigate to **MANAGE | System Setup | Network > DHCP Server**.

2 Under **DHCPv4/6 Server Lease Scopes** table, click **ADD STATIC**. For:

- IPv6, the **Add DHCPv6 Static Scope** dialog displays. Go to Add DHCPv6 Static Scope on page 418.
- IPv4, the **Static Entry Configuration** dialog displays. Go to Static Entry Configuration on page 419.

Add DHCPv6 Static Scope



Static DHCPv6 Scope Settings

☑ Enable this DHCPv6 Scope

Entry Name:	
Prefix:	/64
Static IPv6 Address:	
IAID:	
DUID:	
Valid Lifetime (minutes):	2160
Preferred Lifetime (minutes):	1440
Comment:	

1 To enable this scope, ensure **Enable this DHCP Scope** is selected. This option is selected by default.

2 Enter a name for the static DHCPv6 entry in the **Entry Name** field.

3 Enter the prefix the scope uses to distribute IPv6 addresses in the **Prefix** field.

4 Enter the IPv6 address in the **Static IPv6 Address** field. The address must fall within the scope of the prefix.

5 Enter an IAID (Interface Association Identifier), in decimal format, in the **IAID** field. The maximum length is 10 numbers, and the maximum length is 4294967295.

6 Enter a DUID (Device Unique Identifier) in the **DUID** field. The maximum length is 128 characters.

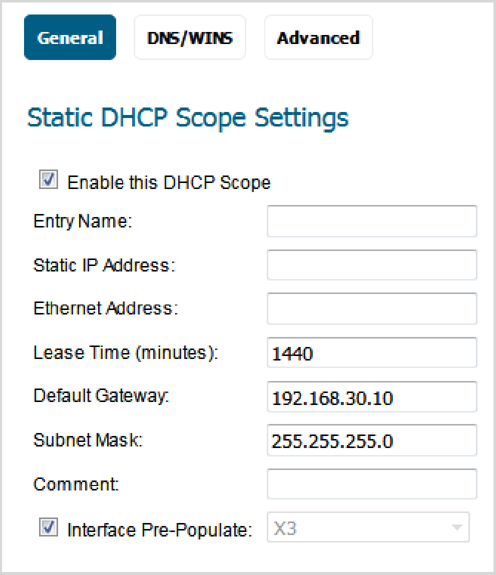
7 Enter the valid lifetime of an IPv6 address leased by the scope, in minutes, in the **Valid Lifetime** field. The minimum is 0, the maximum is 71582789, and the default is **2160**.

8 Enter the preferred lifetime of an IPv6 address leased by the scope, in minutes, in the **Preferred Lifetime** field. The minimum is 0, the maximum is 71582789, and the default is **1440**.

9 Optionally, enter a comment in the **Comment** field.

10 For how to configure DNS and Advanced settings, see DNS on page 413 and Advanced on page 414, respectively.

Static Entry Configuration



Static DHCP Scope Settings

☑ Enable this DHCP Scope

Entry Name:	
Static IP Address:	
Ethernet Address:	
Lease Time (minutes):	1440
Default Gateway:	192.168.30.10
Subnet Mask:	255.255.255.0
Comment:	
☑ Interface Pre-Populate:	X3

1 To enable this scope, ensure **Enable this DHCP Scope** is selected. This option is selected by default.

2 Enter a name for the static entry in the **Entry Name** field.

3 Enter the device IP address in the **Static IP Address** field.

4 Enter the device Ethernet (MAC) address in the **Ethernet Address** field.

5 To populate the **Lease Time**, **Default Gateway**, and **Subnet Mask** fields with default values for a certain interface, select **Interface Pre-Populate** near the bottom of the dialog. The drop-down menu becomes available. This option is not selected by default.

   a Select the interface from the drop-down menu. The populated IP addresses are in the same private subnet as the selected interface.

   ⓘ **IMPORTANT:** To select an interface from the Interface menu, it must first be fully configured and it must be of the zone type LAN or DMZ, or be a VLAN sub-interface.

6 Enter the number of minutes an IP address is leased by the scope before it is issued another IP address in the **Lease Time (minutes)** field. The minimum is 0, the maximum is 71582789, and **1440** minutes (24 hours) is the default.

7 Use the populated gateway address or enter the IP address of the gateway into the **Default Gateway** field.

8 Use the populated subnet mask or enter the gateway subnet mask into the **Subnet Mask** field.

9 Optionally, enter a comment in the **Comment** field.

10 For how to configure DNS/WINS and Advanced settings, see DNS/WINS on page 416 and Advanced on page 417, respectively.

11 Click **OK** to add the settings to the firewall.

12 Click **Accept** for the settings to take effect on the firewall.

For more information on VoIP support features on the SonicWall Security Appliance, see About VoIP on page 506.

Configuring DHCP Generic Options for DHCP Lease Scopes

This section provides configuration tasks for DHCP generic options for lease scopes.

ⓘ **NOTE:** Before generic options for a DHCP lease scope can be configured, a static or dynamic DHCP server lease scope must be created.

The RFC-defined DHCP Option Numbers on page 420 provides a list of DHCP options by RFC-assigned option number.

To configure DHCP generic options for DHCP server lease scopes:

1 If:

- Modifying an existing DHCP lease scope:
  1) Locate the lease scope under DHCP Server Lease Scopes on **MANAGE | System Setup | Network > DHCP Server**.
  2) Click the **Configure** icon.
  3) Click **Advanced** on the displayed dialog.
- Creating a new DHCP lease scope:
  1) Click the **Advanced** tab after configuring the options under the **General** and **DNS/WINS** tabs (see Configuring DHCP Server for Dynamic Ranges on page 412 or Configuring Static DHCP Entries on page 418).

2 Select a DHCP option or option group in the **DHCP Generic Option Group** drop-down menu.

When the **Network Boot Settings** fields are configured for use with PXE, select **PXE** here.

3 To always use DHCP options for this DHCP server lease scope, check **Send Generic options always**.

4 Click **OK**.

RFC-defined DHCP Option Numbers

Option Number	IPv6 √	Name	Description
2		Time Offset	Time offset in seconds from UTC
3		Router	N/4 router addresses
4		Time Servers	N/4 time server addresses
5		Name Servers	N/4 IEN-116 server addresses
6		DNS Servers	N/4 DNS server addresses
7		Log Servers	N/4 logging server addresses
8		Cookie Servers	N/4 quote server addresses
9		LPR Servers	N/4 printer server addresses
10		Impress Servers	N/4 impress server addresses
11		RLP Servers	N/4 RLP server addresses
12	√	Host Name	Hostname string, such as **(Server Unicast)**
13		Boot File Size	Size of boot file in 512-byte chunks

Option Number	IPv6 √	Name	Description
14		Merit Dump File	Client to dump and name of file to dump to
15		Domain Name	DNS domain name of the client
16		Swap Server	Swap server addresses
17		Root Path	Path name for root disk
18		Extension File	Patch name for more BOOTP info
19		IP Layer Forwarding	Enable or disable IP forwarding
20		Src route enabler	Enable or disable source routing
21	√	Policy Filter (IPv4) SIP Servers Domain Name List (IPv6)	Routing policy filters (IPv4) Enables listing of SIP Servers domain names (IPv6)
22	√	Maximum DG Reassembly Size (IPv4) SIP Servers IPv6 Address List (IPv6)	Maximum datagram reassembly size (IPv4) Enables listing of SIP Servers IPv6 Addresses (IPv6)
23	√	Default IP TTL (IPv4) DNS Recursive Name Server (IPv6)	Default IP time-to-live (IPv4) Enables listing of DNS Recursive Name servers (IPv6)
24	√	Path MTU Aging Timeout (IPv4) Domain Search List (IPv6)	Path MTU aging timeout (IPv4) Enables listing of domain names for searching (IPv6)
25		MTU Plateau	Path MTU plateau table
26		Interface MTU Size	Interface MTU size
27	√	All Subnets Are Local (IPv4) Network Information Service (NIS) Servers (IPv6)	All subnets are local (IPv4) Enables listing of Network Information Service (NIS) servers (IPv6)
28	√	Broadcast Address (IPv4) Network Information Service V2 (NIS+) Servers (IPv6)	Broadcast address (IPv4) Enables listing of Network Information Service V2 (NIS+) servers (IPv6)
29	√	Perform Mask Discovery (IPv4) Network Information Service (NIS) Domain Name (IPv6)	Perform mask discovery (IPv4) Enables listing of Network Information Service (NIS) domain names (IPv6)
30	√	Provide Mask to Others (IPv4) Network Information Service V2 (NIS+) Domain Name (IPv6)	Provide mask to others (IPv4) Enables listing of Network Information Service V2 (NIS+) domain names (IPv6)
31	√	Perform Router Discovery (IPv4) Simple Network Time Protocol (SNTP) Servers (IPv6)	Perform router discovery (IPv4) Enables listing of Simple Network Time Protocol (SNTP) servers (IPv6)
32	√	Router Solicitation Address (IPv4) Information Refresh Time (IPv6)	Router solicitation address (IPv4) Information refresh time (IPv6)
33		Static Routing Table	Static routing table
34		Trailer Encapsulation	Trailer encapsulation
35		ARP Cache Timeout	ARP cache timeout
36		Ethernet Encapsulation	Ethernet encapsulation
37		Default TCP Time to Live	Default TCP time to live

Option Number	IPv6 √	Name	Description
38		TCP Keepalive Interval	TCP keepalive interval
39		TCP Keepalive Garbage	TCP keepalive garbage
40		NIS Domain Name	NIS domain name
41		NIS Server Addresses	NIS server addresses
42		NTP Servers Addresses	NTP servers addresses
43		Vendor Specific Information	Vendor specific information
44		NetBIOS Name Server	NetBIOS name server
45		NetBIOS Datagram Distribution	NetBIOS datagram distribution
46		NetBIOS Node Type	NetBIOS node type
47		NetBIOS Scope	NetBIOS scope
48		X Window Font Server	X window font server
49		X Window Display Manager	X window display manager
50		Requested IP address	Requested IP address
51		IP Address Lease Time	IP address lease time
52		Option Overload	Overload “sname” or “file”
53		DHCP Message Type	DHCP message type
54		DHCP Server Identification	DHCP server identification
55		Parameter Request List	Parameter request list
56		Message	DHCP error message
57		DHCP Maximum Message Size	DHCP maximum message size
58		Renew Time Value	DHCP renewal (T1) time
59		Rebinding Time Value	DHCP rebinding (T2) time
60		Client Identifier	Client identifier
61		Client Identifier	Client identifier
62		Netware/IP Domain Name	Netware/IP domain name
63		Netware/IP sub Options	Netware/IP sub options
64		NIS+ V3 Client Domain Name	NIS+ V3 client domain name
65		NIS+ V3 Server Address	NIS+ V3 server address
66		TFTP Server Name	TFTP server name
67		Boot File Name	Boot file name
68		Home Agent Addresses	Home agent addresses
69		Simple Mail Server Addresses	Simple mail server addresses
70		Post Office Server Addresses	Post office server addresses
71		Network News Server Addresses	Network news server addresses
72		WWW Server Addresses	WWW server addresses
73		Finger Server Addresses	Finger server addresses
74		Chat Server Addresses	Chat server addresses
75		StreetTalk Server Addresses	StreetTalk server addresses
76		StreetTalk Directory Assistance Addresses	StreetTalk directory assistance addresses
77		User Class Information	User class information

Option Number	IPv6 √	Name	Description
78		SLP Directory Agent	Directory agent information
79		SLP Service Scope	Service location agent scope
80		Rapid Commit	Rapid commit
81		FQDN, Fully Qualified Domain Name	Fully qualified domain name
82		Relay Agent Information	Relay agent information
83		Internet Storage Name Service	Internet storage name service
84		Undefined	N/A
85		Novell Directory Servers	Novell Directory Services servers
86		Novell Directory Server Tree Name	Novell Directory Services server tree name
87		Novell Directory Server Context	Novell Directory Services server context
88		BCMCS Controller Domain Name List	CMCS controller domain name list
89		BCMCS Controller IPv4 Address List	BCMCS controller IPv4 address list
90		Authentication	Authentication
91- 92		Undefined	N/A
93		Client System	Client system architecture
94		Client Network Device Interface	Client network device interface
95		LDAP Use	Lightweight Directory Access Protocol
96		Undefined	N/A
97		UUID/GUID-based Client Identifier	UUID/GUID-based client identifier
98		Open Group’s User Authentication	Open group’s user authentication
99 - 108		Undefined	N/A
109		Autonomous System Number	Autonomous system number
110 - 111		Undefined	N/A
112		NetInfo Parent Server Address	NetInfo parent server address
113		NetInfo Parent Server Tag	NetInfo parent server tag
114		URL:	URL
115		Undefined	N/A
116		Auto Configure	DHCP auto-configuration
117		Name Service Search	Name service search
118		Subnet Collection	Subnet selection
119		DNS Domain Search List	DNS domain search list
120		SIP Servers DHCP Option	SIP servers DHCP option
121		Classless Static Route Option	Classless static route option
122		CCC, CableLabs Client Configuration	CableLabs client configuration
123		GeoConf	GeoConf
124		Vendor-Identifying Vendor Class	Vendor-identifying vendor class
125		Vendor Identifying Vendor Specific	Vendor-identifying vendor specific
126 - 127		Undefined	N/A
128		TFTP Server IP Address	TFTP server IP address for IP phone software load

Option Number	IPv6 √	Name	Description
129		Call Server IP Address	Call server IP address
130		Discrimination String	Discrimination string to identify vendor
131		Remote Statistics Server IP Address	Remote statistics server IP address
132		802.1Q VLAN ID	IEEE 802.1Q VLAN ID
133		802.1Q L2 Priority	IEEE 802.1Q layer 2 priority
134		Diffserv Code Point	Diffserv code point for VoIP signalling and media streams
135		HTTP Proxy For Phone Applications	HTTP proxy for phone-specific applications
136 - 149		Undefined	N/A
150		TFTP Server Address, Etherboot, GRUB Config	TFTP server address, Etherboot, GRUB configuration
151 - 174		Undefined	N/A
175		Ether Boot	Ether Boot
176		IP Telephone	IP telephone
177		Ether Boot PacketCable and CableHome	Ether Boot PacketCable and CableHome
178 - 207		Undefined	N/A
208		`pxelinux.magic` (string) = `241.0.116.126`	`pxelinux.magic` (string) = `241.0.116.126`
209		`pxelinux.configfile` (text)	`pxelinux.configfile` (text)
210		`pxelinux.pathprefix` (text)	`pxelinux.pathprefix` (text)
211		`pxelinux.reboottime`	`pxelinux.reboottime`
212 - 219		Undefined	N/A
220		Subnet Allocation	Subnet allocation
221		Virtual Subnet Allocation	Virtual subnet selection
222 - 223		Undefined	N/A
224 - 254		Private Use	Private use

DHCP and IPv6

For complete information on the SonicOS NS*v* implementation of IPv6, see IPv6 on page 659.

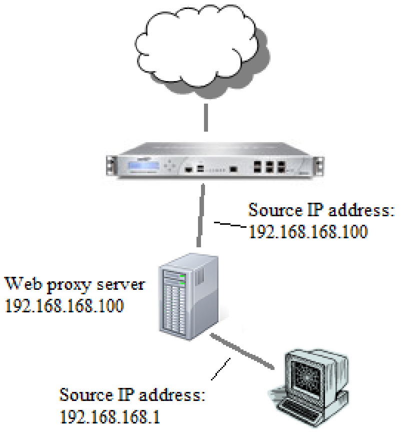
25

Setting Up Web Proxy Forwarding

Topics:

Network > Web Proxy

When users access the web through a proxy server located on the internal network (between the user and the SonicWall Security Appliance), the HTTP/HTTPS connections seen by the Security Appliance originate from the proxy server, not from the user.



A web proxy server intercepts HTTP requests and determines if it has stored copies of the requested Web pages. If it does not, the proxy completes the request to the server on the Internet, returning the requested information to the user and also saving it locally for future requests. Setting up a web proxy server on a network can be cumbersome, because each computer on the network must be configured to direct web requests to the server.

If you have a proxy server on your network, instead of configuring each computer's web browser to point to the proxy server, you can move the server to the WAN or DMZ zone and enable Web Proxy Forwarding using the settings on the **MANAGE | System Setup | Network > Web Proxy** page. The Security Appliance automatically forwards all web proxy requests to the proxy server without requiring all the computers on the network to be configured.

Topics:

Configuring Automatic Proxy Forwarding (Web Only)

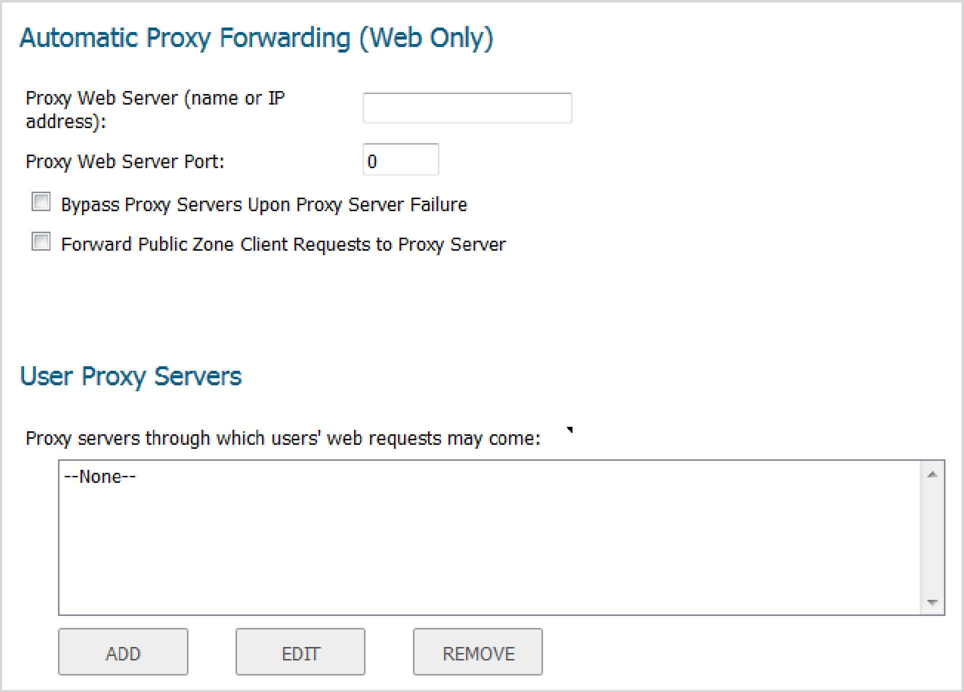
To configure Automatic Proxy Forwarding (Web Only):

1 Connect the Web proxy server to a hub.

2 Connect the hub to the firewall WAN or DMZ port.

> **NOTE:** The proxy server must be located on a WAN or DMZ zone; it cannot be located on the LAN.

3 Go to **MANAGE | System Setup | Network > Web Proxy**.



Automatic Proxy Forwarding (Web Only)

Proxy Web Server (name or IP address):

Proxy Web Server Port: 0

□ Bypass Proxy Servers Upon Proxy Server Failure

□ Forward Public Zone Client Requests to Proxy Server

User Proxy Servers

Proxy servers through which users' web requests may come:

--None--

4 To have all web proxy requests forwarded to the proxy server automatically, in the **Automatic Proxy Forwarding (Web Only)** section, enter the name or IP address of the proxy server in the **Proxy Web Server (name or IP address)** field. The minimum length is 0 and the maximum is 39 characters.

5 Enter the proxy IP port in the **Proxy Web Server Port** field. The default is 0.

6 To have clients access the Internet directly when the web proxy server becomes unavailable, select **Bypass Proxy Servers Upon Proxy Server Failure**. This option is disabled by default.

> **NOTE:** The **Bypass Proxy Servers Upon Proxy Server Failure** checkbox allows clients behind the firewall to bypass the Web proxy server if it becomes unavailable. Instead, the client's browser accesses the Internet directly as if a Web proxy server is not specified.

7 To force clients on public zones to use the proxy server as well. Select **Forward Public Zone Client Requests to Proxy Server**. This option is disabled by default.

8 Click **Accept**.

After the Security Appliance has been updated, a message confirming the update is displayed at the bottom of the browser window.

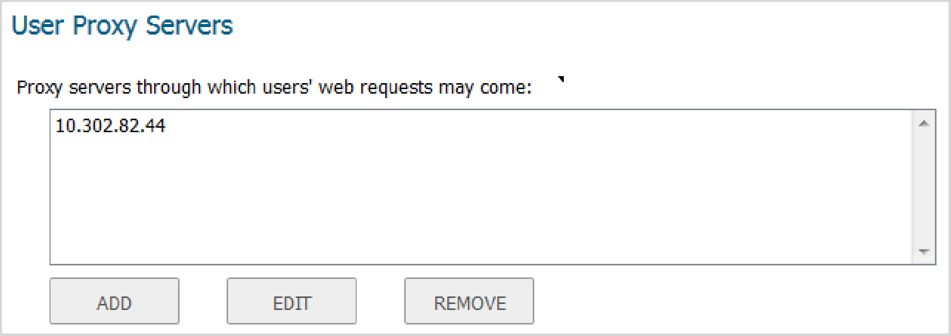
Configuring User Proxy Servers

You can configure up to 32 user proxy servers by entering the host name or IP address.

To configure a user proxy sever:

1 Navigate to **MANAGE | System Setup | Network > Web Proxy**.

2 Go to the **User Proxy Servers** section.

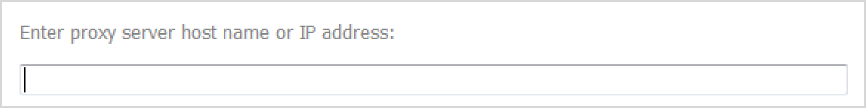


User Proxy Servers

Proxy servers through which users' web requests may come:

10.302.82.44

3 Click **Add**. The **Add Proxy Servers** pop-up dialog displays.



Enter proxy server host name or IP address:

ⓘ **NOTE:** If users' web requests go through a proxy server before reaching the SonicWall Security Appliance, then the web requests seen by the Security Appliance come from the proxy server, not directly from the user. Thus, the Security Appliance cannot identify the user from the source IP address. The proxy server to identify the source of each web request, however, normally includes this information in the HTTP headers.

If any internal proxy servers are configured here, then the Security Appliance uses the information from the servers to identify the users.

This works for both identification of users accessing the web through proxy servers on the internal network and for remote HTTP management of the Security Appliance through a WAN-side external proxy server.

4 Enter the name or IP address of the proxy server.

5 Click **OK**.

6 Repeat Step 3 through Step 5 to add more proxy servers.

7 Click **Accept**.

8 After you have configured the interface, you can connect it to the host. See Configuring Interfaces on page 242.

Editing User Proxy Servers

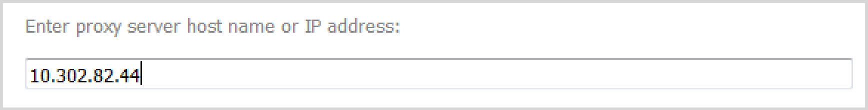
To edit the name or IP address of a proxy server:

1 Navigate to **MANAGE | System Setup | Network > Web Proxy**.

2 Go to the **User Proxy Servers** section.

3 In the **Users Proxy Servers** table, select the proxy server you want to edit.

4 Click **Edit**. The **Edit Proxy Server** pop-up dialog displays.



Enter proxy server host name or IP address:

10.302.82.44

5 Change the name or IP address of the proxy server.

6 Click **OK**.

Removing User Proxy Servers

To remove a proxy server:

1 Navigate to **MANAGE | System Setup | Network > Web Proxy**.

2 Go to the **User Proxy Servers** section.

3 In the **Users Proxy Servers** table, select the proxy server you want to remove.

4 Click **Remove**.

5 Click **Accept**.

26

Using IP Helper

Topics:

About IP Helper

ⓘ **IMPORTANT:** IP Helper is not supported for WAN interfaces or for interfaces that are configured for NAT.

Many User Datagram Protocols (UDP) rely on broadcast/multicast to find its respective server, usually requiring their servers to be present on the same broadcast subnet. To support cases where servers lie on different subnets than clients, a mechanism is needed to forward these UDP broadcasts/multicasts to those subnets. This mechanism is referred to as UDP broadcast forwarding. IP Helper helps broadcast/multicast packets to cross a SonicWall Security Appliance's interface and be forwarded to other interfaces based on policy. IP Helper allows the Security Appliance to forward DHCP requests originating from its interfaces to a centralized DHCP server.

IP Helper supports user-defined protocols and extended policies. IP Helper provides better control on existing NetBIOS/DHCP relay applications. Some of the built-in applications that have been extended are:

Extended Built-in Relay Applications

Protocol	UDP Port Number
DHCP	67/68
DHCPv6	546, 547
Net-Bios NS	137
Net-Bios Datagram	138
DNS	53

Extended Built-in Relay Applications (Continued)

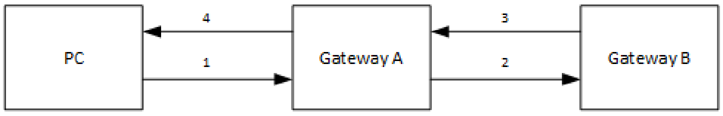
Protocol	UDP Port Number
Time Service	37
Wake on LAN (WOL)	
mDNS	5353 Multicast address: `224.0.0.251`

VPN Tunnel Interface Support for IP Helper

The VPN Tunnel Interface can support IP Helper. DHCP Replay in IP Helper with Tunnel Interface Support shows a simple example of DHCP replay in IP Helper:

- PC is the device needed to get an IPv4 address from the DHCP protocol.
- GatewayA is the gateway-enabled IP helper.
- GatewayB is the gateway with a DHCP server.

DHCP Replay in IP Helper with Tunnel Interface Support



To configure IP Helper with a VPN Tunnel Interface:

ⓘ **NOTE:** The numbers in DHCP Replay in IP Helper with Tunnel Interface Support correspond to the numbered tasks.

1 In PC:

  a Connect to the LAN (X0) subnet of Gateway A.

  b Set to obtain an IP address through DHCP mode.

2 Set up a VPN tunnel between Gateway A and Gateway B.

  - Add a VPN Tunnel Interface.

3 In Gateway B:

  a Add a route entry from the Tunnel Interface’s IP address to Gateway A’s X0 interface.

  b Add the outbound interface of the Tunnel Interface.

  c Add an IP address range as the DHCP scope for PC.

4 In Gateway A:

  a Enable IP Helper.

  b Add an IP Helper DHCP relay protocol from X0 to Gateway B’s Tunnel Interface address. The protocol is DHCP.

DHCPv6 Relay

Topics:

About DHCPv6 Relay

SonicOS NS*v* supports DHCPv6 Relay. A DHCP relay agent is a node that acts as an intermediary to deliver DHCP messages between clients and server, and is on the same link as the client. A DHCPv6 relay agent is used to relay messages between the client and the server when they are not on the same IPv6 link. The DHCPv6 relay agent operation is transparent to the client.

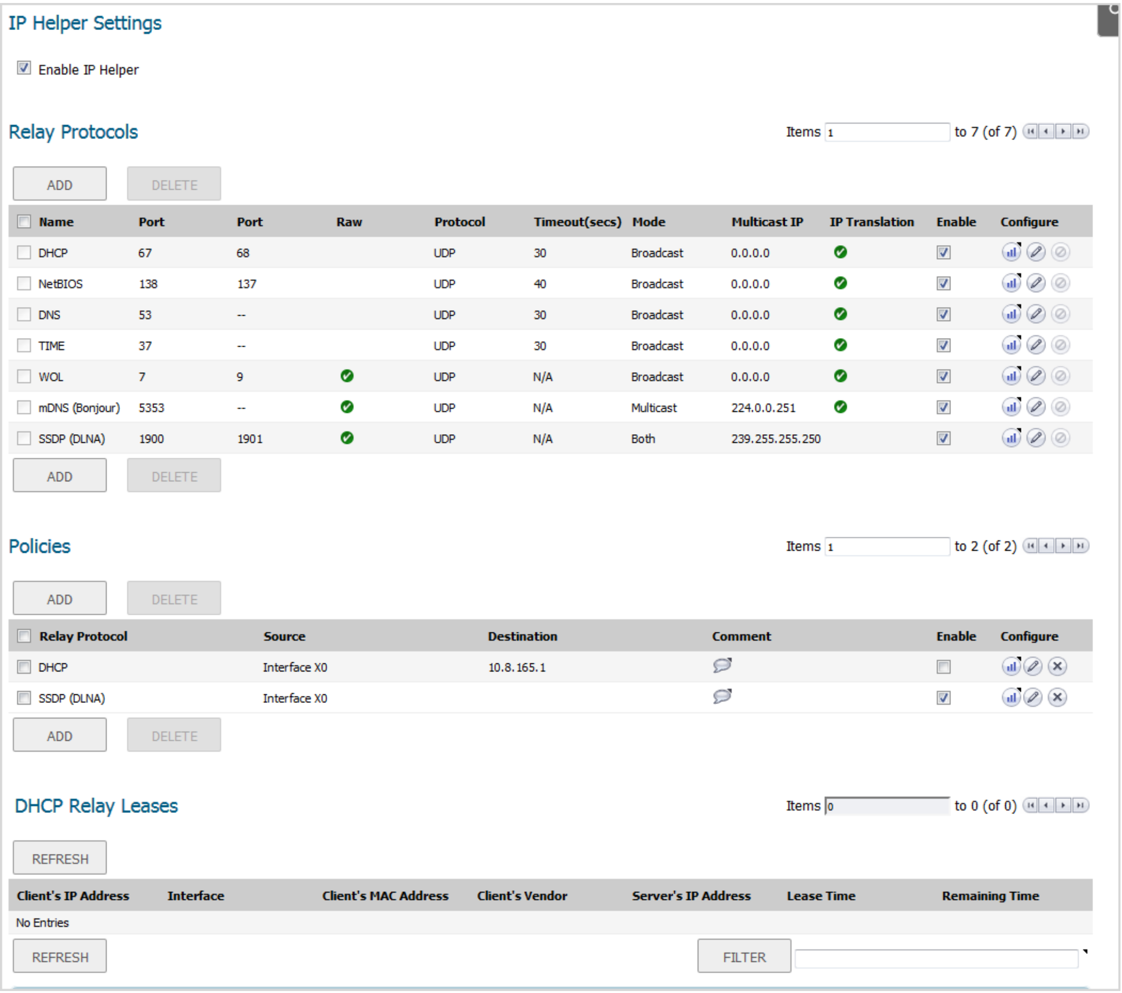
In SonicOS NS*v*, supported destination addresses can be global addresses or link-local addresses, but not multicast addresses.

DHCPv6 relay can be enabled on both physical and virtual interfaces. DHCPv6 is a built-in application in IP Helper protocols.

Configuring DHCPv6 Relay

To configure DHCPv6 Relay:

1 Navigate to the **MANAGE | System Setup > Network > IP Helper** page.



IP Helper Settings

☑ Enable IP Helper

Relay Protocols

Items 1 to 7 (of 7)

ADD DELETE

☐ Name	Port	Port	Raw	Protocol	Timeout(secs)	Mode	Multicast IP	IP Translation	Enable	Configure
☐ DHCP	67	68		UDP	30	Broadcast	0.0.0.0	✓	☑	
☐ NetBIOS	138	137		UDP	40	Broadcast	0.0.0.0	✓	☑	
☐ DNS	53	--		UDP	30	Broadcast	0.0.0.0	✓	☑	
☐ TIME	37	--		UDP	30	Broadcast	0.0.0.0	✓	☑	
☐ WOL	7	9	✓	UDP	N/A	Broadcast	0.0.0.0	✓	☑	
☐ mDNS (Bonjour)	5353	--	✓	UDP	N/A	Multicast	224.0.0.251	✓	☑	
☐ SSDP (DLNA)	1900	1901	✓	UDP	N/A	Both	239.255.255.250		☑	

ADD DELETE

Policies

Items 1 to 2 (of 2)

ADD DELETE

☐ Relay Protocol	Source	Destination	Comment	Enable	Configure
☐ DHCP	Interface X0	10.8.165.1		☐	
☐ SSDP (DLNA)	Interface X0			☑	

ADD DELETE

DHCP Relay Leases

Items 0 to 0 (of 0)

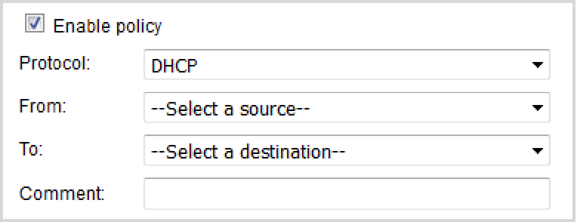
REFRESH

Client's IP Address	Interface	Client's MAC Address	Client's Vendor	Server's IP Address	Lease Time	Remaining Time
No Entries						

REFRESH FILTER

2 Scroll to the **Policies** section.

3 Click **ADD**. The **Add IP Helper Policy** dialog displays.



☑ Enable policy

Protocol:	DHCP
From:	--Select a source--
To:	--Select a destination--
Comment:	

4 Select **DHCPv6** from **Protocol**.

5 Select the desired interface from **From**.

6 In the **To** field, type in the destination IPv6 address. This might be a list of destination addresses, which might include Link-Local or Multicast addresses, or other addresses you select.

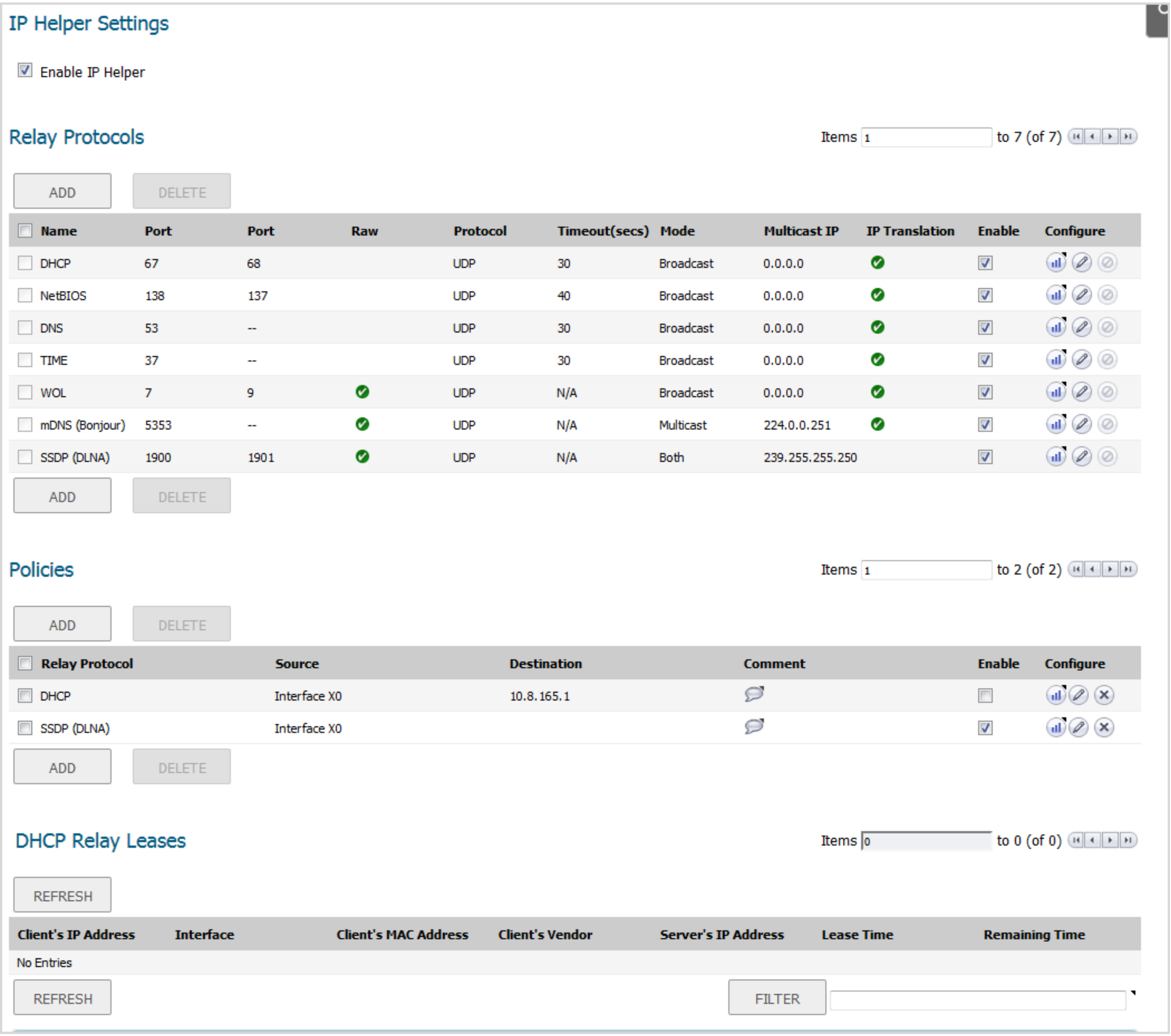
7 If the destination in the **To** field is a:

- Global address, there is no need to select an egress interface. Go to Step 8.
- Link-local address, select an egress interface from **Egress Interface**.

8 Click **OK**.

A new DHCP lease appears in the **DHCPv6 Relay Leases** section of the page when the client gets a new IP address from the server.

Network > IP Helper



IP Helper Settings

☑ Enable IP Helper

Relay Protocols

Items 1 to 7 (of 7)

☐ Name	Port	Port	Raw	Protocol	Timeout(secs)	Mode	Multicast IP	IP Translation	Enable	Configure
☐ DHCP	67	68		UDP	30	Broadcast	0.0.0.0	✓	☑	
☐ NetBIOS	138	137		UDP	40	Broadcast	0.0.0.0	✓	☑	
☐ DNS	53	--		UDP	30	Broadcast	0.0.0.0	✓	☑	
☐ TIME	37	--		UDP	30	Broadcast	0.0.0.0	✓	☑	
☐ WOL	7	9	✓	UDP	N/A	Broadcast	0.0.0.0	✓	☑	
☐ mDNS (Bonjour)	5353	--	✓	UDP	N/A	Multicast	224.0.0.251	✓	☑	
☐ SSDP (DLNA)	1900	1901	✓	UDP	N/A	Both	239.255.255.250		☑	

Policies

Items 1 to 2 (of 2)

☐ Relay Protocol	Source	Destination	Comment	Enable	Configure
☐ DHCP	Interface X0	10.8.165.1	💬	☐	
☐ SSDP (DLNA)	Interface X0		💬	☑	

DHCP Relay Leases

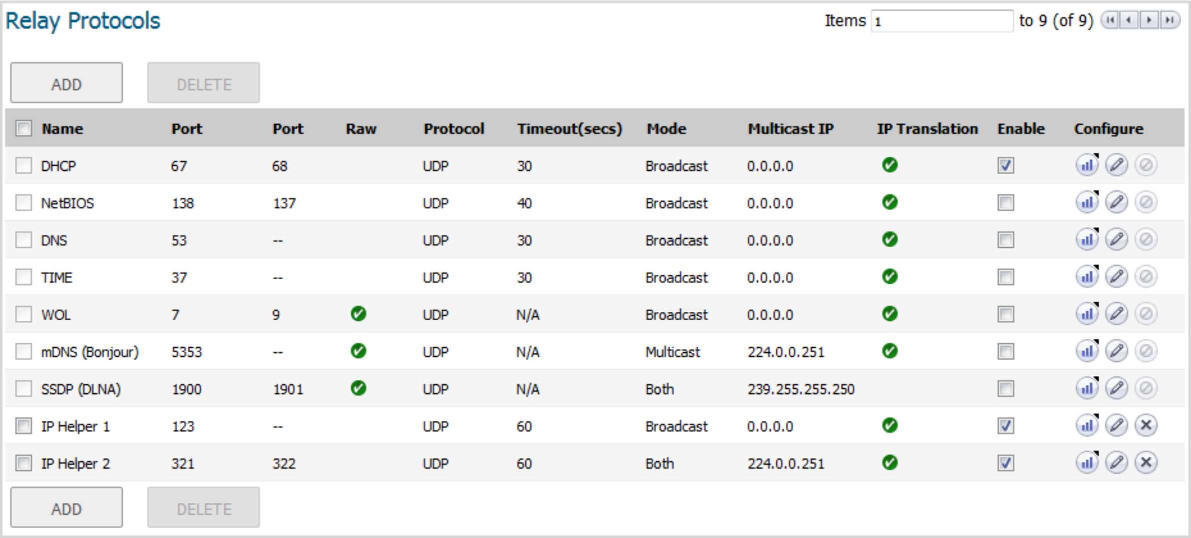
Items 0 to 0 (of 0)

Client's IP Address	Interface	Client's MAC Address	Client's Vendor	Server's IP Address	Lease Time	Remaining Time
No Entries						

Topics:

- Relay Protocols on page 434
- Policies on page 435
- DHCP/DHCPv6 Relay Leases on page 435

Relay Protocols



Relay Protocols

Items 1 to 9 (of 9)

□	Name	Port	Port	Raw	Protocol	Timeout(secs)	Mode	Multicast IP	IP Translation	Enable	Configure
□	DHCP	67	68		UDP	30	Broadcast	0.0.0.0	✓	☑	📊 ✎ ⊘
□	NetBIOS	138	137		UDP	40	Broadcast	0.0.0.0	✓	□	📊 ✎ ⊘
□	DNS	53	--		UDP	30	Broadcast	0.0.0.0	✓	□	📊 ✎ ⊘
□	TIME	37	--		UDP	30	Broadcast	0.0.0.0	✓	□	📊 ✎ ⊘
□	WOL	7	9	✓	UDP	N/A	Broadcast	0.0.0.0	✓	□	📊 ✎ ⊘
□	mDNS (Bonjour)	5353	--	✓	UDP	N/A	Multicast	224.0.0.251	✓	□	📊 ✎ ⊘
□	SSDP (DLNA)	1900	1901	✓	UDP	N/A	Both	239.255.255.250		□	📊 ✎ ⊘
□	IP Helper 1	123	--		UDP	60	Broadcast	0.0.0.0	✓	☑	📊 ✎ ✕
□	IP Helper 2	321	322		UDP	60	Both	224.0.0.251	✓	☑	📊 ✎ ✕

Name IP Helper application name.

Port First UDP port number for the IP Helper application.

Port Optional second UDP port number for the IP Helper application.

Raw Indicates whether raw mode was selected when the IP Helper application was configured. Timeout is ignored if this option is enabled.

Protocol UDP.

Timeout (secs) Timeout for the IP Helper cache. **N/A** indicates Raw mode is selected and the timeout is ignored.

Mode Indicates the mode the protocol supports:

- **Broadcast**
- **Multicast**
- **Both**

Multicast IP Multicast IP the protocol uses.

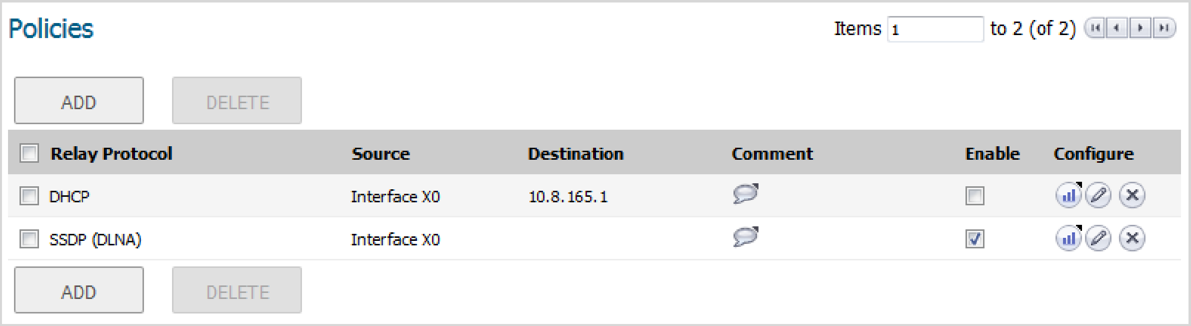
IP Translation Indicates whether the source IP address is translated when packets are forwarded by an IP Helper policy.

Enable Indicates whether the IP Helper policy is enabled.

Configure Contains the **Statistics**, **Edit**, and **Delete** icons for the entries.

NOTE: Only user-generated Relay protocols can be deleted.

Policies



Policies

Items 1 to 2 (of 2)

ADD DELETE

☐ Relay Protocol	Source	Destination	Comment	Enable	Configure
☐ DHCP	Interface X0	10.8.165.1	💬	☐	
☐ SSDP (DLNA)	Interface X0		💬	☑	

ADD DELETE

Relay Protocol Protocol for the policy.

Source Interface or zone for the policy.

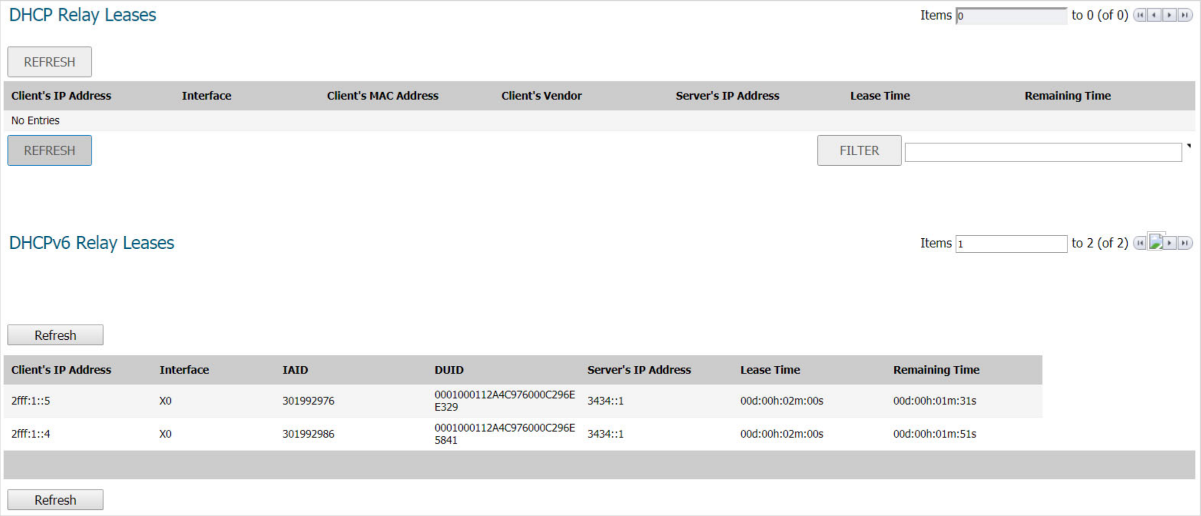
Destination Network destination.

Comment Comment entered when the policy was configured.

Enable Indicates whether the IP Helper policy is enabled.

Configure Contains the Statistics, Edit, and Delete icons for each entry.

DHCP/DHCPv6 Relay Leases



DHCP Relay Leases

Items 0 to 0 (of 0)

REFRESH

Client's IP Address	Interface	Client's MAC Address	Client's Vendor	Server's IP Address	Lease Time	Remaining Time
No Entries						

REFRESH FILTER

DHCPv6 Relay Leases

Items 1 to 2 (of 2)

Refresh

Client's IP Address	Interface	IAID	DUID	Server's IP Address	Lease Time	Remaining Time
2fff:1::5	X0	301992976	0001000112A4C976000C296E E329	3434::1	00d:00h:02m:00s	00d:00h:01m:31s
2fff:1::4	X0	301992986	0001000112A4C976000C296E 5841	3434::1	00d:00h:02m:00s	00d:00h:01m:51s

Refresh

Client's IP Address IP address of the client device.

Interface Receiving interface on the Security Appliance.

DHCP Relay Leases:

Client's MAC Address MAC address of the client device.

Client's Vendor Manufacturer of the client device.

DHCPv6 Relay Leases:

IAID Interface ID; an Interface Association Identifier that is a binding between the interface and one or several IP addresses.

DUID Device (host) ID; a DHCP Unique Identifier for a DHCP participant.

Server's IP Address	IP address of the DHCP server.
Lease Time	Time of the relay lease.
Remaining Time	Time remaining on the relay lease.

To refresh the DHCP Relay Leases table:

1 Click **REFRESH**.

Configuring IP Helper

Topics:

- Enabling IP Helper on page 436
- Managing Relay Protocols on page 436
- Managing IP Helper Policies on page 438

Enabling IP Helper

To activate IP Helper features:

1 Navigate to **Network > IP Helper.**

2 Select **Enable IP Helper** in **IP Helper Settings**.

Managing Relay Protocols

Topics:

- Viewing Traffic Statistics on page 436
- Adding User-Defined Relay Protocols on page 437
- Deleting Custom Protocols on page 438

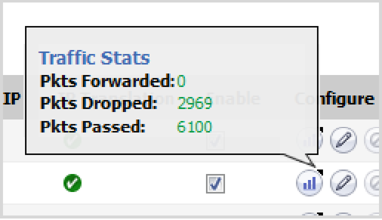
Viewing Traffic Statistics

You can view traffic statistics for both the **Relay Protocols** table and the **Policies** table.

To view traffic statistics:

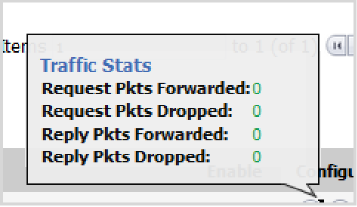
1 Hover the cursor over a protocol or policy's **Statistics** icon. A popup displays the traffic status for that entry.

Relay Protocols Table



Traffic Stats
Pkts Forwarded: 0
Pkts Dropped: 2969
Pkts Passed: 6100

Policies Table



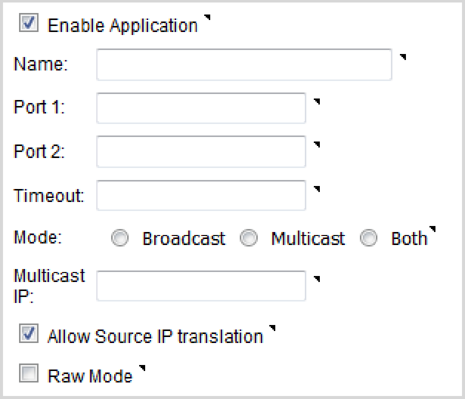
Traffic Stats
Request Pkts Forwarded: 0
Request Pkts Dropped: 0
Reply Pkts Forwarded: 0
Reply Pkts Dropped: 0

Adding User-Defined Relay Protocols

To add a relay protocol:

1 Navigate to **MANAGE | System Setup | Network > IP Helper**.

2 Click **Add** in the **Relay Protocols** section. The **Add IP Helper Application** dialog displays.



☑ Enable Application

Name:

Port 1:

Port 2:

Timeout:

Mode: ○ Broadcast ○ Multicast ○ Both

Multicast IP:

☑ Allow Source IP translation

□ Raw Mode

3 Enable the IP Helper application by selecting **Enable Application**.

> ⓘ **NOTE:** If this option is disabled, all IP Helper cache is deleted.

4 Enter a unique, case-sensitive name for the IP Helper application in the **Name** field.

5 In the **Port 1** field, specify a unique UDP port number for the application.

6 Optionally, in the **Port 2** field, specify a second unique UDP port number for the application.

7 Optionally, specify the IP Helper cache timeout, in seconds, in an increment of 10 from 10 to 60, in the **Timeout** field. If a timeout is not specified, a default value of **30** seconds is selected.

> ⓘ **TIP:** This field is ignored if **Raw Mode** is selected.

8 Choose a **Mode**:

- **Broadcast**
- **Multicast**
- **Both**

9. If you selected **Multicast** or **Both** for **Mode**, specify a valid multicast IP that this protocol is used in the **Multicast IP** field.
10. To allow the source IP address to be translated when a packet is forwarded by an IP Helper policy, select **Allow Source IP Translation**. This option is selected by default.
11. To prevent a cache from being created when a packet is forwarded by an IP Helper policy, select **Raw Mode**. Unidirectional forwarding is supported. This option is not selected by default.

    ⓘ | **NOTE:** Any time set in the **Timeout** field is ignored.

12. Click **OK**.

Deleting Custom Protocols

To delete a custom protocol:

1. Navigate to **MANAGE | System Setup | Network > IP Helper**.
2. Select the **Delete** icon for that protocol.

To delete one or more custom relay protocols:

1. Navigate to **MANAGE | System Setup | Network > IP Helper**.
2. Select the left-most checkbox(es) (by the protocol name) of the desired protocol(s). **DELETE** becomes available.
3. Click **DELETE**.

To delete all custom relay protocols:

1. Navigate to **MANAGE | System Setup | Network > IP Helper**.
2. Select the checkbox in the **Relay Protocols** table header. **DELETE** becomes available.
3. Click **DELETE**.

Managing IP Helper Policies

IP Helper policies allow you to forward DHCP and NetBIOS broadcasts from one interface to another interface.

ⓘ | **IMPORTANT:** IP Helper is not supported for WAN interfaces or for interfaces that are configured for NAT.

Topics:

- Adding an IP Helper Policy on page 438
- Editing an IP Helper Policy on page 439
- Deleting IP Helper Policies on page 439
- Displaying IP Helper Cache from TSR on page 440

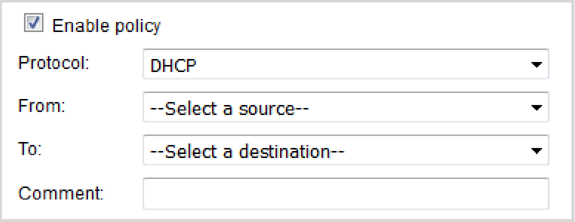
Adding an IP Helper Policy

You can add up to 256 policies.

To add an IP Helper policy:

1 Navigate to **MANAGE | System Setup | Network > IP Helper**.

2 Click **Add** for the **IP Helper Policies** table. The **Add IP Helper Policy** dialog displays.



☑ Enable policy

Protocol: DHCP

From: --Select a source--

To: --Select a destination--

Comment:

3 The policy is enabled by default. To configure the policy without enabling it, clear **Enable policy**.

4 Select a protocol from the **Protocol** menu. The default is **DHCP**.

5 Select a source interface or zone from **From**.

6 From **To**, select either:

- A destination Address Group or Address Object.
- **Create a new network** to create a new Address Object. The **Add Address Object** dialog displays. For further information about creating an Address Object, see the *SonicOS Policies Guide*.

7 Enter an optional comment in the **Comment** field.

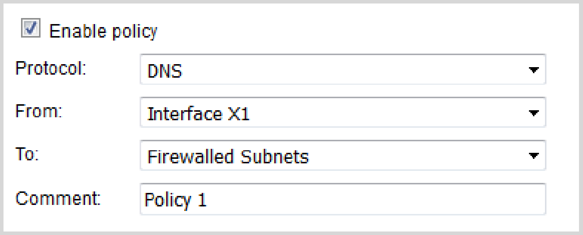
8 Click **OK**.

Editing an IP Helper Policy

To edit an IP Helper policy:

1 Navigate to **MANAGE | System Setup | Network > IP Helper**.

2 Click the **Edit** icon in the **Configure** column of the entry in the **IP Helper Policies** table. The **Edit IP Helper Policy** dialog displays.



☑ Enable policy

Protocol: DNS

From: Interface X1

To: Firewalled Subnets

Comment: Policy 1

3 The settings are the same as the **Add IP Helper Policy** dialog. For information about the dialog, see Adding an IP Helper Policy on page 438.

Deleting IP Helper Policies

To delete a custom policy:

1 Navigate to **MANAGE | System Setup | Network > IP Helper**.

2 Select the **Delete** icon in the **Policies** table for that policy.

To delete one or more custom policies:

1 Navigate to **MANAGE | System Setup | Network > IP Helper**.

2 Select the left-most checkbox(es) (by the relay protocol) of the desired policies. **DELETE** becomes available.

3 Click **DELETE**.

To delete all custom policies:

1 Navigate to **MANAGE | System Setup | Network > IP Helper**.

2 Select the checkbox in the **Policies** table header. **DELETE** becomes available.

3 Click **DELETE**.

Filtering What DHCP Relay Leases are Displayed

You can display only a specific device(s) in the **Anti-Spoof Cache** and **Spoof Detected List** tables by using the **Filter** function.

To filter the table display:

1 Navigate to **MANAGE | System Setup | Network > MAC-IP Anti-spoof**.

2 In the **Filter** field below the table to be filtered, specify either the device's IP address, interface, MAC address, host name, or name. The field must be filled using the appropriate syntax for operators shown in Filter Operator Syntax Options.

Filter Operator Syntax Options

Operator	Syntax Options
Value with a type	• Ip=1.1.1.1 or ip=1.1.1.0/24 • Mac=00:01:02:03:04:05 • Iface=x1
String	• X1 • 00:01 • Tst-mc • 1.1.
AND	• Ip=1.1.1.1;iface=x1 • Ip=1.1.1.0/24;iface=x1;just-string
OR	• Ip=1.1.1.1,2.2.2.2,3.3.3.0/24 • Iface=x1,x2,x3
Negative	• !ip=1.1.1.1;!just-string • !iface=x1,x2
Mixed	• Ip=1.1.1.1,2.2.2.2;mac=00:01:02:03:04:05; just-string;!iface=x1,x2

Displaying IP Helper Cache from TSR

The TSR shows all the IP Helper caches, current policies, and protocols:

```
#IP_HELPER_START
IP Helper
-----IP Helper Global Run-time Data-------
```

```
 IP Helper is OFF
 IP Helper - DHCP Relay is OFF
 IP Helper - Netbios Relay is OFF
  Total Number Of Fwded Packets           :0
  Total Number Of Dropped Packets         :0
  Total Number Of Passed Packets          :0
  Total Number Of Unknown Packets         :0
  Total Number Of record create failure   :0
  Total Number Of element create failure  :0User-defined
-----IP Helper Applications -------
 Name: DHCP
  Port: 67, 68, Max Record: 4000, Status: OFF
  CanBeDel: NO, ChangeIp: 1, Raw: NO
  Max Element: 8000, Timeout: 3, index: 1, proto: 1,
  Record Count: 0, Element Count: 0,
  Fwded: 0, Dropped: 0, Passed: 0
 Name: NetBIOS
  Port: 138, 137, Max Record: 4000, Status: OFF
  CanBeDel: NO, ChangeIp: 1, Raw: NO
  Max Element: 8000, Timeout: 4, index: 2, proto: 1,
  Record Count: 0, Element Count: 0,
  Fwded: 0, Dropped: 0, Passed: 0
 Name: DNS
  Port: 53, 0, Max Record: 8000, Status: OFF
  CanBeDel: NO, ChangeIp: 1, Raw: NO
  Max Element: 16000, Timeout: 3, index: 3, proto: 1,
  Record Count: 0, Element Count: 0,
  Fwded: 0, Dropped: 0, Passed: 0
 Name: TIME
  Port: 37, 0, Max Record: 8000, Status: OFF
  CanBeDel: NO, ChangeIp: 1, Raw: NO
  Max Element: 16000, Timeout: 3, index: 4, proto: 1,
  Record Count: 0, Element Count: 0,
  Fwded: 0, Dropped: 0, Passed: 0
 Name: WOL
  Port: 7, 9, Max Record: 8000, Status: OFF
  CanBeDel: NO, ChangeIp: 1, Raw: YES
  Max Element: 16000, Timeout: 3, index: 5, proto: 1,
  Record Count: 0, Element Count: 0,
  Fwded: 0, Dropped: 0, Passed: 0
 Name: mDNS
  Port: 5353, 0, Max Record: 8000, Status: OFF
  CanBeDel: NO, ChangeIp: 1, Raw: YES
  Max Element: 16000, Timeout: 3, index: 6, proto: 1,
  Record Count: 0, Element Count: 0,
  Fwded: 0, Dropped: 0, Passed: 0
----------GEN APP Relay Policy-----------
----------------------------------Record Table----------------------------
Record(hash)[ClientIP, ClientIf, ClientMac, Proto, Vpn, transId, Age(pkts)]
 Elmnt(hash)[serverIp, serverIf, srcIp, dhcpMac, transId, Vpn, proto(fm,to)]
---------------------------------------------------------------------------
----------DHCP Relay Policy-----------
--------NETBIOS Relay Policy-----------#IP_HELPER_END
```

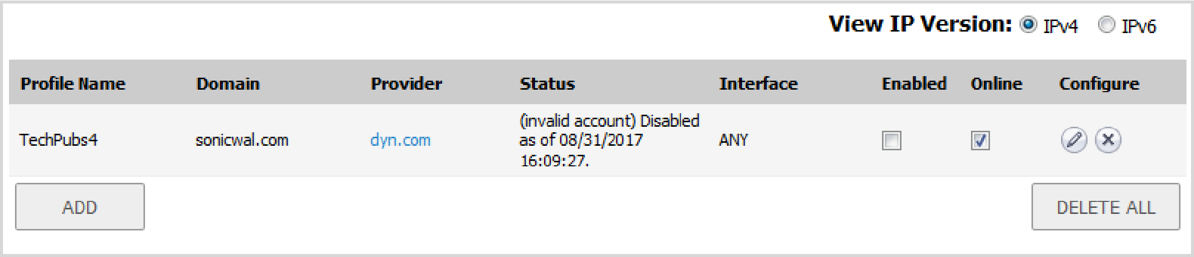
27

Configuring Dynamic DNS

Topics:

- **Network > Dynamic DNS** on page 442
  - About Dynamic DNS on page 442
  - Supported DDNS Providers on page 443
  - Dynamic DNS Profiles Table on page 444
  - Configuring a Dynamic DNS Profile on page 445
  - Editing a DDNS Profile on page 448
  - Deleting DDNS Profiles on page 448

Network > Dynamic DNS



View IP Version: ● IPv4 ○ IPv6

Profile Name	Domain	Provider	Status	Interface	Enabled	Online	Configure
TechPubs4	sonicwal.com	dyn.com	(invalid account) Disabled as of 08/31/2017 16:09:27.	ANY	□	☑	✎ ✕

Topics:

- About Dynamic DNS on page 442
- Supported DDNS Providers on page 443
- Dynamic DNS Profiles Table on page 444
- Configuring a Dynamic DNS Profile on page 445
- Editing a DDNS Profile on page 448
- Deleting DDNS Profiles on page 448

About Dynamic DNS

Dynamic DNS (DDNS) is a service provided by various companies and organizations that allows for dynamic changing IP addresses to automatically update DNS records without manual intervention. This service allows for network access using domain names rather than IP addresses, even when the target's IP addresses change. For example, when a user has a DSL connection with a dynamically assigned IP address from the ISP, the user can use DDNS to register the IP address, and any subsequent address changes, with a DDNS service provider so that external hosts can reach it using an unchanging domain name.

Dynamic DNS implementations change from one service provider to another. There is no strict standard for the method of communication, for the types of records that can be registered, or for the types of services that can be offered. Some providers offer premium versions of their services, as well, for a fee. As such, supporting a particular DDNS provider requires explicit interoperability with that provider's specific implementation.

Most providers strongly prefer that DDNS records only be updated when IP address changes occur. Frequent updates, particularly when the registered IP address is unchanged, might be considered abuse by providers, and could result in your DDNS account getting locked out. Refer to the use policies posted on the provider's pages and abide by the guidelines. SonicWall does not provide technical support for DDNS providers; the providers themselves must be contacted.

Supported DDNS Providers

Not all services and features from all providers are supported, and the list of supported providers is subject to change. SonicOS NS*v* currently supports the services from providers listed in Dynamic DNS Providers:

Dynamic DNS Providers

dns.org	SonicOS NS*v* requires a username, password, Mail Exchanger, and Backup MX to configure DDNS from `Dyndns.org`.
changeip.com	A single, traditional Dynamic DNS service requiring only username, password, and domain name for SonicOS NS*v* configuration.
no-ip.com	Dynamic DNS service requiring only username, password, and domain name for SonicOS NS*v* configuration. Also supports hostname grouping.
Yi.org	Dynamic DNS service requiring only username, password, and domain name for SonicOS NS*v* configuration. Requires that an RR record be created on the `yi.org` administrative page for dynamic updates to occur properly.

Additional Services offered by Dynamic DNS Providers

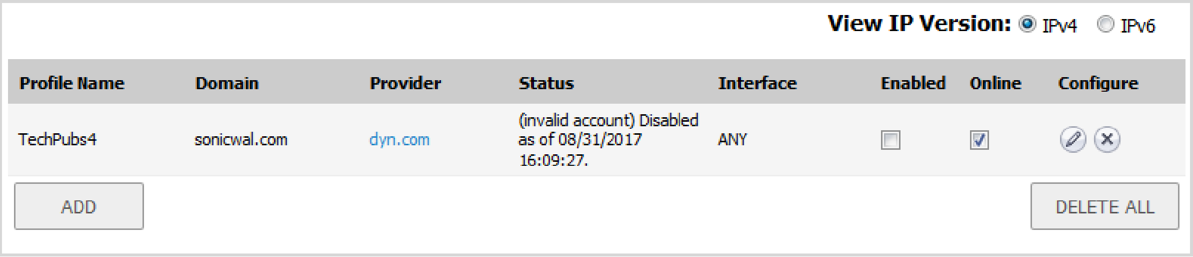
Some common additional services offered by Dynamic DNS providers include:

Wildcards	Allows for wildcard references to sub-domains. For example, if you register `yourdomain.dyndns.org`, your site would be reachable at `*.yourdomain.dyndyn.org`, for example, `server.yourdomain.dyndyn.org`, `www.yourdomain.dyndyn.org`, `ftp.yourdomain.dyndyn.org`.
Mail Exchangers	Creates MX record entries for your domain so that SMTP servers can locate it through DNS and send mail. **NOTE:** Inbound SMTP is frequently blocked by ISPs; check with your provider before attempting to host a mail server.
Backup MX (offered by `dns.org, yi.org`)	Allows for the specification of an alternative IP address for the MX record in the event that the primary IP address is inactive.
Groups	Allows for the grouping of hosts so that an update can be performed once at the group level, rather than multiple times for each member.
Off-Line IP Address	Allows for the specification of an alternative address for your registered host names if primary registered IP is offline.

For information on setting up DDNS Profiles, see Configuring a Dynamic DNS Profile on page 445.

Dynamic DNS Profiles Table

The **Dynamic DNS Profiles** table provides information about configured DDNS profiles.



View IP Version: ● IPv4 ○ IPv6

Profile Name	Domain	Provider	Status	Interface	Enabled	Online	Configure
TechPubs4	sonicwal.com	dyn.com	(invalid account) Disabled as of 08/31/2017 16:09:27.	ANY	□	☑	

View IP Version Allows you to toggle the table between IPv4 and IPv6 DDNS profiles.

Profile Name Name assigned to the DDNS entry during its creation. This can be any value, and is used only for identification.

Domain Fully qualified domain name (FQDN) of the DDNS entry.

Provider DDNS provider with whom the entry is registered.

Status Last reported/current status of the DDNS entry:

- **Online** DDNS entry is administratively online. The current IP setting for this entry is shown with a timestamp.
- **Taken Offline Locally** DDNS entry is administratively offline. If the entry is **Enabled**, the action configured in the **Offline Settings** section of the **Advanced** page of **Add DDNS Profile** is taken.
- **Abuse** DDNS provider has considered the type or frequency of updates to be abusive. Check with the DDNS provider's guidelines to determine what is considered abuse.
- **No IP change** Abuse possible. A forced update without an IP address change is considered by some DDNS providers to be abusive. Automatic updates only occur when address or state changes occur. Manual or forced updates should only be made when absolutely necessary, such as when registered information is incorrect.
- **Disabled** Account has been disabled because of a configuration error or a policy violation. Check the profile's settings, and verify the DDNS account status with the provider.
- **Invalid Account** Account information provided is not valid. Check the profile's settings, and verify the DDNS account status with the provider.
- **Network Error** Unable to communicate with the DDNS provider because of a suspected network error. Verify that the provider is reachable and online. Try the action again later.
- **Provider Error** DDNS provider is unable to perform the requested action at this time. Check the profile's settings, and verify the DDNS account status with the provider. Try the action again later.
- **Not Donator Account** Certain functions provided from certain provider, such as offline address settings, are only available to paying or donating subscribers. Check with the provider for more details on which services might require payment or donation.

Enabled When selected, this profile is administratively enabled, and the Security Appliance takes the **Online Settings** action configured on the **Advanced** page of **Add DDNS Profile**. This setting can also be controlled using the **Enable this DDNS Profile** option of the entry's **Add DDNS Profile**. Deselecting this option disable the profiles, and no communications with the DDNS provider occurs for this profile until the profile is again enabled.

Online When selected, this profile is administratively online. The setting can also be controlled using the **Use Online Settings** option on the entry's **Add DDNS Profile**. Deselecting this option while the profile is enabled takes the profile offline, and the Security Appliance takes the **Offline Settings** action that is configured on the **Advanced** page.

Configure Includes the **Edit** icon for configuring the DDNS profile settings and the **Delete** icon for deleting the DDNS profile entry.

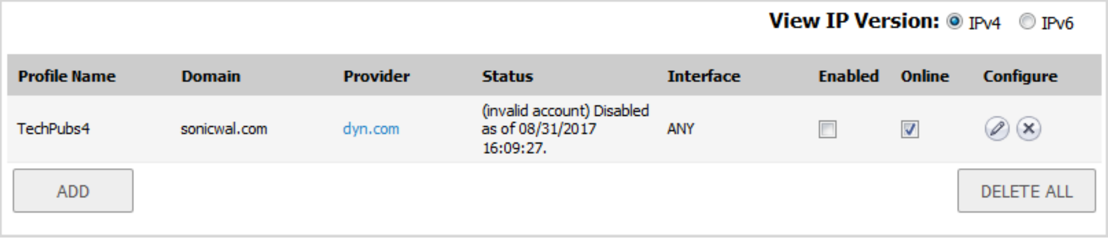
Configuring a Dynamic DNS Profile

For general information on setting up DDNS Profiles, see About Dynamic DNS on page 442.

Using any Dynamic DNS service begins with settings up an account with the DDNS service provider (or providers) of your choice. It is possible to use multiple providers simultaneously. Refer to the various providers listed in Dynamic DNS Providers. The registration process normally involves a confirmation email from the provider, with a final acknowledgment performed by visiting a unique URL embedded in the confirmation email. After logging in to the selected provider's page, you should visit the administrative link (typically add or manage), and create your host entries. This must be performed prior to attempting to use the dynamic DNS client on SonicOS NS*v*. The **MANAGE | System Setup | Network > Dynamic DNS** page provides the settings for configuring the SonicWall Security Appliance to use your DDNS service.

To configure Dynamic DNS on the SonicWall Security Appliance:

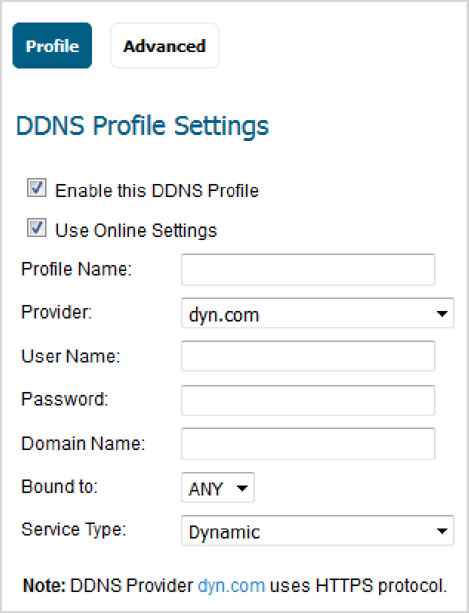
1 Navigate to **MANAGE | System Setup | Network > Dynamic DNS**.



View IP Version: ● IPv4 ○ IPv6

Profile Name	Domain	Provider	Status	Interface	Enabled	Online	Configure
TechPubs4	sonicwal.com	dyn.com	(invalid account) Disabled as of 08/31/2017 16:09:27.	ANY	□	☑	✎ ⊗

2 Click **Add**. The **Add DDNS Profile** dialog displays.



DDNS Profile Settings

☑ Enable this DDNS Profile

☑ Use Online Settings

Profile Name:

Provider: dyn.com

User Name:

Password:

Domain Name:

Bound to: ANY

Service Type: Dynamic

Note: DDNS Provider dyn.com uses HTTPS protocol.

3 When **Enable this DDNS Profile** is checked, the profile is administratively enabled, and the Security Appliance takes the actions defined in the **Online Settings** section on the **Advanced** page. This option is selected by default.

4 If **Use Online Settings** is checked, the profile is administratively online. This option is selected by default.

5 Enter a name to assign to the DDNS entry in the **Profile Name** field. This can be any value used to identify the entry in the **Dynamic DNS Settings** table. The minimum length is 1 character, and the maximum length is 63 characters.

6 From **Provider**, select the dynamic DNS provider; these providers are described in Dynamic DNS Providers. The default is **dyn.com**.

ⓘ **IMPORTANT:** You must have created a dynamic service record with the DNS provider you select.

ⓘ **TIP:** Not all options are available for all DNS providers. Also, the **Note** at the bottom of the page displays whether the DNS provider uses HTTP or HTTPS protocol along with a link to the provider's website.

7 Enter the username for your DNS-provider account in the **User Name** field. The minimum length is 1 character, and the maximum length is 63 characters.

8 Enter your DNS password in the **Password** field. The minimum length is one character, and the maximum length is 31 characters.

9 Enter the fully qualified domain name (FQDN) of the host name you registered with the DNS provider in the **Domain Name** field. Make sure you provide the same host name and domain as you configured. The minimum length is one character, and the maximum length is 63 characters.

10 Optionally, to assign this DDNS profile to a specific WAN interface, select that WAN interface from **Bound to**. If you are configuring multiple-WAN load balancing, this option allows you to advertise a predictable IP address to the DDNS service. By default, this is set to **ANY**, which means the profile is free to use any of the WAN interfaces on the Security Appliance.

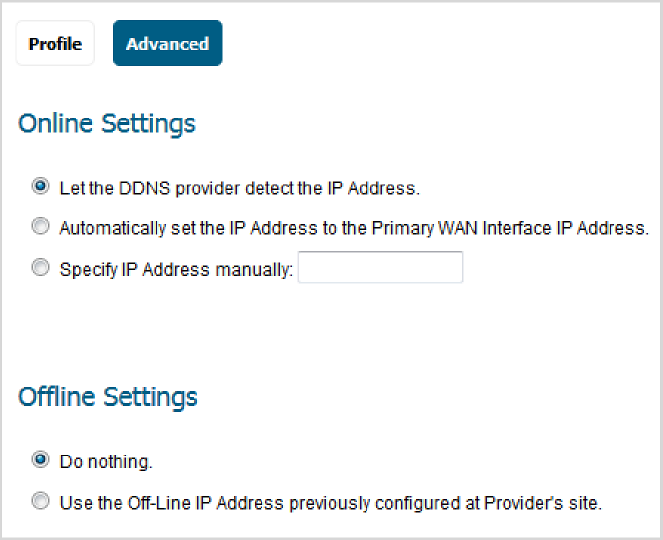
11 If you selected **dyn.com** for **Provider**, go to Step 13.

12 When using `dyn.org`, select the service type that corresponds to your type of service from **Service Type**:

Dynamic	Free Dynamic DNS service. This is the default.
Custom	Managed primary DNS solution that provides a unified primary/secondary DNS service and a Web-based interface. Supports both dynamic and static IP addresses.
Static	Free DNS service for static IP addresses.

13 Click **Advanced**.

ⓘ | **TIP:** You can typically leave the default settings on this page.



Online Settings

● Let the DDNS provider detect the IP Address.

○ Automatically set the IP Address to the Primary WAN Interface IP Address.

○ Specify IP Address manually:

Offline Settings

● Do nothing.

○ Use the Off-Line IP Address previously configured at Provider's site.

14 The **Online Settings** section provides control over what address is registered with the dynamic DNS provider. Choose:

Let the DDNS provider detect the IP Address	The Security Appliance allows the DNS provider to specify the IP address **NOTE:** IPv4 only. This option is selected by default.
Automatically set IP Address to the Primary WAN Interface IP Address	Causes the Security Appliance to assert its WAN IP address as the registered IP address, overriding auto-detection by the dynamic DNS server. Useful if detection is not working correctly. This option is selected by default. **NOTE:** In IPv6: This option is selected by default.
Specify IP Address manually	Allows for the IP address to be registered to be manually specified and asserted.

15 The **Offline Settings** section controls what IP address is registered with the dynamic DNS service provider if the dynamic DNS entry is taken off-line locally (disabled) on the Security Appliance. Choose:

Do nothing	Allows the previously registered address to remain current with the dynamic DNS provider. This option is selected by default.
Use the Off-Line IP address previously configured at Providers site	If your provider supports manual configuration of Offline Settings, you can select this option to use those settings when this profile is taken administratively offline.

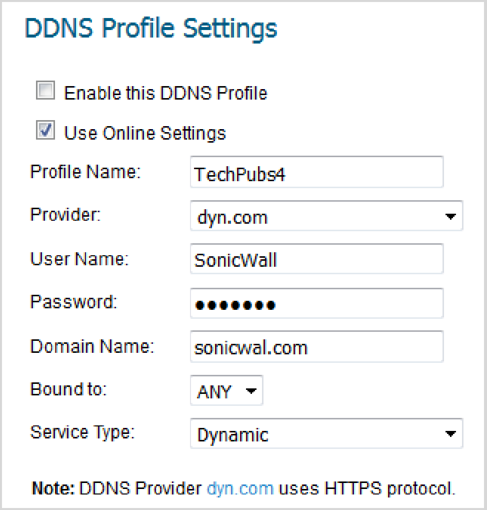
16 Click **OK**.

Editing a DDNS Profile

To edit a DDNS profile:

1 Navigate to **MANAGE | System Setup | Network > Dynamic DNS**.

2 In the Dynamic DNS Profiles table, click the **Edit** icon of the profile. The Edit DDNS Profile dialog displays.



DDNS Profile Settings

□ Enable this DDNS Profile

☑ Use Online Settings

Profile Name:	TechPubs4
Provider:	dyn.com
User Name:	SonicWall
Password:	●●●●●●●
Domain Name:	sonicwal.com
Bound to:	ANY
Service Type:	Dynamic

Note: DDNS Provider dyn.com uses HTTPS protocol.

3 Make changes; for a description of the options, follow the instructions for Configuring a Dynamic DNS Profile on page 445.

4 Click **OK**.

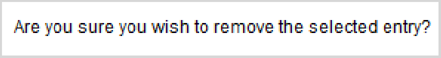
Deleting DDNS Profiles

You can delete one or all DDNS profiles.

To delete a DDNS profile.

1 Navigate to **MANAGE | System Setup | Network > Dynamic DNS**.

2 Click the **Delete** icon of the profile to be deleted. A confirmation message displays:



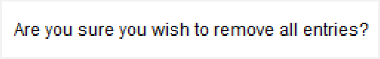
Are you sure you wish to remove the selected entry?

3 Click **OK**.

To delete all DDNS entries:

1 Navigate to **MANAGE | System Setup | Network > Dynamic DNS**.

2 Click **Delete All**. A confirmation message displays:



Are you sure you wish to remove all entries?

3 Click **OK**.

28

Configuring AWS Credentials

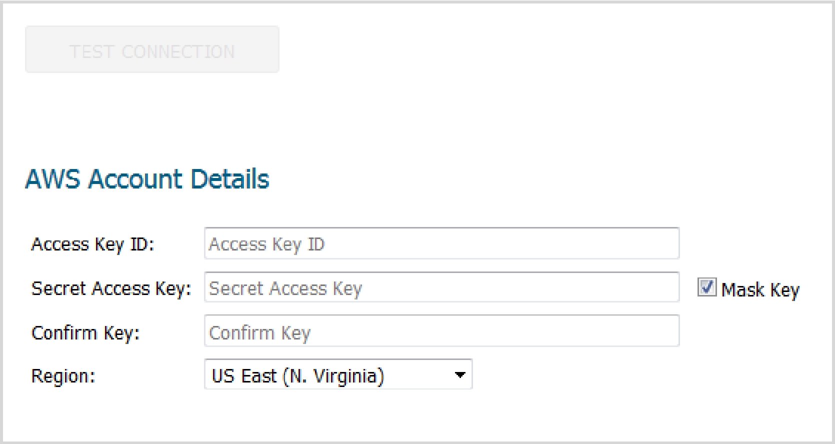
IMPORTANT: To use the SonicOS NS*v*-AWS integration feature, you must:

- Be registered with Amazon Web Services (AWS).
- Have an AWS Identity and Access Management (IAM) User's Access Key ID and Access Key.
- Be familiar with IAM Best Practices.

Topics:

- **Network > AWS Configuration** on page 449
  - About AWS on page 449
  - Configuring AWS on page 450
  - Troubleshooting the Connection on page 451

Network > AWS Configuration



AWS Account Details

Access Key ID: Access Key ID

Secret Access Key: Secret Access Key ☑ Mask Key

Confirm Key: Confirm Key

Region: US East (N. Virginia)

Topics:

- About AWS on page 449
- Configuring AWS on page 450
- Troubleshooting the Connection on page 451

About AWS

SonicOS NS*v* integration with Amazon Web Service (AWS) enables you to:

- Store your logs on the AWS CloudWatch Logs service monitor and troubleshoot your systems and applications.
- Use AWS-hosted analysis tools such as ElasticSearch and Kibana.

To integrate SonicOS NS*v* with AWS and allow the Security Appliance to communicate with the various application programming interfaces (APIs) of AWS, you need to:

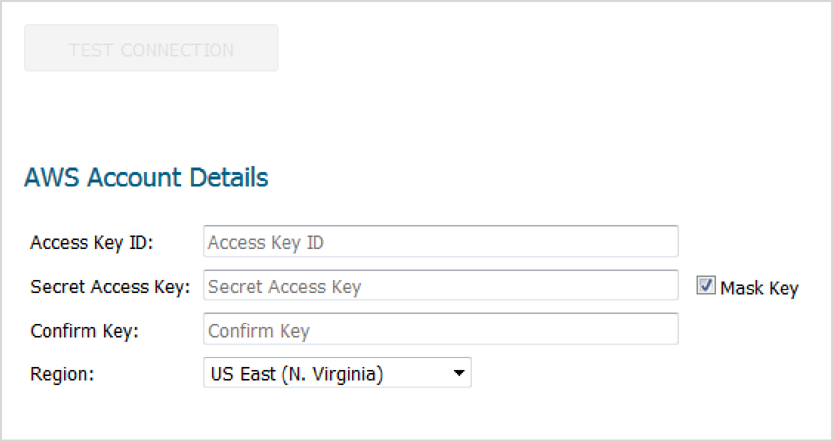
1. Provide AWS security credentials; see Configuring AWS on page 450.
2. Create AWS Objects, such as Address Objects and Address Groups, that correspond to AWS EC2 Instances For further information about creating AWS Objects, see *SonicOS NSv 6.5 Policies*.
3. Create VPN connections from the Security Appliance to the AWS Virtual Private Clouds (VPCs). For further information about creating VPN connections, see *SonicOS NSv 6.5 Connectivity*.
4. Create a Log Stream and enable logging. For more information about logging to Amazon CloudWatch Logs, see *SonicOS NSv 6.5 Logs and Reporting*.

Configuring AWS

NOTE: To configure SonicOS NS*v* to allow TLS v1.0 for AWS, contact SonicWall Support.

To configure AWS:

1. Ensure you have:
   - Registered with Amazon Web Services (AWS).
   - An AWS Identity and Access Management (IAM) User’s Access Key ID and Secret Access Key.
   - Familiarity with IAM Best Practices.
2. Navigate to **MANAGE | System Setup > Network > AWS Configuration**.



3. Enter the AWS Access Key ID in the **Access Key ID** field. The AWS Access Key ID is used by the Security Appliance to access AWS APIs. This option is not selected by default.
4. To mask the key for security, ensure **Mask Key** is selected. This option is selected by default.
5. Enter the AWS Secret Access Key in the **Secret Access Key** field. The Secret Access Key is used by the Security Appliance to access AWS APIs. If **Mask Key** is selected, the field is a series of bullets.
6. Reenter the AWS Secret Access Key in the **Confirm Key** field.

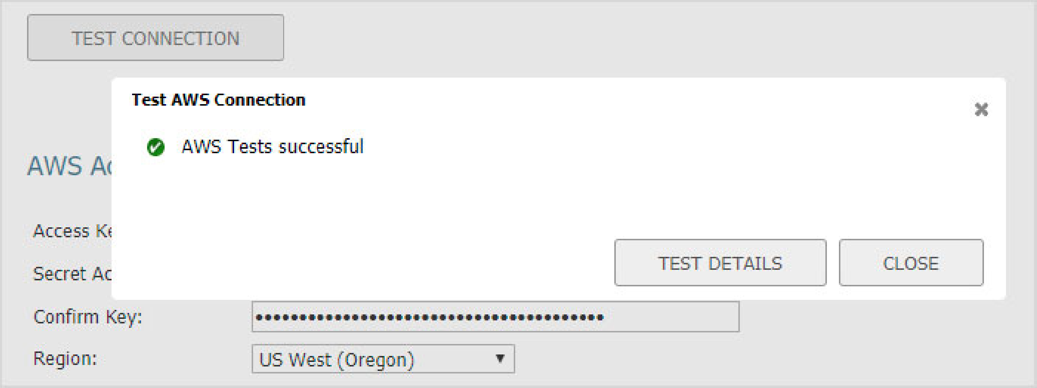
7 From **Region**, select the default region used to initialize the **MANAGE | Policies > Objects > AWS Objects** and **MANAGE | Connectivity > VPN > AWS VPN** pages. The default is **US East (N. Virginia)**.

> ⓘ **IMPORTANT:** If the default region is the region used when sending Security Appliance event logs to AWS CloudWatch Logs, it is affected by changes on the **MANAGE | Logs & Reporting > Log Settings > AWS Logs** page.

8 Click **ACCEPT**. **TEST CONNECTION** becomes available.

> △ **CAUTION: It is important to test the connection and configuration at this time as any error at this point could result in issues later.**

9 To test validity of the credentials and that Security Appliance can successfully communicate with AWS, click **TEST CONNECTION**. Several tests are run to test the credentials and the connection to AWS. The results display.



Test AWS Connection

✓ AWS Tests successful

Confirm Key: ••

Region: US West (Oregon)

> ⓘ **TIP:** If there were problems with the test, see Troubleshooting the Connection on page 451.

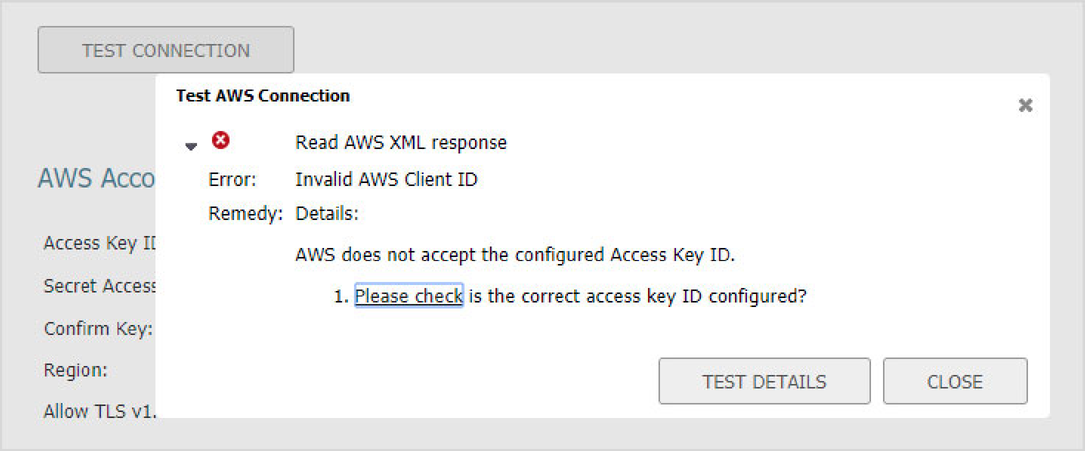
10 Click **Close**.

Troubleshooting the Connection

This example shows an invalid Access Key ID.

To troubleshoot the connection:

1 Click **TEST CONNECTION**. The results display.



Test AWS Connection

✗ Read AWS XML response

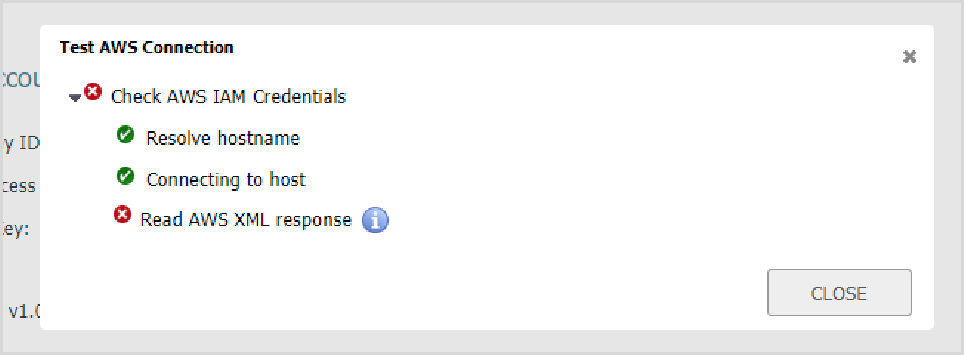
Error: Invalid AWS Client ID

Remedy: Details:

AWS does not accept the configured Access Key ID.

1. Please check is the correct access key ID configured?

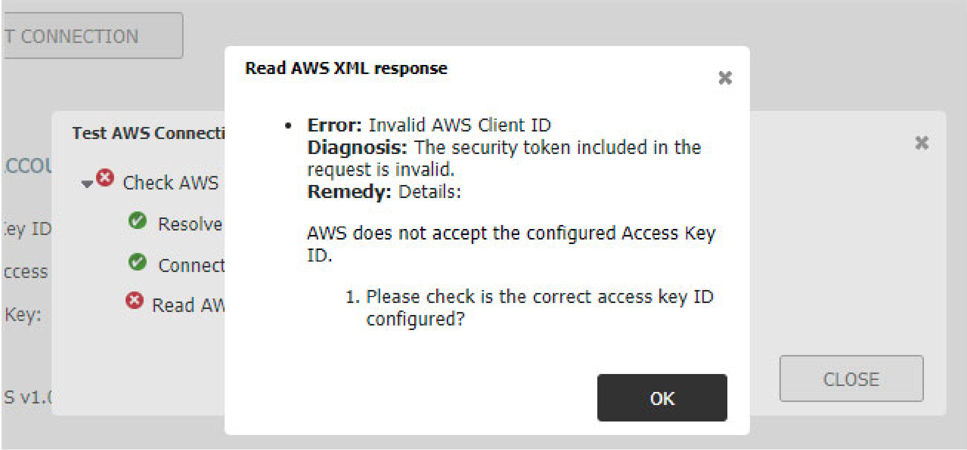
2 Click **TEST DETAILS**. More information displays.



Test AWS Connection

- Check AWS IAM Credentials
  - Resolve hostname
  - Connecting to host
  - Read AWS XML response

3 To display more information, click the **Information** icon. Another popup displays.



Read AWS XML response

- **Error:** Invalid AWS Client ID
  Diagnosis: The security token included in the request is invalid.
  Remedy: Details:

  AWS does not accept the configured Access Key ID.

  1. Please check is the correct access key ID configured?

4 Note the diagnosis.

5 Click **OK**.

6 Click **CLOSE**.

7 Correct the problem described in **Diagnosis**.

8 Click **TEST CONNECTION**.

9 Repeat Step 1 through Step 8 until you solve the problem(s).

10 Click **CLOSE**.

Part 5

SYSTEM SETUP | SD-WAN

29

About SD-WAN

SD-WAN (Software-Defined Wide Area Network) provides software-based control over wide area network (WAN) connections. SonicOS NS*v* SD-WAN offers these features:

- SD-WAN Interface Groups
  - WAN and VPN
  - Scalable from one to N interfaces
- Dynamic path selection based on:
  - Latency, jitter, and/or packet loss
  - User-defined thresholds for quality assessment
- Application-aware routing
- Path Performance Probes for metrics
- Connection-based traffic distribution
- Automatic connection failover over VPN
- Provisioning and management (GMS and Capture Security Center)

SD-WAN is best used for specific traffic types and/or applications requiring dynamically chosen optimal destination interfaces depending on how the network paths are behaving. To operate well, each application has a certain requirement from the network path. For example the network quality for VoIP to operate well requires the optimal latency be 100 ms or less while a latency of 150 ms or higher results in choppy calls. SD-WAN helps in such scenarios by first dynamically measuring the various network performance metrics, such as latency, jitter and packet loss, on multiple network paths. SD-WAN then compares these metrics with the performance threshold for a particular traffic flow and determines the optimal network that meets the flow’s network quality accordingly.

Topics:

30

Configuring SD-WAN Groups

Topics:

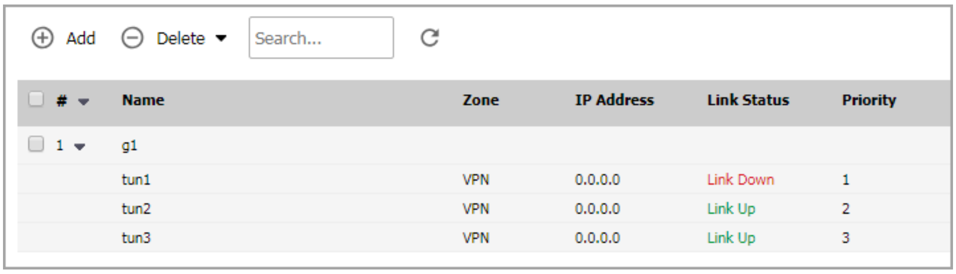
SD-WAN Groups

SD-WAN supports physical and virtual WAN interface types as well as VPN Numbered and Unnumbered Tunnel Interface instances, all choices provided during SD-WAN Group Configuration.

Numbered Tunnel Interface groups are more evolved versions of the route-based implementations, and they are also far more intuitive to work with. However, they do scale poorly as they borrow from other actual entries in the interface table. Unnumbered Tunnel Interface configurations can meet the necessary scalability requirements because they are not tied to an interface table entry.

SD-WAN Groups are logical groups of interfaces that can be used for load-balancing as well as dynamic path selection based on the performance criterion through each interface path. You can create your own custom groups. For a description of SonicOS SD-WAN and its features, see About SD-WAN on page 454.

The **SD-WAN Groups** page displays the custom pool of interfaces used for optimized and resilient traffic flow.



□	#	Name	Zone	IP Address	Link Status	Priority
□	1	g1				
		tun1	VPN	0.0.0.0	Link Down	1
		tun2	VPN	0.0.0.0	Link Up	2
		tun3	VPN	0.0.0.0	Link Up	3

Name Name of the SD-WAN group.

Zone The zone of the interface member:

- WAN
- VPN

IP Address IP address of the interface.

Link Status Indicates whether the link is:

- **Link Up** (green)
- **Link Down** (red)

Priority Priority of the interface in the group.

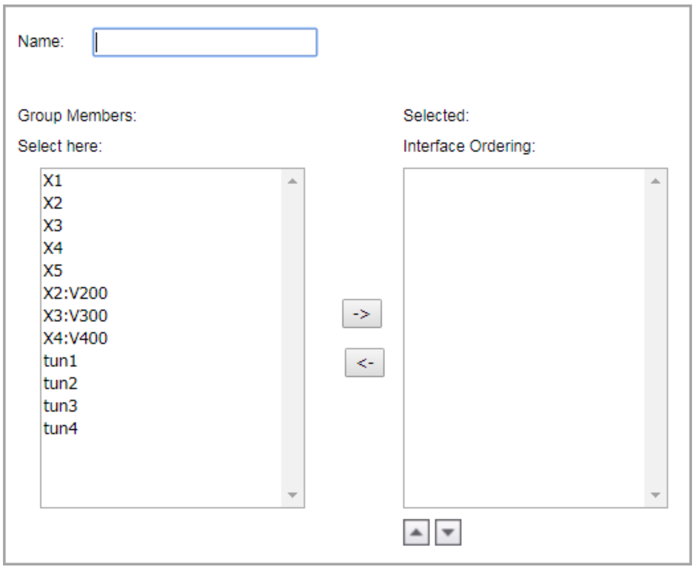
Configure Contains the **Edit** and **Delete** icons for the group.

Creating an SD-WAN Group

You can create multiple SD-WAN Groups to meet your requirements.

To add an SD-WAN group:

1. Navigate to **MANAGE | System Setup > SD-WAN > SD-WAN Groups**. Note the Unnumbered Tunnel Interfaces included as an interface configuration option in an SD-WAN group.
2. Click the **Add** icon. The **Add SD-WAN Group** dialog displays.



Name:

Group Members:
Select here:

X1
X2
X3
X4
X5
X2:V200
X3:V300
X4:V400
tun1
tun2
tun3
tun4

Selected:
Interface Ordering:

3. Enter a descriptive name in the **Name** field.
4. Select one or more interfaces from the **Group Members Select here** list. Member interfaces can be only WAN, Numbered or Unnumbered Tunnel Interfaces.

   ⓘ | **IMPORTANT:** An interface cannot be a member of more than one SD-WAN group.

5. Click the **Right Arrow** to move the selected interfaces to the **Selected Interface Ordering** column.
6. To change the priority of the selected group members:
   a. Select the interface.
   b. Click the **Up Arrow** or **Down Arrow**.
7. Repeat Step 6 for each interface to prioritize.
8. Click **OK**.

Editing an SD-WAN Group

To edit an SD-WAN group:

1. Navigate to **MANAGE | System Setup > SD-WAN > SD-WAN Groups**.
2. Click the **Edit** icon of the group to edit. The **Edit SD-WAN group** dialog displays, which is the same as the **Add SD-WAN group** dialog.
3. Make changes as described in Creating an SD-WAN Group on page 456.

4 Click **OK**.

Deleting SD-WAN Groups

You can delete one, multiple, or all SD-WAN groups.

Topics:

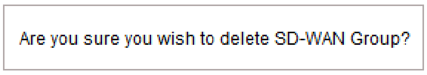
- Deleting an SD-WAN Group on page 457
- Deleting Multiple SD-WAN Groups on page 457
- Deleting All SD-WAN Groups on page 458

Deleting an SD-WAN Group

To delete an SD-WAN group:

1 Navigate to **MANAGE | System Setup > SD-WAN > SD-WAN Groups**.

2 Click the **Delete** icon of the group to delete. A confirmation message displays.



Are you sure you wish to delete SD-WAN Group?

3 Click **OK**.

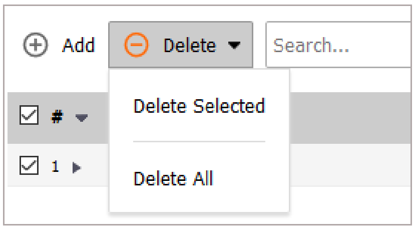
Deleting Multiple SD-WAN Groups

To delete multiple SD-WAN groups:

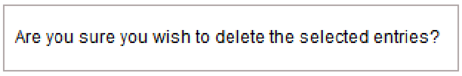
1 Navigate to **MANAGE | System Setup > SD-WAN > SD-WAN Groups**.

2 Select the groups to delete.

3 From **Delete** above the **SD-WAN Groups** table, select **Delete Selected**.



A confirmation message displays.



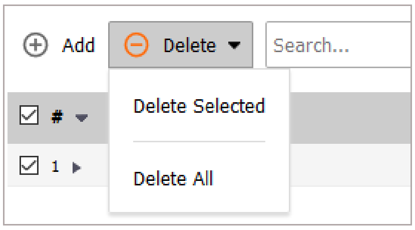
Are you sure you wish to delete the selected entries?

4 Click **OK**.

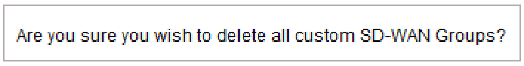
Deleting All SD-WAN Groups

To delete all SD-WAN groups:

1. Navigate to **MANAGE | System Setup > SD-WAN > SD-WAN Groups**.
2. Select the checkbox in the header of the **SD-WAN Groups** table. All the groups are selected.
3. From **Delete** above the **SD-WAN Groups** table, select **Delete All**.



A confirmation message displays.



Are you sure you wish to delete all custom SD-WAN Groups?

4. Click **OK**.

31

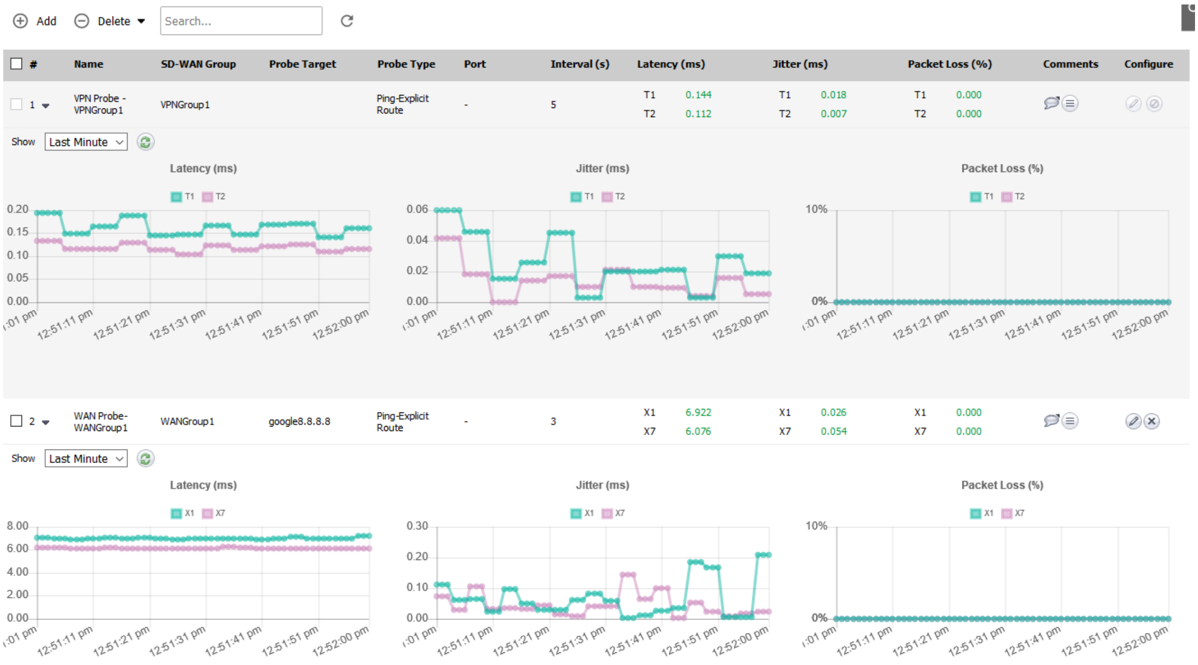
Configuring Performance Probes

Topics:

About Performance Probes

Network path performance metrics are determined using SD-WAN performance probes, which are similar to Network Monitor Probes. SonicOS NS*v* supports ICMP and TCP probe types. An SD-WAN performance probe can be used by multiple Path Selection profiles (for further information, see Configuring Path Selection Profiles on page 470; for a description of SonicOS NS*v* SD-WAN and its features, see About SD-WAN on page 454.).

The **MANAGE | System Setup > SD-WAN > Performance Probes** page shows the dynamic performance data (latency/jitter/packet loss) and probe status for each path (interface) in the SD-WAN group, in both tabular and graphic displays. The display can show data for the last minute (default), last day, last week, or last month.

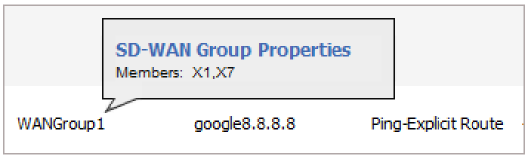


□ #	Name	SD-WAN Group	Probe Target	Probe Type	Port	Interval (s)	Latency (ms)	Jitter (ms)	Packet Loss (%)	Comments	Configure
□ 1	VPN Probe - VPNGroup1	VPNGroup1		Ping-Explicit Route	-	5	T1 0.144 T2 0.112	T1 0.018 T2 0.007	T1 0.000 T2 0.000		
□ 2	WAN Probe-WANGroup1	WANGroup1	google8.8.8.8	Ping-Explicit Route	-	3	X1 6.922 X7 6.076	X1 0.026 X7 0.054	X1 0.000 X7 0.000		

Number of the probe. The **Collapse/Expand** icon toggles the display of the graphs.

Name Name of the SD-WAN performance probe.

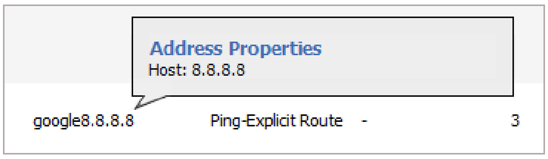
SD-WAN Group Name of the SD-WAN group associated with the SD-WAN performance probe. Mousing over the entry displays properties about the SD-WAN group:



SD-WAN Group Properties
Members: X1,X7

WANGroup1 google8.8.8.8 Ping-Explicit Route

Probe Target Target address object of the SD-WAN performance probe. Mousing over the entry displays the host address:



Address Properties
Host: 8.8.8.8

google8.8.8.8 Ping-Explicit Route - 3

Probe Type Type of performance probe:

- **Ping – Explicit Route**
- **TCP – Explicit Route**

Note: When - **TCP – Explicit Route** is selected along with the **RST Response Counts as Miss** field, the **Port** field also becomes available.

Port Port for the SD-WAN performance probe. The minimum/maximum values are 1 to 65535.

NOTE: Ports are displayed only for **TCP - Explicit Route** probe types. A hyphen (**–**) displays for **Ping - Explicit Route** probe types.

Interval (s) Time between SD-WAN performance probes, in seconds.

Latency (ms) Round trip delay for the probes sent through a particular path/interface to reach the probe target and acknowledge back, in milliseconds. This is also displayed as a graph below the probe’s entry in the **Performance Probe** table.

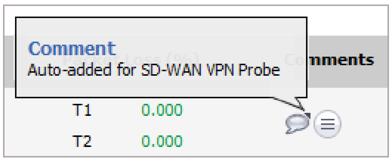
Jitter (ms) Variation in the latency measurements for the probes through a particular path/interface, in milliseconds. This is also displayed as a graph below the probe’s entry in the **Performance Probe** table.

Packet Loss (%) Percentage of probes that are missed of the probes sent through a particular path/interface. This is also displayed as a graph below the probe’s entry in the **Performance Probe** table.

Comments

Displays the:

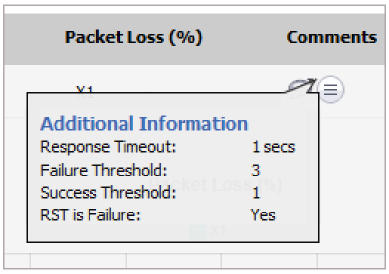
- **Comment** icon; mousing over the icon displays the comment entered when the performance probe was configured.



Comment
Auto-added for SD-WAN VPN Probe

		Comments
T1	0.000	
T2	0.000	

- **Notes** icon; mousing over the displays statistics about the performance probe.



Packet Loss (%)	Comments
X1	

Additional Information

Response Timeout:	1 secs
Failure Threshold:	3
Success Threshold:	1
RST is Failure:	Yes

  - **Response Timeout**: Maximum delay for a response.
  - **Failure Threshold**: Number of missed intervals before the probe state is set to DOWN.
  - **Success Threshold**: Number of successful intervals until the probe state is set to UP.
  - **RST is Failure**: For probe types of **TCP – Explicit Route**, whether RST responses count as misses.

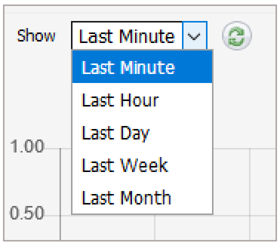
Configure

Displays the **Edit** and **Delete** icons for the SD-WAN performance probe.

NOTE: These icons are dimmed for auto-added probes, such as those for SD-WAN groups containing a numbered tunnel interface. These probes are deleted automatically when its SD-WAN group is deleted.

Show

Controls the display interval of graph data:



The default is **Last Minute**.

Graphs

Graphical depictions of the columnar data:

- **Latency (ms)**
- **Jitter (ms)**
- **Packet Loss (%)**

TIP: You can toggle the display of the graphs for each performance probe by clicking the **Collapse/Expand** icon by the probe number.

TIP: These graphs display a snapshot of historical data for the time frame specified in the **Show** drop-down menu. The graphs in the **MONITOR | Appliance Health > SD-WAN Monitor** and **MANAGE | System Setup > SD-WAN > SD-WAN Monitor** pages display moving real-time data. For information about the **SD-WAN Monitor** graphs, see *SonicOS NSv 6.5 Monitoring* or Monitoring SD-WAN on page 481.

When configuring SD-WAN Performance Probes, default row(s) are created for each of the interfaces used by the SD-WAN Group in the **Network Monitor Policies** screen.

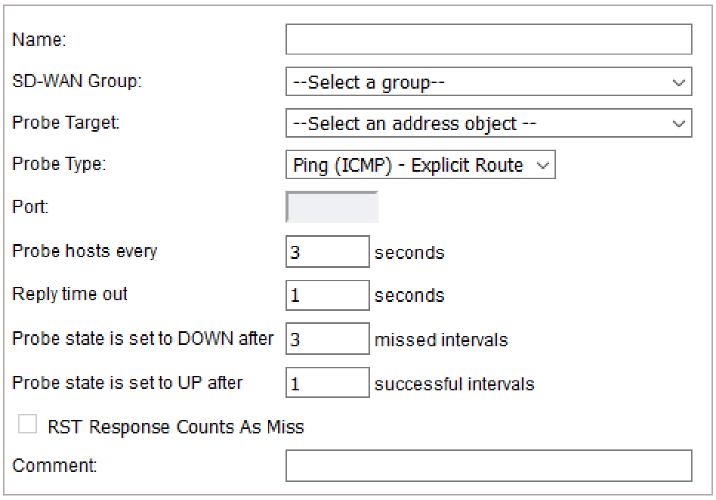
Configuring Performance Probes

IMPORTANT: A Performance Probe is created automatically for a SD-WAN Group containing a VPN numbered tunnel interface. You do not need to create an additional performance probe.

To add a performance probe for non-VPN SD-WAN Groups:

1 Navigate to **MANAGE | System Setup > SD-WAN > Performance Probes**.

2 Click the **Add** icon. The **Add SD-WAN Performance Probe** dialog displays.



Name:	
SD-WAN Group:	--Select a group--
Probe Target:	--Select an address object --
Probe Type:	Ping (ICMP) - Explicit Route
Port:	
Probe hosts every	3 seconds
Reply time out	1 seconds
Probe state is set to DOWN after	3 missed intervals
Probe state is set to UP after	1 successful intervals
□ RST Response Counts As Miss	
Comment:	

3 Enter a meaningful name in the **Name** field.

4 Select an SD-WAN group from **SD-WAN Group**.

5 Select an address object from **Probe Target**.

6 From **Probe Type**, select:

- **Ping (ICMP) - Explicit Route** (default); go to Step 8.
- **TCP - Explicit Route**; the **Port** field becomes available.

7 Enter the port number of the explicit route in the **Port** field.

8 Enter the interval between probes in the **Probe hosts every ... seconds** field. The minimum is 1 second, the maximum is 3600 seconds, and the default is **3** seconds.

TIP: The probe interval must be greater than the reply timeout.

9 Enter the maximum delay for a response in the **Reply time out ... seconds** field. The minimum is 1 second, the maximum is 60 seconds, and the default is **1** second.

10 Enter the maximum number of missed intervals before the performance probe is set to the DOWN state in the **Probe state is set to DOWN after ... missed intervals** field. The minimum number is 1, the maximum is 100, and the default is **3**.

11 Enter the maximum number of successful intervals before the performance probe is set to the UP state in the **Probe state is set to UP after ... successful intervals** field. The minimum number is 1, the maximum is 100, and the default is **1**.

12 If you selected **TCP - Explicit Route** for **Probe Type**, the **RST Response Counts As Miss** option becomes available. Select the option to count RST responses as missed intervals. This option is not selected by default.

13 Optionally, enter a comment in the **Comment** field.

14. Click **ADD**.
15. Repeat Step 3 through Step 14 to add more probes.
16. Click **CLOSE**.

Editing an SD-WAN Performance Probe

To edit an SD-WAN performance probe:

1. Navigate to **MANAGE | System Setup > SD-WAN > Performance Probes**.
2. Click the **Edit** icon of the performance probe to edit. The **Edit SD-WAN Performance Probe** dialog displays, which is the same as the **Add SD-WAN Performance Probe** dialog.
3. Make changes as described in Configuring Performance Probes on page 462.
4. Click **OK**.

Deleting SD-WAN Performance Probes

You can delete one, multiple, or all SD-WAN performance probes.

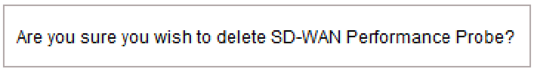
Topics:

- Deleting a Performance Probe on page 463
- Deleting Multiple Performance Probes on page 463
- Deleting All Performance Probes on page 464

Deleting a Performance Probe

To delete an SD-WAN performance probe:

1. Navigate to **MANAGE | System Setup > SD-WAN > Performance Probes**.
2. Click the **Delete** icon of the performance probe to delete. A confirmation message displays.



Are you sure you wish to delete SD-WAN Performance Probe?

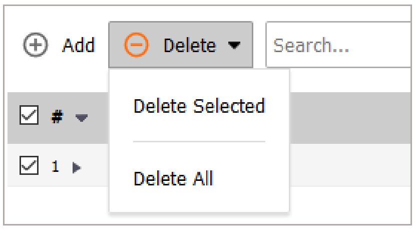
3. Click **OK**.

Deleting Multiple Performance Probes

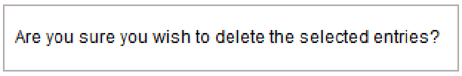
To delete multiple SD-WAN performance probes:

1. Navigate to **MANAGE | System Setup > SD-WAN > Performance Probes**.
2. Select the performance probes to delete.

3 From **Delete** above the **SD-WAN Performance Probe** table, select **Delete Selected**.



A confirmation message displays.



Are you sure you wish to delete the selected entries?

4 Click **OK**.

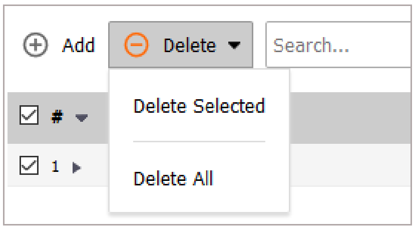
Deleting All Performance Probes

To delete all SD-WAN performance probes:

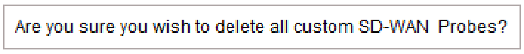
1 Navigate to **MANAGE | System Setup > SD-WAN > Performance Probes**.

2 Select the checkbox in the header of the **SD-WAN Performance Probe** table. All the performance probes are selected.

3 From **Delete** above the **SD-WAN Performance Probe** table, select **Delete All**.



A confirmation message displays.



Are you sure you wish to delete all custom SD-WAN Probes?

4 Click **OK**.

32

Configuring Performance Class Objects

Topics:

About Performance Class Objects

A Performance Class specifies the performance criterion for selecting the optimal path. It could be the:

- Best latency/jitter/packet loss among the existing paths.
- Performance Class Object that defines the metric thresholds for latency, jitter and packet loss.

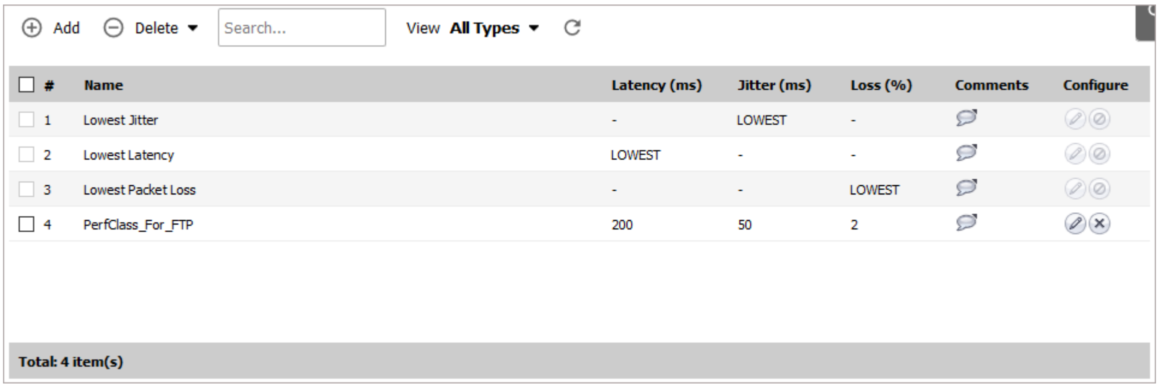
Use SD-WAN Performance Class Objects to configure the desired performance characteristics for the application/traffic categories. These objects are used in the **Path Selection Profile** to automate the selection of paths based on these metrics. (For a description of SonicOS NS*v* SD-WAN and its features, see About SD-WAN on page 454.)

These are the default Performance Class Objects:

- **Lowest Jitter**
- **Lowest Latency**
- **Lowest Packet Loss**

ⓘ | **NOTE:** These default Performance Class Objects cannot be edited or deleted.

Configure custom performance thresholds that best meet the needs of your application/traffic categories with Performance Class Objects.



⊕ Add ⊖ Delete ▾ Search... View **All Types** ▾

□ #	Name	Latency (ms)	Jitter (ms)	Loss (%)	Comments	Configure
□ 1	Lowest Jitter	-	LOWEST	-		
□ 2	Lowest Latency	LOWEST	-	-		
□ 3	Lowest Packet Loss	-	-	LOWEST		
□ 4	PerfClass_For_FTP	200	50	2		

Total: 4 item(s)

Name Name of the Performance Class Object

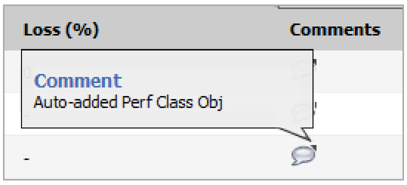
Latency (ms) Threshold time for the round trip delay for the probes sent through a particular path/interface to reach the probe target and acknowledge back, in milliseconds, in milliseconds. For the **Lowest Latency** Performance Class Object, the time is always **LOWEST**; for the other default Performance Class Objects, a hyphen (**–**) displays.

Jitter (ms) Threshold variation in the latency measurements for the probes through a particular path/interface, in milliseconds. For the **Lowest Jitter** Performance Class Object, the time is always **LOWEST**; for the other default Performance Class Objects, a hyphen (**–**) displays.

Loss (%) Threshold percentage of probes that are missed of the probes sent through a particular path/interface. For the **Lowest Packet Loss** Performance Class Object, the percentage is always **LOWEST**; for the other default Performance Class Objects, a hyphen (**–**) displays.

Comments Displays the **Comment** icon; mousing over the icon displays the comment entered when the Performance Class Object was configured.

NOTE: When mousing over the **Comment** icon for a default Performance Class Object, the comment is the same:



Loss (%) Comments

Comment
Auto-added Perf Class Obj

-

Configure Displays the **Edit** and **Delete** icons for the SD-WAN Performance Class Object.

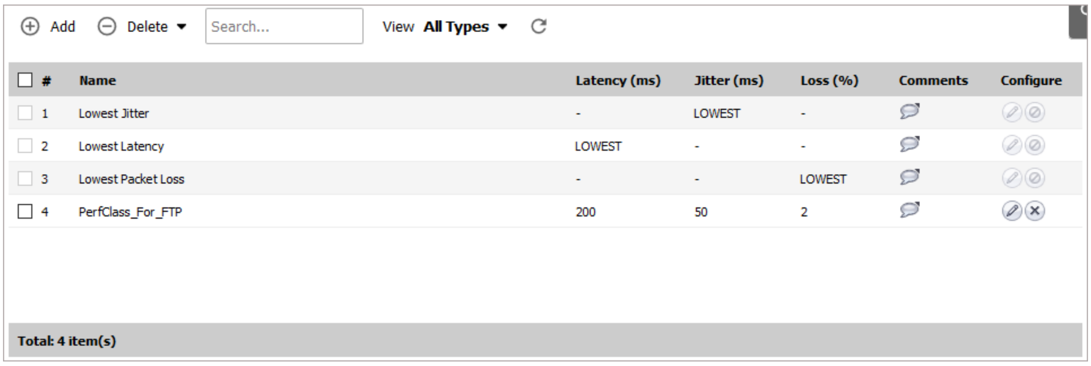
NOTE: You cannot edit or delete the default Performance Class Objects, and these icons are dimmed.

Total Displays the total number of Performance Class Objects in the **Performance Class Object** table.

Configuring Performance Class Objects

To add a Performance Class Object:

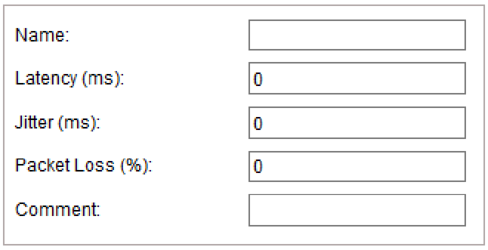
1 Navigate to **MANAGE | System Setup > SD-WAN > Performance Class Objects**.



#	Name	Latency (ms)	Jitter (ms)	Loss (%)	Comments	Configure
1	Lowest Jitter	-	LOWEST	-		
2	Lowest Latency	LOWEST	-	-		
3	Lowest Packet Loss	-	-	LOWEST		
4	PerfClass_For_FTP	200	50	2		

Total: 4 item(s)

2 Click the **Add** icon. The **Add Performance Class Object** dialog displays.



Name:	
Latency (ms):	0
Jitter (ms):	0
Packet Loss (%):	0
Comment:	

3 Enter a meaningful name in the **Name** field.

4 Enter the acceptable latency, in milliseconds, in the **Latency (ms)** field. The minimum is 0 milliseconds, the maximum is 1000, and the default is **0**.

5 Enter the acceptable jitter, in milliseconds, in the **Jitter (ms)** field. The minimum is 0 milliseconds, the maximum is 100 milliseconds, and the default is **0** milliseconds.

6 Enter the acceptable percentage of packet loss in the **Packet Loss (%)** field. The minimum is 0, the maximum is 100, and the default is **0**.

7 Optionally, enter a comment in the **Comment** field.

8 Click **OK**.

9 To configure more Performance Class Objects, repeat Step 3 through Step 8 for each Performance Class Object.

10 When finished, click **CANCEL**.

Editing a Performance Class Object

To edit an SD-WAN performance probe:

1 Navigate to **MANAGE | System Setup > SD-WAN > Performance Class Objects**.

2 Click the **Edit** icon of the performance probe to edit. The **Edit SD-WAN Performance Class Object** dialog displays, which is the same as the **Add SD-WAN Performance Class Object** dialog.

3 Make changes as described in Configuring Performance Class Objects on page 466.

4 Click **OK**.

Deleting SD-WAN Performance Class Objects

You can delete one, multiple, or all SD-WAN Performance Class Objects, but you cannot delete the default Performance Class Objects.

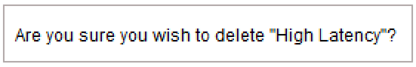
Topics:

- Deleting a Performance Class Object on page 468
- Deleting Multiple Performance Class Objects on page 468
- Deleting All Performance Class Objects on page 469

Deleting a Performance Class Object

To delete an SD-WAN Performance Class Object:

1. Navigate to **MANAGE | System Setup > SD-WAN > Performance Class Objects**.
2. Click the **Delete** icon of the Performance Class Object to delete. A confirmation message displays.

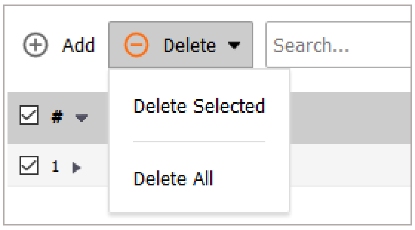
   Are you sure you wish to delete "High Latency"?

3. Click **OK**.

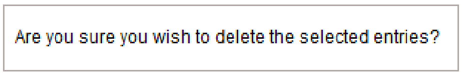
Deleting Multiple Performance Class Objects

To delete multiple SD-WAN Performance Class Objects:

1. Navigate to **MANAGE | System Setup > SD-WAN > Performance Class Objects**.
2. Select the Performance Class Objects to delete.
3. From **Delete** above the **SD-WAN Performance Class Object** table, select **Delete Selected**.

   A confirmation message displays.

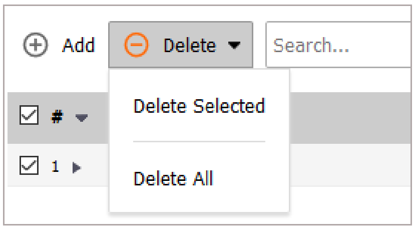
   Are you sure you wish to delete the selected entries?

4. Click **OK**.

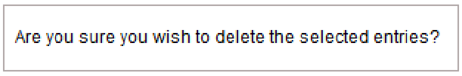
Deleting All Performance Class Objects

To delete all SD-WAN Performance Class Objects:

1. Navigate to **MANAGE | System Setup > SD-WAN > Performance Class Objects**.
2. Select the checkbox in the header of the **SD-WAN Performance Class Object** table. All the Performance Class Objects are selected.
3. From **Delete** above the **SD-WAN Performance Class Object** table, select **Delete All**.



A confirmation message displays.



Are you sure you wish to delete the selected entries?

4. Click **OK**.

33

Configuring Path Selection Profiles

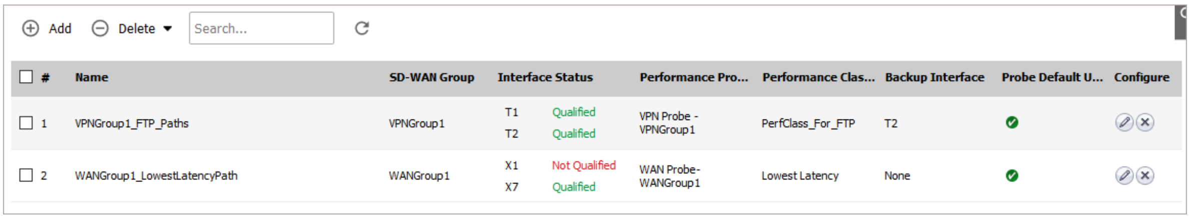
Topics:

- About Path Selection Profiles on page 470

About Path Selection Profiles

Path Selection Profiles (PSPs) are the settings that help to determine the network path or interface that satisfies a specific network performance criteria, from a pool of available network paths/interfaces. A qualified path or interface meets the performance class criteria.

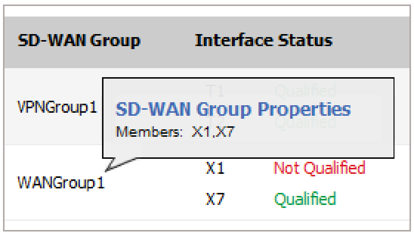
The dynamic path selection mechanism is implemented using the PSP settings when associated with Policy-based Routes (PBR). When more than one network path meets the criterion (as per the performance class in the PSP), then traffic is load balanced among the qualified network paths/interfaces. When associated with a policy-based routing policy, a path selection profile helps select the optimal path among the SD-WAN interfaces for the application/service.



☐	#	Name	SD-WAN Group	Interface Status		Performance Pro...	Performance Clas...	Backup Interface	Probe Default U...	Configure
☐	1	VPNGroup1_FTP_Paths	VPNGroup1	T1 T2	Qualified Qualified	VPN Probe - VPNGroup1	PerfClass_For_FTP	T2	✓	
☐	2	WANGroup1_LowestLatencyPath	WANGroup1	X1 X7	Not Qualified Qualified	WAN Probe-WANGroup1	Lowest Latency	None	✓	

Name Name of the Path Selection Profile.

SD-WAN Group SD-WAN interface group to which the profile applies. Mousing over the SD-WAN group name displays the members of the group:



SD-WAN Group	Interface Status	
VPNGroup1		
WANGroup1	X1 X7	Not Qualified Qualified

SD-WAN Group Properties

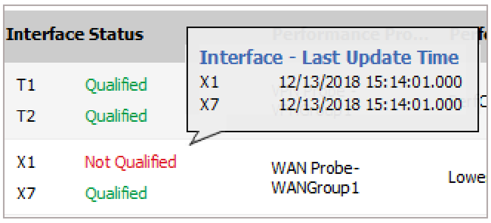
Members: X1,X7

Interface Status

Status of the members of the SD-WAN interface group:

- Interface member
- Member Status:
  - **Qualified** (green)
  - **Not Qualified** (red)

Mousing over the status displays a popup with last-update time:



Interface Status

T1	Qualified
T2	Qualified
X1	Not Qualified
X7	Qualified

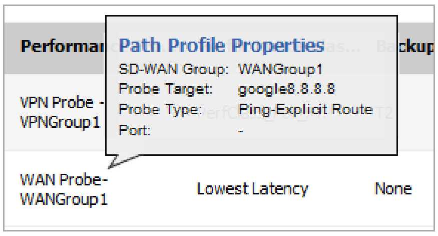
Interface - Last Update Time

X1	12/13/2018 15:14:01.000
X7	12/13/2018 15:14:01.000

WAN Probe-WANGroup1 Lowe

Performance Probe

Performance Probe used by the Path Selection Profile. Mousing over the name of the performance probe displays a popup with the properties of the performance probe:



Performan ... ckup

VPN Probe - VPNGroup1

Path Profile Properties

SD-WAN Group:	WANGroup1
Probe Target:	google8.8.8.8
Probe Type:	Ping-Explicit Route
Port:	-

WAN Probe-WANGroup1	Lowest Latency	None

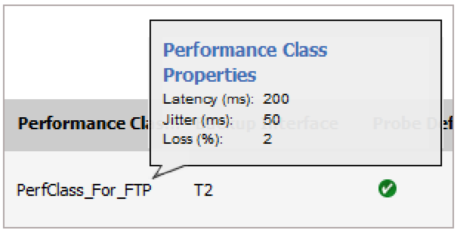
- **SD-WAN Group**: Name of the SD-WAN interface group associated with the group.
- **Probe Target**: Address object of the probe.
- **Probe Type**: Type of probe:
  - **Ping (ICMP) - Explicit Route**
  - **TCP - Explicit Route**
- **Port**: Port associated with the Probe Type; displayed only for a probe type of **TCP - Explicit Route**.

Performance Class Object

Performance Class Object used by the Path Selection Profile:

- **Lowest Latency**
- **Lowest Jitter**
- **Lowest Packet Loss**
- Custom Performance Class Object

Mousing over the entry displays a popup displaying the Performance Class Object's properties:



Performance Cl

Performance Class Properties

Latency (ms):	200
Jitter (ms):	50
Loss (%):	2

PerfClass_For_FTP	T2	✓

Backup Interface

Indicates the interface chosen when none of the SD-WAN group interfaces meet the performance criteria. If a backup interface was not chosen, **None** displays.

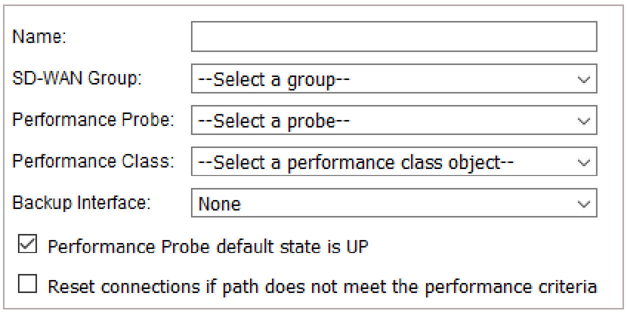
Probe Default UP	Indicates whether the default state of the performance probe is: • UP (green checkmark icon) • DOWN (red X icon)
Configure	Displays the **Edit** and **Delete** icons for the Path Selection Profile.

Configuring Path Selection Profiles

To add a Path Selection Profile:

1 Navigate to **MANAGE | System Setup > SD-WAN > Path Selection Profiles**.

2 Click the **Add** icon. The **Add Path Selection Profile** dialog displays.



Name:

SD-WAN Group: --Select a group--

Performance Probe: --Select a probe--

Performance Class: --Select a performance class object--

Backup Interface: None

☑ Performance Probe default state is UP

☐ Reset connections if path does not meet the performance criteria

3 Add a meaningful name in the **Name** field.

4 From **SD-WAN Group**, select the SD-WAN interface group to which the profile applies.

5 From **Performance Probe**, select the probe to use in the profile.

6 From **Performance Class**, select the Performance Class Object for the dynamic selection of the optimal network path:

- **Lowest Latency**
- **Lowest Jitter**
- **Lowest Packet Loss**
- Custom Performance Class Object

7 From **Backup Interface**, select the interface to use when all the SD-WAN Group interfaces fail to meet the performance criteria specified **Performance Class**; in or all the interfaces are down:

- **None** (default)
- Individual interface
- VPN Tunnel Interface (if any)

8 To specify whether the default state of the performance probe should be treated as UP, select **Performance Probe default state is UP**. If this option is not selected, the performance probe is treated as DOWN. This option is selected by default.

9 For path selection profiles with Non-VPN SD-WAN groups, if existing connections on the path should be reset when the path does not meet the performance criteria any more, select **Reset conditions if path does not meet the performance criteria**. This option is not selected by default.

10 Click **ADD**.

11 To add more Path Selection Profiles, repeat Step 3 through Step 10 for each additional profile.

12 Click **CLOSE**.

Editing a Path Selection Profile

To edit an SD-WAN Path Selection Profile:

1 Navigate to **MANAGE | System Setup > SD-WAN > Path Selection Profiles**.

2 Click the **Edit** icon of the Path Selection Profile to edit. The **Edit SD-WAN Path Selection Profile** dialog displays, which is the same as the **Add SD-WAN Path Selection Profile** dialog.

3 Make changes as described in Configuring Path Selection Profiles on page 472.

4 Click **OK**.

Deleting SD-WAN Path Selection Profiles

You can delete one, multiple, or all SD-WAN Path Selection Profiles

Topics:

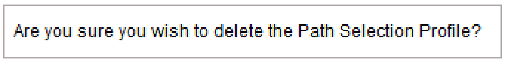
- Deleting a Path Selection Profile on page 473
- Deleting Multiple Path Selection Profiles on page 473
- Deleting All Path Selection Profiles on page 474

Deleting a Path Selection Profile

To delete an SD-WAN Path Selection Profile:

1 Navigate to **MANAGE | System Setup > SD-WAN > Path Selection Profiles**.

2 Click the **Delete** icon of the Performance Class Object to delete. A confirmation message displays.



Are you sure you wish to delete the Path Selection Profile?

3 Click **OK**.

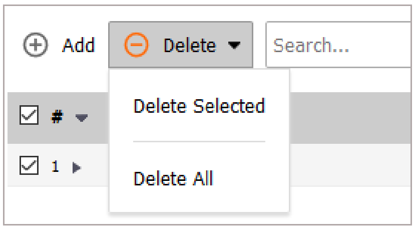
Deleting Multiple Path Selection Profiles

To delete multiple SD-WAN Path Selection Profiles:

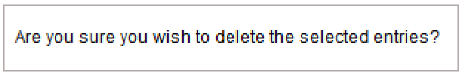
1 Navigate to **MANAGE | System Setup > SD-WAN > Path Selection Profiles**.

2 Select the Path Selection Profiles to delete.

3 From **Delete** above the **SD-WAN Path Selection Profile** table, select **Delete Selected**.



A confirmation message displays.



Are you sure you wish to delete the selected entries?

4 Click **OK**.

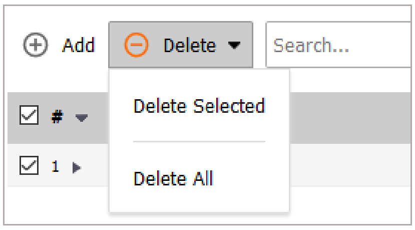
Deleting All Path Selection Profiles

To delete all SD-WAN Path Selection Profiles:

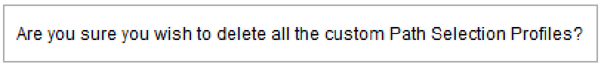
1 Navigate to **MANAGE | System Setup > SD-WAN > Path Selection Profiles**.

2 Select the checkbox in the header of the **SD-WAN Path Selection Profile** table. All the Path Selection Profiles are selected.

3 From **Delete** above the **SD-WAN Path Selection Profile** table, select **Delete All**.



A confirmation message displays.



Are you sure you wish to delete all the custom Path Selection Profiles?

4 Click **OK**.

34

Configuring SD-WAN Route Policies

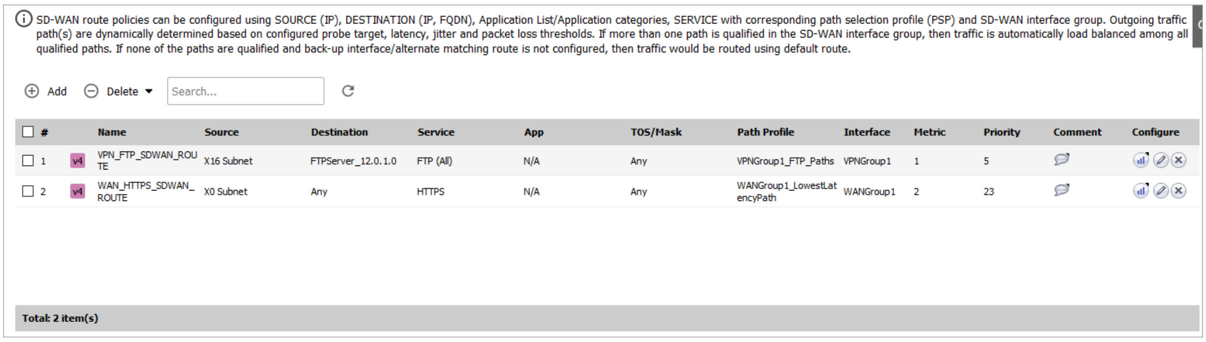
TIP: For non-SD-WAN network routing and policies, see Configuring Route Advertisements and Route Policies on page 335.

Topics:

About SD-WAN Route Policies

Dynamic Path selection for specific traffic flows uses Policy-based Routes. An SD-WAN Policy-based Route is used to configure the route policy for the specific source/destination service/app combination, with a corresponding Path Selection Profile that determines the outgoing path dynamically based on the Path Selection Profile. If there is more than one path qualified by the Path Selection Profile, the traffic is automatically load balanced among the qualified paths. If none of the paths are qualified by the path selection profile and the backup interface in the profile is not configured or is down, the route is disabled. For information about SonicOS NS*v* SD-WAN, see About SD-WAN on page 454.

TIP: SD-WAN routing can be configured from the **MANAGE | System Setup > Network > Routing** page or **MANAGE | System Setup > SD-WAN > SD-WAN Route Policies** page. The **SD-WAN > SD-WAN Route Policies** page, however, only shows the SD-WAN Routes and only allows configuration of SD-WAN-type routes.



SD-WAN route policies can be configured using SOURCE (IP), DESTINATION (IP, FQDN), Application List/Application categories, SERVICE with corresponding path selection profile (PSP) and SD-WAN interface group. Outgoing traffic path(s) are dynamically determined based on configured probe target, latency, jitter and packet loss thresholds. If more than one path is qualified in the SD-WAN interface group, then traffic is automatically load balanced among all qualified paths. If none of the paths are qualified and back-up interface/alternate matching route is not configured, then traffic would be routed using default route.

☐ #		Name	Source	Destination	Service	App	TOS/Mask	Path Profile	Interface	Metric	Priority	Comment	Configure
☐ 1	v4	VPN_FTP_SDWAN_ROUTE	X16 Subnet	FTPServer_12.0.1.0	FTP (All)	N/A	Any	VPNGroup1_FTP_Paths	VPNGroup1	1	5		
☐ 2	v4	WAN_HTTPS_SDWAN_ROUTE	X0 Subnet	Any	HTTPS	N/A	Any	WANGroup1_LowestLatencyPath	WANGroup1	2	23		

Total: 2 item(s)

Name Name of the SD-WAN Route Policy. The IP version is shown by an icon. Included in this column is an icon showing whether the Route Policy is for IPv4 and/or IPv6.

Source Source address object for the SD-WAN route.

Destination	Destination address object for the SD-WAN route.
Service	Service object for the for the SD-WAN route. If **App** was selected instead of **Service** for the type of route policy, **N/A** appears.
App	App object for the for the SD-WAN route. If **Service** was selected instead of **App** for the type of route policy, **N/A** appears.
TOS/Mask	Hexadecimal TOS and TOS Mask. If these options were not configured, **Any** appears.
Path Profile	Path Selection Profile for the SD-WAN route.
Interface	SD-WAN interface group associated with the SD-WAN route.
Metric	Metric used for the SD-WAN route.
Priority	Priority of the Route Policy.
Comment	Information icon that, when moused over, displays the comment entered when the SD-WAN route policy was configured. It the **Comment** field was left blank, the popup displays the name of the SD-WAN route policy.
Configure	Displays the **Statistics**, **Edit**, and **Delete** icons for the route policy. Mousing over the **Statistics** icon displays the number of active connections for the route.

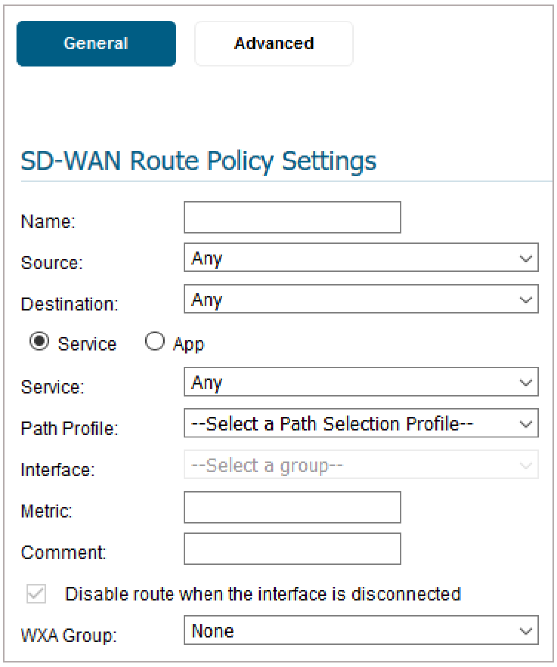
Configuring SD-WAN Route Policies

To add an SD-WAN route policy:

1 Navigate to **MANAGE | System Setup > SD-WAN > SD-WAN Route Policies**.

2 Click the **Add** icon. The **Add SD-WAN Route Policy** dialog displays.

> ⓘ **IMPORTANT:** When configuring an SD-WAN route from the **MANAGE | System Setup > Network > Routing > Route Policies** page, choose **SD-WAN Route** on the **Add Route Policy** dialog; the options change to match those of the **Add SD-WAN Route Policy** dialog.



SD-WAN Route Policy Settings

Name:

Source: Any

Destination: Any

● Service ○ App

Service: Any

Path Profile: --Select a Path Selection Profile--

Interface: --Select a group--

Metric:

Comment:

☑ Disable route when the interface is disconnected

WXA Group: None

NOTE: The **Interface** and **Disable route when the interface is disconnected** options are dimmed because these options cannot be edited in SD-WAN policies. The **Interface** option is populated with the SD-WAN group name in the associated Path Selection Profile (PSP) and cannot be changed. The interface for the SD-WAN route is selected from the SD-WAN group that is part of the PSP associated with the SD-WAN route and, therefore, cannot be configured.

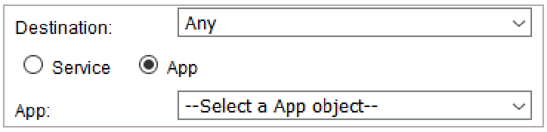
3 Enter a meaningful name in the **Name** field.

4 From **Source**, select the source address object for the static route or select **Create new address object** to dynamically create a new address object. The default is **Any**.

5 From **Destination**, select the destination address object or select **Create new address object** to dynamically create a new address object. The default is **Any**.

6 Choose the type of route policy:

- **Service** (default)
- **App** – Service changes to **App**:



Destination: Any

○ Service ● App

App: --Select a App object--

IMPORTANT: Application Control Licensing is required for application-based routing.

Go to Step 9.

7 From **Service**, select a service object. For a generic static route that allows all traffic types, simply select **Any** (the default).

8 Go to Step 10.

9 From **App**, select an App Object.

10 From **Path Profile**, select a Path Selection Profile.

11 Enter the **Metric** (weighted cost) for the route. The minimum is 1, and the maximum is 254.

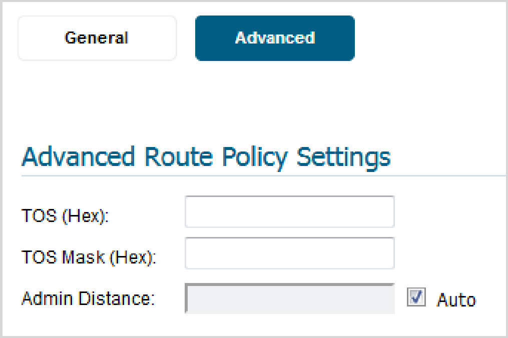
For more information on metrics, see About Metrics and Administrative Distance on page 336 and Policy-based Routing on page 338.

ⓘ | **TIP:** Lower metrics are considered better and take precedence over higher metrics (costs).

12 Optionally, enter a **Comment** for the route. This field allows you to enter a descriptive comment for the new static route policy.

13 If WXA is licensed, select the WXA group from **WXA Group**. The default is **None**.

14 Click **Advanced**.



General | Advanced

Advanced Route Policy Settings

TOS (Hex):

TOS Mask (Hex):

Admin Distance: ☑ Auto

15 Enter a TOS value in the **TOS (Hex)** field. The maximum value is FF. If the **TOS** and **TOS Mask** fields are not configured, a value of 0 is used. For further information about TOS and TOS Mask values, see Policy-based TOS Routing on page 338.

16 Enter the same value in the **TOS Mask (Hex)** field.

17 To manually specify an administration distance:

   a Deselect **Auto**. The **Admin Distance** field becomes available. This option is selected by default. For information about administration distance, see About Metrics and Administrative Distance on page 336.

   b Enter the administration distance in the **Admin Distance** field.

18 Click **OK**.

Editing SD-WAN Route Policies

To edit SD-WAN Route Policies:

1 Navigate to **MANAGE | System Setup > SD-WAN > SD-WAN Route Policies**.

2 Click the **Edit** icon of the Path Selection Profile to edit. The **Edit SD-WAN SD-WAN Route Policy** dialog displays, which is the same as the **Add SD-WAN Route Policy** dialog.

3 Make changes as described in Configuring SD-WAN Route Policies on page 476.

4 Click **OK**.

Deleting SD-WAN Route Policies

You can delete one, multiple, or all SD-WAN Route Policies.

Topics:

Deleting SD-WAN Route Policies

To delete an SD-WAN route policy:

1 Navigate to **MANAGE | System Setup > SD-WAN > SD-WAN Route Policies**.

2 Click the **Delete** icon of the SD-WAN route policy to delete.

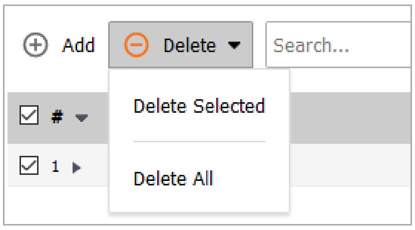
Deleting Multiple SD-WAN Route Policies

To delete multiple SD-WAN SD-WAN Route Policies

1 Navigate to **MANAGE | System Setup > SD-WAN > SD-WAN Route Policies**.

2 Select the Path Selection Profiles to delete.

3 From **Delete** above the **SD-WAN Path Selection Profile** table, select **Delete Selected**.



A confirmation message displays.

Are you sure you wish to delete the selected entries?

4 Click **OK**.

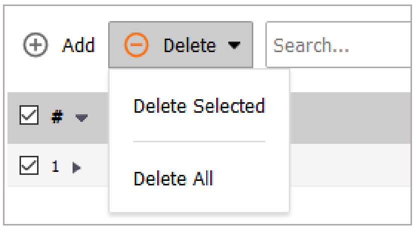
Deleting All SD-WAN Route Policies

To delete all SD-WAN Route Policies:

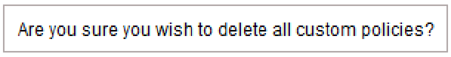
1 Navigate to **MANAGE | System Setup > SD-WAN > SD-WAN Route Policies**.

2 Select the checkbox in the header of the **SD-WAN SD-WAN Route Policies** table. All the Path Selection Profiles are selected.

3 From **Delete** above the **SD-WAN Path Selection Profile** table, select **Delete All**.



A confirmation message displays.



Are you sure you wish to delete all custom policies?

4 Click **OK**.

35

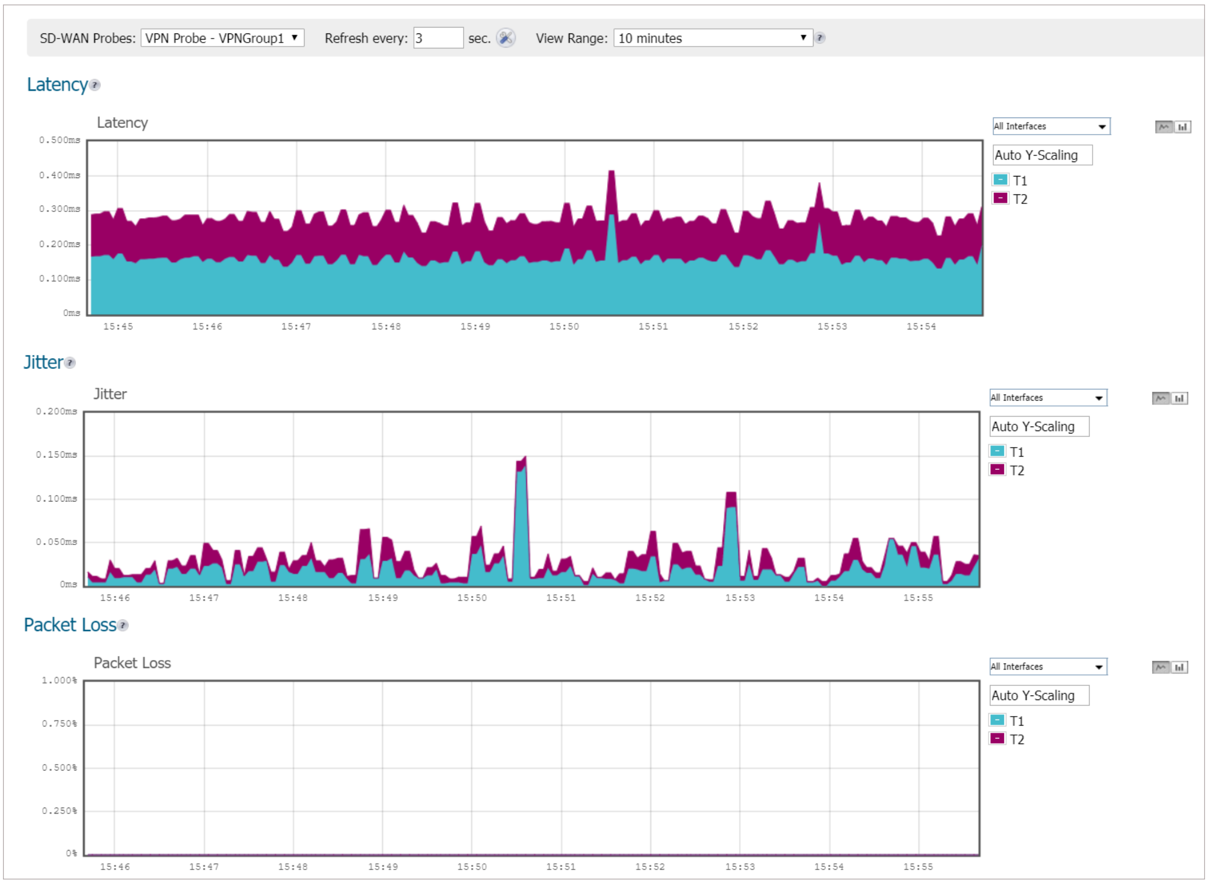
Monitoring SD-WAN

Topics:

- **SD-WAN > SD-WAN Monitor** on page 481

SD-WAN > SD-WAN Monitor

ⓘ **TIP:** You can also view these graphs on the **MONITOR | Appliance Health > SD-WAN Monitor** page; for further information, see *SonicOS NSv 6.5 Monitoring*.



SD-WAN Probes: VPN Probe - VPNGroup1 ▾ Refresh every: 3 sec. View Range: 10 minutes ▾

ⓘ **NOTE:** A chart might be empty or blank if there are no recent data entries received within the viewing range.

To monitor SD-WAN performance:

1 Navigate to **MONITOR | Appliance Health > SD-WAN Monitor.**

2 From **SD-WAN Probes**, select the performance probe you would like to use to monitor.

3 Indicate the Refresh rate, in seconds, in the **Refresh every:** field.

4 Select a **View Range**:

- **60 seconds**
- **2 Minutes**
- **5 minutes**
- **10 minutes** (default)

5 Choose an interface to track or select **All Interfaces** from the drop-down menu on the right side.

6 For scaling ratios, you can enter values such as:

- **Auto** - Auto Y-Scaling
- **<num>[<unit>]** - *num* is a numeric integer. The unit is optional, but can also be empty, K for Kilo, M for Mega, G for Giga, or % for percentages.

  ⓘ **NOTE:** An invalid value defaults to Auto Y-scaling.

7 The two small icons on the right allow you to toggle between line and block displays.

36

Viewing SD-WAN Route Policy Connections

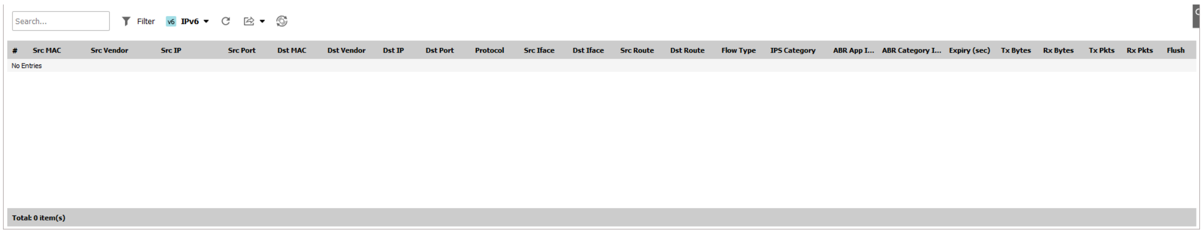
Topics:

- SD-WAN > SD-WAN Connection Logs on page 483

SD-WAN > SD-WAN Connection Logs

You can view the connections that have been associated with SD-WAN Route Policies on the **MANAGE | System Setup > SD-WAN > SD-WAN Connection Logs** page. For information about SonicOS SD-WAN and its functions, see About SD-WAN on page 454.

ⓘ | **TIP:** You can also view this information on the **INVESTIGATE | Logs > SD-WAN Connection Logs** page.



#	Src MAC	Src Vendor	Src IP	Src Port	Dst MAC	Dst Vendor	Dst IP	Dst Port	Protocol	Src Iface	Dst Iface	Src Route	Dst Route	Flow Type	IPS Category	ABR App I...	ABR Category I...	Expiry (sec)	Tx Bytes	Rx Bytes	Tx Pkts	Rx Pkts	Flush
No Entries																							

Total: 0 item(s)

Src MAC MAC address of the appliance that is the source of the connection.

Src Vendor Name of the vendor of the appliance that is the source of the connection.

Src IP IP address of the appliance that is the source of the connection.

Src Port Port on the appliance that is the source of the connection.

Dst MAC MAC address of the appliance that is the destination of the connection.

Dst Vendor Name of the vendor of the appliance that is the destination of the connection.

Dst IP IP address of the appliance that is the destination of the connection.

Dst Port Port on the appliance that is the destination of the connection.

Protocol Protocol used for the connection.

Src Iface Interface on the appliance that is the source of the connection.

Dst Iface Interface on the appliance that is the destination of the connection.

Flow Type Type of data flow control, such as **FTP Control**.

IPS Category Internet Provider Security (IPS) category. If this information is not available or relevant, the column displays **N/A**.

ABR App ID App-Based Routing Application ID.

ABR Category ID App-Based Routing Category ID.

Expiry (sec) Number of seconds until the connection expires.

TX Bytes	Number of bytes transmitted on the connection.
Rx Bytes	Number of bytes received on the connection.
TX Pkts	Number of packets transmitted on the connection.
Rx Pkts	Number of packets received on the connection.
Flush	Displays the **Flush** icon. Clicking the icon flushes the connection.
Total	Total number of entries in the **SD-WAN > SD-WAN Connection Logs** page.

Part 6

SYSTEM SETUP | High Availability

37

About High Availability and Active/Standby Clustering

Topics:

High Availability

This section provides conceptual information about High Availability (HA) in SonicOS NS*v* and describes how to connect the Security Appliances for HA.

Topics:

About High Availability

Topics:

What Is High Availability?

High Availability (HA) is a redundancy design that allows two identical SonicWall Security Appliances running SonicOS NS*v* to be configured to provide a reliable, continuous connection to the public Internet. One SonicWall is configured as the Primary unit, and an identical Security Appliance is configured as the Secondary unit. If the Primary Security Appliance fails, the Secondary Security Appliance takes over to secure a reliable connection between the protected network and the Internet. Two Security Appliances configured in this way are also known as a High Availability Pair (HA Pair).

High Availability provides a way to share SonicWall licenses between two SonicWall Security Appliances when one is acting as a high-availability system for the other. Both Security Appliances must be the same SonicWall model.

To use this feature, you must register the SonicWall Security Appliances on MySonicWall as Associated Products. For further information, see *SonicOS NSv 6.5 Updates*.

High Availability Terminology

Active	The operative condition of a hardware unit. The Active identifier is a logical role that can be assumed by either a Primary or Secondary hardware unit.
Failover	The actual process in which the Standby unit assumes the Active role following a qualified failure of the Active unit. Qualification of failure is achieved by various configurable physical and logical monitoring facilities described in Configuring High Availability on page 496.
HA	High Availability: non-state, hardware failover capability.
IDV	Interface Disambiguation through VLAN.
Preempt	Applies to a post-failover condition in which the Primary unit has failed, and the Secondary unit has assumed the Active role. Enabling Preempt causes the Primary unit to seize the Active role from the Secondary after the Primary has been restored to a verified operational state.
Primary	The principal hardware unit itself. The Primary identifier is a manual designation and is not subject to conditional changes. Under normal operating conditions, the Primary hardware unit operates in an Active role.
Secondary (Backup)	The subordinate hardware unit itself. The Secondary identifier is a relational designation and is assumed by a unit when paired with a Primary unit. Under normal operating conditions, the Secondary unit operates in a Standby mode. Upon failure of the Primary unit, the Secondary unit assumes the Active role.
SHF	State Hardware Failover, a SonicOS NS*v* feature that allows existing network flows to remain active when the primary Security Appliance fails and the backup Security Appliance takes over.
Standby (Idle)	The passive condition of a hardware unit. The Standby identifier is a logical role that can be assumed by either a Primary or Secondary hardware unit. The Standby unit assumes the Active role upon a determinable failure of the Active unit.
STP	Spanning Tree Protocol.

High Availability Modes

High Availability has several operation modes, which can be selected on **MANAGE | System Setup | High Availability > Base Setup**:

- **None**—Selecting **None** activates a standard high availability configuration and hardware failover functionality, with the option of enabling Stateful HA.

- **Active/Standby**—Active/Standby mode provides basic high availability with the configuration of two identical Security Appliances as a High Availability Pair. The Active unit handles all traffic, while the Standby unit shares its configuration settings and can take over at any time to provide continuous network connectivity if the Active unit stops working.

  By default, Active/Standby mode is stateless, meaning that network connections and VPN tunnels must be re-established after a failover. To avoid this, Stateful Synchronization can be licensed and enabled with Active/Standby mode. In this Stateful HA mode, the dynamic state is continuously synchronized between the Active and Standby units. When the Active unit encounters a fault condition, stateful failover occurs as the Standby Security Appliance takes over the Active role with no interruptions to the existing network connections.

High Availability Encryption

High Availability encryption adds security to the communication between appliances in a HA pair. HA control messages between active and standby firewalls, such as heartbeats, configuration sync and HA state information, are encrypted to ensure security for inter-node communication.

This option is available in Active-Standby HA mode only and does not apply to messages exchanged for stateful synchronization even in Active-Standby mode. Discovery messages (find-peer and found-peer) are transmitted without encryption. After the discovery stage, however, all control messages are encrypted between the firewalls:

- Heartbeats
- Messages used for incremental config updates
- `prefSync` messages
- Various messages for sending HA commands between the firewall pair

Crash Detection

The HA feature has a thorough self-diagnostic mechanism for both the Active and Standby Security Appliances. The failover to the standby unit occurs when critical services are affected, physical (or logical) link failure is detected on monitored interfaces, or when the Security Appliance loses power.

The self-checking mechanism is managed by software diagnostics, which check the complete system integrity of the Security Appliance. The diagnostics check internal system status, system process status, and network connectivity. There is a weighting mechanism on both sides to decide which side has better connectivity to avoid potential failover looping.

Critical internal system processes such as NAT, VPN, and DHCP (among others) are checked in real time. The failing service is isolated as early as possible, and the failover mechanism repairs it automatically.

Stateful Synchronization with DHCP

DHCP can be enabled on interfaces in both Active/Standby (non-stateful) and Stateful Synchronization modes.

Only the Active Security Appliance can get a DHCP lease. The Active Security Appliance synchronizes the DHCP IP address along with the DNS and gateway addresses to the Secondary Security Appliance. The DHCP client ID is also synchronized, allowing this feature to work.

During a failover, the Active Security Appliance releases the DHCP lease and, as it becomes the Active unit, the Secondary Security Appliance renews the DHCP lease using the existing DHCP IP address and client ID. The IP address does not change, and network traffic, including VPN tunnel traffic, continues to pass.

If the Active Security Appliance does not have an IP address when failover occurs, the Secondary Security Appliance starts a new DHCP discovery.

Stateful Synchronization with DNS Proxy

DNS Proxy supports stateful synchronization of DNS cache. When the DNS cache is added, deleted, or updated dynamically, it synchronizes to the idle Security Appliance.

About HA Monitoring

On **MANAGE | System Setup > High Availability > Monitoring Settings**, you can configure both physical and logical interface monitoring:

- By enabling physical interface monitoring, you enable link detection for the designated HA interfaces. The link is sensed at the physical layer to determine link viability.
- Logical monitoring involves configuring the SonicWall to monitor a reliable device on one or more of the connected networks.

Failure to periodically communicate with the device by the Active unit in the HA Pair triggers a failover to the Standby unit. If neither unit in the HA Pair can connect to the device, no action is taken.

The Primary and Secondary IP addresses configured on **MANAGE | System Setup | High Availability > Monitoring Settings** can be configured on LAN or WAN interfaces, and are used for multiple purposes:

- As independent management addresses for each unit (supported on all physical interfaces)
- To allow synchronization of licenses between the Standby unit and the SonicWall licensing server
- As the source IP addresses for the probe pings sent out during logical monitoring

Configuring unique management IP addresses for both units in the HA Pair allows you to log in to each unit independently for management purposes. Note that non-management traffic is ignored if it is sent to one of these IP addresses. The Primary and Secondary Security Appliances' unique LAN IP addresses cannot act as an active gateway; all systems connected to the internal LAN needs to use the virtual LAN IP address as their gateway.

If WAN monitoring IP addresses are configured, then X0 monitoring IP addresses are not required. If WAN monitoring IP addresses are not configured, then X0 monitoring IP addresses are required, because in such a scenario the Standby unit uses the X0 monitoring IP address to connect to the licensing server with all traffic routed through the Active unit.

The management IP address of the Secondary/Standby unit is used to allow license synchronization with the SonicWall licensing server, which handles licensing on a per-Security Appliance basis (not per-HA Pair). Even if the Secondary unit was already registered on MySonicWall before creating the HA association, you must use the link on **MANAGE | Updates > Licenses** to connect to the SonicWall server while accessing the Secondary Security Appliance through its management IP address (for more information, see SonicOS NS*v* *Updates*).

When using logical monitoring, the HA Pair pings the specified Logical Probe IP address target from the Primary as well as from the Secondary unit. The IP address set in the Primary IP Address or Secondary IP Address field is used as the source IP address for the ping. If both units can successfully ping the target, no failover occurs. If both cannot successfully ping the target, no failover occurs, as SonicOS NS*v* assumes that the problem is with the target, and not the Security Appliances. If one Security Appliance can ping the target but the other cannot, however, the HA Pair failovers to the unit that can ping the target.

The configuration tasks on **MANAGE | System Setup | High Availability > Monitoring Settings** are performed on the Primary unit and then are automatically synchronized to the Secondary.

About Active/Standby HA

HA allows two identical Security Appliances running SonicOS NS*v* to be configured to provide a reliable, continuous connection to the public Internet. One Security Appliance is configured as the Primary unit, and an identical Security Appliance is configured as the Secondary unit. In the event of the failure of the Primary Security Appliance, the Secondary Security Appliance takes over to secure a reliable connection between the protected network and the Internet. Two Security Appliances configured in this way are also known as a High Availability Pair (HA Pair).

Active/Standby HA provides standard, high availability, and hardware failover functionality with the option of enabling stateful HA.

HA provides a way to share licenses between two Security Appliances when one is acting as a high availability system for the other. To use this feature, you must register the Security Appliances on MySonicWall as Associated Products. Both Security Appliances must be the same SonicWall model.

Topics:

Benefits of Active/Standby HA

- **Increased network reliability** – In a High Availability configuration, the Secondary Security Appliance assumes all network responsibilities when the Primary unit fails, ensuring a reliable connection between the protected network and the Internet.
- **Cost-effectiveness** – High Availability is a cost-effective option for deployments that provide high availability by using redundant Security Appliances. You do not need to purchase a second set of licenses for the Secondary unit in a High Availability Pair.

How Active/Standby HA Works

HA requires one SonicWall Security Appliance configured as the Primary SonicWall, and an identical Security Appliance configured as the Secondary SonicWall. During normal operation, the Primary SonicWall is in an Active state and the Secondary SonicWall in an Standby state. If the Primary device loses connectivity, the Secondary SonicWall transitions to Active mode and assumes the configuration and role of Primary, including the interface IP addresses of the configured interfaces.

Basic Active/Standby HA provides stateless high availability. After a failover to the Secondary Security Appliance, all the preexisting network connections must be reestablished, including the VPN tunnels that must be renegotiated. Stateful Synchronization can be licensed and enabled separately. For more information, see About Stateful Synchronization on page 491.

The failover applies to loss of functionality or network-layer connectivity on the Primary SonicWall. The failover to the Secondary SonicWall occurs when critical services are affected, physical (or logical) link failure is detected on monitored interfaces, or when the Primary SonicWall loses power. The Primary and Secondary SonicWall devices are currently only capable of performing Active/Standby High Availability.

There are two types of synchronization for all configuration settings:

- **Incremental** – If the timestamps are in sync and a change is made on the Active unit, an incremental synchronization is pushed to the Standby unit.
- **Complete** –If the timestamps are out of sync and the Standby unit is available, a complete synchronization is pushed to the Standby unit. When incremental synchronization fails, a complete synchronization is automatically attempted.

About Stateful Synchronization

Stateful Synchronization provides dramatically improved failover performance. When enabled, the network connections and VPN tunnel information is continuously synchronized between the two units so that the Secondary can seamlessly assume all network responsibilities if the Primary Security Appliance fails, with no interruptions to existing network connections.

Topics:

Benefits of Stateful Synchronization

- **Improved reliability** - By synchronizing most critical network connection information, Stateful Synchronization prevents down time and dropped connections in case of Security Appliance failure.
- **Faster failover performance** - By maintaining continuous synchronization between the Primary and Secondary Security Appliances, Stateful Synchronization enables the Secondary Security Appliance to take over in case of a failure with virtually no down time or loss of network connections.
- **Minimal impact on CPU performance** - Typically less than one percent usage.
- **Minimal impact on bandwidth** - Transmission of synchronization data is throttled so as not interfere with other data.

How Does Stateful Synchronization Work?

Stateful Synchronization is not load-balancing. It is an active-standby configuration where the Primary Security Appliance handles all traffic. When Stateful Synchronization is enabled, the Primary Security Appliance actively communicates with the Secondary to update most network connection information. As the Primary Security Appliance creates and updates network connection information (such as VPN tunnels, active users, connection cache entries), it immediately informs the Secondary Security Appliance. This ensures that the Secondary Security Appliance is always ready to transition to the Active state without dropping any connections.

The synchronization traffic is throttled to ensure that it does not interfere with regular network traffic. All configuration changes are performed on the Primary Security Appliance and automatically propagated to the Secondary Security Appliance. The High Availability pair uses the same LAN and WAN IP addresses—regardless of which Security Appliance is currently Active.

When using SonicWall Global Management System (GMS) to manage the Security Appliances, GMS logs into the shared WAN IP address. In case of a failover, GMS administration continues seamlessly, and GMS administrators currently logged into the Security Appliance are not logged out; however, **Get** and **Post** commands might result in a time out with no reply returned.

Synchronized and Non-synchronized Information lists the information that is synchronized and information that is not currently synchronized by Stateful Synchronization.

Synchronized and Non-synchronized Information

Information that is Synchronized	Information that is not Synchronized
Basic connection cache	Deep Packet Inspection (GAV, IPS, and Anti Spyware)
FTP	IPHelper bindings (such as NetBIOS and DHCP)
Oracle SQL*NET	SYNFlood protection information

Synchronized and Non-synchronized Information (Continued)

Information that is Synchronized	Information that is not Synchronized
Real Audio	Content Filtering Service information
RTSP	VoIP protocols
GVC information	ARP cache time outs
Dynamic Address Objects	Active wireless client information
DHCP server information	Wireless client packet statistics
Multicast and IGMP	Rogue AP list
Active users	
ARP	
License information	
Weighted Load Balancing information	
RIP and OSPF information	

Stateful Synchronization Example

In case of a failover, the following sequence of events occurs:

1. A PC user connects to the network, and the Primary Security Appliance creates a session for the user.
2. The Primary Security Appliance synchronizes with the Secondary Security Appliance. The Secondary now has all of the user's session information.
3. The administrator restarts the Primary unit.
4. The Secondary unit detects the restart of the Primary unit and switches from Standby to Active.
5. The Secondary Security Appliance begins to send gratuitous ARP messages to the LAN and WAN switches using the same IP address as the Primary Security Appliance. No routing updates are necessary for downstream or upstream network devices.
6. When the PC user attempts to access a Web page, the Secondary Security Appliance has all of the user's session information and is able to continue the user's session without interruption.

Active/Standby Prerequisites

This section lists the supported platforms, provides recommendations and requirements for physically connecting the units, and describes how to register, associate, and license the units for High Availability.

Topics:

- Supported Platforms and Licensing for HA on page 493
- Maintenance on page 493

Supported Platforms and Licensing for HA

Licenses included with the purchase of a SonicWall Security Appliance are available from MySonicWall. Some platforms require additional licensing to use the HA features.

ⓘ **NOTE:** HA licenses must be activated on each Security Appliance, either by registering the unit on MySonicWall from the SonicOS NS*v* management interface, or by applying the license keyset to each unit if Internet access is not available.

SonicOS NS*v* Expanded licenses or High Availability licenses can be purchased on MySonicWall or from a SonicWall reseller.

ⓘ **NOTE:** Stateful High Availability licenses must be activated on each Security Appliance, either by registering the unit on MySonicWall from the SonicOS NS*v* management interface, or by applying the license keyset to each unit if Internet access is not available.

You can view system licenses on **MANAGE | Updates > Licenses**. This page also provides a way to log into MySonicWall and to apply licenses to a Security Appliance. For further information, see *SonicOS NSv 6.5 Updates*.

There is also a way to synchronize licenses for an HA pair whose Security Appliances do not have Internet access. When live communication with SonicWall's licensing server is not permitted because of a network policy, you can use license keysets to manually apply security services licenses to your Security Appliances. When you register a Security Appliance on MySonicWall, a license keyset is generated for the Security Appliance. If you add a new security service license, the keyset is updated. However, until you apply the licenses to the Security Appliance, it cannot perform the licensed services.

ⓘ **IMPORTANT:** In a High Availability deployment without Internet connectivity, you must apply the license keyset to both of the Security Appliances in the HA pair.

You can view system licenses on **MANAGE | Updates > Licenses**. This page also provides a way to log into MySonicWall. For information about licensing, see *SonicOS NSv 6.5 Updates*.

ⓘ **IMPORTANT:** Even if you first register your Security Appliances on MySonicWall, you must individually register both the Primary and the Secondary Security Appliances from the SonicOS NS*v* management interface while logged into the individual management IP address of each Security Appliance. This allows the Secondary unit to synchronize with the SonicWall license server and share licenses with the associated Primary Security Appliance. When Internet access is restricted, you can manually apply the shared licenses to both Security Appliances.

Maintenance

Topics:

- Removing an HA Association on page 493
- Replacing a SonicWall Security Appliance on page 494

Removing an HA Association

You can remove the association between two SonicWall Security Appliances on MySonicWall at any time. You might need to remove an existing HA association if you replace an Security Appliance or reconfigure your network. For example, if one of your SonicWall Security Appliances fails, you need to replace it. Or, you might need to switch the HA Primary Security Appliance with the Secondary, or HA Secondary, unit after a network reconfiguration. In either case, you must first remove the existing HA association, and then create a new association that uses a new Security Appliance or changes the parent-child relationship of the two units (see Replacing a SonicWall Security Appliance on page 494).

To remove the association between two registered SonicWall Security Appliances:

1 Login to MySonicWall.

2 In the left navigation bar, click **My Products**.

3 On the **My Products** page, under **Registered Products**, scroll down to find the secondary Security Appliance from which you want to remove associations. Click the product **name** or **serial number.**

4 On the **Service Management - Associated Products** page, scroll down to the **Parent Product** section, just above the **Associated Products** section.

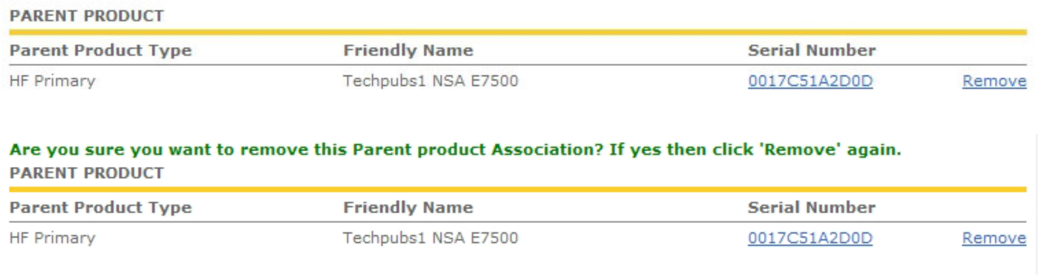
5 Under **Parent Product**, to remove the association for this Security Appliance:

   a Click **Remove**.

   b Wait for the page to reload.

   c Scroll down.

   d Click **Remove** again.



PARENT PRODUCT

Parent Product Type	Friendly Name	Serial Number	
HF Primary	Techpubs1 NSA E7500	0017C51A2D0D	Remove

Are you sure you want to remove this Parent product Association? If yes then click 'Remove' again.

PARENT PRODUCT

Parent Product Type	Friendly Name	Serial Number	
HF Primary	Techpubs1 NSA E7500	0017C51A2D0D	Remove

Replacing a SonicWall Security Appliance

If your SonicWall Security Appliance has a hardware failure while still under warranty, SonicWall replaces it. In this case, you need to remove the HA association containing the failed Security Appliance in MySonicWall, and add a new HA association that includes the replacement. If you contact SonicWall Technical Support to arrange the replacement (known as an RMA), Support often takes care of this for you.

After replacing the failed Security Appliance with the new unit, you can update MySonicWall and your SonicOS NS*v* configuration.

Replacing a failed HA Primary unit is slightly different than replacing an HA Secondary unit. Both procedures are provided in these sections:

- Replacing an HA Primary Unit on page 494
- Replacing an HA Secondary Unit on page 495

Replacing an HA Primary Unit

To replace an HA Primary unit:

1 In the SonicOS NS*v* management interface of the remaining SonicWall Security Appliance (the Secondary unit), on the High Availability page, uncheck **Enable High Availability** to disable it.

2 Check **Enable High Availability**.

The old Secondary unit now becomes the Primary unit. Its serial number is automatically displayed in the Primary SonicWall Serial Number field.

3 Type the serial number for the replacement unit into the **Secondary SonicWall Serial Number** field.

4 Click **Synchronize Settings**.

5 On MySonicWall, remove the old HA association. See Removing an HA Association on page 493.

6 On MySonicWall, register the replacement SonicWall Security Appliance and create an HA association with the new Primary (original Secondary) unit as the HA Primary, and the replacement unit as the HA Secondary. See SonicOS NS*v* *Updates*.

7 Contact SonicWall Technical Support to transfer the security services licenses from the former HA Pair to the new HA Pair.

This step is required when the HA Primary unit has failed because the licenses are linked to the Primary unit in an HA Pair.

Replacing an HA Secondary Unit

To replace an HA Secondary unit:

1 On MySonicWall, remove the old HA association as described in Removing an HA Association on page 493.

2 On MySonicWall, register the replacement SonicWall Security Appliance.

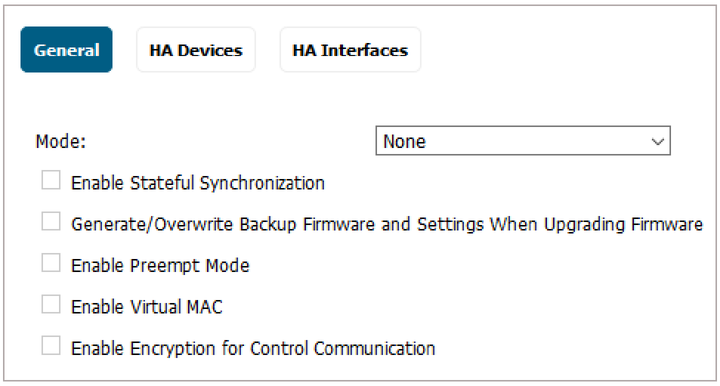
3 Create an HA association with the original HA Primary, using the replacement unit as the HA Secondary as described in Replacing an HA Primary Unit on page 494.

Configuring High Availability

Topics:

- **High Availability > Base Setup** on page 496
  - Configuring Active/Standby High Availability Settings on page 496

High Availability > Base Setup



Mode: None

□ Enable Stateful Synchronization

□ Generate/Overwrite Backup Firmware and Settings When Upgrading Firmware

□ Enable Preempt Mode

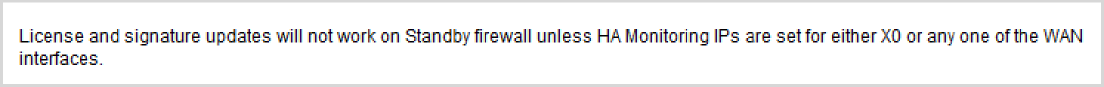
□ Enable Virtual MAC

□ Enable Encryption for Control Communication

You configure High Availability (HA) on **MANAGE | System Setup > High Availability > Base Setup**:

- Configuring Active/Standby High Availability Settings on page 496

License and signature updates do not work on Standby Security Appliances unless HA Monitoring IP addresses are set for either X0 or any WAN interface. If these interfaces have not been set, a message displays:



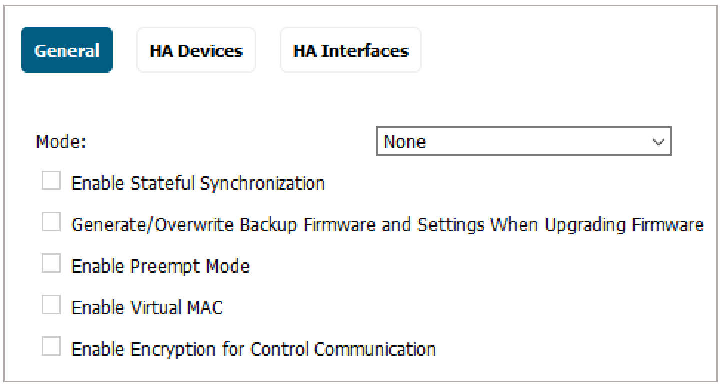
License and signature updates will not work on Standby firewall unless HA Monitoring IPs are set for either X0 or any one of the WAN interfaces.

Configuring Active/Standby High Availability Settings

The configuration tasks on **High Availability > Base Setup** are performed on the Primary firewall and then are automatically synchronized to the Secondary firewall.

To configure Active/Standby:

1 Navigate to **System Setup | High Availability > Base Setup**.



Mode: None

□ Enable Stateful Synchronization

□ Generate/Overwrite Backup Firmware and Settings When Upgrading Firmware

□ Enable Preempt Mode

□ Enable Virtual MAC

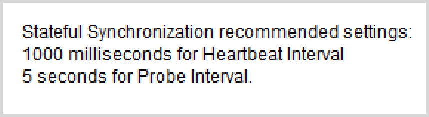
□ Enable Encryption for Control Communication

2 From **Mode**, select **Active/Standby**. The options become available.

3 Select **Enable Stateful Synchronization**. This option is not selected by default.

When Stateful High Availability is not enabled, session state is not synchronized between the Primary and Secondary firewalls. If a failover occurs, any session that had been active at the time of failover needs to be renegotiated.

A recommendation message displays.



Stateful Synchronization recommended settings:
1000 milliseconds for Heartbeat Interval
5 seconds for Probe Interval.

4 Click **OK**.

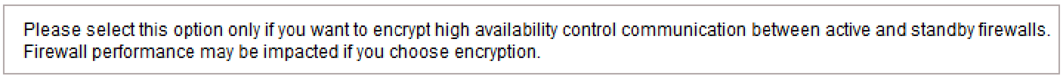
5 To configure the High Availability Pair so that the Primary firewall takes back the Primary role when it restarts after a failure, select **Enable Preempt Mode**. This option is not selected by default.

ⓘ **TIP:** It is recommended that preempt mode be disabled when enabling Stateful High Availability because preempt mode can be over-aggressive about failing over to the Secondary firewall.

6 To encrypt HA control communication between the active and standby firewalls, select **Enable Encryption for Control Communication**. This option is not selected by default.

ⓘ **IMPORTANT:** Firewall performance might be affected if you choose encryption.

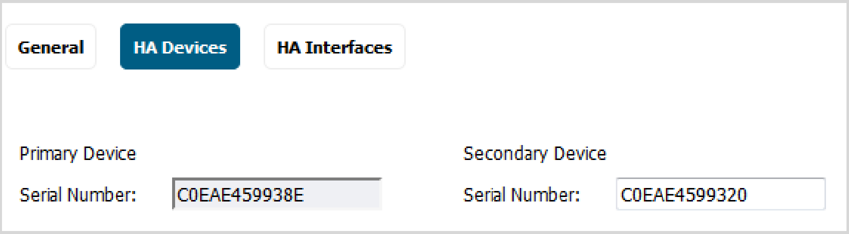
A confirmation message displays:



Please select this option only if you want to encrypt high availability control communication between active and standby firewalls.
Firewall performance may be impacted if you choose encryption.

Click **OK**.

7 Click **HA Devices** to configure the Secondary firewall serial number. The serial number for the Primary Device is displayed, but the field is dimmed and cannot be edited.



Primary Device

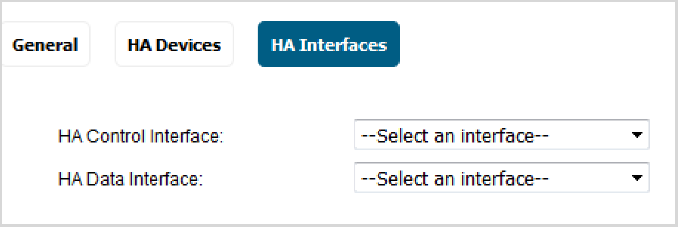
Serial Number: C0EAE459938E

Secondary Device

Serial Number: C0EAE4599320

8 Enter the **Serial Number** of the **Secondary Device**.

9 Click **HA Interfaces**.



HA Control Interface: --Select an interface--

HA Data Interface: --Select an interface--

10 Select the interface for the **HA Control Interface**. This option is dimmed and the interface displayed if the firewall detects that the interface is already configured.

11 Select the interface for the **HA Data Interface**. This option is dimmed and the interface displayed out if the firewall detects that the interface is already configured.

12 When finished with all High Availability configuration, click **Accept**. All settings are synchronized to the Secondary firewall, and the Secondary firewall reboots.

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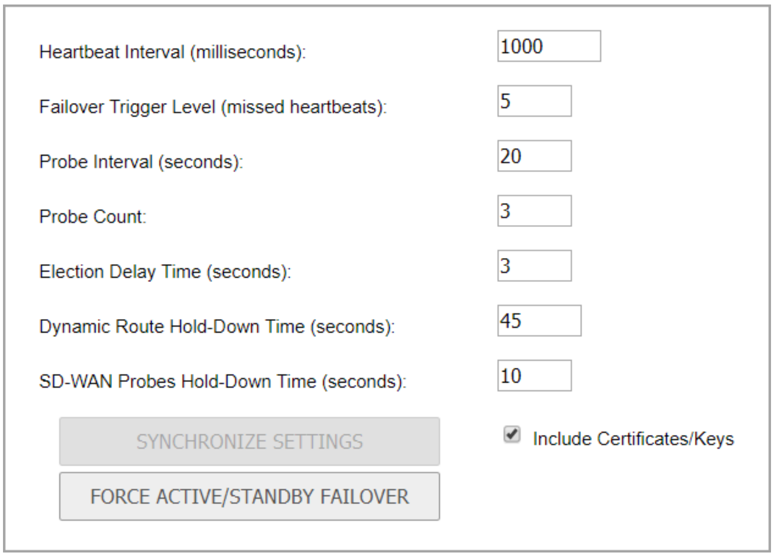
Fine-tuning High Availability

Topics:

High Availability > Advanced Settings



Heartbeat Interval (milliseconds):	1000
Failover Trigger Level (missed heartbeats):	5
Probe Interval (seconds):	20
Probe Count:	3
Election Delay Time (seconds):	3
Dynamic Route Hold-Down Time (seconds):	45
SD-WAN Probes Hold-Down Time (seconds):	10

☑ Include Certificates/Keys

MANAGE | System Setup > High Availability > Advanced Settings provides the ability to fine-tune the High Availability configuration as well as synchronize setting and firmware among the High Availability Security Appliances.

The **Heartbeat Interval** and **Failover Trigger Level (missed heartbeats)** settings apply to the SVRRP heartbeats and HA heartbeats. Other settings on **High Availability > Advanced Settings** apply only to the HA pairs within the Cluster Nodes.

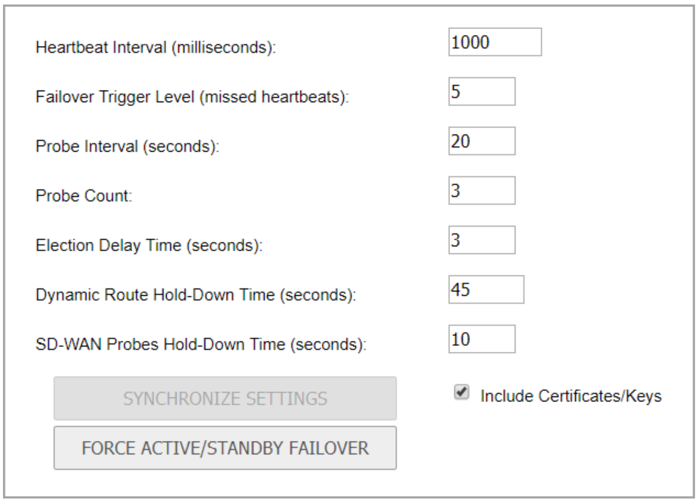
NOTE: For more information on High Availability, see About High Availability on page 486.

Configuring Advanced High Availability

To configure advanced settings:

1 Login as an administrator to the SonicOS NS*v* Management Interface on the Master Node, that is, on the Virtual Group1 IP address (on X0 or another interface with HTTP management enabled).

2 Navigate to **MANAGE | System Setup > High Availability > Advanced Settings**.



Heartbeat Interval (milliseconds):	1000
Failover Trigger Level (missed heartbeats):	5
Probe Interval (seconds):	20
Probe Count:	3
Election Delay Time (seconds):	3
Dynamic Route Hold-Down Time (seconds):	45
SD-WAN Probes Hold-Down Time (seconds):	10

3 Optionally adjust the **Heartbeat Interval** to control how often the Security Appliances in the cluster communicate. This setting applies to all units in the cluster. The default is **1,000** milliseconds (1 second), the minimum value is 1,000 milliseconds, and the maximum is 300000.

NOTE: SonicWall recommends that you set the Heartbeat Interval to at least 1000.

You can use higher values if your deployment handles a lot of network traffic. Lower values can cause unnecessary failovers, especially when the Security Appliance is under a heavy load.

This timer is linked to the **Failover Trigger Level (missed heartbeats)** timer.

4 Set the **Failover Trigger Level** to the number of heartbeats that can be missed before failing over. This setting applies to all units in the cluster. The default is **5**, the minimum is 4, and the maximum is 99.

This timer is linked to the Heartbeat Interval timer. If the **Failover Trigger Level** is set to 5 and the **Heartbeat Interval** is set to 10000 milliseconds (10 seconds), it takes 50 seconds without a heartbeat before a failover is triggered.

5 Set the **Probe Interval** to the interval, in seconds, between probes sent to specified IP addresses to monitor that the network critical path is still reachable. This interval is used in logical monitoring for the local HA pair. The default is **20** seconds, and the allowed range is 5 to 255 seconds.

TIP: SonicWall recommends that you set the interval for at least 5 seconds.

You can set the Probe IP Address(es) on **MANAGE | System Setup > High Availability > Advanced Settings**. See **High Availability > Monitoring Settings** on page 502.

6 Set the **Probe Count** to the number of consecutive probes before SonicOS NS*v* concludes that the network critical path is unavailable or the probe target is unreachable. This count is used in logical monitoring for the local HA pair. The default is **3**, and the allowed range is 3 to 10.

7 Set the **Election Delay Time** to the number of seconds the Primary Security Appliance waits to consider an interface up and stable. The default is **3** seconds, the minimum is 3 seconds, and the maximum is 255 seconds.

8 Set the **Dynamic Route Hold-Down Time** to the number of seconds the newly-active Security Appliance keeps the dynamic routes it had previously learned in its route table. The default value is **45** seconds, the minimum is 0 seconds, and the maximum is 1200 seconds (20 minutes).

NOTE: The **Dynamic Route Hold-Down Time** setting is displayed only when the **Advanced Routing** option is selected on **MANAGE | System Setup > Network > Routing**.

TIP: In large or complex networks, a larger value might improve network stability during a failover

This setting is used when a failover occurs on a High Availability pair that is using either RIP or OSPF dynamic routing. During this time, the newly-active appliance relearns the dynamic routes in the network. When the **Dynamic Route Hold-Down Time** duration expires, SonicOS NS*v* deletes the old routes and implements the new routes it has learned from RIP or OSPF.

9 To have the appliances synchronize all certificates and keys within the HA pair. select **Include Certificates/Keys**. This option is selected by default.

10 (Optional) To synchronize the SonicOS NS*v* preference settings between your primary and secondary HA firewalls, click **SYNCHRONIZE SETTINGS**.

11 (Optional) To test the HA failover functionality is working properly by attempting an Active/Standby HA failover to the secondary Security Appliance, click **FORCE ACTIVE/STANDBY FAILOVER**.

12 When finished with all High Availability configuration, click **ACCEPT**. All settings are synchronized to the Secondary Security Appliance or to other units in the cluster.

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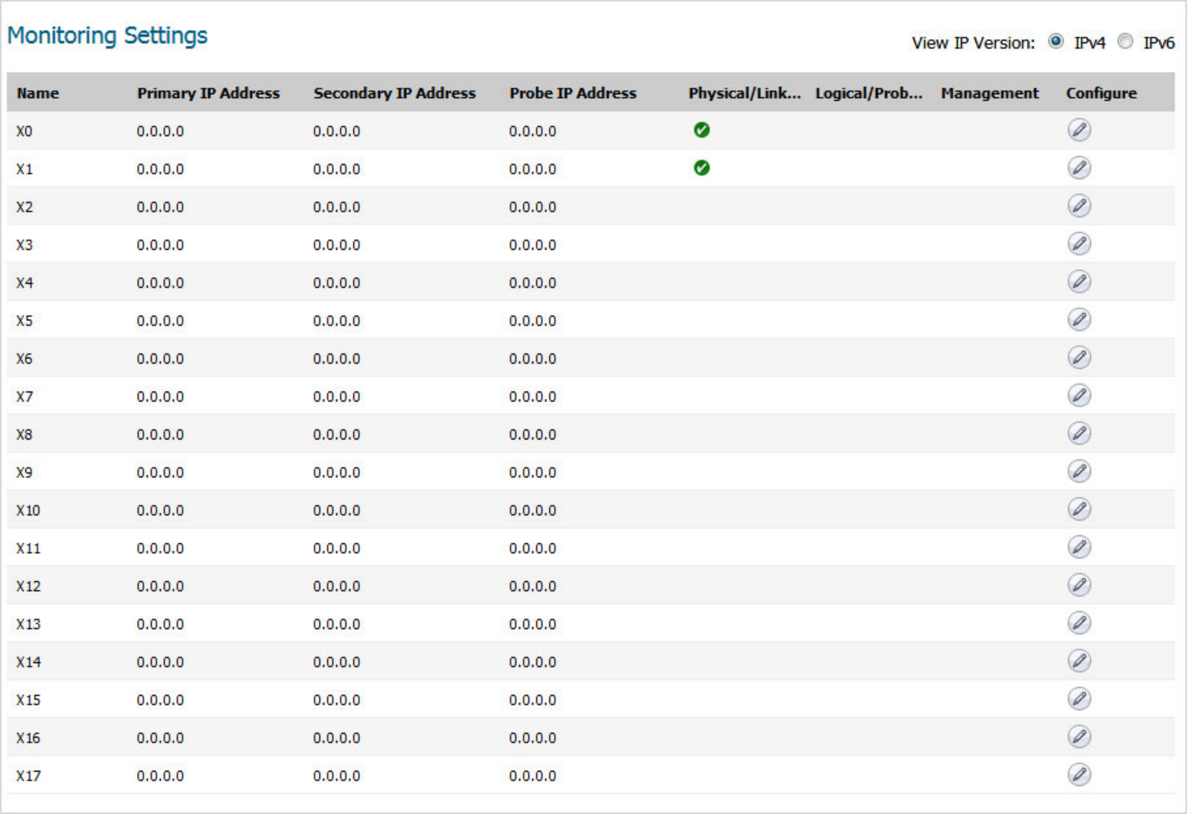
Monitoring High Availability

Topics:

- **High Availability > Monitoring Settings** on page 502
  - Configuring Active/Standby High Availability Monitoring on page 503
  - IPv6 High Availability Monitoring on page 504

High Availability > Monitoring Settings



Monitoring Settings

View IP Version: ● IPv4 ○ IPv6

Name	Primary IP Address	Secondary IP Address	Probe IP Address	Physical/Link...	Logical/Prob...	Management	Configure
X0	0.0.0.0	0.0.0.0	0.0.0.0	✓			✎
X1	0.0.0.0	0.0.0.0	0.0.0.0	✓			✎
X2	0.0.0.0	0.0.0.0	0.0.0.0				✎
X3	0.0.0.0	0.0.0.0	0.0.0.0				✎
X4	0.0.0.0	0.0.0.0	0.0.0.0				✎
X5	0.0.0.0	0.0.0.0	0.0.0.0				✎
X6	0.0.0.0	0.0.0.0	0.0.0.0				✎
X7	0.0.0.0	0.0.0.0	0.0.0.0				✎
X8	0.0.0.0	0.0.0.0	0.0.0.0				✎
X9	0.0.0.0	0.0.0.0	0.0.0.0				✎
X10	0.0.0.0	0.0.0.0	0.0.0.0				✎
X11	0.0.0.0	0.0.0.0	0.0.0.0				✎
X12	0.0.0.0	0.0.0.0	0.0.0.0				✎
X13	0.0.0.0	0.0.0.0	0.0.0.0				✎
X14	0.0.0.0	0.0.0.0	0.0.0.0				✎
X15	0.0.0.0	0.0.0.0	0.0.0.0				✎
X16	0.0.0.0	0.0.0.0	0.0.0.0				✎
X17	0.0.0.0	0.0.0.0	0.0.0.0				✎

On **MANAGE | System Setup > High Availability > Monitoring Settings**, you can configure independent management IP addresses for each unit in the HA Pair, using either LAN or WAN interfaces. You can also configure physical/link monitoring and logical/probe monitoring.

Topics:

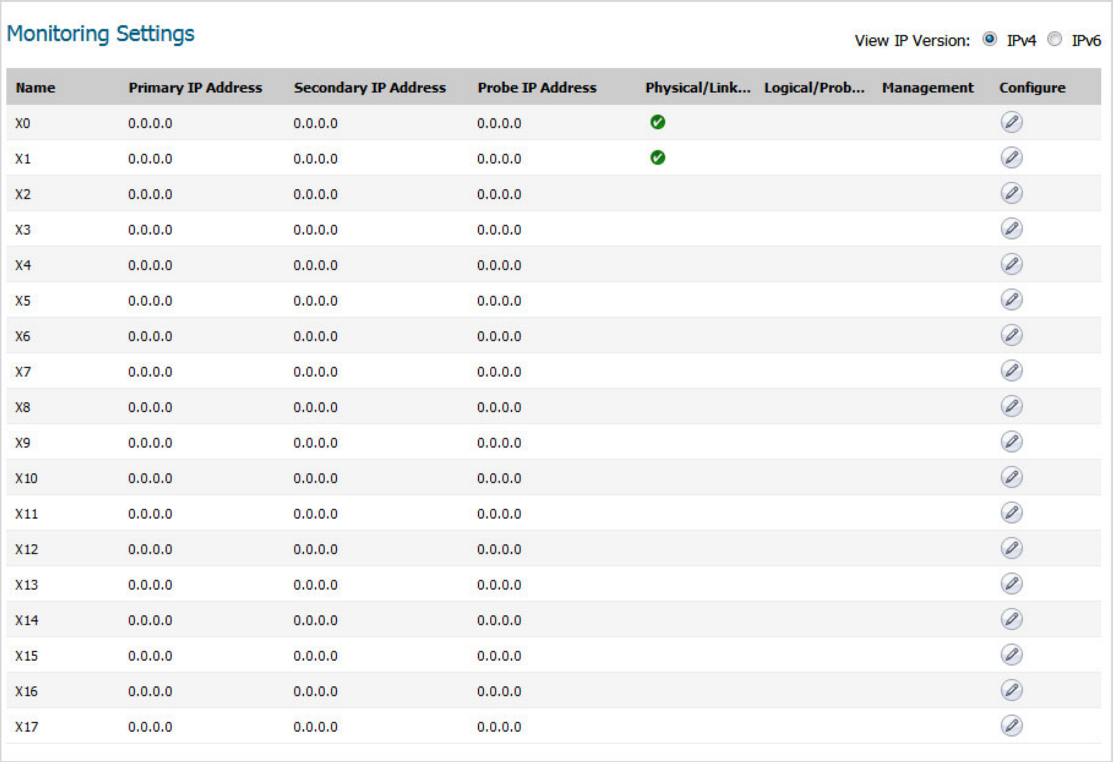
- Configuring Active/Standby High Availability Monitoring on page 503
- IPv6 High Availability Monitoring on page 504

Configuring Active/Standby High Availability Monitoring

To set the independent LAN management IP addresses and configure physical and/or logical interface monitoring:

1 Login as an administrator to the SonicOS NS*v* Management Interface on the Primary SonicWall Security Appliance.

2 Navigate to **MANAGE | System Setup > High Availability > Monitoring Settings**.

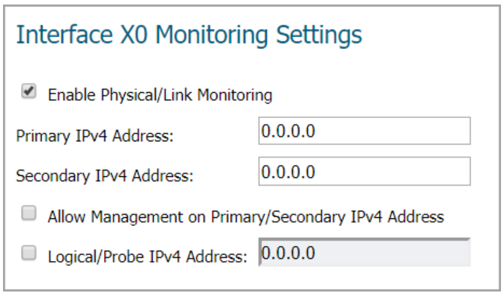


Monitoring Settings

View IP Version: ● IPv4 ○ IPv6

Name	Primary IP Address	Secondary IP Address	Probe IP Address	Physical/Link...	Logical/Prob...	Management	Configure
X0	0.0.0.0	0.0.0.0	0.0.0.0	✓			✎
X1	0.0.0.0	0.0.0.0	0.0.0.0	✓			✎
X2	0.0.0.0	0.0.0.0	0.0.0.0				✎
X3	0.0.0.0	0.0.0.0	0.0.0.0				✎
X4	0.0.0.0	0.0.0.0	0.0.0.0				✎
X5	0.0.0.0	0.0.0.0	0.0.0.0				✎
X6	0.0.0.0	0.0.0.0	0.0.0.0				✎
X7	0.0.0.0	0.0.0.0	0.0.0.0				✎
X8	0.0.0.0	0.0.0.0	0.0.0.0				✎
X9	0.0.0.0	0.0.0.0	0.0.0.0				✎
X10	0.0.0.0	0.0.0.0	0.0.0.0				✎
X11	0.0.0.0	0.0.0.0	0.0.0.0				✎
X12	0.0.0.0	0.0.0.0	0.0.0.0				✎
X13	0.0.0.0	0.0.0.0	0.0.0.0				✎
X14	0.0.0.0	0.0.0.0	0.0.0.0				✎
X15	0.0.0.0	0.0.0.0	0.0.0.0				✎
X16	0.0.0.0	0.0.0.0	0.0.0.0				✎
X17	0.0.0.0	0.0.0.0	0.0.0.0				✎

3 Click the **Configure** icon for an interface on the LAN, such as **X0**. The **Edit HA Monitoring** dialog displays.



Interface X0 Monitoring Settings

☑ Enable Physical/Link Monitoring

Primary IPv4 Address: 0.0.0.0

Secondary IPv4 Address: 0.0.0.0

☐ Allow Management on Primary/Secondary IPv4 Address

☐ Logical/Probe IPv4 Address: 0.0.0.0

4 To enable link detection between the designated HA interfaces on the Primary and Secondary units, leave **Enable Physical Interface Monitoring** selected. This option is selected by default.

5 In the **Primary IPv4/v6 Address** field, enter the unique LAN management IP address of the Primary unit. The default is `0.0.0.0`.

6 In the **Secondary IPv4/v6 Address** field, enter the unique LAN management IP address of the Secondary unit. The default is `0.0.0.0`.

7 Select **Allow Management on Primary/Secondary IP Address**. When this option is enabled for an interface, a green icon appears in the interface's **Management** column in the **Monitoring Settings** table. Management is only allowed on an interface when this option is enabled. This option is not selected by default.

8 In the **Logical Probe IPv4/v6 Address** field, enter the IP address of a downstream device on the LAN network that should be monitored for connectivity. Typically, this should be a downstream router or server. (If probing is desired on the WAN side, an upstream device should be used.) This option is not selected by default.

The Primary and Secondary Security Appliances regularly ping this probe IP address. If both successfully ping the target, no failover occurs. If neither successfully ping the target, no failover occurs, because it is assumed that the problem is with the target, and not the Security Appliances. But, if one Security Appliance can ping the target but the other cannot, failover occurs to the Security Appliance that can ping the target.

The **Primary IPv4/v6 Address** and **Secondary IPv4/v6 Address** fields must be configured with independent IP addresses on a LAN interface, such as X0, (or a WAN interface, such as X1, for probing on the WAN) to allow logical probing to function correctly.

9 Click **OK**.

10 To configure monitoring on any of the other interfaces, repeat Step 3 through Step 9 for each interface.

11 When finished with all High Availability configuration, click **ACCEPT.** All settings are synchronized to the Secondary unit automatically.

IPv6 High Availability Monitoring

For complete information on the SonicOS NS*v* implementation of IPv6, see IPv6 on page 659.

IPv6 High Availability (HA) Monitoring is implemented as an extension of HA Monitoring in IPv4. After configuring HA Monitoring for IPv6, both the primary and backup Security Appliances can be managed from the IPv6 monitoring address, and IPv6 Probing is capable of detecting the network status of HA pairs.

For easy configuration of both IP versions, toggle between IPv6 and IPv4 displays in **MANAGE | System Setup > High Availability > Monitoring Settings**.

The IPv6 HA Monitoring configuration page is inherited from IPv4, so the configuration procedures are almost identical. Just select IPv6 and refer to About High Availability on page 486 and IPv6 HA Monitoring Considerations on page 504 for configuration details.

IPv6 HA Monitoring Considerations

Consider the following when configuring IPv6 HA Monitoring:

- In the **Edit HA Monitoring** dialog, **Enable Physical/Link Monitoring** is dimmed because it has layer 2 properties. That is, the properties are used by both IPv4 and IPv6, so you configure them in the IPv4 monitoring page.
- The primary/backup IPv6 address must be in the same subnet of the interface, and it cannot be same as the global IP and Link-Local-IP of the primary/backup Security Appliance.
- If the primary/backup monitoring IP is set to (not **::**), then they cannot be the same.
- If **Allow Management on Primary/Secondary IPv6 Address** is enabled, then primary/backup monitoring IPv6 addresses cannot be unspecified (that is, **::**).
- If **Logical/Probe IPv6 Address** is enabled, then the probe IP cannot be unspecified.

Part 7

SYSTEM SETUP | VoIP

41

About VoIP

Topics:

About VoIP

Topics:

What is VoIP?

Voice over IP (VoIP) is an umbrella term for a set of technologies that allow voice traffic to be carried over Internet Protocol (IP) networks. VoIP transfers the voice streams of audio calls into data packets as opposed to traditional, analog circuit-switched voice communications used by the public switched telephone network (PSTN).

VoIP is the major driving force behind the convergence of networking and telecommunications by combining voice telephony and data into a single integrated IP network system. VoIP is all about saving cost for companies through eliminating costly redundant infrastructures and telecommunication usage charges while also delivering enhanced management features and calling services features.

VoIP Security

Companies implementing VoIP technologies in an effort to cut communication costs and extend corporate voice services to a distributed workforce face security risks associated with the convergence of voice and data networks. VoIP security and network integrity are an essential part of any VoIP deployment.

The same security threats that plague data networks today are inherited by VoIP but the addition of VoIP as an application on the network makes those threats even more dangerous. By adding VoIP components to your network, you are also adding new security requirements.

VoIP encompasses a number of complex standards that leave the door open for bugs and vulnerabilities within the software implementation. The same types of bugs and vulnerabilities that hamper every operating system and application available today also apply to VoIP equipment. Many of today's VoIP call servers and gateway devices are built on vulnerable Windows and Linux operating systems.

Security Appliance Requirements for VoIP

VoIP is more complicated than standard TCP/UDP-based applications. Because of the complexities of VoIP signaling and protocols, as well as inconsistencies that are introduced when a Security Appliance modifies source address and source port information with Network Address Translation (NAT), it is difficult for VoIP to effectively traverse a standard Security Appliance. Here are a few of the reasons why.

- **VoIP operates using two separate protocols** - A signaling protocol (between the client and VoIP Server) and a media protocol (between the clients). Port/IP address pairs used by the media protocols (RTP/RTCP) for each session are negotiated dynamically by the signaling protocols. Firewalls need to dynamically track and maintain this information, securely opening selected ports for the sessions and closing them at the appropriate time.
- **Multiple media ports are dynamically negotiated through the signaling session** - negotiations of the media ports are contained in the payload of the signaling protocols (IP address and port information). Firewalls need to perform deep packet inspection on each packet to acquire the information and dynamically maintain the sessions, thus demanding extra Security Appliance processing.
- **Source and destination IP addresses are embedded within the VoIP signaling packets** - A Security Appliance supporting NAT translates IP addresses and ports at the IP header level for packets. Fully symmetric NAT Security Appliances adjust their NAT bindings frequently, and might arbitrarily close the pinholes that allow inbound packets to pass into the network they protect, eliminating the service provider's ability to send inbound calls to the customer. To effectively support VoIP it is necessary for a NAT Security Appliance to perform deep packet inspection and transformation of embedded IP addresses and port information as the packets traverse the Security Appliance.
- **Firewalls need to process the signaling protocol suites consisting of different message formats used by different VoIP systems** - Just because two vendors use the same protocol suite does not necessarily mean they interoperate.

To overcome many of the hurdles introduced by the complexities of VoIP and NAT, vendors are offering Session Border Controllers (SBCs). An SBC sits on the Internet side of a Security Appliance and attempts to control the border of a VoIP network by terminating and re-originating all VoIP media and signaling traffic. In essence, SBCs act as a proxy for VoIP traffic for non-VoIP enabled Security Appliances. SonicWall Security Appliances are VoIP enabled Security Appliances that eliminate the need for an SBC on your network.

ⓘ **NOTE:** VoIP is supported on all SonicWall appliances that can run SonicOS NS*v*, as long as the VoIP application is RFC-compliant.

VoIP Protocols

VoIP technologies are built on two primary protocols: SIP and H.323. These protocols can be applied either globally or per firewall rule.

Topics:

SIP

The Session Initiation Protocol (SIP) standard was developed by the Internet Engineering Task Force (IETF). RFC 2543 was released in March 1999. RFC 3261 was released in June 2002. SIP is a signaling protocol for initiating, managing and terminating sessions. SIP supports ‘presence’ and mobility and can run over User Datagram Protocol (UDP) and Transmission Control Protocol (TCP).

Using SIP, a VoIP client can initiate and terminate call sessions, invite members into a conferencing session, and perform other telephony tasks. SIP also enables Private Branch Exchanges (PBXs), VoIP gateways, and other communications devices to communicate in standardized collaboration. SIP was also designed to avoid the heavy overhead of H.323.

A SIP network is composed of the following logical entities:

- **User Agent (UA)** - Initiates, receives and terminates calls.
- **Proxy Server** - Acts on behalf of UA in forwarding or responding to requests. A Proxy Server can fork requests to multiple servers. A back-to-back user agent (B2BUA) is a type of Proxy Server that treats each leg of a call passing through it as two distinct SIP call sessions: one between it and the calling phone and the other between it and the called phone. Other Proxy Servers treat all legs of the same call as a single SIP call session.
- **Redirect Server** - Responds to request but does not forward requests.
- **Registration Server** - Handles UA authentication and registration.

H.323

H.323 is a standard developed by the International Telecommunications Union (ITU). It is a comprehensive suite of protocols for voice, video, and data communications between computers, terminals, network devices, and network services. H.323 is designed to enable users to make point-to-point multimedia phone calls over connectionless packet-switching networks such as private IP networks and the Internet. H.323 is widely supported by manufacturers of video conferencing equipment, VoIP equipment and Internet telephony software and devices.

H.323 uses a combination of TCP and UDP for signaling and ASN.1 for message encoding. H.323v1 was released in 1996 and H.323v5 was released in 2003. As the older standard, H.323 was embraced by many early VoIP players.

An H.323 network consists of four different types of entities:

- **Terminals** - Client end points for multimedia communications. An example would be an H.323 enabled Internet phone or PC.
- **Gatekeepers** - Performs services for call setup and tear down, and registering H.323 terminals for communications. Includes:
  - Address translation.
  - Registration, admission control, and status (RAS).
  - Internet Locator Service (ILS) also falls into this category (although it is not part of H.323). ILS uses LDAP (Lightweight Directory Access Protocol) rather than H.323 messages.
- **Multipoint control units (MCUs)** - Conference control and data distribution for multipoint communications between terminals.
- **Gateways** - Interoperation between H.323 networks and other communications services, such as the circuit-switched Packet Switched Telephone Network (PSTN).

SonicWall's VoIP Capabilities

Topics:

VoIP Security

- **Traffic legitimacy** - Stateful inspection of every VoIP signaling and media packet traversing the Security Appliance ensures all traffic is legitimate. Packets that exploit implementation flaws, causing effects such as buffer overflows in the target device, are the weapons of choice for many attackers. SonicWall Security Appliances detect and discard malformed and invalid packets before they reach their intended target.
- **Application-layer protection for VoIP protocols** - Full protection from application-level VoIP exploits through SonicWall Intrusion Prevention Service (IPS). IPS integrates a configurable, high performance scanning engine with a dynamically updated and provisioned database of attack and vulnerability signatures to protect networks against sophisticated Trojans and polymorphic threats. SonicWall extends its IPS signature database with a family of VoIP-specific signatures designed to prevent malicious traffic from reaching protected VoIP phones and servers.
- **DoS and DDoS attack protection** - Prevention of DoS and DDoS attacks, such as the SYN Flood, Ping of Death, and LAND (IP) attack, which are designed to disable a network or service.
  - Validating packet sequence for VoIP signaling packets using TCP to disallow out of sequence and retransmitted packets beyond window.
  - Using randomized TCP sequence numbers (generated by a cryptographic random number generator during connection setup) and validating the flow of data within each TCP session to prevent replay and data insertion attacks.
  - Ensures that attackers cannot overwhelm a server by attempting to open many TCP/IP connections (that are never fully established-usually caused by a spoofed source address) by using SYN Flood protection.
- **Stateful monitoring** - Stateful monitoring ensures that packets, even though appearing valid in themselves, are appropriate for the current state of their associated VoIP connection.
- **Encrypted VoIP device support** - SonicWall supports VoIP devices capable of using encryption to protect the media exchange within a VoIP conversation or secure VoIP devices that do not support encrypted media using IPsec VPNs to protect VoIP calls.
- **Application-layer protection -** SonicWall delivers full protection from application-level VoIP exploits through SonicWall Intrusion Prevention Service (IPS). SonicWall IPS is built on a configurable, high performance Deep Packet Inspection engine that provides extended protection of key network services including VoIP, Windows services, and DNS. The extensible signature language used in SonicWall's Deep Packet Inspection engine also provides proactive defense against newly discovered application and protocol vulnerabilities. Signature granularity allows SonicWall IPS to detect and prevent attacks based

on a global, attack group, or per-signature basis to provide maximum flexibility and control false positives.

VoIP Network

- **Bandwidth Management (BWM) and Quality-of-Service (QoS)** - Bandwidth management (both ingress and egress) can be used to ensure that bandwidth remains available for time-sensitive VoIP traffic. BWM is integrated into SonicWall Quality of Service (QoS) features to provide predictability that is vital for certain types of applications.
- **WAN redundancy and load balancing** - WAN redundancy and load balancing allows for an interface to act as a secondary WAN port. This secondary WAN port can be used in a simple active/passive setup, where traffic is only routed through it if the primary WAN port is down or unavailable. Load balancing can be performed by splitting the routing of traffic based on destination.
- **High availability** - High availability is provided by SonicOS NS*v* high availability, which ensures reliable, continuous connectivity in the event of a system failure.

VoIP Network Interoperability

- **Plug-and-protect support for VoIP devices** - With SonicOS NS*v*, VoIP device adds, changes, and removals are handled automatically, ensuring that no VoIP device is left unprotected. Using advanced monitoring and tracking technology, a VoIP device is automatically protected as soon as it is plugged into the network behind a Security Appliance.
- **Full syntax validation of all VoIP signaling packets** - Received signaling packets are fully parsed within SonicOS NS*v* to ensure they comply with the syntax defined within their associated standard. By performing syntax validation, the Security Appliance can ensure that malformed packets are not permitted to pass through and adversely affect their intended target.
- **Support for dynamic setup and tracking of media streams** - SonicOS NS*v* tracks each VoIP call from the first signaling packet requesting a call setup, to the point where the call ends. Only based on the successful call progress are additional ports opened (for additional signaling and media exchange) between the calling and called party.

  Media ports that are negotiated as part of the call setup are dynamically assigned by the Security Appliance. Subsequent calls, even between the same parties, uses different ports, thwarting an attacker who might be monitoring specific ports. Required media ports are only opened when the call is fully connected, and are shut down upon call termination. Traffic that tries to use the ports outside of the call is dropped, providing added protection to the VoIP devices behind the Security Appliance.
- **Validation of headers for all media packets** - SonicOS NS*v* examines and monitors the headers within media packets to allow detection and discarding of out-of-sequence and retransmitted packets (beyond window). Also, by ensuring that a valid header exists, invalid media packets are detected and discarded. By tracking the media streams as well as the signaling, SonicWall provides protection for the entire VoIP session.
- **Configurable inactivity timeouts for signaling and media** - In order to ensure that dropped VoIP connections do not stay open indefinitely, SonicOS NS*v* monitors the usage of signaling and media streams associated with a VoIP session. Streams that are idle for more than the configured timeout are shut down to prevent potential security holes.
- **SonicOS NS*v* allows the administrator to control incoming calls** - By requiring that all incoming calls are authorized and authenticated by the H.323 Gatekeeper or SIP Proxy, SonicOS NS*v* can block unauthorized and spam calls. This allows the administrator to be sure that the VoIP network is being used only for those calls authorized by the company.
- **Comprehensive monitoring and reporting** - For all supported VoIP protocols, SonicOS NS*v* offers extensive monitoring and troubleshooting tools:

- Dynamic live reporting of active VoIP calls, indicating the caller and called parties, and bandwidth used.
- Audit logs of all VoIP calls, indicating caller and called parties, call duration, and total bandwidth used. Logging of abnormal packets seen (such as a bad response) with details of the parties involved and condition seen.
- Detailed syslog reports and ViewPoint reports for VoIP signaling and media streams. SonicWall ViewPoint is a Web-based graphical reporting tool that provides detailed and comprehensive reports of your security and network activities based on syslog data streams received from the Security Appliance. Reports can be generated about virtually any aspect of Security Appliance activity, including individual user or group usage patterns and events on specific Security Appliances or groups of Security Appliances, types and times of attacks, resource consumption and constraints.

Supported Interfaces

VoIP devices are supported on the following SonicOS NS*v* zones:

- Trusted zones (LAN, VPN)
- Untrusted zones (WAN)
- Public zones (DMZ)

Supported VoIP Protocols

Topics:

- SIP on page 511
- H.323 on page 512
- SonicWall VoIP Vendor Interoperability on page 512
- CODECs on page 513
- VoIP Protocols on which SonicOS NS*v Does Not Perform Deep Packet Inspection* on page 513

SIP

SonicOS NS*v* provides the following support for SIP:

- Base SIP standard (both RFC 2543 and RFC 3261)
- SIP INFO method (RFC 2976)
- Reliability of provisional responses in SIP (RFC 3262)
- SIP specific event notification (RFC 3265)
- SIP UPDATE method (RFC 3311)
- DHCP option for SIP servers (RFC 3361)
- SIP extension for instant messaging (RFC 3428)
- SIP REFER method (RFC 3515)
- Extension to SIP for symmetric response routing (RFC 3581)

H.323

SonicOS NS*v* provides the following support for H.323:

- VoIP devices running all versions of H.323 (currently 1 through to 5) are supported
- Microsoft's LDAP-based Internet Locator Service (ILS)
- Discovery of the Gatekeeper by LAN H.323 terminals using multicast
- Stateful monitoring and processing of Gatekeeper registration, admission, and status (RAS) messages
- Support for H.323 terminals that use encryption for the media streams
- DHCP Option 150. The DHCP Server can be configured to return the address of a VoIP specific TFTP server to DHCP clients
- In addition to H.323 support, SonicOS NS*v* supports VoIP devices using the following additional ITU standards:
  - T.120 for application sharing, electronic white-boarding, file exchange, and chat
  - H.239 to allow multiple channels for delivering audio, video and data
  - H.281 for Far End Camera Control (FECC)

SonicWall VoIP Vendor Interoperability

Partial List of Devices with which SonicWall VoIP Interoperates lists many devices from leading manufacturers with which SonicWall VoIP interoperates.

Partial List of Devices with which SonicWall VoIP Interoperates

H.323	**SIP**
Soft-Phones: Avaya Microsoft NetMeeting OpenPhone PolyCom SJLabs SJ Phone Telephones/VideoPhones: Avaya Cisco D-Link PolyCom Sony Gatekeepers: Cisco OpenH323 Gatekeeper Gateway: Cisco	Soft-Phones: Apple iChat Avaya Microsoft MSN Messenger Nortel Multimedia PC Client PingTel Instant Xpressa PolyCom Siemens SCS Client SJLabs SJPhone XTen X-Lite Ubiquity SIP User Agent Telephones/ATAs: Avaya Cisco Grandstream BudgetOne Mitel Packet8 ATA PingTel Xpressa PolyCom PolyCom Pulver Innovations WiSIP SoundPoint SIP Proxies/Services: Cisco SIP Proxy Server Brekeke Software OnDo SIP Proxy Packet8 Siemens SCS SIP Proxy Vonage

CODECs

- SonicOS NS*v* **supports media streams from any CODEC** - Media streams carry audio and video signals that have been processed by a hardware/software CODEC (COder/DECoder) within the VoIP device. CODECs use coding and compression techniques to reduce the amount of data required to represent audio/video signals. Some examples of CODECs are:
  - H.264, H.263, and H.261 for video
  - MPEG4, G.711, G.722, G.723, G.728, G.729 for audio

VoIP Protocols on which SonicOS NS*v* Does Not Perform Deep Packet Inspection

SonicWall network Security Appliances do not currently support deep packet inspection for the following protocols; therefore, these protocols should only be used in non-NAT environments.

- Proprietary extensions to H.323 or SIP
- MGCP
- Megaco/H.248
- Cisco Skinny Client Control Protocol (SCCP)
- IP-QSIG
- Proprietary protocols (Mitel's MiNET, 3Com NBX, and so on)

BWM and QoS

One of the greatest challenges for VoIP is ensuring high speech quality over an IP network. IP was designed primarily for asynchronous data traffic, which can tolerate delay. VoIP, however, is very sensitive to delay and packet loss. Managing access and prioritizing traffic are important requirements for ensuring high-quality, real-time VoIP communications.

SonicWall's integrated Bandwidth Management (BWM) and Quality of Service (QoS) features provide the tools for managing the reliability and quality of your VoIP communications.

Quality of Service

QoS encompasses a number of methods intended to provide predictable network behavior and performance. Network predictability is vital to VoIP and other mission critical applications. No amount of bandwidth can provide this sort of predictability, because any amount of bandwidth is ultimately used to its capacity at some point in a network. Only QoS, when configured and implemented correctly, can properly manage traffic, and guarantee the desired levels of network service.

SonicOS NS*v* includes QoS features that adds the ability to recognize, map, modify and generate the industry-standard 802.1p and Differentiated Services Code Points (DSCP) Class of Service (CoS) designators.

How SonicOS NS*v* Handles VoIP Calls

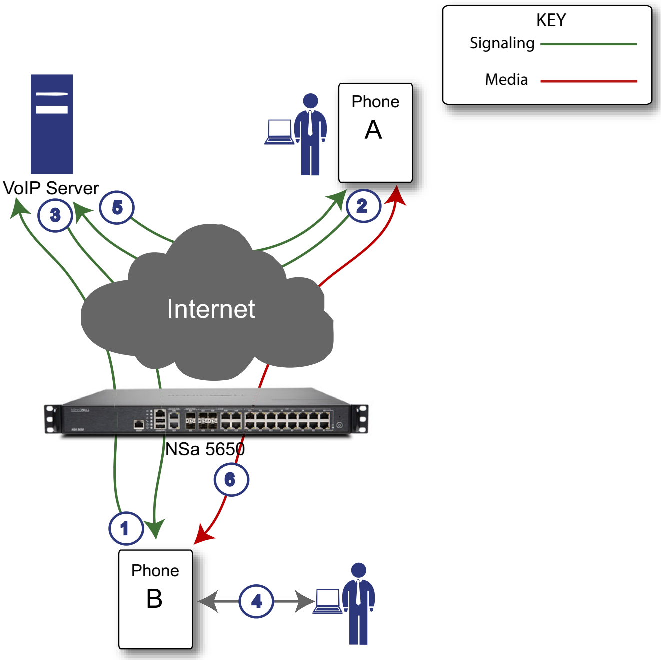
SonicOS NS*v* provides an efficient and secure solution for all VoIP call scenarios. The following are examples of how SonicOS NS*v* handles VoIP call flows:

- Incoming Calls on page 514
- Local Calls on page 515

Incoming Calls

Incoming Call Sequence of Events shows the sequence of events that occurs during an incoming call.

Incoming Call Sequence of Events



The following describes the sequence of events shown in Incoming Call Sequence of Events:

1 **Phone B registers with VoIP server** - The Security Appliance builds a database of the accessible IP phones behind it by monitoring the outgoing VoIP registration requests. SonicOS NS*v* translates between phone B's private IP address and the Security Appliance's public IP address used in registration messages. The VoIP server is unaware that phone B is behind a Security Appliance and has a private IP address—it associates phone B with the Security Appliance's public IP address.

2 **Phone A initiates a call to phone B** - Phone A initiates a call to phone B using a phone number or alias. When sending this information to the VoIP server, it also provides details about the media types and formats it can support as well as the corresponding IP addresses and ports.

3 **VoIP Server validates the call request and sends the request to phone B** - The VoIP server sends the call request to the Security Appliance's public IP address. When it reaches the Security Appliance, SonicOS NS*v* validates the source and content of the request. The Security Appliance then determines phone B's private IP address.

4 **Phone B rings and is answered** - When phone B is answered, it returns information to the VoIP server for the media types and formats it supports as well as the corresponding IP addresses and ports. SonicOS NS*v* translates this private IP information to use the Security Appliance's public IP address for messages to the VoIP server.

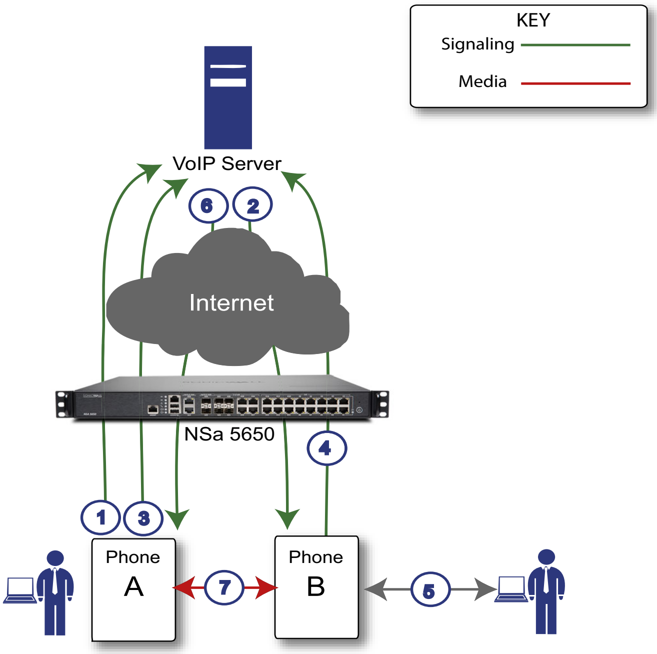
5 **VoIP server returns phone B media IP information to phone A** - Phone A now has enough information to begin exchanging media with Phone B. Phone A does not know that Phone B is behind a Security Appliance, as it was given the public address of the Security Appliance by the VoIP Server.

6 **Phone A and phone B exchange audio/video/data through the VoIP server** - Using the internal database, SonicOS NS*v* ensures that media comes from only Phone A and is only using the specific media streams permitted by Phone B.

Local Calls

Local VoIP Call Sequence of Events shows the sequence of events that occurs during a local VoIP call.

Local VoIP Call Sequence of Events



The following describes the sequence of events shown in Local VoIP Call Sequence of Events:

1 **Phones A and B register with VoIP server** - The Security Appliance builds a database of the accessible IP phones behind it by monitoring the outgoing VoIP registration requests. SonicOS NS*v* translates between the phones' private IP addresses and the Security Appliance's public IP address. The VoIP server is unaware that the phones are behind a Security Appliance. It associates the same IP address for both phones, but different port numbers.

2 **Phone A initiates a call to phone B by sending a request to the VoIP server -** Even though they are behind the same Security Appliance, phone A does not know Phone B's IP address. Phone A initiates a call to phone B using a phone number or alias.

3 **VoIP Server validates the call request and sends the request to phone B -** The VoIP server sends the call request to the Security Appliance's public IP address. The Security Appliance then determines phone B's private IP address.

4 **Phone B rings and is answered** - When phone B is answered, the Security Appliance translate its private IP information to use the Security Appliance's public IP address for messages to the VoIP server.

5 **VoIP Server returns phone B media IP information to phone A -** Both the called and calling party information within the messages are translated by SonicOS NS*v* back to the private addresses and ports for phone A and phone B.

6 **Phone A and phone B directly exchange audio/video/data -** The Security Appliance routes traffic directly between the two phones over the LAN. Directly connecting the two phones reduces the bandwidth requirements for transmitting data to the VoIP server and eliminates the need for the Security Appliance to perform address translation.

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Configuring SonicWall VoIP Features

Topics:

Configuration Tasks

Configuring the SonicWall Security Appliance for VoIP deployments builds on your basic network configuration in the SonicWall Management Interface. This section assumes the Security Appliance is configured for your network environment.

ⓘ | **NOTE:** For general information on VoIP, see About VoIP on page 506.

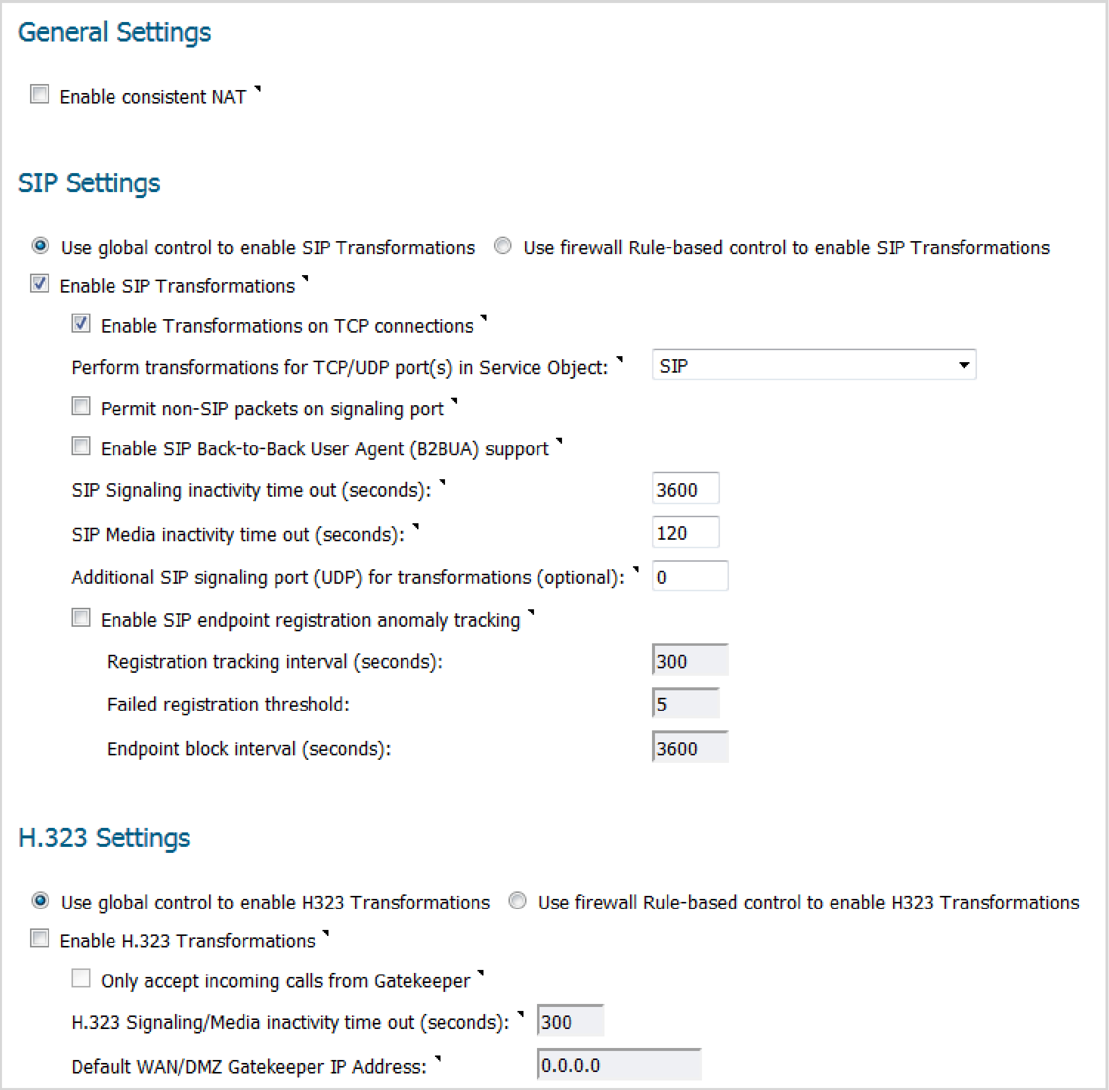
Topics:

Configuring VoIP

You configure VoIP through settings on **MANAGE | System Setup > VOIP**. This page is divided into three sections:

- **General Settings**
- **SIP Settings**

- **H.323 Settings**



General Settings

☐ Enable consistent NAT

SIP Settings

● Use global control to enable SIP Transformations ○ Use firewall Rule-based control to enable SIP Transformations

☑ Enable SIP Transformations

☑ Enable Transformations on TCP connections

Perform transformations for TCP/UDP port(s) in Service Object: SIP

☐ Permit non-SIP packets on signaling port

☐ Enable SIP Back-to-Back User Agent (B2BUA) support

SIP Signaling inactivity time out (seconds): 3600

SIP Media inactivity time out (seconds): 120

Additional SIP signaling port (UDP) for transformations (optional): 0

☐ Enable SIP endpoint registration anomaly tracking

Registration tracking interval (seconds): 300

Failed registration threshold: 5

Endpoint block interval (seconds): 3600

H.323 Settings

● Use global control to enable H323 Transformations ○ Use firewall Rule-based control to enable H323 Transformations

☐ Enable H.323 Transformations

☐ Only accept incoming calls from Gatekeeper

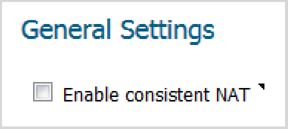
H.323 Signaling/Media inactivity time out (seconds): 300

Default WAN/DMZ Gatekeeper IP Address: 0.0.0.0

Topics:

- General Settings on page 517
- SIP Settings on page 518
- H.323 Settings on page 520

General Settings



General Settings

☐ Enable consistent NAT

There is one option under **General Settings**: **Enable Consistent NAT**.

Consistent NAT enhances standard NAT policy to provide greater compatibility with peer-to-peer applications that require a consistent IP address to connect to, such as VoIP. Consistent NAT uses an MD5 hashing method to consistently assign the same mapped public IP address and UDP Port pair to each internal private IP address and port pair.

For example, NAT could translate the private (LAN) IP address and port pairs, `192.116.168.10/50650` and `192.116.168.20/50655` into public (WAN) IP/port pairs, as shown in IP Address and Port Pairs:

IP Address and Port Pairs

Private IP/Port	Translated Public IP/Port
`192.116.168.10/50650`	`64.41.140.167/40004`
`192.116.168.20/50655`	`64.41.140.167/40745`

With Consistent NAT enabled, all subsequent requests from either host `192.116.168.10` or `192.116.168.20` using the same ports illustrated in IP Address and Port Pairs result in using the same translated address and port pairs. Without Consistent NAT, the port and possibly the IP address change with every request.

> **NOTE:** Enabling Consistent NAT causes a slight decrease in overall security, because of the increased predictability of the address and port pairs. Most UDP-based applications are compatible with traditional NAT. Therefore, do not enable Consistent NAT unless your network uses applications that require it.

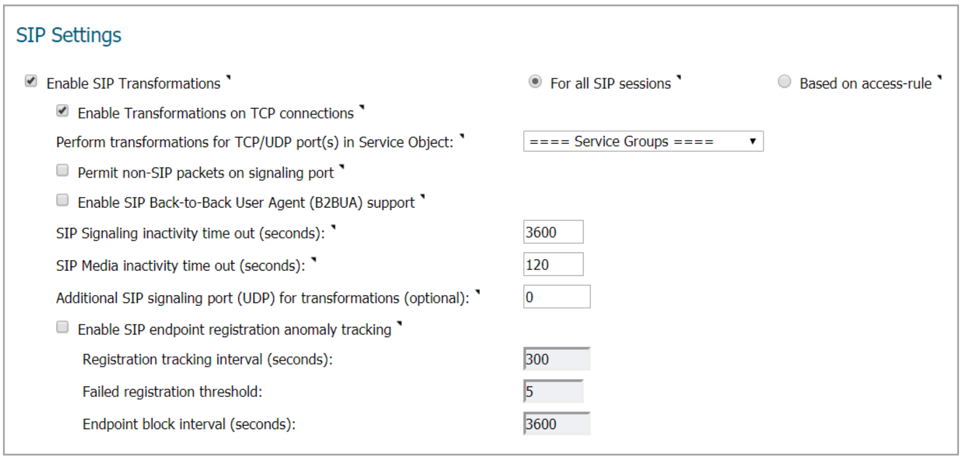
> **IMPORTANT:** For Consistent NAT to work properly, the minimum time interval between calls must be at least 200 msec.

Enabling Consistent NAT

To enable consistent NAT:

1. Select the **Enable Consistent NAT** option. This option is not selected by default.
2. Click **Accept**.

SIP Settings



SIP Settings

☑ Enable SIP Transformations — ● For all SIP sessions — ○ Based on access-rule

☑ Enable Transformations on TCP connections

Perform transformations for TCP/UDP port(s) in Service Object: ==== Service Groups ====

□ Permit non-SIP packets on signaling port

□ Enable SIP Back-to-Back User Agent (B2BUA) support

SIP Signaling inactivity time out (seconds): 3600

SIP Media inactivity time out (seconds): 120

Additional SIP signaling port (UDP) for transformations (optional): 0

□ Enable SIP endpoint registration anomaly tracking

Registration tracking interval (seconds): 300

Failed registration threshold: 5

Endpoint block interval (seconds): 3600

By default, SIP clients use their private IP address in the SIP (Session Initiation Protocol) Session Definition Protocol (SDP) messages that are sent to the SIP proxy. If your SIP proxy is located on the public (WAN) side of the firewall and the SIP clients are located on the private (LAN) side of the firewall, the SDP messages are not translated and the SIP proxy cannot reach the SIP clients.

Enabling SIP

To enable SIP:

1 Navigate to **MANAGE | System Setup > VOIP**.

2 If you are not configuring SIP transformations, go to Step 11.

3 **Enable SIP Transformations** is not selected by default. Select this option to:

- Transform SIP messages between LAN (trusted) and WAN/DMZ (untrusted).

  You need to check this setting when you want the Security Appliance to do the SIP transformation. If your SIP proxy is located on the public (WAN) side of the Security Appliance and SIP clients are on the LAN side, the SIP clients by default embed/use their private IP address in the SIP/Session Definition Protocol (SDP) messages that are sent to the SIP proxy; consequently, these messages are not changed and the SIP proxy does not know how to get back to the client behind the Security Appliance.

- Enable the Security Appliance to go through each SIP message and change the private IP address and assigned port.

- Control and open up the RTP/RTCP ports that need to be opened for SIP session calls to happen.

NAT translates Layer 3 addresses, but not Layer 7 SIP/SDP addresses, which is why you need to select **Enable SIP Transformations** to transform the SIP messages.

ⓘ **TIP:** In general, you should select **Enable SIP Transformations** unless there is another NAT traversal solution that requires this feature to be turned off. SIP Transformations works in bi-directional mode, meaning messages are transformed going from LAN to WAN and vice versa.

When **Enable SIP Transformations** is selected, the other options become available.

4 To perform SIP transformations on TCP-based SIP sessions, select **Enable SIP Transformation on TCP connections**. This option is selected by default.

5 Select a Service Object from Perform transformations to **TCP/UDP port(s) in Service Object**. The default is **SIP**.

6 Selecting **Permit non-SIP packets on signaling port** enables applications such as Apple iChat and MSN Messenger, which use the SIP signaling port for additional proprietary messages. This option is not selected by default.

ⓘ **IMPORTANT:** Enabling this checkbox might open your network to malicious attacks caused by malformed or invalid SIP traffic.

7 If the SIP Proxy Server is being used as a B2BUA, enable the **Enable SIP Back-to-Back User Agent (B2BUA) support** setting. This option is disabled by default and should be enabled only when the Security Appliance can see both legs of a voice call (for example, when a phone on the LAN calls another phone on the LAN).

ⓘ **TIP:** If there is no possibility of the firewall seeing both legs of voice calls (for example, when calls are only made to and received from phones on the WAN), the **Enable SIP Back-to-Back User Agent (B2BUA) support** setting should be disabled to avoid unnecessary CPU usage.

8 Use the **SIP Signaling inactivity time out (seconds)** and **SIP Media inactivity time out (seconds)** options to define the amount of time a call can be idle (no traffic exchanged) before the firewall blocks further traffic. A call goes idle when placed on hold. Specify the maximum idle time when:

- There is no signaling (control) message being exchanged in **SIP Signaling inactivity time out.** The minimum time is 30 seconds, the maximum time is 1000000 seconds (~1.2 days) and the default is **3600** seconds (60 minutes).

- No media (for example, audio or video) packets are being exchanged in the **SIP Media inactivity time out**. The minimum time is 30 seconds, the maximum time is 3600 seconds (one hour), and the default time is **120** seconds (two minutes).

9 Use the **Additional SIP signaling port (UDP) for transformations** setting to specify a non-standard UDP port to carry SIP signaling traffic. Normally, SIP signaling traffic is carried on UDP port 5060. However, a number of commercial VOIP services use different ports, such as 1560. When this setting is non zero (**0** is the default; the maximum value is 65535), the Security Appliance performs SIP transformation on these non-standard ports.

ⓘ | **TIP:** Vonage's VoIP service uses UDP port 5061.

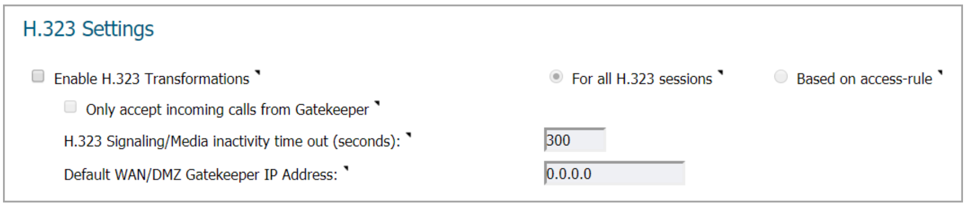
10 To track SIP endpoint registration anomalies, select the **Enable SIP endpoint registration anomaly tracking** option. This option is not selected by default. When it is selected, these options become available:

- **Registration tracking interval (seconds)** – Specify the interval between checking for anomalies. The default is **300** seconds (five minutes).
- **Failed registration threshold** – Specify the number of failed registrations before checking for anomalies. The default is **5** failures.
- **Endpoint block interval (seconds)** – The default is **3600** (60 minutes).

11 Either:

- Click **Accept**.
- Go to H.323 Settings on page 520.

H.323 Settings



H.323 Settings

□ Enable H.323 Transformations | ● For all H.323 sessions | ○ Based on access-rule

□ Only accept incoming calls from Gatekeeper

H.323 Signaling/Media inactivity time out (seconds): 300

Default WAN/DMZ Gatekeeper IP Address: 0.0.0.0

Configuring H.323 Settings

To configure H.323 settings:

1 Navigate to **MANAGE | System Setup > VOIP | H.323 Settings**.

2 If you are not configuring H.323 transformations, go to Step 5.

1 Select **Enable H.323 Transformation** to allow stateful H.323 protocol-aware packet content inspection and modification by the firewall. This option is disabled by default. When the option is selected, the other H.323 options become active.

The firewall performs any dynamic IP address and transport port mapping within the H.323 packets, which is necessary for communication between H.323 parties in trusted and untrusted networks/zones.

Disable the **Enable H.323 Transformation** to bypass the H.323 specific processing performed by the firewall.

2 Select **Only accept incoming calls from Gatekeeper** to ensure all incoming calls go through the Gatekeeper for authentication. The Gatekeeper refuses calls that fail authentication.

3 In the **H.323 Signaling/Media inactivity time out (seconds)** field, specify the amount of time a call can be idle before the firewall blocks further traffic. A call goes idle when placed on hold. The default time is **300** seconds (five minutes), the minimum time is 60 seconds (one minute), and the maximum time is 122400 seconds (34 hours).

4 The **Default WAN/DMZ Gatekeeper IP Address** field has a default value of **0.0.0.0**. Enter the default H.323 Gatekeeper IP address in this field to allow LAN-based H.323 devices to discover the Gatekeeper using the multicast address `225.0.1.41`. If you do not enter an IP address, multicast discovery messages from LAN-based H.323 devices go through the configured multicast handling.

5 Click **Accept**.

Topics:

- Configuring Bandwidth on the WAN Interface on page 521
- Configuring VoIP Access Rules on page 521

Configuring Bandwidth on the WAN Interface

ⓘ **NOTE:** For information on Bandwidth Management (BWM) and configuring BWM on the WAN interface, see SonicOS NSv *Policies*.

Configuring VoIP Access Rules

By default, stateful packet inspection on the firewall allows all communication from the LAN to the Internet and blocks all traffic to the LAN from the Internet. Additional network access rules can be defined to extend or override the default access rules.

If you are defining VoIP access for client to use a VoIP service provider from the WAN, you configure network access rules between source and destination interface or zones to enable clients behind the firewall to send and receive VoIP calls.

ⓘ **TIP:** Although custom rules can be created that allow inbound IP traffic, the firewall does not disable protection from Denial of Service attacks, such as the SYN Flood and Ping of Death attacks.

ⓘ **NOTE:** You must select Bandwidth Management on **MANAGE | System Setup| Network > Interfaces** for the **WAN** interface before you can configure bandwidth management for network access rules.

For how to add access rules for VoIP traffic on the SonicWall Security Appliance, see *SonicOS Policies*.

Configuring VoIP Logging

You can enable the logging of VoIP events, which are displayed on **INVESTIGATE | Logs | Event Logs**. To enable logging of VoIP, see *SonicOS Investigate*.

Part 8

SYSTEM SETUP | Appendices

- Configuring Open Authentication, Social Login, and LHM
- BGP Advanced Routing
- IPv6
- SonicWall Support

A

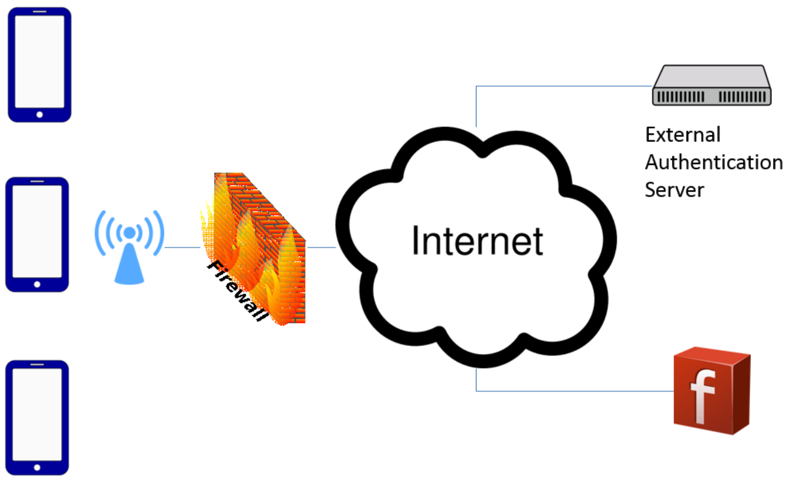
Configuring Open Authentication, Social Login, and LHM

Topics:

About OAuth and Social Login

Social Login is a form of single sign-on authentication that utilizes existing user credentials from social networking services such as Facebook, Twitter, or Google+ to then sign in to a third-party website instead of creating a new login account specifically for that website. The Open Authentication (OAuth) Social Login feature can be used with guest service on LAN zones or DMZ zones using pass-through authentication; see External Authentication Server Login Topology. Pass-though authentication is a method of performing authentication to a domain controller that resides within a trusted domain.

External Authentication Server Login Topology



Topics:

- Benefits of OAuth and Social Login on page 524
- Supported Platforms on page 525

What are OAuth and Social Login?

OAuth is an open standard for authorization. OAuth provides client applications “secure delegated access” to server resources on behalf of a resource owner, and specifies a process for owners to authorize third-party access to their server resources without sharing their credentials.

Social Login, also known as social sign-in, is a form of single sign-on (SSO) using existing login information from a social networking service such as Facebook, Twitter, or Google+ to sign into a third-party website instead of creating a new login account specifically for that website.

Benefits of OAuth and Social Login

Topics:

- OAuth
- Social Login

OAuth

OAuth is a popular mechanism that assists users in sharing data between applications. You can take advantage of OAuth by using it as a login provider for your web application.

Other Advantages

- Limiting customer profiles on the net
- Fewer passwords to track
- Not required to submit a password where trust might be an issue
- You can still prevent access from the OAuth provider
- Lower risk of ID theft. Authentication is assumed by the provider
- Lower risk of bug failure with authentication using previously proven APIs
- Less storage requirement on your data servers

Disadvantages

- You cannot tailor user profiles for your own applications
- User confusion in creating accounts with OAuth providers when they do not have existing accounts

Social Login

Social login is designed to simplify the login process and to realize a higher conversion rate for registrations.

Other Advantages

- Quick registration
- Remember fewer logins
- Target-rich content
- Use of multiple identities
- Collection of visitor data
- Detailed or personalized user experience
- Familiar login environments
- Fewer failed logins
- Ease of use for mobile

Disadvantages

- Low trust level
- Non-Social users excluded
- Data accuracy can be falsified
- Blocked content from Social networks
- Security issues

Supported Platforms

Open Authentication and Social Login is supported on SonicWall firewalls:

- Running SonicOS NS*v* 6.2.7 and higher
- Under GMS Management running GMS 8.3 and higher

Requirements for Development and Production

- A Facebook account
  - Enable Facebook For Developers
- External server
  - Public accessible
  - Has a domain name
  - PHP support
  - SSL Certificate
- SonicWall firewall
  - Can be reached by the external server (by IP or FQDN)

About Lightweight Hotspot Messaging (LHM)

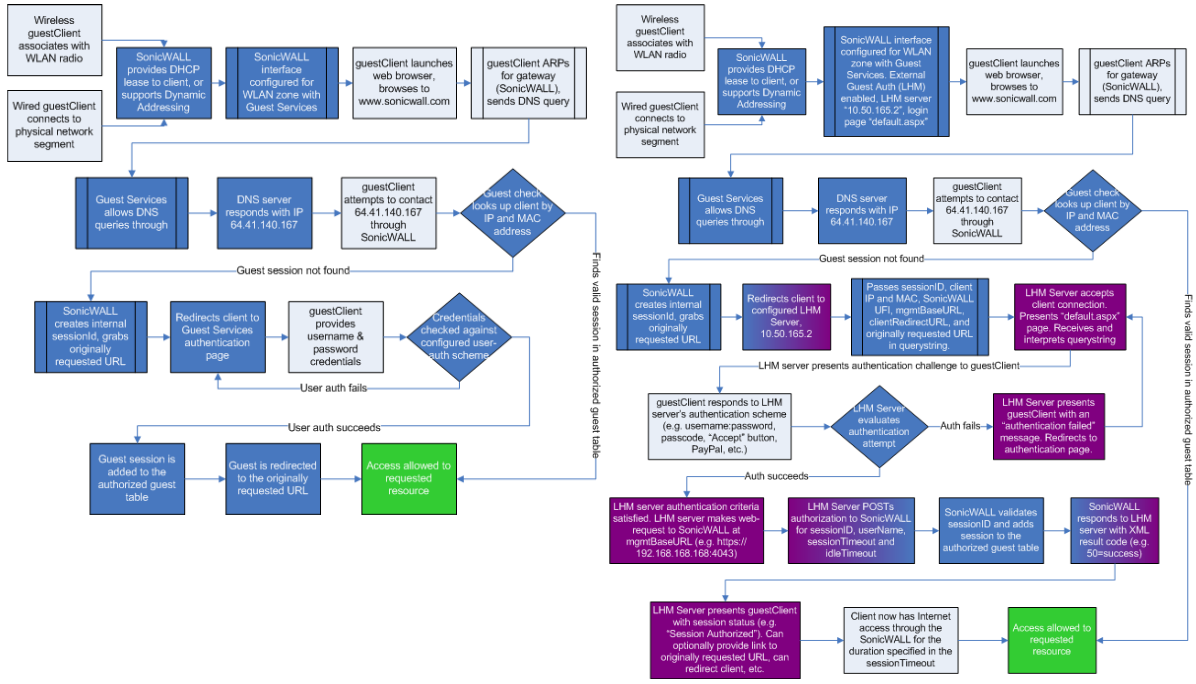
Lightweight Hotspot Messaging (LHM) leverages the SonicWall Guest Service model, wherein users can be classified and authorized for differentiated network access through a SonicWall Security Appliance. For example, the SonicWall can be configured such that any user connecting through an interface belonging to a guest-services-enabled Zone only has access to the Internet (Untrusted network), but does not have access to the LAN (Trusted network). This allows a single firewall to offer simultaneous access to trusted and guest users.

LHM extends the Guest Services model by breaking apart the authentication and authorization processes, thereby allowing the authentication to occur external to the SonicWall. This allows for extensive customization of the authentication interface, and also allows for any kind of imaginable authentication scheme to be used.

A side by side view of the original Guest Services authorization flow and the LHM authorization flow is shown in Comparison of Authorization Flows:

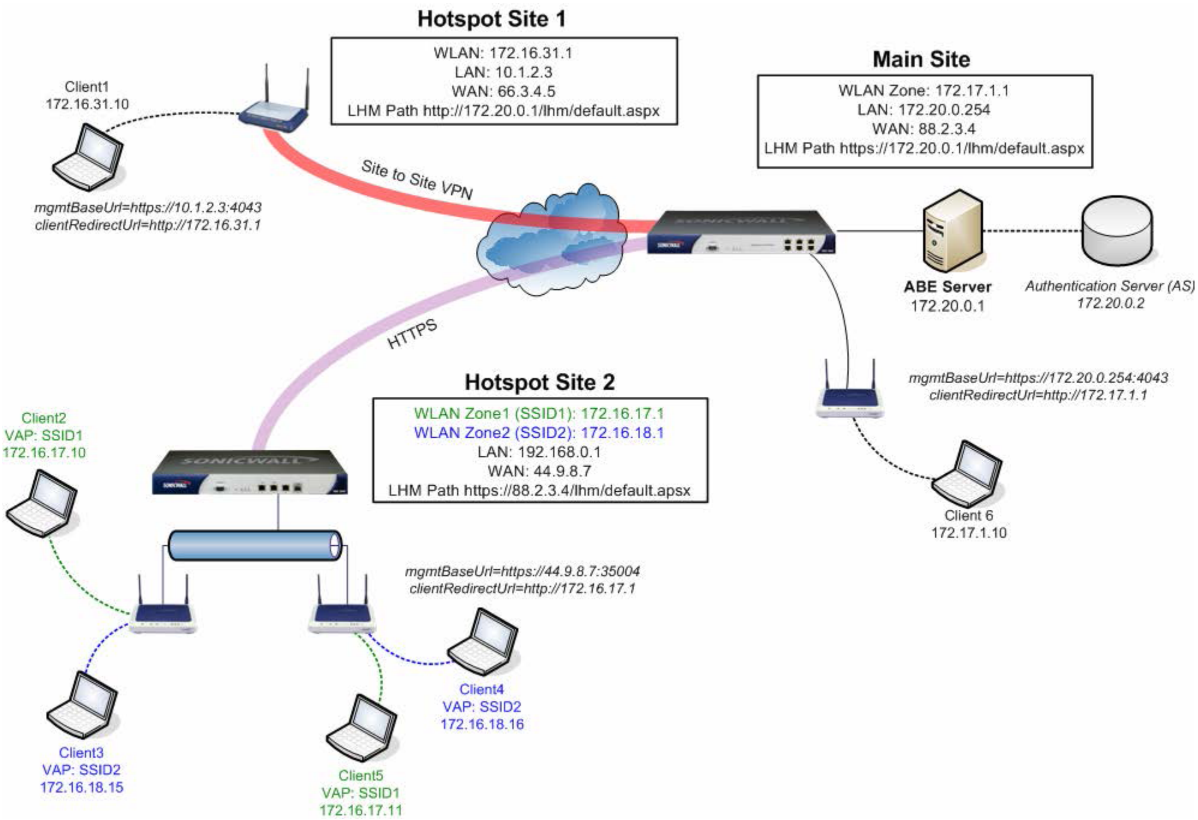
Comparison of Authorization Flows

Original Guest Services Authorization Flow **LHM Authorization Flow**


Wireless guestClient associates with WLAN radio
Wired guestClient connects to physical network segment
SonicWALL provides DHCP lease to client, or supports Dynamic Addressing
SonicWALL interface configured for WLAN zone with Guest Services
guestClient launches web browser, browses to www.sonicwall.com
guestClient ARPs for gateway (SonicWALL), sends DNS query
Guest Services allows DNS queries through
DNS server responds with IP 64.41.140.167
guestClient attempts to contact 64.41.140.167 through SonicWALL
Guest check looks up client by IP and MAC address
Guest session not found
Finds valid session in authorized guest table
SonicWALL creates internal sessionId, grabs originally requested URL
Redirects client to Guest Services authentication page
guestClient provides username & password credentials
Credentials checked against configured user-auth scheme
User auth fails
User auth succeeds
Guest session is added to the authorized guest table
Guest is redirected to the originally requested URL
Access allowed to requested resource
Wireless guestClient associates with WLAN radio
Wired guestClient connects to physical network segment
SonicWALL provides DHCP lease to client, or supports Dynamic Addressing
SonicWALL interface configured for WLAN zone with Guest Services. External Guest Auth (LHM) enabled, LHM server "10.50.165.2", login page "default.aspx"
guestClient launches web browser, browses to www.sonicwall.com
guestClient ARPs for gateway (SonicWALL), sends DNS query
Guest Services allows DNS queries through
DNS server responds with IP 64.41.140.167
guestClient attempts to contact 64.41.140.167 through SonicWALL
Guest check looks up client by IP and MAC address
Guest session not found
Finds valid session in authorized guest table
SonicWALL creates internal sessionId, grabs originally requested URL
Redirects client to configured LHM Server, 10.50.165.2
Passes sessionID, client IP and MAC, SonicWALL UFI, mgmtBaseURL, clientRedirectURL, and originally requested URL in querystring.
LHM Server accepts client connection. Presents "default.aspx" page. Receives and interprets querystring
LHM server presents authentication challenge to guestClient
guestClient responds to LHM server's authentication scheme (e.g. username:password, passcode, "Accept" button, PayPal, etc.)
LHM Server evaluates authentication attempt
Auth fails
LHM Server presents guestClient with an "authentication failed" message. Redirects to authentication page.
Auth succeeds
LHM server authentication criteria satisfied. LHM server makes web-request to SonicWALL at mgmtBaseURL (e.g. https://192.168.168.168:4043)
LHM Server POSTs authorization to SonicWALL for sessionID, userName, sessionTimeout and idleTimeout
SonicWALL validates sessionID and adds session to the authorized guest table
SonicWALL responds to LHM server with XML result code (e.g. 50=success)
LHM Server presents guestClient with session status (e.g. "Session Authorized"). Can optionally provide link to originally requested URL, can redirect client, etc.
Client now has Internet access through the SonicWALL for the duration specified in the sessionTimeout
Access allowed to requested resource

LHM defines the method and syntax for communications between a SonicWall access device and an Authentication Back-End (ABE) for authenticating Hotspot users and providing them parametrically bound network access. LHM Configuration Example depicts a generic configuration.

LHM Configuration Example


Hotspot Site 1
WLAN: 172.16.31.1
LAN: 10.1.2.3
WAN: 66.3.4.5
LHM Path http://172.20.0.1/lhm/default.aspx
Client1
172.16.31.10
mgmtBaseUrl=https://10.1.2.3:4043
clientRedirectUrl=http://172.16.31.1
Site to Site VPN
Main Site
WLAN Zone: 172.17.1.1
LAN: 172.20.0.254
WAN: 88.2.3.4
LHM Path https://172.20.0.1/lhm/default.aspx
ABE Server
172.20.0.1
Authentication Server (AS)
172.20.0.2
mgmtBaseUrl=https://172.20.0.254:4043
clientRedirectUrl=http://172.17.1.1
Client 6
172.17.1.10
HTTPS
Hotspot Site 2
WLAN Zone1 (SSID1): 172.16.17.1
WLAN Zone2 (SSID2): 172.16.18.1
LAN: 192.168.0.1
WAN: 44.9.8.7
LHM Path https://88.2.3.4/lhm/default.apsx
Client2
VAP: SSID1
172.16.17.10
mgmtBaseUrl=https://44.9.8.7:35004
clientRedirectUrl=http://172.16.17.1
Client4
VAP: SSID2
172.16.18.16
Client3
VAP: SSID2
172.16.18.15
Client5
VAP: SSID1
172.16.17.11

LHM allows network operators to provide centralized management of multiple Hotspot locations by providing an interface between SonicWall’s Guest Services and any existing ABE. LHM is an adaptation of the generalized WISPr and GIS specifications.

LHM was designed to satisfy the requirements of a particularly common operational environment rather than a broad set of environments. Specifically, LHM allows for Hotspot user-management and authentication to occur entirely on the network operator’s ABE, supporting any method of account creation and management, and any extent of site customization and branding. This approach enables integration into any existing environment without dependencies upon particular billing, accounting or database systems, and also provides the network operator with unrestricted control of the site’s design, from look-and-feel to redirection.

To provide authentication of IPv4 Traffic and IPv6 Traffic, SonicOS NS*v* supports two external Lightweight Hotspot Messaging (LHM) web servers, one for IPv4 and the other for IPv6. Different traffic types redirect to their corresponding LHM server.

Configuring Facebook for Social Login

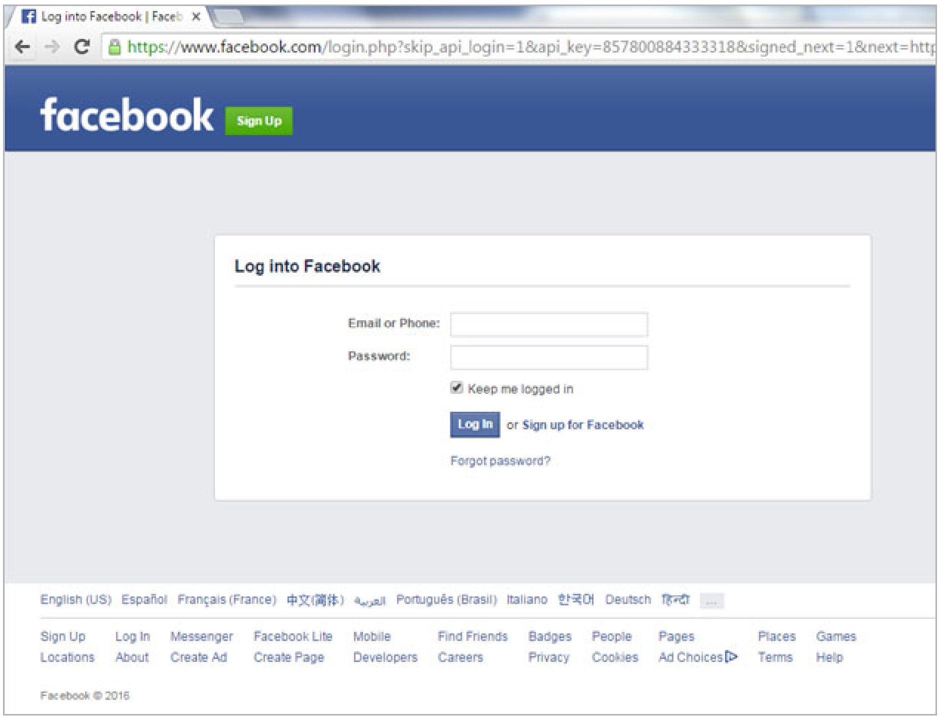
Topics:

- Facebook Settings on page 528
- Client OAuth Settings on page 529
- Guest Status (demo) on page 529

Facebook Settings

To login to Facebook for Developers:

1. Open a Web browser
2. Log in to your Facebook for Developers account at https://developers.facebook.com/.



https://www.facebook.com/login.php?skip_api_login=1&api_key=857800884333318&signed_next=1&next=http

Log into Facebook

Email or Phone:

Password:

☑ Keep me logged in

Log In or Sign up for Facebook

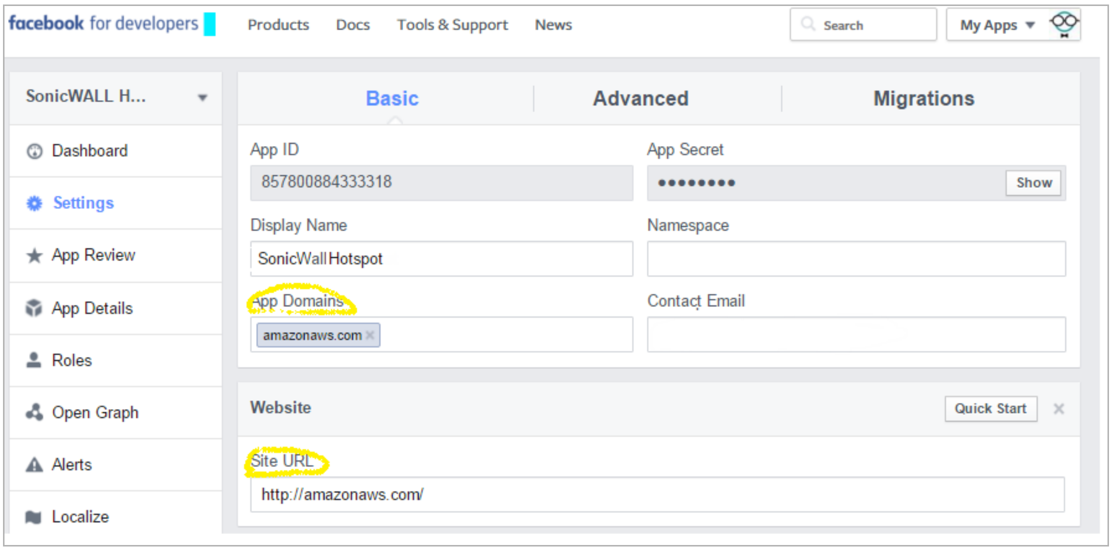
Forgot password?

Log into Facebook | Faceb
facebook
Sign Up
English (US) Español Français (France) 中文(简体) العربية Português (Brasil) Italiano 한국어 Deutsch हिन्दी ...
Sign Up Log In Messenger Facebook Lite Mobile Find Friends Badges People Pages Places Games
Locations About Create Ad Create Page Developers Careers Privacy Cookies Ad Choices Terms Help
Facebook © 2016

3. Complete the login process or sign up for a new developer's account.
4. Click **Settings** in the left column.

   See Example of Settings for Facebook for Developers to fill the form, but adjust the Facebook **Settings** to work with your LHM server.

   Example of Settings for Facebook for Developers



App ID: 857800884333318

App Secret: ••••••••

Display Name: SonicWall Hotspot

Namespace:

App Domains: amazonaws.com

Contact Email:

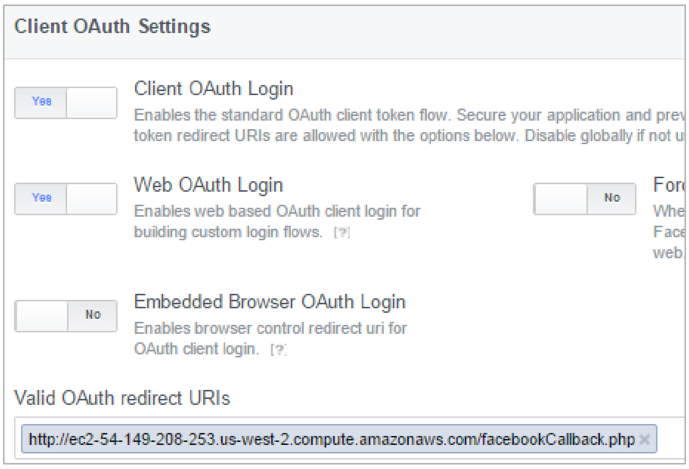
Website

Site URL: http://amazonaws.com/

Client OAuth Settings

You should adjust your Client OAuth settings at Facebook for Developers, https://developers.facebook.com/ (**Products > Facebook Login > Settings**), similar to those shown in Example of OAuth Facebook Settings.

Example of OAuth Facebook Settings



Client OAuth Settings

Yes — Client OAuth Login
Enables the standard OAuth client token flow. Secure your application and prev
token redirect URIs are allowed with the options below. Disable globally if not u

Yes — Web OAuth Login
Enables web based OAuth client login for building custom login flows. [?]

No — For
Whe
Face
web

No — Embedded Browser OAuth Login
Enables browser control redirect uri for OAuth client login. [?]

Valid OAuth redirect URIs

http://ec2-54-149-208-253.us-west-2.compute.amazonaws.com/facebookCallback.php ×

Guest Status (demo)

When a wireless client is allowed access to the SonicWall WiFi, the owner’s account name and information is sent to SonicOS NS*v*. You can collect and store this information in your own databases.

Configuring Open Authentication and Social Login

Topics:

- About Configuring Guest Services on page 529
- About Configuring Social Login on page 530
- Configuring Social Login in SonicOS NS*v* on page 530

About Configuring Guest Services

Although SonicOS NS*v* provides its own guest account management, you can use your own IT infrastructure to better accommodate your business requirements. This configuration can be done by setting up external guest authentication or a social login. **Guest Services** is provided in the **Add/Edit Zone** dialogs of the SonicOS NS*v* LAN zone or DMZ zone (**MANAGE | System Setup > Network > Zones**).

About Configuring Social Login

This feature simplifies cumbersome logins for end users as well as provides reliable demographic information to web developers.

To prepare for configuring Social Login:

1 Create a LAN zone or DMZ zone as described in Adding a New Zone on page 288, and set up or edit a network zone with security capabilities.

2 In SonicOS NS*v*, the external server can also be created or selected as a Lightweight Hotspot Messaging (LHM) server IP or FQDN address object.

Configuring Social Login in SonicOS NS*v*

Setting up your Security Appliance properly requires some configuration. The Security Appliance blocks most Internet applications, but a few should be allowed for this feature to function correctly.

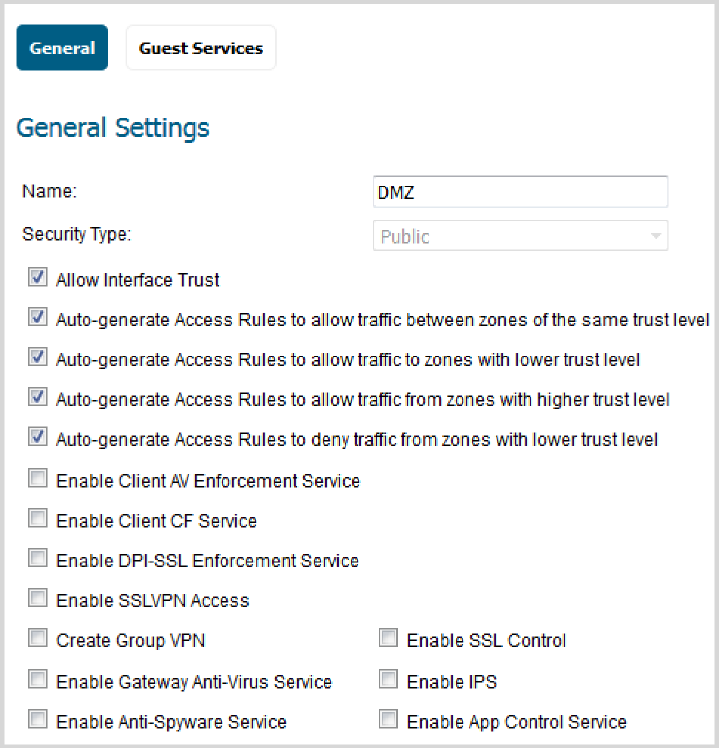
> **IMPORTANT:** An LHM server should be in service before configuring Social Login.

To configure your Security Appliance for Social Login:

1 Navigate to **MANAGE | System Setup > Network > Zones** to set up or edit a network zone. For more information on adding the network zone, Adding a New Zone on page 288.

> **NOTE:** The external server can also be created or selected as an Lightweight Hotspot Messaging (LHM) server IP or FQDN address object.

2 Click the DMZ **Edit** icon to access the DMZ network zone. The **Edit Zone** dialog displays.



General Settings

Name: DMZ

Security Type: Public

☑ Allow Interface Trust

☑ Auto-generate Access Rules to allow traffic between zones of the same trust level

☑ Auto-generate Access Rules to allow traffic to zones with lower trust level

☑ Auto-generate Access Rules to allow traffic from zones with higher trust level

☑ Auto-generate Access Rules to deny traffic from zones with lower trust level

☐ Enable Client AV Enforcement Service

☐ Enable Client CF Service

☐ Enable DPI-SSL Enforcement Service

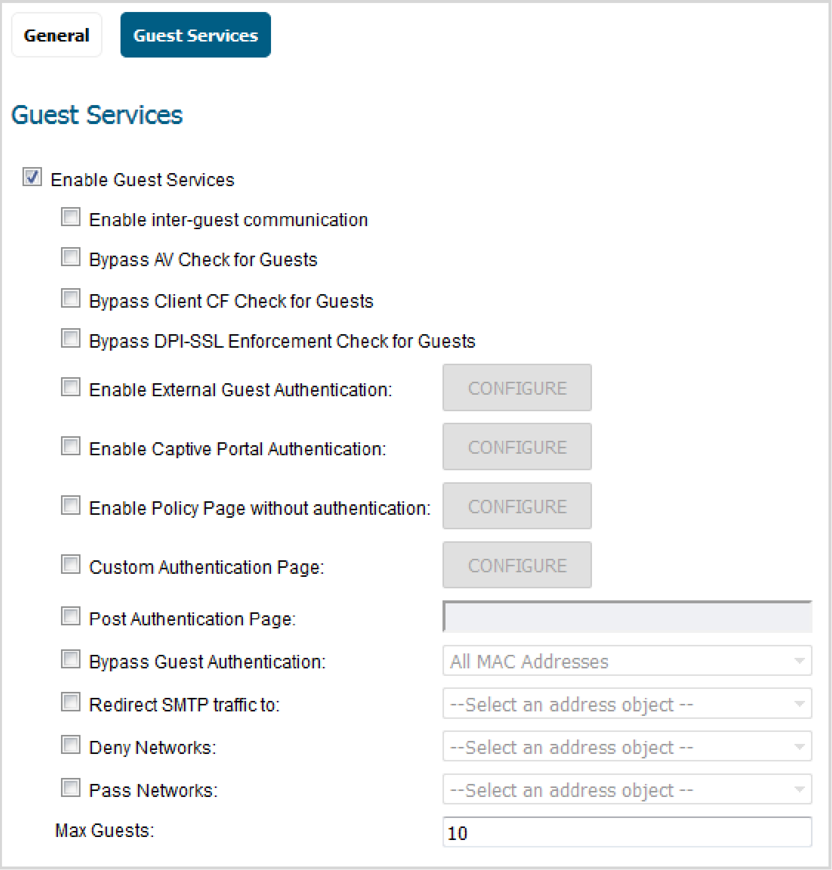
☐ Enable SSLVPN Access

☐ Create Group VPN ☐ Enable SSL Control

☐ Enable Gateway Anti-Virus Service ☐ Enable IPS

☐ Enable Anti-Spyware Service ☐ Enable App Control Service

3 Click **Guest Services**.



Guest Services

☑ Enable Guest Services

□ Enable inter-guest communication

□ Bypass AV Check for Guests

□ Bypass Client CF Check for Guests

□ Bypass DPI-SSL Enforcement Check for Guests

□ Enable External Guest Authentication: CONFIGURE

□ Enable Captive Portal Authentication: CONFIGURE

□ Enable Policy Page without authentication: CONFIGURE

□ Custom Authentication Page: CONFIGURE

□ Post Authentication Page:

□ Bypass Guest Authentication: All MAC Addresses

□ Redirect SMTP traffic to: --Select an address object --

□ Deny Networks: --Select an address object --

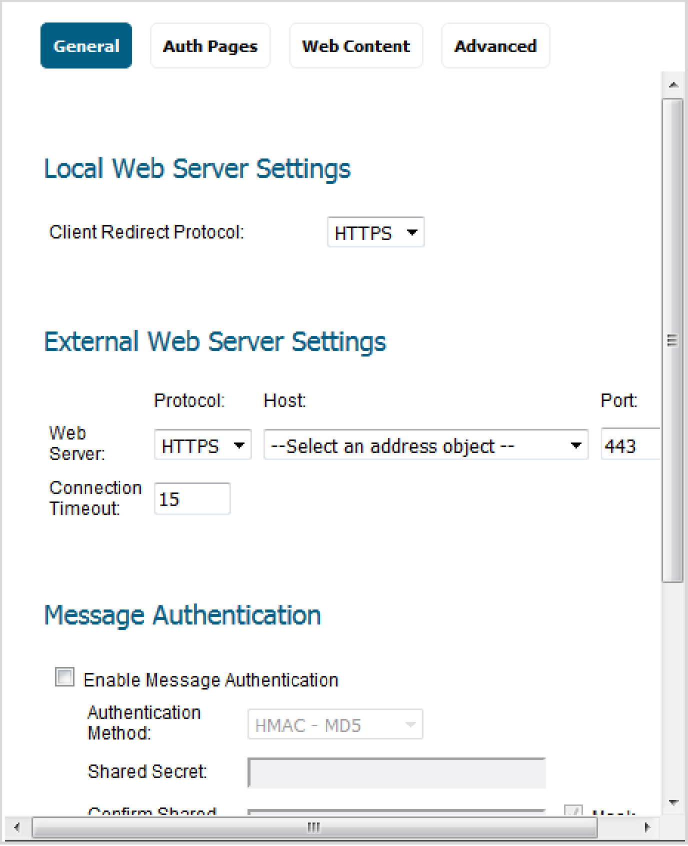
□ Pass Networks: --Select an address object --

Max Guests: 10

4 Select **Enable Guest Services**. The other options activate.

5 Select **Enable External Guest Authentication**. **CONFIGURE** activates and the next four options become unavailable.

6 Click **Configure**. The **External Guest Authentication** dialog displays.



Local Web Server Settings

Client Redirect Protocol: HTTPS

External Web Server Settings

	Protocol:	Host:	Port:
Web Server:	HTTPS	--Select an address object --	443
Connection Timeout:	15		

Message Authentication

□ Enable Message Authentication

Authentication Method: HMAC - MD5

Shared Secret:

Confirm Shared

7 From **Client Redirect Protocol** under **Local Web Server Settings**, select either:

- **HTTPS** (default)
- **HTTP**

SonicOS NSv automatically creates the necessary pass-through authentication network domains for allowing authentication process traffic between the authentication server and the user. The automatically added address object groups are named Default Social Login Pass Group. This address object group is appended to the currently configured pass networks, if any, or it is added into a new group called Social Login Pass Group.

8 For the **External Web Server Settings**, you should have an LHM server already in service:

- Select a protocol: **HTTPS** (default) or **HTTP**.
- Select an Address Object associated with the LHM server from **Host**.
- Enter the TCP port of operations for the selected protocol on the LHM server in **Port**; the default is **80**.
- Enter duration, in seconds, before the LMH server is considered unavailable on a redirect attempt in **Connection Timeout**; the default is **15** minutes. On timeout, the client is presented with the `Server Down` message configured on **Web Content**.

9 To enable message authentication, under **Message Authentication**, select **Enable Message Authentication**. The subordinate options become available. This option is not selected by default.

> **TIP:** Use HMAC digest and embedded querystring in communication with the LHM server. This is useful if you are concerned about message tampering when HTTP is used to communicate with the LHM server. Optional.

a From **Authentication Method**, select:

- **HMAC - MD5** (default)
- **HMAC - SHA1**
- **HMAC - SHA256**

b Enter the shared secret for the hashed MAC in the **Shared Secret** field.

ⓘ **TIP:** If a shared secret is used, it also needs to be configured on the LHM server scripts.

c Repeat the shared secret in the **Confirm Shared Secret** field.

d To see the shared secret in both fields, deselect **Mask Shared Secret**. This option is selected by default.

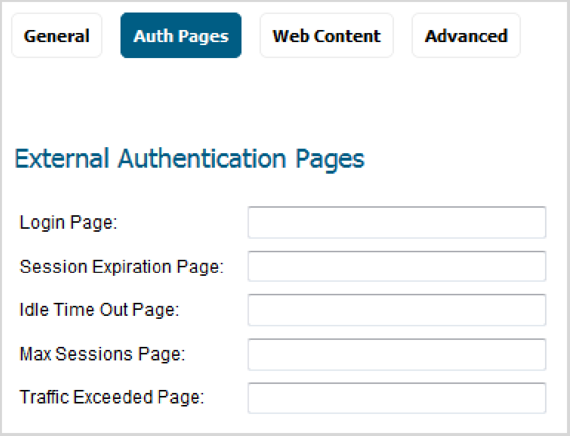
10 In the **Social Network Login** section, select **Enable Social Network Login**. The social network options activate.

11 Select one or more social networks to enable for open authentication:

- **Facebook**
- **Google**
- **Twitter**

SonicOS NS*v* automatically creates the necessary pass-through authentication network domains for allowing authentication process traffic between the authentication server and the user. The automatically added address object groups are named **Default Social Login Pass Group**. This address object group is appended to the currently configured pass networks, if any, or it is added into a new group called **Social Login Pass Group**.

12 Click **Auth Pages**.



External Authentication Pages

Login Page:

Session Expiration Page:

Idle Time Out Page:

Max Sessions Page:

Traffic Exceeded Page:

ⓘ **TIP:** These pages might each be a unique page on the LHM server, or they might all be the same page with a separate event handler for each status message. Examples are provided as follows to work with the newly developed scripts.

13 Enter a **Login Page** location, such as `login.php`, but based on your developer's input pages. These scripts are hosted by your own LHM server, so you should be able to make sure they function correctly.

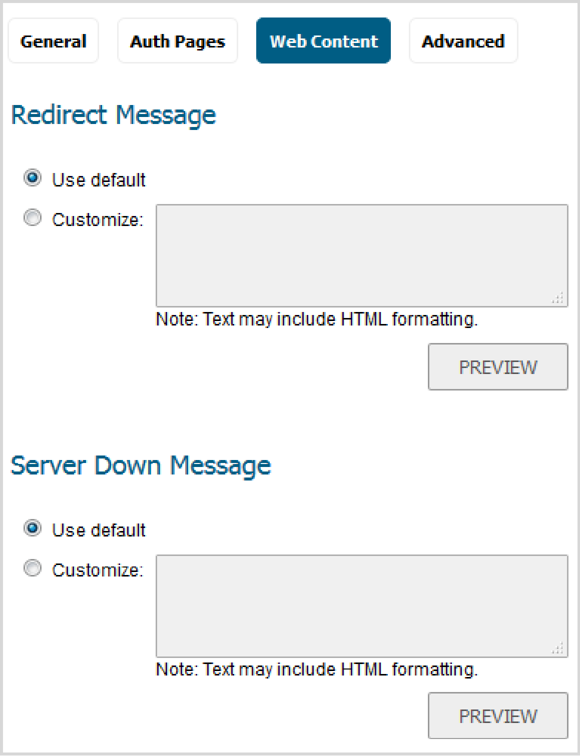
14 Enter the location of the remaining pages:

- **Session Expiration Page** – The page to which the client is redirected when the session expires. After a session expires, the user must create a new LHM session.

- **Idle time Out Page** – The page to which the client is redirected when the idle timer is exceeded. After the idle timer is exceeded, the user can log in again with the same credentials as long as there is time left for the session.
- **Max Sessions Page** – The page to which the client is redirected when the maximum number of sessions has been reached.
- **Traffic Exceeded Page** – The page to which the client is redirected when the maximum traffic has been reached.

15 If you have finished configuring the options, go to Step 27.

16 Optionally, click **Web Content**.



Redirect Message

● Use default
○ Customize:

Note: Text may include HTML formatting.

Server Down Message

● Use default
○ Customize:

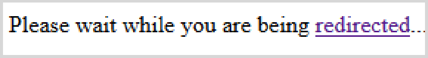
Note: Text may include HTML formatting.

17 Under **Redirect Message**, specify either the default or customized message that is presented to the client (usually for no more than one second) explaining that the session is being redirected to the LHM server. This interstitial page is used (rather than going directly to the LHM server) so that the SonicWall Security Appliance can verify the availability of the LHM server. Choose either:

- **Use default** (default); go to Step 20.
- **Customize** – The customize field and **PREVIEW** become active.

18 Enter the custom message in the **Customize** field. The text might include HTML formatting.

19 To see a preview of your customized message or the default message, click **PREVIEW**. The **External Guest Redirect** message displays, for example, the default message:



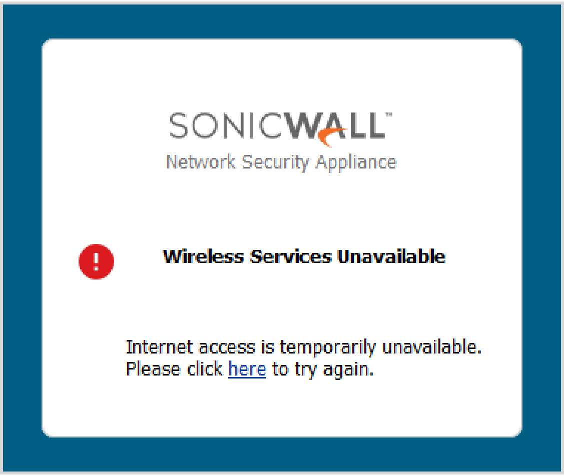
Please wait while you are being redirected...

20 Under **Server Down Message**, you can specify a default or customized message that is presented to the client when the Redirector determines that the LHM server in unavailable. Choose either:

- **Use default** (default); go to Step 21.

- **Customize** – Enter the custom message in the **Customize** field. The text might include HTML formatting.

21 To see a preview of your customized message or the default message, click **PREVIEW**. The **Wireless Services Unavailable** message displays, for example, the default message:

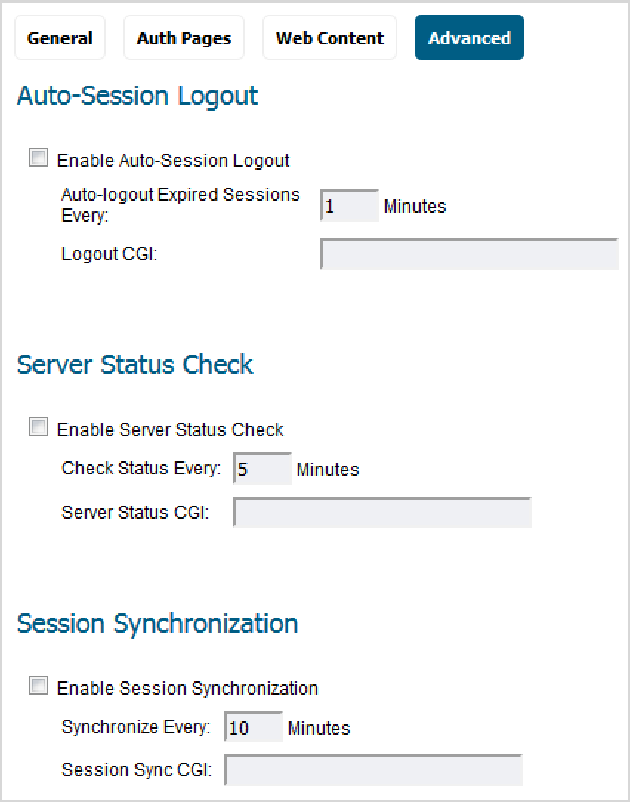


Wireless Services Unavailable

Internet access is temporarily unavailable.
Please click here to try again.

22 If you have finished configuring the options, go to Step 27.

23 Optionally, click **Advanced**.



Auto-Session Logout

□ Enable Auto-Session Logout

Auto-logout Expired Sessions Every: 1 Minutes

Logout CGI:

Server Status Check

□ Enable Server Status Check

Check Status Every: 5 Minutes

Server Status CGI:

Session Synchronization

□ Enable Session Synchronization

Synchronize Every: 10 Minutes

Session Sync CGI:

24 To specify the time increment and the page to which the SonicWall Security Appliance POSTs when a session is logged out (either automatically or manually), in the Auto Session Logout section, select **Enable Auto-Session Logout**. The two suboptions become available. This option is not selected by default.

a To specify the time increment for logging out auto-sessions, specify the number of minutes in **Auto-logout Expired Sessions Every Minutes** field. The default is **1** minute.

b Enter the logout common gateway interface (CGI) in **Logout CGI**.

25 To specify the time increment and the page to which the Security Appliance POSTs to determine the availability of components on or behind the LHM server (such as a back-end database), in the **Server Status Check** section, select **Enable Server Status Check**. The two suboptions become available. This option is not selected by default.

a To specify the time increment for checking the server status, specify the number of minutes in **Check Status Every Minutes** field. The default is **1** minute.

b Enter the server status CGI in **Server Status CGI**.

26 To specify the time increment and the page to which the Security Appliance POSTs the entire Guest Services session table, in the **Session Synchronization** section, select **Enable Session Synchronization**. The two suboptions become available. This option is not selected by default.

a To specify the time increment for posting the Guest Services session table, specify the number of minutes in **Synchronization Minutes** field. The default is **10** minutes.

b Enter the session synchronization CGI in **Session Synch CGI**.

27 Click **OK.**

Verifying the Social Login Configuration

You can verify the correct configuration of Open Authentication and Social Login by viewing **MANAGE | Policies > Objects**. For more information about objects, see SonicOS NS*v* *Policies*.

To verify settings:

1 Navigate to **MANAGE | Policies > Objects > Address Objects**.

2 Select **Address Groups**, which should show:

- Domains have been added automatically.
- Facebook, Google, and/or Twitter login traffic can pass through successfully.

Using Social Login, LHM, and ABE

Topics:

About ABE

The ABE consists of a Web Server (WS) to host content for user interaction and an (optional) Authentication Server (AS) to provide directory services authentication. The AS can be any kind of user authentication mechanism, including, but not limited to LDAP or AD; the only requirement is that the WS can communicate with the AS for authentication purposes. The WS and AS can be administered on a single server or on separate servers.

LHM also provides the ability for the AS to use the SonicWall Security Appliance's internal user database for user authentication. For details on messaging, see Message Format on page 543, Local Authentication Request on page 544, and Local Authentication Reply on page 544.

The ABE needs to communicate with the Hotspot SonicWall to exchange result codes and session information. All communications are HTTPS and can occur either directly (such as to the LAN, WAN, X0 interface of the SonicWall Security Appliance) or over a VPN tunnel to one of the SonicWall Security Appliance's management interface addresses. The LHM management interface is automatically derived through a route (path) lookup, and only the management interface(s) accepts LHM management messaging through automatically added Access Rules.

LHM communications occur on a specific LHM management port that must be defined on the SonicWall Security Appliance, and the LHM management port must be different from the standard HTTPS Management port.

To allow the ABE to communicate with the SonicWall, and to redirect clients to the appropriate interface on the SonicWall, two parameters are constructed by the SonicWall and passed (among others) through the client redirect to the ABE. The following communication parameters must be used for all communications between the ABE and the SonicWall.

- *`mgmtBaseUrl`* - The IP address and the port that the ABE uses to communicate with the SonicWall. It is composed of the HTTPS protocol designator, the IP of the selected LHM management interface, and the LHM port (such as `https://10.1.2.3:4043`).
- *`clientRedirectUrl`* - The IP address (and optionally the port) on the SonicWall to which clients are redirected during various phases of the session, namely the LAN management IP on the TZW.

The parameter values are passed to the ABE by the SonicWall during Session Creation (see Session Popup Window on page 538) and during the Session State Sync (see Message Format on page 543), and should be used by the ABE as the base in the construction of all relevant URLs. The following are the pages on the SonicWall Security Appliance that is referenced by the ABE:

- *`wirelessServicesUnavailable.html`* – ABE is unavailable message. This redirect is typically sent by the SonicWall, but can also be referenced by the ABE. Text is configurable.
- *`externalGuestRedirect.html`* – Initial redirect message provided by the SonicWall on session creation. Text is configurable.
- *`externalGuestLogin.cgi`* – The page to which the ABE posts session creation data.
- *`externalGuestLogoff.cgi`* – The page to which the ABE posts session termination data.
- *`localGuestLogin.cgi`* – The page to which the ABE posts for authenticating user credentials against the SonicWall's internal user database.
- *`createGuestAccount.cgi`* – The page to which the ABE posts to create a guest account in the SonicWall's internal user database.
- *`externalGuestUpdateSession.cgi`* – The page to which the ABE posts to update the *sessionLifetime* and *idleTimeout* parameters of an existing session (see Session Update on page 542).

For communications from the SonicWall to the ABE, URLs (including host, port, and page/resource) hosted on the ABE is fully configurable at the SonicWall Security Appliance. The host can be specified using either an IP address or fully qualified domain name (FQDN). When using FQDN, the name is resolved upon first use and is stored by the SonicWall as an IP address.

Session Life Cycle

The following sections describe the phases of a session life cycle, as well as the Session Popup Window and Web Server (WS) Status Check components:

- Session Popup Window on page 538
- Idle Timeout on page 538
- Session Timeout on page 539
- User Logout on page 539
- Administrator Logout (Optional) on page 540
- Web Server Status Check on page 541
- Session State Sync on page 542
- Message Authentication on page 542
- Session Update on page 542

Session Popup Window

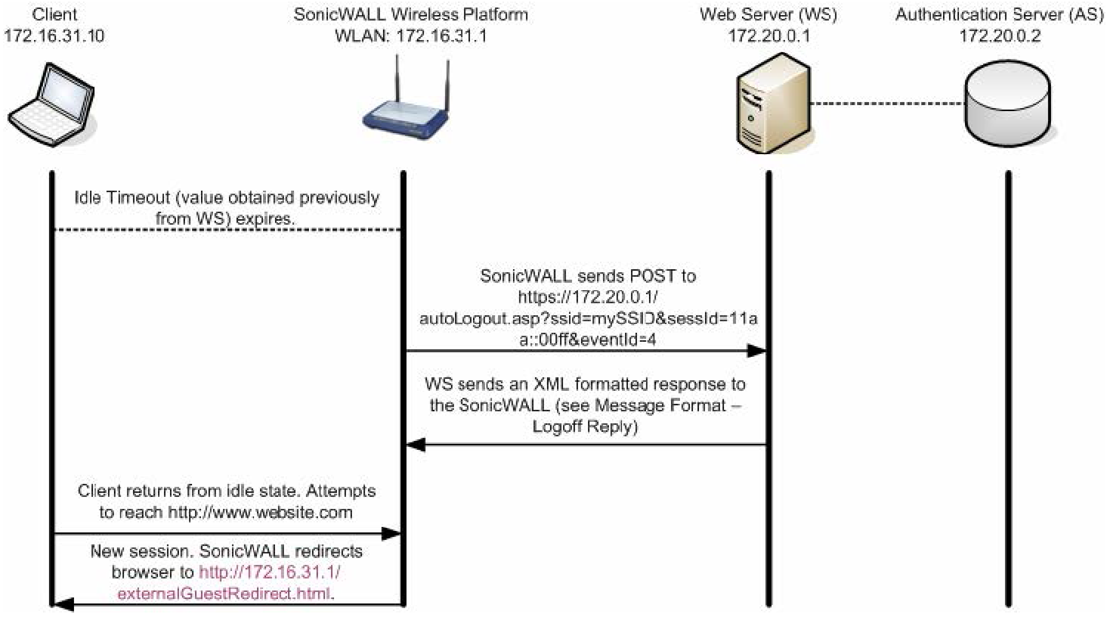
It is recommended that sessions be managed through a Session Popup window. This should be a browser window instantiated at the time of Session Creation providing session time information (such as lifetime, idle timeout value, timer countdowns) and **Logout**. Sample code is provided.

- Clicking **Logout** ends the session and triggers a User Logout event.
- Attempting to close the window should provide a warning message that closing the window ends the session.
- Closing the window ends the session and triggers a User Logout event.

Idle Timeout

Idle timeout occurs when the idle timeout is exceeded.

Idle Timeout Flow


Client
172.16.31.10
SonicWALL Wireless Platform
WLAN: 172.16.31.1
Web Server (WS)
172.20.0.1
Authentication Server (AS)
172.20.0.2
Idle Timeout (value obtained previously from WS) expires.
SonicWALL sends POST to https://172.20.0.1/ autoLogout.asp?ssid=mySSID&sessId=11aa::00ff&eventId=4
WS sends an XML formatted response to the SonicWALL (see Message Format – Logoff Reply)
Client returns from idle state. Attempts to reach http://www.website.com
New session. SonicWALL redirects browser to http://172.16.31.1/ externalGuestRedirect.html.

1 Idle timer (as set during Session Popup Window on page 538) expires.

2 Because the client's browser might not be open at this time, we do not initiate this process with a redirect. Instead, SonicWall sends a POST to the WS at: `https://172.20.0.1/autoLogout.asp?ssid=mySSID&sessId=11aa::00ff&eventId=4` (see Message Format on page 543 for Logoff event IDs).

- The resource to which the POST is sent is configurable on the Security Appliance from **MANAGE | System Setup | Network > Zones**. Edit the zone (on the **Edit Zone** dialog: **Guest Services > External Guest Authentication > Advanced > Auto-Session Logout > Logout CGI**.
- The WS hosted page must expect and interpret the *sessId* and *eventId* values.

3 The WS sends an XML result to the WS in the same connection. Results are described in Logoff Reply on page 545.

4 If the client returns from the idle state and attempts to reach a web resource, the Security Appliance redirects the user to the internal `externalGuestRedirect.html` page, starting the session creation process over (see Session Popup Window on page 538).

ⓘ **NOTE:** To conserve resources, it is recommended that the idle timeout be set to a maximum of 10 minutes.

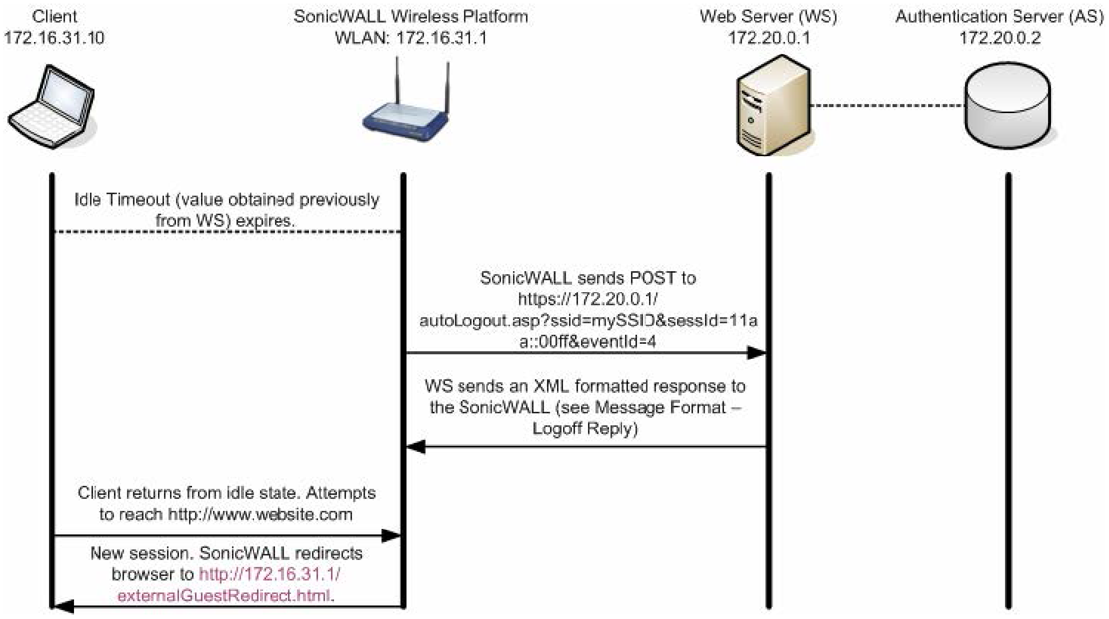
Session Timeout

The event occurs when the Session lifetime expires. The exchange is the same as the Idle Timeout above, except the Session Timeout *eventId* value is 3 instead of 4 for an Idle Timeout.

User Logout

Event occurs when the user actively ends the session by closing their Session Popup window or by using **Logout** provided on the Session Popup window. The Session Popup window is the preferred method for user logout; however, the same result can be achieved without this method by allowing the session's lifetime to expire. The latter removes the dependency on the Session Popup window, but manages resources less efficiently.

User Logout Flow


Client
172.16.31.10
SonicWALL Wireless Platform
WLAN: 172.16.31.1
Web Server (WS)
172.20.0.1
Authentication Server (AS)
172.20.0.2
Idle Timeout (value obtained previously from WS) expires.
SonicWALL sends POST to https://172.20.0.1/autoLogout.asp?ssid=mySSID&sessId=11aa::00ff&eventId=4
WS sends an XML formatted response to the SonicWALL (see Message Format – Logoff Reply)
Client returns from idle state. Attempts to reach http://www.website.com
New session. SonicWALL redirects browser to http://172.16.31.1/externalGuestRedirect.html.

1 Client logs out using **Logout**, or closes the session popup window.

2 The WS sends a POST to: `https://10.1.2.3:4043/externalGuestLogoff.cgi?sessId=11aa::00ff&eventId=1` (for Logoff event IDs, see Message Format on page 543).

- `sessId` — The value generated during Session Creation (see Session Popup Window on page 538) by the Security Appliance, which is used by the Security Appliance and the WS for indexing clients.
- `eventId` — Describes the logoff request event.

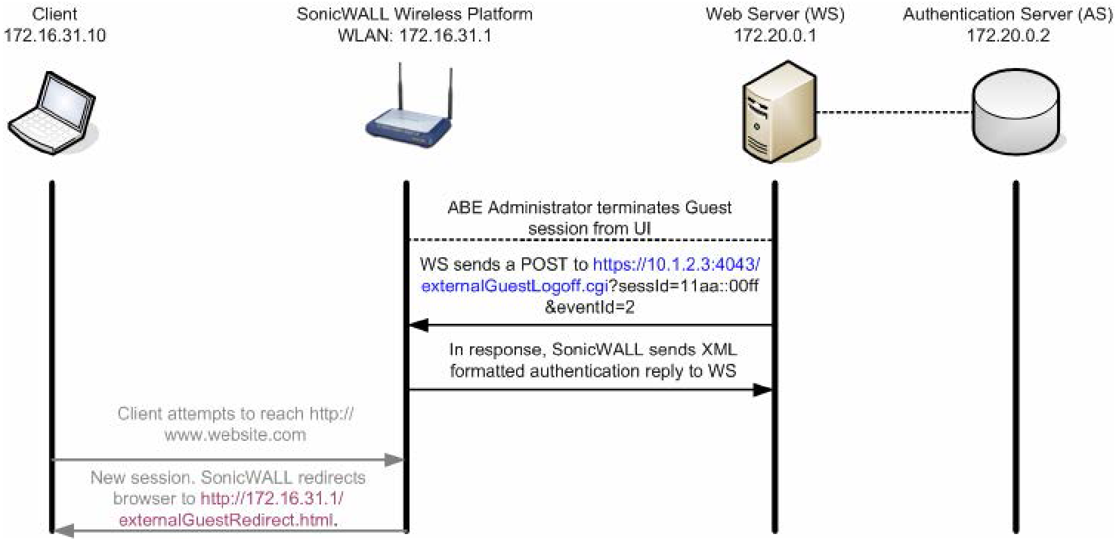
3 SonicWall Security Appliance responds with a result to the WS in the same connection. Results are described in Logoff Reply on page 545.

4 If the client attempts to reach a web resource, the Security Appliance redirects the user to the internal `http://172.16.31.1/externalGuestRedirect.html` page, starting the Session Creation process over (see Session Popup Window on page 538).

Administrator Logout (Optional)

The event occurs when the ABE administrator logs out from a Guest session from the management interface. It is not possible at this time to terminate ABE-established Guest Sessions from the SonicOS NS*v* Management Interface itself. ABE-established Guest Sessions are represented as such (or distinctly from internal WGS Guest Sessions) on the SonicOS NS*v* Management Interface and are not editable.

Administrator Logout Flow


Client
172.16.31.10
SonicWALL Wireless Platform
WLAN: 172.16.31.1
Web Server (WS)
172.20.0.1
Authentication Server (AS)
172.20.0.2
ABE Administrator terminates Guest session from UI
WS sends a POST to https://10.1.2.3:4043/externalGuestLogoff.cgi?sessId=11aa::00ff&eventId=2
In response, SonicWALL sends XML formatted authentication reply to WS
Client attempts to reach http://www.website.com
New session. SonicWALL redirects browser to http://172.16.31.1/externalGuestRedirect.html.

1 The ABE administrator terminates the Guest session from the web management interface.

2 The WS sends a POST to the Security Appliance: `https://10.1.2.3:4043/externalGuestLogoff.cgi?sessId=11aa::00ff&eventId=2`. (for Logoff event IDs, see Message Format on page 543).

   - `sessId` — The value generated during Session Creation by the Security Appliance, which is used by the Security Appliance and the WS for indexing clients.
   - `eventId` — Describes the logoff request event.

3 The SonicWall sends a result to the WS in the same connection. Results are described in Logoff Reply on page 545.

4 If the client returns from the idle state and attempts to reach a web resource, the Security Appliance redirects the user to the internal `http://172.16.31.1/externalGuestRedirect.html` page, starting the Session Creation process over (see Session Popup Window on page 538).

Web Server Status Check

To provide more granular ABE status than simple Web Server (WS) availability (as is provided by the mandatory JavaScript redirect), the SonicWall can optionally send a secure HTTP GET operation to the WS in order to determine server operational status. The target URL is configurable, as is the interval of the query (between 1 and 60 minutes). The WS responds back in an XML format listing the server's current state. For details. see Message Format on page 543.

If an error response code (1, 2, or 255) is received (indicating that the WS itself is available, but that some other ABE error condition has occurred), the SonicWall logs the response and redirects all subsequent authentication requests to an internal `wirelessServicesUnavailable.html` page. This page provides administrator-configurable text explaining recourse.

The Security Appliance continues to attempt to query the ABE at the configured interval and resumes redirection to the WS (rather than to the `wirelessServicesUnavailable.html` page) when a response code of 0 (Server Up) is received.

Session State Sync

At a configurable interval (between 1 and 60 minutes), the Security Appliance optionally sends a secure HTTP POST operation to the WS containing an XML list of all currently active guest sessions. The CGI post provides the `sessionList` as an XML list of all active guest sessions. For details, see Message Format on page 543.

The feature itself is enabled through a checkbox on the Security Appliance, but is disabled by default. The target URL is configurable.

Message Authentication

This feature ensures that the CGI data exchanged between both the Security Appliance and ABE originated from the SonicWall Security Appliance/ABE device, and that it has not been tampered with. If enabled, an additional CGI parameter, named `hmac`, is added to all CGI data exchanged. The following is an example of what the redirect URL now looks like with message authentication enabled:

```
https://10.1.2.3/login.asp?sessionId=faad7f12ac26d5c2fe3236de2c149a22&ip=172.16.31.2&mac=00:90
:4b:6a:37:32&ufi=0006B1020148&mgmtBaseUrl=https://10.0.61.222:4043/&clientRedirectUrl=http://1
92.168.168.168:80/&req=http%3A//www.google.com/&hmac=cd2399aeff26d5c2fe3236d211549acc
```

> **NOTE:** The SonicWall Security Appliance URL encodes the following characters within the value of the `req` (and only the `req`) variable:
>
> ```
> % = %25
> : = %3A
> = %20 (space)
> ? = %3F
> + = %2B
> & = %26
> = = %3D
> ```

In the preceding example, the HMAC signature was generated using the following data:

```
HMAC(
   faad7f12ac26d5c2fe3236de2c149a22 +
   172.16.31.2 +
   00:90:4b:6a:37:32 +
   0006B1020148 +
   https://10.0.61.222:4043/ +
   https://10.0.61.222:4043/ +
   http%3A//www.google.com/
)
```

If message authentication is enabled, then the SonicWall device expects an HMAC signature as part of the CGI post data originating from the ABE. If the SonicWall detects that the HMAC is missing or incorrect, then an error code of 251 is returned, and the requested operation (such as guest login, account creation) is aborted.

Session Update

Session update allows for the ABE to update the Session Lifetime and Idle Timeout values of existing session on the Security Appliance. This allows, for example, for additional time to be purchased by guest users and added to an existing session.

- The Session Update can be sent from the ABE to the SonicWall at any time during a session's lifetime.
- The *userName* and *sessionLifetime* values must be specified in the message
- The *sessID* value can be specified. If included, the update pertains to the specified session. If omitted, the update pertains to all sessions matching the specified *userName*.

For details, see Message Format on page 543.

Message Format

Topics:

ⓘ **NOTE:** The XML Schema location is subject to change.

The SonicWall Security Appliance IP address and port is defined in the *mgmtBaseUrl* variable.

External Authentication Request

The WS sends a secure HTTP POST operation to: `https://SonicWall.ip.add.ress:port/externalGuestLogin.cgi`. The post parameters include these arguments:

- *sessId*: Session ID
- *userName*: The full user ID
- *sessionLifetime*: The session lifetime of the user (in seconds)
- *idleTimeout*: The maximum idle timeout (in seconds)

External Authentication Reply

The Security Appliance returns an XML response in this format:

```
<?xml version="1.0" encoding="UTF-8">
<SonicWallAccessGatewayParam
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:noNamespaceSchemaLocation="http://www.SonicWall.com/
   SonicWallAccessGatewayParam.xsd">
   <AuthenticationReply>
      <ResponseCode>{response code}</ResponseCode>
      <ReplyMessage>{reply message}</ReplyMessage>
   </AuthenticationReply>
</SonicWallAccessGatewayParam>
```

The `{response code}` includes one of the values listed in External Authentication Response Codes.

External Authentication Response Codes

Response Code	Response Meaning
50	Login succeeded
51	Session limit exceeded
100	Login failed -- access reject
251	Msg. Auth failed -- Invalid HMAC
253	Invalid session ID
254	Invalid or missing CGI parameter
255	Internal error

Local Authentication Request

The WS sends a secure HTTP POST operation to: `https://SonicWall.ip.add.ress:port/localGuestLogin.cgi`. The post parameters includes these arguments:

- *`sessId`*: Session ID
- *`userName`*: The full user ID
- *`passwd`*: The guest's clear-text password

Local Authentication Reply

The SonicWall returns an XML response in this format:

```
<?xml version="1.0" encoding="UTF-8">
<SonicWallAccessGatewayParam
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:noNamespaceSchemaLocation="http://www.SonicWall.com/
   SonicWallAccessGatewayParam.xsd">
   <AuthenticationReply>
      <ResponseCode>{response code}</ResponseCode>
      <ReplyMessage>{reply message}</ReplyMessage>
   </AuthenticationReply>
</SonicWallAccessGatewayParam>
```

The `{response code}` includes one of the values listed in Local Authentication Response Codes.

Local Authentication Response Codes

Response Code	Response Meaning
50	Login succeeded
51	Session limit exceeded
52	Invalid username/password
100	Login failed -- access reject
251	Msg. Auth failed -- Invalid HMAC
253	Invalid session ID
254	Invalid or missing CGI parameter
255	Internal error

Logoff Request

The WS sends a secure HTTP POST operation to: `https://SonicWall.ip.add.ress:port/externalGuestLogoff.cgi`. The post parameters includes the following arguments:

- *`sessId`*: GW Session ID
- *`eventId`*: Logoff event ID. Must be one of the following:

Logoff Event ID	Event Meaning
1	Guest logged out manually
2	Admin logged off the specified guest
3	Guest session expired
4	Guest idle timeout expired

Logoff Reply

The Security Appliance returns an XML response in this format:

```
<?xml version="1.0" encoding="UTF-8">
<SonicWallAccessGatewayParam
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:noNamespaceSchemaLocation="http://www.SonicWall.com/
   SonicWallAccessGatewayParam.xsd">
   <LogoffReply>
         <ResponseCode>{response code}</ResponseCode>
         <ReplyMessage>{reply message}</ReplyMessage>
   </LogoffReply>
</SonicWallAccessGatewayParam>
```

The *`{response code}`* includes one of the values listed in Logoff Response Codes:

Logoff Response Codes

Response Code	Response Meaning
150	Logoff succeeded
251	Msg. Auth failed -- Invalid HMAC
253	Invalid session ID
254	Invalid or missing CGI parameter
255	Internal error

Web Server Status Check

The WS returns an XML response in this format:

```
<?xml version="1.0" encoding="UTF-8">
<SonicWallAccessGatewayParam
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:noNamespaceSchemaLocation="http://www.SonicWall.com/
   SonicWallAccessGatewayParam.xsd">
   <ServerStatus >{status code}</ ServerStatus >
</SonicWallAccessGatewayParam>
```

The *`{response code}`* includes one of the values listed in Web Server Status Check Response Codes.

Web Server Status Check Response Codes

Response Code	Response Meaning
0	Server Up
1	DB down
2	Configuration error
255	Internal error

Session State Sync

Periodically, the GW sends a secure HTTP POST operation to the AS containing an XML list of all currently active guest sessions. Both the target URL and time period are configurable by the GW administrator.

The CGI post parameters include this argument:

- *sessionList*: XML list of all active GW guest sessions.

The session list returns an XML response in this format:

```
<?xml version="1.0" encoding="UTF-8">
<SonicWallAccessGatewayParam
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:noNamespaceSchemaLocation="http://www.SonicWall.com/
   SonicWallAccessGatewayParam.xsd">
   <SessionSync>
      <SessionCount>{Session Count}</SessionCount>
      <SessionList>
      <Session>
      <Ssid>{ESSID}</Ssid>8
      <ID>{Session ID}</ID>
      <UserName>{User Name}</UserName>
      <IP>{IP Address}</IP>
      <MAC>{MAC Address}</MAC>
      <Idle>
      {Time Idle (expressed in seconds)}
      </Idle>
      <SessionRemaining>
      {Session Remaining (expressed in seconds)}
      <SessionRemaining>
      <BaseMgmtUrl>
      {https://ip.add.re.ss:port}
      </BaseMgmtUrl>
      <RxBytes>
      {total bytes received}
      </RxBytes>
      <TxBytes>
      {total bytes transmitted}
      </TxBytes>
      </Session>
   </SessionList>
</SessionSync>
</SonicWallAccessGatewayParam>
```

Session State Sync Reply

The WS returns an XML response in this format:

```
<?xml version="1.0" encoding="UTF-8">
<SonicWallAccessGatewayParam
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:noNamespaceSchemaLocation="http://www.SonicWall.com/
```

```
      SonicWallAccessGatewayParam.xsd">
      <SessionSync>
         <ResponseCode>{response code}</ResponseCode>
      </SessionSync>
   </SonicWallAccessGatewayParam>
```

The *{response code}* includes one of the values listed in Session State Sync Reply Response Codes.

Session State Sync Reply Response Codes

Response Code	Response Meaning
200	Sync successful
201	Sync failed
255	Internal error

Local Account Creation Request

The WS sends a secure HTTP POST operation to: `https://SonicWall.ip.add.ress:port/createGuestAccount.cgi`. The post parameters include these arguments:

- *userName*: The full user ID (maximum length: 32)
- *passwd*: The guest's clear-text password (maximum length: 64)
- *comment*: Optional (maximum length: 16). Default=**NULL**
- *enforceUniqueLogin*: Optional: 1=true, 0=false. Default=**1**
- *activateNow*: Optional: 1=true, 0=false. Default=**0**
- *autoPrune*: Optional: 1=true, 0=false. Default=**1**
- *accountLifetime*: The account lifetime of the user (expressed in seconds)
- *sessionLifetime*: The session lifetime of the user (expressed in seconds)
- *idleTimeout*: The maximum idle timeout (expressed in seconds)

Local Account Creation Reply

The Security Appliance returns an XML response in this format:

```
   <?xml version="1.0" encoding="UTF-8">
   <SonicWallAccessGatewayParam
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:noNamespaceSchemaLocation="http://www.SonicWall.com/
      SonicWallAccessGatewayParam.xsd">
      <AccountCreationReply>
         <ResponseCode>{response code}</ResponseCode>
         <ReplyMessage>{reply message}</ReplyMessage>
      </AccountCreationReply>
   </SonicWallAccessGatewayParam>
```

The *{response code}* includes one of the values listed in Local Account Creation Reply Response Codes.

Local Account Creation Reply Response Codes

Response Code	Response Meaning
10	Account creation succeeded
11	Max account limit
12	Account Exists
251	Msg. Auth failed -- Invalid HMAC
254	Invalid or missing CGI parameter
255	Internal error

Update Session Request

The POST from the ABE might be made to the Security Appliance at `externalGuestUpdateSession.cgi` in this format:

```
https://10.1.2.3:4043/externalGuestUpdateSession.cgi?sessId=11aa::00ff&userName=guest&sessionL
ifetime=600&idleTimeout=180
```

The post parameters include these arguments:

- *`sessID`*: The value can be specified. If the value is not specified, then all guest sessions matching the specified username are updated.
- *`userName`*: The value must be specified as it defines the name of the user session (or potentially sessions if no session ID is provided) that is updated.
- *`sessionLifetime`*: The value must be specified as it defines the number of seconds to assign to the session. It can be any number from 1 to 863,913,600.
- *idleTimeout*: The value can be specified. It:
  - Defines the number of seconds to assign to the session.
  - Can be any number from 1 to 863,913,600.
  - Must be less than or equal to the *`sessionLifetime`*.

  If an *`idleTimeout`* is not provided, the session's existing *`idleTimeout`* value is maintained.

Update Session Reply

The Security Appliance returns an XML response in this format:

```
<?xml version="1.0" encoding="UTF-8">
<SonicWallAccessGatewayParam
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:noNamespaceSchemaLocation="http://www.SonicWall.com/
   SonicWallAccessGatewayParam.xsd">
   <UpdateSessionReply>
      <ResponseCode>{response code}</ResponseCode>
      <ReplyMessage>{reply message}</ReplyMessage>
   </ UpdateSessionReply >
</SonicWallAccessGatewayParam>
```

The *`{response code`*} includes one of the values listed in Update Session Reply Response Codes.

Update Session Reply Response Codes

Response Code	Response Meaning
210	Session Update succeeded
211	Session Update failed
251	Msg. Auth failed -- Invalid HMAC
254	Invalid or missing CGI parameter
255	Internal error

LHM RESTful API

SonicOS NS*v* supports LHM RESTful API.

Lightweight Hotspot Messaging (LHM) defines the method and syntax for communications between a SonicWall access device and an Authentication Back-End (ABE) for authenticating Hotspot users and providing them parametrically bound network access.

A RESTful API is an application program interface (API) that uses HTTP requests to GET, PUT, POST and DELETE data. A RESTful API, also referred to as a RESTful web service, is based on representational state transfer (REST) technology, an architectural style and approach to communications often used in web services development.

Frequently Asked Questions (FAQs)

Topics:

Do the LHM server scripts have to be written in ASP?

No. The LHM server scripts can be written using any platform capable of handling web requests and XML, the two core components of LHM. This includes Perl, PHP, ASP, ASP.NET, and J2EE.

Why were these new scripts written in ASP.NET?

ASP.NET was chosen for the new scripts because of its prevalence, and because it does lots of things well, not the least of which being the ease with which it handles XML.

What is the difference between authentication and authorization?

Authentication describes the process of a user providing a response to some kind of challenge. The challenge can be just about anything, although traditionally it is a `username:password`. LHM breaks this dependence of the traditional model by abstracting the authentication. The role of authenticator is fulfilled by the LHM server, and the methods of authentication are bound only by imagination. Consider the following methods of authentication:

- Provide a valid username and password
- Guess the number the computer generated
- Complete this questionnaire
- Pass a quiz with a score of at least 80 percent
- Click **I Accept**

After authentication, the client can then be authorized to do something.

Authorization is the process of granting access to something. For authorization to be useful, the authorizer must have a means of stopping the client from getting to guarded resources. In the case of LHM, the SonicWall is the client's gateway, so it can very effectively act as authorizer. After the SonicWall receives the OK from the authenticator for a client, it creates the Guest Services session and allows the client access to the Internet.

Can I use LHM to provide access using LDAP, a button, the time of day, tasseography, a survey, relative barometric pressure, a pass code, and so on as the authenticator?

Yes.

Can SonicWall write the script for me that does that?

We have provided a series of sample scripts as examples and for you to freely modify, but we do not provide custom scripts. We can, however, put you in touch with someone who can provide custom scripts. There are many SonicWall partners who have web development teams on staff who can provide these services.

I want to use the sample scripts SonicWall provided. What do I need to do to use them?

You need:

- Microsoft Windows 2000, XP, 2003 platform running IIS 5.0 or higher, running the latest service packs and Hotfixes.
- The Microsoft .NET 1.1 (or higher) Framework: http://www.microsoft.com/downloads/details.aspx?FamilyId=262D25E3-F589-4842-8157-034D1E7CF3A3&displaylang=en
- The latest .NET Framework Service Pack: http://www.microsoft.com/downloads/details.aspx?familyid=A8F5654F-088E-40B2-BBDB-A83353618B38&displaylang=en

To use the scripts:

1. Copy the LHM script (or scripts) you wish to use to the `wwwroot` directory (usually in `C:\inetpub\wwwroot`).
2. Configure Guest Services on your SonicWall to use External Guest Authentication, as described in the What do all the LHM settings mean? How do I configure them? on page 553.

   Some scripts need write privileges, particularly those that use databases. Depending on your configuration, two or three separate "users" need to have write access to the script directories that require writing.

   - The first account (all platforms) is **IUSR_MACHINENAME** (where *`machinename`* = the name of the local machine).
   - The second account on:
     - Windows XP is **ASPNET** (ASP.NET machine account).
     - Other platforms is **IWAM_MACHINENAME** (where *`machinename`* = the name of the local machine).
   - If database read/write access continues to fail even after assigning these permissions, it might be necessary to add read/write privileges for the **NETWORK SERVICE** account.

   NOTE: Versions on .NET Framework prior to 1.1 had user permission problems on domain controllers (http://support.microsoft.com/default.aspx?scid=kb;en-us;Q315158). It is strongly recommended that 1.1 (or higher) be installed.

3. After your environment is set up, you need to customize the scripts. This has been made as simple as possible by placing all the interesting configurable bits in the `myvars.aspx` file. All entries are well commented, and their purposes and syntax should be evident. Further customization to the scripts themselves can be performed, but is generally not necessary.

Where can the LHM server reside?

The LHM Server can be virtually anywhere in the network, as long as it is reachable by the Guest Clients. It can be located at a centralized network operations center where it can administer LHM for multiple hot spots, or it can be co-located with a single SonicWall Security Appliance.

Why are my Guest Clients unable to reach the LHM Server, or why are the pages on the LHM server not loading?

Guest clients communicate directly with the LHM server; the communication is not proxied by the SonicWall Security Appliance. In other words:

- The Guest Client's subnet must be able to reach the LHM server.
- The LHM server must know how to reach the Guest Client's subnet (by route, NAT, or VPN).
- Firewall Access Rules must be configured to allow the Guest Client subnet to reach the LHM server.

How does the LHM exchange between the SonicWall and the LHM server work (concise version, typical environment)?

1 The Guest Client associates, gets a DHCP lease, and launches a web browser.

2 DNS is allowed through the SonicWall Security Appliance. The URL FQDN resolves to its IP address.

3 The SonicWall Security Appliance checks if the Guest Client has an authenticated session.

   - If it's new, SonicWall Security Appliance redirects the client to the internal redirect (`Please wait while you are being redirected`) page.

4 The internal redirect page attempts to redirect the Guest Client to the LHM server.

   - If it fails, it redirects the client to the internal server-down (`Wireless Internet access is temporarily unavailable. Please click here to try again`) page.

5 The Guest Client is redirected to the LHM server. In the redirect URL, the Security Appliance embeds `querystring` information describing the embryonic session (such as the `sessionID`, the client's MAC and IP address, the Security Appliance's LHM management IP and port, the UFI, the originally requested URL).

   - The LHM server script grabs the `querystring` information.
   - The client directly retrieves the LHM landing page from the LHM server.

6 Depending on the authorization model used (such as `username:password`, `passcode`, **I Accept** button), the LHM server decides that the Guest Client is worthy of access.

7 The LHM server initiates a web-request to the SonicWall Security Appliance at the configured management port (such as TCP 4043) to the `externalGuestLogin.cgi` page.

   - The LHM server POSTs the `sessionID` (which it obtained in Step 5) along with the `username` (which it either got from the user or made up) and the `session-lifetime` and `idle-timeout` (both of which it determines).

8 The Security Appliance validates the `sessionID`, tries to create the session, and then responds to the POST with a result code describing whether or not it was able to authorize (create) the Guest session.

9 The LHM Server interprets the result code and reports the results (such as `Session Authorized - You can now start browsing`, `Session creation failed - Rats`, `Max sessions`) to the Guest Client.

What do all the LHM settings mean? How do I configure them?

Rather than going into the full detail provided in About Lightweight Hotspot Messaging (LHM) on page 526, let's just explain what the settings mean and how you might configure them:

Topics:

General

Local Web Server Settings

Client Redirect Protocol The protocol (HTTP or HTTPS) used by the SonicWall Security Appliance when performing the initial internal client redirect through the `Please wait while you are being redirected` page. (This message is configurable from the **Redirect Message** area on the **Web Content** tab.) This step is prior to redirection to the LHM server.

External Web Server Settings

Web Server Protocol The protocol (HTTP or HTTPS) running on the LHM server.

Web Server Host The IP or resolvable FQDN of the LHM server.

Web Server Port The TCP port of operations for the selected protocol on the LHM server.

Connection Timeout The duration of time, in seconds, before the LMH server is considered unavailable on a redirect attempt. On timeout, the client is presented with the `Server Down` message configured on the **Web Content** tab.

Message Authentication

Enable Message Authentication Use HMAC digest and embedded querystring in communication with the LHM server. This is useful if you are concerned about message tampering when HTTP is used to communicate with the LHM server. Optional.

Authentication Method Select **MD5** or **SHA1**.

Shared Secret The shared secret for the hashed MAC. If used, it also needs to be configured on the LHM server scripts.

Auth Pages

External Authentication Pages

ⓘ **NOTE:** These pages might each be a unique page on the LHM server, or they might all be the same page with a separate event handler for each status message. Examples are provided as follows to work with the newly developed scripts.

Login Page	The first page to which the client is redirected (such as `lhm/accept/default.aspx`).
Session Expiration Page	The page to which the client is redirected when the session expires (such as `lhm/accept/default.aspx?cc=2`). After a session expires, the user must create a new LHM session.
Idle Timeout Page -	The page to which the client is redirected when the idle timer is exceeded (such as `lhm/accept/default.aspx?cc=3`). After the idle timer is exceeded, the user can log in again with the same credentials as long as there is time left for the session.
Max Session Page	The page to which the client is redirected when the maximum number of sessions has been reached (such as `lhm/accept/default.aspx?cc=4`).

Web Content

Redirect Message

The default or customized message that is presented to the client (usually for no more than one second) explaining that the session is being redirected to the LHM server. This interstitial page is used (rather than going directly to the LHM server) so that the Security Appliance can verify the availability of the LHM server.

Server Down Message

The default or customized message that is presented to the client when the Redirector determines that the LHM server in unavailable.

Advanced

The parameters are optional.

Auto Session Logout	The time increment and the page to which the SonicWall Security Appliance POSTs when a session is logged out (either automatically or manually).
Server Status Check	The time increment and the page to which the SonicWall POSTs to determine the availability of components on or behind the LHM server (such as a back-end database).
Session Synchronization	The time increment and the page to which the SonicWall POSTs the entire Guest Services session table. This allows the LHM server to synchronize the state of Guest Users for accounting, billing, or heuristics.

Can I change the LHM Management port from its default of TCP 4043?

Yes. This is easily done in SonicOS NS*v* by modifying the port values of the External Guest Authentication Service Object.

Do I need to use the HMAC option? If I do want to use it, how do I use it?

The HMAC function is optional. It ensures that messages sent by the SonicWall to the LHM server and the LHM server to the SonicWall Security Appliance have not been tampered with. HMAC achieves this by calculating a keyed (password-aided) message authentication code on the information being passed between the two peers, and by adding that calculated digest to the data. Upon receiving the data, the other side calculates the digest itself, and compares it to the transmitted MAC; if the two match, the data was delivered intact. You should consider using the HMAC option if you are in an insecure environment or if you are concerned with security.

If you choose to use HMAC, you might implement your own HMAC routines, but the simplest method is to use the SonicWall-written `SonicSSL.dll` library, along with the `libeay32.dll`, which is freely available as part of OpenSSL; both are available from SonicWall by request.

To use HMAC:

1. Copy the `libeay32.dll` file to the path on the LHM (IIS) server (for example, into the `C:\Windows\system32` folder).
2. Copy the `SonicSSL.dll` file to any location on the same server.
3. Register the `SonicSSL.dll` file with the command `regsvr32 SonicSSL.dll`.

After this is done, the LHM scripts are able to use the `Server.CreateObject(SonicSSL.Crypto)` object for HMAC calculations. The HMAC functions are included in the scripts described in LHM Script Library on page 556.

> **IMPORTANT:** The SonicWall Security Appliance URL Encodes (converts certain characters from their ASCII notation to hex notation) the `req` (originally requested URL) portion of the `querystring`, but the SonicWall method of URL encoding is slightly different from the Microsoft method (as employed by `Request.QueryString`, for example). Because of this difference in methods, it is possible for the string upon which the HMAC is being performed to be different between the Security Appliance and the LHM server. The provided scripts compensate for this by manually encoding the `req` portion of the `querystring` in a fashion consistent with the SonicWall method.

Does SonicWall provide any support for these scripts?

The scripts are provided as examples, and they are not supported by SonicWall Technical Support, nor can SonicWall support assist with the configuration of your LHM back-end environment. Future consultative support services might address this.

I've written a new script, I've made some great enhancements to your scripts, or I've just made your

scripts work a whole lot better than you did; is SonicWall interested?

Yes! We are always looking for new ways to use LHM, and for people to contribute to the library of available scripts. We consider LHM scripts written on any platform, using any authentication method. Send an email to `products@SonicWall.com` describing your script, and do consider it for addition to our library. Submitting a script gives SonicWall permission to freely modify and/or redistribute the submitted script.

LHM Script Library

The SonicWall LHM Script library was established to serve as a resource for people using or wishing to use LHM for Guest Services. The goal is to attract multiple contributors and consumers, helping the library to grow to house a large, varied, and useful collection of scripts that anyone can modify or use as-is.

The first contribution to the library comprises six scripts: some in response to common user requests (`accept`, `guestbook`, and `adauth`), and some more uncommon (`lhmquiz`, `random`, and `paypal`). They were written outside of a Visual Studio .NET development environment, so their styles can be diverse. Common to all the scripts, however, are:

- Modularization of the configurable variables, such as the paths to files, server IP addresses, use of a popup logout window, salt values, and timer settings. These configurable values are gathered into the `myvars.aspx` file so per-environment editing can be done in one place rather than having to search for configurable elements.
- Extensive commentary explaining step-by-step what is being done.

A `chooser.aspx` landing page has been provided at the top-level of the scripts directory. This script was designed for demonstration environments to allow for the selection of a lower-level (specific) script without having to reconfigure the LHM settings on the SonicWall Security Appliance to point to a specific script. In other words, LHM on the Security Appliance can be configured to point to the top-level `chooser.aspx` script, which then enumerate all the sub-directories (lower-level scripts such as `random`, `accept`, `adauth`). The top-level `chooser.aspx` script opens the target lower-level `default.aspx` script in a new window, and passes the original `querystring` in its entirety.

All of the scripts begin with the `default.aspx` page, and client redirection is performed automatically as needed. The LHM configuration on the SonicWall should, therefore, point to the `default.aspx` page at the appropriate path (such as `lhm/accept/default.aspx` or `lhm/adauth/default.aspx`). Some scripts have separate administrative function page; these are noted in the script descriptions.

A `logout.aspx` page is also provided with each script. The use of this page is controllable with the `logoutPopup` variable in `myvars`. Setting a value of `1` enables the use of the popup logout window. The window is invoked by the LHM authentication process after a successful response code (50) is received from the Security Appliance. The script passes the `sessID`, `mgmtBaseUrl`, and `sessTimer` variables to the `logout.aspx` window so that the window can track the session time, and can POST a logout event back to the Security Appliance (at the `mgmtBaseUrl`) for the correct session (`sessID`) when/if the user wants to manually terminate the session.

About the Use of the Logout Popup Window

- The use of the logout popup is not necessary. Sessions timeout by themselves after their configured lifetime expires. The popup window simply provides users a mechanism to manually terminate their own sessions.
- The window launches with a javascript popup, so popup blockers block the window.
- Closing the window does not interrupt the session. Only **Logout** can end a session.
- Because the countdown timer runs client-side, steps have been taken to prevent refreshing the page. Refreshing the page resets the client-side countdown timer, but it does not affect the actual session

timer. The F5 key and right-click mouse event are captured and suppressed, which does not work on all browsers.

- The use of the logout popup should agree with the nature of the scripts authentication scheme:
  - Some scripts have non-exclusive login processes, meaning that the user can login repeatedly (such as the `Accept` and `ADAuth` scripts). The use of the logout popup on these non-exclusive scripts is encouraged.
  - Some scripts are non-exclusive, but gather data that should be kept unique (such as the `Guestbook` and `LHMQuiz` scripts). The use of the logout popup on these scripts is acceptable, but can lead to redundant data being gathered.
  - Some scripts are exclusive, meaning that after the user authenticates, it is not possible to repeat the authentication process without some kind of cost (such as the `PayPal` script or the `Random` script where `useDB` is enabled). The use of the logout popup is discouraged on these scripts because the user has no simple means of logging back in.

The scripts also provide hidden output for a .NET procedure error, where the text is hidden by matching it to the color of the background. In the event of some kind of failure or error condition, error output might be provided and made visible by hitting CTRL-A on the web-page to select all of the text.

The following is a description of each of the scripts, what they do, and how they do it. As new scripts are added to the library, similar descriptions accompany them to help with understanding, customization, and integration.

Topics:

Accept Script

Authentication Model	The Guest Client clicks **I Accept**.	
Purpose	Present an acceptable use policy, terms of service, or welcome screen to the client.	
myvars Variables	`logoutPopup`	Controls the use of the logout popup window. Set to: • **0** to disable the popup window. • **1** to enable the popup window.
	`sessTimer`	The session timer in seconds.
	`idleTimer`	The idle timer in seconds.
	`username`	The username applied to the guest sessions. Because the script does not obtain a username from the client, it can be: • Explicitly set here for all clients. • Set to `useMAC` to set the username to the MAC address.
	`strHmac`	The shared secret for the optional HMAC function.
	`hmacType`	The digest type to use if HMAC is in use: **MD5** or **SHA1**.

	`logo`	The names of the logo (image) file to use on page headers.

Session Flow

1 The Guest Client clicks **I Accept**.

2 The LHM post string is assembled with the `sessionID`, the username (either default of MAC), the default session lifetime, and idle lifetime.

3 The script performs the LHM post to the SonicWall Security Appliance to authorize the session.

Additional Considerations Only the basic LHM configuration is required.

Topics:

- default.aspx on page 558
- logout.aspx on page 563
- myvars.aspx on page 568

default.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy. CheckValidationResult
         Return True
   End Function
End Class

'Sample LHM redirect querystring:
'http://127.0.0.1/lhm/accept/default.aspx?sessionId=0b712fd83b9f5313db5af1cea6b1004f&ip=10.50.
165.231&mac=00:0e:35:bd:c9:37&ufi=0006b11184300&mgmtBaseUrl=https://10.50.165.193:4043/&client
RedirectUrl=https://10.50.165.193:444/&req=http%3A//www.google.com/ig

Dim ip as String
Dim sessionId as String
Dim mac as String
Dim ufi as String
Dim mgmtBaseUrl as String
Dim clientRedirectUrl as String
Dim req as String
Dim hmac as String
Dim customCode as String

Sub Page_Load(src as Object, e as EventArgs)

   LHMResult.Text=""
   catchError.Text=""

   ip=Request.QueryString("ip")
   sessionId=Request.QueryString("sessionId")
   mac=Request.QueryString("mac")
   ufi=Request.QueryString("ufi")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   clientRedirectUrl=Request.QueryString("clientRedirectUrl")
   req=Request.QueryString("req")
   hmac=Request.QueryString("hmac")
   customCode=Request.QueryString("cc")

   'customCode grabs the "cc=" querystring value sent by the SonicWall. This allows you to use
the same
   'page (e.g. this page) for the "Session Expiration" (?cc=2), "Idle Timeout" (?cc=3) and "Max
Sessions" (?cc=4) page.
   If customCode <> "" Then
      Select Case customCode
      Case "2"
         LHMResult.Text="<br><H3><font color=""red"">Your LHM session has expired. You can try
to initiate a new session.</font></H3>"
      Case "3"
         LHMResult.Text="<br><H3><font color=""red"">You have exceeded your idle timeout. Log
back in.</font></H3>"
      Case "4"
         LHMResult.Text="<br><H3><font color=""red"">The maximum number of sessions has been
reached. Try again later.</font></H3>"
      End Select
   End If

   'Set the userName to the grabbed client MAC address if so configured in myvars
   If userName = "useMAC" Then
      userName = mac
   End If

   'Use the override class in myvars.aspx to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts

   'Note - the routine below for handling the hmac requires the use of the SonicSSL.dll and
libeay.dll libraries.
   'The DLL must be copied to the IIS server, and the SonicSSL dll must be registered with
"regsvr32 sonicssl.dll"
   If hmac <> "" Then

      'SonicWall URL Encode routine is different from Microsoft - this is the SonicWall method
      req=Replace(req,"%","%25")
      req=Replace(req,":","%3A")
      req=Replace(req," ","%20")
      req=Replace(req,"?","%3F")
      req=Replace(req,"+","%2B")
      req=Replace(req,"&","%26")
      req=Replace(req,"=","%3D")

      Dim strHmacText as String
      Dim objCrypto as Object
      Dim strHmacGenerated
      Dim loginError as String

      'Initialize the Crypto object
      objCrypto = Server.CreateObject("SonicSSL.Crypto")

      'The text to be encoded
      strHmacText = sessionId & ip & mac & ufi & mgmtBaseUrl & clientRedirectUrl & req

      'Calculate the hash with a key strHmac, the return value is a string converted form the
output sha1 binary.
      'The hash algorithm (MD5 or SHA1) is configured in myvars and in the Extern Guest Auth
config on the SonicWall
      If hmacType = "MD5" Then
         strHmacGenerated = objCrypto.hmac_md5(strHmacText, strHmac)
      Else
         strHmacGenerated = objCrypto.hmac_sha1(strHmacText, strHmac)
      End If

      If strHmacGenerated <> hmac Then
         Dim hmacFail as String
         hmacFail = "<font color=""red"">The HMAC failed validation. Notify an 
attendant.</font><br><br>"
         hmacFail+="<font color=""9CBACE"">Received HMAC: " & hmac & "<br>Calculated HMAC: " & 
strHmacGenerated & "<br>"
         hmacFail+="Make sure the digest functions on the SonicWall and LHM server match.<br>"
         hmacFail+="Also make sure the shared secret on the SonicWall and myvars match</font>"
         catchError.Text=hmacFail
      End If

   End If

End Sub

Sub btnSubmit_Click(Sender As Object, E As EventArgs)

   'Let the user know that we are setting up the session, just in case it takes more than a 
second
   LHMResult.Text = "Authorizing session. Please wait."

   'The LHM cgi on the SonicWall - this does not change
   Dim loginCgi as String = "externalGuestLogin.cgi"

   'Assemble the data to post back to the SonicWall to authorize the LHM session
   Dim loginParams as String = "sessId=" & sessionId & "&userName=" & 
Server.URLEncode(userName) & "&sessionLifetime=" & sessTimer & "&idleTimeout=" & idleTimer

   'Combine mgmtBaseUrl from the original redirect with the login cgi
   Dim postToSNWL as String = mgmtBaseUrl & loginCgi

   'Convert the loginParams to a well behaved byte array
   Dim byteArray As Byte() = Encoding.UTF8.GetBytes(loginParams)

   Try
      'Create the webrequest to the SonicWall
      Dim toSNWL as WebRequest = WebRequest.Create(postToSNWL)

      'Calculate the length of the byte array
      toSNWL.ContentLength = byteArray.Length

      'Set the method for the webrequest to POST
      toSNWL.Method = "POST"

      'Set the content type
      toSNWL.ContentType = "application/x-www-form-urlencoded"

      'Open the request stream
      Dim dataStream As Stream = toSNWL.GetRequestStream()

      'Write the byte array to the request stream
      dataStream.Write(byteArray, 0, byteArray.Length)

      'Close the Stream object
      dataStream.Close()

      'Get the response
      Dim snwlReply As WebResponse = toSNWL.GetResponse()

      'Display the status - looking for 200 = OK.
      'Response.Write(CType(snwlReply, HttpWebResponse).StatusCode)

      'Grab the response and stuff it into an xml doc for possible review
      Dim snwlResponse as XmlDocument = New XmlDocument()
      snwlResponse.Load(snwlReply.GetResponseStream())

      'Set the xPath to the SNWL reply, and get the response
      Dim codePath as String = "SonicWallAccessGatewayParam/AuthenticationReply/ResponseCode"

      'Response.Write(snwlResponse.SelectSingleNode(codePath).InnerXml)

      'Response code 50 - Login Succeeded
      If snwlResponse.SelectSingleNode(codePath).InnerXml = "50"

         'Do we want to provide a logout popup window?
         If logoutPopup = "1" Then
            'Popup hack using Javascript for logout window
            Dim sb As New System.Text.StringBuilder()
            sb.Append("<script language='javascript'>")
            sb.Append("window.open('logout.aspx?sessId=")
            sb.Append(Server.URLEncode(CStr(sessionId)))
            sb.Append("&mgmtBaseUrl=")
            sb.Append(Server.URLEncode(CStr(mgmtBaseUrl)))
            sb.Append("&sessTimer=")
            sb.Append(Server.URLEncode(CStr(sessTimer)))
            sb.Append("','logOut','toolbar=no,")
            sb.Append("addressbar=no,menubar=no,")
            sb.Append("width=400,height=250');")
            sb.Append("<")
            sb.Append("/")
            sb.Append("script>")
            RegisterStartupScript("stp", sb.ToString)
         End If

         LHMResult.Text = "<br><b><font color=""green"">Session Authorized:</font></b> You can
now go to the URL you originally requested: <a target=""_blank"" href=""" & req & """>" & req &
"</a>"

      'Response code 51 - Session Limit Exceeded
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "51"
         LHMResult.Text = "<br><b><font color=""red"">Session Limit Reached:</font></b> The
maximum number of guest session has been reached. Sorry for the inconvenience. Close and
relaunch your browser to try again."

      'Response code 100 - Login Failed.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "100"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> Your
session cannot be created at this time. Sorry for the inconvenience. Close and relaunch your
browser to try again."

      'Response code 251 - Bad HMAC.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "251"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed message authentication. Sorry for the inconvenience. Close and
relaunch your browser to try again."

      'Response code 253 - Invalid SessionID.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "253"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed to match a known session identity. Sorry for the
inconvenience. Close and relaunch your browser to try again."

      'Response code 254 - Invalid CGI.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "254"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization was missing an essential parameter. Sorry for the inconvenience.
Close and relaunch your browser to try again."

      'Response code 255 - Internal Error.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "255"
```

```
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed because of an unspecified error. Sorry for the inconvenience.
Close and relaunch your browser to try again."

      End If

      'Close the streams
      dataStream.Close()
      snwlReply.Close()

      'If there is some asp.net error trying to talk to the SonicWall, print it in the same
color as the background.
      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed because of an unspecified error. Sorry for the inconvenience.
Close and relaunch your browser to try again. If the problem persists, notify an attendant."
      End Try
End Sub


</script>

<STYLE>
body {
  font-size: 10pt;
  font-family: verdana,helvetica,arial,sans-serif;
  color:#000000;
  background-color:#9CBACE;
}

tr.heading {
  background-color:#006699;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM Accept Script</TITLE>
</HEAD>

<BODY>
<form id="frmValidator" runat="server">

<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td width="50%" valign="center"><font color="white"><b>Welcome <%= ip%></b></font></td>
      <td><center><img width="216" height="51" src="<%= logo%>"></center></td>
      <td width="50%" align="right" valign="center"><font color="white"><b>Powered by
SonicWall LHM</b>&nbsp</font></td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>

<table width="100%" border="0" cellpadding="2" cellspacing="0">

   <tr>
   <td><br></td>
   </tr>
   <tr>
      <td align=left>
      By clicking the <b>Accept</b> button below, you accept the following terms of 
service:<br><br><b>
      1. You will not try to download bad things.<br>
      2. You will not try to upload bad things.<br>
      3. You will not try to use all the bandwidth so that others have none.<br>
      4. You will be happy when the SonicWall blocks bad things from reaching you.</b><br><br>
      </td>
      <td>
   </tr>
   <tr>
      <td><br><asp:button id="btnSubmit" class="button" text="  Accept  " 
onClick="btnSubmit_Click" runat="server" /></td>
   </tr>
   <tr>
      <td><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td><asp:Label id=catchError runat="server" /></td>
   </tr>
</table>
</form>
</BODY>
</HTML>
```

logout.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy.CheckValidationResult
         Return True
   End Function
End Class

Dim sessionId as String
Dim mgmtBaseUrl as String
Dim eventId as String = "&eventId=1"

'Grab the code and the session lifetime from the generator page
Sub Page_Load(src as Object, e as EventArgs)
   sessionId=Request.QueryString("sessId")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   sessTimer=Request.QueryString("sessTimer")


   'Use the override class in myvars.aspx to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts

   'When the page loads, make the loggedIn span visible
   loggedIn.Visible=True
   loggedOut.Visible=False

   Me.Button1.Attributes.Add("OnClick", "self.close()")

End Sub

'The Logout button
Sub btnSubmit_Click(Sender As Object, E As EventArgs)

   'Let the user know that we are setting up the session, just in case it takes more than a 
second
   LHMResult.Text = "Authorizing session. Please wait."

   'The LHM cgi on the SonicWall - this does not change
   Dim loginCgi as String = "externalGuestLogoff.cgi"

   'Assemble the data to post back to the SonicWall to authorize the LHM session
   Dim loginParams as String = "sessId=" & sessionId & eventId

   'Combine mgmtBaseUrl from the original redirect with the login cgi
   Dim postToSNWL as String = mgmtBaseUrl & loginCgi

   'Convert the loginParams to a well behaved byte array
   Dim byteArray As Byte() = Encoding.UTF8.GetBytes(loginParams)

   Try
      'Make the loggedOut span visible
      loggedIn.Visible=False
      loggedOut.Visible=True

      'Create the webrequest to the SonicWall
      Dim toSNWL as WebRequest = WebRequest.Create(postToSNWL)

      'Calculate the length of the byte array
      toSNWL.ContentLength = byteArray.Length

      'Set the method for the webrequest to POST
      toSNWL.Method = "POST"

      'Set the content type
      toSNWL.ContentType = "application/x-www-form-urlencoded"

      'Open the request stream
      Dim dataStream As Stream = toSNWL.GetRequestStream()

      'Write the byte array to the request stream
      dataStream.Write(byteArray, 0, byteArray.Length)

      'Close the Stream object
      dataStream.Close()

      'Get the response
      Dim snwlReply As WebResponse = toSNWL.GetResponse()

      'Display the status - looking for 200 = OK.
      'Response.Write(CType(snwlReply, HttpWebResponse).StatusCode)

      'Grab the response and stuff it into an xml doc for possible review
      Dim snwlResponse as XmlDocument = New XmlDocument()
      snwlResponse.Load(snwlReply.GetResponseStream())

      'Set the xPath to the SNWL reply, and get the response
      Dim codePath as String = "SonicWallAccessGatewayParam/LogoffReply/ResponseCode"

      'Response.Write(snwlResponse.SelectSingleNode(codePath).InnerXml)

      'Response code 150 - Logout Succeeded
      If snwlResponse.SelectSingleNode(codePath).InnerXml = "150"
         LHMResult.Text = "<br><b><font color=""green"">Your session has been logged 
out.<br><br>Thank you for using LHM Guest Services.</font></b>"

      'Response code 251 - Bad HMAC.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "251"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed message authentication. Sorry for the inconvenience. Close and relaunch your 
browser to try again."

      'Response code 253 - Invalid SessionID.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "253"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed to match a known session identity. Sorry for the inconvenience. Close and 
relaunch your browser to try again."

      'Response code 254 - Invalid CGI.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "254"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request was missing an essential parameter. Sorry for the inconvenience. Close and relaunch 
your browser to try again."

      'Response code 255 - Internal Error.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "255"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed because of an unspecified error. Sorry for the inconvenience. Close and relaunch 
your browser to try again."

      End If

      'Close the streams
      dataStream.Close()
      snwlReply.Close()

      'If there is some asp.net error trying to talk to the SonicWall, print it in the same 
color as the background.
      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed because of o an unspecified error. Sorry for the inconvenience. Close and 
relaunch your browser to try again. If the problem persists, notify an attendant."
      End Try
End Sub

</script>
<STYLE>
body {
   font-size: 10pt;
   font-family: verdana,helvetica,arial,sans-serif;
   color:#000000;
   background-color:#9CBACE;
}

tr.heading {
   font-size: 10pt;
   background-color:#006699;
}

tr.smalltext {
   font-size: 8pt;
}
```

```
.button {
   border: 1px solid #000000;
   background-color: #ffffff;
   font-size: 8pt;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM Logout Page</TITLE>

<SCRIPT LANGUAGE="Javascript">

//'Javascript Seconds Countdown Timer
var SecondsToCountDown = <%= sessTimer%>;
var originalTime=" ";

function CountDown()
{
   clockStr="";

   dayStr=Math.floor(SecondsToCountDown/86400)%100000
   if(dayStr>0){
      if(dayStr>1){
         dayStr+=" days ";
      } else dayStr+=" day ";
      clockStr=dayStr;
   }
   hourStr=Math.floor(SecondsToCountDown/3600)%24
   if(hourStr>0){
      if(hourStr>1){
         hourStr+=" hours ";
      } else hourStr+=" hour ";
      clockStr+=hourStr;
   }
   minuteStr=Math.floor(SecondsToCountDown/60)%60
   if(minuteStr>0){
      if(minuteStr>1){
         minuteStr+=" minutes ";
      } else minuteStr+=" minute ";
      clockStr+=minuteStr;
   }
   secondStr=Math.floor(SecondsToCountDown/1)%60
   if(secondStr>0){
      if(secondStr>1){
         secondStr+=" seconds ";
      } else secondStr+=" second ";
      clockStr+=secondStr;
   }

   if(SecondsToCountDown > 0)
   {
      --SecondsToCountDown;
   }

   if(originalTime.length < 2)
   {
      originalTime = clockStr;
   }

   // Make sure the form is still there before trying to set a value
   if(document.frmValidator){
      document.frmValidator.originalTime.value = originalTime;
      document.frmValidator.countdown.value = clockStr;
   }

   setTimeout("CountDown()", 1000);
   if(SecondsToCountDown == 0)
   {
      document.frmValidator.countdown.value = "Session Expired";
   }
}

//'Disable right-click so that the window does not get refreshed because the countdown is
clientside.
document.oncontextmenu = disableRightClick;
function disableRightClick()
{
  return false;
}

//'Disable F5 key, too, on IE at least.
function noF5()
{
   var key_f5 = 116;
   if (key_f5==event.keyCode)
   {
      event.keyCode=0;
      return false;
   }
   return false;
}

document.onkeydown=noF5
document.onmousedown=disableRightClick

</SCRIPT>

</HEAD>

<BODY onload='CountDown()'>
<span id="loggedIn" runat="server">
<form id="frmValidator" runat="server">
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center"><font color="white"><b>SonicWall LHM Logout
Window</b></font></td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="smalltext"><td><br></td></tr>
   <tr class="smalltext">
      <td>Original Session Time:</td>
      <td><asp:textbox width=250 id="originalTime" runat="server" /></td>
   </tr>
   <tr class="smalltext">
      <td>Remaining Session Time:</td>
      <td><asp:textbox width=250 id="countdown" runat="server" /></td>
   </tr>
   <tr class="smalltext">
      <td colspan=2><br>You can use this window to manually logout your session at any time, or
you can safely close this window if you prefer to let your session timeout
automatically.</font></td>
   </td>
   <tr>
      <td colspan=2><center><asp:button id="btnSubmit" class="button" text="  Logout  "
onClick="btnSubmit_Click" runat="server" /></center></td>
   </tr>
</table>
</form>
```

```
</span>

<span id="loggedOut" runat="server">
<form id="logout" runat="server">
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center"><font color="white"><b>SonicWall LHM Logout
Window</b></font></td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr>
      <td><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td><asp:Label id=catchError runat="server" /></td>
   </tr>
   <tr><td><br></td></tr>
   <tr>
      <td><center><asp:button id="Button1" class="button" text="  Close  " runat="server"
/></center></td>
   </tr>
</table>
</form>
</span>

</BODY>
</HTML>
```

myvars.aspx

```
<script language="VB" runat="server">

'Set the logoutPopup window flag - 0 = no popup, 1 = popup
'The use of the logoutPopup in this script is encouraged because the login event is
non-exclusive.
Dim logoutPopup as String = "1"

'Set the LHM Session Timeout
Dim sessTimer as String = "3600"

'Set the LHM Idle Timeout
Dim idleTimer as String = "300"

'Set the username to record for LHM session because this does not gather one. Set to
userName="useMAC" to use the MAC address.
Dim userName="useMAC"
'Dim userName = "LHM Guest User"

'Set the secret for use with optional HMAC auth, as configured in the Extern Guest Auth config
on the SonicWall
Dim strHmac as String = "password"

'Set the digest method for the HMAC, either MD5 or SHA1
Dim hmacType as String = "MD5"
'Dim hmacType as String = "SHA1"

'Set the logo image to use
Dim logo as String = "SonicWall.gif"

'------------------------End of Configurable Settings-------------------------

</script>
```

ADAuth Script

Authentication Model

The Guest Client provides their username and password. These credentials are then authenticated against an Active Directory or LDAP database.

Purpose

Classical authorization model using Active Directory through LDAP. Support for per-user session-timer and idle-timer setting provided by optionally grabbing LDAP attributes from the database during authorization.

myvars Variables

`logoutPopup` Controls the use of the logout popup window. Set to:

- **0** to disable the popup window.
- **1** to enable the popup window.

`myLdapServer` The IP address or resolvable FQDN of the LDAP/AD server providing authentication.

`myLdapDomain` The LDAP/AD domain name

`retrAttr` Specifies whether to retrieve session and idle timer values from the authenticating user's LDAP `attributes` (defined later). Set to:

- **0** to disable retrieval.
- **1** to attempt retrieval.

`useCN` If `reAttr`=1, then this flag sets whether to use the common name (`cn`) to retrieve attributes, or the AD default login name (`sAMAccountName`).

Set to **1** to use `cn`. When authenticating against AD, this flag should be set to **0**.

`sessAttr` The LDAP attribute from which to retrieve the session timer (in seconds). If no value can be retrieved, or if the retrieved value is not numeric, the default session timer (`sessTimer`, defined below) are used.

`idleAttr` The LDAP attribute from which to retrieve the idle timer (in seconds). If no value can be retrieved, or if the retrieved value is not numeric, the default idle timer (`idleTimer`, defined below) are used.

`sessTimer` The default session timer in seconds.

`idleTimer` The default idle timer in seconds.

`strHmac` The shared secret for the optional HMAC function.

`hmacType` The digest type to use if HMAC is in use: **MD5** or **SHA1**.

`logo` The names of the logo (image) file to use on page headers.

Session Flow

1. The Guest Client enters their LDAP/AD username and password.
2. The provided credentials are used to bind with the configured LDAP server.
3. If the bind attempt succeeds, the user is authenticated.
4. If the `reAttr` flag is set, an attempt is made to retrieve the defined `sessAttr` and `idleAttr` attributes (such as `pager` and `mobile`) from the LDAP DB. If valid results are retrieved, they are used; otherwise the default values are used.
5. The script performs the LHM post to the SonicWall Security Appliance to authorize the session.

Additional Considerations

Requires that the LHM server be able to communicate with the configured LDAP/AD server, either by route, NAT, or VPN. If the `reAttr` option is used, it requires that the LDAP attributes be defined for user-specific values to take effect.

NOTE: The `pager` and `mobile` attributes were selected because they are not frequently used, and because they can be set directly through Microsoft's Users and Computers MMC.)

Topics:

- default.aspx on page 570
- logout.aspx on page 577
- myvars.aspx on page 582

default.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Math" %>
<%@ Import Namespace="System.DirectoryServices" %>
<%@ Import Namespace="System.Collections" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>
<%@ Assembly name="System.DirectoryServices, Version=1.0.3300.0,
Culture=neutral,PublicKeyToken=b03f5f7f11d50a3a"%>

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy.CheckValidationResult
      Return True
   End Function
End Class

'Sample LHM redirect querystring:
'http://127.0.0.1/lhm/adauth/default.aspx?sessionId=0b712fd83b9f5313db5af1cea6b1004f&ip=10.50.
165.231&mac=00:0e:35:bd:c9:37&ufi=0006b11184300&mgmtBaseUrl=https://10.50.165.193:4043/&client
RedirectUrl=https://10.50.165.193:444/&req=http%3A//www.google.com/ig

Dim ip as String
Dim sessionId as String
Dim mac as String
Dim ufi as String
Dim mgmtBaseUrl as String
Dim clientRedirectUrl as String
Dim req as String
Dim hmac as String
Dim customCode as String

Sub Page_Load(src as Object, e as EventArgs)

   LHMResult.Text=""
   catchError.Text=""
   authResult.Text=""

   ip=Request.QueryString("ip")
   sessionId=Request.QueryString("sessionId")
   mac=Request.QueryString("mac")
   ufi=Request.QueryString("ufi")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   clientRedirectUrl=Request.QueryString("clientRedirectUrl")
   req=Request.QueryString("req")
   hmac=Request.QueryString("hmac")
   customCode=Request.QueryString("cc")

   'customCode grabs the "cc=" querystring value sent by the SonicWall. This allows you to use 
the same
   'page (e.g. this page) for the "Session Expiration" (?cc=2), "Idle Timeout" (?cc=3) and "Max 
Sessions" (?cc=4) page.
   If customCode <> "" Then
      Select Case customCode
      Case "2"
         LHMResult.Text="<br><H3><font color=""red"">Your LHM session has expired. You can try 
to initiate a new session.</font></H3>"
      Case "3"
         LHMResult.Text="<br><H3><font color=""red"">You have exceeded your idle timeout. Log 
back in.</font></H3>"
      Case "4"
         LHMResult.Text="<br><H3><font color=""red"">The maximum number of sessions has been 
reached. Try again later.</font></H3>"
      End Select
   End If

   'Use the override class in myvars.aspx to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts

   'Note - the routine below for handling the hmac requires the use of the SonicSSL.dll and 
libeay.dll libraries.
   'The DLL must be copied to the IIS server, and the SonicSSL dll must be registered with 
"regsvr32 sonicssl.dll"
   If hmac <> "" Then

      'SonicWall URL Encode routine is different from Microsoft - this is the SonicWall method
      req=Replace(req,"%","%25")
      req=Replace(req,":","%3A")
      req=Replace(req," ","%20")
      req=Replace(req,"?","%3F")
      req=Replace(req,"+","%2B")
      req=Replace(req,"&","%26")
      req=Replace(req,"=","%3D")

      Dim strHmacText as String
      Dim objCrypto as Object
      Dim strHmacGenerated
      Dim loginError as String

      'Initialize the Crypto object
      objCrypto = Server.CreateObject("SonicSSL.Crypto")

      'The text to be encoded
      strHmacText = sessionId & ip & mac & ufi & mgmtBaseUrl & clientRedirectUrl & req

      'Calculate the hash with a key strHmac, the return value is a string converted form the 
output sha1 binary.
      'The hash algorithm (MD5 or SHA1) is configured in myvars and in the Extern Guest Auth 
config on the SonicWall
      If hmacType = "MD5" Then
         strHmacGenerated = objCrypto.hmac_md5(strHmacText, strHmac)
      Else
         strHmacGenerated = objCrypto.hmac_sha1(strHmacText, strHmac)
      End If

      If strHmacGenerated <> hmac Then
         Dim hmacFail as String
         hmacFail = "<font color=""red"">The HMAC failed validation. Notify an 
attendant.</font><br><br>"
         hmacFail+="<font color=""9CBACE"">Received HMAC: " & hmac & "<br>Calculated HMAC: " & 
strHmacGenerated & "<br>"
         hmacFail+="Make sure the digest functions on the SonicWall and LHM server match.<br>"
         hmacFail+="Also make sure the shared secret on the SonicWall and myvars match</font>"
         catchError.Text=hmacFail
      End If

   End If

End Sub

sub OnBtnClearClicked (Sender As Object, e As EventArgs)
   txtName.Text = ""
   txtPassword.Text = ""
   authResult.Text=""
   LHMResult.Text=""
   catchError.Text=""
end sub

Sub btnSubmit_Click(Sender As Object, E As EventArgs)

   'Try to connect to LDAP with the user supplied attributes
   Try
      Dim ldapPath as String = "LDAP://" & myLdapServer
      Dim ldapUser as String = myLdapDomain & "\" & txtName.Text
      Dim validateUser as New DirectoryEntry(ldapPath,ldapUser,txtPassword.Text)

      'This is the actual authentication piece
      Dim nativeCheck as Object = validateUser.NativeObject

      'If retrAttr is set in the myvars file, attempt to retrieve the session and idle values 
from LDAP
      If retrAttr = "1" Then
         Dim mySearch as New DirectorySearcher(validateUser)

         'Check the myvars for selecting either sAMAccountName or cn
         If useCN = "0" Then
            mySearch.Filter = "(sAMAccountName=" & Server.URLEncode(txtName.Text) & ")"
         Else
            mySearch.Filter = "(cn=" & Server.URLEncode(txtName.Text) & ")"
         End If
         mySearch.PageSize="1"
         mySearch.PropertiesToLoad.Add(sessAttr)
         mySearch.PropertiesToLoad.Add(idleAttr)
         Dim adResult as SearchResult

         'If we get results on the attribute query, set timer values
         adResult = mySearch.FindOne
         If Not (adResult is Nothing) Then
            If (adResult.Properties.Contains(sessAttr)) Then
                  'Check to see if the LDAP value returned is a number
                  Dim isNumber as New RegEx("^\d+$")
                  If (isNumber.IsMatch(adResult.Properties(sessAttr)(0).ToString())) Then
                     sessTimer=adResult.Properties(sessAttr)(0).ToString()
                  End If
            End If 'End If sessAttr
            If (adResult.Properties.Contains(idleAttr)) Then
                  'Check to see if the LDAP value returned is a number
                  Dim isNumber as New RegEx("^\d+$")
                  If (isNumber.IsMatch(adResult.Properties(idleAttr)(0).ToString())) Then
                     idleTimer=adResult.Properties(idleAttr)(0).ToString()
                  End If
            End If 'End if idleAttr
         End If 'End if adResult is present
      End If 'End if retrAttr is in use

      authResult.Text="<font color=""green""><b>Credentials Accepted.</b></font><br>Session 
Lifetime: " & round(sessTimer/60) & " minutes.<br>Idle Timer: " & round(idleTimer/60) & " 
minutes."

      'Auth succeeded - move on to LHM Auth
      LHM()

      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         authResult.Text="<font color=""Red""><b>Credentials Rejected.</b></font><br>Enter a 
valid username and password. "
   End Try

End Sub

Sub LHM()

      'Let the user know that we are setting up the session, just in case it takes more than a 
second
      LHMResult.Text = "Authorizing session. Please wait."

      'The LHM cgi on the SonicWall - this does not change
      Dim loginCgi as String = "externalGuestLogin.cgi"

      'Assemble the data to post back to the SonicWall to authorize the LHM session
      Dim loginParams as String = "sessId=" & sessionId & "&userName=" & 
Server.URLEncode(txtName.Text) & "&sessionLifetime=" & sessTimer & "&idleTimeout=" & idleTimer

      'Combine mgmtBaseUrl from the original redirect with the login cgi
      Dim postToSNWL as String = mgmtBaseUrl & loginCgi

      'Convert the loginParams to a well behaved byte array
      Dim byteArray As Byte() = Encoding.UTF8.GetBytes(loginParams)

      Try
         'Create the webrequest to the SonicWall
         Dim toSNWL as WebRequest = WebRequest.Create(postToSNWL)

         'Calculate the length of the byte array
         toSNWL.ContentLength = byteArray.Length

         'Set the method for the webrequest to POST
         toSNWL.Method = "POST"

         'Set the content type
         toSNWL.ContentType = "application/x-www-form-urlencoded"

         'Open the request stream
         Dim dataStream As Stream = toSNWL.GetRequestStream()
         'Write the byte array to the request stream
         dataStream.Write(byteArray, 0, byteArray.Length)

         'Close the Stream object
         dataStream.Close()

         'Get the response
         Dim snwlReply As WebResponse = toSNWL.GetResponse()

         'Display the status - looking for 200 = OK.
         'Response.Write(CType(snwlReply, HttpWebResponse).StatusCode)

         'Grab the response and stuff it into an xml doc for possible review
         Dim snwlResponse as XmlDocument = New XmlDocument()
         snwlResponse.Load(snwlReply.GetResponseStream())

         'Set the xPath to the SNWL reply, and get the response
         Dim codePath as String =
"SonicWallAccessGatewayParam/AuthenticationReply/ResponseCode"

         'Response.Write(snwlResponse.SelectSingleNode(codePath).InnerXml)

         'Response code 50 - Login Succeeded
         If snwlResponse.SelectSingleNode(codePath).InnerXml = "50"

            'Do we want to provide a logout popup window?
            If logoutPopup = "1" Then
               'Popup hack using Javascript for logout window
               Dim sb As New System.Text.StringBuilder()
               sb.Append("<script language='javascript'>")
               sb.Append("window.open('logout.aspx?sessId=")
               sb.Append(Server.URLEncode(CStr(sessionId)))
               sb.Append("&mgmtBaseUrl=")
               sb.Append(Server.URLEncode(CStr(mgmtBaseUrl)))
               sb.Append("&sessTimer=")
               sb.Append(Server.URLEncode(CStr(sessTimer)))
               sb.Append("','logOut','toolbar=no,")
               sb.Append("addressbar=no,menubar=no,")
               sb.Append("width=400,height=250');")
               sb.Append("<")
               sb.Append("/")
               sb.Append("script>")
               RegisterStartupScript("stp", sb.ToString)
            End If

            LHMResult.Text = "<br><b><font color=""green"">Session authorized:</font></b> You
can now go to the URL you originally requested: <a target=""_blank"" href=""" & req & """>" &
req & "</a>"

         'Response code 51 - Session Limit Exceeded
         ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "51"
            LHMResult.Text = "<br><b><font color=""red"">Session Limit Reached:</font></b> The
maximum number of guest session has been reached. Sorry for the inconvenience. Close and
relaunch your browser to try again."

         'Response code 100 - Login Failed.
         ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "100"
            LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b>
Your session cannot be created at this time. Sorry for the inconvenience. Close and relaunch
your browser to try again."

         'Response code 251 - Bad HMAC.
         ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "251"
            LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b>
The request for authorization failed message authentication. Sorry for the inconvenience. Close
and relaunch your browser to try again."
```

```
         'Response code 253 - Invalid SessionID.
         ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "253"
            LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> 
The request for authorization failed to match a known session identity. Sorry for the 
inconvenience. Close and relaunch your browser to try again."

         'Response code 254 - Invalid CGI.
         ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "254"
            LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> 
The request for authorization was missing an essential parameter. Sorry for the inconvenience. 
Close and relaunch your browser to try again."

         'Response code 255 - Internal Error.
         ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "255"
            LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> 
The request for authorization failed because of an unspecified error. Sorry for the 
inconvenience. Close and relaunch your browser to try again."

         End If

         'Close the streams
         dataStream.Close()
         snwlReply.Close()

         'If there is some asp.net error trying to talk to the SonicWall, print it in the same 
color as the background.
         Catch ex as Exception
            catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
            LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> 
The request for authorization failed because of an unspecified error. Sorry for the 
inconvenience. Close and relaunch your browser to try again. If the problem persists, notify an 
attendant."
      End Try
End Sub
</script>

<STYLE>
body {
  font-size: 10pt;
  font-family: verdana,helvetica,arial,sans-serif;
  color:#000000;
  background-color:#9CBACE;
}

tr.heading {
  background-color:#006699;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM ADAuth Script</TITLE>
</HEAD>

<BODY>
<form id="frmValidator" runat="server">

<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td width="50%" valign="center"><font color="white"><b>LDAP/AD LHM 
Authentication</b></font></td>
      <td><center><img width="216" height="51" src="<%= logo %>"></center></td>
      <td width="50%" align="right" valign="center"><font color="white"><b>Powered by 
SonicWall LHM</b>&nbsp</font></td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>

<table width="90%" border="0" cellpadding="2" cellspacing="0">
   <tr>
      <td><b>Welcome <%= ip%> to SonicWall's LHM AD/LDAP Authenticator.</b><br><br>Enter your 
LDAP or Active Directory username and password to obtain secure guest Internet 
access.<br><br>If your domain account specifies session timeout values, those values will be 
applied to your account, otherwise you will receive the default one hour (60 minutes) of access 
with a five minute idle timeout.<br>
      </td>
   </tr>
</table>
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">Authentication domain: 
<%=myLdapDomain%></td>
   </tr>
</table>
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr>
      <td width="30%"><br>Enter your login name:</td>
      <td width="30%"><asp:TextBox id="txtName" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtName" ControlToValidate="txtName" 
ErrorMessage="Enter your name." runat="server" /></td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your password:</td>
      <td width="30%"><asp:TextBox id="txtPassword" textmode="password" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtPassword" 
ControlToValidate="txtPassword" ErrorMessage="Enter your password." runat="server" /></td>
   </tr>
   <tr>
      <td></td><td><asp:Label id=authResult runat="server" />&nbsp</td>
   </tr>
   <tr>
      <td></td>
      <td><asp:button id="btnSubmit" class="button" text="  Submit  " 
onClick="btnSubmit_Click" runat="server" />
      &nbsp&nbsp
      <asp:button id="btnClear" class="button" text=" Clear All " CausesValidation="False" 
onClick="OnBtnClearClicked" runat="server" />
      </td>
   </tr>
   <tr>
      <td colspan=2><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td colspan=2><asp:Label id=catchError runat="server" /></td>
   </tr>
</table>
</form>
</BODY>
</HTML>
```

logout.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy.CheckValidationResult
      Return True
   End Function
End Class

Dim sessionId as String
Dim mgmtBaseUrl as String
Dim eventId as String = "&eventId=1"

'Grab the code and the session lifetime from the generator page
Sub Page_Load(src as Object, e as EventArgs)
   sessionId=Request.QueryString("sessId")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   sessTimer=Request.QueryString("sessTimer")


   'Use the override class in myvars.aspx to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts

   'When the page loads, make the loggedIn span visible
   loggedIn.Visible=True
   loggedOut.Visible=False

   Me.Button1.Attributes.Add("OnClick", "self.close()")

End Sub

'The Logout button
Sub btnSubmit_Click(Sender As Object, E As EventArgs)

   'Let the user know that we are setting up the session, just in case it takes more than a
second
   LHMResult.Text = "Authorizing session. Please wait."

   'The LHM cgi on the SonicWall - this does not change
   Dim loginCgi as String = "externalGuestLogoff.cgi"

   'Assemble the data to post back to the SonicWall to authorize the LHM session
   Dim loginParams as String = "sessId=" & sessionId & eventId

   'Combine mgmtBaseUrl from the original redirect with the login cgi
   Dim postToSNWL as String = mgmtBaseUrl & loginCgi

   'Convert the loginParams to a well behaved byte array
   Dim byteArray As Byte() = Encoding.UTF8.GetBytes(loginParams)
   Try
      'Make the loggedOut span visible
      loggedIn.Visible=False
      loggedOut.Visible=True

      'Create the webrequest to the SonicWall
      Dim toSNWL as WebRequest = WebRequest.Create(postToSNWL)

      'Calculate the length of the byte array
      toSNWL.ContentLength = byteArray.Length

      'Set the method for the webrequest to POST
      toSNWL.Method = "POST"

      'Set the content type
      toSNWL.ContentType = "application/x-www-form-urlencoded"

      'Open the request stream
      Dim dataStream As Stream = toSNWL.GetRequestStream()

      'Write the byte array to the request stream
      dataStream.Write(byteArray, 0, byteArray.Length)

      'Close the Stream object
      dataStream.Close()

      'Get the response
      Dim snwlReply As WebResponse = toSNWL.GetResponse()

      'Display the status - looking for 200 = OK.
      'Response.Write(CType(snwlReply, HttpWebResponse).StatusCode)

      'Grab the response and stuff it into an xml doc for possible review
      Dim snwlResponse as XmlDocument = New XmlDocument()
      snwlResponse.Load(snwlReply.GetResponseStream())

      'Set the xPath to the SNWL reply, and get the response
      Dim codePath as String = "SonicWallAccessGatewayParam/LogoffReply/ResponseCode"

      'Response.Write(snwlResponse.SelectSingleNode(codePath).InnerXml)

      'Response code 150 - Logout Succeeded
      If snwlResponse.SelectSingleNode(codePath).InnerXml = "150"
         LHMResult.Text = "<br><b><font color=""green"">Your session has been logged 
out.<br><br>Thank you for using LHM Guest Services.</font></b>"

      'Response code 251 - Bad HMAC.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "251"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed message authentication. Sorry for the inconvenience. Close and relaunch your 
browser to try again."

      'Response code 253 - Invalid SessionID.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "253"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed to match a known session identity. Sorry for the inconvenience. Close and 
relaunch your browser to try again."

      'Response code 254 - Invalid CGI.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "254"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request was missing an essential parameter. Sorry for the inconvenience. Close and relaunch 
your browser to try again."

      'Response code 255 - Internal Error.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "255"
```

```
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The
request failed because of an unspecified error. Sorry for the inconvenience. Close and relaunch
your browser to try again."

      End If

      'Close the streams
      dataStream.Close()
      snwlReply.Close()

      'If there is some asp.net error trying to talk to the SonicWall, print it in the same
color as the background.
      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The
request failed because of an unspecified error. Sorry for the inconvenience. Close and relaunch
your browser to try again. If the problem persists, notify an attendant."
      End Try
End Sub

</script>
<STYLE>
body {
   font-size: 10pt;
   font-family: verdana,helvetica,arial,sans-serif;
   color:#000000;
   background-color:#9CBACE;
}

tr.heading {
   font-size: 10pt;
   background-color:#006699;
}

tr.smalltext {
   font-size: 8pt;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
   font-size: 8pt;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM Logout Page</TITLE>

<SCRIPT LANGUAGE="Javascript">

//'Javascript Seconds Countdown Timer
var SecondsToCountDown = <%= sessTimer%>;
var originalTime=" ";

function CountDown()
{
   clockStr="";

   dayStr=Math.floor(SecondsToCountDown/86400)%100000
   if(dayStr>0){
      if(dayStr>1){
         dayStr+=" days ";
      } else dayStr+=" day ";
      clockStr=dayStr;
   }
   hourStr=Math.floor(SecondsToCountDown/3600)%24
   if(hourStr>0){
      if(hourStr>1){
         hourStr+=" hours ";
      } else hourStr+=" hour ";
      clockStr+=hourStr;
   }
   minuteStr=Math.floor(SecondsToCountDown/60)%60
   if(minuteStr>0){
      if(minuteStr>1){
         minuteStr+=" minutes ";
      } else minuteStr+=" minute ";
      clockStr+=minuteStr;
   }
   secondStr=Math.floor(SecondsToCountDown/1)%60
   if(secondStr>0){
      if(secondStr>1){
         secondStr+=" seconds ";
      } else secondStr+=" second ";
      clockStr+=secondStr;
   }

   if(SecondsToCountDown > 0)
   {
      --SecondsToCountDown;
   }

   if(originalTime.length < 2)
   {
      originalTime = clockStr;
   }

   // Make sure the form is still there before trying to set a value
   if(document.frmValidator){
      document.frmValidator.originalTime.value = originalTime;
      document.frmValidator.countdown.value = clockStr;
   }

   setTimeout("CountDown()", 1000);
   if(SecondsToCountDown == 0)
   {
      document.frmValidator.countdown.value = "Session Expired";
   }
}

//'Disable right-click so that the window doesn't get refreshed because the countdown is
clientside.
document.oncontextmenu = disableRightClick;
function disableRightClick()
{
  return false;
}

//'Disable F5 key, too, on IE at least.
function noF5()
{
   var key_f5 = 116;
   if (key_f5==event.keyCode)
   {
      event.keyCode=0;
      return false;
   }
   return false;
}

document.onkeydown=noF5
document.onmousedown=disableRightClick
```

```
</SCRIPT>

</HEAD>

<BODY onload='CountDown()'>
<span id="loggedIn" runat="server">
<form id="frmValidator" runat="server">
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center"><font color="white"><b>SonicWall LHM Logout 
Window</b></font></td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="smalltext"><td><br></td></tr>
   <tr class="smalltext">
      <td>Original Session Time:</td>
      <td><asp:textbox width=250 id="originalTime" runat="server" /></td>
   </tr>
   <tr class="smalltext">
      <td>Remaining Session Time:</td>
      <td><asp:textbox width=250 id="countdown" runat="server" /></td>
   </tr>
   <tr class="smalltext">
      <td colspan=2><br>You can use this window to manually logout of your session at any time, 
or you can safely close this window if you prefer to let your session timeout 
automatically.</font></td>
   </td>
   <tr>
      <td colspan=2><center><asp:button id="btnSubmit" class="button" text="  Logout  " 
onClick="btnSubmit_Click" runat="server" /></center></td>
   </tr>
</table>
</form>
</span>

<span id="loggedOut" runat="server">
<form id="logout" runat="server">
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center"><font color="white"><b>SonicWall LHM Logout 
Window</b></font></td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr>
      <td><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td><asp:Label id=catchError runat="server" /></td>
   </tr>
   <tr><td><br></td></tr>
   <tr>
      <td><center><asp:button id="Button1" class="button" text="  Close  " runat="server" 
/></center></td>
   </tr>
</table>
</form>
</span>
```

```
</BODY>
</HTML>
```

myvars.aspx

```
<script language="VB" runat="server">

'Set the logoutPopup window flag - 0 = no popup, 1 = popup
'The use of the logoutPopup in this script is encouraged because the login event is
non-exclusive.
Dim logoutPopup as String = "1"

'Set the LDAP server IP or Name
Dim myLdapServer as String = "10.50.128.40"

'Set the LDAP domain
Dim myLdapDomain as String = "sv.us.SonicWall.com"

'Set the retrAttr to 0 to use default session and idle timeouts
'Set the retrAttr to 1 to try to retrieve the session and idle timeouts from LDAP attributes.
Dim retrAttr as String ="1"

'Set useCN=1 to use common name (e.g. "joe levy", non-Active Directory LDAP) for attribute
retrieval (retrAttr).
'Set useCN=0 to use saMACcountName (e.g. "jlevy", Active Directory / Windows) for attribute
retrieval.
Dim useCN as String = "0"

'If using retrAttr=1, you must define the ldap attributes from which to retrieve the values
   'Set the ldap attribute from which to retrieve the session timeout value (use is optional)
   Dim sessAttr as String = "pager"

   'Set the ldap attribute from which to retrieve the idle timeout value (use is optional)
   Dim idleAttr as String = "mobile"

'If retrAttr=0, of if no attributes value can be retrieved, use the following timeout values
   'Set the default LHM Session Timeout (for when no attributes is retrieved)
   Dim sessTimer as String = "3600"

   'Set the default LHM Idle Timeout (for when no attributes is retrieved)
   Dim idleTimer as String = "300"

'Set the secret for use with optional HMAC auth, as configured in the Extern Guest Auth config
on the SonicWall
Dim strHmac as String = "password"

'Set the digest method for the HMAC, either MD5 or SHA1
Dim hmacType as String = "MD5"
'Dim hmacType as String = "SHA1"

'Set the logo image to use
Dim logo as String = "SonicWall.gif"

'-------------------------End of Configurable Settings-------------------------
</script>
```

Guestbook Script

Authentication Model	The Guest Client provides their name, address, phone, email, URL (optional), and comment (optional) information.
Purpose	Gather market information; write the information to a database for later use.

myvars Variables	`logoutPopup`	Controls the use of the logout popup window. Set to: • **0** to disable the popup window. • **1** to enable the popup window.
	`sessTimer`	The session timer in seconds.
	`idleTimer`	The idle timer in seconds.
	`strHmac`	The shared secret for the optional HMAC function.
	`hmacType`	The digest type to use if HMAC is in use: **MD5** or **SHA1**.
	`logo`	The names of the logo (image) file to use on page headers.
Session Flow	1 The Guest Client enters their personal information and clicks Submit. 2 The entered information is written to a local `.mdb` database file for later use. 3 The LHM post string is assembled with the `sessionID`, the username (as provided in the web-form), the default session lifetime and idle lifetime. 4 The script performs the LHM post to the SonicWall Security Appliance to authorize the session.	
Additional Considerations	Because the script is writing to the database, it is necessary to configure write privileges for the **IUSR_MACHINENAME** and **IWAM_MACHINENAME** (or **ASPNET**) accounts, as described in I want to use the sample scripts SonicWall provided. What do I need to do to use them? on page 551.	

Topics:

- default.aspx on page 583
- logout.aspx on page 590
- myvars.aspx on page 596

default.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Data" %>
<%@ Import Namespace="System.Data.OleDB" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy.CheckValidationResult
      Return True
   End Function
End Class

'Sample LHM redirect querystring:
'http://127.0.0.1/lhm/guestbook/default.aspx?sessionId=0b712fd83b9f5313db5af1cea6b1004f&ip=10.
50.165.231&mac=00:0e:35:bd:c9:37&ufi=0006b11184300&mgmtBaseUrl=https://10.50.165.193:4043/&cli
entRedirectUrl=https://10.50.165.193:444/&req=http%3A//www.google.com/ig
```

```
Dim ip as String
Dim sessionId as String
Dim mac as String
Dim ufi as String
Dim mgmtBaseUrl as String
Dim clientRedirectUrl as String
Dim req as String
Dim hmac as String
Dim customCode as String

Sub Page_Load(src as Object, e as EventArgs)

   LHMResult.Text=""
   catchError.Text=""

   ip=Request.QueryString("ip")
   sessionId=Request.QueryString("sessionId")
   mac=Request.QueryString("mac")
   ufi=Request.QueryString("ufi")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   clientRedirectUrl=Request.QueryString("clientRedirectUrl")
   req=Request.QueryString("req")
   hmac=Request.QueryString("hmac")
   customCode=Request.QueryString("cc")

   'customCode grabs the "cc=" querystring value sent by the SonicWall. This allows you to use 
the same
   'page (e.g. this page) for the "Session Expiration" (?cc=2), "Idle Timeout" (?cc=3) and "Max 
Sessions" (?cc=4) page.
   If customCode <> "" Then
      Select Case customCode
      Case "2"
         LHMResult.Text="<br><H3><font color=""red"">Your LHM session has expired. You can try 
to initiate a new session.</font></H3>"
      Case "3"
         LHMResult.Text="<br><H3><font color=""red"">You have exceeded your idle timeout. Log 
back in.</font></H3>"
      Case "4"
         LHMResult.Text="<br><H3><font color=""red"">The maximum number of sessions has been 
reached. Try again later.</font></H3>"
      End Select
   End If

   'Use the override class in myvars.aspx to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts

   'Note - the routine below for handling the hmac requires the use of the SonicSSL.dll and 
libeay.dll libraries.
   'The DLL must be copied to the IIS server, and the SonicSSL dll must be registered with 
"regsvr32 sonicssl.dll"
   If hmac <> "" Then

      'SonicWall URL Encode routine is different from Microsoft - this is the SonicWall method
      req=Replace(req,"%","%25")
      req=Replace(req,":","%3A")
      req=Replace(req," ","%20")
      req=Replace(req,"?","%3F")
      req=Replace(req,"+","%2B")
      req=Replace(req,"&","%26")
      req=Replace(req,"=","%3D")

      Dim strHmacText as String
      Dim objCrypto as Object
      Dim strHmacGenerated
      Dim loginError as String
      'Initialize the Crypto object
      objCrypto = Server.CreateObject("SonicSSL.Crypto")

      'The text to be encoded
      strHmacText = sessionId & ip & mac & ufi & mgmtBaseUrl & clientRedirectUrl & req

      'Calculate the hash with a key strHmac, the return value is a string converted form the 
output sha1 binary.
      'The hash algorithm (MD5 or SHA1) is configured in myvars and in the Extern Guest Auth 
config on the SonicWall
      If hmacType = "MD5" Then
         strHmacGenerated = objCrypto.hmac_md5(strHmacText, strHmac)
      Else
         strHmacGenerated = objCrypto.hmac_sha1(strHmacText, strHmac)
      End If

      If strHmacGenerated <> hmac Then
         Dim hmacFail as String
         hmacFail = "<font color=""red"">The HMAC failed validation. Notify an 
attendant.</font><br><br>"
         hmacFail+="<font color=""9CBACE"">Received HMAC: " & hmac & "<br>Calculated HMAC: " & 
strHmacGenerated & "<br>"
         hmacFail+="Make sure the digest functions on the SonicWall and LHM server match.<br>"
         hmacFail+="Also make sure the shared secret on the SonicWall and myvars match</font>"
         catchError.Text=hmacFail
      End If

   End If

End Sub

sub OnBtnClearClicked (Sender As Object, e As EventArgs)
   txtName.Text = ""
   txtAddress.Text = ""
   txtCity.Text = ""
   txtState.Text = ""
   txtZip.Text = ""
   txtPhone.Text = ""
   txtEMail.Text = ""
   txtURL.Text = ""
   txtComment.Text = ""
   LHMResult.Text=""
   catchError.Text=""
end sub

Sub btnSubmit_Click(Sender As Object, E As EventArgs)

   Try
      'Try to write the submitted info to the database file
      Dim strConn as string = "Provider=Microsoft.Jet.OLEDB.4.0;Data Source=" & 
server.mappath("guestbook.mdb") & ";"

      Dim MySQL as string = "INSERT INTO Guestbook (Name, Address, City, State, Zip, Phone, 
EMail, URL, Comment) VALUES ('" & txtName.Text & "','" & txtAddress.Text & "','" & txtCity.Text 
& "','" & txtState.Text & "','" & txtZip.Text & "','" & txtPhone.Text & "','" & txtEMail.Text & 
"','" & txtURL.Text & "','" & txtComment.Text & "')"
      Dim MyConn as New OleDBConnection (strConn)
      Dim cmd as New OleDBCommand (MySQL, MyConn)
      MyConn.Open ()
      cmd.ExecuteNonQuery ()
      MyConn.Close ()

      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
   End Try
   'Let the user know that we are setting up the session, just in case it takes more than a
second
   LHMResult.Text = "Authorizing session. Please wait."

   'The LHM cgi on the SonicWall - this does not change
   Dim loginCgi as String = "externalGuestLogin.cgi"

   'Assemble the data to post back to the SonicWall to authorize the LHM session
   Dim loginParams as String = "sessId=" & sessionId & "&userName=" &
Server.URLEncode(txtName.Text) & "&sessionLifetime=" & sessTimer & "&idleTimeout=" & idleTimer

   'Combine mgmtBaseUrl from the original redirect with the login cgi
   Dim postToSNWL as String = mgmtBaseUrl & loginCgi

   'Convert the loginParams to a well behaved byte array
   Dim byteArray As Byte() = Encoding.UTF8.GetBytes(loginParams)

   Try
      'Create the webrequest to the SonicWall
      Dim toSNWL as WebRequest = WebRequest.Create(postToSNWL)

      'Calculate the length of the byte array
      toSNWL.ContentLength = byteArray.Length

      'Set the method for the webrequest to POST
      toSNWL.Method = "POST"

      'Set the content type
      toSNWL.ContentType = "application/x-www-form-urlencoded"

      'Open the request stream
      Dim dataStream As Stream = toSNWL.GetRequestStream()

      'Write the byte array to the request stream
      dataStream.Write(byteArray, 0, byteArray.Length)

      'Close the Stream object
      dataStream.Close()

      'Get the response
      Dim snwlReply As WebResponse = toSNWL.GetResponse()

      'Display the status - looking for 200 = OK.
      'Response.Write(CType(snwlReply, HttpWebResponse).StatusCode)

      'Grab the response and stuff it into an xml doc for possible review
      Dim snwlResponse as XmlDocument = New XmlDocument()
      snwlResponse.Load(snwlReply.GetResponseStream())

      'Set the xPath to the SNWL reply, and get the response
      Dim codePath as String = "SonicWallAccessGatewayParam/AuthenticationReply/ResponseCode"

      'Response.Write(snwlResponse.SelectSingleNode(codePath).InnerXml)

      'Response code 50 - Login Succeeded
      If snwlResponse.SelectSingleNode(codePath).InnerXml = "50"

         'Do we want to provide a logout popup window?
         If logoutPopup = "1" Then
            'Popup hack using Javascript for logout window
            Dim sb As New System.Text.StringBuilder()
            sb.Append("<script language='javascript'>")
            sb.Append("window.open('logout.aspx?sessId=")
            sb.Append(Server.URLEncode(CStr(sessionId)))
            sb.Append("&mgmtBaseUrl=")
            sb.Append(Server.URLEncode(CStr(mgmtBaseUrl)))
            sb.Append("&sessTimer=")
            sb.Append(Server.URLEncode(CStr(sessTimer)))
            sb.Append("','logOut','toolbar=no,")
            sb.Append("addressbar=no,menubar=no,")
            sb.Append("width=400,height=250');")
            sb.Append("<")
            sb.Append("/")
            sb.Append("script>")
            RegisterStartupScript("stp", sb.ToString)
         End If

         LHMResult.Text = "<br><b><font color=""green"">Session authorized:</font></b> You can 
now go to the URL you originally requested: <a target=""_blank"" href=""" & req & """>" & req & 
"</a>"

      'Response code 51 - Session Limit Exceeded
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "51"
         LHMResult.Text = "<br><b><font color=""red"">Session Limit Reached:</font></b> The 
maximum number of guest session has been reached. Sorry for the inconvenience. Close and 
relaunch your browser to try again."

      'Response code 100 - Login Failed.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "100"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> Your 
session cannot be created at this time. Sorry for the inconvenience. Close and relaunch your 
browser to try again."

      'Response code 251 - Bad HMAC.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "251"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The 
request for authorization failed message authentication. Sorry for the inconvenience. Close and 
relaunch your browser to try again."

      'Response code 253 - Invalid SessionID.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "253"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The 
request for authorization failed to match a known session identity. Sorry for the 
inconvenience. Close and relaunch your browser to try again."

      'Response code 254 - Invalid CGI.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "254"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The 
request for authorization was missing an essential parameter. Sorry for the inconvenience. 
Close and relaunch your browser to try again."

      'Response code 255 - Internal Error.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "255"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The 
request for authorization failed because of an unspecified error. Sorry for the inconvenience. 
Close and relaunch your browser to try again."

      End If

      'Close the streams
      dataStream.Close()
      snwlReply.Close()

      'If there is some asp.net error trying to talk to the SonicWall, print it in the same 
color as the background.
      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The 
request for authorization failed because of an unspecified error. Sorry for the inconvenience. 
Close and relaunch your browser to try again. If the problem persists, notify an attendant."
      End Try
End Sub
</script>
```

```
<STYLE>
body {
  font-size: 10pt;
  font-family: verdana,helvetica,arial,sans-serif;
  color:#000000;
  background-color:#9CBACE;
}

tr.heading {
  background-color:#006699;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM Guestbook Script</TITLE>
</HEAD>

<BODY>
<form id="frmValidator" runat="server">

<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td width="50%" valign="center"><font color="white"><b>LHM Guestbook</b></font></td>
      <td><center><img width="216" height="51" src="<%= logo %>"></center></td>
      <td width="50%" align="right" valign="center"><font color="white"><b>Powered by 
SonicWall LHM</b>&nbsp</font></td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>

<table width="90%" border="0" cellpadding="2" cellspacing="0">
   <tr>
      <td>Welcome <%= ip%> to SonicWall's LHM Guestbook. In exchange for providing us with your 
contact information,
      along with your permission to occasionally contact you while you are in the middle of 
dinner, we will
      provide you with <b>one complimentary hour of secure Internet access.</b><br>
      </td>
   </tr>
</table>
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3><font color="white"><center><b>Thank you for your 
participation.</b></center></td>
   </tr>
</table>
<table width="100%" border="0" cellpadding="0" cellspacing="0">
   <tr>
      <td width="30%"><br>Enter your full name:</td>
      <td width="30%"><asp:TextBox id="txtName" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtName" ControlToValidate="txtName" 
ErrorMessage="Enter your name." runat="server" /></td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your address:</td>
      <td width="30%"><asp:TextBox id="txtAddress" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtAddress"
ControlToValidate="txtAddress" ErrorMessage="Enter your address." runat="server" /></td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your city:</td>
      <td width="30%"><asp:TextBox id="txtCity" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtCity" ControlToValidate="txtCity"
ErrorMessage="Enter your city." runat="server" /></td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your State:</td>
      <td width="30%"><asp:TextBox id="txtState" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtState"
ControlToValidate="txtState" ErrorMessage="Enter your State." runat="server" /></td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your zip code:</td>
      <td width="30%"><asp:TextBox id="txtZip" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtZip" ControlToValidate="txtZip"
ErrorMessage="Enter your zip code." Display="Dynamic" runat="server" />
      <asp:RegularExpressionValidator id=regEx1 runat="server" Display="Dynamic"
ControlToValidate="txtZip" ErrorMessage="Enter in the format #####"
ValidationExpression="^\d{5}"></asp:RegularExpressionValidator>
      </td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your phone number:</td>
      <td width="30%"><asp:TextBox id="txtPhone" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtPhone"
ControlToValidate="txtPhone" ErrorMessage="Enter your phone number." Display="Dynamic"
runat="server" />
      <asp:RegularExpressionValidator id=regEx2 runat="server" Display="Dynamic"
ControlToValidate="txtPhone" ErrorMessage="Enter in the format ###-###-####"
ValidationExpression="((\(\d{3}\)?)|(\d{3}-))?\d{3}-\d{4}"></asp:RegularExpressionValidator>
      </td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your email address:</td>
      <td width="30%"><asp:TextBox id="txtEmail" runat="server" /></td>
      <td width="40%"><asp:RegularExpressionValidator id=regEx3 runat="server"
ControlToValidate="txtEmail" ValidationExpression=".*@.*\..*" ErrorMessage="Enter a valid
email address." Display="Dynamic" />
      </asp:RegularExpressionValidator>
      <asp:RequiredFieldValidator id="valTxtEnail" runat="server" ControlToValidate="txtEmail"
ErrorMessage="Enter your email address." Display="Dynamic" />
      </asp:RequiredFieldValidator>
      </td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your web site URL (optional):</td>
      <td width="30%"><asp:TextBox id="txtURL" runat="server" /></td>
   </tr>
   <tr>
      <td valign="top" width="30%"><br>Enter a comment (optional):</td>
      <td width="30%"><asp:TextBox id="txtComment" width="300px" height="100px"
textmode="MultiLine" tabindex="4" runat="server" /></td>
   </tr>
   <tr>
      <td></td>
      <td><br><asp:button id="btnSubmit" class="button" text=" Submit "
onClick="btnSubmit_Click" runat="server" />
      &nbsp&nbsp
      <asp:button id="btnClear" class="button" text=" Clear All " CausesValidation="False"
onClick="OnBtnClearClicked" runat="server" />
      </td>
   </tr>
   <tr>
```

```
      <td colspan=2><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td colspan=2><asp:Label id=catchError runat="server" /></td>
   </tr>
</table>
</form>
</BODY>
</HTML>
```

logout.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Data" %>
<%@ Import Namespace="System.Data.OleDB" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy.CheckValidationResult
      Return True
   End Function
End Class

'Sample LHM redirect querystring:
'http://127.0.0.1/lhm/guestbook/default.aspx?sessionId=0b712fd83b9f5313db5af1cea6b1004f&ip=10.
50.165.231&mac=00:0e:35:bd:c9:37&ufi=0006b11184300&mgmtBaseUrl=https://10.50.165.193:4043/&cli
entRedirectUrl=https://10.50.165.193:444/&req=http%3A//www.google.com/ig

Dim ip as String
Dim sessionId as String
Dim mac as String
Dim ufi as String
Dim mgmtBaseUrl as String
Dim clientRedirectUrl as String
Dim req as String
Dim hmac as String
Dim customCode as String

Sub Page_Load(src as Object, e as EventArgs)

   LHMResult.Text=""
   catchError.Text=""

   ip=Request.QueryString("ip")
   sessionId=Request.QueryString("sessionId")
   mac=Request.QueryString("mac")
   ufi=Request.QueryString("ufi")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   clientRedirectUrl=Request.QueryString("clientRedirectUrl")
   req=Request.QueryString("req")
   hmac=Request.QueryString("hmac")
   customCode=Request.QueryString("cc")

   'customCode grabs the "cc=" querystring value sent by the SonicWall. This allows you to use 
the same
   'page (e.g. this page) for the "Session Expiration" (?cc=2), "Idle Timeout" (?cc=3) and "Max 
Sessions" (?cc=4) page.
   If customCode <> "" Then
      Select Case customCode
      Case "2"
         LHMResult.Text="<br><H3><font color=""red"">Your LHM session has expired. You can try 
to initiate a new session.</font></H3>"
      Case "3"
         LHMResult.Text="<br><H3><font color=""red"">You have exceeded your idle timeout. Log 
back in.</font></H3>"
      Case "4"
         LHMResult.Text="<br><H3><font color=""red"">The maximum number of sessions has been 
reached. Try again later.</font></H3>"
      End Select
   End If

   'Use the override class in myvars.aspx to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts

   'Note - the routine below for handling the hmac requires the use of the SonicSSL.dll and 
libeay.dll libraries.
   'The DLL must be copied to the IIS server, and the SonicSSL dll must be registered with 
"regsvr32 sonicssl.dll"
   If hmac <> "" Then

      'SonicWall URL Encode routine is different from Microsoft - this is the SonicWall method
      req=Replace(req,"%","%25")
      req=Replace(req,":","%3A")
      req=Replace(req," ","%20")
      req=Replace(req,"?","%3F")
      req=Replace(req,"+","%2B")
      req=Replace(req,"&","%26")
      req=Replace(req,"=","%3D")

      Dim strHmacText as String
      Dim objCrypto as Object
      Dim strHmacGenerated
      Dim loginError as String

      'Initialize the Crypto object
      objCrypto = Server.CreateObject("SonicSSL.Crypto")

      'The text to be encoded
      strHmacText = sessionId & ip & mac & ufi & mgmtBaseUrl & clientRedirectUrl & req

      'Calculate the hash with a key strHmac, the return value is a string converted form the 
output sha1 binary.
      'The hash algorithm (MD5 or SHA1) is configured in myvars and in the Extern Guest Auth 
config on the SonicWall
      If hmacType = "MD5" Then
         strHmacGenerated = objCrypto.hmac_md5(strHmacText, strHmac)
      Else
         strHmacGenerated = objCrypto.hmac_sha1(strHmacText, strHmac)
      End If

      If strHmacGenerated <> hmac Then
         Dim hmacFail as String
         hmacFail = "<font color=""red"">The HMAC failed validation. Notify an 
attendant.</font><br><br>"
         hmacFail+="<font color=""9CBACE"">Received HMAC: " & hmac & "<br>Calculated HMAC: " & 
strHmacGenerated & "<br>"
         hmacFail+="Make sure the digest functions on the SonicWall and LHM server match.<br>"
```

```
            hmacFail+="Also make sure the shared secret on the SonicWall and myvars match</font>"
            catchError.Text=hmacFail
         End If

      End If

   End Sub

   sub OnBtnClearClicked (Sender As Object, e As EventArgs)
      txtName.Text = ""
      txtAddress.Text = ""
      txtCity.Text = ""
      txtState.Text = ""
      txtZip.Text = ""
      txtPhone.Text = ""
      txtEMail.Text = ""
      txtURL.Text = ""
      txtComment.Text = ""
      LHMResult.Text=""
      catchError.Text=""
   end sub

   Sub btnSubmit_Click(Sender As Object, E As EventArgs)

      Try
         'Try to write the submitted info to the database file
         Dim strConn as string = "Provider=Microsoft.Jet.OLEDB.4.0;Data Source=" &
server.mappath("guestbook.mdb") & ";"

         Dim MySQL as string = "INSERT INTO Guestbook (Name, Address, City, State, Zip, Phone,
EMail, URL, Comment) VALUES ('" & txtName.Text & "','" & txtAddress.Text & "','" & txtCity.Text
& "','" & txtState.Text & "','" & txtZip.Text & "','" & txtPhone.Text & "','" & txtEMail.Text &
"','" & txtURL.Text & "','" & txtComment.Text & "')"
         Dim MyConn as New OleDBConnection (strConn)
         Dim cmd as New OleDBCommand (MySQL, MyConn)
         MyConn.Open ()
         cmd.ExecuteNonQuery ()
         MyConn.Close ()

         Catch ex as Exception
            catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
      End Try

      'Let the user know that we are setting up the session, just in case it takes more than a
second
      LHMResult.Text = "Authorizing session. Please wait."

      'The LHM cgi on the SonicWall - this does not change
      Dim loginCgi as String = "externalGuestLogin.cgi"

      'Assemble the data to post back to the SonicWall to authorize the LHM session
      Dim loginParams as String = "sessId=" & sessionId & "&userName=" &
Server.URLEncode(txtName.Text) & "&sessionLifetime=" & sessTimer & "&idleTimeout=" & idleTimer

      'Combine mgmtBaseUrl from the original redirect with the login cgi
      Dim postToSNWL as String = mgmtBaseUrl & loginCgi

      'Convert the loginParams to a well behaved byte array
      Dim byteArray As Byte() = Encoding.UTF8.GetBytes(loginParams)

      Try
         'Create the webrequest to the SonicWall
         Dim toSNWL as WebRequest = WebRequest.Create(postToSNWL)

         'Calculate the length of the byte array
         toSNWL.ContentLength = byteArray.Length
         'Set the method for the webrequest to POST
         toSNWL.Method = "POST"

         'Set the content type
         toSNWL.ContentType = "application/x-www-form-urlencoded"

         'Open the request stream
         Dim dataStream As Stream = toSNWL.GetRequestStream()

         'Write the byte array to the request stream
         dataStream.Write(byteArray, 0, byteArray.Length)

         'Close the Stream object
         dataStream.Close()

         'Get the response
         Dim snwlReply As WebResponse = toSNWL.GetResponse()

         'Display the status - looking for 200 = OK.
         'Response.Write(CType(snwlReply, HttpWebResponse).StatusCode)

         'Grab the response and stuff it into an xml doc for possible review
         Dim snwlResponse as XmlDocument = New XmlDocument()
         snwlResponse.Load(snwlReply.GetResponseStream())

         'Set the xPath to the SNWL reply, and get the response
         Dim codePath as String = "SonicWallAccessGatewayParam/AuthenticationReply/ResponseCode"

         'Response.Write(snwlResponse.SelectSingleNode(codePath).InnerXml)

         'Response code 50 - Login Succeeded
         If snwlResponse.SelectSingleNode(codePath).InnerXml = "50"

            'Do we want to provide a logout popup window?
            If logoutPopup = "1" Then
               'Popup hack using Javascript for logout window
               Dim sb As New System.Text.StringBuilder()
               sb.Append("<script language='javascript'>")
               sb.Append("window.open('logout.aspx?sessId=")
               sb.Append(Server.URLEncode(CStr(sessionId)))
               sb.Append("&mgmtBaseUrl=")
               sb.Append(Server.URLEncode(CStr(mgmtBaseUrl)))
               sb.Append("&sessTimer=")
               sb.Append(Server.URLEncode(CStr(sessTimer)))
               sb.Append("','logOut','toolbar=no,")
               sb.Append("addressbar=no,menubar=no,")
               sb.Append("width=400,height=250');")
               sb.Append("<")
               sb.Append("/")
               sb.Append("script>")
               RegisterStartupScript("stp", sb.ToString)
            End If

            LHMResult.Text = "<br><b><font color=""green"">Session authorized:</font></b> You can
   now go to the URL you originally requested: <a target=""_blank"" href=""" & req & """>" & req &
   "</a>"

         'Response code 51 - Session Limit Exceeded
         ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "51"
            LHMResult.Text = "<br><b><font color=""red"">Session Limit Reached:</font></b> The
   maximum number of guest session has been reached. Sorry for the inconvenience. Close and
   relaunch your browser to try again."

         'Response code 100 - Login Failed.
         ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "100"
```

```
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> Your
session cannot be created at this time. Sorry for the inconvenience. Close and relaunch your
browser to try again."

      'Response code 251 - Bad HMAC.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "251"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed message authentication. Sorry for the inconvenience. Close and
relaunch your browser to try again."

      'Response code 253 - Invalid SessionID.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "253"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed to match a known session identity. Sorry for the
inconvenience. Close and relaunch your browser to try again."

      'Response code 254 - Invalid CGI.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "254"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization was missing an essential parameter. Sorry for the inconvenience.
Close and relaunch your browser to try again."

      'Response code 255 - Internal Error.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "255"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed because of an unspecified error. Sorry for the inconvenience.
Close and relaunch your browser to try again."

      End If

      'Close the streams
      dataStream.Close()
      snwlReply.Close()

      'If there is some asp.net error trying to talk to the SonicWall, print it in the same
color as the background.
      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed because of an unspecified error. Sorry for the inconvenience.
Close and relaunch your browser to try again. If the problem persists, notify an attendant."
      End Try
End Sub
</script>

<STYLE>
body {
  font-size: 10pt;
  font-family: verdana,helvetica,arial,sans-serif;
  color:#000000;
  background-color:#9CBACE;
}

tr.heading {
  background-color:#006699;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM Guestbook Script</TITLE>
</HEAD>
```

```
<BODY>
<form id="frmValidator" runat="server">

<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td width="50%" valign="center"><font color="white"><b>LHM Guestbook</b></font></td>
      <td><center><img width="216" height="51" src="<%= logo %>"></center></td>
      <td width="50%" align="right" valign="center"><font color="white"><b>Powered by 
SonicWall LHM</b>&nbsp</font></td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>

<table width="90%" border="0" cellpadding="2" cellspacing="0">
   <tr>
      <td>Welcome <%= ip%> to SonicWall's LHM Guestbook. In exchange for providing us with your 
contact information,
      along with your permission to occasionally contact you while you are in the middle of 
dinner, we will
      provide you with <b>one complimentary hour of secure Internet access.</b><br>
      </td>
   </tr>
</table>
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3><font color="white"><center><b>Thank you for your 
participation.</b></center></td>
   </tr>
</table>
<table width="100%" border="0" cellpadding="0" cellspacing="0">
   <tr>
      <td width="30%"><br>Enter your full name:</td>
      <td width="30%"><asp:TextBox id="txtName" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtName" ControlToValidate="txtName" 
ErrorMessage="Enter your name." runat="server" /></td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your address:</td>
      <td width="30%"><asp:TextBox id="txtAddress" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtAddress" 
ControlToValidate="txtAddress" ErrorMessage="Enter your address." runat="server" /></td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your city:</td>
      <td width="30%"><asp:TextBox id="txtCity" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtCity" ControlToValidate="txtCity" 
ErrorMessage="Enter your city." runat="server" /></td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your State:</td>
      <td width="30%"><asp:TextBox id="txtState" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtState" 
ControlToValidate="txtState" ErrorMessage="Enter your State." runat="server" /></td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your zip code:</td>
      <td width="30%"><asp:TextBox id="txtZip" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtZip" ControlToValidate="txtZip" 
ErrorMessage="Enter your zip code." Display="Dynamic" runat="server" />
```

```
      <asp:RegularExpressionValidator id=regEx1 runat="server" Display="Dynamic"
ControlToValidate="txtZip" ErrorMessage="Enter in the format #####"
ValidationExpression="^\d{5}"></asp:RegularExpressionValidator>
      </td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your phone number:</td>
      <td width="30%"><asp:TextBox id="txtPhone" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valTxtPhone"
ControlToValidate="txtPhone" ErrorMessage="Enter your phone number." Display="Dynamic"
runat="server" />
      <asp:RegularExpressionValidator id=regEx2 runat="server" Display="Dynamic"
ControlToValidate="txtPhone" ErrorMessage="Enter in the format ###-###-####"
ValidationExpression="((\(\d{3}\)?)|(\d{3}-))?\d{3}-\d{4}"></asp:RegularExpressionValidator>
      </td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your email address:</td>
      <td width="30%"><asp:TextBox id="txtEmail" runat="server" /></td>
      <td width="40%"><asp:RegularExpressionValidator id=regEx3 runat="server"
ControlToValidate="txtEmail" ValidationExpression=".*@.*\..*" ErrorMessage="Enter a valid
email address." Display="Dynamic" />
      </asp:RegularExpressionValidator>
      <asp:RequiredFieldValidator id="valTxtEnail" runat="server" ControlToValidate="txtEmail"
ErrorMessage="Enter your email address." Display="Dynamic" />
      </asp:RequiredFieldValidator>
      </td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your web site URL (optional):</td>
      <td width="30%"><asp:TextBox id="txtURL" runat="server" /></td>
   </tr>
   <tr>
      <td valign="top" width="30%"><br>Enter a comment (optional):</td>
      <td width="30%"><asp:TextBox id="txtComment" width="300px" height="100px"
textmode="MultiLine" tabindex="4" runat="server" /></td>
   </tr>
   <tr>
      <td></td>
      <td><br><asp:button id="btnSubmit" class="button" text="  Submit  "
onClick="btnSubmit_Click" runat="server" />
      &nbsp&nbsp
      <asp:button id="btnClear" class="button" text=" Clear All " CausesValidation="False"
onClick="OnBtnClearClicked" runat="server" />
      </td>
   </tr>
   <tr>
      <td colspan=2><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td colspan=2><asp:Label id=catchError runat="server" /></td>
   </tr>
</table>
</form>
</BODY>
</HTML>
```

myvars.aspx

```
<script language="VB" runat="server">

'Set the logoutPopup window flag - 0 = no popup, 1 = popup
'The use of the logoutPopup in this script is discouraged because although the login event
'is non-exclusive, the login event produces data where redundancy is undesirable.
Dim logoutPopup as String = "0"

'Set the LHM Session Timeout
```

```
Dim sessTimer as String = "3600"

'Set the LHM Idle Timeout
Dim idleTimer as String = "300"

'Set the secret for use with optional HMAC auth, as configured in the Extern Guest Auth config
on the SonicWall
Dim strHmac as String = "password"

'Set the digest method for the HMAC, either MD5 or SHA1
Dim hmacType as String = "MD5"
'Dim hmacType as String = "SHA1"

'Set the logo image to use
Dim logo as String = "SonicWall.gif"

'------------------------End of Configurable Settings-------------------------

</script>
```

LHMQuiz Script

Authentication Model	The Guest Client takes a quiz. A passing score serves as the authentication credentials	
Purpose	It is common for network access to be provided in a classroom environment. By using a passing score on a test of the material being taught as the method for authentication, an instructor can ensure that the course material has been mastered before the irresistible temptation of the Internet diverts attention. The script also emails the completed passing test to the test-taker, and mails failing tests to the proctor/instructor.	
myvars Variables	`logoutPopup`	Controls the use of the logout popup window. Set to: • **0** to disable the popup window. • **1** to enable the popup window.
	`passingScore`	The score (an integer representing a percentage) required to pass the quiz.
	`quizFile`	The filename for the XML source for the quiz (such as `quiz.xml`, `shortquiz.xml`).
	`quizName`	The name of the quiz, used throughout the script.
	`quizFrom`	The `From: email` address used when emailing the quiz.
	`quizTo`	The `To: email` address where failing quizzes are to be sent (such as the test proctor or instructor).
	`imagePath`	The email includes an attachment for the correct and incorrect answers. This sets the path for those image files. This is generally set to the same path of the script files themselves.
	`smtpServer`	The IP address or resolvable FQDN of the SMTP server to be used for quiz result delivery. This can be set to `127.0.0.1` if the local IIS SMTP server instances is to be used.
	`sessTimer`	The session timer in seconds.
	`idleTimer`	The idle timer in seconds.
	`strHmac`	The shared secret for the optional HMAC function.
	`hmacType`	The digest type to use if HMAC is in use: **MD5** or **SHA1**.
	`logo`	The names of the logo (image) file to use on page headers.

Session Flow

1 The Guest Client is prompted to enter their full name and email address. A correct/valid email address is required for delivery of the completed passing quiz.
2 After entering name and email, the Guest Client is redirected to the `quiz.aspx` page. This is where the multiple choice test is administered.
3 The test questions themselves are contained in the `quiz.xml` file, defined by the `quiz.xsd` (XML Schema Definition) file. The `quiz.xml` file can and should be edited to customize the quiz, but the `quiz.xsd` document should not be edited unless absolutely necessary.

   Two versions of the quiz are included: `quiz.xml` (containing 10 questions) and `shortquiz.xml` (containing 2 questions, for testing that the script works). The quiz supports any number of questions, and each question supports any number of answers, one of which must be marked the correct answer, with `correct=yes`. It should be fairly straightforward to modify the provided `quiz.xml` file as needed.

4 At the end of the quiz, the results are shown. If it is a:
   - Failing score, the test results are emailed to the instructor (email address defined in `myvars`), and the Guest Client is prompted to take the test again. The LHM session is not authorized.
   - Passing score, the test results are emailed to the test-taker, and the LHM session is authorized.

   The emailed test is sent in an HTML format, and includes the `checkmark.gif` and `block.gif` (right and wrong) graphics as an attachment so that they can be displayed in the email.
5 If the test was passed, the LHM post string is assembled with the `sessionID`, the username (as provided in the web-form), the default session lifetime and idle lifetime.
6 The script performs the LHM post to the SonicWall Security Appliance to authorize the session.

Additional Considerations

Access to an SMTP server is required to deliver the test results. Because the script is relaying the mail through the server, the SMTP server needs to be configured to allow relaying from the LHM server. This is best accomplished by configuring the SMTP server to allow relaying from the IP address of the LHM server.

Most IIS installations include a local SMTP server, so it is convenient to use this local SMTP server for mail delivery by configuring the `smtpServer` variable in `myvars` as `127.0.0.1`.

Even when using the local SMTP server for mail delivery, it is necessary to allow relaying. In most configurations, this is performed by:

1 Going into the IIS MMC configurator.
2 Right clicking on **Default SMTP Virtual Server**.
3 Selecting **Properties**.
4 Selecting **Access**.
5 Clicking **Relay**.
6 Adding `127.0.0.1` to the access granted list.

When using a non-local SMTP server, that SMTP server should be configured to allow the LHM server to relay by its actual IP address.

Topics:

- default.aspx on page 599
- logout.aspx on page 602
- myvars.aspx on page 607
- quiz.aspx on page 608

default.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>

<!-- #INCLUDE file="myvars.aspx" -->

<script runat="server">

'Sample LHM redirect querystring:
'http://10.50.165.231/xmlquiz/default.aspx?sessionId=0b712fd83b9f5313db5af1cea6b1004f&ip=10.50
.165.231&mac=00:0e:35:bd:c9:37&ufi=0006b11184300&mgmtBaseUrl=https://10.50.165.193:4043/&clien
tRedirectUrl=https://10.50.165.193:444/&req=http%3A//www.google.com/ig

Dim ip as String
Dim sessionId as String
Dim mac as String
Dim ufi as String
Dim mgmtBaseUrl as String
Dim clientRedirectUrl as String
Dim req as String
Dim hmac as String
Dim emailAddr as String
Dim userName as String
Dim customCode as String

Sub Page_Load(src as Object, e as EventArgs)
   ip=Request.QueryString("ip")
   sessionId=Request.QueryString("sessionId")
   mac=Request.QueryString("mac")
   ufi=Request.QueryString("ufi")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   clientRedirectUrl=Request.QueryString("clientRedirectUrl")
   req=Request.QueryString("req")
   hmac=Request.QueryString("hmac")
   customCode=Request.QueryString("cc")

   'customCode grabs the "cc=" querystring value sent by the SonicWall. This allows you to use
the same
   'page (e.g. this page) for the "Session Expiration" (?cc=2), "Idle Timeout" (?cc=3) and "Max
Sessions" (?cc=4) page.
   If customCode <> "" Then
      Select Case customCode
      Case "2"
         LHMResult.Text="<br><H3><font color=""red"">Your LHM session has expired. You can try
to initiate a new session.</font></H3>"
      Case "3"
         LHMResult.Text="<br><H3><font color=""red"">You have exceeded your idle timeout. Log
back in.</font></H3>"
      Case "4"
         LHMResult.Text="<br><H3><font color=""red"">The maximum number of sessions has been
reached. Try again later.</font></H3>"
      End Select
   End If

   'Note - the routine below for handling the hmac requires the use of the SonicSSL.dll and
libeay.dll libraries.
   'The DLL must be copied to the IIS server, and the SonicSSL dll must be registered with
"regsvr32 sonicssl.dll"
   If hmac <> "" Then

      'SonicWall URL Encode routine is different from Microsoft - this is the SonicWall method
      req=Replace(req,"%","%25")
      req=Replace(req,":","%3A")
      req=Replace(req," ","%20")
      req=Replace(req,"?","%3F")
      req=Replace(req,"+","%2B")
      req=Replace(req,"&","%26")
      req=Replace(req,"=","%3D")

      Dim strHmacText as String
      Dim objCrypto as Object
      Dim strHmacGenerated
      Dim loginError as String

      'Initialize the Crypto object
      objCrypto = Server.CreateObject("SonicSSL.Crypto")

      'The text to be encoded
      strHmacText = sessionId & ip & mac & ufi & mgmtBaseUrl & clientRedirectUrl & req

      'Calculate the hash with a key strHmac, the return value is a string converted form the 
output sha1 binary.
      'The hash algorithm (MD5 or SHA1) is configured in myvars and in the Extern Guest Auth 
config on the SonicWall
      If hmacType = "MD5" Then
         strHmacGenerated = objCrypto.hmac_md5(strHmacText, strHmac)
      Else
         strHmacGenerated = objCrypto.hmac_sha1(strHmacText, strHmac)
      End If

      If strHmacGenerated <> hmac Then
         Dim hmacFail as String
         hmacFail = "<font color=""red"">The HMAC failed validation. Notify an 
attendant.</font><br><br>"
         hmacFail+="<font color=""9CBACE"">Received HMAC: " & hmac & "<br>Calculated HMAC: " & 
strHmacGenerated & "<br>"
         hmacFail+="Make sure the digest functions on the SonicWall and LHM server match.<br>"
         hmacFail+="Also make sure the shared secret on the SonicWall and myvars match</font>"
         catchError.Text=hmacFail
      End If

   End If

End Sub

'When the submit button is clicked, pass the variables we need and load the quiz
Sub btnSubmit_Click(Sender As Object, E As EventArgs)

   Context.Items.Add("req", req)
   Context.Items.Add("sessionId", sessionId)
   Context.Items.Add("emailAddr",clientEmail.Text)
   Context.Items.Add("userName",clientName.Text)
   Context.Items.Add("mgmtBaseUrl",mgmtBaseUrl)
   Server.Transfer("quiz.aspx",true)

End Sub

</script>

<STYLE>
body {
  font-size: 10pt;
  font-family: verdana,helvetica,arial,sans-serif;
  color:#000000;
  background-color:#9CBACE;
}

tr.heading {
  background-color:#006699;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM Quiz Script</TITLE>
</HEAD>

<BODY>
<form id="frmValidator" runat="server">

<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td width="50%" valign="center"><font color="white"><b>LHM Quiz 
Authorization</b></font></td>
      <td><center><img width="216" height="51" src="SonicWall.gif"></center></td>
      <td width="50%" align="right" valign="center"><font color="white"><b>Powered by 
SonicWall LHM</b>&nbsp</font></td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr>
      <td width="30%"><br>Enter your full name:</td>
      <td width="20%"><asp:TextBox id="clientName" runat="server" /></td>
      <td ><asp:RequiredFieldValidator id="valTxtName" ControlToValidate="clientName" 
ErrorMessage="Enter your name." Display="Dynamic" runat="server" /></td>
   </tr>
   <tr>
      <td width="30%"><br>Enter your real email address:</td>
      <td width="20%"><asp:TextBox id="clientEmail" runat="server" /></td>
      <td ><asp:RegularExpressionValidator id="fromEmail" runat="server" 
ControlToValidate="clientEmail" ValidationExpression=".*@.*\..*" ErrorMessage="Enter a valid 
email address." Display="Dynamic" />
      </asp:RegularExpressionValidator>
      <asp:RequiredFieldValidator id="fromRequired" runat="server" 
ControlToValidate="clientEmail" ErrorMessage="Enter your email address." Display="Dynamic" />
      </asp:RequiredFieldValidator>
      </td>
   </tr>
   <tr>
      <td></td>
      <td><asp:button id="btnSubmit" class="button" text="  Submit  " 
onClick="btnSubmit_Click" runat="server" /><br></td>
   </tr>

   <tr class="heading">
      <td colspan=3 align="left"><font color="white"><b>Welcome Quiztaker <%= 
ip%></b></font></td>
   </tr>
</table>
<table width="70%" border="0" cellpadding="2" cellspacing="0">
   <tr>
      <td>
      <br>You have been redirected here by Lightweight Hotspot Messaging.
      This environment has been setup to demonstrate the flexibility of LHM, including
      support for clients, and also the ability for LHM to use
      more than just username and password authentication for providing access.<br><br>
      The page that you are about to continue on to is a <%= quizName %> written in ASP.net.
      A passing score of <%= passingScore%>% serves as the authentication for LHM, and grants
      you network access. You must pass the test to continue, and are prompted to retake
      the entire quiz if you do not pass. <br><br>
      When you are done, the completed test is emailed to you at the address you
      specify above.<br><br>
      So it is not just a good way to prove your understanding of some
      key SonicOS NSv concepts, but also a practical example of the versatility of LHM.
      </td>
   </tr>
   <tr>
      <td><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td colspan=2><asp:Label id=catchError runat="server" /></td>
   </tr>
</table>
</form>
</BODY>
</HTML>
```

logout.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy.CheckValidationResult
      Return True
   End Function
End Class

Dim sessionId as String
Dim mgmtBaseUrl as String
Dim eventId as String = "&eventId=1"

'Grab the code and the session lifetime from the generator page
Sub Page_Load(src as Object, e as EventArgs)
   sessionId=Request.QueryString("sessId")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   sessTimer=Request.QueryString("sessTimer")


   'Use the override class in myvars.aspx to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts

   'When the page loads, make the loggedIn span visible
   loggedIn.Visible=True
   loggedOut.Visible=False

   Me.Button1.Attributes.Add("OnClick", "self.close()")

End Sub
```

```
'The Logout button
Sub btnSubmit_Click(Sender As Object, E As EventArgs)

   'Let the user know that we are setting up the session, just in case it takes more than a
second
   LHMResult.Text = "Authorizing session. Please wait."

   'The LHM cgi on the SonicWall - this does not change
   Dim loginCgi as String = "externalGuestLogoff.cgi"

   'Assemble the data to post back to the SonicWall to authorize the LHM session
   Dim loginParams as String = "sessId=" & sessionId & eventId

   'Combine mgmtBaseUrl from the original redirect with the login cgi
   Dim postToSNWL as String = mgmtBaseUrl & loginCgi

   'Convert the loginParams to a well behaved byte array
   Dim byteArray As Byte() = Encoding.UTF8.GetBytes(loginParams)

   Try
      'Make the loggedOut span visible
      loggedIn.Visible=False
      loggedOut.Visible=True

      'Create the webrequest to the SonicWall
      Dim toSNWL as WebRequest = WebRequest.Create(postToSNWL)

      'Calculate the length of the byte array
      toSNWL.ContentLength = byteArray.Length

      'Set the method for the webrequest to POST
      toSNWL.Method = "POST"

      'Set the content type
      toSNWL.ContentType = "application/x-www-form-urlencoded"

      'Open the request stream
      Dim dataStream As Stream = toSNWL.GetRequestStream()

      'Write the byte array to the request stream
      dataStream.Write(byteArray, 0, byteArray.Length)

      'Close the Stream object
      dataStream.Close()

      'Get the response
      Dim snwlReply As WebResponse = toSNWL.GetResponse()

      'Display the status - looking for 200 = OK.
      'Response.Write(CType(snwlReply, HttpWebResponse).StatusCode)

      'Grab the response and stuff it into an xml doc for possible review
      Dim snwlResponse as XmlDocument = New XmlDocument()
      snwlResponse.Load(snwlReply.GetResponseStream())

      'Set the xPath to the SNWL reply, and get the response
      Dim codePath as String = "SonicWallAccessGatewayParam/LogoffReply/ResponseCode"

      'Response.Write(snwlResponse.SelectSingleNode(codePath).InnerXml)

      'Response code 150 - Logout Succeeded
      If snwlResponse.SelectSingleNode(codePath).InnerXml = "150"
         LHMResult.Text = "<br><b><font color=""green"">Your session has been logged
out.<br><br>Thank you for using LHM Guest Services.</font></b>"

      'Response code 251 - Bad HMAC.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "251"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed message authentication. Sorry for the inconvenience. Close and relaunch your 
browser to try again."

      'Response code 253 - Invalid SessionID.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "253"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed to match a known session identity. Sorry for the inconvenience. Close and 
relaunch your browser to try again."

      'Response code 254 - Invalid CGI.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "254"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request was missing an essential parameter. Sorry for the inconvenience. Close and relaunch 
your browser to try again."

      'Response code 255 - Internal Error.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "255"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed because of an unspecified error. Sorry for the inconvenience. Close and relaunch 
your browser to try again."

      End If

      'Close the streams
      dataStream.Close()
      snwlReply.Close()

      'If there is some asp.net error trying to talk to the SonicWall, print it in the same 
color as the background.
      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed because of an unspecified error. Sorry for the inconvenience. Close and relaunch 
your browser to try again. If the problem persists, notify an attendant."
      End Try
End Sub

</script>
<STYLE>
body {
   font-size: 10pt;
   font-family: verdana,helvetica,arial,sans-serif;
   color:#000000;
   background-color:#9CBACE;
}

tr.heading {
   font-size: 10pt;
   background-color:#006699;
}

tr.smalltext {
   font-size: 8pt;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
   font-size: 8pt;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM Logout Page</TITLE>
```

```
<SCRIPT LANGUAGE="Javascript">

//'Javascript Seconds Countdown Timer
var SecondsToCountDown = <%= sessTimer%>;
var originalTime=" ";

function CountDown()
{
   clockStr="";

   dayStr=Math.floor(SecondsToCountDown/86400)%100000
   if(dayStr>0){
      if(dayStr>1){
         dayStr+=" days ";
      } else dayStr+=" day ";
      clockStr=dayStr;
   }
   hourStr=Math.floor(SecondsToCountDown/3600)%24
   if(hourStr>0){
      if(hourStr>1){
         hourStr+=" hours ";
      } else hourStr+=" hour ";
      clockStr+=hourStr;
   }
   minuteStr=Math.floor(SecondsToCountDown/60)%60
   if(minuteStr>0){
      if(minuteStr>1){
         minuteStr+=" minutes ";
      } else minuteStr+=" minute ";
      clockStr+=minuteStr;
   }
   secondStr=Math.floor(SecondsToCountDown/1)%60
   if(secondStr>0){
      if(secondStr>1){
         secondStr+=" seconds ";
      } else secondStr+=" second ";
      clockStr+=secondStr;
   }

   if(SecondsToCountDown > 0)
   {
      --SecondsToCountDown;
   }

   if(originalTime.length < 2)
   {
      originalTime = clockStr;
   }

   // Make sure the form is still there before trying to set a value
   if(document.frmValidator){
      document.frmValidator.originalTime.value = originalTime;
      document.frmValidator.countdown.value = clockStr;
   }

   setTimeout("CountDown()", 1000);
   if(SecondsToCountDown == 0)
   {
      document.frmValidator.countdown.value = "Session Expired";
   }
}

//'Disable right-click so that the window doesn't get refreshed because the countdown is 
clientside.
document.oncontextmenu = disableRightClick;
function disableRightClick()
```

```
{
  return false;
}

//'Disable F5 key, too, on IE at least.
function noF5()
{
   var key_f5 = 116;
   if (key_f5==event.keyCode)
   {
      event.keyCode=0;
      return false;
   }
   return false;
}

document.onkeydown=noF5
document.onmousedown=disableRightClick

</SCRIPT>

</HEAD>

<BODY onload='CountDown()'>
<span id="loggedIn" runat="server">
<form id="frmValidator" runat="server">
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center"><font color="white"><b>SonicWall LHM Logout 
Window</b></font></td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="smalltext"><td><br></td></tr>
   <tr class="smalltext">
      <td>Original Session Time:</td>
      <td><asp:textbox width=250 id="originalTime" runat="server" /></td>
   </tr>
   <tr class="smalltext">
      <td>Remaining Session Time:</td>
      <td><asp:textbox width=250 id="countdown" runat="server" /></td>
   </tr>
   <tr class="smalltext">
      <td colspan=2><br>You can use this window to manually logout your session at any time, or 
you can safely close this window if you prefer to let your session timeout 
automatically.</font></td>
   </td>
   <tr>
      <td colspan=2><center><asp:button id="btnSubmit" class="button" text="  Logout  " 
onClick="btnSubmit_Click" runat="server" /></center></td>
   </tr>
</table>
</form>
</span>

<span id="loggedOut" runat="server">
<form id="logout" runat="server">
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="heading">
```

```
      <td colspan=2 align="center"><font color="white"><b>SonicWall LHM Logout
Window</b></font></td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr>
      <td><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td><asp:Label id=catchError runat="server" /></td>
   </tr>
   <tr><td><br></td></tr>
   <tr>
      <td><center><asp:button id="Button1" class="button" text="  Close  " runat="server"
/></center></td>
   </tr>
</table>
</form>
</span>

</BODY>
</HTML>
```

myvars.aspx

```
<script language="VB" runat="server">

'Set the logoutPopup window flag - 0 = no popup, 1 = popup
'The use of the logoutPopup in this script is discouraged because although the login event
'is non-exclusive, the login event produces data where redundancy is undesirable.
Dim logoutPopup as String = "0"

'Set the passing score
Dim passingScore as Integer = 80

'Set the filename of the quiz XML source
Dim quizFile as String = "quiz.xml"
'Dim quizFile as String = "shortquiz.xml"

'Set the name of the Quiz
Dim quizName as String = "SonicOS NSv Quiz"

'Set the emailed quiz results "from" email address
Dim quizFrom as String = "joelevy@SonicWall.com"

'Set the email address to send failed test results to (the proctor/instructor)
Dim quizTo as String = "joelevy@SonicWall.com"

'Set the path for check and block embedded images - usually the same path as the quiz
Dim imagePath as String = "C:\inetpub\wwwroot\lhm\lhmquiz\"

'Set the IP or resolvable FQDN for the SMTP Server
'Make sure the server is configured to relay from the IP address of this server
'If setting to 127.0.0.1 (local IIS SMTP), you need to allow IIS SMTP to relay from 127.0.0.1
Dim smtpServer as String = "127.0.0.1"

'Set the LHM Session Timeout
Dim sessTimer as String = "86400"

'Set the LHM Idle Timeout
Dim idleTimer as String = "3600"

'Set the secret for use with optional HMAC auth, as configured in the Extern Guest Auth config
on the SonicWall
```

```
Dim strHmac as String = "password"

'Set the digest method for the HMAC, either MD5 or SHA1
Dim hmacType as String = "MD5"
'Dim hmacType as String = "SHA1"

'Set the logo image to use
Dim logo as String = "SonicWall.gif"

'------------------------End of Configurable Settings-------------------------

</script>
```

quiz.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>
<%@ Import Namespace="System.Web" %>
<%@ Import Namespace="System.Web.Mail" %>

<!-- Original quiz code from www.codeproject.com -->

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy.CheckValidationResult
      Return True
   End Function
End Class

'Set the path to the XML quiz data
Dim strXmlFilePath as String = Server.MapPath(quizFile)

'Setup our variables
Dim emailAddr as String
Dim userName as String
Dim req as String
Dim sessionId as String
Dim mgmtBaseUrl as String
Dim xDoc as XmlDocument = New XmlDocument()
Dim intTotalQuestion as Integer
Dim intQuestionNo as Integer = 1
Dim intScore as Integer = 0
Dim arrAnswerHistory as new ArrayList()
Dim arrRightOrWrong as new ArrayList()
Dim arrCorrect as new ArrayList()

Sub Page_Load(src as Object, e as EventArgs)

   LHMResult.Text=""
   catchError.Text=""

   'Grab context items set in default.aspx
   emailAddr = Context.Items("emailAddr")
   userName = Context.Items("userName")
   req = Context.Items("req")
   sessionId = Context.Items("sessionId")
   mgmtBaseUrl = Context.Items("mgmtBaseUrl")

   'Use the override class in myvars.aspx to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts

   'Load xml data
   xDoc.Load(strXmlFilePath)

   'Start a new quiz?
   If Not Page.IsPostBack Then

      'Yes. Count total question
      intTotalQuestion = xDoc.SelectNodes("/quiz/mchoice").Count

      'Record start time
      ViewState("StartTime") = DateTime.Now

      ShowQuestion(intQuestionNo)
   End If
End Sub

Sub btnSubmit_Click(src as Object, e as EventArgs)

   'Retrieve variables from ViewState
   intTotalQuestion = ViewState("TotalQuestion")
   intQuestionNo = ViewState("QuestionNo")
   intScore = ViewState("Score")
   arrAnswerHistory = ViewState("AnswerHistory")
   arrRightOrWrong = ViewState("RightOrWrong")
   arrCorrect = ViewState("AnswerList")
   req = ViewState("origReq")
   userName = ViewState("origUserName")
   emailAddr = ViewState("origEmailAddr")
   mgmtBaseUrl = ViewState("mgmtUrl")
   sessionId = ViewState("sessID")

   'Correct answer?
   If rblAnswer.SelectedItem.Value = ViewState("CorrectAnswer") Then
      intScore += 1
      arrRightOrWrong.Add(0)
   Else
      arrRightOrWrong.Add(rblAnswer.SelectedItem.Value)
   End If

   'Remember all selected answers
   arrAnswerHistory.Add(rblAnswer.SelectedItem.Value)
   arrCorrect.Add(ViewState("CorrectAnswer"))

   'End of quiz?
   If intQuestionNo=intTotalQuestion Then

      'Yes. Show the result.
      QuizScreen.Visible = False
      ResultScreen.Visible = True

      'Render result screen
      ShowResult()

   Else

      'Not yet. Show another question.
      QuizScreen.Visible = True
      ResultScreen.Visible = False
      intQuestionNo += 1

      'Render next question
      ShowQuestion(intQuestionNo)
   End If
End Sub

Sub ShowQuestion(intQuestionNo as Integer)
   Dim xNodeList as XmlNodeList
   Dim xNodeAttr as Object
   Dim strXPath as String
   Dim i as Integer
   Dim tsTimeSpent as TimeSpan

   strXPath = "/quiz/mchoice[" & intQuestionNo.ToString() & "]"

   'Extract question
   lblQuestion.Text = intQuestionNo.ToString() & ". " & xDoc.SelectSingleNode(strXPath &
"/question").InnerXml

   'Extract answers
   xNodeList = xDoc.SelectNodes(strXPath & "/answer")

   'Clear previous listitems
   rblAnswer.Items.Clear

   For i = 0 to xNodeList.Count-1

      'Add item to radiobuttonlist
      rblAnswer.Items.Add(new ListItem(xNodeList.Item(i).InnerText, i+1))

      'Extract correct answer
      xNodeAttr = xNodeList.Item(i).Attributes.ItemOf("correct")
      If not xNodeAttr is Nothing Then
         If xNodeAttr.Value = "yes" Then
            ViewState("CorrectAnswer") = i+1
         End If
      End If
   Next

   'Output Total Question and passing score
   lblTotalQuestion.Text = intTotalQuestion
   lblPassingScore.Text = passingScore

   'Output Time Spent
   tsTimeSpent = DateTime.Now.Subtract(ViewState("StartTime"))
   lblTimeSpent.Text = tsTimeSpent.Minutes.ToString() & ":" & tsTimeSpent.Seconds.ToString()

   'Store data to viewstate
   ViewState("TotalQuestion") = intTotalQuestion
   ViewState("Score") = intScore
   ViewState("QuestionNo") = intQuestionNo
   ViewState("AnswerHistory") = arrAnswerHistory
   ViewState("RightOrWrong") = arrRightOrWrong
   ViewState("AnswerList") = arrCorrect
   ViewState("origReq")=req
   ViewState("origUserName")=userName
   ViewState("origEmailAddr")=emailAddr
   ViewState("mgmtUrl")=mgmtBaseUrl
   ViewState("sessID")=sessionID

End Sub

Sub ShowResult()
   Dim strResult as String
   Dim intCompetency as Integer
   Dim i as Integer
   Dim strXPath as String
   Dim tsTimeSpent as TimeSpan

   tsTimeSpent = DateTime.Now.Subtract(ViewState("StartTime"))

   strResult  = "<center>"

   if passingScore <= Int(intScore/intTotalQuestion*100).ToString()
      strResult += "<h2><font color=""green"">You Passed!</h3></font>"
   else
      strResult += "<h2><font color=""red"">You Failed!</h3><b>Review the answers and retake 
the test.</b><br></font>"
   End If

   strResult += "User Name: " & userName & "<br>"
   strResult += "Elapsed Time: " & tsTimeSpent.Minutes.ToString() & ":" & 
tsTimeSpent.Seconds.ToString() & "<br>"
   strResult += "Correct Answers: " & intScore.ToString() & " out of " & 
intTotalQuestion.ToString() & "<br>"
   strResult += "Your Percentage: " & Int(intScore/intTotalQuestion*100).ToString() & "%<br>"
   strResult += "Required Percentage:" & passingScore.ToString() & "%<br>"
   strResult += "</center>"

   strResult += "<h3>Quiz Results</h3>"
   For i = 1 to intTotalQuestion
      strXPath = "/quiz/mchoice[" & i.ToString() & "]"
      strResult += "<b>" & i.ToString() & ". " & xDoc.SelectNodes(strXPath & 
"/question").Item(0).InnerXml & "</b><br>"
      If arrRightOrWrong.Item(i-1)=0 Then
         strResult += "<img src = ""checkMark.gif""><font color=""green"">&nbsp"
         strResult += "<b>You answered:</b> " & xDoc.SelectNodes(strXPath & "/answer[" & 
arrAnswerHistory.Item(i-1).ToString() & "]").Item(0).InnerXml & "</font><br><br>"
      Else
         strResult += "<img src = ""Block.gif""><font color=""red"">&nbsp"
         strResult += "<b>You answered:</b> " & xDoc.SelectNodes(strXPath & "/answer[" & 
arrAnswerHistory.Item(i-1).ToString() & "]").Item(0).InnerXml & "<br>"
         strResult += "The correct anwer is: " & xDoc.SelectNodes(strXPath & "/answer[" & 
arrCorrect.Item(i-1).ToString() & "]").Item(0).InnerXml & "</font><br><br>"
      End If
   Next

   'Setup the common Mail settings
   Dim objMail As MailMessage
   objMail = New MailMessage()
   objMail.From = quizFrom
   objMail.Body = strResult
   objMail.BodyFormat = MailFormat.Html

   'Path to the attachments for the Check and X images - update these in myvars.aspx
   objMail.Attachments.Add(New MailAttachment(imagePath & "block.gif"))
   objMail.Attachments.Add(New MailAttachment(imagePath & "checkMark.gif"))

   'Address of the SMTP server - can be localhost if SMTP is running on IIS - in myvars.aspx
   SmtpMail.SmtpServer = smtpServer

   'Determine pass/fail
   If passingScore <= Int(intScore/intTotalQuestion*100).ToString()

      'Mail the passing test result to the test-taker
      'Be sure to update the mail fields in myvars.aspx
      objMail.To =emailAddr
      objMail.Subject = quizName & " Results for " & emailAddr

      'Send the mail
      SmtpMail.Send(objMail)
      strResult +="Your test is being emailed to you at " & emailAddr
      'Send the session Auth message to LHM
      postLHM()

   else
      'Mail failing test results to the instuctor
      objMail.To =quizTo
      objMail.Subject = "Failing " & quizName & " Test Results for " & emailAddr

      'Send the mail
      SmtpMail.Send(objMail)
      strResult += "<a href=""quiz.aspx"">Click here to retake the quiz</a>"
   End If

   'Write it
   lblResult.Text = strResult

End Sub

Sub postLHM()

   'The LHM cgi on the SonicWall - this does not change
   Dim loginCgi as String = "externalGuestLogin.cgi"

   'Assemble the data to post back to the SonicWall to authorize the LHM session
   Dim loginParams as String = "sessId=" & sessionId & "&userName=" &
Server.URLEncode(userName) & "&sessionLifetime=" & sessTimer & "&idleTimeout=" & idleTimer

   'Combine mgmtBaseUrl from the original redirect with the login cgi
   Dim postToSNWL as String = mgmtBaseUrl & loginCgi

   'Convert the loginParams to a well behaved byte array
   Dim byteArray As Byte() = Encoding.UTF8.GetBytes(loginParams)

   Try
      'Let the user know that we are setting up the session, just in case it takes more than a
second
      LHMResult.Text = "Authorizing session. Please wait."

      'Create the webrequest to the SonicWall
      Dim toSNWL as WebRequest = WebRequest.Create(postToSNWL)

      'Calculate the length of the byte array
      toSNWL.ContentLength = byteArray.Length

      'Set the method for the webrequest to POST
      toSNWL.Method = "POST"

      'Set the content type
      toSNWL.ContentType = "application/x-www-form-urlencoded"

      'Open the request stream
      Dim dataStream As Stream = toSNWL.GetRequestStream()

      'Write the byte array to the request stream
      dataStream.Write(byteArray, 0, byteArray.Length)

      'Close the Stream object
      dataStream.Close()

      'Get the response
      Dim snwlReply As WebResponse = toSNWL.GetResponse()

      'Display the status - looking for 200 = OK.
      'Response.Write(CType(snwlReply, HttpWebResponse).StatusCode)

      'Grab the response and stuff it into an xml doc for possible review
      Dim snwlResponse as XmlDocument = New XmlDocument()
      snwlResponse.Load(snwlReply.GetResponseStream())

      'Set the xPath to the SNWL reply, and get the response
      Dim codePath as String = "SonicWallAccessGatewayParam/AuthenticationReply/ResponseCode"

      'Response code 50 - Login Succeeded

      If snwlResponse.SelectSingleNode(codePath).InnerXml = "50"

         'Do we want to provide a logout popup window?
         If logoutPopup = "1" Then
            'Popup hack using Javascript for logout window
            Dim sb As New System.Text.StringBuilder()
            sb.Append("<script language='javascript'>")
            sb.Append("window.open('logout.aspx?sessId=")
            sb.Append(Server.URLEncode(CStr(sessionId)))
            sb.Append("&mgmtBaseUrl=")
            sb.Append(Server.URLEncode(CStr(mgmtBaseUrl)))
            sb.Append("&sessTimer=")
            sb.Append(Server.URLEncode(CStr(sessTimer)))
            sb.Append("','logOut','toolbar=no,")
            sb.Append("addressbar=no,menubar=no,")
            sb.Append("width=400,height=250');")
            sb.Append("<")
            sb.Append("/")
            sb.Append("script>")
            RegisterStartupScript("stp", sb.ToString)
         End If

         LHMResult.Text = "<br><b><font color=""green"">Session authorized:</font></b> You can
now go to the URL you originally requested: <a target=""_blank"" href=""" & req & """>" & req &
"</a>"

      'Response code 51 - Session Limit Exceeded
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "51"
         LHMResult.Text = "<br><b><font color=""red"">Session Limit Reached:</font></b> The
maximum number of guest session has been reached. Sorry for the inconvenience. Close and
relaunch your browser to try again."

      'Response code 100 - Login Failed.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "100"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> Your
session cannot be created at this time. Sorry for the inconvenience. Close and relaunch your
browser to try again."

      'Response code 251 - Bad HMAC.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "251"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed message authentication. Sorry for the inconvenience. Close and
relaunch your browser to try again."

      'Response code 253 - Invalid SessionID.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "253"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed to match a known session identity. Sorry for the
inconvenience. Close and relaunch your browser to try again."

      'Response code 254 - Invalid CGI.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "254"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization was missing an essential parameter. Sorry for the inconvenience.
Close and relaunch your browser to try again."

      'Response code 255 - Internal Error.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "255"
```

```
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed because of an unspecified error. Sorry for the inconvenience.
Close and relaunch your browser to try again."

      End If

      'Close the streams
      dataStream.Close()
      snwlReply.Close()

      'If there is some asp.net error trying to talk to the SonicWall, print it
      'in the same color as the background, but still show the quiz results.
      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed because of an unspecified error. Sorry for the inconvenience.
Close and relaunch your browser to try again. If the problem persists, notify an attendant."
   End Try
End Sub

</script>
<html>
<head>
<title><%= quizName %> </title>
</head>
<style>
body {
  font-size: 10pt;
  font-family: verdana,helvetica,arial,sans-serif;
  color:#000000;
  background-color:#9CBACE;
}

tr.heading {
  background-color:#006699;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
}
</style>

<HTML>
<HEAD>
<TITLE>LHM Quiz Script</TITLE>
</HEAD>

<body>
<span id="QuizScreen" runat="server">
<form runat="server">
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td width="50%" valign="center"><font color="white"><b><%= quizName %>  - <%=
userName%></b></font></td>
      <td><center><img width="216" height="51" src="<%= logo %>"></center></td>
      <td width="50%" align="right" valign="center"><font color="white"><b>This quiz has
<asp:label id="lblTotalQuestion" runat="server" /> questions</b></font></td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>
<table width="100%" border="0" cellpadding="2" cellspacing="0">
```

```
   <tr>
      <td colspan="2">
         <b><asp:label id="lblQuestion" runat="server" /></b><br>
         <asp:radiobuttonlist id="rblAnswer" RepeatDirection="vertical" TextAlign="right" 
RepeatLayout="table" runat="server" /><br>
         <asp:button id="btnSubmit" class="button" text="  Submit  " onClick="btnSubmit_Click" 
runat="server" />
         <asp:requiredfieldvalidator ControlToValidate="rblAnswer" ErrorMessage="Select an 
answer" runat="server" />
      </td>
   </tr>
   <tr class="heading">
      <td width="70%"><font color="white"><b>Score required to pass <asp:label 
id="lblPassingScore" runat="server" />%</b></font></td>
      <td width="30%" align="right"><font color="white"><b>Time spent <asp:label 
id="lblTimeSpent" runat="server" /></b></font></td>
   </tr>
</table>
</form>
</span>

<span id="ResultScreen" runat="server"> <asp:label id="lblResult" runat="server" /> <br>
<asp:Label id=LHMResult runat="server" />
<asp:Label id=catchError runat="server" />
</span>

</body>
</html>
```

PayPal Script

Authentication Model	The Guest Client buys one-hour or 24-hour access with a **Buy Now** button using their PayPal account. Payment is made through PayPal to the hotspot provider's PayPal merchant account.
Purpose	Nearly everyone who buys or sells on the Internet uses PayPal. It is very easy to setup a buyer account, and to link it to any form of payment (such as credit card, bank card, checking account). It is almost equally easy to upgrade a buyer-only account to a merchant account. Having a merchant account allows PayPal users to accept payment from other PayPal users for goods or services. The funds transfer is run through PayPal, providing merchants a way to do business online, accepting any form of payment, without having to setup any sort of complicated payment processing. This eliminates what is perhaps the single biggest obstacle to being a fee-based hot spot provider. PayPal provides a feature called **Buy Now**, which allows for one-click transactions. The buttons are forms, generated with the assistance of PayPal, that contain information about the item or service being purchased. When the buyer clicks on **Buy Now**, the session is redirected to the PayPal site with a `querystring` containing all the details of the transaction (such as the seller, the item, the price). Rather than using **Buy Now** (which is client-side rather than server-side code), the PayPal script uses a custom, server-side Buy Now routine.

Also included in the Buy Now redirect is the path for the auto-return. Auto-return is a PayPal feature that sends the buyer back to the merchant's site after the PayPal transaction. Auto-return is required when using PDT (`pdtPath`, described below).

The custom Buy Now redirect also embeds the LHM `sessionID` and the `mgmtBaseUrl` into a custom string in the Buy Now redirect to PayPal. This allows us to track the session even though it leaves the LHM server, goes to PayPal, and then comes back (through auto-return for PDT).

The basic PayPal payment system provides notification of payment to merchants by email. This is acceptable for physical goods because the purchase/ship transaction does not have to occur in real-time; the merchant can wait hours or days for the notification before shipping the product. For transactions that require instantaneous delivery, such as buying hot spot access, a more real-time method of payment is required.

PayPal offers two methods of payment notification:

- Instant Payment Notification (IPN), which works by PayPal making a web-services call to the merchant's site indicating that payment for a particular transaction has cleared. Unfortunately, this does not always occur in real-time (it can take up to 20 minutes for this asynchronous notification to arrive), so it was not employed in this script. (More can be read about IPN at https://www.paypal.com/cgi-bin/webscr?cmd=p/xcl/rec/ipn-intro-outside)
- Payment Data Transfer (PDT: see http://www.paypal.com/cgi-bin/webscr?cmd=p/xcl/rec/pdt-intro-outside). This method occurs in absolute real-time using PayPal's auto-return method. PDT provides instant notification to the merchant of the state of a transaction (either SUCCESS or FAIL), as well as of the `payment_status` (Completed, Pending, Denied, Failed, Refunded, Reversed, or Cancelled_Reversal). By instantly knowing the status of the transaction and the payment, it is possible to immediately provide service without the risk of losing payment.

myvars Variables

`logoutPopup` Controls the use of the logout popup window. Set to:

- **0** to disable the popup window.
- **1** to enable the popup window.

`debugFlag` Sets the debug output for the PayPal PDT transfer:

- **0** = Off
- **1** = On

`pdtPath` The path to which the Guest Client is redirected by the PDT auto-return (described above in the Purpose section).

`paypalCGI` The URL for the PayPal CGI serving as the gateway for the PayPal transaction. The URL itself should not be changed, but there are two options; either the:

- Live (real) PayPal site.
- PayPal sandbox (part of the PayPal developer network), which can be used for testing.

`myBusiness` The email address (how PayPal recognizes the business) of the hot spot provider. This must match the email address of the merchant account that is receiving payment for the transactions.

`token` The Payment Data Transfer option generates a unique token for each merchant. This is where you specify your PayPal-provided unique token. The token must be correct, or the PDT transaction (not the actual PayPal transaction) fails.

`itemName1` `itemName2`	The names of the two access options, such as `1 Hour Secure Internet Access` and `24 Hours Secure Internet Access`.
`itemNumber1` `itemNumber2`	The item number (a mostly arbitrary internal PayPal reference) for the two access options, such as `1hour` and `24hour`.
`itemTimer1` `itemTimer2`	The session timer, in seconds, for the two access options, such as `3600` for one hour and `86400` for 24 hours.
`itemAmount1` `itemAmount2`	The price in US dollars for the two access options, such as `0.01` (one cent) and `0.02` (two cents). Limited time promotional bargain pricing.
`itemButton1` `itemButton2`	The button text for the two access options, such as `1 Hour Access - $0.01` and `24 Hours Access - $0.02`.
`strHmac`	The shared secret for the optional HMAC function.
`hmacType`	The digest type to use if HMAC is in use: **MD5** or **SHA1**.
`logo`	The names of the logo (image) file to use on page headers.

Session Flow

1 The Guest Client launches their web-browser, and is redirected by LHM to `http://`*`<lhmserver>`*`/paypal/default.aspx`, where *`<lhmserver>`* is your LHM server.

2 Guest client (buyer) clicks on one of the **Buy Now** buttons, such as **1 Hour Access - $0.01**.

3 The client is redirected to the PayPal site with a `querystring` containing all the information about the merchant, the item, the LHM session (in the custom variable), and the auto-return URL (defined in `myvars` as pdtPath).

The `pdtPath` resides on the LHM server. The path should be the same as the `default.aspx` path (as configured on the SonicWall Security Appliance), but should point to the `pdt.aspx` file. This way, when the PayPal transaction is completed and PayPal redirects the client back to the merchant site, the client is redirected back to the `http://`*`<lhmserver>`*`/paypal/pdt.aspx` page.

HTTP can be used on the LHM Server because no sensitive information is entered on the LHM server itself; the PayPal transaction occurs through HTTPS directly between the Guest Client and PayPal.

Sample Buy Now redirect string:

```
https://www.sandbox.paypal.com/cgi-bin/webscr?cmd
=_xclick&business=demo@SonicWall.com&item_name=1%
20Hour%20Access&item_number=1hour&amount=0.01&cur
rency_code=USD&lc=US&bn=PP-BuyNowBF&no_note=1&no_
shipping=1&cancel_return=http://lhmserverpaypal/d
efault.aspx&return=http://lhmserver/lhm/paypal/pd
t.aspx&custom=35378e67833faa3de83aa3b771https%3a%
2f%2f172.16.17.1%3a4043%2f
```

4 The Guest Client logs into PayPal (or creates a new account, as needed) and completes the transaction with PayPal. After the transaction is completed, the client is redirected back to `http://`*`<lhmserver>`*`/paypal/pdt.aspx`. Included in the redirect is a `querystring` containing the transaction id (`tx`), the status (`st`), the amount (`amt`), the currency type (`cc`), the custom value (`cm`), and an encrypted signature (`sig`).

Sample redirect string:

```
http://lhmserver/lhm/paypal/pdt.aspx?tx=4LN76482J
F4605045&st=Completed&amt=0.01&cc=USD&cm=35378e67
833faa3b771https%3a%2f%2f172%2e16%2e17%2e1%3a4043
%2f&sig=qdsNC4flKwtPviggoGAXCpeV9gS%2f2E%2bGGVbTZ
3STrUV1Ci9K3c2zTdJMuuKCmRiif1SybsZtUqDYqzzfMg64AF
3PKCk85rrPubYT4K4aC
```

5 The Guest Client accessing the `pdt.aspx` script at the URL above starts the PDT process on the LHM server. The script builds a `querystring` consisting on `cmd=_notify-synch` (indicating that it is a PDT transacation) along with the `tx` (transaction ID) and the `at` variable set to the merchant's token (defined in `myvars`). This is then POSTed to the `paypalCGI` URL (as defined in `myvars`).

6 PayPal responds to the POST with a SUCCESS of a FAIL code.

- FAIL – the script indicates to the client that the PayPal transaction fails, and they are prompted to seek assistance.

- SUCCESS – provides details about the transaction:

```
SUCCESS
txn_type=web_accept
payment_date=00%3A39%3A48+Oct+30%2C+2005+PDT
last_name=Niqual
item_name=1+Hour+Secure+Internet+Access
payment_gross=0.01
mc_currency=USD
business=lhmdemo%40SonicWall.com
payment_type=instant
payer_status=verified
tax=0.00
payer_email=lhmClient%40SonicWall.com
txn_id=84K306380G150640T
quantity=1
receiver_email=lhmdemo%40SonicWall.com
first_name=Sah
payer_id=XWRZGABD6UV2W
receiver_id=REW4W5WANU294
item_number=1hour
payment_status=Completed
payment_fee=0.01
mc_fee=0.01
shipping=0.00
mc_gross=0.01
custom=35378e67833faa3de833755d3aa3b771https%3A//172
.16.17.1%3A4043/
charset=windows-1252
```

7 The script checks the `payment_status` to make sure the payment is completed. If it is not completed, an incomplete-payment message is provided to the user.

8 If `payment_status` is completed, the script also obtains the client name, item name, amount, transaction ID, business, and custom variables for generating the client's receipt, a userName for the LHM session, and identifying the LHM `sessionID` and `mgmtBaseUrl`.

9 The script presents the PayPal transaction receipt to the Guest Client.

10 The script performs the LHM post to the SonicWall Security Appliance to authorize the session.

Additional Considerations

Requires a PayPal merchant account.

Requires that the PayPal account be setup for auto-return and for PDT (see http://www.paypal.com/cgi-bin/webscr?cmd=p/xcl/rec/pdt-techview-outside)

For testing, it is strongly suggested that a (free) PayPal sandbox account be setup through the PayPal Developer's Network (https://developer.paypal.com) and (https://www.sandbox.paypal.com)

IMPORTANT: Because the Guest Client is redirected directly to the PayPal site, ALL PayPal site IP addresses must be setup on the SonicWall Security Appliance as Allowed Networks on the Guest Services configuration. These include the following:

www.paypal.com

```
64.4.241.32
64.4.241.33
216.113.188.32
216.113.188.35
216.113.188.66
216.113.188.67
```

www.paypalobjects.com

```
216.113.188.25
64.4.241.62
216.113.188.9
```

www.sandbox.paypal.com

```
66.135.197.160
```

developer.paypal.com

```
66.135.197.163
```

Topics:

default.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>
```

```
<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy.CheckValidationResult
      Return True
   End Function
End Class

'Note: For PayPal authorization to work, it is necessary to set up the PayPal sites
(www.paypal.com, www.paypalobjects.com, and www.sandbox.paypal.com) as a bypass network on
WGS. This is so that WGS/LHM users can access PayPal directly to complete the payment
transactions. This list currently includes the following addresses: [64.4.241.32, 64.4.241.33,
216.113.188.32, 216.113.188.35, 216.113.188.66, 216.113.188.67], [216.113.188.25, 64.4.241.62,
216.113.188.9] and [66.135.197.160].

'Sample LHM redirect querystring:
'http://127.0.0.1/lhm/paypal/default.aspx?sessionId=0b712fd83b9f5313db5af1cea6b1004f&ip=10.50.
165.231&mac=00:0e:35:bd:c9:37&ufi=0006b11184300&mgmtBaseUrl=https://10.50.165.193:4043/&client
RedirectUrl=https://10.50.165.193:444/&req=http%3A//www.google.com/ig

Dim ip as String
Dim sessionId as String
Dim mac as String
Dim ufi as String
Dim mgmtBaseUrl as String
Dim clientRedirectUrl as String
Dim req as String
Dim hmac as String
Dim customCode as String

Sub Page_Load(src as Object, e as EventArgs)

   ip=Request.QueryString("ip")
   sessionId=Request.QueryString("sessionId")
   mac=Request.QueryString("mac")
   ufi=Request.QueryString("ufi")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   clientRedirectUrl=Request.QueryString("clientRedirectUrl")
   req=Request.QueryString("req")
   hmac=Request.QueryString("hmac")
   customCode=Request.QueryString("cc")

   'customCode grabs the "cc=" querystring value sent by the SonicWall. This allows you to use
the same
   'page (e.g. this page) for the "Session Expiration" (?cc=2), "Idle Timeout" (?cc=3) and "Max
Sessions" (?cc=4) page.
   If customCode <> "" Then
      Select Case customCode
      Case "2"
         LHMResult.Text="<br><H3><font color=""red"">Your LHM session has expired. You can try
to initiate a new session.</font></H3>"
      Case "3"
         LHMResult.Text="<br><H3><font color=""red"">You have exceeded your idle timeout. Log
back in.</font></H3>"
      Case "4"
         LHMResult.Text="<br><H3><font color=""red"">The maximum number of sessions has been
reached. Try again later.</font></H3>"
      End Select
   End If
   'Set the button Text for the two buttons with the variable configured in myvars
   btnBuyNow1.Text=itemButton1
   btnBuyNow2.Text=itemButton2

   'Use the override class in myvars.aspx to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts

   'Note - the routine below for handling the hmac requires the use of the SonicSSL.dll and 
libeay.dll libraries.
   'The DLL must be copied to the IIS server, and the SonicSSL dll must be registered with 
"regsvr32 sonicssl.dll"
   If hmac <> "" Then

      'SonicWall URL Encode routine is different from Microsoft - this is the SonicWall method
      req=Replace(req,"%","%25")
      req=Replace(req,":","%3A")
      req=Replace(req," ","%20")
      req=Replace(req,"?","%3F")
      req=Replace(req,"+","%2B")
      req=Replace(req,"&","%26")
      req=Replace(req,"=","%3D")

      Dim strHmacText as String
      Dim objCrypto as Object
      Dim strHmacGenerated
      Dim loginError as String

      'Initialize the Crypto object
      objCrypto = Server.CreateObject("SonicSSL.Crypto")

      'The text to be encoded
      strHmacText = sessionId & ip & mac & ufi & mgmtBaseUrl & clientRedirectUrl & req

      'Calculate the hash with a key strHmac, the return value is a string converted form the 
output sha1 binary.
      'The hash algorithm (MD5 or SHA1) is configured in myvars and in the Extern Guest Auth 
config on the SonicWall
      If hmacType = "MD5" Then
         strHmacGenerated = objCrypto.hmac_md5(strHmacText, strHmac)
      Else
         strHmacGenerated = objCrypto.hmac_sha1(strHmacText, strHmac)
      End If

      If strHmacGenerated <> hmac Then
         Dim hmacFail as String
         hmacFail = "<font color=""red"">The HMAC failed validation. Notify an 
attendant.</font><br><br>"
         hmacFail+="<font color=""9CBACE"">Received HMAC: " & hmac & "<br>Calculated HMAC: " & 
strHmacGenerated & "<br>"
         hmacFail+="Make sure the digest functions on the SonicWall and LHM server match.<br>"
         hmacFail+="Also make sure the shared secret on the SonicWall and myvars match</font>"
         catchError.Text=hmacFail
      End If

   End If

End Sub

Sub btnBuyNow_Click(Sender As Object, E As EventArgs)

'sample redirect generated by this routine:
'https://www.paypal.com/cgi-bin/webscr?cmd=_xclick&business=jlevy@SonicWall.com&item_name=24%2
0Hour%20Secure%20Internet%20Access&item_number=24hour&amount=0.02&currency_code=USD&lc=US&bn=P
P-BuyNowBF&no_note=1&no_shipping=1&cancel_return=http://127.0.0.1/lhm/paypal/default.aspx&retu
rn=http://www.moosifer.com/pdt.aspx
```

```
'sample redirect from the paypal server back the LHM server on transaction completion
(modified).
'http://127.0.0.1/lhm/paypal/pdt.aspx?tx=4PG453F7LS133715V&st=Completed&amt=0.02&cc=USD&cm=&si
g=EZhZtJygi7RTXulJt4SEhVBRi%2bJwLaC9z9kRLsrsXk4gQKnzvI5vjGy0vdhKPXAVyhbh%2bwBxWon2cieEQDJ9P6R9
qqjuKnzvI5vjGy0vdhKPXAVyJ3GtOq5Jd3%2fvTY3s7FrRcKdKnzvI5vjGy0vdhKPXAVyyEKNxY3d

   Dim str, itemName, itemNumber, itemAmount As String
   Dim sb As New StringBuilder()

   'Determine which button was pressed, and set item attributes appropriately
   Select Case Sender.Text
      Case itemButton1
         itemName = itemName1
         itemNumber = itemNumber1
         itemAmount = itemAmount1
      Case itemButton2
         itemName = itemName2
         itemNumber = itemNumber2
         itemAmount = itemAmount2
   End Select

   'The paypal CGI URL - You can select either the real CGI or the sandbox CGI in myvars
   sb.Append(paypalCGI & "?")
   'The cmd passed to PayPal - do not change!
   sb.Append("cmd=_xclick")
   'The email address of the paypal merchant receiving payment. Replace in myvars with your
paypal email address.
   sb.Append("&business=" & myBusiness)
   'The name of the item being purchased. This is the first item option (e.g. 1 hour). Set in
myvars
   sb.Append("&item_name=" & itemName)
   'The optional item id
   sb.Append("&item_number=" & itemNumber)
   'The price being charged for the item (access)
   sb.Append("&amount=" & itemAmount)
   'The currency
   sb.Append("&currency_code=USD")
   'The country
   sb.Append("&lc=US")
   'The banana nullifier
   sb.Append("&bn=PP-BuyNowBF")
   'Disables the note option on the transaction
   sb.Append("&no_note=1")
   'Disables the shipping option on the transaction
   sb.Append("&no_shipping=1")
   'Build the path to return the client to (the LHM server address) on a canceled transaction
   sb.Append("&cancel_return=http://" & Request.ServerVariables("SERVER_NAME") &
Request.ServerVariables("URL"))
   'The return (success page) path to return the buyer to after the transaction. This is the
PDT receiver/processor page.
   sb.Append("&return=" & pdtPath)
   'The LHM sessionID - append this so that it can be returned to us later by the PDT
transaction - do not change!
   sb.Append("&custom=" & sessionId & Server.URLEncode(mgmtBaseUrl))
   'Optional notify_url that PayPal asynchronously sends IPN confirmation to. Not used because
it's not real-time.
   'sb.Append("&notify_url=http://www.moosifer.com/ipn.aspx")
   str = sb.ToString
   Response.Redirect(str)

End Sub

</script>

<STYLE>
body {
  font-size: 10pt;
  font-family: verdana,helvetica,arial,sans-serif;
  color:#000000;
  background-color:#9CBACE;
}

tr.heading {
  background-color:#006699;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM PayPal Script</TITLE>
</HEAD>

<BODY>
<form id="frmValidator" runat="server">

<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td width="50%" valign="center"><font color="white"><b>LHM Access with PayPal Buy 
Now</b></font></td>
      <td><center><img width="216" height="51" src="<%= logo%>"></center></td>
      <td width="50%" align="right" valign="center"><font color="white"><b>Powered by 
SonicWall LHM</b>&nbsp</font></td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>

<table width="100%" border="0" cellpadding="2" cellspacing="0">

   <tr>
      <td colspan=3><br></td>
   </tr>
   <tr>
      <td colspan=3 align="left">Purchase Secure Internet Access through SonicWall's LHM and 
PayPal's Buy Now feature.
      <br><br>The two Buy Now buttons below will send you to PayPal's website where you can use 
your PayPal account to pay <b>$<%= itemAmount1 %> for <%= itemName1 %></b>, or <b>$<%= 
itemAmount2 %> for <%= itemName2 %></b>.
      <br><br>
      PayPal then redirects you to this site to initiate the Payment Data Transfer (PDT) 
exchange. The PDT exchange begins with the LHM server posting a PayPal constructed querystring 
back to PayPal. The response to the post is then parsed by the LHM server to determine if the 
PayPal transaction was successful. After all data is exchanged and verified, LHM authorizes 
access on the SonicWall for the period of time purchased.
      <br><br>
      The clock for access will start immediately upon successful session authorization, and 
can be used on the local SonicWall appliance by the client (as tracked by IP and MAC address) 
so long as session time remains. The idle timeout is effectively disabled by setting the idle 
timer to the same value as the session timer.
      <br><br>
      Select "<%= itemName1 %>" or "<%= itemName2 %>" below. You are redirected to the PayPal 
site, and are returned to this site on transaction completion.

      <br><br>
      </td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td align="center"><asp:Button ID="btnBuyNow1" Class="button" OnClick="btnBuyNow_Click"
runat="server" />
      &nbsp&nbsp<asp:Button ID="btnBuyNow2" Class="button" OnClick="btnBuyNow_Click"
runat="server" /></td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr>
      <td colspan=3><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td colspan=3><asp:Label id=catchError runat="server"/></td>
   </tr>
</table>

</form>
</BODY>
</HTML>
```

logout.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy.CheckValidationResult
      Return True
   End Function
End Class

Dim sessionId as String
Dim mgmtBaseUrl as String
Dim eventId as String = "&eventId=1"

'Grab the code and the session lifetime from the generator page
Sub Page_Load(src as Object, e as EventArgs)
   sessionId=Request.QueryString("sessId")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   sessTimer=Request.QueryString("sessTimer")


   'Use the override class in myvars.aspx to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts
   'When the page loads, make the loggedIn span visible
   loggedIn.Visible=True
   loggedOut.Visible=False

   Me.Button1.Attributes.Add("OnClick", "self.close()")

End Sub

'The Logout button
Sub btnSubmit_Click(Sender As Object, E As EventArgs)

   'Let the user know that we are setting up the session, just in case it takes more than a
second
   LHMResult.Text = "Authorizing session. Please wait."

   'The LHM cgi on the SonicWall - this does not change
   Dim loginCgi as String = "externalGuestLogoff.cgi"

   'Assemble the data to post back to the SonicWall to authorize the LHM session
   Dim loginParams as String = "sessId=" & sessionId & eventId

   'Combine mgmtBaseUrl from the original redirect with the login cgi
   Dim postToSNWL as String = mgmtBaseUrl & loginCgi

   'Convert the loginParams to a well behaved byte array
   Dim byteArray As Byte() = Encoding.UTF8.GetBytes(loginParams)

   Try
      'Make the loggedOut span visible
      loggedIn.Visible=False
      loggedOut.Visible=True

      'Create the webrequest to the SonicWall
      Dim toSNWL as WebRequest = WebRequest.Create(postToSNWL)

      'Calculate the length of the byte array
      toSNWL.ContentLength = byteArray.Length

      'Set the method for the webrequest to POST
      toSNWL.Method = "POST"

      'Set the content type
      toSNWL.ContentType = "application/x-www-form-urlencoded"

      'Open the request stream
      Dim dataStream As Stream = toSNWL.GetRequestStream()

      'Write the byte array to the request stream
      dataStream.Write(byteArray, 0, byteArray.Length)

      'Close the Stream object
      dataStream.Close()

      'Get the response
      Dim snwlReply As WebResponse = toSNWL.GetResponse()

      'Display the status - looking for 200 = OK.
      'Response.Write(CType(snwlReply, HttpWebResponse).StatusCode)

      'Grab the response and stuff it into an xml doc for possible review
      Dim snwlResponse as XmlDocument = New XmlDocument()
      snwlResponse.Load(snwlReply.GetResponseStream())

      'Set the xPath to the SNWL reply, and get the response
      Dim codePath as String = "SonicWallAccessGatewayParam/LogoffReply/ResponseCode"

      'Response.Write(snwlResponse.SelectSingleNode(codePath).InnerXml)
      'Response code 150 - Logout Succeeded
      If snwlResponse.SelectSingleNode(codePath).InnerXml = "150"
         LHMResult.Text = "<br><b><font color=""green"">Your session has been logged 
out.<br><br>Thank you for using LHM Guest Services.</font></b>"

      'Response code 251 - Bad HMAC.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "251"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed message authentication. Sorry for the inconvenience. Close and relaunch your 
browser to try again."

      'Response code 253 - Invalid SessionID.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "253"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed to match a known session identity. Sorry for the inconvenience. Close and 
relaunch your browser to try again."

      'Response code 254 - Invalid CGI.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "254"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request was missing an essential parameter. Sorry for the inconvenience. Close and relaunch 
your browser to try again."

      'Response code 255 - Internal Error.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "255"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed because of an unspecified error. Sorry for the inconvenience. Close and relaunch 
your browser to try again."

      End If

      'Close the streams
      dataStream.Close()
      snwlReply.Close()

      'If there is some asp.net error trying to talk to the SonicWall, print it in the same 
color as the background.
      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The 
request failed because of an unspecified error. Sorry for the inconvenience. Close and relaunch 
your browser to try again. If the problem persists, notify an attendant."
      End Try
End Sub

</script>
<STYLE>
body {
   font-size: 10pt;
   font-family: verdana,helvetica,arial,sans-serif;
   color:#000000;
   background-color:#9CBACE;
}

tr.heading {
   font-size: 10pt;
   background-color:#006699;
}

tr.smalltext {
   font-size: 8pt;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
   font-size: 8pt;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM Logout Page</TITLE>

<SCRIPT LANGUAGE="Javascript">

//'Javascript Seconds Countdown Timer
var SecondsToCountDown = <%= sessTimer%>;
var originalTime=" ";

function CountDown()
{
   clockStr="";

   dayStr=Math.floor(SecondsToCountDown/86400)%100000
   if(dayStr>0){
      if(dayStr>1){
         dayStr+=" days ";
      } else dayStr+=" day ";
      clockStr=dayStr;
   }
   hourStr=Math.floor(SecondsToCountDown/3600)%24
   if(hourStr>0){
      if(hourStr>1){
         hourStr+=" hours ";
      } else hourStr+=" hour ";
      clockStr+=hourStr;
   }
   minuteStr=Math.floor(SecondsToCountDown/60)%60
   if(minuteStr>0){
      if(minuteStr>1){
         minuteStr+=" minutes ";
      } else minuteStr+=" minute ";
      clockStr+=minuteStr;
   }
   secondStr=Math.floor(SecondsToCountDown/1)%60
   if(secondStr>0){
      if(secondStr>1){
         secondStr+=" seconds ";
      } else secondStr+=" second ";
      clockStr+=secondStr;
   }

   if(SecondsToCountDown > 0)
   {
      --SecondsToCountDown;
   }

   if(originalTime.length < 2)
   {
      originalTime = clockStr;
   }

   // Make sure the form is still there before trying to set a value
   if(document.frmValidator){
      document.frmValidator.originalTime.value = originalTime;
      document.frmValidator.countdown.value = clockStr;
   }

   setTimeout("CountDown()", 1000);
   if(SecondsToCountDown == 0)
   {
      document.frmValidator.countdown.value = "Session Expired";
   }
}

//'Disable right-click so that the window does not get refreshed because the countdown is
clientside.
document.oncontextmenu = disableRightClick;
function disableRightClick()
{
  return false;
}

//'Disable F5 key, too, on IE at least.
function noF5()
{
   var key_f5 = 116;
   if (key_f5==event.keyCode)
   {
      event.keyCode=0;
      return false;
   }
   return false;
}

document.onkeydown=noF5
document.onmousedown=disableRightClick

</SCRIPT>

</HEAD>

<BODY onload='CountDown()'>
<span id="loggedIn" runat="server">
<form id="frmValidator" runat="server">
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center"><font color="white"><b>SonicWall LHM Logout
Window</b></font></td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="smalltext"><td><br></td></tr>
   <tr class="smalltext">
      <td>Original Session Time:</td>
      <td><asp:textbox width=250 id="originalTime" runat="server" /></td>
   </tr>
   <tr class="smalltext">
      <td>Remaining Session Time:</td>
      <td><asp:textbox width=250 id="countdown" runat="server" /></td>
   </tr>
   <tr class="smalltext">
      <td colspan=2><br>You can use this window to manually logout your session at any time, or
you can safely close this window if you prefer to let your session timeout
automatically.</font></td>
   </td>
   <tr>
      <td colspan=2><center><asp:button id="btnSubmit" class="button" text="  Logout  "
onClick="btnSubmit_Click" runat="server" /></center></td>
   </tr>
</table>
</form>
</span>

<span id="loggedOut" runat="server">
```

```
<form id="logout" runat="server">
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center"><font color="white"><b>SonicWall LHM Logout
Window</b></font></td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr>
      <td><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td><asp:Label id=catchError runat="server" /></td>
   </tr>
   <tr><td><br></td></tr>
   <tr>
      <td><center><asp:button id="Button1" class="button" text="  Close  " runat="server"
/></center></td>
   </tr>
</table>
</form>
</span>

</BODY>
</HTML>
```

myvars.aspx

```
<script language="VB" runat="server">

'Set the logoutPopup window flag - 0 = no popup, 1 = popup
'The use of the logoutPopup in this script is discouraged because the login event is exclusive.
Dim logoutPopup as String = "0"

'Set the debug flag (0 = off, 1 = on)
Dim debugFlag as String = "0"

'Set the path and file for the PDT responder script - this should be the same path as the LHM
settings
'configured on the SonicWall "External Web Server Settings" page, but pointing to the PDT
handler script.
'Refer to http://www.paypal.com/cgi-bin/webscr?cmd=p/xcl/rec/pdt-techview-outside for
information on PDT
Dim pdtPath as String = "http://10.50.165.2/lhm/paypal/pdt.aspx"

'Set the path the PayPal processing CGI. Use the sandbox (https://developer.paypal.com) and
(https://www.sandbox.paypal.com) for testing
'Using the sandbox requires a developer network account and login.
Dim paypalCGI as String = "https://www.sandbox.paypal.com/cgi-bin/webscr"
'Dim paypalCGI as String = "https://www.paypal.com/cgi-bin/webscr"

'Set the email address of the PayPal merchant account to which payment will be made
'The following is a valid sandbox account, but requires authentication by the parent (real)
account.
'You must replace this with you own (real or sandbox account) for use.
Dim myBusiness as String = "lhmdemo@SonicWall.com"

'Set this to token from PayPal account. It must be your actual, valid token.
'Refer to http://paypaltech.com/PDTGen/PDTtokenhelp.htm for information on the identity token
'The following is a valid sandbox token, but requires authentication by the parent (real)
account.
'You must replace this with you own (real or sandbox token) for use.
```

```
Dim token as String = "ucistq6vmKGWPxwJbrTJFDhFq889RxYt_6Mkz_3viraSzjiQJ5iPYCZ5Mdq"

'Set the names for the purchase item options (e.g. 1 hour Access, 3 hours access, etc.)
Dim itemName1 as String = "1 Hour Secure Internet Access"
Dim itemName2 as String = "24 Hours Secure Internet Access"

'Set the PayPal querystring number for purchase item options (e.g. 1hour, 60mins, itemone,
etc.)
Dim itemNumber1 as String = "1hour"
Dim itemNumber2 as String = "24hour"

'Set the purchase item options session and idle timers (timers use the same value because we do
not want sessions idling out)
Dim itemTimer1 as String = "3600"'One hour, in minutes
Dim itemTimer2 as String = "86400"'24 hours

'Set the costs in dollars for purchase item options (e.g. one penny = 0.01, one dollar = 1.00,
etc.)
Dim itemAmount1 as String = "0.01"
Dim itemAmount2 as String = "0.02"

'Set the button names and descriptions for purchase item options
Dim itemButton1 as String = "1 Hour Access - $0.01"
Dim itemButton2 as String = "24 Hours Access - $0.02"

'Set the secret for use with optional HMAC auth, as configured in the Extern Guest Auth config
on the SonicWall
Dim strHmac as String = "password"

'Set the digest method for the HMAC, either MD5 or SHA1
Dim hmacType as String = "MD5"
'Dim hmacType as String = "SHA1"

'Set the logo image to use
Dim logo as String = "SonicWall.gif"
'-------------------------End of Configurable Settings-------------------------

</script>
```

pdt.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy.CheckValidationResult
      Return True
   End Function
End Class

'Sample LHM redirect querystring:
```

```
'http://127.0.0.1/lhm/paypal/default.aspx?sessionId=0b712fd83b9f5313db5af1cea6b1004f&ip=10.50.
165.231&mac=00:0e:35:bd:c9:37&ufi=0006b11184300&mgmtBaseUrl=https://10.50.165.193:4043/&client
RedirectUrl=https://10.50.165.193:444/&req=http%3A//www.google.com/ig

Dim ip as String
Dim sessionId as String
Dim mac as String
Dim ufi as String
Dim mgmtBaseUrl as String
Dim clientRedirectUrl as String
Dim req as String
Dim sessTimer as String
Dim idleTimer as String
Dim userName as String
Dim hmac as String
Dim firstname, lastName, itemName, mcGross, mcCurrency, itemNumber, business, txn, payStatus As
String

Sub Page_Load(ByVal sender As System.Object, ByVal e As System.EventArgs) Handles MyBase.Load

   'Use the override class to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts

   Dim tx, PDTvalidateQuery As String
   Dim strResponse As HttpWebResponse
   Dim temp As String
   Dim PDTArray() As String
   Dim iParts, sResults(0, 0), aParts(), sParts(), sKey, sValue, snwlCustom As String
   Dim i As Integer

   'Set tx to value of tx passed in via Querystring from PayPal
   tx = Request.QueryString("tx")

   'Set string = to the cmd value, tx and at that needs to be
   'POSTed back to PayPal to validate the PDT
   PDTvalidateQuery = "cmd=_notify-synch&tx=" & tx & "&at=" & token

   'Now we need to POST this info back to PayPal for validation of the PDT
   'Create the request back
   Dim req As HttpWebRequest = CType(WebRequest.Create(paypalCGI), HttpWebRequest)

   'Set values for the request back
   'set method
    req.Method = "POST"
    'set content type
    req.ContentType = "application/x-www-form-urlencoded"
    'set length
    req.ContentLength = PDTvalidateQuery.Length

   'Write the request back to PayPal
   Dim stOut As StreamWriter = New StreamWriter(req.GetRequestStream(), Encoding.ASCII)
   stOut.Write(PDTvalidateQuery)
   stOut.Close()

   Try
      strResponse = CType(req.GetResponse(), HttpWebResponse)
   Catch ex As SystemException
      catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
   End Try

        'After we write the stream back to PayPal, we need to read the response.

        Dim IPNResponseStream As Stream = strResponse.GetResponseStream
        Dim encode As Encoding = System.Text.Encoding.GetEncoding("utf-8")
        Dim readStream As New StreamReader(IPNResponseStream, encode)
        'Read the response in String variable "temp"
        temp = readStream.ReadToEnd

      'Debug flag, set in myvars - prints the whole output from the POST reply
      If debugFlag = "1" Then
         OutputEntirePDTString(temp)
      End If

        'Check to see if the 1st line of the response was "SUCCESS"
        If Mid(temp, 1, 7) = "SUCCESS" Then

            'if it is SUCCESS, the code below puts the response in a nice array
            temp = Mid(temp, 9)
            sParts = Split(temp, vbLf)
            iParts = UBound(sParts) - 1
            ReDim sResults(iParts, 1)

            For i = 0 To iParts

                aParts = Split(sParts(i), "=")
                sKey = aParts(0)
                sValue = aParts(1)
                sResults(i, 0) = sKey
                sResults(i, 1) = sValue

                'You can add more case statements here for other returned variables

            Try
                Select Case sKey
                    Case "first_name"
                        firstname = Server.URLDecode(sValue)
                    Case "last_name"
                        lastName = Server.URLDecode(sValue)
                    Case "item_name"
                        itemName = Server.URLDecode(sValue)
                    Case "mc_gross"
                        mcGross = sValue
                    Case "mc_currency"
                        mcCurrency = sValue
               Case "item_number"
                  itemNumber = Server.URLDecode(sValue)
               Case "business"
                  business = Server.URLDecode(sValue)
               Case "txn_id"
                  txn = sValue
               Case "payment_status"
                  payStatus = sValue
                    Case "custom"
                  snwlCustom = sValue
                  sessionID = snwlCustom.SubString(0,32)
                  mgmtBaseUrl=(Server.URLDecode(Mid(snwlCustom,33)))
                End Select
         Catch ex as Exception
            catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         End Try

            Next

         If payStatus = "Completed" Then
            'Transaction Succeeded - Give the Guest a receipt
            Dim receipt as String

            receipt =  "<h3>Transaction Succeeded. Thank you for selecting SonicWall 
LHM.</h3><br>"
            receipt + = "<b>Transaction Invoice:</b><br><br>"
            receipt + = "Name: " & firstname & " " & lastName & "<br>"
            receipt + = "Description: " & itemName & "<br>"
            receipt + = "Amount: " & mcCurrency & " " & mcGross &"<br>"
            receipt + = "Paid to: " & business &"<br>"
            receipt + = "Transaction ID: " & txn &"<br>"
            receipt + = "<br><br>"

            paypalResult.Text = receipt

            LHMResult.Text = "Authorizing your LHM session."

            'Setup the LHM session variables and call LHM Routine
            'Set the session and idle timers to match the variables set in myvars
            If itemNumber = itemNumber1 Then
               sessTimer=itemTimer1
               idleTimer=itemTimer1
            Else
               sessTimer=itemTimer2
               idleTimer=itemTimer2
            End If

            userName = firstname & " " & lastName

            LHM()
         Else
            'The transaction itself was a success, but the payment status was not Completed.
            paypalResult.Text = "The transaction succeeded, but the payment was not completed.
The session cannot be authorized at this time."
         End If

        Else
            ' If PDT response is not "SUCCESS"
          paypalResult.Text = "The PayPal transaction did not succeed. The returned status is:
<b>" &  temp & "</b>"
        End If

        'Close the streams
        readStream.Close()
        strResponse.Close()

    End Sub

   'This is the parser for the debug function to print the entire resonse to the PDT POST
    Private Function OutputEntirePDTString(ByVal myPDTString As String) As String
        Dim tempString() As String = Split(myPDTString, vbLf)
        Dim x As Integer
        For x = 0 To tempString.GetUpperBound(0)
            Response.Write(tempString(x) & "<br>")
        Next
    End Function

Sub LHM()

   'Let the user know that we are setting up the session, just in case it takes more than a
second
   LHMResult.Text = "Authorizing session. Please wait."

   'The LHM cgi on the SonicWall - this does not change
   Dim loginCgi as String = "externalGuestLogin.cgi"

   'Assemble the data to post back to the SonicWall to authorize the LHM session
   Dim loginParams as String = "sessId=" & sessionId & "&userName=" &
Server.URLEncode(userName) & "&sessionLifetime=" & sessTimer & "&idleTimeout=" & idleTimer

   'Combine mgmtBaseUrl from the original redirect with the login cgi
   Dim postToSNWL as String = mgmtBaseUrl & loginCgi

   'Convert the loginParams to a well behaved byte array
   Dim byteArray As Byte() = Encoding.UTF8.GetBytes(loginParams)
   Try
      'Create the webrequest to the SonicWall
      Dim toSNWL as WebRequest = WebRequest.Create(postToSNWL)

      'Calculate the length of the byte array
      toSNWL.ContentLength = byteArray.Length

      'Set the method for the webrequest to POST
      toSNWL.Method = "POST"

      'Set the content type
      toSNWL.ContentType = "application/x-www-form-urlencoded"

      'Open the request stream
      Dim dataStream As Stream = toSNWL.GetRequestStream()

      'Write the byte array to the request stream
      dataStream.Write(byteArray, 0, byteArray.Length)

      'Close the Stream object
      dataStream.Close()

      'Get the response
      Dim snwlReply As WebResponse = toSNWL.GetResponse()

      'Display the status - looking for 200 = OK.
      'Response.Write(CType(snwlReply, HttpWebResponse).StatusCode)

      'Grab the response and stuff it into an xml doc for possible review
      Dim snwlResponse as XmlDocument = New XmlDocument()
      snwlResponse.Load(snwlReply.GetResponseStream())

      'Set the xPath to the SNWL reply, and get the response
      Dim codePath as String = "SonicWallAccessGatewayParam/AuthenticationReply/ResponseCode"

      'Response.Write(snwlResponse.SelectSingleNode(codePath).InnerXml)

      'Response code 50 - Login Succeeded

      If snwlResponse.SelectSingleNode(codePath).InnerXml = "50"

         'Do we want to provide a logout popup window?
         If logoutPopup = "1" Then
            'Popup hack using Javascript for logout window
            Dim sb As New System.Text.StringBuilder()
            sb.Append("<script language='javascript'>")
            sb.Append("window.open('logout.aspx?sessId=")
            sb.Append(Server.URLEncode(CStr(sessionId)))
            sb.Append("&mgmtBaseUrl=")
            sb.Append(Server.URLEncode(CStr(mgmtBaseUrl)))
            sb.Append("&sessTimer=")
            sb.Append(Server.URLEncode(CStr(sessTimer)))
            sb.Append("','logOut','toolbar=no,")
            sb.Append("addressbar=no,menubar=no,")
            sb.Append("width=400,height=250');")
            sb.Append("<")
            sb.Append("/")
            sb.Append("script>")
            RegisterStartupScript("stp", sb.ToString)
         End If

         LHMResult.Text = "<br><b><font color=""green"">Session authorized:</font></b> You can
now begin your secure Internet access session."

      'Response code 51 - Session Limit Exceeded
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "51"
```

```
         LHMResult.Text = "<br><b><font color=""red"">Session Limit Reached:</font></b> The
maximum number of guest session has been reached. Sorry for the inconvenience. Close and
relaunch your browser to try again."

      'Response code 100 - Login Failed.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "100"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> Your
session cannot be created at this time. Sorry for the inconvenience. Close and relaunch your
browser to try again."

      'Response code 251 - Bad HMAC.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "251"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed message authentication. Sorry for the inconvenience. Close and
relaunch your browser to try again."

      'Response code 253 - Invalid SessionID.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "253"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed to match a known session identity. Sorry for the
inconvenience. Close and relaunch your browser to try again."

      'Response code 254 - Invalid CGI.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "254"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization was missing an essential parameter. Sorry for the inconvenience.
Close and relaunch your browser to try again."

      'Response code 255 - Internal Error.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "255"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed because of an unspecified error. Sorry for the inconvenience.
Close and relaunch your browser to try again."

      End If

      'Close the streams
      dataStream.Close()
      snwlReply.Close()

      'If there is some asp.net error trying to talk to the SonicWall, print it in the same
color as the background.
      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The
request for authorization failed because of an unspecified error. Sorry for the inconvenience.
Close and relaunch your browser to try again. If the problem persists, notify an attendant."
      End Try
End Sub

</script>

<STYLE>
body {
  font-size: 10pt;
  font-family: verdana,helvetica,arial,sans-serif;
  color:#000000;
  background-color:#9CBACE;
}

tr.heading {
  background-color:#006699;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM PayPal Script</TITLE>
</HEAD>

<BODY>

<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td width="50%" valign="center"><font color="white"><b>LHM Access with PayPal Buy 
Now</b></font></td>
      <td><center><img width="216" height="51" src="<%= logo%>"></center></td>
      <td width="50%" align="right" valign="center"><font color="white"><b>Powered by 
SonicWall LHM</b>&nbsp</font></td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>

<table width="100%" border="0" cellpadding="2" cellspacing="0">

   <tr>
   <td><br></td>
   </tr>
   <tr>
      <td><asp:Label id=paypalResult runat="server" /></td>
   </tr>
   <tr>
      <td><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td><asp:Label id=catchError runat="server" /></td>
   </tr>
</table>
</BODY>
</HTML>
```

Random Script

Authentication Model	The Guest Client enters an algorithmically validated, randomly generated passcode.
Purpose	Traditional passcode authentication requires that a passcode be generated prior to use and stored on the authenticating platform. The Random script eliminates this dependency by using a salted algorithm to generate and validate passcodes. This means that passcodes never have to be stored anywhere, and as long as the salt is the same, passcodes are completely migratory (that is, they can be used at any site, even against different LHM servers). The practical implication of this is that guest account passcodes can be generated in bulk, distributed, and used at any time in the future. For example, passcodes could be generated (using a particular salt), printed (for example, on certificates, business cards, scratch cards) distributed, and used at any site whose LHM server employs the same algorithmic salt. The passcodes could be given an absolute (rather than relative) expiration date, at which time the salt can be changed to invalidate the expired passcodes.

The same way that a common salt can be used to validate a set of passcodes across multiple sites, unique salts can ensure that passcodes generated at one site cannot be used at another with a dissimilar salt; so although a common algorithm is used to generate and validate all passcodes, the addition of the salt to the hash function provides uniqueness as needed.

In addition to the `default.aspx` script is a `generator.aspx` script, which is where passcodes are generated. Anywhere from 1 to 999 passcodes might be generated at one time. After generation, individual passcodes can be printed or the entire list can be exported to a `.csv` file.

Support was included for two classes of passcodes: 1 hour and 24 hour. Either type of passcode can be generated by the generator script.

How the generation algorithm works:

1 Generate a random code (root-passcode) of `randChars` (integer with a default value of six) characters, as defined in `myvars`. The character set for the random code generator can be modified within the `default.aspx` file.

2 The salt (defined in `myvars` as the salt string) is prefixed to the root-passcode.

3 A SHA1 hash is then calculated on the resulting string. Three pairs of characters are then obtained from the hash; for a:
   - 1-hour passcode, the 408 pair are obtained (characters 4,5 + 0,1 + 8,9).
   - 24-hour passcode, the 752 pair are obtained (characters 7,8 + 5,6 + 2,3).

4 The six characters chosen from the hash are then concatenated to root-passcode.

5 The result is the distributable passcode.

The validation algorithm works in reverse:

1 Guest client enters their passcode (call this `enteredCode`).

2 The script grabs the first `randChars` characters of the entered code (call this root-passcode).

3 The salt is prefixed to the root-passcode, and a SHA1 hash is calculated. The 408 pair of characters are obtained and attached to the root-passcode. The 408 pair is then matched to the `enteredCode`:
   - If the 408 pair matches, then it is validated as a 1-hour passcode.
   - If the 408 pair did not match, then the 752 pair is tried. If this matches the `enteredCode`, then it is validated as a 24-hour passcode.
   - If neither matches, then the code is not valid.

   After the `enteredCode` has been validated, the `usedcodes.mdb` database is queried to see if the code has already been used. If the `enteredCode` is not found in the database, the LHM session authorization sequence commences, using the MAC address as the userName. After the LHM session is authorized and an acknowledgment has been received by the LHM server, the root-passcode from the `enteredCode` is written to the `usedcodes.mdb` database so that it cannot be re-used. When (if) the salt is changed, it is advisable to flush the database.

myvars Variables

`logoutPopup` Controls the use of the logout popup window. Set to:

- **0** to disable the popup window.
- **1** to enable the popup window.

`useDB` Controls the use of the used passcode database. If `useDB` is:

- **0**, then the database is not read from or written to, allowing passcodes to be used repeatedly.
- **1**, then used passcodes are written to the database, and new authentication processes check the database to determine whether the passcodes have already been used.

`randChars` The number of random characters to include in the root-passcode. The default is six. This results in 12-character passcodes because the hash component always adds an additional six characters.

`salt` The salt to use in computing the hash. Be sure to use a good salt to prevent unwanted passcode migration/collisions.

`sessTimer` The session timer in seconds.

`idleTimer` The idle timer in seconds.

`strHmac` The shared secret for the optional HMAC function.

`hmacType` The digest type to use if HMAC is in use: **MD5** or **SHA1**.

`logo` The name of the logo (image) file to use on page headers.

Session Flow

1 The Guest Client enters their passcode.
2 The passcode is validated using algorithmic validation, described in the **Purpose** section above.
3 If the code is validated, it is checked for previous use in the `usedcodes.mdb` database.
4 If it is not present, the LHM session (either 1-hour or 24-hours) is initiated, using the MAC address as the username.
5 After the LHM session is initiated, the script writes the root-passcode to the `usedcodes.mdb` database so that it cannot be reused.
6 The script performs the LHM post to the SonicWall Security Appliance to authorize the session.

Additional Considerations

Because the script is writing to the database, it is necessary to configure write privileges for the **IUSR_MACHINENAME** and **IWAM_MACHINENAME** (or **ASPNET**) accounts, as described in the I want to use the sample scripts SonicWall provided. What do I need to do to use them? on page 551

The `generator.aspx` script should be located in a secure (publicly inaccessible) area on the web-server.

Topics:

default.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Data" %>
<%@ Import Namespace="System.Data.OleDB" %>
<%@ Import Namespace="System.Security" %>
<%@ Import Namespace="System.Security.Cryptography" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy.CheckValidationResult
      Return True
   End Function
End Class

'Sample LHM redirect querystring:
'http://127.0.0.1/lhm/random/default.aspx?sessionId=0b712fd83b9f5313db5af1cea6b1004f&ip=10.50.
165.231&mac=00:0e:35:bd:c9:37&ufi=0006b11184300&mgmtBaseUrl=https://10.50.165.193:4043/&client
RedirectUrl=https://10.50.165.193:444/&req=http%3A//www.google.com/ig

Dim ip as String
Dim sessionId as String
Dim mac as String
Dim ufi as String
Dim mgmtBaseUrl as String
Dim clientRedirectUrl as String
Dim req as String
Dim hmac as String
Dim customCode as String

Dim passCode as String
Dim grabCode as String

Sub Page_Load(Source as Object, E as EventArgs)

   LHMResult.Text=""
   catchError.Text=""
   authResult.Text=""

   ip=Request.QueryString("ip")
   sessionId=Request.QueryString("sessionId")
   mac=Request.QueryString("mac")
   ufi=Request.QueryString("ufi")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   clientRedirectUrl=Request.QueryString("clientRedirectUrl")
   req=Request.QueryString("req")
   hmac=Request.QueryString("hmac")
   customCode=Request.QueryString("cc")

   'customCode grabs the "cc=" querystring value sent by the SonicWall. This allows you to use
the same
   'page (e.g. this page) for the "Session Expiration" (?cc=2), "Idle Timeout" (?cc=3) and "Max
Sessions" (?cc=4) page.
   If customCode <> "" Then
      Select Case customCode
      Case "2"
         LHMResult.Text="<br><H3><font color=""red"">Your LHM session has expired. You can try
to initiate a new session.</font></H3>"
      Case "3"
         LHMResult.Text="<br><H3><font color=""red"">You have exceeded your idle timeout. Log
back in.</font></H3>"
      Case "4"
```

```
         LHMResult.Text="<br><H3><font color=""red"">The maximum number of sessions has been 
reached. Try again later.</font></H3>"
      End Select
   End If

   'Use the override class in myvars.aspx to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts

   'Note - the routine below for handling the hmac requires the use of the SonicSSL.dll and 
libeay.dll libraries.
   'The DLL must be copied to the IIS server, and the SonicSSL dll must be registered with 
"regsvr32 sonicssl.dll"
   If hmac <> "" Then

      'SonicWall URL Encode routine is different from Microsoft - this is the SonicWall method
      req=Replace(req,"%","%25")
      req=Replace(req,":","%3A")
      req=Replace(req," ","%20")
      req=Replace(req,"?","%3F")
      req=Replace(req,"+","%2B")
      req=Replace(req,"&","%26")
      req=Replace(req,"=","%3D")

      Dim strHmacText as String
      Dim objCrypto as Object
      Dim strHmacGenerated
      Dim loginError as String

      'Initialize the Crypto object
      objCrypto = Server.CreateObject("SonicSSL.Crypto")

      'The text to be encoded
      strHmacText = sessionId & ip & mac & ufi & mgmtBaseUrl & clientRedirectUrl & req

      'Calculate the hash with a key strHmac, the return value is a string converted form the 
output sha1 binary.
      'The hash algorithm (MD5 or SHA1) is configured in myvars and in the Extern Guest Auth 
config on the SonicWall
      If hmacType = "MD5" Then
         strHmacGenerated = objCrypto.hmac_md5(strHmacText, strHmac)
      Else
         strHmacGenerated = objCrypto.hmac_sha1(strHmacText, strHmac)
      End If

      If strHmacGenerated <> hmac Then
         Dim hmacFail as String
         hmacFail = "<font color=""red"">The HMAC failed validation. Notify an 
attendant.</font><br><br>"
         hmacFail+="<font color=""9CBACE"">Received HMAC: " & hmac & "<br>Calculated HMAC: " & 
strHmacGenerated & "<br>"
         hmacFail+="Make sure the digest functions on the SonicWall and LHM server match.<br>"
         hmacFail+="Also make sure the shared secret on the SonicWall and myvars match</font>"
         catchError.Text=hmacFail
      End If

   End If

End Sub

sub OnBtnClearClicked (Sender As Object, e As EventArgs)
   enteredCode.Text = ""
   LHMResult.Text=""
   catchError.Text=""
end sub

Sub btnSubmit_Click(Sender As Object, E As EventArgs)
```

```
   'The following subroutine validates client provided passcodes.
   'The first 6 characters (definable in myars) are grabbed.
   'These characters are then run though a SHA1 hash with a salt that is defined in myvars.

   '3 pairs of substrings are then retrieved from the hash.
   'The code is validated if the 3 pairs concatenated to the randChars (defined in myvars)
characters consist of the following:

   'Validating the 4 0 8 pairs (4,5+0,1+8,9 characters) will provide 1 hour of guest access.
   'Validating the 7 5 2 pairs (7,8+5,6+2,3 characters) will provide 24 hours of guest access.

   grabCode = enteredCode.Text.SubString(0,randChars)

   'Manually compute SHA1 on salt+randomCode, and convert result to base64 - gives stranger
output
   Dim sha1 As sha1 = sha1.Create()
   Dim manualHash As Byte() = sha1.ComputeHash(Encoding.UTF8.GetBytes(salt & grabCode))
   Dim hashResult as String = Convert.ToBase64String(manualHash)

   'Alternatively, use forms hash routine - only provides upper case A-Z + 0-9 output.
   'Dim hashResult as String = FormsAuthentication.HashPasswordForStoringInConfigFile(salt &
randomCode,"SHA1")

   'First try to match on 1 hour code
   passCode  = ""
   passCode = grabCode & hashResult.SubString(4, 2)
   passCode = passCode & hashResult.SubString(0, 2)
   passCode = passCode & hashResult.SubString(8, 2)
   If enteredCode.Text = passCode Then
      sessTimer = "3600"
      authResult.Text="<font color=""green""><b>1 hour code validated.</b></font>"

      'Check the used passcode DB if useDB is enabled in myvars.
      If useDB = "1" Then
         wasItUsed()
      End If
   Else
      'Now try to match on 24 hour code
      passCode = ""
      passCode = grabCode & hashResult.SubString(7, 2)
      passCode = passCode & hashResult.SubString(5, 2)
      passCode = passCode & hashResult.SubString(2, 2)
      If enteredCode.Text = passCode Then
         sessTimer = "86400"
         authResult.Text="<font color=""green""><b>24 hour code validated.</b></font>"

         'Check the used passcode DB if useDB is enabled in myvars.
         If useDB = "1" Then
            wasItUsed()
         End If

      Else
         authResult.Text="<font color=""Red""><b>Passcode cannot be validated.</b><br>The
passcode is case-sensitive.<br>Try again.</font>"
      End if
   End If

End Sub

Sub wasItUsed ()

   'Check to see if the root (randChars) of the passcode is already in the used database.
   Dim strConn as string = "Provider=Microsoft.Jet.OLEDB.4.0;Data Source=" &
server.mappath("usedcodes.mdb") & ";"
   Dim MySQL as string = "SELECT * From passCodes Where passCode = '" & grabCode & "'"
   Dim MyConn as New OleDBConnection (strConn)
   Dim cmd as New OleDBCommand (MySQL, MyConn)
   Dim objDR As OleDbDataReader
   Dim isUsed As Boolean

   MyConn.Open()
   objDR = cmd.ExecuteReader()
   isUsed = objDR.Read()
   objDR.Close()
   MyConn.Close()

   'If the passcode is not found in the database
   if isUsed = False
      LHM()
   Else
      authResult.Text="<font color=""Red""><b>Passcode has already been used.</b><br>See an 
attendant for assistance.</font>"
   End If

End Sub

Sub writeToDB ()

   'Try to write the submitted (only randChars characters instead of the whole passcode) info 
to the database file
   Try
      Dim strConn as string = "Provider=Microsoft.Jet.OLEDB.4.0;Data Source=" & 
server.mappath("usedcodes.mdb") & ";"

      Dim MySQL as string = "INSERT INTO passCodes (passCode) VALUES ('" & grabCode & "')"
      Dim MyConn as New OleDBConnection (strConn)
      Dim cmd as New OleDBCommand (MySQL, MyConn)
      MyConn.Open ()
      cmd.ExecuteNonQuery ()
      MyConn.Close ()

      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
   End Try

End Sub

Sub LHM()

   'The writeToDB sub is in the Response code 50 - Login Succeeded routine, after the LHM 
exchange succeeds. You can move it to the top to write the passcode to the DB before the LHM 
transaction for testing purposes.
   'writeToDB ()

   enteredCode.Text = "Code Accepted."

   'Let the user know that we are setting up the session, just in case it takes more than a 
second
   LHMResult.Text = "Authorizing session. Please wait."

   'The LHM cgi on the SonicWall - this does not change
   Dim loginCgi as String = "externalGuestLogin.cgi"

   'Assemble the data to post back to the SonicWall to authorize the LHM session
   Dim loginParams as String = "sessId=" & sessionId & "&userName=" & mac & "&sessionLifetime=" 
& sessTimer & "&idleTimeout=" & idleTimer

   'Combine mgmtBaseUrl from the original redirect with the login cgi
   Dim postToSNWL as String = mgmtBaseUrl & loginCgi

   'Convert the loginParams to a well behaved byte array
   Dim byteArray As Byte() = Encoding.UTF8.GetBytes(loginParams)
   Try
      'Create the webrequest to the SonicWall
      Dim toSNWL as WebRequest = WebRequest.Create(postToSNWL)

      'Calculate the length of the byte array
      toSNWL.ContentLength = byteArray.Length

      'Set the method for the webrequest to POST
      toSNWL.Method = "POST"

      'Set the content type
      toSNWL.ContentType = "application/x-www-form-urlencoded"

      'Open the request stream
      Dim dataStream As Stream = toSNWL.GetRequestStream()

      'Write the byte array to the request stream
      dataStream.Write(byteArray, 0, byteArray.Length)

      'Close the Stream object
      dataStream.Close()

      'Get the response
      Dim snwlReply As WebResponse = toSNWL.GetResponse()

      'Display the status - looking for 200 = OK.
      'Response.Write(CType(snwlReply, HttpWebResponse).StatusCode)

      'Grab the response and stuff it into an xml doc for possible review
      Dim snwlResponse as XmlDocument = New XmlDocument()
      snwlResponse.Load(snwlReply.GetResponseStream())

      'Set the xPath to the SNWL reply, and get the response
      Dim codePath as String = "SonicWallAccessGatewayParam/AuthenticationReply/ResponseCode"

      'Response.Write(snwlResponse.SelectSingleNode(codePath).InnerXml)

      'Response code 50 - Login Succeeded

      If snwlResponse.SelectSingleNode(codePath).InnerXml = "50"

         'Do we want to provide a logout popup window?
         If logoutPopup = "1" Then
            'Popup hack using Javascript for logout window
            Dim sb As New System.Text.StringBuilder()
            sb.Append("<script language='javascript'>")
            sb.Append("window.open('logout.aspx?sessId=")
            sb.Append(Server.URLEncode(CStr(sessionId)))
            sb.Append("&mgmtBaseUrl=")
            sb.Append(Server.URLEncode(CStr(mgmtBaseUrl)))
            sb.Append("&sessTimer=")
            sb.Append(Server.URLEncode(CStr(sessTimer)))
            sb.Append("','logOut','toolbar=no,")
            sb.Append("addressbar=no,menubar=no,")
            sb.Append("width=400,height=250');")
            sb.Append("<")
            sb.Append("/")
            sb.Append("script>")
            RegisterStartupScript("stp", sb.ToString)
         End If

         LHMResult.Text = "<br><b><font color=""green"">Session authorized:</font></b> You can
now go to the URL you originally requested: <a target=""_blank"" href=""" & req & """>" & req &
"</a>"

         'Write the passcode the DB if the LHM session succeeds and if useDB = 1.
         If useDB = "1" Then
```

```
            writeToDB ()
         End If

      'Response code 51 - Session Limit Exceeded
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "51"
         LHMResult.Text = "<br><b><font color=""red"">Session Limit Reached:</font></b> The 
maximum number of guest session has been reached. Sorry for the inconvenience. Close and 
relaunch your browser to try again."

      'Response code 100 - Login Failed.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "100"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> Your 
session cannot be created at this time. Sorry for the inconvenience. Close and relaunch your 
browser to try again."

      'Response code 251 - Bad HMAC.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "251"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The 
request for authorization failed message authentication. Sorry for the inconvenience. Close and 
relaunch your browser to try again."

      'Response code 253 - Invalid SessionID.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "253"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The 
request for authorization failed to match a known session identity. Sorry for the 
inconvenience. Close and relaunch your browser to try again."

      'Response code 254 - Invalid CGI.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "254"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The 
request for authorization was missing an essential parameter. Sorry for the inconvenience. 
Close and relaunch your browser to try again."

      'Response code 255 - Internal Error.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "255"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The 
request for authorization failed because of an unspecified error. Sorry for the inconvenience. 
Close and relaunch your browser to try again."

      End If

      'Close the streams
      dataStream.Close()
      snwlReply.Close()

      'If there is some asp.net error trying to talk to the SonicWall, print it in the same 
color as the background.
      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         LHMResult.Text = "<br><b><font color=""red"">Session creation failed:</font></b> The 
request for authorization failed because of an unspecified error. Sorry for the inconvenience. 
Close and relaunch your browser to try again. If the problem persists, notify an attendant."
      End Try
End Sub


</script>

<STYLE>
body {
  font-size: 10pt;
  font-family: verdana,helvetica,arial,sans-serif;
  color:#000000;
  background-color:#9CBACE;
}

tr.heading {
  background-color:#006699;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM Random Script</TITLE>
</HEAD>

<BODY>
<form id="frmValidator" onKeyPress="if(event.keyCode==13)
{document.getElementById('btnSubmit').click(); return false}" runat="server">

<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td width="50%" valign="center"><font color="white"><b>Algorithmic 
Authentication</b></font></td>
      <td><center><img width="216" height="51" src="<%= logo %>"></center></td>
      <td width="50%" align="right" valign="center"><font color="white"><b>Powered by 
SonicWall LHM</b>&nbsp</font></td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>

<table width="90%" border="0" cellpadding="2" cellspacing="0">
   <tr>
      <td><b>Welcome <%= ip%> to SonicWall's LHM Algorithmic Authenticator.</b><br><br>Enter 
your unique randomly generated passcode to obtain secure guest Internet access.<br><br>Valid 
passcodes are not stored anywhere, so validation is not performed against any kind of database. 
Instead, when a passcode is entered, it is algorithmically validated. After a passcode is 
successfully used, it is written to a "used passcode" database so that it cannot be 
reused.<br><br>The validator recognizes 1 hour and 24 hour passcodes - these characteristics 
were encoded within the passcodes themselves during generation.<br><br>
      </td>
   </tr>
</table>
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr><br>
      <td width="30%">Enter your passcode:</td>
      <td width="30%"><asp:TextBox id="enteredCode" runat="server" /></td>
      <td width="40%"><asp:RequiredFieldValidator id="valEnteredCode" 
ControlToValidate="enteredCode" ErrorMessage="Enter your passcode." runat="server" /></td>
   </tr>
   <tr>
      <td></td><td colspan=2><asp:Label id=authResult runat="server" />&nbsp</td>
   </tr>
   <tr>
      <td></td>
      <td><asp:button id="btnSubmit" class="button" text="  Submit  " 
onClick="btnSubmit_Click" runat="server" />
      &nbsp&nbsp
      <asp:button id="btnClear" class="button" text=" Clear " CausesValidation="False"
onClick="OnBtnClearClicked" runat="server" />
      </td>
   </tr>
   <tr>
      <td colspan=2><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td colspan=2><asp:Label id=catchError runat="server" /></td>
   </tr>
</table>
</form>
</BODY>
</HTML>
```

generator.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Data" %>
<%@ Import Namespace="System.Data.OleDB" %>
<%@ Import Namespace="System.Security" %>
<%@ Import Namespace="System.Security.Cryptography" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

Dim genCodes As New ArrayList()
Dim codeType As String

Sub Page_Load(Source as Object, E as EventArgs)
   If Not isPostBack Then
      Heading.Text="&nbsp"
      btnExport.Visible = False
   End If
End Sub

Sub btnSubmit_Click(Sender As Object, E As EventArgs)
   'The following generates passcodes beginning with a random character generator.
   'The number of characters in randomCode is configurable in myvars.
   'The randomCode output is then run though a SHA1 hash with a salt that is defined in myvars.
   'Note: If you are using this in a live environment, it is important to change the salt to
prevent algorithm compromise.

   '3 pairs of substrings are then retrieved from the hash, and concatenated to the randomCode
to form the passcode.

   'In the current sample implementation:
   'The 4 0 8 pairs (4,5+0,1+8,9 characters) from the hash will provide 1 hour of guest access.
   'The 7 5 2 pairs (7,8+5,6+2,3 characters) from the hash will provide 24 hours of guest
access.

   Dim myLooper As Integer
   Dim passCode as String

      For myLooper = 1 to Convert.ToInt32(codeCount.Text)

         Dim x As Integer = 0
         Dim isitRand as boolean = False
         Dim intRand as Integer = 0
         Dim randomCode as String = ""

         For x = 1 to randChars
            Do Until isItRand = True
               '48 to 57 for numbers, 65 to 90 for uppercase, 97 to 122 for lowercase
               intRand = Int((122 - 48 + 1) * Rnd + 48)
               'Select the legal characterset for randomCode by including legal characters 
below.
               If InStr(1, "abcdefgh jk mn pqrstuvwxyzABCDEFGH JKLMN PQRSTUVWXYZ 23456789 
",Chr(intRand), 1) Then
                  isItRand = True
               End If
            Loop
            randomCode = randomCode & Chr(intRand)
            isItRand = False
         Next

         'Manually compute SHA1 on salt+randomCode, and convert result to base64 - gives 
stranger output
         Dim sha1 As sha1 = sha1.Create()
         Dim manualHash As Byte() = sha1.ComputeHash(Encoding.UTF8.GetBytes(salt & 
randomCode))
         Dim hashResult as String = Convert.ToBase64String(manualHash)

         'Alternatively, use forms hash routine - only provides upper case A-Z + 0-9 output.
         'Dim hashResult as String = 
FormsAuthentication.HashPasswordForStoringInConfigFile(salt & randomCode,"SHA1")

         If dropDownList1.SelectedItem.Value = "1 Hour" Then
            passCode = randomCode & hashResult.SubString(4, 2)
            passCode = passCode & hashResult.SubString(0, 2)
            passCode = passCode & hashResult.SubString(8, 2)
            genCodes.Add(passCode)
         Else
            passCode = randomCode & hashResult.SubString(7, 2)
            passCode = passCode & hashResult.SubString(5, 2)
            passCode = passCode & hashResult.SubString(2, 2)
            genCodes.Add(passCode)
         End If

      Next

      btnExport.Visible = True
      heading.Text = "Your " & codeCount.Text & " <b>" & dropDownList1.SelectedItem.Value & 
"</b> Passcodes:"
      genOutput.DataSource = genCodes
      genOutput.DataBind()
      codeCount.Text=""

      'Store the genCodes array in session state for retrieval for printing and exporting
      Session("myGenCodes") = genCodes
      Session("codeType") = dropDownList1.SelectedItem.Value

   End Sub

   Sub printIt(Src As Object, e As DataListCommandEventArgs)
      If not Session.Item("myGenCodes") is Nothing Then
         genCodes=Session.Item("myGenCodes")
         codeType=Session.Item("codeType")
         'response.write(CStr(genCodes.Item(e.Item.ItemIndex)))

         'Popup hack using Javascript so that individual entries can be printed from the 
DataList
         Dim sb As New System.Text.StringBuilder()
         sb.Append("<script language='javascript'>")
         sb.Append("window.open('print.aspx?genCode=")
         sb.Append(Server.URLEncode(CStr(genCodes.Item(e.Item.ItemIndex))))
         sb.Append("&sessLife=")
         sb.Append(Server.URLEncode(codeType))
         sb.Append("','printCode','toolbar=no,")
         sb.Append("addressbar=no,menubar=no,")
         sb.Append("width=400,height=250');")
         sb.Append("<")
         sb.Append("/")
         sb.Append("script>")
         RegisterStartupScript("stp", sb.ToString)
      End If

   End Sub

   Sub exporter(Sender As Object, E As EventArgs)

   If not Session.Item("myGenCodes") is Nothing Then
      genCodes=Session.Item("myGenCodes")

      'Convert the genCodes array to a string with CRs for later conversion to a byte array
      Dim i as Integer
      Dim genCodeString as String
      for i = 0 To genCodes.Count - 1
         genCodeString += CStr(genCodes.Item(i)) & Chr(13)
      Next

      'response.write(genCodeString)

      'Create the byte array and send it to the browser as genCodes.csv
      Dim data() As Byte = System.Text.ASCIIEncoding.ASCII.GetBytes(genCodeString)
      Response.Clear()
      Response.AddHeader("Content-Type", "application/Excel")
      Response.AddHeader("Content-Disposition", "inline;filename=genCodes.csv")
      Response.BinaryWrite(data)
      Response.End()
   End If

End Sub

</script>

<STYLE>
body {
  font-size: 10pt;
  font-family: verdana,helvetica,arial,sans-serif;
  color:#000000;
  background-color:#9CBACE;
}

tr.heading {
  background-color:#006699;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM Random Script</TITLE>
</HEAD>

<BODY>
<form id="frmValidator" runat="server">

<table width="100%" border="0" cellpadding="2" cellspacing="0">
```

```
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td width="50%" valign="center"><font color="white"><b>Algorithmic
Authentication</b></font></td>
      <td><center><img width="216" height="51" src="<%= logo %>"></center></td>
      <td width="50%" align="right" valign="center"><font color="white"><b>Passcode
Generator</b>&nbsp</font></td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>

<table width="90%" border="0" cellpadding="2" cellspacing="0">
   <tr>
      <td><b>Welcome to SonicWall's LHM Algorithmic Generator.</b><br><br>This will allow you
to create randomly generated passcodes for secure guest Internet access.<br><br>Valid passcodes
are not stored anywhere, so validation is not performed against any kind of database. Instead,
when a passcode is entered, it is algorithmically validated. After a passcode is successfully
used, it is written to a "used passcode" database so that it cannot be reused.<br><br>The
validator will recognize 1 hour and 24 hour passcodes - these characteristics were encoded
within the passcodes themselves during generation.<br><br>
      </td>
   </tr>
</table>
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr><br>
      <td width="15%">Passcode type:</td>
      <td width="10%"><asp:DropDownList id="DropDownList1" runat="server">
         <asp:ListItem>1 Hour</asp:ListItem>
         <asp:ListItem>24 Hours</asp:ListItem>
      </asp:DropDownList></td>
      <td width="20%">Number to generate:</td>
      <td width="20%"><asp:TextBox id="codeCount" runat="server" /></td>
      <td width="50%"><asp:RequiredFieldValidator id="valcodeCount"
ControlToValidate="codeCount" ErrorMessage="Enter a value." Font-Size="10" Display="Dynamic"
runat="server" />
      <asp:RangeValidator id="Range1" ControlToValidate="codeCount" MinimumValue="1"
MaximumValue="999" Type="Integer" Font-Size="10" ErrorMessage="Values from 1 to 999."
runat="server" /></td>
   </tr>
   <tr>
      <td colspan=3></td>
      <td><asp:button id="btnSubmit" class="button" text=" Submit " onClick="btnSubmit_Click"
runat="server" />&nbsp&nbsp<asp:button id="btnExport" class="button" text=" Export "
CausesValidation="False" onClick="exporter" runat="server" /><br></td>
      <td><br></td>

   </tr>
   <tr><tr class="heading">
      <td colspan=5><font color="white"><asp:Label id=heading runat="server" /></td>
   </tr>
   <tr><td><br></td></tr>
</table>

<asp:DataList id="genOutput" Runat="Server" RepeatColumns="4" RepeatDirection="Horizontal"
CellPadding="0" Cellspacing="0" GridLines="Both" align="center" OnItemCommand="printIt">
  <ItemTemplate>
   <td>
   <asp:Label Text='<%# Container.DataItem %>' Runat="Server"/>
   </td>
   <td>
   <asp:ImageButton id="print" runat="server" ImageUrl="print.gif" EnableViewState="False" 
CausesValidation="False" CommandName='<%# Container.DataItem %>' />
   </td>
  </ItemTemplate>
</asp:DataList>

</form>
</BODY>
</HTML>
```

logout.aspx

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>

<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

'This class allows SSL certs signed by unknown CAs to be accepted.
'This is necessary for the POST to the SonicWall authorizing the LHM session.
Public Class acceptAllCerts
   Implements System.Net.ICertificatePolicy
   Public Function CheckValidationResult(ByVal srvPoint As ServicePoint, _
   ByVal cert As X509Certificate, ByVal request As WebRequest, ByVal problem As Integer) _
      As Boolean Implements ICertificatePolicy.CheckValidationResult
      Return True
   End Function
End Class

Dim sessionId as String
Dim mgmtBaseUrl as String
Dim eventId as String = "&eventId=1"

'Grab the code and the session lifetime from the generator page
Sub Page_Load(src as Object, e as EventArgs)
   sessionId=Request.QueryString("sessId")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   sessTimer=Request.QueryString("sessTimer")


   'Use the override class in myvars.aspx to accept untrusted certificates from the SonicWall
   'This is necessary for the POST to the SonicWall authorizing the LHM session.
   System.Net.ServicePointManager.CertificatePolicy = New acceptAllCerts

   'When the page loads, make the loggedIn span visible
   loggedIn.Visible=True
   loggedOut.Visible=False

   Me.Button1.Attributes.Add("OnClick", "self.close()")

End Sub

'The Logout button
Sub btnSubmit_Click(Sender As Object, E As EventArgs)

   'Let the user know that we are setting up the session, just in case it takes more than a 
second
```

```
   LHMResult.Text = "Authorizing session. Please wait."

   'The LHM cgi on the SonicWall - this does not change
   Dim loginCgi as String = "externalGuestLogoff.cgi"

   'Assemble the data to post back to the SonicWall to authorize the LHM session
   Dim loginParams as String = "sessId=" & sessionId & eventId

   'Combine mgmtBaseUrl from the original redirect with the login cgi
   Dim postToSNWL as String = mgmtBaseUrl & loginCgi

   'Convert the loginParams to a well behaved byte array
   Dim byteArray As Byte() = Encoding.UTF8.GetBytes(loginParams)

   Try
      'Make the loggedOut span visible
      loggedIn.Visible=False
      loggedOut.Visible=True

      'Create the webrequest to the SonicWall
      Dim toSNWL as WebRequest = WebRequest.Create(postToSNWL)

      'Calculate the length of the byte array
      toSNWL.ContentLength = byteArray.Length

      'Set the method for the webrequest to POST
      toSNWL.Method = "POST"

      'Set the content type
      toSNWL.ContentType = "application/x-www-form-urlencoded"

      'Open the request stream
      Dim dataStream As Stream = toSNWL.GetRequestStream()

      'Write the byte array to the request stream
      dataStream.Write(byteArray, 0, byteArray.Length)

      'Close the Stream object
      dataStream.Close()

      'Get the response
      Dim snwlReply As WebResponse = toSNWL.GetResponse()

      'Display the status - looking for 200 = OK.
      'Response.Write(CType(snwlReply, HttpWebResponse).StatusCode)

      'Grab the response and stuff it into an xml doc for possible review
      Dim snwlResponse as XmlDocument = New XmlDocument()
      snwlResponse.Load(snwlReply.GetResponseStream())

      'Set the xPath to the SNWL reply, and get the response
      Dim codePath as String = "SonicWallAccessGatewayParam/LogoffReply/ResponseCode"

      'Response.Write(snwlResponse.SelectSingleNode(codePath).InnerXml)

      'Response code 150 - Logout Succeeded
      If snwlResponse.SelectSingleNode(codePath).InnerXml = "150"
         LHMResult.Text = "<br><b><font color=""green"">Your session has been logged
out.<br><br>Thank you for using LHM Guest Services.</font></b>"

      'Response code 251 - Bad HMAC.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "251"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The
request failed message authentication. Sorry for the inconvenience. Close and relaunch your
browser to try again."

      'Response code 253 - Invalid SessionID.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "253"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The
request failed to match a known session identity. Sorry for the inconvenience. Close and
relaunch your browser to try again."

      'Response code 254 - Invalid CGI.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "254"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The
request was missing an essential parameter. Sorry for the inconvenience. Close and relaunch
your browser to try again."

      'Response code 255 - Internal Error.
      ElseIf snwlResponse.SelectSingleNode(codePath).InnerXml = "255"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The
request failed because of an unspecified error. Sorry for the inconvenience. Close and relaunch
your browser to try again."

      End If

      'Close the streams
      dataStream.Close()
      snwlReply.Close()

      'If there is some asp.net error trying to talk to the SonicWall, print it in the same
color as the background.
      Catch ex as Exception
         catchError.Text = "<font color=""9CBACE"">" & ex.ToString & "</font>"
         LHMResult.Text = "<br><b><font color=""red"">Session logout failed:</font></b> The
request failed because of an unspecified error. Sorry for the inconvenience. Close and relaunch
your browser to try again. If the problem persists, notify an attendant."
      End Try
End Sub

</script>
<STYLE>
body {
   font-size: 10pt;
   font-family: verdana,helvetica,arial,sans-serif;
   color:#000000;
   background-color:#9CBACE;
}

tr.heading {
   font-size: 10pt;
   background-color:#006699;
}

tr.smalltext {
   font-size: 8pt;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
   font-size: 8pt;
}
</STYLE>

<HTML>
<HEAD>
<TITLE>LHM Logout Page</TITLE>

<SCRIPT LANGUAGE="Javascript">

//'Javascript Seconds Countdown Timer
var SecondsToCountDown = <%= sessTimer%>;
var originalTime=" ";
```

```
function CountDown()
{
   clockStr="";

   dayStr=Math.floor(SecondsToCountDown/86400)%100000
   if(dayStr>0){
      if(dayStr>1){
         dayStr+=" days ";
      } else dayStr+=" day ";
      clockStr=dayStr;
   }
   hourStr=Math.floor(SecondsToCountDown/3600)%24
   if(hourStr>0){
      if(hourStr>1){
         hourStr+=" hours ";
      } else hourStr+=" hour ";
      clockStr+=hourStr;
   }
   minuteStr=Math.floor(SecondsToCountDown/60)%60
   if(minuteStr>0){
      if(minuteStr>1){
         minuteStr+=" minutes ";
      } else minuteStr+=" minute ";
      clockStr+=minuteStr;
   }
   secondStr=Math.floor(SecondsToCountDown/1)%60
   if(secondStr>0){
      if(secondStr>1){
         secondStr+=" seconds ";
      } else secondStr+=" second ";
      clockStr+=secondStr;
   }

   if(SecondsToCountDown > 0)
   {
      --SecondsToCountDown;
   }

   if(originalTime.length < 2)
   {
      originalTime = clockStr;
   }

   // Make sure the form is still there before trying to set a value
   if(document.frmValidator){
      document.frmValidator.originalTime.value = originalTime;
      document.frmValidator.countdown.value = clockStr;
   }

   setTimeout("CountDown()", 1000);
   if(SecondsToCountDown == 0)
   {
      document.frmValidator.countdown.value = "Session Expired";
   }
}

//'Disable right-click so that the window does not get refreshed because the countdown is 
clientside.
document.oncontextmenu = disableRightClick;
function disableRightClick()
{
  return false;
}

//'Disable F5 key, too, on IE at least.
function noF5()
```

```
{
   var key_f5 = 116;
   if (key_f5==event.keyCode)
   {
      event.keyCode=0;
      return false;
   }
   return false;
}

document.onkeydown=noF5
document.onmousedown=disableRightClick

</SCRIPT>

</HEAD>

<BODY onload='CountDown()'>
<span id="loggedIn" runat="server">
<form id="frmValidator" runat="server">
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center"><font color="white"><b>SonicWall LHM Logout 
Window</b></font></td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="smalltext"><td><br></td></tr>
   <tr class="smalltext">
      <td>Original Session Time:</td>
      <td><asp:textbox width=250 id="originalTime" runat="server" /></td>
   </tr>
   <tr class="smalltext">
      <td>Remaining Session Time:</td>
      <td><asp:textbox width=250 id="countdown" runat="server" /></td>
   </tr>
   <tr class="smalltext">
      <td colspan=2><br>You can use this window to manually logout your session at any time, or 
you can safely close this window if you prefer to let your session timeout 
automatically.</font></td>
   </td>
   <tr>
      <td colspan=2><center><asp:button id="btnSubmit" class="button" text="  Logout  " 
onClick="btnSubmit_Click" runat="server" /></center></td>
   </tr>
</table>
</form>
</span>

<span id="loggedOut" runat="server">
<form id="logout" runat="server">
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center"><font color="white"><b>SonicWall LHM Logout 
Window</b></font></td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center">&nbsp</td>
   </tr>
   <tr>
```

```
      <td><asp:Label id=LHMResult runat="server" /></td>
   </tr>
   <tr>
      <td><asp:Label id=catchError runat="server" /></td>
   </tr>
   <tr><td><br></td></tr>
   <tr>
      <td><center><asp:button id="Button1" class="button" text="  Close  " runat="server" 
/></center></td>
   </tr>
</table>
</form>
</span>

</BODY>
</HTML>
```

myvars.aspx

```
<script language="VB" runat="server">

'Set the logoutPopup window flag - 0 = no popup, 1 = popup
'The use of the logoutPopup in this script is discouraged because the login event is exclusive.
'The login event can be made non exclusive in this script by setting useDB to 0.
Dim logoutPopup as String = "0"

'Set the use of the database for storing and checking used passcodes. 0 = do not use DB, 1 = use 
DB.
Dim useDB as String = "1"

'The number of characters in the randomCode
Dim randChars as Integer = 6

'Set the salt the generation of the SHA1 hash
Dim salt as String = "moosifer"

'The LHM Session Timeout is set by the passcode in this script
Dim sessTimer as String

'Set the LHM Idle Timeout
Dim idleTimer as String = "300"

'Set the secret for use with optional HMAC auth, as configured in the Extern Guest Auth config 
on the SonicWall
Dim strHmac as String = "password"

'Set the digest method for the HMAC, either MD5 or SHA1
Dim hmacType as String = "MD5"
'Dim hmacType as String = "SHA1"

'Set the logo image to use
Dim logo as String = "SonicWall.gif"

'------------------------End of Configurable Settings------------------------

</script>
```

print.aspx

```
<!-- #INCLUDE file="myvars.aspx" -->

<script language="VB" runat="server">

Dim genCode as String
Dim sessLife as String
```

```
'Grab the code and the session lifetime from the generator page
Sub Page_Load(src as Object, e as EventArgs)
   genCode=Request.QueryString("genCode")
   sessLife=Request.QueryString("sessLife")
End Sub

</script>
<STYLE>
body {
  font-size: 10pt;
  font-family: verdana,helvetica,arial,sans-serif;
  color:#000000;
  background-color:#9CBACE;
}
tr.heading {
  background-color:#006699;
}
</STYLE>
<BODY>
<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=2 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center"><img width="216" height="51" src="<%= logo %>"></td>
   </tr>
   <tr class="heading">
      <td colspan=2 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr><td><br><br></td></tr>
   <tr>
      <td>Your Pass Code is:</td>
      <td><b><%= genCode%></b></td>
   </tr>
   <tr><td><br></td></tr>
   <tr>
      <td>Session Lifetime is:</td>
      <td><b><%= sessLife%></b></td>
   </tr>
</table>

<script language='javascript'>window.print();</script>

</BODY>
</HTML>
```

Chooser.aspx Script

```
<%@ Page Language="VB" Debug="true" %>
<%@ Import Namespace="System" %>
<%@ Import Namespace="System.Net" %>
<%@ Import Namespace="System.IO" %>
<%@ Import Namespace="System.Xml" %>
<%@ Import Namespace="System.Text" %>
<%@ Import Namespace="System.Security" %>
<%@ Import namespace="System.Security.Cryptography.X509Certificates"%>

<script language="VB" runat="server">

Dim ip as String
Dim sessionId as String
Dim mac as String
Dim ufi as String
Dim mgmtBaseUrl as String
Dim clientRedirectUrl as String
Dim req as String
Dim hmac as String
Dim customCode as String
Dim qString as String

Sub Page_Load(src as Object, e as EventArgs)

   'Grab the querystring one element at a time because we need to do a custom URL encode on the
req variable
   sessionId=Request.QueryString("sessionId")
   ip=Request.QueryString("ip")
   mac=Request.QueryString("mac")
   ufi=Request.QueryString("ufi")
   mgmtBaseUrl=Request.QueryString("mgmtBaseUrl")
   clientRedirectUrl=Request.QueryString("clientRedirectUrl")
   req=Request.QueryString("req")
   hmac=Request.QueryString("hmac")
   customCode=Request.QueryString("cc")

   'SonicWall URL Encode routine is different from Microsoft - this is the SonicWall method
   req=Replace(req,"%","%25")
   req=Replace(req,":","%3A")
   req=Replace(req," ","%20")
   req=Replace(req,"?","%3F")
   req=Replace(req,"+","%2B")
   req=Replace(req,"&","%26")
   req=Replace(req,"=","%3D")

   'Rebuild the querystring variable
   qString = "sessionId=" & sessionId & "&ip=" & ip & "&mac=" & mac & "&ufi=" & ufi &
"&mgmtBaseUrl=" & mgmtBaseUrl & "&clientRedirectUrl=" & clientRedirectUrl & "&req=" & req

   'Add the optional hmac and cc vars if they are there.
   If hmac <> "" Then
      qString+="&hmac=" & hmac
   End If

   If customCode <> "" Then
      qString+="&cc=" & customCode
   End If

   'Bind the directory data
   Dim lhmDir As New DirectoryInfo(Server.MapPath("."))
   lhmList.DataSource = lhmDir.GetDirectories
   lhmList.DataBind()


End Sub

</script>

<STYLE>
body {
  font-size: 10pt;
  font-family: verdana,helvetica,arial,sans-serif;
  color:#000000;
  background-color:#9CBACE;
}

tr.heading {
  background-color:#006699;
}

.button {
   border: 1px solid #000000;
   background-color: #ffffff;
}
```

```
tr.hidden {
   font-size: 5pt;
   color:#9CBACE;
}

</STYLE>

<HTML>
<HEAD>
<TITLE>LHM Script Chooser</TITLE>
</HEAD>

<BODY>

<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
   <tr class="heading">
      <td width="50%" valign="center"><font color="white"><b>LHM Script 
Chooser</b></font></td>
      <td><center><img width="216" height="51" src="SonicWall.gif"></center></td>
      <td width="50%" align="right" valign="center"><font 
color="white"><b></b>&nbsp</font></td>
   </tr>
   <tr class="heading">
      <td colspan=3 align="center"><font color="white">&nbsp</td>
   </tr>
</table>

<table width="100%" border="0" cellpadding="2" cellspacing="0">
   <tr><td><br></td></tr>
   <tr><td><H3>Select one of the LHM Scripts below</H3></td></tr>
   <tr><td>Your original querystring information is passed to the target script, and it opens 
in a new window.</td></tr>
   <tr><td><br></td></tr>
</table>

<asp:Repeater id="lhmList" runat="server">
   <ItemTemplate >
        <li><a href = <%# DataBinder.Eval(Container.DataItem, "Name").ToString() & 
"/default.aspx?" & qString & " target=""_blank""" %> >
        <%# DataBinder.Eval(Container.DataItem, "Name").ToString() %>
        </a>
        </li>
    </ItemTemplate>
 </asp:Repeater>

<table>
<tr class="hidden">
<td>default.aspx?sessionId=0b712fd83b9f5313db5af1cea6b1004f&ip=10.50.165.231&mac=00:0e:35:bd:c
9:37&ufi=0006b11184300&mgmtBaseUrl=https://10.50.165.193:4043/&clientRedirectUrl=https://10.50
.165.193:444/&req=http%3A//www.google.com/ig</td></tr>
</table>

</BODY>
</HTML>
```

B

IPv6

Topics:

IPv6

This appendix provides an overview of the SonicOS NS*v* implementation of IPv6, how IPv6 operates, and how to configure IPv6 for your network.

Topics:

About IPv6

Topics:

IPv6 Ready Certification

SonicWall has met the requirements for “IPv6 Ready” Phase-1 and Phase-2, as specified by the IPv6 Forum, a world-wide consortium providing technical guidance for the deployment of IPv6. The IPv6 Ready Logo Program is a conformance and interoperability testing program intended to increase user confidence by demonstrating that IPv6 is available now and ready to be used.

The IPv6 Ready series of tests extends from a basic level of minimum coverage in Phase-1 to a more complete coverage with Phase-2:

- Phase-1 (Silver) Logo: In a first stage, the Logo indicates that the product includes IPv6 mandatory core protocols and can interoperate with other IPv6 implementations.
- Phase-2 (Gold) Logo: The “IPv6 ready” step implies a proper care, technical consensus and clear technical references. The IPv6 Ready Logo indicates a product has successfully satisfied strong requirements stated by the IPv6 Logo Committee (v6LC).

SonicWall has been certified for Phase 2 (Gold) IPv6 Ready status. A future Phase-3 level of IPv6 Ready coverage is currently being developed.

For more information, see: http://www.ipv6ready.org/

ⓘ **NOTE:** Wizards for IPv6 are not supported in SonicOS NS*v*.

IPv6 Technology Overview

Every device connected to the Internet (computer, printer, smart phone, smart meter, and so on) requires an IP address. The Internet Protocol version 4 (IPv4) provides for approximately 4.3 billion unique IP addresses. The rapid global expansion in usage of the Internet, mobile phones, and VoIP telephony soon leads to the exhaustion of these 4.3 billion IP addresses.

On February 3rd, 2011, the Internet Assigned Numbers Authority (IANA) distributed the last-remaining blocks of IPv4 addresses to the Regional Internet Registries (RIRs). When the RIRs distribute these addresses to ISPs later this year, the world’s supply of new IPv4 addresses are exhausted.

Luckily, the Internet Engineering Task Force (IETF) began planning for this day back around 1992, and in 1998, RFC 2460 was published to define Internet Protocol, Version 6 (IPv6). By increasing the address length from 32 bits to 128 bits, IPv6 dramatically increases the number of available addresses compared to IPv4:

- IPv4: 4,294,967,296 addresses
- IPv6: 340,282,366,920,938,463,463,374,607,431,768,211,456 addresses

Understanding IPv6 Addresses

IPv6 addresses are written in eight groups of four hexadecimal digits separated by colons:

```
XXXX:XXXX:XXXX:XXXX:XXXX:XXXX:XXXX:XXXX
```

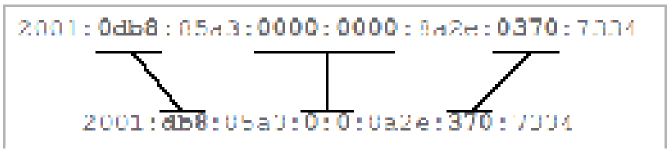
IPv6 addresses are logically divided into two parts: a 64-bit (sub-)network prefix, and a 64-bit interface identifier. Here is an example of an IPv6 address:

```
2001:0db8:85a3:0000:0000:8a2e:0370:7334
```

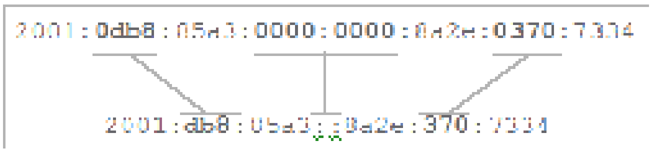
ⓘ **NOTE:** The hexadecimal digits in IPv6 addresses are case-insensitive.

IPv6 address can be abbreviated using the following two rules:

1. Leading zeroes within a 16-bit value might be omitted. This way our example address can be abbreviated from the full form as follows:


2001:0db8:05a3:0000:0000:0a2e:0370:7334
2001:db8:5a3:0:0:a2e:370:7334

2. Any number of consecutive groups of four zeros (technically 16-bits of zeros) can be expressed by a double colon (`::`). Combining these two rules, our example address can be abbreviated from the full form as follows:


2001:0db8:05a3:0000:0000:0a2e:0370:7334
2001:db8:5a3::a2e:370:7334

ⓘ **TIP:** The abbreviation for an empty address, or `0:0:0:0:0:0:0:0`, is `::`.

Types of IPv6 Addresses

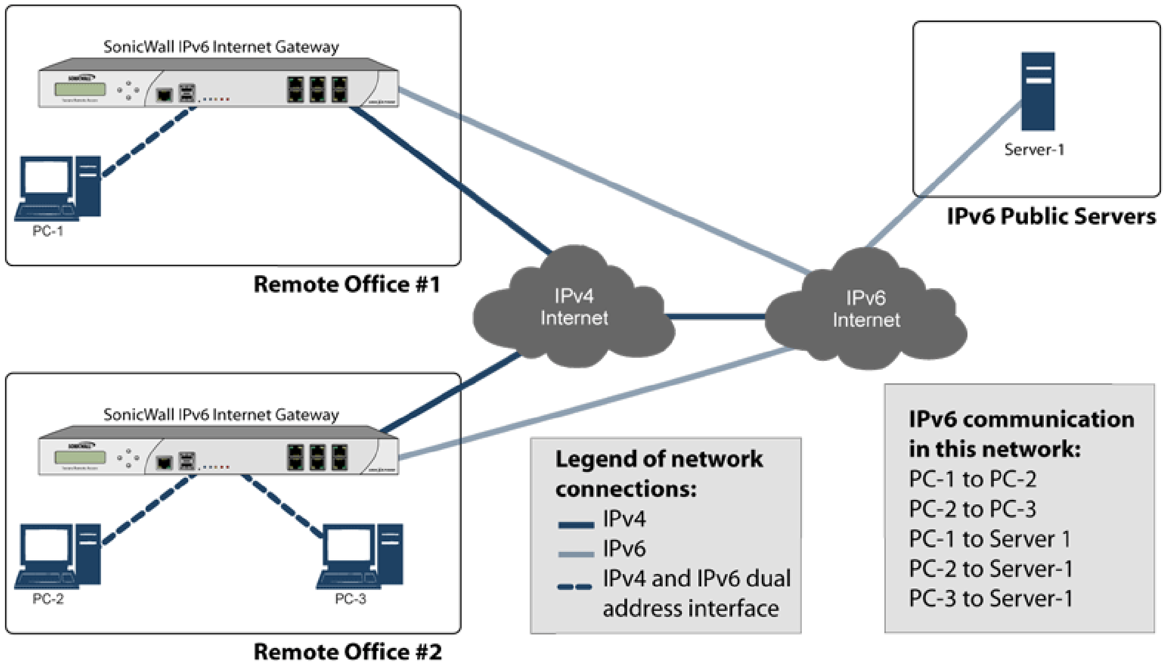
Type of Address	Full Address	Abbreviated Address
unicast address	1080:0:0:0:8:800:200C:417A	1080::8:800:200C:417A
multicast address	FF01:0:0:0:0:0:0:101	FF01::101
loopback address	0:0:0:0:0:0:0:1	::1
unspecified address	0:0:0:0:0:0:0:0	::

ⓘ **NOTE:** Networks must have IPv4 Internet connectivity to get connected to IPv6 Internet.

ⓘ **NOTE:** IPv6 stack must be enabled for computers at the local network sites.

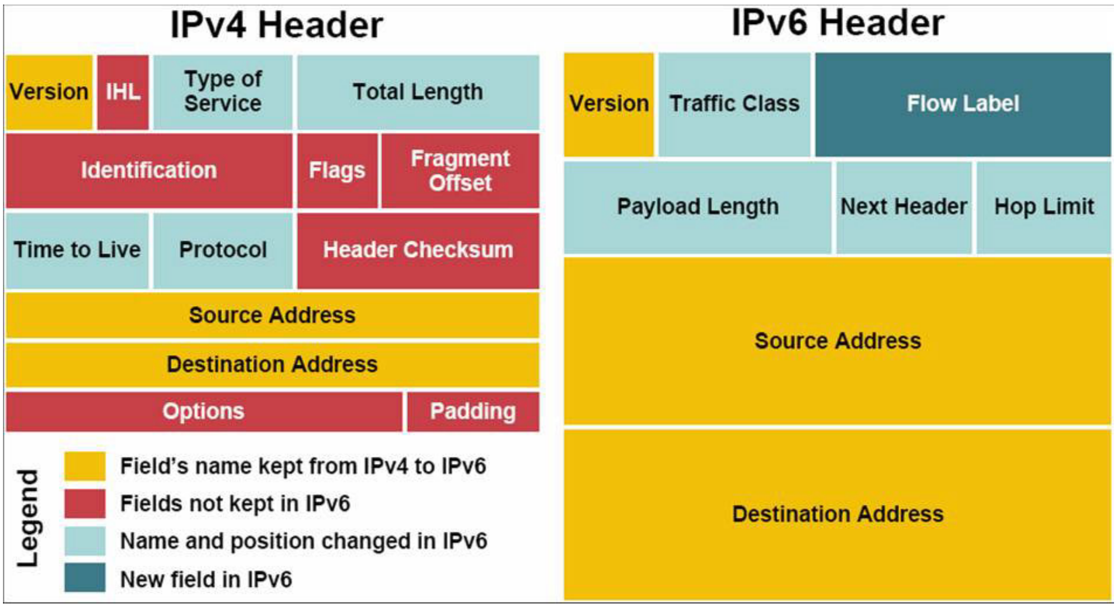
Typical IPv6 Deployment is a simplified picture showing connectivity model for a typical IPv6 deployment.

Typical IPv6 Deployment



Comparison of IPv4 and IPv6 Header Elements compares of the header elements between IPv4 and IPv6.

Comparison of IPv4 and IPv6 Header Elements



IPv6 Benefits

IPv6 brings some key features to improve the limitations exposed by IPv4. The new IP standard extends IPv4 in a number of important aspects:

- 6to4 tunnel (allows IPv6 nodes to connect to outside IPv6 services over an IPv4 network)
  - 6to4 Auto Tunnel
  - GRE Tunnel
- IPv6 Manual Tunnel
- New, simplified IPv6 header format
- Massively large number of available IPv6 addresses
- Efficient and hierarchical addressing and routing infrastructure
- Auto address assignment to hosts and routers using Neighbor Discovery Protocol (NDP) and DHCPv6
- Stateless and stateful address configuration
- Built-in security - AH and ESP strongly recommended
- Better support for QoS - Flow label in the header
- New protocol for neighboring node interaction
- Extensibility for new features using extension headers
  - Extension header detection report an log support
  - Extension header order check enforcement
  - Hop-by-hop extension header support
  - Inbound type 0 routing header packet check

SonicWall IPv6 Services and Features Currently Supported

For a complete list of currently supported IPv6 services and features, see the Knowledge Base article, *Supported/Unsupported IPv6 Features in SonicOS NSv 6.x.x firmware*.

SonicWall IPv6 Features Not Currently Supported

ⓘ **NOTE:** SonicOS NSv is a dual IP stack firmware. Features that are not supported for IPv6 are still supported for IPv4.

For a complete list of IPv6 services and features currently not supported, see the Knowledge Base article, *Supported/Unsupported IPv6 Features in SonicOS NSv 6.x.x firmware*.

Supported IPv6 RFCs

This section lists the IPv6 RFCs supported in SonicOS NSv:

- TCP/IP Stack and Network Protocols on page 663
- IPsec Conformance on page 664
- NAT Conformance on page 664
- DNS Conformance on page 664

TCP/IP Stack and Network Protocols

- RFC 1886 DNS Extensions to support IP version 6 [IPAPPL DNS client]

- RFC 1981 Path MTU Discovery for IPv6
- RFC 2113 IP Router Alert Option
- RFC 2373 IPv6 Addressing Architecture
- RFC 2374 An IPv6 Aggregatable Global Unicast Address Format (obsoleted by 3587)
- RFC 2375 IPv6 Multicast Address Assignments
- RFC 2460 IPv6 specification
- RFC 2461 Neighbor discovery for IPv6
- RFC 2462 IPv6 Stateless Address Autoconfiguration
- RFC 2463 ICMPv6 for IPv6 specification
- RFC 2464 Transmission of IPv6 Packets over Ethernet Networks
- RFC 2473 Generic Packet Tunneling in IPv6 Specification
- RFC 2474 Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers
- RFC 2545 Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing
- RFC 2553 Basic Socket Interface Extensions for IPv6
- RFC 2710 Multicast Listener Discovery (MLD) for IPv6
- RFC 2711 IPv6 Router Alert Option
- RFC 2784 Generic Routing Encapsulation
- RFC 2893 Transition Mechanisms for IPv6 Hosts and Routers
- RFC 2991 Multipath Issues in Unicast and Multicast Next-Hop Selection
- RFC 3056 Connection of IPv6 Domains through IPv4 Clouds
- RFC 3484 Default Address Selection for Internet Protocol version 6 (IPv6) (no policy hooks)
- RFC 3493 Basic Socket Interface Extensions for IPv6
- RFC 3513 Internet Protocol Version 6 (IPv6) Addressing Architecture
- RFC 3542 Advanced Sockets Application Program Interface (API) for IPv6
- RFC 3587 IPv6 Global Unicast Address Format (obsoletes 2374)

IPsec Conformance

- RFC 1826 IP Authentication Header [old AH]
- RFC 1827 IP Encapsulating Security Payload (ESP) [old ESP]

NAT Conformance

- RFC 2663 IP Network Address Translator (NAT) Terminology and Considerations
- RFC 3022 Traditional IP Network Address Translator (Traditional NAT)

DNS Conformance

- RFC 1886 DNS Extensions to support IP version 6

Non-supported IPv6 RFCs

This section lists the IPv6 RFCs currently not supported in SonicOS NS*v*:

- RFC 2002 IP Mobility Support
- RFC 2766 Network Address Translation - Protocol Translation (NAT-PT)
- RFC 2472 IP Version 6 over PPP
- RFC 2452 IP Version 6 Management Information Base for the Transmission Control Protocol
- RFC 2454 IP Version 6 Management Information Base for the User Datagram Protocol
- RFC 2465 Management Information Base for IP Version 6: Textual Conventions and General Group

Configuring IPv6

Topics:

IPv6 Interface Configuration

IPv6 interfaces are configured on the **MANAGE | System Setup | Network > Interfaces** page by clicking **IPv6** in the **View IP Version** at the top right corner of the **Interface Settings** table.

By default, all IPv6 interfaces appear as routed with no IP address. Multiple IPv6 addresses can be added on the same interface. Auto IP assignment can only be configured on WAN interfaces.

ⓘ | **NOTE:** PortShield interfaces are not supported in IPv6.

Each interface can be configured to receive router advertisement or not. IPv6 can be enabled or disabled on each interface.

ⓘ | **NOTE:** The zone assignment for an interface must be configured through the IPv4 interface page before switching to IPv6 mode.

Topics:

- Configuring an Interface for Auto Mode on page 673
- Configuring a VLAN Sub-Interface on page 675

IPv6 Interface Configuration Constraints

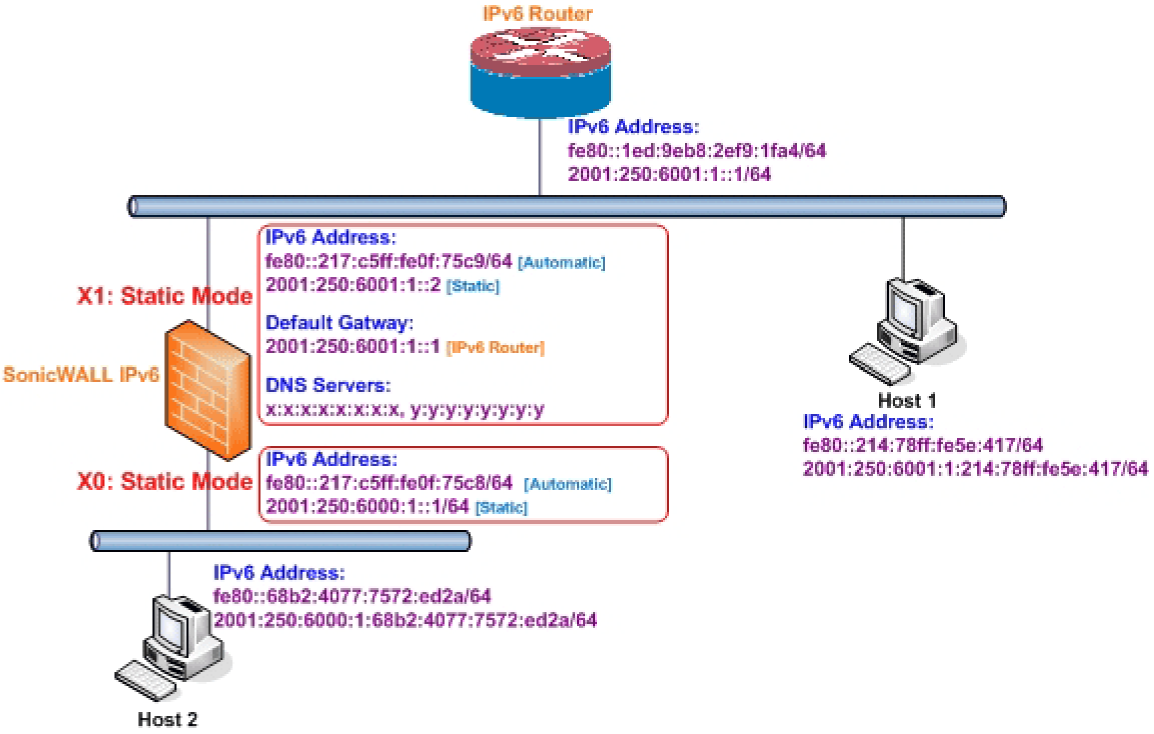
- The HA interface cannot be configured for IPv6.
- Only the parent interface of a SwitchPort group can be configured as an IPv6 interface; for this reason, all children of a switch port group must be excluded from this list.
- Zone groups are shared configurations between by IPv4 and IPv6 on an interface. When they are configured on the IPv4 side, the IPv6 side of the interface uses the same configuration.
- Default Gateway and DNS Servers can only be configured for WAN zone interfaces.
- Wire mode is supported for IPv6, but you cannot edit any settings. Instead, SonicOS NS*v* uses the same configuration options set for IPv4.

Configuring an Interface for IPv6 Static Mode

Static mode provides user a way to assign static IPv6 address as opposed to an auto-assigned address. Using static mode, the IPv6 interface can still listen for Router Advertisements and learn an autonomous address from the appropriate prefix option. Static Mode does not disturb the running of Stateless Address Autoconfiguration on IPv6 interface unless the user manually disables it.

IPv6 Static Mode Configuration shows a sample topology with IPv6 configured in static mode.

IPv6 Static Mode Configuration


IPv6 Router
IPv6 Address:
fe80::1ed:9eb8:2ef9:1fa4/64
2001:250:6001:1::1/64
X1: Static Mode
IPv6 Address:
fe80::217:c5ff:fe0f:75c9/64 [Automatic]
2001:250:6001:1::2 [Static]
Default Gatway:
2001:250:6001:1::1 [IPv6 Router]
DNS Servers:
x:x:x:x:x:x:x:x, y:y:y:y:y:y:y:y
SonicWALL IPv6
X0: Static Mode
IPv6 Address:
fe80::217:c5ff:fe0f:75c8/64 [Automatic]
2001:250:6000:1::1/64 [Static]
Host 1
IPv6 Address:
fe80::214:78ff:fe5e:417/64
2001:250:6001:1:214:78ff:fe5e:417/64
IPv6 Address:
fe80::68b2:4077:7572:ed2a/64
2001:250:6000:1:68b2:4077:7572:ed2a/64
Host 2

Three types of IPv6 address are possible to assign under this mode:

- Automatic Address
- Autonomous Address

- Static Address

To configure an interface for a static IPv6 address:

1 Navigate to the **MANAGE | System Setup | Network > Interfaces** page.

2 Click **IPv6** at the top right corner of the page. IPv6 addresses for the appliance are displayed.

3 Click **Configure** for the interface you want to configure an IPv6 address for. The **Edit Interface** dialog displays.

> ⓘ **NOTE:** The zone assignment for interfaces must be configured on the IPv4 addressing page. To modify the zone assignment for an IPv6 interface, click **IPv4** at the top right of the page, modify the zone for the interface, and then return to the IPv6 interface page.

4 In the **IP Assignment** drop-down menu, select **Static**.

5 Enter the **IPv6 Address** for the interface.

6 Enter the **Prefix Length** for the address.

7 If this is the primary WAN interface, enter the IPv6 address of the **Default Gateway**. If this is not the primary WAN interface, any Default Gateway entry is ignored, so you can leave this as `::`. (The double colon is the abbreviation for an empty address, or `0:0:0:0:0:0:0:0`.)

8 If this is the primary WAN interface, enter up to three **DNS Server** IPv6 addresses. Again, if this is not the primary WAN interface, any DNS Server entries are ignored.

9 Select **Enable Router Advertisement** to make this an advertising interface that distributes network and prefix information.

10 Select **Advertise Subnet Prefix of IPv6 Primary Static Address** to add a default prefix into the interface advertising prefix list. This prefix is the subnet prefix of interface IPv6 primary static address. This option helps all hosts on the link stay in the same subnet.

Configuring Advanced IPv6 Interface Options and Multiple IPv6 Addresses

To modify Advanced IPv6 interface options or to configure multiple static IPv6 addresses:

1 In the **Edit Interface** dialog, click on the **Advanced** tab.

2 Click **Add Address** to configure multiple static IPv6 addresses for the interface. The **Add Interface IPv6 Address** dialog displays.

> ⓘ **NOTE:** Multiple IPv6 addresses can only be added for an interface that is configured for Static IPv6 address mode. Multiple IPv6 addresses cannot be configured for **Auto** or **DHCPv6** modes.

3 Enter the **IPv6 Address** for the additional address for the interface.

4 Enter the **Prefix Length** for the address.

5 Select **Advertise Subnet Prefix of IPv6 Address** to add a default prefix into the interface advertising prefix list. This prefix is the subnet prefix of interface IPv6 primary static address. This option helps all hosts on the link stay in the same subnet.

6 Click **OK**.

7 The following additional options can be configured on the **Advanced** tab under the **Advanced Settings** heading:

- Select **Disable all IPv6 Traffic on the Interface** to stop the interface from handling all IPv6 traffic. Disabling IPv6 traffic can improve firewall performance for non-IPv6 traffic. This option is not selected by default.

  > **TIP:** If the firewall is deployed in a pure IPv4 environment, SonicWall recommends enabling this option.

- Select **Enable Listening to Router Advertisement** to have the firewall receive router advertisement. If disabled, the interface filters all incoming Router Advertisement messages, which can enhance security by eliminating the possibility of receiving malicious network parameters (for example, prefix information or default gateway). This option is selected by default.

  > **NOTE:** When this option is disabled, all assigned autonomous IPv6 address are removed from this interface.

  This option is not visible for **Auto** mode. In **Auto** mode, it is always enabled.

  - Select **Enable Stateless Address Autoconfiguration** to allow autonomous IPv6 addresses to be assigned to this interface. If unchecked, all assigned autonomous IPv6 address are removed from this interface.

    This option is not visible for **Auto** mode. In **Auto** mode, it is always enabled.

- Enter a numeric value for **Duplicate Address Detection Transmits** to specify the number of consecutive Neighbor Solicitation messages sent while performing Duplicate Address Detection (DAD) before assigning a tentative address to the interface. The minimum number is 0, the maximum is 9, and the default is **1**. A value of 0 indicates that DAD is not performed on the interface.
- In **Neighbor Discovery Base Reachable Time (seconds)**, enter a base value, in seconds, to use for computing the random Reachable Time value for the interface. The minimum value is 0, the maximum is 9999, and the default is **30**.

  A value of 0 indicates the parameter is unspecified, and the global setting in **Network > Neighbor Discovery** is used. If RA is enabled on this interface, however, the value in the **Reachable Time** option in the **Router Advertisement** tab is used.

- Select **Enable Max NDP Size Per Interface** to enable a maximum NDP size per interface. Every interface should have a maximum NP size for preventing system resources from being exhausted.
  - Enter the maximum NDP size in the **Max NDP Size Per Interface** field. The minimum value is 64, the maximum value is 9999, and the default values are **128** for WAN interfaces and **1200** for others.
- Similar with IPv4 gratuitous ARP, IPv6 node uses Neighbor Solicitation message to detect duplicate IPv6 address on the same link. DAD must be performed on any Unicast address (except Anycast address) before assigning a tentative to an IPv6 interface.

Configuring Router Advertisement Settings

Router Advertisement allows IPv6 routers to advertise DNS recursive server addresses to IPv6 hosts. Router Advertisement-based DNS configuration is a useful, optional alternative in networks where an IPv6 host's address is autoconfigured through IPv6 stateless address autoconfiguration, and where the delays in acquiring server addresses and communicating with the servers are critical. Router Advertisement allows the host to acquire the nearest server addresses on every link. Furthermore, it learns these addresses from the same RA message that provides configuration information for the link, thereby avoiding an additional protocol run. This can be beneficial in some mobile environments, such as with Mobile IPv6. SonicWall’s implementation of IPv6 is full conformable with RFC 4861 in Router and Prefix Discovery.

> **NOTE:** Router Advertisement can only be enabled when interface is under Static mode.

To configure Router Advertisement for an IPv6 interface:

1 In the **Edit Interface** dialog, click on the **Router Advertisement** tab.

2 Select the **Enable Router Advertisement** checkbox to make this an advertising interface that distributes network and prefix information.

3 Optionally, you can modify the following Router Advertisement settings:

- **Router Adv Interval Range (seconds)** – Enter the time interval allowed between unsolicited multicast Router Advertisements sent from the interface, in seconds. Advertisements are sent at a random value between the minimum and maximum interval:
    - Minimum interval – Enter the shortest interval allowed between Router Advertisements. The minimum time is 3 seconds, the maximum is 1350 seconds, and the default minimum time is **200** seconds.
    - Maximum interval – Enter the longest interval allowed between Router Advertisements. The minimum time is 4 seconds, the maximum is 1800 seconds, and the default maximum time is **600** seconds.
- **Link MTU** – Enter the recommended MTU for the interface link. The minimum value is 0, the maximum value is 99999, and the default value is **0**, which means the firewall does not advertise link MTU for the link.
- **Reachable Time (seconds)** – Enter the time that a node assumes a neighbor is reachable after having received a reachability confirmation. The minimum value is 0, the maximum value is 9999999999, and the default value is **0**, which means this parameter is unspecified by this firewall.
- **Retrans Time** – Enter the time between retransmitted Neighbor Solicitation messages. The minimum value is 0, the maximum value is 9999999999, and the default value is **0**, which means this parameter is unspecified by this firewall.
- **Current Hop Limit** – Enter the default value that should be placed in the Hop Count field of the IP header for outgoing IP packets. The minimum value is 0, which means this parameter is unspecified by this firewall; the maximum value is 255; and the default value is **64**.
- **Router Lifetime (seconds)** – Enter the lifetime when the firewall is accepted as a default router. The minimum value is 0 seconds, which means that the router is not a default router; the maximum time is 9000 seconds, and the default value is **1800** seconds.
- **Router Preference** – Indicates whether the advertising default router should be preferred over other default routers. Select **High**, **Medium** (default), or **Low** from the drop-down menu.

4 Select the **Managed** checkbox to set the managed address configuration flag in the Router Advertisement message. If set, the flag indicates that IPv6 addresses are available through Dynamic Host Configuration Protocol.

5 Select the **Other Configuration** checkbox to set the Other configuration flag in Router Advertisement message. If set, the flag indicates that other configuration information is available through Dynamic Host Configuration Protocol.

Configuring Router Advertisement Prefix Settings

Advertising prefixes provide hosts with prefixes for on-link determination and Address Autoconfiguration.

To configure a router advertisement prefix:

1 Go to the **Prefix List Settings** table on the **Router Advertisement** tab of the **Edit Interface** dialog.

2 Click **Add Prefix**. The **Add Advertising Prefix** dialog displays.

3 Enter the **Prefix** that is to be advertised with the Router Advertisement message.

4 Enter the **Valid Lifetime (minutes)** to set the length of time that the prefix is valid for the purpose of on-link determination. The minimum value is 1; the maximum value is 71582789, which means the lifetime is infinite, and the default value is **43200** minutes.

5 Enter the **Preferred Lifetime (minutes)** to set the length of time that addresses generated from the prefix through stateless address autoconfiguration remain preferred. The minimum value is 1; the maximum value is 71582789, which means the lifetime is infinite; and the default value is **10080** minutes.

6 Optionally select the **On-link** checkbox to enable the on-link flag in the Prefix Information option to indicate that this prefix can be used for on-link determination.

7 Optionally select the **Autonomous** checkbox to enable the autonomous address-configuration flag in Prefix Information option to indicate that this prefix can be used for stateless address configuration.

8 Click **OK**.

Configuring an Interface for DHCPv6 Mode

DHCPv6 (DHCP for IPv6) is a client/server protocol that provides stateful address configuration or stateless configuration setting for IPv6 hosts. DHCPv6 client is enabled to learn IPv6 address and network parameters when the interface is configured to DHCPv6 mode.

DHCPv6 defines two different configuration modes:

- **DHCPv6 stateful mode**: DHCPv6 clients require IPv6 address together with other network parameters (for example, DNS Server, Domain Name).
- **DHCPv6 stateless mode**: DHCPv6 client only obtains network parameters other than IPv6 address.

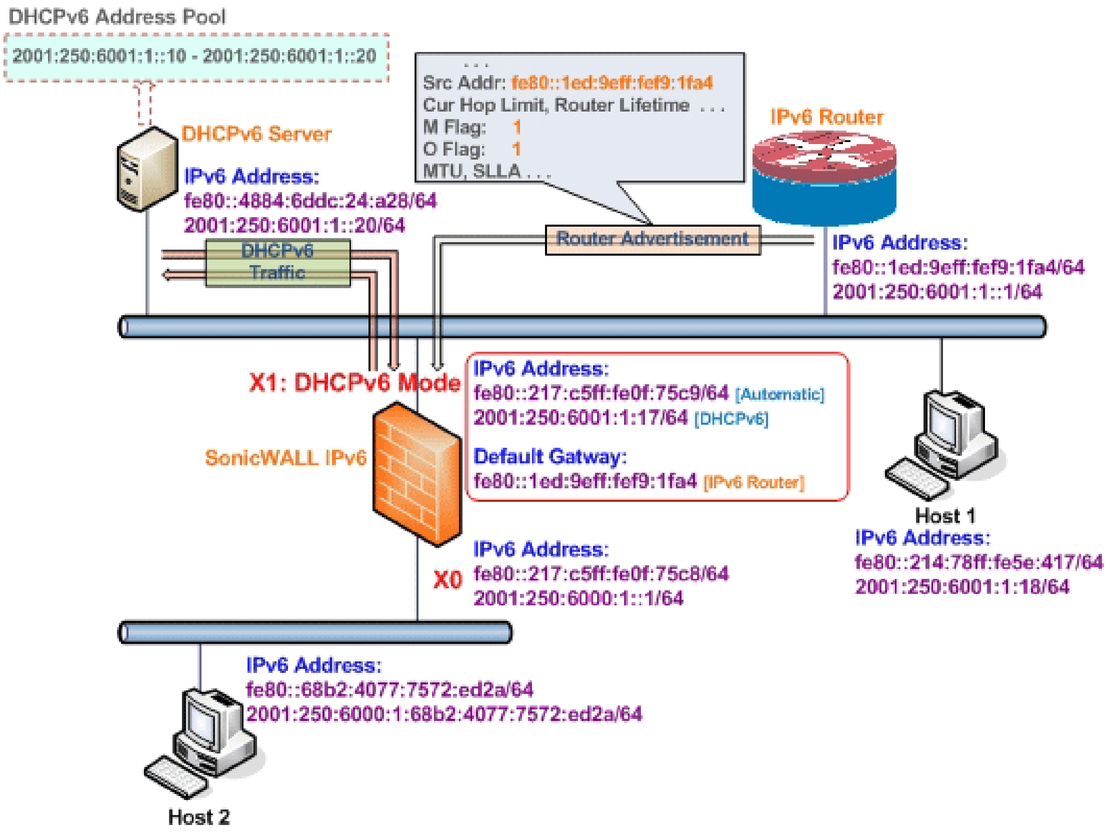
Choosing which mode depends on the Managed (M) Address Configuration and Other (O) Configuration flags in the advertised Router Advertisement message:

DHCPv6 Infrastructure

Flag		Configuration
M	O	
0	0	No DHCPv6 infrastructure.
1	1	IPv6 host uses DHCPv6 for both IPv6 address and other network parameter settings.
0	1	IPv6 host uses DHCPv6 only for IPv6 address assignment.
1	0	IPv6 host uses DHCPv6 only for other network parameter settings, known as DHCPv6 stateless.

DHCPv6 Topology shows a sample DHCPv6 topology.

DHCPv6 Topology



There are three types of IPv6 addresses that can be assigned under DHCPv6:

- Automatic Address
- Autonomous Address
- IPv6 Address assigned through DHCPv6 client

To configure an interface for a DHCPv6 address:

1 Navigate to **MANAGE | System Setup | Network > Interfaces**.

2 If you are configuring an unassigned interface, click **IPv4** at the top right corner of the page.

3 Click **Edit** for the interface to be configured. The **Edit Interface** dialog displays.

4 Select **WAN** from the **Zone** drop-down menu. More options appear.

5 Select **DHCP** from the **IP Assignment** drop-down menu.

6 Click **OK**.

7 Click **IPv6** at the top right corner of the page. IPv6 addresses for the appliance are displayed.

8 Click **Configure** for the interface you want to configure an IPv6 address for. The **Edit Interface** dialog displays.

9 In the **IP Assignment** drop-down menu, select **DHCPv6**. The options change.

- **Use Rapid Commit Option** - If enabled, DHCPv6 client use Rapid Commit Option to use the two message exchange for address assignment.

10 Select the **DHCPv6 Mode** for the interface. As required by RFC, DHCPv6 client depends on the Router Advertisement message to decide which mode (stateful or stateless) it should choose. This definition

limits the user's choice to determine the DHCPv6 mode by itself. SonicWall's implementation of DHCPv6 defines two different modes to balance the conformance and flexibility:

- **Automatic** - The IPv6 interface configures IPv6 addresses using stateless/stateful autoconfiguration in accord with the M and O settings in the most recently received router advertisement message. See DHCPv6 Infrastructure.
- **Manual** - The DHCPv6 mode is manually configured regardless of any received Router Advertisement.

The **Only Request Stateless Information** option determines which DHCPv6 mode is used. If this option is unchecked, DHCPv6 client is under stateful mode; if it is checked, DHCPv6 client is under stateless mode and only obtains network parameters.

11 Optionally, select the **Only Request Stateless Information** checkbox to have DHCPv6 clients only request network parameter setting from the DHCPv6 server. The IPv6 address is assigned through stateless auto-configuration.

12 Optionally, you can configure **Management** login or **User Login**.

13 Optionally click the **Advanced** tab to configure Advanced options and/or click the **Protocol** tab to view DHCPv6 stateful and stateless configuration information.

14 Click **OK** to complete the configuration.

Configuring Advanced Settings for an IPv6 Interface

To configure advanced IPv6 interface settings:

1 On the **Edit Interface** dialog, click the **Advanced** tab.

2 Select **Disable all IPv6 Traffic on the Interface** to stop the interface from handling all IPv6 traffic. Disabling IPv6 traffic can improve firewall performance for non-IPv6 traffic. This option is not selected by default.

> ⓘ **TIP:** If the firewall is deployed in a pure IPv4 environment, SonicWall recommends enabling this option.

3 Select **Enable Listening to Router Advertisement** to have the firewall receive router advertisement. If disabled, the interface filters all incoming Router Advertisement messages, which can enhance security by eliminating the possibility of receiving malicious network parameters (for example, prefix information or default gateway). This option is not selected by default.

> ⓘ **NOTE:** If this option is disabled, all assigned autonomous IPv6 addresses are removed from this interface.

This option is not visible for Auto mode. In Auto mode, it is always enabled.

When this option is selected the Enable Stateless Address Autoconfiguration option becomes available.

- Select **Enable Stateless Address Autoconfiguration** to allow autonomous IPv6 addresses to be assigned to this interface. If unchecked, all assigned autonomous IPv6 addresses are removed from this interface.

  > ⓘ **NOTE:** If this option is disabled, all assigned autonomous IPv6 addresses are removed from this interface.

  This option is not visible for Auto mode. In Auto mode, it is always enabled.

4 Enter a numeric value for **Duplicate Address Detection Transmits** to specify the number of consecutive Neighbor Solicitation messages sent while performing Duplicate Address Detection (DAD) before assigning a tentative address to this interface. The minimum value is 0, which indicates that DAD is not performed on the interface; the maximum number is 9; and the default number is **1**.

Similar to IPv4 gratuitous ARP, IPv6 node uses a Neighbor Solicitation message to detect a duplicate IPv6 address on the same link. DAD must be performed on any Unicast address (except Anycast address) before assigning a tentative to an IPv6 interface.

5 In **Neighbor Discovery Base Reachable Time (seconds)**, enter a base value, in seconds, to use for computing the random Reachable Time value for the interface. The minimum value is 0, the maximum is 9999, and the default is **30**.

A value of 0 indicates the parameter is unspecified, and the global setting in **Network > Neighbor Discovery** is used. If RA is enabled on this interface, however, the value in the **Reachable Time** option in the **Router Advertisement** tab is used.

6 Select **Enable Max NDP Size Per Interface** to enable a maximum NDP size per interface. Every interface should have a maximum NP size for preventing system resources from being exhausted. This option is selected by default.

Enter the maximum NDP size in the **Max NDP Size Per Interface** field. The minimum value is 64, the maximum value is 9999, and the default values are **128** for WAN interfaces and **1200** for others.

Viewing DHCPv6 Protocol Information

When configuring an IPv6 interface in DHCpv6 mode, the **Protocol** tab displays additional DHCPv6 information.

- **DHCPv6 General Information**
  - **DHCPv6 State**: If the interface is configured for:
    - Stateless mode, the DHCPv6 State is Stateless.
    - Stateful mode, the DHCPv6 State is either **Enabled** or **Disabled**.

      When the interface is in Stateful DHCPv6 mode, mousing over the **Comment** icon displays current Router Advertisement information for the interface.
  - **DHCPv6 Server**: The IPv6 address of the DHCPv6 server.
  - **DHCPv6 DUID**: The DUID (DHCP Unique Identifier) or host identifier.
- **Stateful Addresses Acquired via DHCPv6**: Displays information on any acquired stateful IPv6 addresses:
  - IAID (Identity Association Identifier)
  - Type
  - IPv6 Address
  - Lease Expires
- **Stateless Configuration Settings Acquired via DHCPv6**
  - **DNS Servers 1/2/3**: The IPv6 addresses of any DNS Servers.

  You can renew, release, or refresh the DNS servers by clicking the appropriate button.
- **Delegated Prefixes Acquired via DHCPv6**: Displays information on any acquired delegated prefixes for stateful IPv6 addresses:
  - IAID
  - Type
  - IPv6 Prefix
  - Prefix Length
  - Lease Expires

  You can renew, release, or refresh the prefixes by clicking the appropriate button.

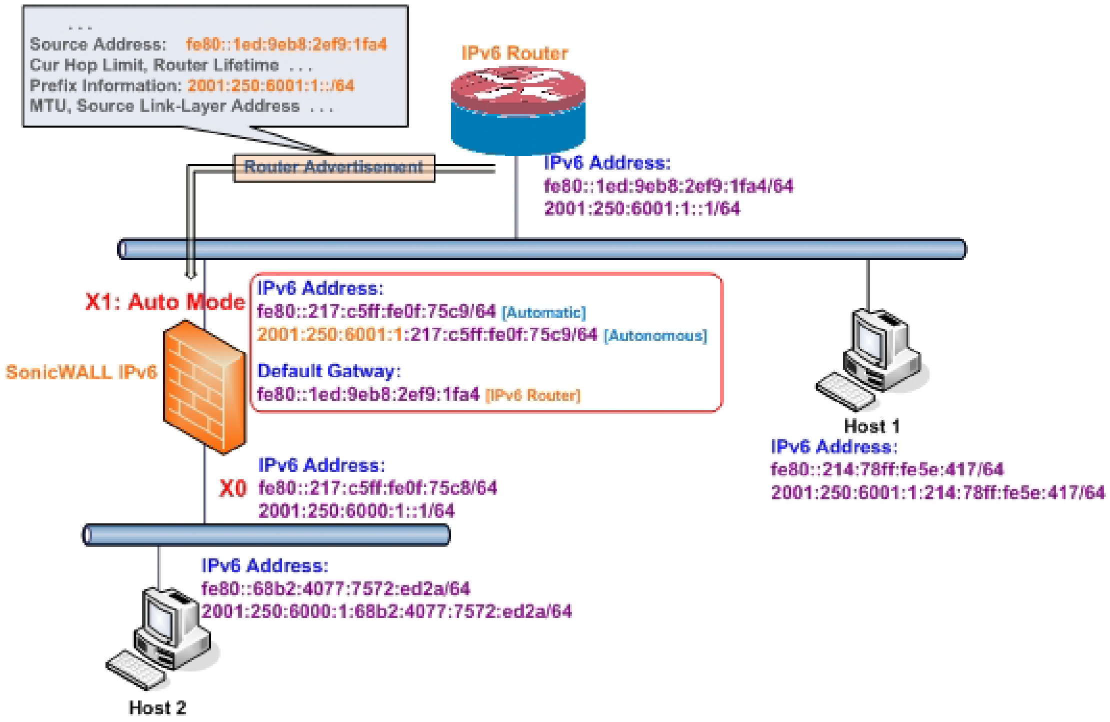
Configuring an Interface for Auto Mode

Auto mode utilities IPv6’s Stateless Address Autoconfiguration to assign IPv6 address. This mode does not require any manual address configuration by the network administrator. The Security Appliance listens to the network and receives prefix information from neighboring routers. The IPv6 Stateless Address Autoconfiguration feature performs all configuration details, such as IPv6 address assignment, address deleting for address conflicting or lifetime expiration, and default gateway selection based on the information collected from on-link router.

NOTE: Auto mode can only be configured for the WAN zone. For security consideration, Auto mode is not available on LAN zone interface.

IPv6 Auto Mode Configuration shows a sample topology for IPv6 configured in Auto mode.

IPv6 Auto Mode Configuration


. . .
Source Address: fe80::1ed:9eb8:2ef9:1fa4
Cur Hop Limit, Router Lifetime . . .
Prefix Information: 2001:250:6001:1::/64
MTU, Source Link-Layer Address . . .
IPv6 Router
Router Advertisement
IPv6 Address:
fe80::1ed:9eb8:2ef9:1fa4/64
2001:250:6001:1::1/64
X1: Auto Mode
SonicWALL IPv6
IPv6 Address:
fe80::217:c5ff:fe0f:75c9/64 [Automatic]
2001:250:6001:1:217:c5ff:fe0f:75c9/64 [Autonomous]
Default Gatway:
fe80::1ed:9eb8:2ef9:1fa4 [IPv6 Router]
Host 1
IPv6 Address:
fe80::214:78ff:fe5e:417/64
2001:250:6001:1:214:78ff:fe5e:417/64
X0
IPv6 Address:
fe80::217:c5ff:fe0f:75c8/64
2001:250:6000:1::1/64
IPv6 Address:
fe80::68b2:4077:7572:ed2a/64
2001:250:6000:1:68b2:4077:7572:ed2a/64
Host 2

In this mode, 2 types of IPv6 address are possible to assign:

- Automatic Address - The interface default link-local address. It is never timed out and is not able to be edited or deleted.
- Autonomous Address - Assigned from Stateless Address Autoconfiguration. Users can manually delete the address if they do not want to wait for its valid lifetime expires.

To configure an IPv6 interface for Auto mode:

1. Navigate to **MANAGE | System Setup | Network > Interfaces**.
2. Click **IPv6** at the top right corner of the page to display IPv6 addresses.
3. Click **Configure** for the interface you want to configure an IPv6 address for. The **Edit Interface** dialog displays.
4. In the **IP Assignment** drop-down menu, select **Auto**.
5. Optionally, you can select enter a numeric value for **Duplicate Address Detection Transmits** on the **Advanced** tab to specify the number of consecutive Neighbor Solicitation messages sent while performing Duplicate Address Detection (DAD) before assigning a tentative address to interface. A value of 0 indicates that DAD is not performed on the interface.
6. Click **OK**.

Configuring a VLAN Sub-Interface

The procedure for configuring a VLAN Sub-interface in IPv6 is identical to that in IPv4. Refer to Configuring Virtual Interfaces (VLAN Subinterfaces) on page 263 for details.

All VLAN Sub-interfaces must be configured in IPv4, before configuring them in IPv6.

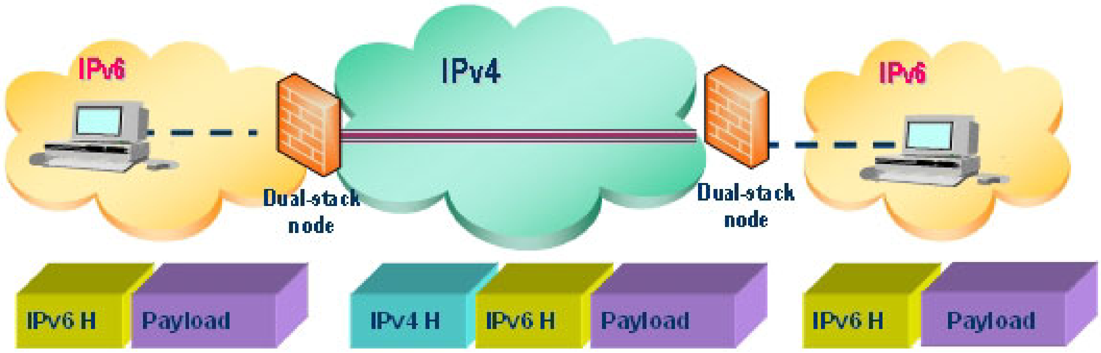
Configuring IPv6 Tunnel Interfaces

This section describes how to tunnel IPv4 packets through IPv6 networks and IPv6 packets through IPv4 networks. For instance, to pass IPv6 packets through the IPv4 network, the IPv6 packet is encapsulated into an IPv4 packet at the ingress side of a tunnel. When the encapsulated packet arrives at the egress of the tunnel, the IPv4 packet is de-capsulated.

Tunnels can be either automatic or manually configured. A configured tunnel determines the endpoint addresses by configuration information on the encapsulating node. An automatic tunnel determines the IPv4 endpoints from the address of the embedded IPv6 datagram. IPv4 multicast tunneling determines the endpoints through Neighbor Discovery.

IPv6-to-IPv4 Tunnel Interface depicts an IPv6-to-IPv4 tunnel.

IPv6-to-IPv4 Tunnel Interface



Topics:

- Configuring the 6to4 Auto Tunnel on page 675
- Configuring 6to4 Relay for Non-2002 Prefix Access on page 677
- Configuring a Manual IPv6 Tunnel on page 677
- Configuring a GRE IPv6 Tunnel on page 678
- Configuring an ISATAP Tunnel on page 678

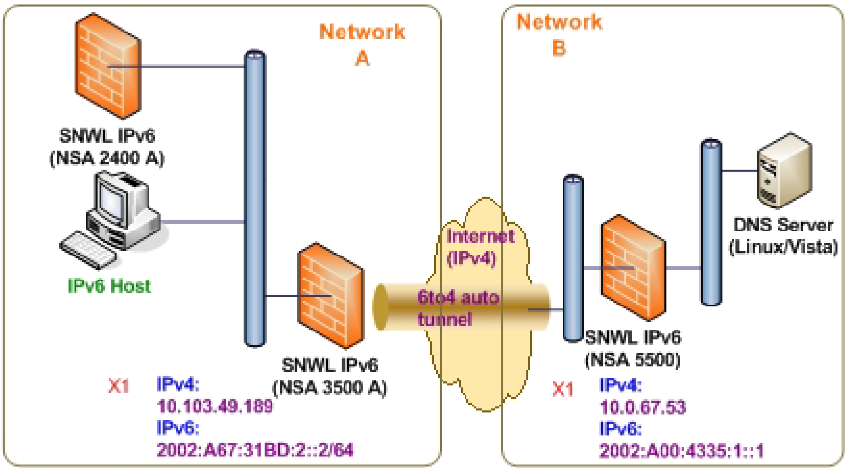
Configuring the 6to4 Auto Tunnel

The 6to4 Auto Tunnel is an automatic tunnel: tunnel endpoints are extracted from the encapsulated IPv6 datagram. No manual configuration is necessary.

6to4 tunnels use a prefix of the form `2002:`*`tunnel-IPv4-address`*`::/48` to tunnel IPv6 traffic over IPv4 (for example, if the tunnel’s IPv4 endpoint has the address a01:203, the 6to4 tunnel prefix is 2002:a01:203::1). Routers advertise a prefix of the form `2002:`*`[IPv4]`*`:`*`xxxx`*`/64` to IPv6 clients. For complete information, see RFC 3056.

6to4 Auto Tunnel Topology shows a sample 6to4 auto tunnel topology.

6to4 Auto Tunnel Topology



In IPv6-to-IPv4 Tunnel Interface, customers do not need to specify the tunnel endpoint, but only need to enable the 6to4 auto tunnel. All packets with a 2002 prefix are routed to the tunnel, and the tunnel's IPv4 destination is extracted from the destination IPv6 address.

6to4 tunnels are easy to configure and use. Users must have a global IPv4 address and IPv6 address, which must also have a 2002 prefix. Therefore, in general, a user can only access network resources with a 2002 prefix.

NOTE: Only one 6to4 auto tunnel can be configured on the Security Appliance.

NOTE: VPN Tunnel Interfaces have automatically created IPv6 link local addresses.

To configure the 6to4 auto tunnel on the firewall:

1 Navigate to **MANAGE | System Setup | Network > Interfaces**.

2 Either:

- Click **Add Interface**.
- Select **Tunnel Interface** from the **Add Interface** drop-down menu.

The **Edit Interface** dialog displays.

3 Select the **Zone** for the 6to4 tunnel interface. This is typically the WAN interface.

4 In the **Tunnel Type** drop-down menu, select **6to4 Auto Tunnel Interface**.

5 Specify a name in the **Name** field. By default, the interface **Name** is set to **6to4AutoTun**.

6 Select the **Enable IPv6 6to4 Tunnel** checkbox. By default, this checkbox is selected.

7 Optionally, you can configure one or more **Management** login protocols: **HTTPS**, **Ping**, or **SNMP**.

NOTE: Selecting **HTTPS** enables the **Add rule to enable redirect from HTTP to HTTPS** option automatically. This option cannot be selected for the other protocols. For more information about this option, see HTTP/HTTPS Redirection on page 245.

8 Optionally, you can configure either or both **User Login** protocols: **HTTP** or **HTTPS**.

NOTE: Selecting only **HTTPS** enables the **Add rule to enable redirect from HTTP to HTTPS** option automatically. For more information about this option, see HTTP/HTTPS Redirection on page 245. If you also select **HTTP**, the **Add rule to enable redirect from HTTP to HTTPS** option is deselected and cannot be selected.

9 Click **OK**.

Configuring 6to4 Relay for Non-2002 Prefix Access

By default, 6to4 auto tunnel can only access the destination with a 2002 prefix. The 6to4 relay feature can be used to access non-2002 prefix destinations.

To enable 6to4 relay:

1 Navigate to **MANAGE | System Setup | Network > Routing**.

2 Click **Add** to create a Route Policy that can route all traffic destined for 2003 prefixes over the 6to4 auto tunnel interface:

This static route can be added on the 6to4 auto tunnel interface to enable the relay feature, which makes it possible to access the IPv6 destination with non-`2002:` prefix through 6to4 tunnel.

NOTE: The gateway must be the IPv6 address with the `2002:` prefix.

Configuring a Manual IPv6 Tunnel

To configure the 6to4 tunnel on the firewall:

1 Navigate to **MANAGE | System Setup | Network > Interfaces**.

2 Click **Add Interface**. The **Edit Interface** dialog displays.

3 Select the **Zone** for the tunnel interface.

4 In the **Tunnel Type** drop-down menu, select **IPv6 Manual Tunnel Interface**. This is the default.

5 Enter a **Name** for the tunnel interface.

6 Enter an address in the **Tunnel Interface IPv6 Address** field. The field starts with **::** already.

7 Select an interface to which the tunnel is bound from the **Bound to** drop-down menu. The default is **X1**.

8 From the **Remote IPv4 Address** drop-down menu, select an IPv4 address object for the tunnel endpoint.

9 From the **Remote IPv6 network** drop-down menu, select an IPv6 Address object, which can be a group, range, network, or host.

10 Optionally, you can configure one or more **Management** login protocols: **HTTPS**, **Ping**, or **SNMP**.

> **NOTE:** Selecting **HTTPS** enables the **Add rule to enable redirect from HTTP to HTTPS** option automatically. For more information about this option, see HTTP/HTTPS Redirection on page 245. This option cannot be selected for the other protocols.

11 Optionally, you can configure either or both **User Login** protocols: **HTTP** or **HTTPS**.

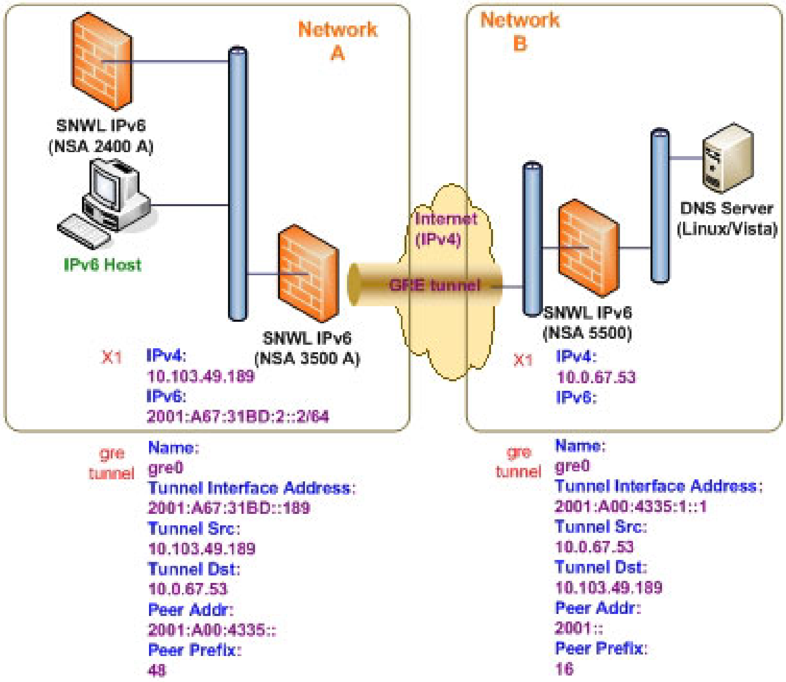
> **NOTE:** Selecting only **HTTPS** enables the **Add rule to enable redirect from HTTP to HTTPS** option automatically. For more information about this option, see HTTP/HTTPS Redirection on page 245. If you also select **HTTP**, the **Add rule to enable redirect from HTTP to HTTPS** option is deselected and cannot be selected.

12 Click **OK**.

Configuring a GRE IPv6 Tunnel

GRE can be used to tunnel IPv4 and IPv6 traffic over IPv4 or IPv6. GRE tunnels are static tunnels where both endpoints are specified manually. GRE IPv6 Tunnel Configuration shows a sample GRE IPv6 tunnel.

GRE IPv6 Tunnel Configuration



The configuration of a GRE tunnel is similar to a manual tunnel, except **GRE Tunnel Interface** is selected for the **Tunnel Type**.

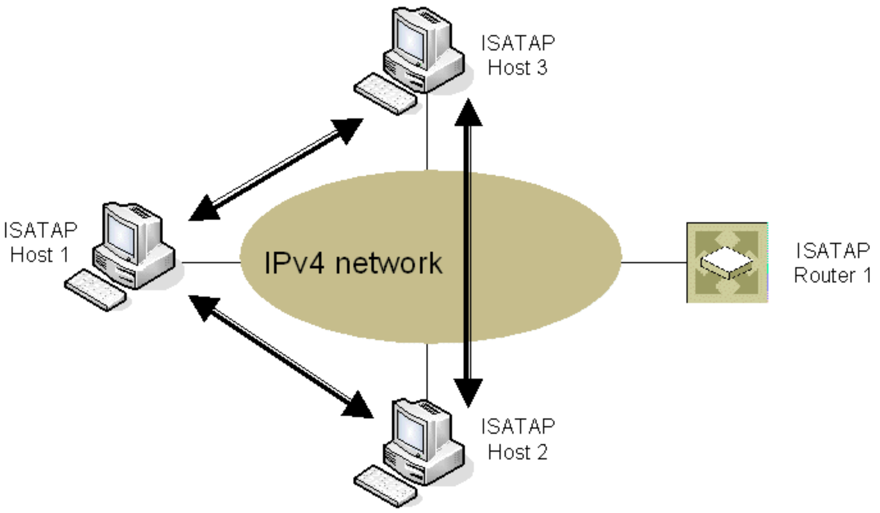
Configuring an ISATAP Tunnel

ISATAP (Intra-Site Automatic Tunnel Addressing Protocol) can be used to provide IPv6 connectivity through an IPv4-only infrastructure. ISATAP is a simple tunneling mechanism that connects dual-stack (IPv6/IPv4) node to other dual-stack nodes or IPv6 nodes over IPv4 networks. The IPv4 network is viewed by ISATAP as a link layer for IPv6.

ISATAP can be used in several scenarios to provide unicast connectivity between ISATAP hosts, and ISATAP host and hosts on IPv6 networks.

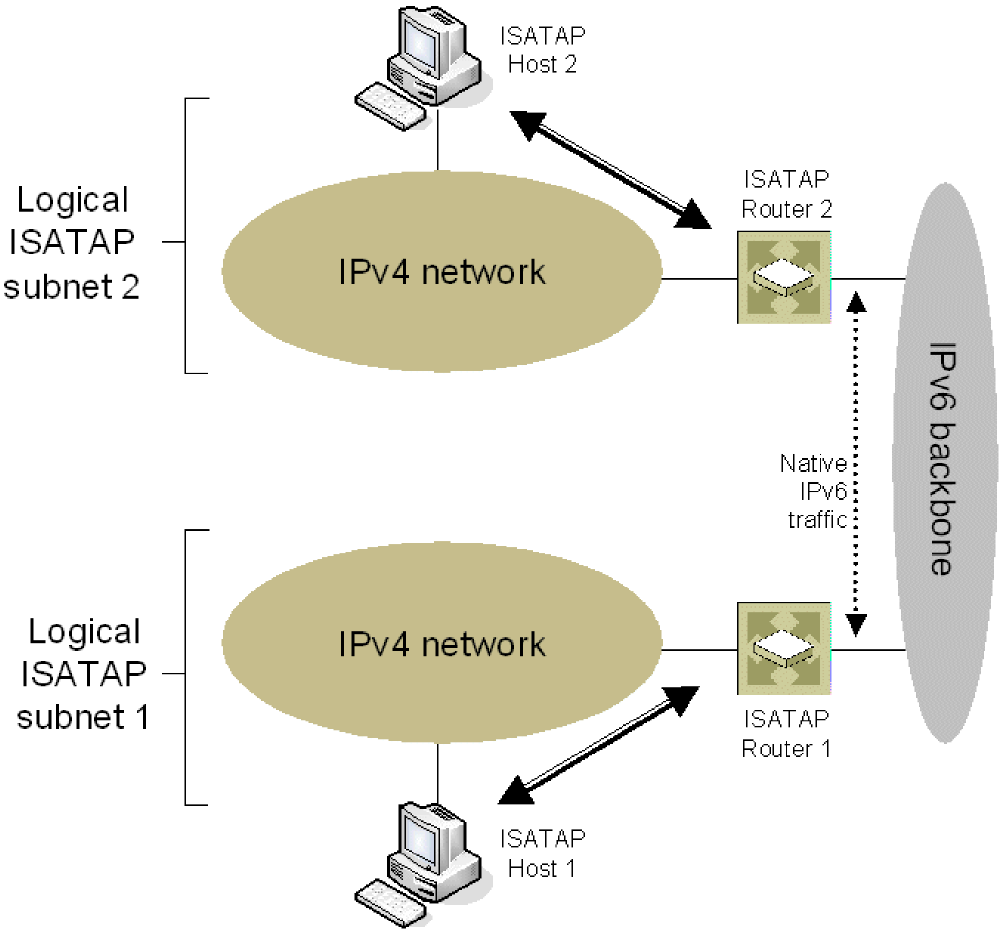
Delivery of Traffic between ISATAP Hosts and Same Logical ISATAP Subnet shows the delivery of ISATAP traffic between ISATAP hosts on the same logical ISATAP subnet:

Delivery of Traffic between ISATAP Hosts and Same Logical ISATAP Subnet



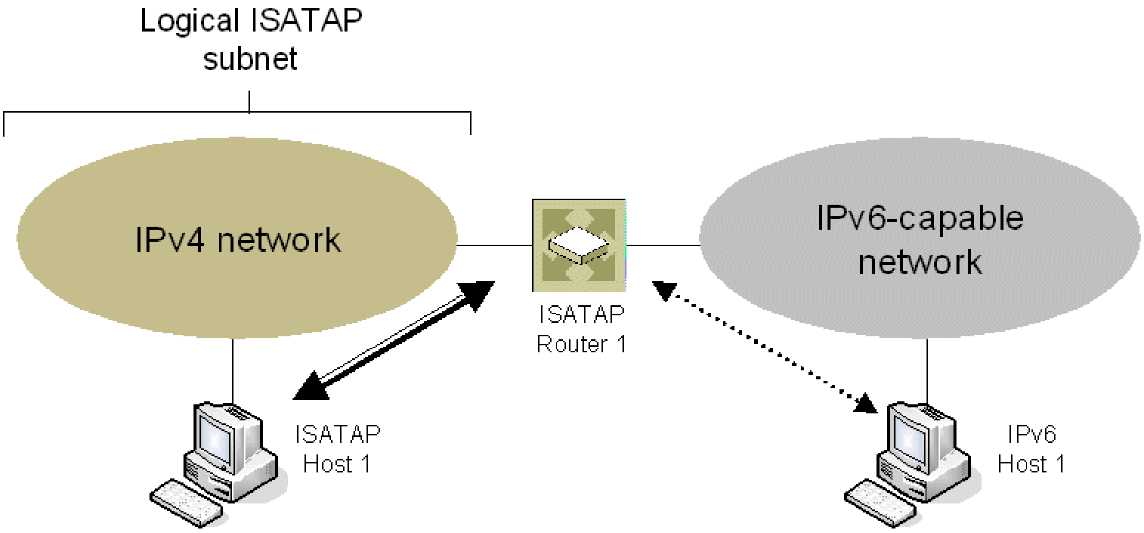
Delivery of Traffic between ISATAP Hosts and Different ISATAP Subnets shows the delivery of ISATAP traffic between hosts on different ISATAP subnets:

Delivery of Traffic between ISATAP Hosts and Different ISATAP Subnets



Delivery of Packets between ISATAP Hosts and Hosts on IPv6-capable Network shows the delivery of packets between ISATAP hosts and hosts on an IPv6-capable network.

Delivery of Packets between ISATAP Hosts and Hosts on IPv6-capable Network



In the scenario presented in Delivery of Packets between ISATAP Hosts and Hosts on IPv6-capable Network, the ISATAP hosts can communicate directly to each other without going through the ISATAP router or IPv6 network. This allows an IPv6-capable application to leverage connectivity of an existing IPv4 infrastructure.

The other two scenarios require the ISATAP router to have an IPv6 interface connected to the IPv6 network which supports forwarding between the ISATAP interface-facing IPv4 network and the IPv6 interface.

ISATAP needs to be implemented and run in both the host and router. Dual-stack node support is enabled by default on the Windows XP and Windows 7 platforms.

ISATAP support in SonicOS NS*v* allows the Security Appliance to function as an ISATAP router on LAN- facing interfaces and forward IPv6 packets between the ISATAP tunneling interface and IPv6 interface connected to the IPv6 network.

To configure an ISATAP tunnel:

1. In **MANAGE | System Setup | Network > Interfaces**, at **View IP Version**, select **IPv6**.
2. Click **Add Interface**.
3. In the **General** tab, Select the **Zone** for the tunnel interface.
4. In the **Tunnel Type** drop-down list, select **ISATAP Tunnel Interface**.
5. Enter a **Name** for the tunnel interface.
6. **Bound to IPv4 Address of** - Select an interface from the drop-down menu. The ISATAP tunnel uses the IPv4 address of the bound interface as the IPv4 end address of 6over4 tunnel.
7. **IPv6 Subnet Prefix** - Select an address object from the drop-down menu (or select Create a new address object). The IPv6 subnet prefix is a 64 bit prefix, and is used by ISATAP hosts for ISATAP address auto configuration.
8. **Tunnel Interface Link MTU** - The recommended MTU for the interface link. A value of 0 means firewall does not advertise link MTU for the link.
9. Enter any optional comment text in the **Comment** field. This text is displayed in the **Comment** column of the **Interface** table.
10. If you want to enable remote management of the firewall from this interface, select the supported management protocol(s): **HTTPS**, **Ping**, or **SNMP**.

11 If you want to allow selected users with limited management rights to log in to the Security Appliance, select **HTTP** and/or **HTTPS** in **User Login**.

Additionally, you can specify how SonicOS NS*v* resolves ISATAP host queries on **MANAGE | Security Configuration | Firewall Settings | Advanced Settings**. For information about configuring advanced firewall settings, see SonicOS NS*v* *Security Configuration*.

12 Locate the **IPv6 Advanced Configurations** section.

- **Enable NetBIOS name query response for ISATAP** – Select this to if you want the Security Appliance to answer a NetBIOS query in order to help ISATAP hosts resolve the name into an IPv4 address.
- **Resolved name ISATAP is valid for (seconds)** – Enter a time period (in seconds).

Accessing the SonicWall Management Interface Using IPv6

After IPv6 addressing has been configured on the Security Appliance, the SonicWall Management Interface can be accessed by entering the IPv6 of the Security Appliance in your browser's URL field.

IPv6 Network Configuration

Topics:

IPv6 DNS

DNS for IPv6 is configured using the same method as for IPv4. Click **IPv6** in **View IP Version** at the top left of **MANAGE | System Setup | Network > DNS**.

Address Objects

IPv6 address objects or address groups can be added in the same manner as IPv4 address objects. For information about configuring address objects, see SonicOS NS*v* *Policies*.

ⓘ **NOTE:** Address Objects of type Host, Range and Network are supported. Dynamic address objects for MAC and FQDN are not currently supported for IPv6 hosts.

IPv4 interfaces define a pair of a default Address Object (DAO) and an Address Object Group for each interface. The basic rule for IPv4 DAO is each IPv4 address corresponds to 2 address objects: Interface IP and Interface Subnet. There are also couples of AO groups for Zone Interface IP, Zone Subnets, All Interface IP, All Interface Management IP, and so forth.

IPv6 interface prepares the same DAO set for each interface. Because multiple IPv6 can be assigned to one interface, all of those address can be added, edited, and deleted dynamically. Therefore, IPv6 DAOs need to be created and deleted dynamically.

To address this, DAOs are not generated dynamically for IPv6 interfaces. Only limited interface DAO are created, which results in limitation support for other module which needs to refer interface DAO.

Policy-based Routing

Policy-based Routing is fully supported for IPv6 by selecting IPv6 address objects and gateways for route policies on **MANAGE | System Setup | Network > Routing**.

Routing Information Protocol next generation (RIPng) is an information routing protocol for IPv6, which allows routers to exchange information for computing routes through an IPv6-based network.

A radio button is added to switch between RIP and RIPng:

IPv6 NAT Policies

NAT policies can be configured for IPv6 or NAT64 on **MANAGE | Policies | Rules |NAT Policies**. When configuring IPv6 NAT policies, the source and destination objects can only be IPv6 address objects unless an IP version of NAT64 is specified. For more information about configuring NAT policies, see *SonicOS NSv Policies*.

ⓘ | **NOTE:** IPv6 probing for NAT policies is not currently supported.

NAT64 Stateful Inspection Network Streams Support

Stateful inspection network streams (usually including application layer data) need to create cache entries on the fly. These cache entries usually are illegal based on the packet filter's rule table, but they are allowed because of specific directives in the application layer data (for instance, the addition of an inbound cache entry for an FTP data connection).

In SonicOS NSv, these network streams are handled differently from general application layer protocol streams like HTTPS or SNMP. These stateful inspection network streams include FTP, TFTP, H.323, MSN, Oracle, RTSP, and RealAudio. Stateful inspection network streams need to anticipate the creation of data cache when client and server communicate with each other through a control channel.

Our system supports FTP (including active and passive mode) and TFTP protocol well for NAT64.

Neighbor Discovery Protocol

The Neighbor Discovery Protocol (NDP) is a new messaging protocol that was created as part of IPv6 to perform a number of the tasks that ICMP and ARP accomplish in IPv4. Just like ARP, Neighbor Discovery builds a cache of dynamic entries, and the administrator can configure static Neighbor Discovery entries. The following table shows the IPv6 neighbor messages and functions that are analogous to the traditional IPv4 neighbor messages.

IPv4 vs. IPv6 Neighbor Messages

IPv4 Neighbor Message	IPv6 Neighbor Message
ARP request message	Neighbor solicitation message
ARP relay message	Neighbor advertisement message
ARP cache	Neighbor cache
Gratuitous ARP	Duplicate address detection
Router solicitation message (optional)	Router solicitation (required)
Router advertisement message (optional)	Router advertisement (required)
Redirect message	Redirect Message

The Static NDP feature allows for static mappings to be created between a Layer 3 IPv6 address and a Layer 2 MAC address.

To configure a Static NDP entry:

1. Navigate to **MANAGE | System Setup | Network > Neighbor Discovery**.
2. Click **Add**.
3. In the **IP Address** field, enter the IPv6 address for the remote device.
4. In the **Interface** drop-down menu, select the interface on the firewall that is used for the entry.
5. In the **MAC Address** field, enter the MAC address of the remote device.
6. Click **OK**. The static NDP entry is added.

   The NDP Cache table displays all current IPv6 neighbors. The follow types of neighbors are displayed:

   - REACHABLE - The neighbor is known to have been reachable within 30 seconds.
   - STALE - The neighbor is no longer known to be reachable, and traffic has been sent to the neighbor within 1200 seconds.
   - STATIC - The neighbor was manually configured as a static neighbor.

DHCPv6 Configuration

DHCPv6 server can be configured similar to IPv4 after selecting **IPv6** in **View IP Version** of **MANAGE | System Setup | Network > DNS**.

IPv6 Access Rules Configuration

IPv6 access rules can be configured in the same manner as IPv4 access rules by choosing IPv6 address objects instead of IPv4 address objects. For more information about firewall access rules, see SonicOS NSv *Policies*.

When adding an IPv6 access rule, the source and destination can only be IPv6 address objects.

IPv6 Advanced Firewall Settings

You can configure advanced firewall settings for IPv6, including packet limitations and traffic restrictions on **MANAGE | Security Configuration | Firewall Settings | Advanced Settings**. For information about configuring advanced firewall settings, see SonicOS NSv *Security Configuration*.

IPv6 IPsec VPN Configuration

IPsec VPNs can be configured for IPv6 in a similar manner to IPv4 VPNs after selecting **IPv6** in the **View IP Version** at the top left of **MANAGE | Connectivity | VPN | Settings**. For information about configuring VPN, see SonicOS NSv *Connectivity*.

There are certain VPN features that are currently not supported for IPv6, including:

- IKEv2 is supported, while IKE is currently not supported
- GroupVPN is not supported
- DHCP Over VPN is not supported.

When configuring an IPv6 VPN policy, in **General** of the dialog, the gateways must be configured using IPv6 addresses. FQDN is not supported. When configuring IKE authentication, IPV6 addresses can be used for the local and peer IKE IDs.

On **Network** of the VPN policy, IPV6 address objects (or address groups that contain only IPv6 address objects) must be selected for the **Local Network** and **Remote Network**.

DHCP Over VPN is not supported, thus the DHCP options for protected network are not available.

The **Any address** option for **Local Networks** and the **Tunnel All** option for **Remote Networks** are removed. Select an all zero IPv6 Network address object could be selected for the same functionality and behavior.

On **Proposals**, the configuration is identical for IPv6 and IPv4, except for the fact that IPv6 only support **IKEv2 mode**.

On **Advanced**, only **Enable Keep Alive** and the **IKEv2 Settings** can be configured for IPv6 VPN policies.

> ⓘ **NOTE:** Because an interface might have multiple IPv6 address, sometimes the local address of the tunnel might vary periodically. If the user needs a consistent IP address, configure the VPN policy to be bound to an interface instead of Zone, and specify the address manually. The address must be one of the IPv6 addresses for that interface.

SSL VPN Configuration for IPv6

SonicOS NS*v* supports NetExtender connections for users with IPv6 addresses. On **MANAGE | Connectivity | SSL VPN | Client Settings**, first configure the traditional IPv6 IP address pool, and then configure an IPv6 IP Pool. Clients are assigned two internal addresses: one IPv4 and one IPv6. For more information about configuring SSL VPN, see *SonicOS NSv 6.5 Connectivity*.

On the **Edit Device Profile** dialog of **MANAGE | Connectivity | SSL VPN | Client Settings**, you can select a client routes from all address objects, including all the predefined IPv6 address objects.

> ⓘ **NOTE:** IPv6 FQDN is supported.

IPv6 Visualization

IPv6 Visualization for the App Flow Reports and Live Monitor is an extension of IPv4 Visualization, providing real-time monitoring of interface/application rates and visibility of sessions in the management interface. You can see what websites you employees are accessing, what applications and services are being used in their networks and to what extent, to police content transmitted in and out of your organization. For more information about these visualization tools, refer to *SonicOS NSv 6.5 Investigate* and *SonicOS NSv 6.5 Monitoring*, respectively.

IPv6 Visualization Feature Limitations

Visualization for IPv6 has these feature limitations:

- The IPv6 URL Rating is not supported, because CFS does not support all aspects of IPv6.
- IPv6 Country information is not supported.
- IPv6 External Reporting is not supported.

Configuring IPv6 Visualization

App Flow Reports and Live Monitor visualization are configured the same in IPv6 and IPv4. For more information about these visualization tools, refer to *SonicOS NSv Investigation* and *SonicOS NSv Monitoring*, respectively.

IPv6 High Availability Monitoring

IPv6 High Availability (HA) Monitoring is implemented as an extension of HA Monitoring in IPv4. After configuring HA Monitoring for IPv6, both the primary and backup appliances can be managed from the IPv6 monitoring address, and IPv6 Probing is capable of detecting the network status of HA pairs.

On **MANAGE | System Setup** | **High Availability > Monitoring Settings**, toggle between the IPv6 and IPv4 views for easy configuration of both IP versions.

Topics:

- IPv6 High Availability Monitoring Feature Limitations on page 685
- IPv6 High Availability Probing on page 685
- Configuring IPv6 High Availability Monitoring on page 685

IPv6 High Availability Monitoring Feature Limitations

The IPv6 HA Monitoring feature limitations are:

- Physical/Link Monitoring property cannot be changed in the IPv6 HA Monitoring configuration page. Set the property in the IPv4 HA Monitoring configuration page.
- HA Probing cannot be enabled on both IPv4 and IP{v6 at the same time. That is, if IPv4 probing is enabled, then IPv6 probing must be disabled, and vice versa.

IPv6 High Availability Probing

An ICMPv6 packet is periodically sent out from the primary and backup appliances to probe the IPv6 address, and the response from the probed IPv6 address is monitored. If the active Security Appliance cannot reach the probed IPv6 address, but the idle Security Appliance can, the backup Security Appliance has a better network status and failover initiates.

In IPv6 HA Probing, the IPv6 addresses, ICMPv6 echo requests, and ICMPv6 echo replies are used. The logic used to judge network status of the primary and backup appliance is the same for IPv4 and IPv6.

Configuring IPv6 High Availability Monitoring

The IPv6 HA Monitoring configuration page is inherited from IPv4, so the configuration procedures are almost identical. Just select IPv6 and refer to IPv6 on page 659 for configuration details.

Consider the following when configuring IPv6 HA Monitoring:

- **Physical/Link Monitoring** is dimmed because it has layer two properties. That is, as the properties are used by both IPv4 and IPv6, you have to configure them in the IPv4 monitoring page.
- The primary/backup IPv6 address must be in the same subnet of the interface, and it cannot be same as the global IP or Link-Local-IP of the primary/backup Security Appliance.
- If the primary/backup monitoring IP is set to (not ::), then they cannot be the same.
- If **Management** is enabled, then primary/backup monitoring IP cannot be unspecified (that is, ::).
- If the probe checkbox is enabled, then the probe IP cannot be unspecified.

IPv6 Diagnostics and Monitoring

SonicOS NS*v* provides a full compliment of diagnostic tools for IPv6, including:

- Packet Monitor on page 686
- IPv6 Ping on page 686
- IPv6 DNS Name Lookup and Reverse Name Resolution on page 686

Packet Monitor

INVESTIGATE | Tools | Packet Monitor fully supports IPv6. In addition, IPv6 keywords can be used to filter the packet capture. For more information about Packet Monitor, see SonicOS NS*v Investigation*.

IPv6 Ping

When pinging a domain name, the tool uses the first IP address that is returned and shows the actual pinging address. If both an IPv4 and IPv6 address are returned, by default, the Security Appliance pings the IPv4 address. The ping tool includes a **Prefer IPv6 networking** option, that when enabled, makes the Security Appliance ping the IPv6 address. For more information about IPv6 Ping, see SonicOS NS*v Investigation*.

IPv6 DNS Name Lookup and Reverse Name Resolution

When performing IPv6 DNS Name Lookup or IPv6 Reverse Name Resolution, you must enter the DNS server address. Either an IPv6 or IPv4 address can be used. For more information about these tools, see SonicOS NS*v Investigation*.

C

BGP Advanced Routing

Topics:

BGP Advanced Routing

This appendix provides an overview of SonicWall’s implementation of Border Gateway protocol (BGP), how BGP operates, and how to configure BGP for your network.

Topics:

About BGP

Topics:

What is BGP?

BGP is a large-scale routing protocol used to communicate routing information between Autonomous Systems (ASs), which are well-defined, separately administered network domains. BGP support allows for SonicWall Security Appliances to replace a traditional BGP router on the edge of a network's AS. The current SonicWall implementation of BGP is most appropriate for single-provider/single-homed environments, where the network uses one ISP as their Internet provider and has a single connection to that provider. SonicWall BGP is also capable of supporting single-provider/multi-homed environments, where the network uses a single ISP but has a small number of separate routes to the provider. BGP is enabled on the **Network > Routing** page of the SonicOS web management interface, and then it is fully configured through the SonicOS command line interface.

Background Information

Routing protocols are not just packets transmitted over a network, but comprise all the mechanisms by which individual routers, and groups of routers, discover, organize, and communicate network topologies. Routing protocols use distributed algorithms that depend on each participant following the protocol as it is specified, and are most useful when routes within a network domain dynamically change as links between network nodes change state.

Routing protocols typically interact with two databases:

- **Routing Information Base (RIB)** - Used to store all the route information required by the routing protocols themselves.
- **Forward Information Base (FIB)** - Used for actual packet forwarding.

The best routes chosen from the RIB are used to populate the FIB. Both the RIB and FIB change dynamically as routing updates are received by each routing protocol, or connectivity on the device changes.

There are two basic classes of routing protocols:

- **Interior Gateway Protocols (IGPs)** - Interior Gateway Protocols are routing protocols designed to communicate routes within the networks that exist inside of an AS. There are two generations of IGPs. The first generation consists of distance-vector protocols. The second generation consists of link-state protocols. The distance-vector protocols are relatively simple, but have issues when scaled to a large number of routers. The link-state protocols are more complex, but have better scaling capability. The existing distance-vector protocols are Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), Routing Information Protocol (RIP), and RIPv2, an enhanced version of RIP. IGRP and EIGRP are proprietary Cisco protocols. The link-state protocols currently in use are Open Shortest Path First (OSPF) protocol and the little-used Intermediate System to Intermediate System (IS-IS) protocol.

  SonicOS NS*v* supports OSPFv2 and RIPv1/v2 protocols, the two most common routing Interior Gateway Protocols, allowing our customers to use our products in their IGP networks and avoid the additional cost of a separate traditional router.

- **Exterior Gateway Protocols (EGPs)** - The standard, ubiquitous Exterior Gateway Protocol is BGP (BGP4, to be exact). BGP is large-scale routing protocol that communicates routing information and policy between well-defined network domains called Autonomous Systems (ASs). An Autonomous System is a separately administered network domain, independent of other Autonomous Systems. BGP is used to convey routes and route policy between Autonomous Systems. ISPs commonly use BGP to convey routes and route policy with their customers as well as with other ISPs.

  Each Autonomous System has a 16-bit number assigned. Like IP addresses, an AS number might be public or private. Public AS numbers are a limited resource and are provisioned based on a number of factors. ISP customers with large networks multi-homed to two or more ISPs usually have a public AS, whereas smaller customers are given a private AS administered by their ISP provider.

As our products evolve in support of enterprise-level requirements, some customers might want to place our products on the edge of their AS in place of a traditional BGP router.

Autonomous Systems

Each Autonomous System has a 16-bit number assigned. Like IP addresses, an AS number might be public or private. Public AS numbers are a limited resource and are provisioned based on a number of factors. ISP customers with large networks multi-homed to two or more ISPs usually have a public AS, whereas smaller customers are given a private AS administered by their ISP provider.

Types of BGP Topologies

BGP is a very flexible and complex routing protocol. As such, BGP routers might be placed in a large variety of topology settings, such as Internet core routers, intermediary ISP routers, ISP Customer Premises Equipment (CPE), or routers in small private BGP networks. The number of BGP routes required for different topologies varies from greater than 300,000 for core routers, to 0 for ISP customers that use a single ISP and use default routing for all destinations outside of their AS. ISP customers are often required to run BGP from their edge router (the CPE) to the ISP regardless of the number of routes they receive from the ISP. This allows ISP customers to control which networks to advertise to the outside world. There's always the fear that a customer might advertise a network, or network aggregate, not owned by the customer, black-holing Internet traffic to those networks. In reality, ISP providers are careful to filter invalid advertisements from their customers (one of BGP's strengths), so this rarely happens.

There are three basic scales of BGP networks:

- **Single-Provider/Single-Homed** - The network receives a single route (single-homed) from a single ISP (single-provider). The number of routes an ISP customer receives from its ISP depends on the nature of its AS. An ISP customer that uses only one ISP as their Internet provider, and has a single connection to that provider (single-provider / single-homed) has no need to receive any routes - all traffic destined outside of the AS goes to their ISP. These customers might still advertise some or all of their inside network to the ISP.
- **Single-Provider/Multi-Homed** - The network receives multiple routes (multi-homed) from a single ISP (single-provider). ISP customers that use a single ISP, but have multiple connections to their ISP might only receive the default route (0.0.0.0/0) at each ISP gateway. If an ISP connection goes down, the advertised default route sent from the connected CPE router to internal routers would be withdrawn, and Internet traffic would then flow to a CPE router that has connectivity to the ISP. The customer's inside network would also be advertised to the ISP at each CPE router gateway, allowing the ISP to use alternate paths should a particular connection to a customer go down.
- **Multi-Provider/Multi-Homed** - ISP customers that use more than one ISP (multi-provider / multi-homed) have one or more separate gateway routers for each ISP. In this case, the customer's AS must be a public AS, and might either be a transit or non-transit AS. A transit AS receives and forwards traffic from one ISP destined for a network reachable through another ISP (the traffic destination is not in the customer's AS). A non-transit AS should only receive traffic destined for its AS - all other traffic would be dropped. BGP routers in a transit AS would often receive a large portion (in many cases, all) of the full BGP route table from each ISP.

BGP over VPN Tunnel Interface

BGP interfaces support both numbered and unnumbered tunnel interfaces. This feature is supported on all platforms where BGP and unnumbered tunnel interfaces can be set up.

Why Use BGP?

- Even if you are not a large network on the Internet, BGP is the standard for multi-homing, load-balancing, and redundancy:
  - **Single-provider/Single-homed** – Not typically a strong candidate for BGP, but might still use it to advertise networks to the ISP. single-homed networks are not eligible for a public AS from RIRs.
  - **Single-provider/Multi-homed** – Common to follow RFC2270 suggestion to use a single private AS (64512 to 65535) to get the benefit of BGP while preserving public ASN.
  - **Multi-provider/Multi-homed** – Highly redundant, typically with dedicated routers to each ISP. Requires public ASN. Large memory footprint
- Route summarization makes routing scalable.

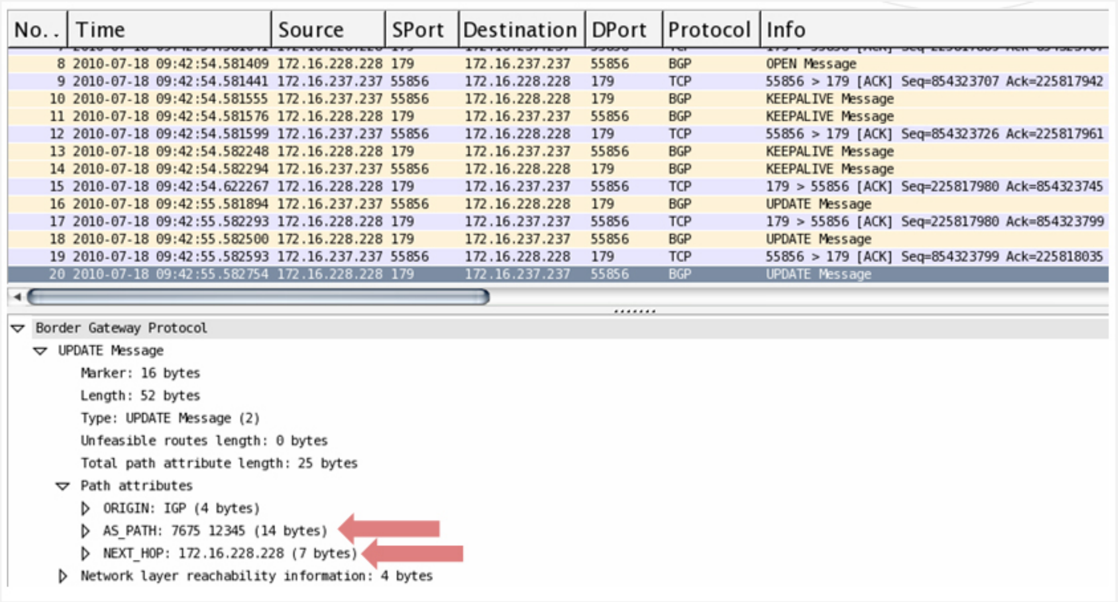
How Does BGP Work?

BGP uses TCP port 179 for communication. BGP is considered a path-vector protocol, containing end-to-end path descriptions for destinations. BGP neighbors can either be internal (iBGP) or external (eBGP):

- **iBGP** – Neighbor is in the same AS.
- **eBGP** – Neighbor is in a different AS.

Paths are advertised in UPDATE messages that are tagged with various path attributes. AS_PATH and NEXT_HOP are the two most important attributes that describe the path of a route in a BGP update message.

- **AS_PATH**: Indicates the ASs that the route is traveling from and two. In the example below, the AS_PATH is from AS 7675 to AS 12345. For internal BGP, the AS_PATH specifies the same AS for both the source and destination.
- **NEXT_HOP**: Indicates the IP address of the next router the path travels to. Paths advertised across AS boundaries inherit the NEXT_HOP address of the boundary router. BGP relies on interior routing protocols to reach NEXT_HOP addresses.



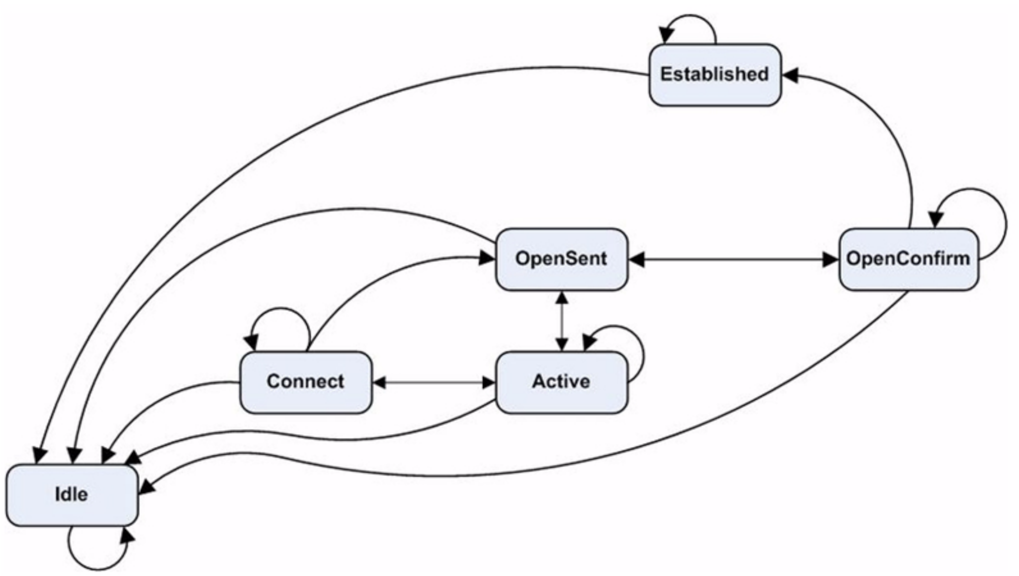
No..	Time	Source	SPort	Destination	DPort	Protocol	Info
8	2010-07-18 09:42:54.581409	172.16.228.228	179	172.16.237.237	55856	BGP	OPEN Message
9	2010-07-18 09:42:54.581441	172.16.237.237	55856	172.16.228.228	179	TCP	55856 > 179 [ACK] Seq=854323707 Ack=225817942
10	2010-07-18 09:42:54.581555	172.16.237.237	55856	172.16.228.228	179	BGP	KEEPALIVE Message
11	2010-07-18 09:42:54.581576	172.16.228.228	179	172.16.237.237	55856	BGP	KEEPALIVE Message
12	2010-07-18 09:42:54.581599	172.16.237.237	55856	172.16.228.228	179	TCP	55856 > 179 [ACK] Seq=854323726 Ack=225817961
13	2010-07-18 09:42:54.582248	172.16.228.228	179	172.16.237.237	55856	BGP	KEEPALIVE Message
14	2010-07-18 09:42:54.582294	172.16.237.237	55856	172.16.228.228	179	BGP	KEEPALIVE Message
15	2010-07-18 09:42:54.622267	172.16.228.228	179	172.16.237.237	55856	TCP	179 > 55856 [ACK] Seq=225817980 Ack=854323745
16	2010-07-18 09:42:55.581894	172.16.237.237	55856	172.16.228.228	179	BGP	UPDATE Message
17	2010-07-18 09:42:55.582293	172.16.228.228	179	172.16.237.237	55856	TCP	179 > 55856 [ACK] Seq=225817980 Ack=854323799
18	2010-07-18 09:42:55.582500	172.16.228.228	179	172.16.237.237	55856	BGP	UPDATE Message
19	2010-07-18 09:42:55.582593	172.16.237.237	55856	172.16.228.228	179	TCP	55856 > 179 [ACK] Seq=854323799 Ack=225818035
20	2010-07-18 09:42:55.582754	172.16.228.228	179	172.16.237.237	55856	BGP	UPDATE Message

```
▽ Border Gateway Protocol
  ▽ UPDATE Message
      Marker: 16 bytes
      Length: 52 bytes
      Type: UPDATE Message (2)
      Unfeasible routes length: 0 bytes
      Total path attribute length: 25 bytes
    ▽ Path attributes
      ▷ ORIGIN: IGP (4 bytes)
      ▷ AS_PATH: 7675 12345 (14 bytes)
      ▷ NEXT_HOP: 172.16.228.228 (7 bytes)
    ▷ Network layer reachability information: 4 bytes
```

BGP Finite State Machine

RFC 1771, which defines BGP, describes the operation of BGP in terms of the following state machine. The table following the diagram provides additional information on the various states.

BGP Finite State Machine



BGP Finite State Descriptions

State	Description
Idle	Waiting for Start event, after establishing new BGP session or resetting an existing session. In the event of errors, falls back to the Idle state. After a Start event, BGP initializes, resets connect retry timer, initiates TCP transport connection, and listens for connections
Connect	After the TCP layer is up, transition to OpenSent, and send OPEN. If no TCP, transition to Active. If the connect retry timer expires, remain in Connect, reset the timer, and initiate a transport connection. Otherwise, transition back to Idle.
Active	Try to establish TCP connection with peer. If successful, transition to OpenSent and send OPEN. If connect retry expires, restart the timer and fall back to the Connect state. Also actively listen for connection by another peer. Go back to Idle in case of other events. Connect to Active flapping indicates a TCP transport problem, for example, TCP retransmissions or unreachability of a peer.
OpenSent	Waiting for OPEN message from peer. Validate on receipt. On validation failure, send NOTIFICATION and go to Idle. On success, send KEEPALIVE and reset the keepalive timer. Negotiate hold time, smaller value wins. If zero, hold timer and keepalive timer are not restarted.
OpenConfirm	Wait for KEEPALIVE or NOTIFICATION. If KEEPALIVE is received, transition to Established. If UPDATE or KEEPALIVE is received, restart the hold timer (unless the negotiated hold time is zero). If NOTIFICATION is received, transition to Idle. Periodic KEEPALIVE messages are sent. If TCP layer breaks, transition to Idle. If an error occurs, send a NOTIFICATION with error code, transition to Idle.
Established	Session up, exchange updates with peers. If a NOTIFICATION is received, transition to Idle. Updates are checked for errors. On error, send NOTIFICATION, and transition to Idle. In case of hold time expiration, disconnect TCP.

BGP Messages

BGP communication includes the following types of messages:

- **Open** – The first message between BGP peers after TCP session establishment. Contains the necessary information to establish a peering session, for example, ASN, hold time, and capabilities such as multi-product extensions and route-refresh.
- **Update** – These messages contain path information, such as route announcements or withdrawals.
- **Keepalive** – Periodic messages to keep TCP layer up, and to advertise liveliness.
- **Notification** – A request to terminate the BGP session. Non-fatal notifications contain the error code "cease". Subcodes provide further detail, as shown in Notification Subcodes.

Notification Subcodes

Subcode	Description
1 – Maximum number of prefixes reached	The configured "neighbor maximum-prefix" value was exceeded
2 – Administratively shutdown	Session was administratively shutdown
3 – Peer unconfigured	Peer configuration has been removed
4 – Administratively reset	Session was administratively reset
5 – Connection rejected	Rejection (sometimes temporary) of BGP session
6 – Other configuration change	Session was administratively reset for some reason

- **Route-refresh** – A request for the peer to resend its routes.

BGP Attributes

BGP update messages can include the attributes shown in BGP Update Message Attributes:

BGP Update Message Attributes

Value	Code
1	ORIGIN
2	AS_PATH
3	NEXT_HOP
4	MULTI_EXIT_DISC
5	LOCAL_PREF
6	ATOMIC_AGGREGATE
7	AGGREGATOR
8	COMMUNITY
9	ORIGINATOR_ID
10	CLUSTER_LIST
11	DPA
12	ADVERTISER (Historic)
13	RCID_PATH / CLUSTER_ID (Historic)
14	MP_REACH_NLRI
15	MP_UNREACH_NLRI
16	EXTENDED COMMUNITIES

BGP Update Message Attributes (Continued)

Value	Code
17	AS4_PATH
18	AS4_AGGREGATOR
19	SAFI Specific Attribute (SSA) (deprecated)
20	Connector Attribute (deprecated)
21	AS_PATHLIMIT (deprecated)
22	PMSI_TUNNEL
23	Tunnel Encapsulation Attribute
24	Traffic Engineering
25	IPv6 Address Specific Extended Community
26	AIGP (TEMPORARY - expires 2011-02-23)
27-254	Unassigned
255	Reserved for development

For more information on BGP attributes, see:
http://www.iana.org/assignments/bgp-parameters/bgp-parameters.xml

BGP Terms

ARD Autonomous Routing Domain – A collection of networks/routers that have a common administrative routing policy.

AS Autonomous System – An ARD that has been assigned an identifying number, typically running BGP4 at its border router(s).

BGP4 Border Gateway Protocol 4: The most prevalent EGP.

CIDR Classless inter-domain routing, enables efficient route advertisement through route aggregation.

CPE Customer Premise Equipment - The equipment at the edge of a customer's network used to interface with the ISP.

EGP Exterior Gateway Protocol – Any protocol (in practice, BGP4) used to communicate routing information between Autonomous Systems.

Full-Routes The entire global BGP route table.

FIB Forwarding Information Base – Our existing route table, used to find the egress interface and next hop when forwarding packets.

Looking Glass* A Looking Glass (LG) server is a read-only view of routers of organizations running the LG servers. Typically, publicly accessible looking glass servers are run by ISPs or NOCs.

Multi-Homed An ISP customer that has multiple connections to one or more ISPs.

Multi-Provider An ISP customer that uses multiple ISPs to connect to the Internet.

NSM Network Services Module - The ZebOS component that centralizes the interface to the FIB and RIB. The separate routing protocol daemons interface with the NSM for all RIB updates. NSM alone updates the FIB with best-route information from the RIB.

Partial Routes A subset of the full BGP route table, usually specific to destinations that are part of an ISP's domain.

RIB Route Information Base – A run-time database owned by the NSM, and used to store all route information gathered and used by the routing protocols.

Caveats

Scale Currently, SonicOS NS*v* supports from 512 to 2,048 policy-based routes (PBRs). This is not sufficient for full or even partial routing tables. The number of routes that exist in the RIB might be greater than the number installed into PBR (which is the FIB). This occurs when multiple competing routes have been received through the routing protocols. For each case in which the RIB contains competing routes to a particular network destination, only one of these routes is chosen to be installed in the FIB.

Currently, our implementation is most appropriate for the single-provider/single-homed customers. Single-provider/multi-homed installations might also be appropriate when either the default route is being received from the ISP, or a very small number of ISP-specific routes are received by the customer. The latter allows inside routers to take the optimal path to destinations outside of the AS, but still within the ISP's network domain (this is called partial-routes).

Load balancing here is currently no multi-path support in SonicOS NS*v* or Zebos (the maximum-paths capability). This precludes load-balancing without splitting networks.

Loopback There is currently no loopback interface support.

NAT BGP is for routing. It does not co-exist well with NAT.

Asymmetric paths Stateful Security Appliance does not currently handle asymmetric paths, especially not across multiple Security Appliances.

Configuring BGP

Topics:

IPsec Configuration for BGP

BGP transmits packets in the clear. Therefore for strong security, SonicWall recommends configuring an IPsec tunnel to use for BGP sessions. The IPsec tunnel and BGP are configured independently of each other. For information about configuring an IPsec tunnel for BGP, see *SonicOS NSv Connectivity*.

To configure an IPsec tunnel for BGP:

1 The IPsec tunnel is configured completely within the **Manage | Connectivity | VPN** configuration section of the SonicOS NS*v* Management Interface. When configuring the IPsec tunnel, ensure that these options are set:

Option	Value
Policy Type	**Site to Site** **NOTE:** A site-to-site VPN tunnel must be used for BGP over IPsec.
IPsec Primary Gateway Name or Address	IP address of the remote peer
Local IKE ID	IP address of the SonicWall firewall
Peer IKE ID	IP address of the remote peer
Network | Choose destination network from list	Remote peer's IP address
Advanced | Enable Keep Alive	Enable

ⓘ **IMPORTANT:** When configuring BGP over IPsec:

1 Configure the IPsec tunnel.

2 Verify connectivity over the tunnel before configuring BGP.

ⓘ **NOTE:** For how to configure VPN policies, see SonicOS NSv *Connectivity*.

2 Enable BGP on **MANAGE | System Setup | Network > Routing** page by selecting **BGP** for the **Service** option when adding a route policy. For how to add a route policy, see Configuring BGP Advanced Routing on page 375; for basic BGP configuration, see Basic BGP Configuration on page 695.

3 Finish configuring the route through the SonicOS command line interface.

4 When the VPN policy is configured on the Security Appliance, complete the corresponding IPsec configuration on the remote peer.

5 When the IPsec configuration on the remote peer is complete, return to **MANAGE | Connectivity | VPN | Base Settings**, and enable the VPN policy to initiate the IPsec tunnel.

6 Use the ping diagnostic on the SonicWall Security Appliance to ping the BGP peer IP address. For more information about the ping diagnostic, see SonicOS NSv *Investigation*.

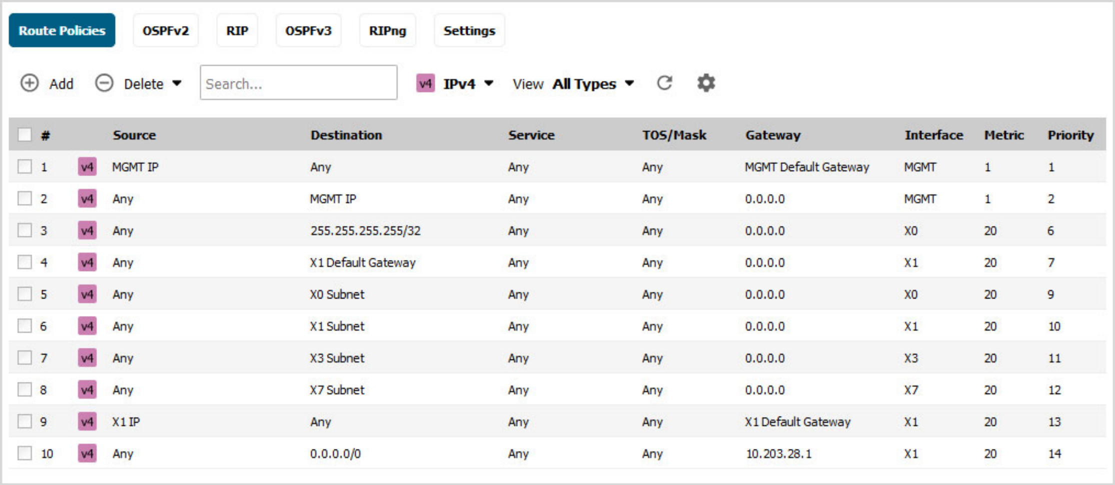
7 Use Wireshark to ensure that the request and response are being encapsulated in ESP packets.

ⓘ **NOTE:** As configured in this example, routed traffic does not go through the IPSEC tunnel used for BGP. That traffic is sent and received in the clear, which is most likely the desired behavior as the goal is to secure BGP, not all the routed network traffic.

Basic BGP Configuration

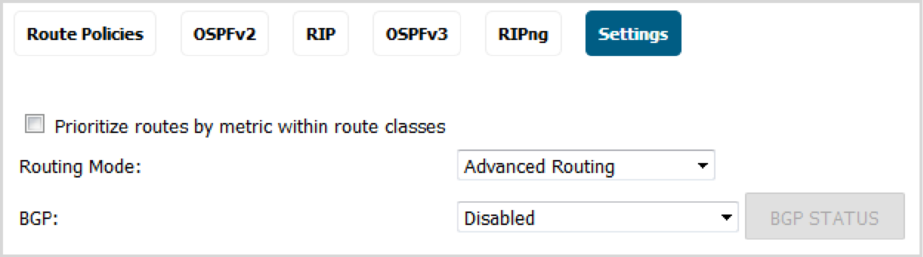
To configure BGP on a SonicWall Security Appliance:

1 Navigate to **MANAGE | System Setup | Network > Routing**.



☐	#		Source	Destination	Service	TOS/Mask	Gateway	Interface	Metric	Priority
☐	1	v4	MGMT IP	Any	Any	Any	MGMT Default Gateway	MGMT	1	1
☐	2	v4	Any	MGMT IP	Any	Any	0.0.0.0	MGMT	1	2
☐	3	v4	Any	255.255.255.255/32	Any	Any	0.0.0.0	X0	20	6
☐	4	v4	Any	X1 Default Gateway	Any	Any	0.0.0.0	X1	20	7
☐	5	v4	Any	X0 Subnet	Any	Any	0.0.0.0	X0	20	9
☐	6	v4	Any	X1 Subnet	Any	Any	0.0.0.0	X1	20	10
☐	7	v4	Any	X3 Subnet	Any	Any	0.0.0.0	X3	20	11
☐	8	v4	Any	X7 Subnet	Any	Any	0.0.0.0	X7	20	12
☐	9	v4	X1 IP	Any	Any	Any	X1 Default Gateway	X1	20	13
☐	10	v4	Any	0.0.0.0/0	Any	Any	10.203.28.1	X1	20	14

2 Click **Settings**.



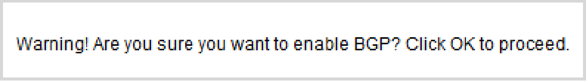
☐ Prioritize routes by metric within route classes

Routing Mode: Advanced Routing

BGP: Disabled

3 From **Routing Mode**, select **Advanced Routing**.

4 From **BGP**, select **Enabled (Configure with CLI)**. A confirmation message displays.



Warning! Are you sure you want to enable BGP? Click OK to proceed.

> **NOTE:** After BGP has been enabled through the SonicOS web management interface, the specifics of the BGP configuration are performed using the SonicOS command line interface (CLI).

5 Log in to the SonicOS CLI through the console interface.

6 Enter configuration mode by typing the **`configure`** command.

7 Enter the BGP CLI by typing the **`configure routing bgp`** command. This prompt displays:

```
ZebOS version 7.7.0 IPIRouter 7/2009

ARS BGP>
```

8 You are now in BGP Non-Config Mode. Type **?** to see a list of non-config commands.

9 Type **`show running-config`** to see the current BGP running configuration.

10 To enter BGP Configuration Mode, type the **`configure terminal`** command. Type **?** to see a list of configuration commands.

11 When you have completed your configuration, type the **`write file`** command. If the unit is part of a High Availability pair or cluster, the configuration changes are automatically conveyed to the other unit or units.

BGP Path Selection Process

BGP Path Selection Process Attributes describes the attributes used to configure the BGP path selection process.

BGP Path Selection Process Attributes

Attribute	Description
Weight	Prefer routes learned from neighbors with the highest weight set. Only relevant to the local router.
Local Preference	Administratively prefer routes learned from a neighbor. Shared with the whole AS.
Network or **Aggregate** paths	Prefer paths that were locally originated from the **network** and **aggregate-address** commands.
AS_PATH	Prefer the path with the shortest AS_PATH.
Origin	Prefer the path with the lowest origin type (as advertised in UPDATE messages): `IGP < EGP < Incomplete`.
Multi Exit Discriminator (MED)	Provides path preference information to neighbors for paths into originating AS.
Recency	Prefer the most recently received path.
Router ID	Prefer the path from the router with the lower router ID.

Weight

The weight command assigns a weight value, per address-family, to all routes learned from a neighbor. The route with the highest weight gets preference when the same prefix is learned from more than one peer. The weight is relevant only to the local router.

The weights assigned using the **`set weight`** command override the weights assigned using this command.

When the weight is set for a peer-group, all members of the peer-group have the same weight. The command can also be used to assign a different weight to a particular peer-group member.

This example shows weight configuration:

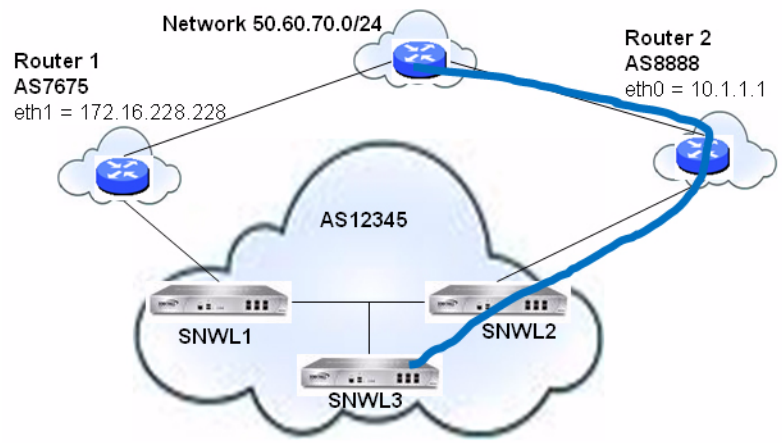
```
router bgp 12345
   neighbor 12.34.5.237 remote-as 12345
   neighbor 12.34.5.237 weight 60


router bgp 12345
   neighbor group1 peer-group
   neighbor 12.34.5.237 peer-group group1
   neighbor 67.78.9.237 peer-group group1
   neighbor group1 weight 60
```

Local Preference

The Local Preference attribute is used to indicate the degree of preference for each external route in an appliance's routing table. The Local Preference attribute is included in all update messages sent to devices in the same AS. Local Preference is not communicated to outside AS. BGP Local Preference Topology shows a sample topology illustrating how Local Preference affects routes between neighboring ASs.

BGP Local Preference Topology



The BGP configurations shown in SNWL1 and SNWL2 Configurations are entered on SNWL1 and SNWL2. The higher Local Preference on SNWL2 leads to SNWL2 being the preferred route advertised by AS 12345 (the SonicWall AS) to outside ASs.

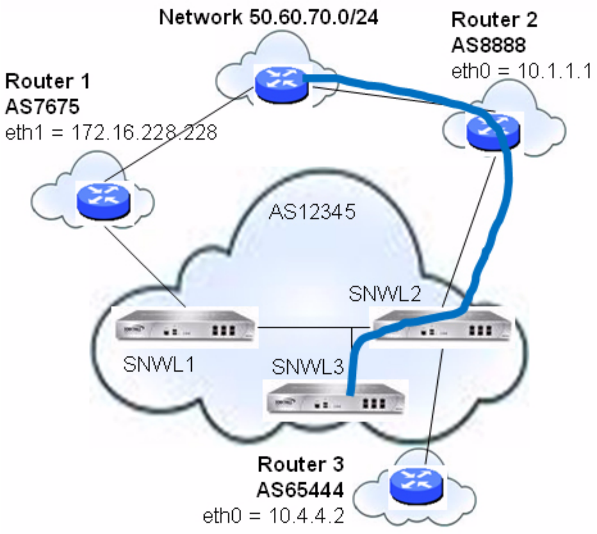
SNWL1 and SNWL2 Configurations

SNWL1 Configuration	SNWL2 Configuration
x0 = 12.34.5.228	x0 = 12.34.5.237
x1 = 172.16.228.45	x1 = 10.1.1.2
------------------	------------------
router bgp 12345	router bgp 12345
neighbor 172.16.228.228 remote-as 7675	neighbor 10.1.1.1 remote-as 8888
neighbor 12.34.5.237 remote-as 12345	neighbor 12.34.5.228 remote-as 12345
bgp default local-preference 150	bgp default local-preference 200

Local Preference used with Route Maps

Route Maps are similar to Access Control Lists. They consist of a series of Permit and/or Deny statements that determine how the appliance processes the routes. Route maps are applied to inbound traffic—not outbound traffic. BGP Local Preference Topology with Route Maps shows a sample topology that uses a route map to configure local preference.

BGP Local Preference Topology with Route Maps



The BGP configurations shown in SNWL1 and SNWL2 Configurations with Route Maps are entered on SNWL1 and SNWL2.

SNWL1 and SNWL2 Configurations with Route Maps

SNWL1 Configuration	SNWL2 Configuration
x1 = 172.16.228.45	x0 = 12.34.5.237
	x1 = 10.1.1.2
	x4 = 10.4.4.1
------------------	------------------
router bgp 12345	router bgp 12345
neighbor 172.16.228.228 remote-as 7675	neighbor 10.1.1.1 remote-as 9999
neighbor 12.34.5.237 remote-as 12345	neighbor 10.1.1.1 route-map rmap1 in
bgp default local-preference 150	neighbor 12.34.5.237 remote-as 12345
	....
	ip as-path access-list 100 permit ^8888$
	...
	route-map rmap1 permit 10
	match as-path 100
	set local-preference 200
	route-map rmap1 permit 20
	set local-preference 150

The Route Map configured on SNWL2 (rmap1) is configured to apply to inbound routes from neighbor `10.1.1.1`. It has two permit conditions:

- **route-map rmap1 permit 10**: This permit condition matches access list 100 that is configured to permit traffic from AS 8888 and set routes from AS 8888 to a Local Preference of 200.
- **route-map rmap1 permit 10**: This permit condition sets all other traffic that does not match access list 100 (that is, traffic coming from ASs other than 8888) to a Local Preference of 150.

AS_Path Prepending

AS_Path Prepending is the practice of adding additional AS numbers at the beginning of a path update. This makes the path for this route longer, and thus decreases its preference.

AS_Path Prepending can be applied on either outbound or inbound paths. AS_Path Prepending might not be honored if it is over-ruled by a neighbor.

Outbound and Inbound Path Configurations

Outbound Path Configuration	Inbound Path Configuration
router bgp 12345	router bgp 7675
bgp router-id 10.50.165.233	bgp router-id 10.50.165.228
network 12.34.5.0/24	network 7.6.7.0/24
neighbor 10.50.165.228 remote-as 7675	neighbor 10.50.165.233 remote-as 12345
neighbor 10.50.165.228 route-map long out	neighbor 10.50.165.233 route-map prepend in
!	!
route-map long permit 10	route-map prepend permit 10
set as-path prepend 12345 12345	set as-path prepend 12345 12345

This configuration leads to a route being installed to the neighbor `10.50.165.233` with the AS_Path Prepended as `12345 12345`. This can be viewed by entering the **show ip bgp** command.

```
ARS BGP>show ip bgp
BGP table version is 98, local router ID is 10.50.165.228
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal, l - labeled
              S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network          Next Hop            Metric LocPrf Weight Path
*> 12.34.5.0/24     10.50.165.233            0             0 12345 12345 12345 i
*> 7.6.7.0/24       0.0.0.0                       100  32768 i
Total number of prefixes 2
```

Multiple Exit Discriminator (MED)

The **`set metric`** command can be used in a route map to make paths more or less preferable:

```
router bgp 7675
network 7.6.7.0/24
   neighbor 10.50.165.233 remote-as 12345
   neighbor 10.50.165.233 route-map highmetric out
!
route-map highmetric permit 10
   set metric 300
```

The Multi Exit Discriminator (MED) is an optional attribute that can be used to influence path preference. It is non-transitive, meaning it is configured on a single appliance and not advertised to neighbors in update messages. In this section, consider the uses of the bgp always-compare-med command on page 700 and bgp deterministic-med command on page 701.

bgp always-compare-med command

The **`bgp always-compare-med`** command allows comparison of the MED values for paths from different ASs for path selection. A path with lower MED is preferred.

As an example, consider the following routes in the BGP table and the **always-compare-med** command is enabled:

```
   Route1: as-path 7675, med 300

   Route2: as-path 200, med 200

   Route3: as-path 7675, med 250
```

Route2 would be the chosen path because it has the lowest MED.

If the **always-compare-med** command was disabled, MED would not be considered when comparing Route1 and Route2 because they have different AS paths. MED would be compared for only Route1 and Route3.

bgp deterministic-med command

The selected route is also affected by the **bgp deterministic-med** command, which compares MED when choosing among routes advertised by different peers in the same autonomous system.

When the **bgp deterministic-med** command is enabled, routes from the same AS are grouped together, and the best routes of each group are compared. If the BGP table showed:

```
   Route1: as-path 200, med 300, internal

   Route2: as-path 400, med 200, internal

   Route3: as-path 400, med 250, external
```

BGP would have a group of Route1 and a second group of Route2 and Route3 (the same AS).

The best of each group is compared. Route1 is the best of its group because it is the only route from AS 200.

Route1 is compared to the Route2, the best of group AS 400 (the lower MED).

As the two routes are not from the same AS, the MED is not considered in the comparison. The external BGP route is preferred over the internal BGP route, making Route3 the best route.

BGP Communities

A community is a group of prefixes that share some common property and can be configured with the transitive BGP community attribute. A prefix can have more than one community attribute. Routers can act on one, some or all the attributes. BGP communities can be thought of as a form of tagging. The following is an example of a BGP communities configuration.

```
router bgp 12345
   bgp router-id 10.50.165.233
   network 12.34.5.0/24
   network 23.45.6.0/24
   neighbor 10.50.165.228 remote-as 7675
   neighbor 10.50.165.228 send-community
   neighbor 10.50.165.228 route-map comm out
!
access-list 105 permit 12.34.5.0/24
access-list 110 permit 23.45.6.0/24
!
route-map comm permit 10
   match ip address 105
   set community 7675:300
!
route-map comm permit 20
   match ip address 110
   set community 7675:500
!
router bgp 7675
   bgp router-id 10.50.165.228
   network 7.6.7.0/24
   neighbor 10.50.165.233 remote-as 12345
   neighbor 10.50.165.233 route-map shape in
!
ip community-list 1 permit 7675:300
ip community-list 2 permit 7675:500
!
route-map shape permit 10
   match community 1
   set local preference 120
route-map shape permit 20
   match community 2
   set local preference 130
```

Synchronization and Auto-Summary

The synchronization setting controls whether the router advertises routes learned from an iBGP neighbor based on the presence of those routes in its IGP. When synchronization is enabled, BGP only advertises routes that are reachable through OSPF or RIP (the Exterior Gateway Protocols as opposed to BGP, the Exterior Gateway Protocol). Synchronization is a common cause of BGP route advertisement problems.

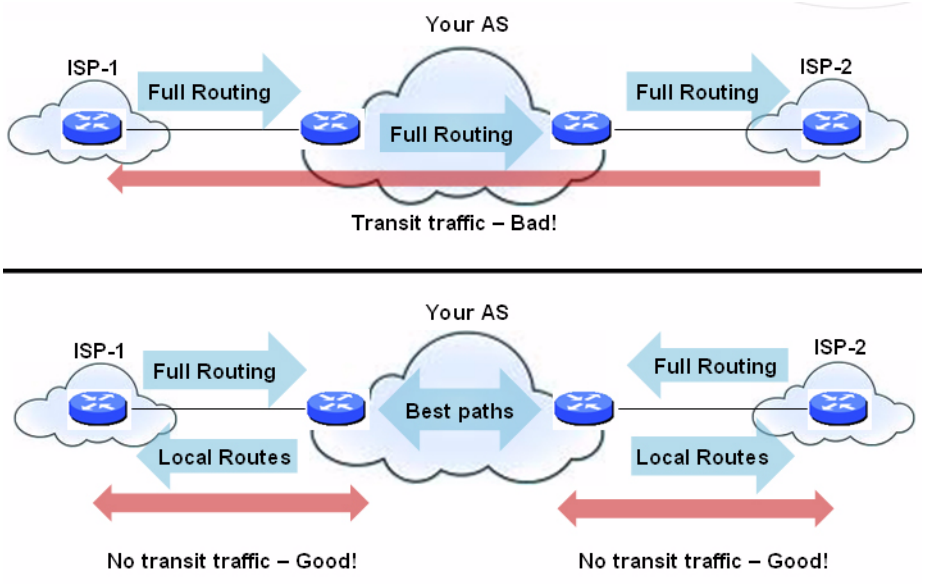
The auto-summary setting controls whether or not routes are advertised classfully. Auto-summary is another common cause of BGP configuration problems

By default, auto-summary and synchronization are disabled on Zebos.

Preventing an Accidental Transit AS

As discussed earlier, an AS peer can either be a transit peer (allowing traffic from an outside AS to another outside AS) or a non-transit peer (requiring all traffic to either originate or terminate on its AS). See Transit Peers vs. Non-transit Peers. Transit peers have dramatically larger routing tables. Typically, you do not want to configure a SonicWall Security Appliance as a transit peer.

Transit Peers vs. Non-transit Peers



To prevent your Security Appliance from inadvertently becoming a transit peer, configure inbound and outbound filters:

- Outbound Filters on page 703
- Inbound Filters on page 703

Outbound Filters

Permit only routes originated from the local AS out:

```
ip as-path access-list 1 permit ^$

router bgp 12345
   bgp router-id 10.50.165.233
   network 12.34.5.0/24
   neighbor 10.50.165.228 remote-as 7675
   neighbor 10.50.165.228 filter-list 1 out
   neighbor 172.1.1.2 remote-as 9999
   neighbor 10.50.165.228 filter list 1 out
```

Permit only owned prefixes out:

```
ip prefix-list myPrefixes seq 5 permit 12.34.5.0/24
ip prefix-list myPrefixes seq 10 permit 23.45.6.0/24

router bgp 12345
   bgp router-id 10.50.165.233
   network 12.34.5.0/24
   network 23.45.6.0/24
   neighbor 10.50.165.228 remote-as 7675
   neighbor 172.1.1.2 remote-as 9999
   neighbor 10.50.165.228 prefix-list myPrefixes out
   neighbor 172.1.1.2 prefix-list myPrefixes out
```

Inbound Filters

Drop all owned and private inbound prefixes.

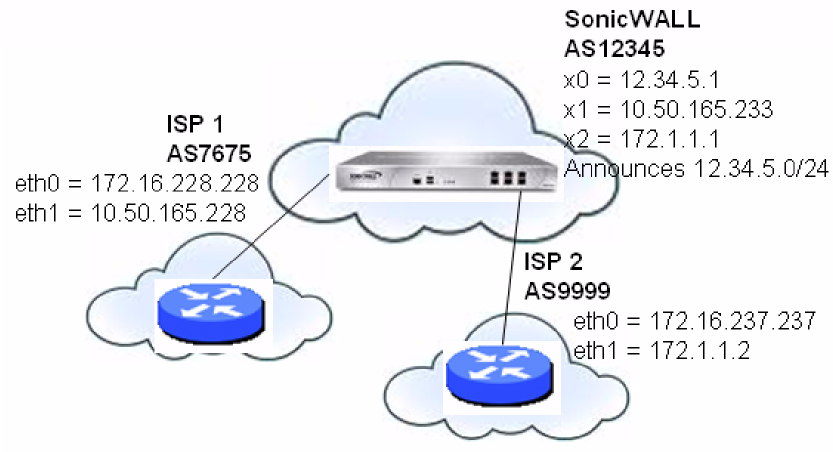
```
ip prefix-list unwantedPrefixes seq 5 deny 12.34.5.0/24 le 32
ip prefix-list unwantedPrefixes seq 10 deny 23.45.6.0/24 le 32
ip prefix-list unwantedPrefixes seq 20 deny 10.0.0.0/8 le 32
ip prefix-list unwantedPrefixes seq 21 deny 172.16.0.0/12 le 32
ip prefix-list unwantedPrefixes seq 22 deny 192.168.0.0/16 le 32
ip prefix-list unwantedPrefixes seq 30 permit 0.0.0.0/0 le 32

router bgp 12345
   bgp router-id 10.50.165.233
   network 12.34.5.0/24
   network 23.45.6.0/24
   neighbor 10.50.165.228 remote-as 7675
   neighbor 172.1.1.2 remote-as 9999
   neighbor 10.50.165.228 prefix-list unwantedPrefixes in
   neighbor 172.1.1.2 prefix-list unwantedPrefixes in
```

Using Multi-Homed BGP for Load Sharing

The topology shown in Multi-homed BGP for Load Sharing Topology is an example where a SonicWall Security Appliance uses a multi-homed BGP network to load share between two ISPs.

Multi-homed BGP for Load Sharing Topology



The SonicWall Security Appliance is configured as follows:

```
router bgp 12345
   bgp router-id 10.50.165.233
   network 12.34.5.0/24
   neighbor 10.50.165.228 remote-as 7675
   neighbor 10.50.165.228 route-map ISP1 out
   neighbor 172.1.1.2 remote-as 9999
   neighbor 10.50.165.228 route-map ISP2 out
!
route-map ISP1 permit 10
match ip address 1
set weight 100

route-map ISP1 permit 20
match ip address 2

route-map ISP2 permit 10
match ip address 1


route-map ISP2 permit 20
match ip address 2
set weight 100


access-list 1 permit 12.34.5.0/25
access-list 2 deny 12.34.5.0/25
access-list 2 permit any
```

Verifying BGP Configuration

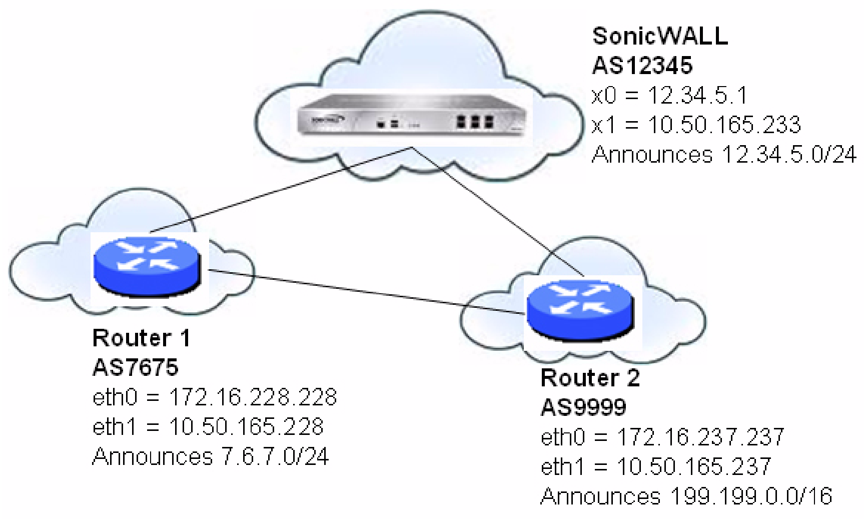
Topics:

- Viewing BGP Routes on page 704
- Configuring BGP Debug and Log on page 706

Viewing BGP Routes

BGP Topology shows a basic BGP topology where a SonicWall Security Appliance is configured for BGP to connect to two routers on two different ASs.

BGP Topology



The routes in the FIB for this network can be viewed either in the SonicOS web management interface or by using the CLI.

Topics:

- Viewing FIB routes in the Management Interface on page 705
- Viewing FIB Routes in the CLI on page 705
- Viewing RIB Routes in the CLI on page 706

Viewing FIB routes in the Management Interface

A summary of the BGP configuration can be viewed on the SonicOS NS*v* Management Interface through **MANAGE | System Setup | Network > Routing > Settings** by clicking **BGP STATUS**. The **BGP Status** dialog displays the output of the **show ip bgp summary** and **show ip bgp neighbor** commands.

The BGP routes in the FIB can also be viewed through the CLI as described in Viewing FIB Routes in the CLI on page 705.

Viewing FIB Routes in the CLI

To view the FIB routes in the CLI:

```
SonicWall> configure
(config[SonicWall])> route ars-nsm

ZebOS version 7.7.0 IPIRouter 7/2009
ARS NSM>show ip route
Codes: K - kernel, C - connected, S - static, R - RIP, B - BGP
       O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default

B       7.6.7.0/24 [20/0] via 10.50.165.228, X1, 05:08:31
B       199.199.0/16 [20/0] via 10.50.165.237, X1, 05:08:31
C       10.50.165.192/26 is directly connected, X1
```

```
C       127.0.0.0/8 is directly connected, lo0
C       12.34.5.0/24 is directly connected, X0
```

Viewing RIB Routes in the CLI

To view the RIB routes in the CLI:

```
ARS BGP>show ip bgp
BGP table version is 98, local router ID is 10.50.165.233
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal, l - labeled
              S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network          Next Hop            Metric LocPrf Weight Path
*> 7.6.7.0/24       10.50.165.228            0             0 7675 i
*> 12.34.5.0/24     0.0.0.0                       100  32768 i
*> 199.199.0.0/16   10.50.165.228            0             0 7675 9999 i
Total number of prefixes 3
```

NOTE: The last route is the path to AS9999 that was learned through AS7675.

Configuring BGP Debug and Log

SonicWall BGP offers a comprehensive selection of debug commands to display log events related to BGP traffic. BGP logging can be configured on the CLI by using the **debug bgp** command followed by one of the keywords shown in BGP Debug Keywords.

BGP Debug Keywords

BGP Debug Keywords	Enables
all	All BGP debugging.
dampening	Debugging for BGP dampening.
events	Debugging for BGP events.
filters	Debugging for BGP filters.
fsm	Debugging for BGP Finite State Machine (FSM).
keepalives	Debugging for BGP keepalives.
nht	Debugging for NHT messages.
nsm	Debugging for NSM messages.
updates	Debugging for inbound/outbound BGP updates.

To disable BGP debugging, enter the “no” form of the command. For example, to disable event debugging, type the **no debug events** command.

BGP log messages can also be viewed on the SonicOS web management interface on **MANAGE | Investigate | Logs | Event Logs**. BGP messages are displayed as part of the **Advanced Routing** category of log messages. For more information about logs and logging, see SonicOS NS*v* *Logs and Reporting*.

To allow for BGP peers that are not directly connected, use the **ebgp-multihop** keyword with the **neighbor** command. For example:

```
neighbor 10.50.165.228 ebgp-multihop
```

IPv6 BGP

IPv6 Border Gateway protocol (BGP) communicates IPv6 routing information between Autonomous Systems (ASs). A SonicWall firewall with IPv6 BGP support can replace a traditional BGP router on the edge of a network's AS.

IPv6 BGP is enabled on **MANAGE | System Setup | Network > Routing**, but must be configured on the SonicOS command line interface (CLI).

The following restrictions apply:

- IPv6 BGP depends on IPv6 functions and ZebOS (Zebra OS).
- MPLS/VPN and multicast are not supported in IPv6 BGP.

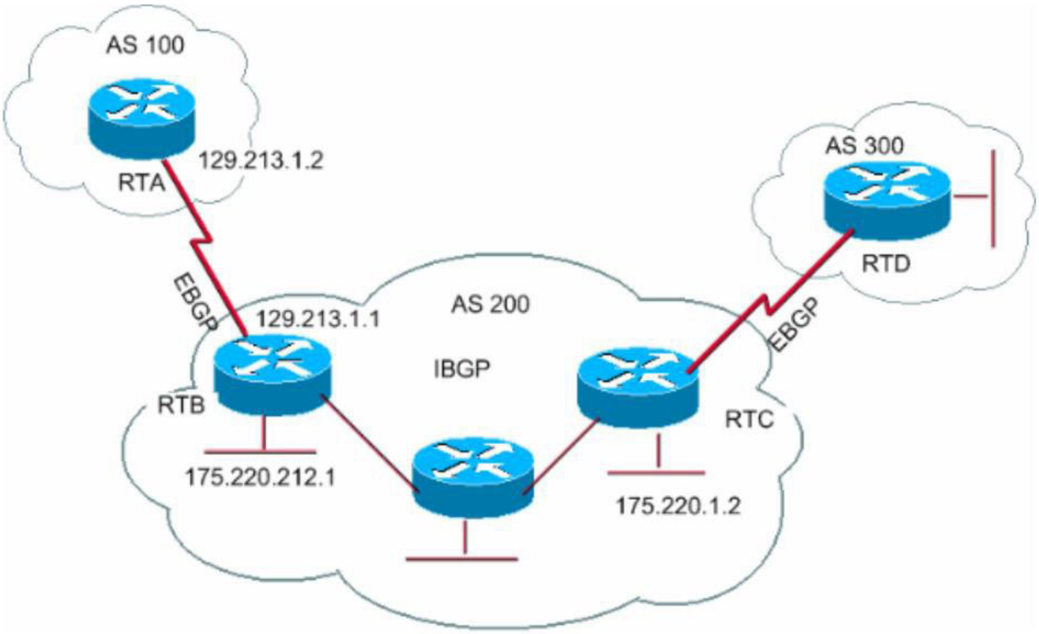
Topics:

Configuring Multiple Autonomous Systems

If an Autonomous System (AS) has multiple BGP routers, the AS can serve as a transit service for other ASs. When BGP runs between routers in different ASs, it uses exterior BGP (eBGP). When BGP runs between routers in the same AS, it uses interior BGP (iBGP).

In Autonomous System with Multiple BGP Routers Configuration, AS 200 is a transit AS for AS 100 and AS 300.

Autonomous System with Multiple BGP Routers Configuration



To configure multiple ASs as shown in Autonomous System with Multiple BGP Routers Configuration, configure routers RTA, RTB, and RTC as follows:

On RTA:

```
router bgp 100
   neighbor 129.213.1.1 remote-as 200
address-family ipv6
   redistribute connected
   neighbor 129.213.1.1 activate
```

On RTB:

```
router bgp 200
   neighbor 129.213.1.2 remote-as 100
   neighbor 175.220.1.2 remote-as 200
address-family ipv6
   redistribute connected
   neighbor 129.213.1.2 activate
   neighbor 175.220.1.2 activate
```

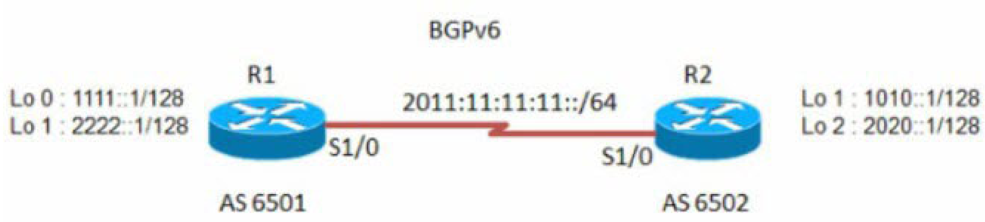
On RTC:

```
router bgp 200
   neighbor 175.220.212.1 remote-as 200
address-family ipv6
   neighbor 175.220.212.1 activate
   neighbor 175.220.212.1 activate
```

Configuring Basic BGP over IPv6

A IPv6 BGP peer router can be configured to carry either IPv4 or IPv6 route information over either an IPv6 address family or an IPv4 address family. See Basic BGP Over IPv6 Configuration.

Basic BGP Over IPv6 Configuration



To configure basic BGP over IPv6:

1 Configure routers R1 and R2:

On R1:

```
router bgp 6501
   bgp router-id 1.1.1.1
   neighbor 2011:11:11:11::2 remote-as 6502

address-family ipv6
   neighbor 2011:11:11:11::2 activate

exit-address-family
```

On R2:

```
router bgp 6502
   bgp router-id 2.2.2.2
   neighbor 2011:11:11:11::1 remote-as 6501


address-family ipv6
   network 1010::1/128
   network 2020::1/128
   neighbor 2011:11:11:11::1 activate
```

Configuring EBGP Multihop

EBGP Multihop enables you to establish a neighbor connection between two external peers that are not directly connected. Multihop is available only for eBGP and is not available in for iBGP. When the Security Appliance has an external neighbor that does not have a direct connection, you can use the **`ebgp-multihop`** command to establish a neighbor connection.

To configure EBGP Multihop:

1 Configure routers R1 and R2:

On R1:

```
router bgp 6501
   bgp router-id 1.1.1.1
   neighbor 2011:11:11:11::2 remote-as 6502
   neighbor 2011:11:11:11::2 ebgp-multihop


address-family ipv6
   neighbor 2011:11:11:11::2 activate
exit-address-family
```

On R2:

```
router bgp 6502
```

```
   bgp router-id 2.2.2.2
   neighbor 2011:11:11:11::1 remote-as 6501
   neighbor 2011:11:11:11::1 ebgp-multihop

address-family ipv6
   network 1010::1/128
   network 2020::1/128
   neighbor 2011:11:11:11::1 activate
```

Configuring IPv6 BGP Outbound Route Filter

IPv6 BGP Outbound Route Filter (ORF) can be used to minimize the number of BGP updates sent between peer routers by filtering out unwanted routing updates at the source.

To configure IPv6 BGP Outbound Route Filter (ORF):

1 Configure routers R1 and R2:

On R1:

```
router bgp 6501
   bgp router-id 1.1.1.1
   neighbor 2011:11:11:11::2 remote-as 6502

address-family ipv6
   redistribute connected
   neighbor 2011:11:11:11::2 activate
   neighbor 2011:11:11:11::2 prefix-list pref1 in
   neighbor 2011:11:11:11::2 prefix-list pref2 out
exit-address-family

ipv6 prefix-list pref1 seq 10 deny 1010::1/128
ipv6 prefix-list pref1 seq 20 permit any
ipv6 prefix-list pref2 seq 10 deny 1111::1/128
ipv6 prefix-list pref2 seq 20 permit any
```

On R2:

```
router bgp 6502
   bgp router-id 2.2.2.2
   neighbor 2011:11:11:11::1 remote-as 6501

address-family ipv6
   redistribute connected
   neighbor 2011:11:11:11::1 activate
```

To check the routes on R1 and R2, use the **show bgp ipv6 unicast** command.

The route on R1 should have IPv6 address 1010::1/128.

The route on R2 should have IPv6 address 1111::1/128.

On R1:

```
R1> show bgp ipv6 unicast
```

On R2:

```
R2> show bgp ipv6 unicast
```

Configuring IPv6 BGP Distribute List

IPv6 BGP Distribute List can be used to minimize the number of BGP updates sent between peer routers by filtering out unwanted routing updates at the source.

To configure IPv6 BGP Distribute List:

1 Configure routers R1 and R2:

On R1:

```
router bgp 6501
   bgp router-id 1.1.1.1
   neighbor 2011:11:11:11::2 remote-as 6502

address-family ipv6
   redistribute connected
   neighbor 2011:11:11:11::2 activate
   neighbor 2011:11:11:11::2 distribute-list acl1 in
   neighbor 2011:11:11:11::2 distribute-list acl2 out
exit-address-family

ipv6 access-list acl1 deny 1010::1/128
ipv6 access-list acl1 permit any
ipv6 access-list acl2 deny 1111::1/128
ipv6 access-list acl2 permit any
```

On R2:

```
router bgp 6502
   bgp router-id 2.2.2.2
   neighbor 2011:11:11:11::1 remote-as 6501

address-family ipv6
   redistribute connected
   neighbor 2011:11:11:11::1 activate
```

To check the routes on R1 and R2, use the **show bgp ipv6 unicast** command.

The route on R1 should have IPv6 address 1010::1/128.

The route on R2 should have IPv6 address 1111::1/128.

On R1:

```
R1> show bgp ipv6 unicast
```

On R2:

```
R2> show bgp ipv6 unicast
```

IPv6 BGP Route-Map

IPv6 BGP Route-Map can be used to minimize the number of BGP updates sent between peer routers by filtering out unwanted routing updates at the source.

To configure IPv6 BGP Route-Map:

1 Configure routers R1 and R2:

On R1:

```
router bgp 6501
   bgp router-id 1.1.1.1
   neighbor 2011:11:11:11::2 remote-as 6502


address-family ipv6
   redistribute connected
   neighbor 2011:11:11:11::2 activate
   neighbor 2011:11:11:11::2 route-map map1 in
   neighbor 2011:11:11:11::2 route-map map2 out
exit-address-family


ipv6 access-list acl1 deny 1010::1/128
ipv6 access-list acl1 permit any
ipv6 access-list acl2 deny 1111::1/128
ipv6 access-list acl2 permit any
!
route-map map1 permit 1 match ipv6 address acl1
!
route-map map2 permit 1 match ipv6 address acl2
!
```

On R2:

```
router bgp 6502
   bgp router-id 2.2.2.2
   neighbor 2011:11:11:11::1 remote-as 6501


address-family ipv6
   redistribute connected
   neighbor 2011:11:11:11::1 activate
```

To check the routes on R1 and R2, use the **show bgp ipv6 unicast** command.

On R1:

```
R1> show bgp ipv6 unicast
```

The route on R1 should have IPv6 address 1010::1/128.

On R2:

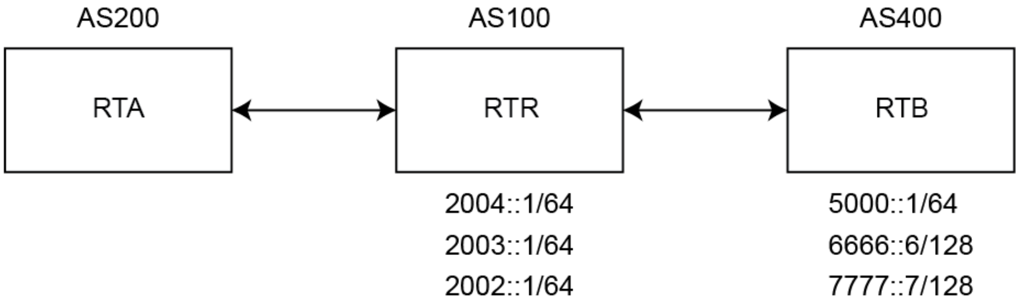
```
R2> show bgp ipv6 unicast
```

The route on R2 should have IPv6 address 1111::1/128.

Configuring an AS Regular Expression

You can configure regular expressions that can be matched and used to deny or allow addresses from an AS. See Autonomous System Regular Expression Configuration.

Autonomous System Regular Expression Configuration



RTB advertises these routes:

- 2004::/64
- 2003::/64
- 2002::/64

RTC advertises these routes:

- 5000::/64
- 6666::6/128
- 7777::7/128

To check the routes on router RTA:

1 Use the **show bgp ipv6 unicast** command:

On RTA:

```
RTA> show bgp ipv6 unicast

BGP table version is 4, local router ID is 10.0.1.2
Status codes: s suppressed, d damped, h history, * valid, > best,
i - internal, l - labeled
S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

Network           Next Hop           Metric     LocPrf     Weight     Path
*> 2002::/64      ::ffff:a00:101     0          0          100        i
*> 2003::/64      ::ffff:a00:101     0          0          100        i
*> 2004::/64      ::ffff:a00:101     0          0          100        i
*> 5000::/64      ::ffff:a00:101     0          0          100        400i
*> 6666::6/128    ::ffff:a00:101     0          0          100        400
*> 7777::7/128    ::ffff:a00:101     0          0          100        400
```

To configure AS regular expressions on RTA and deny all routes originated in AS100:

```
router bgp 200
   neighbor 10.0.1.1 remote-as 100
   neighbor 10.0.1.1 update-source X2
   neighbor 2004::1 remote-as 100
   neighbor 2004::1 update-source X2
!
address-family ipv6
   neighbor 10.0.1.1 activate
   neighbor 10.0.1.1 filter-list 1 in
   neighbor 2004::1 activate
   exit-address-family


ip as-path access-list 1 deny ^100$
ip as-path access-list 1 permit .*
```

To check the routes on router RTA:

1 Use the **`show bgp ipv6 unicast`** command.

On RTA:

```
RTA> show bgp ipv6 unicast

BGP table version is 4, local router ID is 10.0.1.2

Status codes: s suppressed, d damped, h history, * valid, > best,
i - internal, l - labeled

S Stale

Origin codes: i - IGP, e - EGP, ? - incomplete

Network           Next Hop           Metric     LocPrf    Weight   Path

*> 5000::/64      ::ffff:a00:101     0          0         100      400i

*> 6666::6/128    ::ffff:a00:101     0          0         100      400i

*> 7777::7/128    ::ffff:a00:101     0          0         100      400i

Total number of prefixes 3
```

To modify the AS path to deny all routes learned from the AS100:

On RTA:

```
router bgp 200
   neighbor 10.0.1.1 remote-as 100
   neighbor 10.0.1.1 update-source X2
   neighbor 2004::1 remote-as 100
   neighbor 2004::1 update-source X2
!
address-family ipv6
   neighbor 10.0.1.1 activate
   neighbor 10.0.1.1 filter-list 1 in
   neighbor 2004::1 activate
exit-address-family

ip as-path access-list 1 deny _100_
ip as-path access-list 1 permit .*
```

To check the routes on router RTA:

1 Use the **`show bgp ipv6 unicast`** command.

On RTA:

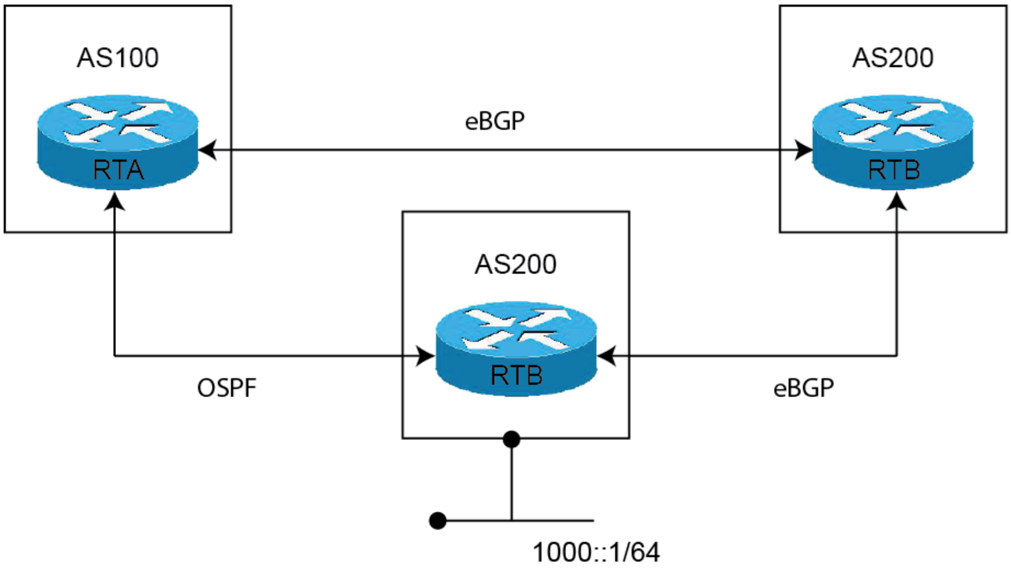
```
RTA> show bgp ipv6 unicast
```

EBGP Route Selection

Routes are selected based on the administrative distance of the routing protocol running on that route. Routing protocols with lower administrative distances are given priority over routing protocols with higher administrative distances. EBGP has an administrative distance of 20. OSPF has an administrative distance of 110.

Autonomous Systems EBGP Route Selection Configuration shows three ASs and the routing protocols used by the BGP routers.

Autonomous Systems EBGP Route Selection Configuration



The RTC router in AS300 advertises route 1000::/64 to both AS100 and to AS200.

The route from RTC (AS300) to RTA (AS100) runs OSPF.

The route from RTC (AS300) to RTB (AS200) runs eBGP.

The route from RTA (AS100) to RTB (AS200) runs eBGP.

RTA (AS100) receives updates about route 1000::/64 from both OSPF and eBGP. The route learned from eBGP is selected and added to RTA’s routing table, because the administrative distance of eBGP is less than the administrative distance of OSPF.

On RTA:

```
router bgp 100
   neighbor 3001::1 remote-as 200
!
address-family ipv6
   distance bgp 150 150 150
   neighbor 3001::1 activate
exit-address-family
```

On RTB:

```
router bgp 200
   bgp log-neighbor-changes
   neighbor 1001::1 remote-as 300
   neighbor 2003::1 remote-as 100

address-family ipv6
   network 6666::6/128
   neighbor 1001::1 activate
   neighbor 2003::1 activate
exit-address-family
```

On RTC:

```
router bgp 300
```

```
   neighbor 3002::1 remote-as 200
!
address-family ipv6 network 1000::/64
   neighbor 3002::1 activate
exit-address-family
```

To check the routes on router RTA, use the **show ipv6 route** command.

```
RTA> show ipv6 route

IPv6 Routing Table

Codes: K - kernel route, C - connected, S - static, R - RIP, O - OSPF, I - IS-IS, B - BGP
Timers: Uptime


B   1000::/64 [20/0] via fe80::204:27ff:fe0c:b006, X1, 00:01:07
C   2003::/64 via ::, X1, 00:30:50
B   6666::6/128 [20/0] via fe80::204:27ff:fe0c:b006, X1, 00:01:07
C   fe80::/64 via ::, X1, 00:30:53
```

As RTC is directly connected to RTA, the route from OSPF is actually a better route than the route learned by BGP. To ensure that the route between RTA and RTC is selected for the routing table, you can use the **distance** command to change the default administrative distance of the BGP route to a higher administrative distance than the OSPF route. For example:

```
   distance bgp 150 150 150
```

You can also use the **backdoor neighbor** command to set the BGP route as the preferred route. For example:

On RTA:

```
router bgp 100
   neighbor 3001::1 remote-as 200
!
address-family ipv6
   network 1000::/64
   backdoor neighbor 3001::1 activate
exit-address-family
```

To check the routes on router RTA:

1 Use the **show ipv6 route** command.

```
RTA> show ipv6 route

IPv6 Routing Table


Codes: K - kernel route, C - connected, S - static, R - RIP, O - OSPF, I - IS-IS, B - BGP
Timers: Uptime


O   1000::/64 [110/2] via fe80::217:c5ff:feb4:57f2, X4, 00:30:53
C   2003::/64 via ::, X1, 00:31:18
B   6666::6/128 [20/0] via fe80::204:27ff:fe0c:b006, X1, 00:00:03
C   fe80::/64 via ::, X1, 00:31:21
```

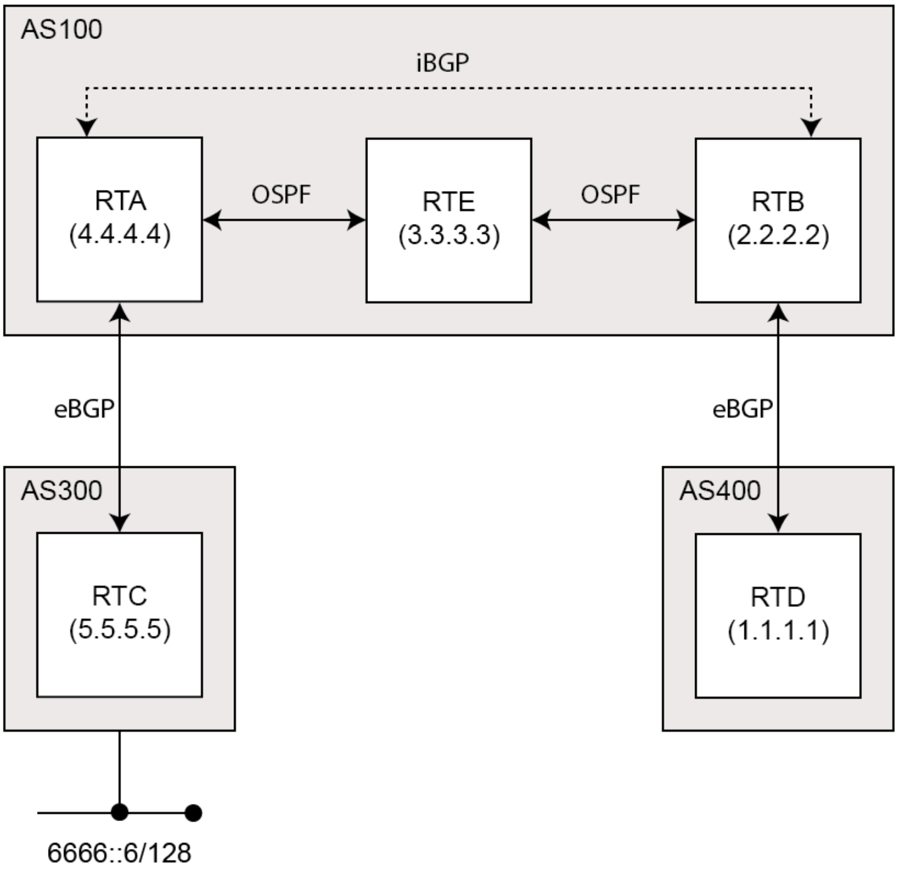
IPv6 BGP Synchronization

IPv6 BGP Synchronization keeps all BGP routers updated with the IPv6 addresses of all available routes and networks.

In BGP Synchronization, if an AS (AS100) passes traffic from another AS (AS300) to a third AS (AS400), BGP does not advertise that route until all the routers in AS100 have learned that route from the IGP. In this case, the IGP is iBGP. AS100 must wait until iBGP has propagated that route to all routers within AS100. Then, eBGP advertises the route to external ASs.

In this example, after RTB learns address `6666::6/128` through iBGP. It then advertises the address to RTD.

IPv6 BGP Synchronization Example



ⓘ **NOTE:** You can make RTB think that IGP has already propagated the route information by adding a static route to `6666::6/128` on RTB and making sure that the other routers can reach `6666::6/128`.

In this example, RTC (AS2) advertises address `6666::6/128` to RTA (AS100). In AS100, RTA and RTB are running iBGP, so RTB learns address `6666::6/128` and is able to reach it through next hop `5.5.5.5` (RTC). Next hop is carried through iBGP. However, to reach the next hop (RTC), RTB must send traffic through RTE, but RTE does not know IP address `6666::6/128`.

If RTB advertises `6666::6/128` to RTD (AS400), traffic that tries to reach `6666::6/128` from RTD must pass through RTB and RTE in AS100. However, as RTE has not learned `6666::6/128`, all packets are dropped at RTE.

To configure BGP Synchronization on RTB in AS100:

On RTB:

```
router bgp 100
   neighbor 10.103.10.129 remote-as 100
   neighbor 3001::1 remote-as 100
   neighbor 3001::1 update-source X4
   neighbor 5000::1 remote-as 400
   neighbor 5000::1 update-source X2
!
address-family ipv6
   synchronization
   neighbor 10.103.10.129 activate
   neighbor 3001::1 activate
   neighbor 5000::1 activate
exit-address-family
```

You can disable synchronization if you do not pass traffic from one AS to another AS through an intermediate AS. You can also disable synchronization if all routers in the intermediate AS run BGP. Disabling synchronization lets you to carry fewer routes in your IGP and allows BGP to converge more quickly.

To disable BGP Synchronization on RTB in AS100:

On RTB:

```
router bgp 100
   neighbor 10.103.10.129 remote-as 100
   neighbor 3001::1 remote-as 100
   neighbor 3001::1 update-source X4
   neighbor 5000::1 remote-as 400
   neighbor 5000::1 update-source X2
!
address-family ipv6
   neighbor 10.103.10.129 activate
   neighbor 3001::1 activate
   neighbor 5000::1 activate
exit-address-family
```

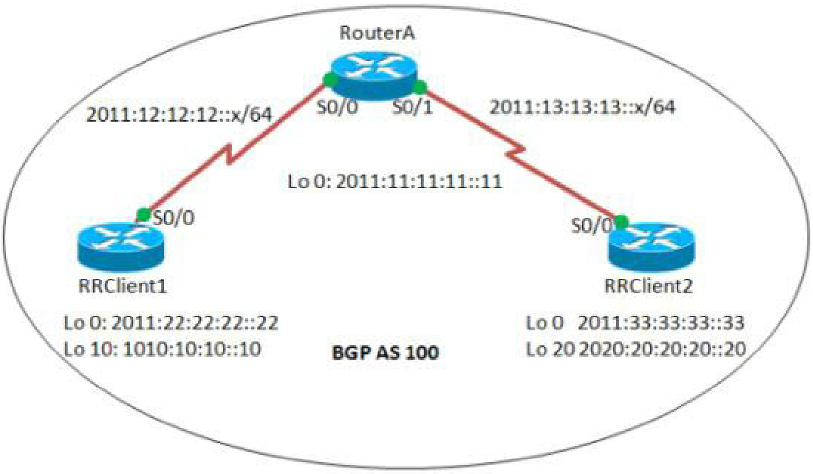
BGP Route Reflection

By default, all iBGP routers in an AS must be in a full mesh configuration. Each router must be configured as a peer to every other router.

With route reflection, all iBGP routers do not need to be fully meshed. Route reflection eliminates the need for each iBGP router to communicate with every other iBGP router in the AS. An iBGP router can be designated as a route reflector and can pass iBGP learned routes to multiple iBGP clients.

When a router is configured as a route reflector, it acts as a single point where all the other iBGP routers can get the iBGP learned routes. The route reflector acts like a server, rather than a peer, for every other router in the AS. All the other IBGP routers become route reflector clients. A router is a route reflector as long as it has at least one route reflector client.

BGP Route Reflection Configuration



To configure route reflection in an AS:

On RouterA:

```
interface Serial0/0
   ipv6 address 2011:12:12:12::1/64
   ipv6 ospf 10 area 0

interface Serial0/1
   ipv6 address 2011:13:13:13::1/64
   ipv6 ospf 10 area 0

router bgp 100

bgp router-id 1.1.1.1
no bgp default ipv4-unicast
bgp log-neighbor-changes
   neighbor 2011:22:22:22::22 remote-as 100
   neighbor 2011:22:22:22::22 update-source Loopback0
   neighbor 2011:33:33:33::33 remote-as 100
   neighbor 2011:33:33:33::33 update-source Loopback0
!
address-family ipv6
   neighbor 2011:22:22:22::22 activate
   neighbor 2011:22:22:22::22 route-reflector-client
   neighbor 2011:33:33:33::33 activate
   neighbor 2011:33:33:33::33 route-reflector-client
exit-address-family
!
ipv6 router ospf 10
   router-id 1.1.1.1
```

On RRClient1:

```
interface Loopback0
   ipv6 address 2011:22:22:22::22/128
   ipv6 ospf 10 area 0
!
interface Loopback10
   ipv6 address 1010:10:10:10::10/128
```

```
interface Serial0/0
   ipv6 address 2011:12:12:12::2/64
   ipv6 ospf 10 area 0
!
router bgp 100
   bgp router-id 2.2.2.2
   bgp log-neighbor-changes
      neighbor 2011:11:11:11::11 remote-as 100
      neighbor 2011:11:11:11::11 update-source Loopback0
!
address-family ipv6
   neighbor 2011:11:11:11::11 activate
   network 1010:10:10:10::10/128
exit-address-family
!
ipv6 router ospf 10
   router-id 2.2.2.2
```

RRClient2:

```
interface Loopback0
   ipv6 address 2011:33:33:33::33/128
   ipv6 ospf 10 area 0
!
interface Loopback20
   ipv6 address 2020:20:20:20::20/128
!
interface Serial0/0
   no ip address
   ipv6 address 2011:13:13:13::2/64
   ipv6 ospf 10 area 0
!
router bgp 100
   bgp router-id 3.3.3.3
   bgp log-neighbor-changes
      neighbor 2011:11:11:11::11 remote-as 100
      neighbor 2011:11:11:11::11 update-source Loopback0
!
address-family ipv6
   neighbor 2011:11:11:11::11 activate
   network 2020:20:20:20::20/128
exit-address-family
!
ipv6 router ospf 10
   router-id 3.3.3.3
   log-adjacency-changes
```

To check the routes:

1 Use the **`show bgp ipv6 unicast`** command:

On RRClient1:

```
RRClient1> show bgp ipv6 unicast
```

You should see route `2020:20:20:20::20/128`.

On RRClient2:

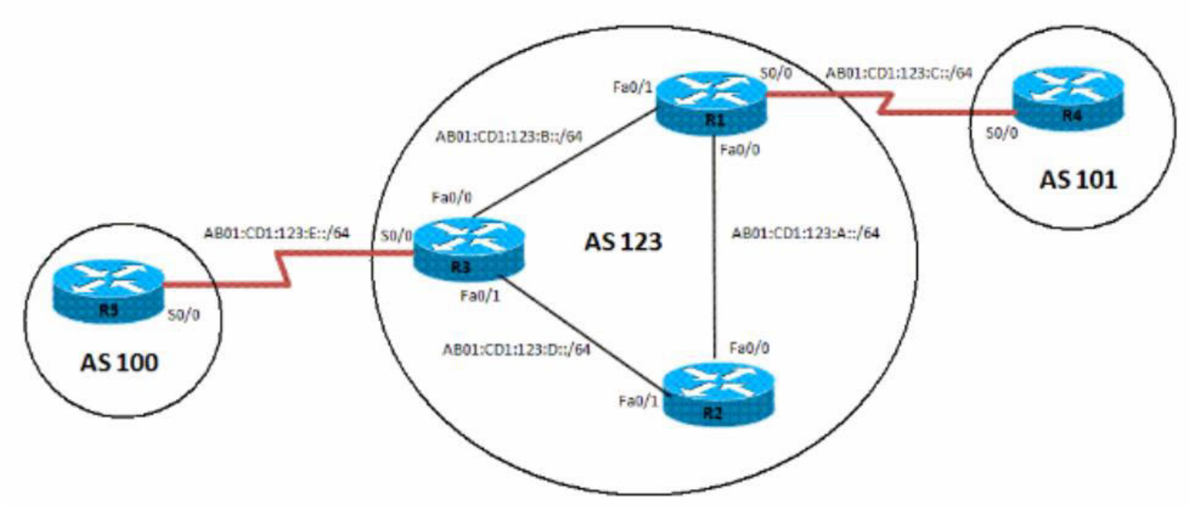
```
RRClient2> show bgp ipv6 unicast
```

You should see route `1010:10:10:10::10/128`.

IPv6 BGP Local Preference

The local preference designates a route to a certain network as the preferred exit route to that network from the AS. The route with a highest local preference is the preferred route. The default value of the local preference is 100, but this can be changed using the **`set local-preference`** command.

IPv6 BGP Local Preference Configuration



To configure the local preference of a preferred route in an AS:

On R1:

```
interface Loopback0
   ipv6 address 1111:111:111:A::/64 eui-64
   ipv6 ospf 10 area 0

interface FastEthernet0/0
   ipv6 address AB01:CD1:123:A::/64 eui-64
   ipv6 ospf 10 area 0
!
interface Serial0/0
   ipv6 address AB01:CD1:123:C::/64 eui-64
!
interface FastEthernet0/1
   ipv6 address AB01:CD1:123:B::/64 eui-64
   ipv6 ospf 10 area 0
!
   ipv6 router ospf 10 router-id 1.1.1.1 log-adjacency-changes
   redistribute connected route-map CONNECTED
!
route-map CONNECTED permit 10
   match interface Serial0/0
!
router bgp 123
bgp router-id 1.1.1.1
   neighbor 2222:222:222:A:C602:3FF:FEF0:0 remote-as 123
   neighbor 2222:222:222:A:C602:3FF:FEF0:0 update-source Loopback0
   neighbor 3333:333:333:A:C603:3FF:FEF0:0 remote-as 123
   neighbor 3333:333:333:A:C603:3FF:FEF0:0 update-source Loopback0
   neighbor AB01:CD1:123:C:C604:16FF:FE98:0 remote-as 101
   neighbor AB01:CD1:123:C:C604:16FF:FE98:0 ebgp-multihop 5
!
address-family ipv6
   neighbor 2222:222:222:A:C602:3FF:FEF0:0 activate
   neighbor 2222:222:222:A:C602:3FF:FEF0:0 next-hop-self
   neighbor 3333:333:333:A:C603:3FF:FEF0:0 activate
   neighbor 3333:333:333:A:C603:3FF:FEF0:0 next-hop-self
   neighbor AB01:CD1:123:C:C604:16FF:FE98:0 activate exit-address-family
```

On R2:

```
interface Loopback0
   ipv6 address 2222:222:222:A::/64 eui-64
   ipv6 ospf 10 area 0
!
interface FastEthernet0/0
   ipv6 address AB01:CD1:123:A::/64 eui-64
   ipv6 ospf 10 area 0
!
interface FastEthernet0/1
   ipv6 address AB01:CD1:123:D::/64 eui-64
   ipv6 ospf 10 area 0
!
   ipv6 router ospf 10 router-id 2.2.2.2 log-adjacency-changes
!
router bgp 123
bgp router-id 2.2.2.2
   neighbor 1111:111:111:A:C601:3FF:FEF0:0 remote-as 123
   neighbor 1111:111:111:A:C601:3FF:FEF0:0 update-source Loopback0
   neighbor 3333:333:333:A:C603:3FF:FEF0:0 remote-as 123
   neighbor 3333:333:333:A:C603:3FF:FEF0:0 update-source Loopback0

address-family ipv6
   neighbor 1111:111:111:A:C601:3FF:FEF0:0 activate
   neighbor 3333:333:333:A:C603:3FF:FEF0:0 activate
exit-address-family
```

On R3:

```
interface Loopback0
   ipv6 address 3333:333:333:A::/64 eui-64
   ipv6 ospf 10 area 0
!
interface FastEthernet0/0
   ipv6 address AB01:CD1:123:B::/64 eui-64
   ipv6 ospf 10 area 0
!
interface Serial0/0
   ipv6 address AB01:CD1:123:E::/64 eui-64
!
interface FastEthernet0/1
   ipv6 address AB01:CD1:123:D::/64 eui-64
   ipv6 ospf 10 area 0
!
ipv6 router ospf 10
   router-id 3.3.3.3
   redistribute connected route-map CONNECTED
!
router bgp 123
   no synchronization
   bgp router-id 3.3.3.3
   neighbor 1111:111:111:A:C601:3FF:FEF0:0 remote-as 123
   neighbor 1111:111:111:A:C601:3FF:FEF0:0 update-source Loopback0
   neighbor 2222:222:222:A:C602:3FF:FEF0:0 remote-as 123
   neighbor 2222:222:222:A:C602:3FF:FEF0:0 update-source Loopback0
   neighbor AB01:CD1:123:E:C605:16FF:FE98:0 remote-as 202
   neighbor AB01:CD1:123:E:C605:16FF:FE98:0 ebgp-multihop 5
!
```

```
address-family ipv6
   neighbor 1111:111:111:A:C601:3FF:FEF0:0 activate
   neighbor 1111:111:111:A:C601:3FF:FEF0:0 next-hop-self
   neighbor 1111:111:111:A:C601:3FF:FEF0:0 route-map LOCAL_PREF out
   neighbor 2222:222:222:A:C602:3FF:FEF0:0 activate
   neighbor 2222:222:222:A:C602:3FF:FEF0:0 next-hop-self
   neighbor 2222:222:222:A:C602:3FF:FEF0:0 route-map LOCAL_PREF out
   neighbor AB01:CD1:123:E:C605:16FF:FE98:0 activate
exit-address-family
!
ipv6 prefix-list 10 seq 5 permit BC01:BC1:10:A::/64
!
route-map LOCAL_PREF permit 10
   match ipv6 address prefix-list 10
   set local-preference 500
!
route-map LOCAL_PREF permit 20
!
route-map CONNECTED permit 10
   match interface Serial0/0
```

On R4:

```
interface Serial0/0
   ipv6 address AB01:CD1:123:C::/64 eui-64
!
interface Loopback10
   ipv6 address BC01:BC1:10:A::/64 eui-64
!
interface Loopback11
   ipv6 address BC02:BC1:11:A::/64 eui-64
!
interface Loopback12
   ipv6 address BC03:BC1:12:A::/64 eui-64

router bgp 101
bgp router-id 4.4.4.4
   neighbor AB01:CD1:123:C:C601:3FF:FEF0:0 remote-as 123
!
address-family ipv6
   neighbor AB01:CD1:123:C:C601:3FF:FEF0:0 activate
   network BC01:BC1:10:A::/64 network BC02:BC1:11:A::/64
   network BC03:BC1:12:A::/64 exit-address-family
```

On R5:

```
interface Serial0/0
   ipv6 address AB01:CD1:123:E::/64 eui-64
   clock rate 2000000
!
interface Loopback10
   ipv6 address BC01:BC1:10:A::/64 eui-64
!
interface Loopback11
   ipv6 address BC02:BC1:11:A::/64 eui-64
!
interface Loopback12
   ipv6 address BC03:BC1:12:A::/64 eui-64
!
router bgp 202
bgp router-id 5.5.5.5
   neighbor AB01:CD1:123:E:C603:3FF:FEF0:0 remote-as 123
   neighbor AB01:CD1:123:E:C603:3FF:FEF0:0 ebgp-multihop 5
!
address-family ipv6
   neighbor AB01:CD1:123:E:C603:3FF:FEF0:0 activate
   network BC01:BC1:10:A::/64
   network BC02:BC1:11:A::/64
   network BC03:BC1:12:A::/64
exit-address-family
```

To verify the route:

1 Use the **`show bgp ipv6 unicast`** command:

On R2:

```
R2> show bgp ipv6 unicast
```

Before the local preference is configured, R2 has R1 as its next hop for all learned IPv6 addresses. After configuring the local preference on R3 to 500, R2 has a different preferred exit route for prefix `BC01:BC1:10:A::/64`. R2 can now reach prefix `BC01:BC1:10:A::/64` through the exit path of R3, which is now designated as the local preference.

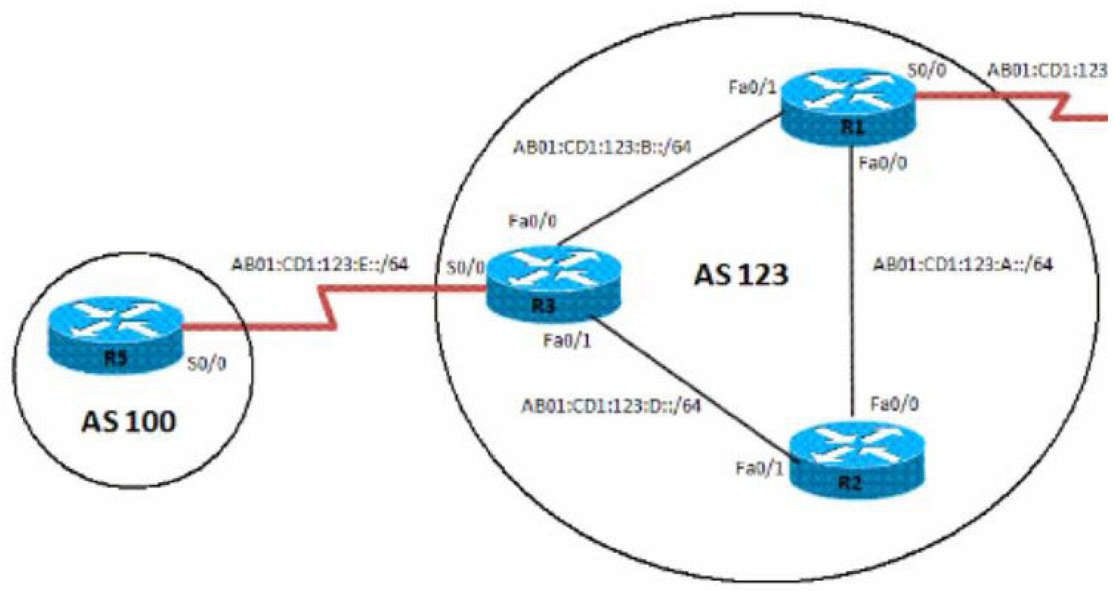
BGP Peer Group Update Policies

A BGP peer group is a group of BGP neighbors that share the same update policies. Update policies are typically set by route maps, distribution lists, and filter lists.

When you define a peer group and add neighbors to it, all of the update policies that you assign to that peer group apply to all of the neighbors in that peer group. You do not need to define a policy for each neighbor.

Members of a peer group inherit all of the configuration settings of that peer group. You can configure certain members to override the update policies, but only if those policies are set for inbound traffic. You cannot configure members to override group policies if the policies apply to outbound traffic.

BGP Peer Group Update Policy Configuration



To configure an IPv6 BGP peer group and its update policies:

On R3:

```
router bgp 123
   no synchronization
   bgp router-id 3.3.3.3
neighbor interalmap peer-group
   neighbor interalmap remote-as 123
   neighbor 1111:111:111:A:C601:3FF:FEF0:0 peer-group interalmap
   neighbor 2222:222:222:A:C602:3FF:FEF0:0 peer-group interalmap
   neighbor AB01:CD1:123:E:C605:16FF:FE98:0 remote-as 202
   neighbor AB01:CD1:123:E:C605:16FF:FE98:0 ebgp-multihop 5
!
address-family ipv6
   neighbor interalmap activate
   neighbor interalmap route-map 1 out
   neighbor 1111:111:111:A:C601:3FF:FEF0:0 peer-group interalmap
   neighbor 2222:222:222:A:C602:3FF:FEF0:0 peer-group interalmap
exit-address-family
!
ipv6 prefix-list 10 seq 5 permit BC01:BC1:10:A::/64
!
route-map 1 permit 10
   match ipv6 address prefix-list 1 set tag 333
   set metric 273
   set local-preference 312
```

To verify that the correct local preference route is configured:

1 Use the **`show bgp ipv6 unicast`** command:

On R3:

```
R3> show bgp ipv6 unicast
```

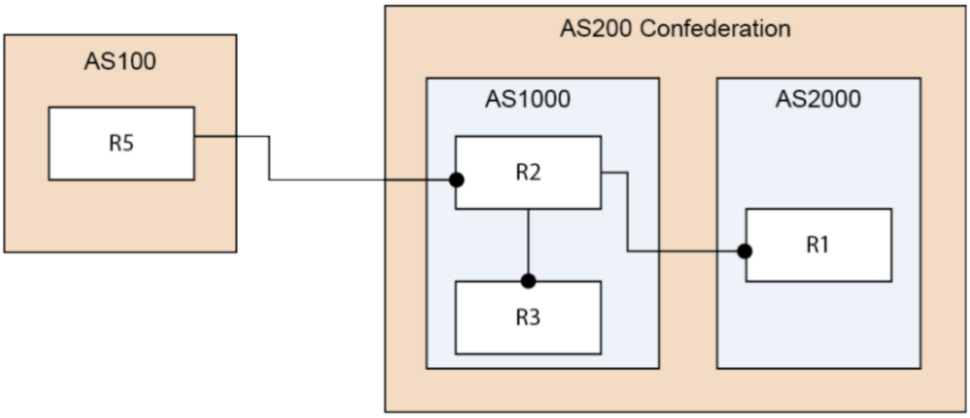
Verify that IPv6 address BC01:BC1:10:A::/64 passes from AS100 to R1 and R2, and that the metric and local preference are set to the corresponding route-map settings.

BGP Confederation

You can divide a single AS into multiple ASs, and then assign these multiple ASs to a single confederation of ASs. The implementation of a BGP confederation reduces the iBGP mesh size of the AS, and the confederation can still advertise as a single AS to external peers.

Each individual AS within a confederation runs fully meshed iBGP, and each individual AS within the confederation also runs eBGP connections to the other ASs inside the confederation. These eBGP peers within the confederation exchange routing information as if they used iBGP. In this way, the confederation preserves next hop, metric, and local preference information. To the outside world, the confederation appears to be a single AS.

BGP Confederation Configuration



To configure a BGP Confederation:

R1:

```
router bgp 2000
   bgp log-neighbor-changes
   bgp confederation identifier 200
   bgp confederation peers 1000
   neighbor 2003::1 remote-as 1000
!
address-family ipv4
   neighbor 2003::1 activate
exit-address-family
!
address-family ipv6
   network 3002::/64
   network 4000::/64
   neighbor 2003::1 activate
exit-address-family
```

On R2:

```
router bgp 1000
   bgp confederation identifier 200
   neighbor 10.0.1.1 remote-as 1000
!
address-family ipv6
   neighbor 10.0.1.1 activate
exit-address-family
```

On R3:

```
router bgp 1000
   bgp confederation identifier 200
   bgp confederation peers 2000
   neighbor 10.0.1.2 remote-as 1000
   neighbor 3001::1 remote-as 2000
   neighbor 5000::1 remote-as 100
   neighbor 5000::1 update-source X2
!
address-family ipv6
   neighbor 10.0.1.2 activate
   neighbor 3001::1 activate
   neighbor 5000::1 activate
exit-address-family
```

On R5:

```
router bgp 100
   bgp router-id 5.5.5.5
   bgp log-neighbor-changes
   neighbor 2002::1 remote-as 200
!
address-family ipv6
   network 6666::6/128
   network 7777::7/128
   neighbor 2002::1 activate
exit-address-family
```

Verify that R1, R2, and R3 can learn this route that is advertised by R5:

```
      6666::6/128 and 7777::7/128
```

Verify that R2 can learn this route from R1 even though they are not directly connected:

```
3002::/64 and 4000::/64
```

ⓘ **NOTE:** The IPv6 BGP configuration data and the IPv6 BGP routes are dumped into a Terminate and Stay Resident (TSR) file.

ⓘ **NOTE:** IPv6 BGP uses the ZebOS debug interface. The default setting for all debug switches is closed. Entering the CLI **`debug`** command on the console opens the debug switch.

D

SonicWall Support

Technical support is available to customers who have purchased SonicWall products with a valid maintenance contract and to customers who have trial versions.

The Support Portal provides self-help tools you can use to solve problems quickly and independently, 24 hours a day, 365 days a year. To access the Support Portal, go to https://support.SonicWall.com.

The Support Portal enables you to:

- View knowledge base articles and technical documentation
- View video tutorials
- Access MySonicWall
- Learn about SonicWall professional services
- Review SonicWall Support services and warranty information
- Register for training and certification
- Request technical support or customer service

To contact SonicWall Support, refer to https://support.SonicWall.com/contact-support.

About This Document

Legend

⚠ **WARNING: A WARNING icon indicates a potential for property damage, personal injury, or death.**

⚠ **CAUTION: A CAUTION icon indicates potential damage to hardware or loss of data if instructions are not followed.**

ⓘ **IMPORTANT, NOTE, TIP, MOBILE, or VIDEO:** An information icon indicates supporting information.

SonicOS NSv 6.5 System Setup
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232-004319-04 Rev B

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