Cisco 500 WPAN Industrial Router

Product Overview

The Cisco® 500 WPAN Industrial Router (IR500) provides unlicensed 915-MHz, ISM-band wireless personal- area network (WPAN) communications to diverse Internet of things (IoT) applications. Among the IoT apps supported are smart grid, distribution automation (DA), and supervisory control and data acquisition (SCADA). The router supplies enterprise-class RF mesh connectivity to IPv4 and serial IoT devices, including recloser control, cap bank control, voltage regulator controls, and other remote terminal units (RTUs). Purpose-built to withstand harsh environments, the IR500 is ideal for installations in pad-mount and pole-mount cabinets and in other demanding locations.

The IR500 provides an open RF mesh solution based on the following standards: IEEE 802.15.4 g/e, IETF 6LoWPAN, IETF Routing Protocol for Low Power and Lossy Networks (RPL), IETF Mapping of Address and Port - Translation (MAP-T), and IETF Constrained Application Protocol (CoAP). It takes full advantage of worldclass Cisco networking capabilities in IPv6, security, legacy (serial) protocol transport, and network management.

Figure 1 displays a Cisco WPAN Industrial Router.

Figure 1.   Cisco IR500

Benefits

- Lowers total cost of ownership (TCO) by consolidating disparate communications networks used for automated metering infrastructure (AMI) and DA applications
- Delivers a communications platform for standards-based, interoperable smart grid and IoT apps using IP-based technologies and innovations
- Increases communications network uptime and grid availability to help ensure message delivery through a rugged industrial hardware design and highly resilient solution architecture
- Improves visibility, availability, and reliability of the distribution grid through enterprise-class network and device management tools
- Facilitates graceful migration and integration of legacy assets with support for several IoT-specific protocols
- Features a compact form factor and low-power design to support connectivity to a diverse set of IoT end devices with varied space and power capabilities
- Integrates into customers' existing IT and security solutions, reducing project costs and risks and eliminating the need for defining new IT processes and certifying new software applications

Architectural Capabilities

Table 1 outlines the architectural capabilities of the IR500.

Table 1.   Cisco IR500 Architectural Capabilities

Architectural Principles	Capabilities
Network Reliability and Disaster Recovery (DR) Architectures	Highly resilient design that optimizes communications network uptime and grid availability to help ensure message delivery: • IP quality of service (QoS) for highest priority of critical DA traffic • Standards-based IPv6 Routing Protocol for Low Power and Lossy Networks (IETF RPL) extends to last mile with route propagation to other IPv6 routing protocols, such as Border Gateway Protocol (BGP) and Open Shortest Path First version 3 (OSPFv3) • Interference-avoiding frequency-hopping spread spectrum (FHSS) and per-device spatial frequency reuse • Rugged industrial design and compliance with IEC-61850-3 and IEEE 1613 for utility environments More details on standards support can be found in Table 3.
Network Security	Comprehensive security capabilities based on open standards and Cisco innovation: • Access control and authentication based on X.509 certs, IEEE 802.1x, and utility public key infrastructure (PKI) • Data confidentiality and privacy based on link-layer AES 128-bit encryption and IEEE 802.11i • Device and platform integrity based on firmware signing and cert-based, role-based access control (RBAC) More details on security capabilities can be found in Table 3.
Standards-Based Integration of Legacy Assets for Graceful Migration	Comprehensive software capabilities for transporting serial and IPv4 traffic: • Supports transport of legacy serial traffic over 6LoWPAN using standards-based solutions such as Raw Sockets • Supports transport of IPv4 traffic over IPv6, using standards-based solutions such as IETF MAP-T
Ease of Use to Reduce TCO	Enterprise-class network management and device management capabilities, based on open standards and Cisco innovation: • Network and device management tools for easy deployment, upgrades, and remote monitoring • Highly secure, automated, zero-touch deployment • Comprehensive wireless monitoring capabilities for multiple communications technologies
Unified FAN Architecture	Architecture based on choice of wired and wireless technologies: • Media-agnostic network services based on IP architectures • Separation of network services and applications

Example of IoT Deployment for Cisco Connected Grid FAN Solution for DA

Utilities are experiencing a significant transition in their distribution grid, in part because smart grid applications like SCADA and DA can reduce outages and save energy. To comply with regulatory mandates, utilities are also integrating solar and wind farms into the grid and adopting smart metering. These changes necessitate a bidirectional communications field area network (FAN) that provides connectivity to a variety of DA devices to support a diverse set of DA applications and SCADA protocols, such as Distributed Network Protocol (DNP3). Examples of a few popular high-value DA applications are:

- Self-healing grid and fault location isolation service restoration (FLISR)
- Volt/VAR monitoring and control (VVC)
- Power quality monitoring and distribution grid sensing
- Asset management
- Outage management

The IR500 is a component of the Cisco Connected Grid FAN Solution, which meets these challenges using designs from the industry-leading Cisco GridBlocks™ Architecture. A typical communications network for the distribution grid is a two-tier architecture with a neighborhood area network (NAN) and a wide area network (WAN).

The NAN connects endpoints, such as DA devices, sensors, and smart meters, using a DA gateway or an embedded IPv6-based communications reference design. The endpoints form a mesh network based on RF or power-line communications (PLC) technologies. The mesh network is aggregated at an intelligent device such as a field area router (FAR) mounted on poletops or in secondary substations. The WAN tier provides network connectivity from the FAR to the utility's control center, over either a public cellular network or a utility-owned (private) WiMAX or Ethernet fiber network.

The Cisco FAN solution comprises four important elements, as shown in Figure 2. They include:

- Cisco IR500 (DA gateway) and Cisco Connected Grid Endpoint (IPv6 reference design), which provide CG-Mesh connectivity to endpoints such as DA devices, sensors, and smart meters
- Cisco 1000 Series Connected Grid Routers providing FAR capabilities
- Cisco ASR 1000 Series Aggregation Services Routers providing headend router (HER) capabilities
- Cisco IoT Field Network Director and Industrial Operations Kit for network management

Figure 2.   Cisco Connected Grid Field Area Network Solution for DA Applications
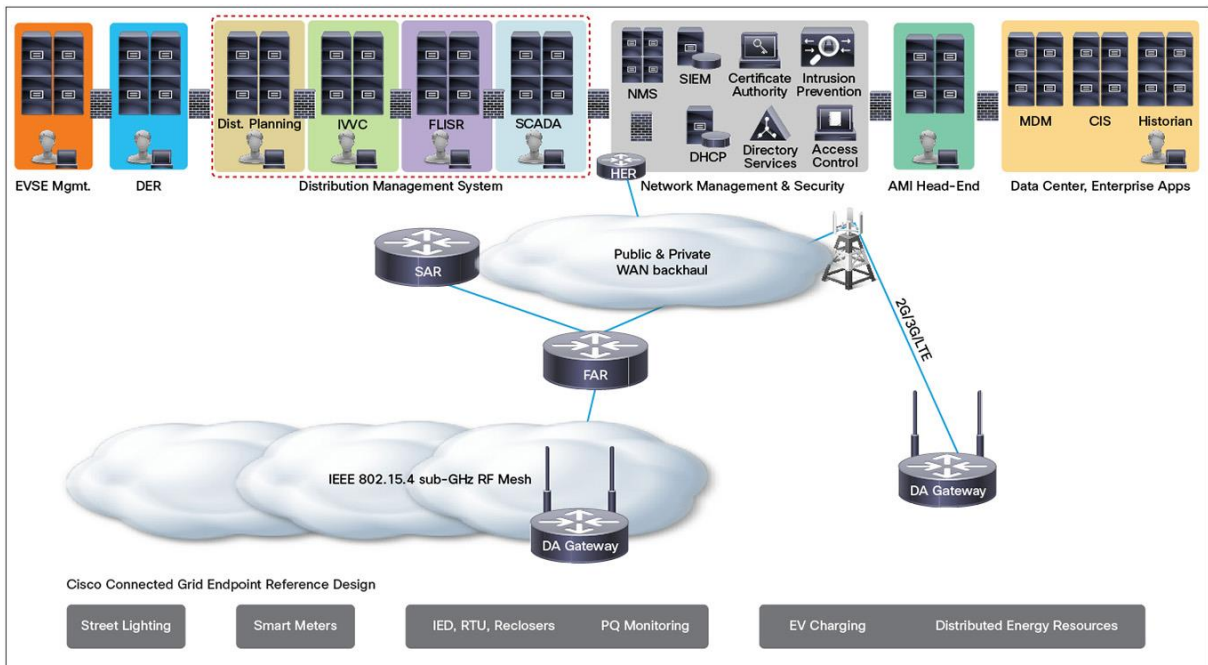
Cisco 500 WPAN Industrial Router Specifications

Table 2 lists hardware specifications and Table 3 lists software features for the IR500.

Table 2. Cisco IR500 Hardware Specifications

Feature	IR 500 Hardware Specifications
Dimensions (W x D x H)	10.2 cm x 12.79 cm x 3 cm (4 in. x 5 in. x 1.2 in.)
Typical Weight Fully Configured	0.85 lbs (0.4 kg)
Operating Temperature	-40°C to +70°C (-40°F to 158°F) with type test up to 85°C (185°F) for 16 hours
Typical Power Consumption or Dissipation	5 Watts, depending on configuration
IEEE 802.15.4 WPAN	IEEE 802.15.4g/e
Frequency Support	902-928 MHz (and subset of it to comply with country's regulations) • North America- ISM: 902-928 MHz • Australia: 915-928 MHz • Brazil: 902-907.5, 915-928 MHz • Hong Kong: 920-925 MHz • China: 920- 925 MHz • Singapore: 920-925 MHz
Spread Spectrum Technology	FHSS
Transmitter Output	30 dBm
Antenna Connector	QMA, female
10/100 Fast Ethernet Copper Ports	1
RS 232/RS 485 Serial Port-Software Configurable (RJ 45 Connector)	1
RS 232 Serial Port (RJ 45 connector)	1
Digital Alarm Inputs	1
USB Type A Network Ports	1 (hardware-ready)
Console and AUX Port (RJ-45)	1
Integrated DC Power Supply	10.6–52 VDC (nominal), 9-60 VDC (optimum)
Environmental Compliance	• IEC-61850-3 • IEEE1613 • C37.90 high-voltage impulse
Immunity	• EN61000-6-2 • EN61000-4-2 (ESD) • EN61000-4-3 (RF) • EN61000-4-4 (EFT) • EN61000-4-5 (SURGE) • EN61000-4-6 (CRF) • EN61000-4-11 (VDI) • EN 55024, CISPR 24 • EN50082-1

Feature	IR 500 Hardware Specifications
EMC	• 47 CFR, Part 15 • ICES-003 Class A • EN55022 Class A • CISPR22 Class A • AS/NZS 3548 Class A • VCCI V-3 • CNS 13438 • EN 300-386
Safety	• USA: UL 60950-1 • Canada: CAN/CSA C22.2 No. 60950-1 • Australia/New Zealand: AS/NZS 60950.1 • Rest of world: IEC 60950-1 • UL certified to UL/CSA 60950-1, 2nd Ed. • CB report to IEC60950-1, 2nd Ed., covering all group differences and national deviations

Table 3.   Cisco IR500 Software Specifications

Feature	Software Specifications
PHY/MAC Layer	• IEEE 802.3 Ethernet 10/100 Mbps • RS232/RS485 Serial • IEEE 802.15.4g WPAN • IEEE 802.15.4e WPAN MAC extensions • 6LoWPAN – RFC 4919, 4944 and 6282
Network and Transport Layer	• IPv4 (RFC 791, 826, 1918) • IPv6 (RFC 2460) • UDP (RFC 768)/TCP (RFC 793) • IETF Routing Protocol for Low Power and Lossy Networks (RPL) (RFC 6206, 6550, 6551, 6553, 6554, 6719) • NAT44 (RFC 1918 and 2663) • MAP-T (draft RFC MAP-T)
Application Layer	• Raw Sockets support on serial ports (for transport of non-IP protocols such as DNP3 and other legacy serial protocols) • DHCPv6 (RFC 3315) for IPv6 address allocation • IETF Draft RFC Constrained Application Protocol (CoAP) for network management
Security	• Encryption: AES-128 (IEEE 802.11i for WPAN key management) • Authentication and authorization: IEEE 802.1x for WPAN authentication and encryption; X.509 certificate support with integration into customer's PKI • Hardware-based device identity: IEEE 802.1AR (hardware-ready) • Role-based access control (RBAC) for device configuration • Secure boot loader and signed firmware images
Quality of Service	• Classification and marking: Layer 3 - Differentiated Services Code Point (DSCP) • Congestion management: Priority Queuing (PQ)

Table 4 lists the IR500 hardware product ID (PID).

Table 4.   Cisco IR500 Product ID

Item	Specification
IR509UWP-915/K9	IR509 with 915MHz-WPAN, 1 FE, 2 serial, utility-grade DC power

Table 5 lists the antenna options for IR500.

Table 5. Cisco IR500 Antenna Options

Item	Specification
ANT-WPAN-OM-OUT-N	• Omni antenna for 900 MHz WPAN • Outdoor

Table 6 lists the RF cable options for the IR500.

Table 6. Cisco IR500 RF Cable Options

Item	Specification
Indoor Cable Options	
CAB-L240-10-Q-N	10-ft (3 m) Low Loss LMR 240 Cable with QMA and N Connectors
CAB-L240-15-Q-N	15-ft (4.5 m) Low Loss LMR 240 Cable with QMA and N Connectors
CAB-L240-20-Q-N	20-ft (6 m) Low Loss LMR 240 Cable with QMA and N Connectors
Outdoor Cable Options	
CAB-L400-5-N-N	5-ft (1.5 m) Low Loss LMR 400 Cable with N Connectors (straight to right angle)
CAB-L400-5-N-NS	5-ft (1.5 m) Low Loss LMR 600 Cable with N Connectors (straight to straight)
CAB-L400-20-N-N	20-ft (6 m) Low Loss LMR 400 Cable with N Connectors
CAB-L600-30-N-N	30-ft (9.14 m) Ultra Low Loss LMR 600 Cable with N Connectors

Table 7 lists additional accessories available for the IR500.

Table 7. Additional Accessories for Cisco IR500

Item	Specification
CGR-LA-NF-NF	Lightning arrestor
ANT-ADPTR-Q-TNC	Connecting adapter for CGR antennas- QMA to TNC

Ordering Information

The Cisco 500 WPAN Industrial Router is available to any Cisco authorized partner. For more information, please contact your Cisco representative.

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For More Information

- To find out more about the Cisco 500 WPAN Industrial Router, visit http://www.cisco.com/go/ir500.

- For more information on the Cisco CGR 1000, visit http://www.cisco.com/go/cgr1000.

- For more information on the Cisco IoT Field Network Director, visit http://www.cisco.com/en/US/products/ps12360/index.html.

- For more information on the Cisco ASR 1000, visit http://www.cisco.com/go/asr1000.

- For more information on the Cisco Field Area Network solution, visit http://www.cisco.com/go/fan.

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