Zebra WPA3

ZEBRA

WPA3 Integrator Guide for Cisco WLAN Infrastructure

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About WPA3

WPA3 is the next generation of Wi-Fi security, enabling robust authentication and increased cryptographic strength.

WPA3 offers the following features:

- Does not allow outdated protocols.
- Requires use of Protected Management Frames (PMF).
- Backwards compatible with WPA2.
- Supports the following authentication modes:
  - WPA3-Personal - Uses simultaneous authentication of equals (SAE)
  - WPA3-Enterprise
  - Enhanced Open - Based on opportunistic wireless encryption (OWE). Note that this is a separate Wi-Fi Alliance certification program and not WPA3.

WPA3-Personal (SAE)

WPA3-Personal uses the Simultaneous Authentication of Equals (SAE) protocol, replacing WPA2-Personal with Pre-shared Key (PSK). SAE is a variant of the Dragonfly protocol which uses a password authenticated key exchange based on zero knowledge proof. In SAE, passwords are used to determine a secret element in the negotiated group, called a password element (PWE). SAE is resistant to offline dictionary attacks.

WPA3-Personal (SAE) has the following modes:

- WPA3-SAE Mode – Devices can only use WPA3-SAE mode and PMF is always required. Information is secured using discrete logarithm cryptography.
- WPA3-SAE Transition Mode – Provides backward compatibility for devices using WPA2. The access point (AP) uses WPA3-SAE Transition Mode to enable both WPA2-PSK and WPA3-SAE at the same time on a single basic service set (BSS).

  WPA (version 1) cannot be used and is not supported on the same BSS as WPA3-SAE. WEP and TKIP cannot be used and are not supported by WPA2-PSK when used on the same BSS as WPA3-SAE.

WPA3-Enterprise

WPA3-Enterprise is based on WPA2-Enterprise but requires Protected Management Frames (PMF) and does not allow outdated WEP and TKIP protocols. WPA3-Enterprise 192-bit Mode requires support for GCMP-256 and SHA384 ciphers.

WPA3-Enterprise has following modes:

- WPA3-Enterprise only Mode - PMF is always required. WPA3-Enterprise devices negotiate PMF when connecting to an AP using WPA3-Enterprise only mode.
- WPA3-Enterprise Transition Mode - Provides backward combability for devices using WPA2-Enterprise. The access point uses WPA3-Enterprise Transition Mode to enable both WPA2-Enterprise and WPA3-Enterprise at the same time on a single basic service set (BSS). WPA3-Enterprise devices negotiate PMF when connecting to an AP using WPA3-Enterprise transition mode.
- WPA3-Enterprise 192-bit Mode - PMF is set to required when WPA3-Enterprise 192-bit Mode is used by a client station (STA). The only 802.1X Authentication allowed is EAP-TLS.

Enhanced Open (OWE)

Opportunistic Wireless Encryption (OWE) is defined in the IETF document RFC 8110.

OWE has the following modes:

- Enhanced Open OWE Mode - PMF is always required. To ensure interoperability, all STAs support group nineteen (19).
- Enhanced Open OWE Transition Mode - Allows both OWE STAs and non-OWE STAs to connect to the same distribution system at the same time.

Supported Devices, Features, and Infrastructure Combinations

Supported Products

WPA3-Personal and WPA3-Enterprise are supported on the following Zebra devices running Android 10 or later.

- PS20
- TC52/TC52HC
- TC57
- TC72
- TC77
- MC93
- TC8300
- VC8300
- EC30
- ET51
- ET56
- L10
- CC600/CC6000
- MC3300x
- MC330x
- TC52x
- TC57x
- EC50 (LAN)
- EC55 (WAN)
- WT6300
- TC21
- TC26

- MC22
- MC27
- TC21 -HC
- TC26 -HC
- MC20
- RZ-H271
- TC52ax
- MC33AX
- TC52L

Supported WPA3 Capabilities

Zebra devices with WPA3 support many modes or suites.

Modes or Suites	Supported Capabilities
WPA3-Personal Modes	WPA3-Personal (SAE) WPA3-Personal Transition Mode WPA3-Personal Fast Transition
AKM Suites for Personal Modes	FT Authentication using SAE: 00-0F-AC:9 SAE Authentication: 00-0F-AC:8 FT Authentication using PSK: 00-0F-AC:4 PSK using SHA-256: 00-0F-AC:6 PSK: 00-0F-AC:2
WPA3-Enterprise Modes	WPA3-Enterprise WPA3-Enterprise Fast Transition WPA3-Enterprise 192-bit Mode WPA3-Enterprise 192-bit Mode Fast Transition
AKM Suites for Enterprise Modes	FT Authentication using IEEE Std 802.1X (SHA 256): 00-0F-AC:3 Authentication using IEEE Std 802.1X (SHA256): 00-0F-AC:5 Authentication using IEEE Std 802.1X: 00-0F-AC:1
AKM Suites for Enterprise 192-bit Modes	FT Authentication using IEEE Std 802.1X (SHA 384) 00-0F-AC:13 Authentication using IEEE Std 802.1X using a Suite B EAP method supporting SHA-384: 00-0F-AC:12
Cipher Suites	AES-CCMP 128: 00-0F-AC:4 GCMP-256: 00-0F-AC:9

Modes or Suites	Supported Capabilities
Group Management Cipher Suites	BIP-CMAC-128: 00-0F-AC:6 BIP-GMAC-256: 00-0F-AC:12

WPA3 Features Validated on Cisco

The following features are validated on a Cisco infrastructure using a supported Zebra device.

- Enhanced open
- Enhanced open transition
- SAE-personal
- SAE-personal-transition
- Enterprise-128ccm SHA-1
- Enterprise-256gcm

Validation was performed using the following Cisco infrastructure:

35xx and 55xx interoperability validation;

- Controller Model - 3504
- AP Model - 3802
- AP Model – 4800 / 3800 / 2800 / 1560 / 1540 / 18XX
- Recommended Minimum Software Version - 8.10.105.0
- Note: The following WPA3 sub features are supported in AireOS Controllers: AES CCMP128, WPA3 SAE
- Software Version - 8.10.128.127
- AP Model - C9120AXE
- Software Version - 8.10.128.127

98xx interoperability validation;

- Controller Model - C9800-L-C-K9
- AP Model – Catalyst 9120 series, 9130 series
- Note: The following WPA3 sub features are supported in 9120: WPA3 SAE, FT-SAE and OWE
- Note: The following WPA3 sub features are supported in 9130: WPA3 SAE, WPA3 GCMP128 SuiteB 1x, GCMP256 SuiteB 192 bit, AES-CCMP128 (802.1x & 802.1x-SHA256), and OWE
- Recommended Minimum Software Version - 16.12.1 for features WPA3 SAE, SAE-FT, OWE, GCMP128 SuiteB 1x, GCMP256 SuiteB 192 bit, AES CCMP128
- WPA3 CCMP256 is not supported
- WPA 802.1x-SHA256 AES CCMP 128, GCMP128 SuiteB 1x, GCMP256 SuiteB 192 bit are not supported in FlexConnect Mode

See WPA3 Deployment Guide for all supported WPA3 Cisco Products and clients supported below:

https://www.cisco.com/c/en/us/products/collateral/wireless/catalyst-9100ax-access-points/wpa3-dep-guide-og.html

AKM and Suite Type Combinations

This section describes each security combination configured on the infrastructure and device and the corresponding AKM type or Suite type over the air.

Security Combination on the Device/Infrastructure	AKM Type/Suite Type over the Air
Enhanced open	Group Cipher Suite type: AES (CCM) (4) Pairwise Cipher Suite type: AES (CCM) (4) Auth Key Management (AKM) type: Opportunistic Wireless Encryption (18) Group Management Cipher Suite type: BIP (128) (6)
Enhanced open-transition	Group Cipher Suite type: AES (CCM) (4) Pairwise Cipher Suite type: AES (CCM) (4) Auth Key Management (AKM) type: Opportunistic Wireless Encryption (18) Group Management Cipher Suite type: BIP (128) (6) Vendor Specific: Wi-Fi Alliance: OWE Transition Mode
SAE -personal	AKM Type : SAE (SHA256) (8) Group Cipher Suite type: AES (CCM) (4) Pairwise Cipher Suite type: AES (CCM) (4) Group Management Cipher Suite type: BIP (128) (6) FT CONNECTION: Auth Key Management (AKM) type: SAE (SHA256) (8) Auth Key Management (AKM) type: FT using SAE (SHA256) (9) Group Cipher Suite type: AES (CCM) (4) Pairwise Cipher Suite type: AES (CCM) (4) Group Management Cipher Suite type: BIP (128) (6)
SAE -personal-transition	AKM Type : PSK (2) AKM Type : SAE (SHA256) (8) Group Cipher Suite type: AES (CCM) (4) Pairwise Cipher Suite type: AES (CCM) (4) Group Management Cipher Suite type: BIP (128) (6)
Enterprise-128ccm	Auth Key Management (AKM) type: WPA (1) Group Cipher Suite type: AES (CCM) (4) Pairwise Cipher Suite type: AES (CCM) (4) Group Management Cipher Suite type: BIP (128) (6)
Enterprise-256gcm	Group Cipher Suite type: GCMP (256) (9) Pairwise Cipher Suite type: GCMP (256) (9) Auth Key Management (AKM) type: WPA (SHA256) (5) Group Management Cipher Suite type: BIP (GMAC-256) (12)
WPA3-192bit	Group Cipher Suite type: GCMP (256) (9) Pairwise Cipher Suite type: GCMP (256) (9) Auth Key Management (AKM) type: WPA (SHA384-SuiteB) (12) Group Management Cipher Suite type: BIP (GMAC-256) (12)

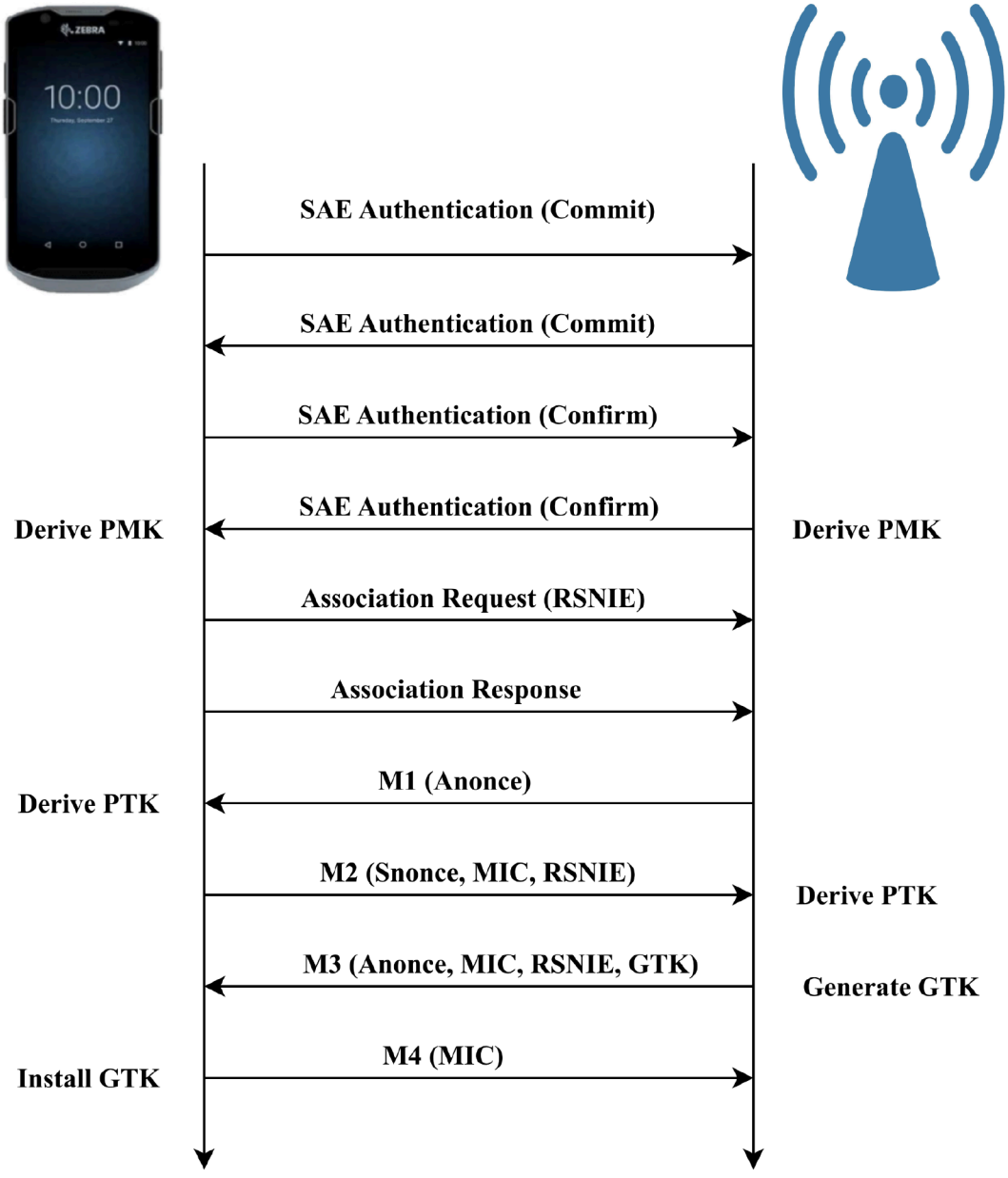
Flow Charts for WPA3 Authentication

This section contains flow charts describing WPA3 based authentication.

WPA3-SAE Authentication Flow Chart

Flow chart demonstrating the WPA3-SAE authentication workflow.

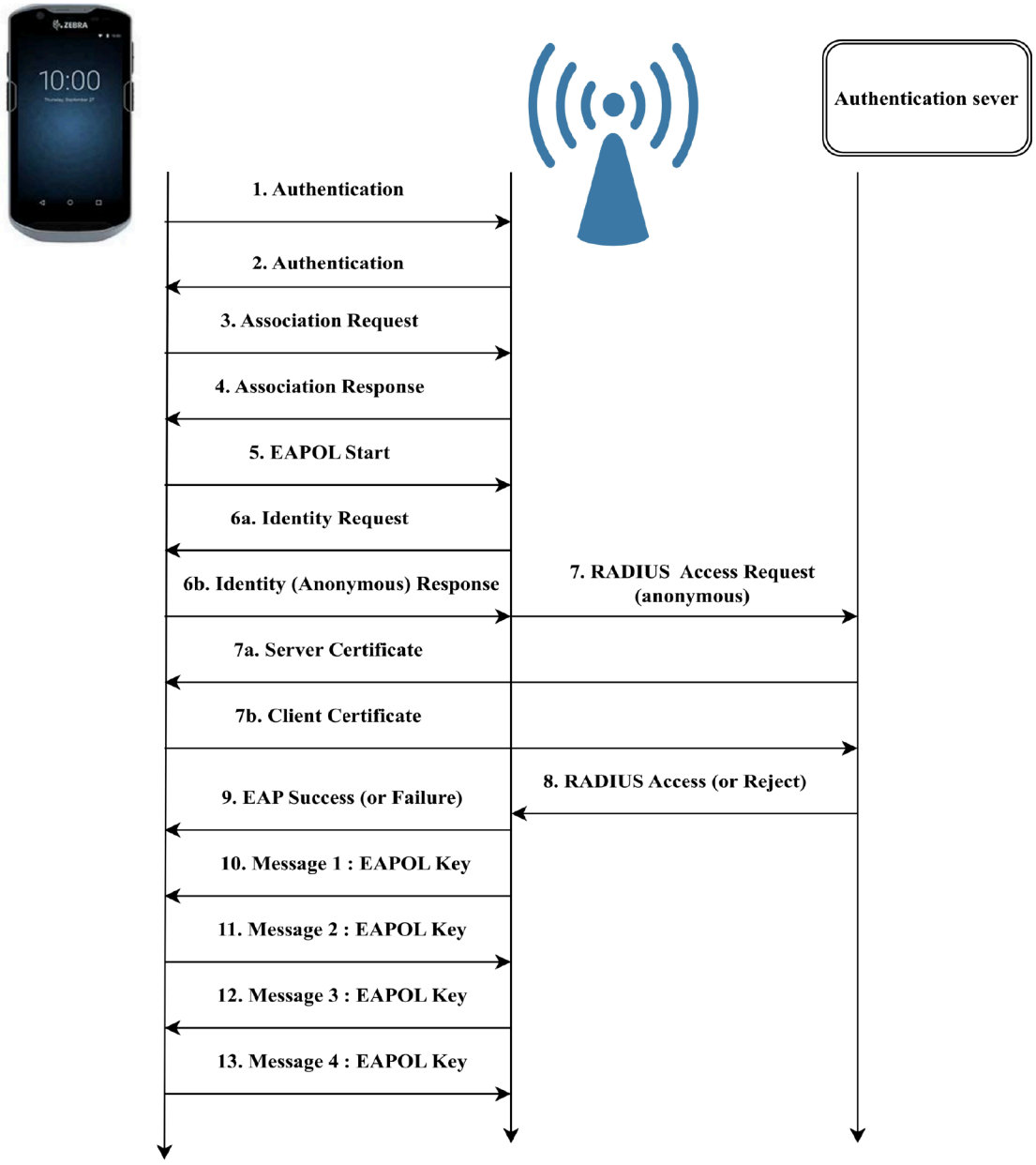
Figure 1 WPA3-SAE Authentication Flow Chart



WPA3-Enterprise EAP-TLS Flow Chart

Flow chart demonstrating the WPA3-Enterprise EAP-TLS authentication workflow.

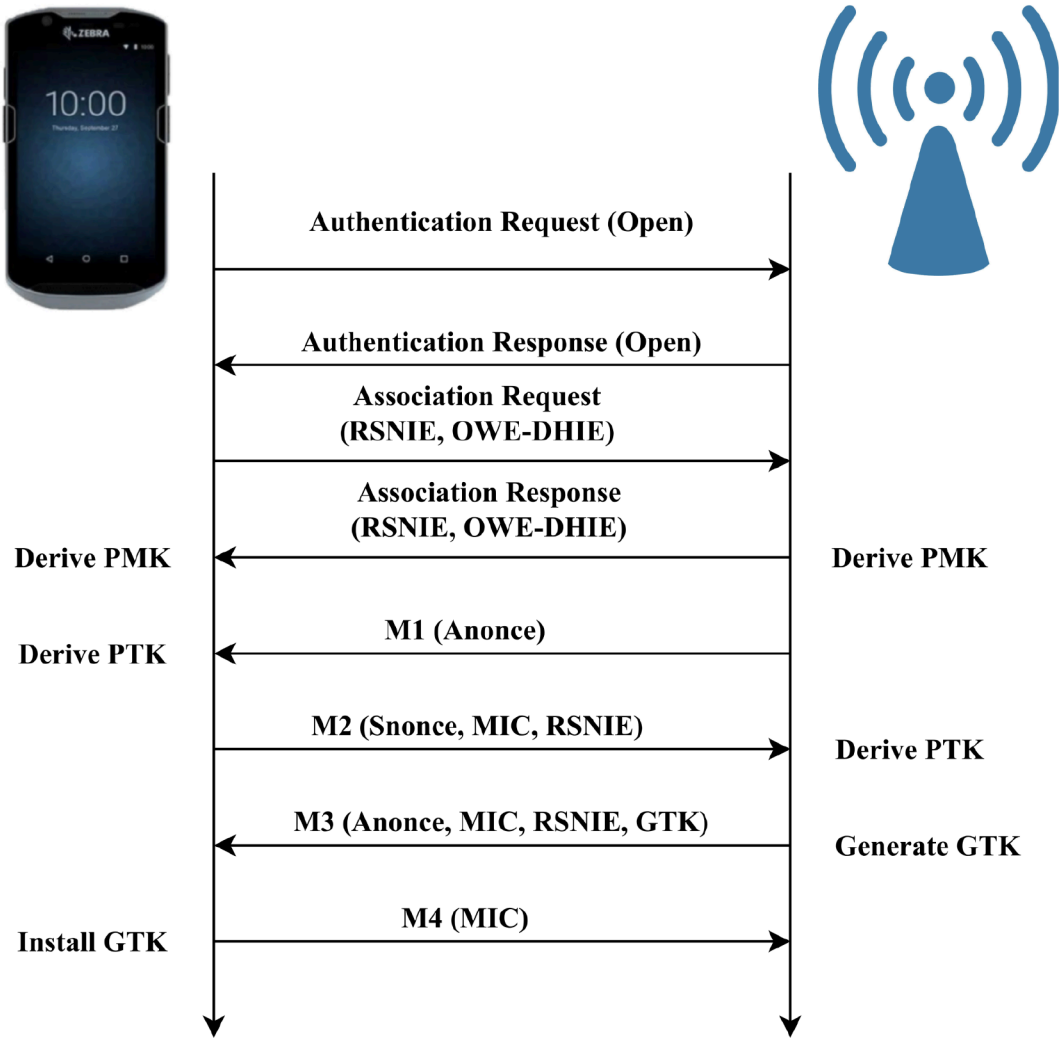
Figure 2 WPA3-Enterprise EAP-TLS Flow Chart



Enhanced Open OWE Flow Chart

Flow chart demonstrating the Enhanced Open OWE authentication workflow.

Figure 3 Enhanced Open OWE Flow Chart



WPA3 Profiles for Cisco Deployment

Create WPA3 profiles on a Cisco infrastructure.

- WPA3-SAE
- WPA3-SAE Transition
- WPA3-Enterprise 128 Bit CCMP
- WPA3-Enterprise 256 Bit
- WPA3-Enterprise 192 Bit
- Enhanced Open
- Enhanced Open Transition.

Create a WPA3-SAE or WPA3-SAE Transition Profile for Cisco Deployment

Create a WPA3-SAE or WPA3-SAE Transition profile in Cisco and configure the network on the device.

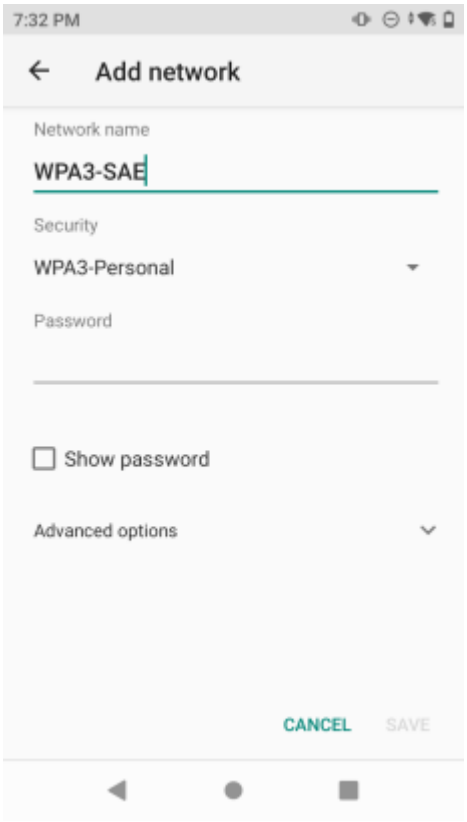
Creating a WPA3-SAE or WPA3-SAE Transition Profile in Cisco

1. In Cisco, create a WLAN profile.
2. Set Layer 2 Security to **WPA2+WPA3**.
3. Set Security Type to **Personal**.
4. If configuring a WPA3-SAE profile, set Policy to **WPA3**.
5. If configuring a WPA-3 SAE Transition profile, set Policy to **WPA2 and WPA3**.

Configuring the WPA3-SAE or WPA3-SAE Network on the Device

1. On the device, enter the SSID Name in the Network name field.
2. In the Security field, select **WPA3-Personal**.
3. In the Password field, enter the password.

Figure 4 Example Android 10/11



Create a WPA3-Enterprise 128 Bit CCMP Profile for Cisco Deployment

Create a WPA3-Enterprise 128 Bit CCMP WLAN profile in Cisco and configure the network on the device.

Creating a WPA3-Enterprise 128 Bit CCMP Profile in Cisco

1. In Cisco, create a WLAN profile.
2. Set Layer 2 Security to **WPA2+WPA3**.
3. Set Security Type to **Enterprise**.
4. Set Policy to **WPA3**.
5. Set Encryption Cipher to **CCMP128**.

Configuring the WPA3-Enterprise 128 Bit CCMP Network on the Device

1. On the device, enter the SSID Name in the Network name field.
2. In the Security field, select **WPA/WPA2/WPA3-Enterprise**.
3. Select the desired EAP method.
4. Set the remaining fields as required.

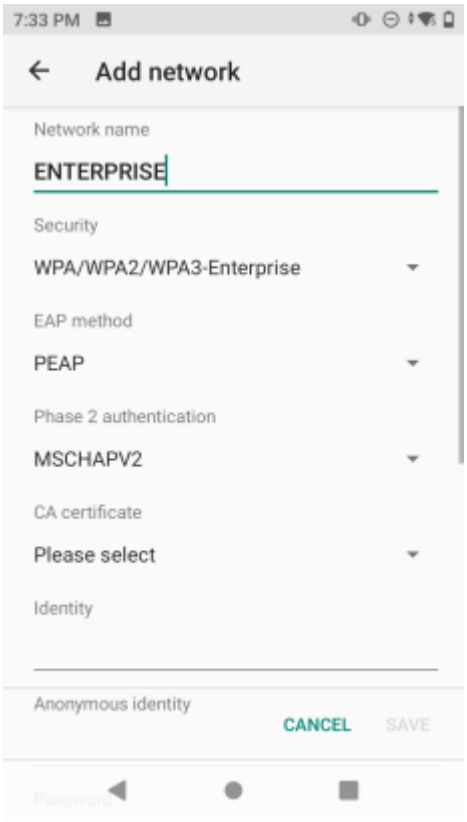
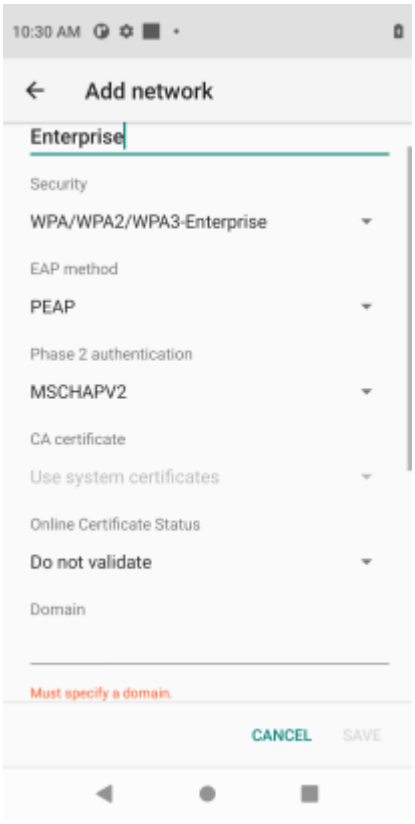

7:33 PM
Add network
Network name
ENTERPRISE
Security
WPA/WPA2/WPA3-Enterprise
EAP method
PEAP
Phase 2 authentication
MSCHAPV2
CA certificate
Please select
Identity
Anonymous identity
CANCEL
SAVE

Figure 5 Android 11: Domain Name should be the same as the Common Name in server Certificate



Create a WPA3-Enterprise 256 Bit GCM Profile for Cisco Deployment

Creating a WPA3-Enterprise 256 Bit GCM Profile in Cisco

1. In Cisco, create a WLAN profile.
2. Set Layer 2 Security to **WPA2+WPA3**.
3. Set Security Type to **Enterprise**.
4. Set Policy to **WPA3**.
5. Set Encryption Cipher to **GCM256**.

Configuring the WPA3-Enterprise 256 Bit GCM Network on the Device

1. On the device, enter the SSID Name in the Network name field.
2. In the Security field, select **WPA/WPA2/WPA3-Enterprise**.
3. Select the desired EAP method.
4. Set the remaining fields as required.

Figure 6 Android 10

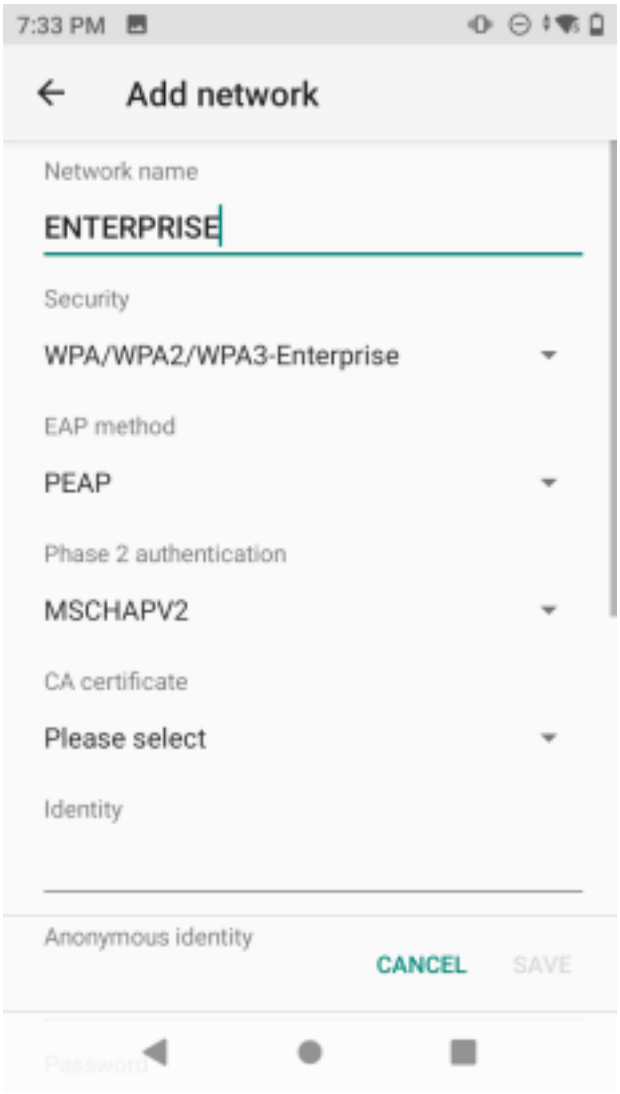
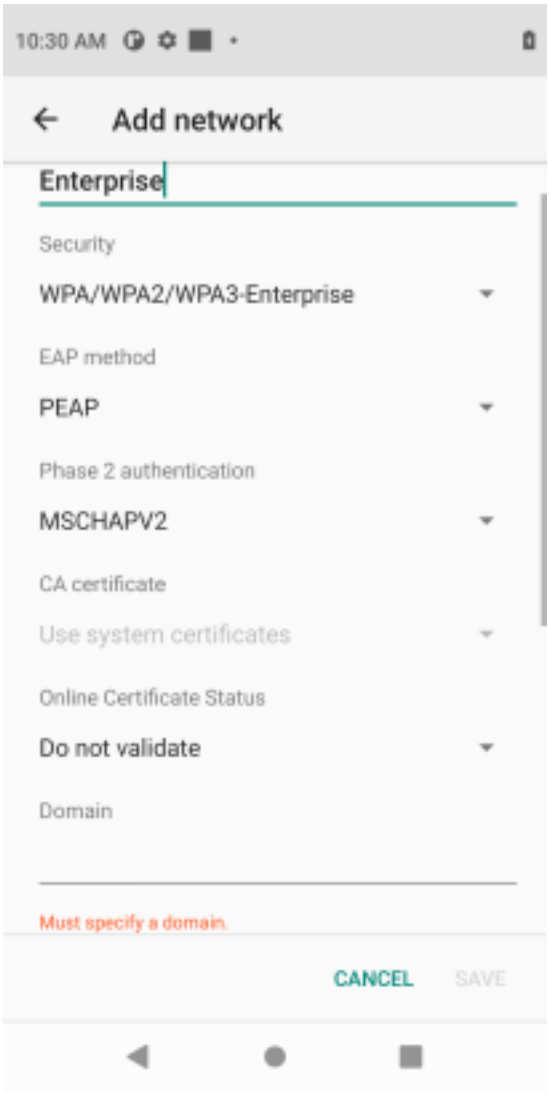


Figure 7 Android 11



NOTE: Domain Name should be the same as the Common Name in server Certificate.

Create a WPA3-Enterprise 192 Bit Profile for Cisco Deployment

Create a WPA3-Enterprise 192 Bit WLAN profile in Cisco and configure the network on the device.

Creating a WPA3-Enterprise 192 Bit Profile in Cisco

1. In Cisco, create a WLAN profile.
2. Set Layer 2 Security to **WPA2+WPA3**.
3. Set Security Type to **Enterprise**.
4. Set Policy to **WPA3**.

5. Set Encryption Cipher to **GCMP256**.

Configuring a WPA3-Enterprise 192 Bit Network on the Device

1. On the device, enter the SSID Name in the Network name field.
2. In the Security field, select **WPA3-Enterprise 192-bit**.
3. Set the remaining fields as required.

Figure 8 Android 10

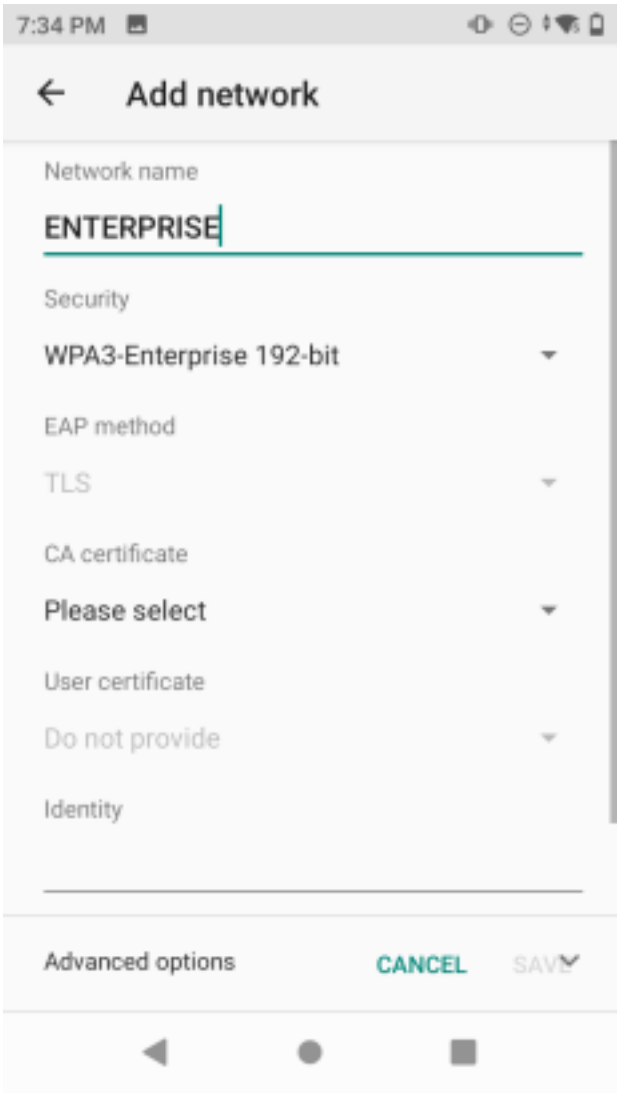
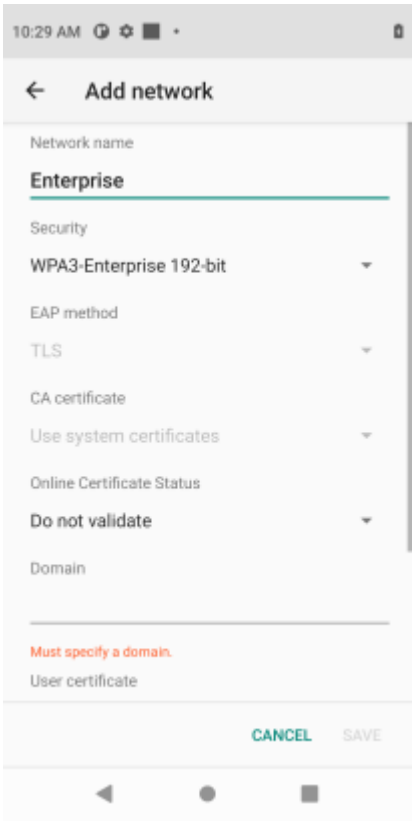


Figure 9 Android 11



NOTE: Domain Name should be the same as the Common Name in server Certificate.

Create an Enhanced Open Profile for Cisco Deployment

Create an Enhanced Open profile in Cisco and configure the network on the device.

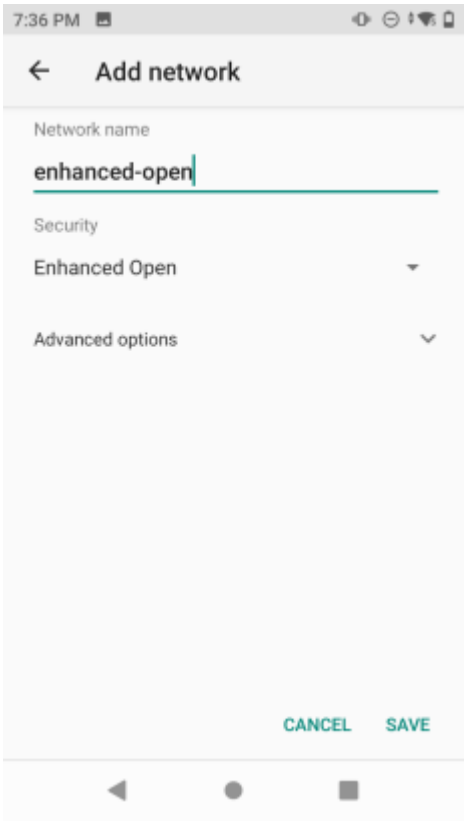
Creating an Enhanced Open Profile in Cisco

1. In Cisco, create a WLAN profile.
2. Set Layer 2 Security to **Enhanced Open**.

Configuring an Enhanced Open Network on the Device

1. On the device, enter the SSID Name in the Network name field.
2. In the Security field, select **Enhanced Open**.

Figure 10 Example Android 10/11



Create an Enhanced Open Transition Profile for Cisco Deployment

Create an Enhanced Open Transition profile in Cisco and configure the network on the device.

Creating an Enhanced Open Transition Profile in Cisco

Create an Enhanced Open profile. See Creating an Enhanced Open Profile on Cisco.

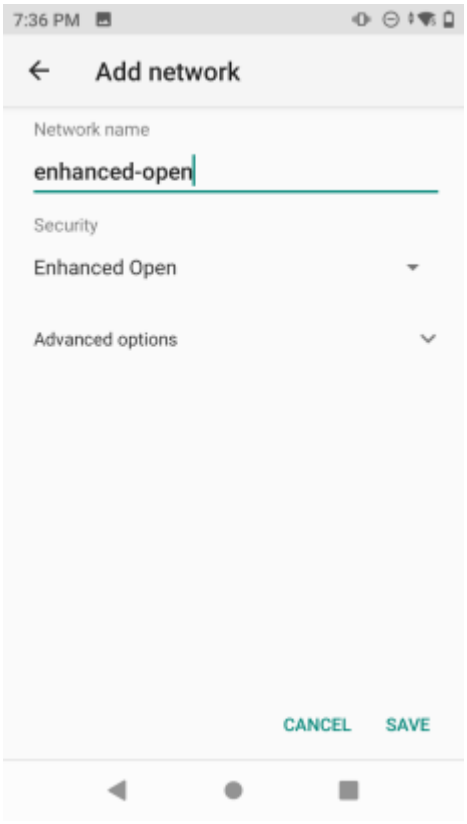
1. In Cisco, create a WLAN profile.
2. Set Layer 2 Security to **None**.
3. In the Enhanced Open SSID drop down menu, select a previously created Enhanced Open profile.

Configuring an Enhanced Open Transition Network on the Device

1. On the device, in the Network name field enter the Enhanced Open profile name.

   Make sure to enter the same Enhanced Open profile name selected in the Cisco profile.
2. In the Security field, select **Enhanced Open**.

Figure 11 Example Android 10/11



Client Certificate Requirements for WPA3 Profiles

Make sure to follow the client certificate requirements for WPA3 profiles and use the correct digital signature algorithm.

WPA3-Enterprise 192-bit uses EAP-TLS authentication with the following TLS ciphers:

- TLS_ECDHE_ECDSA_WITH_AES_256_GCM_SHA384
  - ECDHE and ECDSA using the 384-bit prime modulus curve P-384
- TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384
  - ECDHE using the 384-bit prime modulus curve P-384
  - RSA ≥ 3072-bit modulus

To comply with the above requirements, the client certificate should use one of the following digital signature algorithms:

- ECDSA: Elliptic curve digital signature algorithm
- RSA encryption with a minimum key size of 3072 bits

WPA3 Abbreviations

The following abbreviations are used in this guide.

AES
Advanced Encryption Standard

AKM
Authentication and Key Management

AP
Access Point

BIP
Broadcast Integrity Protocol

BSS
Basic Service Set

CCMP
Counter Mode Cipher Block Chaining Message Authentication Code Protocol

FT
Fast Transition

GMAC
Galois Message Authentication Code

OWE
Opportunistic Wireless Encryption

PMF
Protected Management Frames

PWE
Password Element

PSK
Pre-Shared Key

SAE
Simultaneous Authentication of Equals

SHA
Secure Hash Algorithms

STA
Client Station

WPA
Wi-Fi Protected Access