

Cisco 5500 Series Wireless Controllers

<p>Maximum Performance and Scalability</p> <ul style="list-style-type: none"> • Support for up to 500 access points and 7000 clients • 802.11n optimized for up to nine times the performance of 802.11a/g networks • Enhanced uptime with the ability to simultaneously configure and manage 500 access points per controller
<p>Improved Mobility and Services</p> <ul style="list-style-type: none"> • Larger mobility domain for more simultaneous client associations • Faster radio resource management (RRM) updates for uninterrupted network access when roaming • Intelligent RF control plane for self-configuration, self-healing, and self-optimization • Efficient roaming improves application performance such as toll quality, voice, and consistent streaming of video and data backup
<p>Licensing Flexibility and Investment Protection</p> <ul style="list-style-type: none"> • Additional access point capacity licenses may be added over time
<p>Cisco OfficeExtend Solution</p> <ul style="list-style-type: none"> • Secure, simple, cost-effective mobile teleworker solution • Up to 500 remote access points per controller • Supports Cisco® Unified IP Phones for reduced cell phone charges
<p>Comprehensive Wired/Wireless Security</p> <ul style="list-style-type: none"> • Full Control and Provisioning of Wireless Access Points (CAPWAP) access-point-to-controller encryption • Supports rogue access point detection and denial-of-service attacks • Management frame protection detects malicious users and alerts network administrators
<p>Enterprise Wireless Mesh</p> <ul style="list-style-type: none"> • Dynamic wireless mesh networks support indoor and outdoor connectivity for areas that are difficult to wire
<p>Environmentally Responsible</p> <ul style="list-style-type: none"> • Support for adaptive power management to turn off access point radios during off-peak hours to reduce power consumption • OfficeExtend solution reduces costs and supports green best practices by reducing commuting time and saving on gas, vehicle mileage, and insurance costs

The Cisco® 5500 Series Wireless Controller, shown in Figure 1, is a highly scalable and flexible platform that enables systemwide services for mission-critical wireless networking in medium-sized to large enterprises and campus environments. Designed for [802.11n](#) performance and maximum scalability, the 5500 Series offers enhanced uptime with:

- RF visibility and protection
- The ability to simultaneously manage up to 500 [access points](#)
- Superior performance for reliable streaming video and toll-quality voice
- Sub-second stateful failover of all access points and clients from the primary to standby controller

Figure 1. Cisco 5500 Series Wireless LAN Controller



Features

Optimized for high-performance [wireless](#) networking, the Cisco 5500 Series Controller offers improved mobility and prepares the business for the next wave of mobile devices and applications. The 5500 Series supports a higher density of clients and delivers more efficient roaming, with at least nine times the throughput of existing 802.11a/g networks.

The 5500 Series automates wireless configuration and management functions and allows network managers to have the visibility and control needed to cost-effectively manage, secure, and optimize the performance of their wireless networks. With integrated Cisco CleanAir® technology, the 5500 Series protects 802.11n performance by providing cross-network access to real-time and historic RF interference information for quick troubleshooting and resolution.

The Cisco 5508 Wireless Controller supports Cisco Application Visibility and Control(AVC), the technology that includes the Network-Based Application Recognition 2 (NBAR-2) engine, Cisco's deep packet inspection (DPI) capability. The NBAR-2 engine can classify applications, applies quality of service (QoS) setting to either drop or mark the traffic, and prioritizes business-critical applications in the network. Cisco AVC uses NetFlow Version 9 to export the flows to [Cisco Prime™ Infrastructure](#) or a third-party NetFlow Collector. The 5508 also supports Bonjour Services Directory to enable Bonjour Services to be advertised and utilized in a separate Layer 3 network. Wireless Policy engine is a wireless profiler and policy feature on the Cisco 5500 Series Wireless Controller that enables profiling of wireless devices and enforcement of policies such as VLAN assignment, QoS, ACL and time-of-day-based access.

As a component of the Cisco Unified Wireless Network, this controller provides real-time communications between Cisco Aironet® access points, the Cisco Wireless Control System (WCS), and the Cisco Mobility Services Engine to deliver centralized security policies, wireless intrusion prevention system (IPS) capabilities, award-winning RF management, and QoS.

Software Licensing Flexibility

Base access point licensing offers flexibility to add up to 500 additional access points as business needs grow. The licensing structure supports a variety of business mobility needs as part of the basic feature set, including the Cisco OfficeExtend solution for secure, mobile teleworking and Cisco Enterprise Wireless Mesh, which allows access points to dynamically establish wireless connections in locations where it may be difficult or impossible to physically connect to the wired network.

Table 1 lists the features of the Cisco 5500 Series [Wireless LAN Controllers](#).

Table 1. Cisco 5500 Series Wireless LAN Controller Features

Feature	Benefits
Scalability	<ul style="list-style-type: none"> Supports 12, 25, 50, 100, 250, or 500 access points for business-critical wireless services at locations of all sizes
High Performance	<ul style="list-style-type: none"> Wired speed, nonblocking performance for 802.11n networks
RF Management	<ul style="list-style-type: none"> Provides both real-time and historical information about RF interference impacting network performance across controllers, via systemwide Cisco CleanAir technology integration
OfficeExtend	<ul style="list-style-type: none"> Supports corporate wireless service for mobile and remote workers with secure wired tunnels to the Cisco Aironet® 1130 or 1140 Series Access Points Extends the corporate network to remote locations with minimal setup and maintenance requirements (zero-touch deployment) Improves productivity and collaboration at remote site locations Separate SSID tunnels allow both corporate and personal Internet access Reduced CO2 emissions from decrease in commuting Higher employee job satisfaction from ability to work at home Improves business resiliency by providing continuous, secure connectivity in the event of disasters, pandemics, or inclement weather
Comprehensive End-to-End Security	<ul style="list-style-type: none"> Offers control and provisioning of wireless access points (CAPWAP)-compliant DTLS encryption to help ensure full-line-rate encryption between access points and controllers across remote WAN/LAN links
Enterprise Wireless Mesh	<ul style="list-style-type: none"> Allows access points to dynamically establish wireless connections without the need for a physical connection to the wired network Available on select Cisco Aironet access points, Enterprise Wireless Mesh is ideal for warehouses, manufacturing floors, shopping centers and any other location where extending a wired connection may prove difficult or aesthetically unappealing
High Performance Video	<ul style="list-style-type: none"> Integrates Cisco VideoStream technology as part of the medianet framework to optimize the delivery of video applications across the WLAN

Feature	Benefits
End-to-End Voice	<ul style="list-style-type: none"> • Supports Unified Communications for improved collaboration through messaging, presence, and conferencing • Supports all Cisco Unified IP Phones for cost-effective, real-time voice services
High Availability	<ul style="list-style-type: none"> • An optional redundant power supply that helps to ensure maximum availability
Environmentally Responsible	<ul style="list-style-type: none"> • Organizations may choose to turn off access point radios to reduce power consumption during off peak hours
Mobility, Security and Management for IPv6 & Dual-Stack Clients	<ul style="list-style-type: none"> • Secure, reliable wireless connectivity and consistent end-user experience • Increased network availability through proactive blocking of known threats • Equips administrators for IPv6 troubleshooting, planning, and client traceability from a common wired and wireless management system

Table 2 lists the product specifications for Cisco 5500 Series Wireless Controllers.

Table 2. Product Specifications for Cisco 5500 Series Wireless Controllers

Item	Specifications
Wireless	IEEE 802.11a, 802.11b, 802.11g, 802.11d, WMM/802.11e, 802.11h, 802.11k, 802.11n, 802.11r, 802.11u, 802.11w, 802.11ac.
Wired/Switching/Routing	IEEE 802.3 10BASE-T, IEEE 802.3u 100BASE-TX specification, 1000BASE-T, 1000BASE-SX, 1000BASE-LH, IEEE 802.1Q Vtagging, and IEEE 802.1AX Link Aggregation.
Data Request For Comments (RFC)	<ul style="list-style-type: none"> • RFC 768 UDP • RFC 791 IP • RFC 2460 IPv6 (pass through Bridging mode only) • RFC 792 ICMP • RFC 793 TCP • RFC 826 ARP • RFC 1122 Requirements for Internet Hosts • RFC 1519 CIDR • RFC 1542 BOOTP • RFC 2131 DHCP • RFC 5415 CAPWAP Protocol Specification • RFC 5416 CAPWAP Binding for 802.11
Security Standards	<ul style="list-style-type: none"> • WPA • IEEE 802.11i (WPA2, RSN) • RFC 1321 MD5 Message-Digest Algorithm • RFC 1851 The ESP Triple DES Transform • RFC 2104 HMAC: Keyed Hashing for Message Authentication • RFC 2246 TLS Protocol Version 1.0 • RFC 2401 Security Architecture for the Internet Protocol • RFC 2403 HMAC-MD5-96 within ESP and AH • RFC 2404 HMAC-SHA-1-96 within ESP and AH • RFC 2405 ESP DES-CBC Cipher Algorithm with Explicit IV • RFC 2406 IPsec • RFC 2407 Interpretation for ISAKMP • RFC 2408 ISAKMP • RFC 2409 IKE • RFC 2451 ESP CBC-Mode Cipher Algorithms • RFC 3280 Internet X.509 PKI Certificate and CRL Profile • RFC 3602 The AES-CBC Cipher Algorithm and Its Use with IPsec • RFC 3686 Using AES Counter Mode with IPsec ESP • RFC 4347 Datagram Transport Layer Security • RFC 4346 TLS Protocol Version 1.1

Item	Specifications
Encryption	<ul style="list-style-type: none"> • WEP and TKIP-MIC: RC4 40, 104 and 128 bits (both static and shared keys) • AES: CBC, CCM, CCMP • DES: DES-CBC, 3DES • SSL and TLS: RC4 128-bit and RSA 1024- and 2048-bit • DTLS: AES-CBC • IPSec: DES-CBC, 3DES, AES-CBC
Authentication, Authorization, and Accounting (AAA)	<ul style="list-style-type: none"> • IEEE 802.1X • RFC 2548 Microsoft Vendor-Specific RADIUS Attributes • RFC 2716 PPP EAP-TLS • RFC 2865 RADIUS Authentication • RFC 2866 RADIUS Accounting • RFC 2867 RADIUS Tunnel Accounting • RFC 2869 RADIUS Extensions • RFC 3576 Dynamic Authorization Extensions to RADIUS • RFC 3579 RADIUS Support for EAP • RFC 3580 IEEE 802.1X RADIUS Guidelines • RFC 3748 Extensible Authentication Protocol • Web-based authentication • TACACS support for management users
Management	<ul style="list-style-type: none"> • SNMP v1, v2c, v3 • RFC 854 Telnet • RFC 1155 Management Information for TCP/IP-Based Internets • RFC 1156 MIB • RFC 1157 SNMP • RFC 1213 SNMP MIB II • RFC 1350 TFTP • RFC 1643 Ethernet MIB • RFC 2030 SNTP • RFC 2616 HTTP • RFC 2665 Ethernet-Like Interface types MIB • RFC 2674 Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering, and Virtual Extensions • RFC 2819 RMON MIB • RFC 2863 Interfaces Group MIB • RFC 3164 Syslog • RFC 3414 User-Based Security Model (USM) for SNMPv3 • RFC 3418 MIB for SNMP • RFC 3636 Definitions of Managed Objects for IEEE 802.3 MAUs • Cisco private MIBs
Management Interfaces	<ul style="list-style-type: none"> • Web-based: HTTP/HTTPS • Command-line interface: Telnet, Secure Shell (SSH) Protocol, serial port • Cisco Wireless Control System (WCS)
Interfaces and Indicators	<ul style="list-style-type: none"> • Uplink: 8 (5508) 1000BaseT, 1000Base-SX and 1000Base-LH transceiver slots • Small Form-Factor Pluggable (SFP) options (only Cisco SFPs supported): GLC-T, GLC-SX-MM, GLC-LH-SM • LED indicators: link • Service Port: 10/100/1000 Mbps Ethernet (RJ45). • Service Port: 10/100/1000 Mbps Ethernet (RJ45) For High Availability for future use • LED indicators: link • Utility Port: 10/100/1000 Mbps Ethernet (RJ45) • LED indicators: link • Expansion Slots: 1 (5508) • Console Port: RS232 (DB-9 male/RJ-45 connector included), mini-USB • Other Indicators: Sys, ACT, Power Supply 1, Power Supply 2

Item	Specifications
Physical and Environmental	<ul style="list-style-type: none"> • Dimensions (WxDxH): 17.30 x 21.20 x 1.75 in. (440 x 539 x 44.5 mm) • Weight: 20 lbs (9.1 kg) with 2 power supplies • Temperature: Operating temperature: 32 to 104°F (0 to 40°C); Storage temperature: -13 to 158°F (-25 to 70°C) • Humidity: Operating humidity: 10 95%, noncondensing. Storage humidity: up to 95% • Input power: 100 to 240 VAC; 50/60 Hz; 1.05 A at 110 VAC, 115W Maximum; 0.523 A at 220 VAC, 115W Maximum; Test Conditions: Redundant Power Supplies, 40C, Full Traffic. • Heat Dissipation: 392 Btu/hour at 110/220 VAC Maximum
Regulatory Compliance	CE Mark Safety: <ul style="list-style-type: none"> • UL 60950-1:2003 • EN 60950:2000 • EMI and susceptibility (Class A) • U.S.: FCC Part 15.107 and 15.109 • Canada: ICES-003 • Japan: VCCI • Europe: EN 55022, EN 55024

Tables 3 and Table 4 list the ordering and accessories information for Cisco 5500 Series Wireless Controllers.

Table 3. Ordering Information for Cisco 5500 Series Wireless Controllers

Part Number	Product Name	Cisco SMARTnet® Service 8x5xNBD
AIR-CT5508-12-K9	5500 Series Wireless Controller for up to 12 Cisco access points	CON-SNT-CT0812
AIR-CT5508-25-K9	5500 Series Wireless Controller for up to 25 Cisco access points	CON-SNT-CT0825
AIR-CT5508-50-K9	5500 Series Wireless Controller for up to 50 Cisco access points	CON-SNT-CT0850
AIR-CT5508-100-K9	5500 Series Wireless Controller for up to 100 Cisco access points	CON-SNT-CT08100
AIR-CT5508-250-K9	5500 Series Wireless Controller for up to 250 Cisco access points	CON-SNT-CT08250
AIR-CT5508-500-K9	5500 Series Wireless Controller for up to 500 Cisco access points	CON-SNT-CT08500
AIR-CT5508-500-2PK	2 Pack 5500 Series Wireless Controller for up to 500 Cisco access points each (1000 access points total)	CON-SNT-AIRC552P
AIR-CT5508-HA-K9	Cisco 5508 Series Wireless Controller for High Availability	CON-SNT-CT5508HA

Table 4. Accessories for Cisco 5500 Series Wireless Controllers

Part Number	Product Name
AIR-PWR-5500-AC=	5500 Series Wireless Controller Redundant AC Power Supply
AIR-FAN-5500=	5500 Series Wireless Controller Fan Tray
AIR-CT5500-RK-MNT	5500 Series Wireless Controller Spare mounting kit

Additive Capacity Upgrade Licenses

Tables 5 and 6 list additive capacity upgrade licenses for the Cisco 5500 Series.

Table 5. Ordering Information for Cisco 5500 Series Wireless Controllers Additive Capacity Licenses (e-Delivery Product Authorization Keys [PAKs])

	Part Number	Product Description	Cisco SMARTnet Service 8x5xNBD
e-License	L-LIC-CT5508-UPG	Primary upgrade SKU: Pick any number or combination of the following options under this SKU to upgrade one or many controllers under one product authorization key	CON-SNT-LCTUPG
	L-LIC-CT5508-5A	5 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LICT55A

	Part Number	Product Description	Cisco SMARTnet Service 8x5xNBD
	L-LIC-CT5508-25A	25 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LCT25A
	L-LIC-CT5508-50A	50 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LCT50A
	L-LIC-CT5508-100A	100 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LCT100A
	L-LIC-CT5508-250A	250 AP Adder License for the 5508 Controller (eDelivery)	CON-SNT-LCT250A

Table 6. Ordering Information for Cisco 5500 Series Wireless Controllers Additive Capacity Licenses (Paper PAKs)

	Part Number	Product Description	Cisco SMARTnet Service 8x5xNBD
Paper License	LIC-CT5508-UPG	Primary upgrade SKU: Pick any number or combination of the following options under this SKU, to upgrade one or many controllers under one product authorization key.	CON-SNT-LCTUPG
	LIC-CT5508-5A	5 AP Adder License for the 5508 Controller	CON-SNT-LICT55A
	LIC-CT5508-25A	25 AP Adder License for the 5508 Controller	CON-SNT-LCT25A
	LIC-CT5508-50A	50 AP Adder License for the 5508 Controller	CON-SNT-LCT50A
	LIC-CT5508-100A	100 AP Adder License for the 5508 Controller	CON-SNT-LCT100A
	LIC-CT5508-250A	250 AP Adder License for the 5508 Controller	CON-SNT-LCT250A

The additive capacity licenses allow for the increase in access point capacity supported by the controller up to a maximum of 500 access points. As an example, if a controller was initially ordered with support for 250 access points, that capacity could be later increased to up to 500 access points by purchasing a 250-access-point additive capacity license (1x-LIC-CT5508-250A).

A certificate with a PAK is required to add additional access point capacity on the Cisco 5500 Series Wireless Controller.

The certificate may be expedited via email. If a paper certificate is required for customs, it should be ordered to ship via U.S. mail. Each additive capacity license and PAK must be registered prior to installation.

Ordering and installing the Cisco 5500 Series Wireless Controller additive capacity licenses is a three-step process:

1. Select the correct SKU for email or paper delivery.
2. Register the PAK certificate (see [Registering PAK Certificate](#)).
3. Install the license on the Cisco 5500 Series Wireless Controller (see [Installing License](#)).

Please review the Cisco Wireless LAN Controller Configuration Guide, Release 6.0 or later, for detailed ordering, registration, and installation information for the 5500 Series additive capacity licenses.

Electronic delivery of the same PAKs is available by ordering the e-License SKUs as listed in Table 5. If a paper certificate is required, please use the SKUs listed in Table 6.

PAK Certificate Registration

Customers are required to register a PAK certificate for all upgrade licenses for the Cisco 5500 Series Wireless Controllers. Customer email address and host name are required to register the PAK certificate at:

<http://www.cisco.com/go/license>.

Installing License on Cisco WCS Server

Follow these steps to install a license file. If you need additional help, contact Cisco Technical Assistance Center (TAC) at 800 553-2447 or tac@cisco.com.

1. Install Cisco WCS software if not already completed.
2. Save the license file (.lic) to a temporary directory on your hard drive. (You will receive an email from Cisco with an attached license file)
3. Open a supported version of the Internet Explorer browser.
4. In the location or address field, enter the following URL, replacing IP address with the IP address or host name of the Cisco WCS server: **https:// <IP address>**.
5. Log in to the Cisco WCS server as system administrator. (Be aware that usernames and passwords are case-sensitive.)
6. From the Help menu, select **Licensing**.
7. On the Licensing page, from the Command menu, select **Add License**.
8. On the Add License page, click **Browse** to navigate to the location where you saved the .lic file.
9. Click **Download**. The Cisco WCS server imports the license.

Table 7 shows the optional DTLS license for Cisco 5500 Series Wireless Controllers.

Datagram Transport Layer Security (DTLS) is required for all OfficeExtend deployments to encrypt the Data Plane traffic. **Customers planning to install this device physically in Russia must order the controller with DTLS disabled and then obtain a physical PAK in order to enable a DTLS license and should not download the license from Cisco.com.** Please consult your local government regulations to ensure that Data DTLS encryption is permitted.

If a customer chooses SWC5500K9-60, SWC5500K9-70 or SWC5500K9-72, DTLS Data Encryption is enabled by default. When a customer orders the 5500 Series and chooses either SWC5500LPE-K9-70 or SWC5500LPE-K9-72 in the Optional Licenses tab, data DTLS Encryption is disabled.

The DTLS Paper PAK license is designated for customers who purchase a controller with DTLS disabled due to import restrictions but get permission to add DTLS support after initial purchase. This optional DTLS license is required for Cisco OfficeExtend deployment.

Table 7. Optional Licensing for Cisco 5500 Series Wireless Controllers (PAKs)

Part Number	Description
LIC-CT5508-LPE-K9	5508 Wireless Controller DTLS License (Paper PAK)
L-LIC-CT55-LPE-K9=	Cisco 5508 Controller DTLS License (electronic Certificate)

Other customers can simply use the procedure outlined below in order to download the DTLS license from Cisco.com.

To obtain a data DTLS license, follow these steps:

Step 1. Browse to <http://cisco.com/go/license>

Step 2. On the Product License Registration page, choose **Licenses Not Requiring a PAK**

Step 3. Choose **Cisco Wireless Controllers DTLS License** under Wireless

Step 4. Complete the remaining steps to generate the license file. The license will be provided online or via email

Step 5. Copy the license file to your TFTP server

Step 6. Install the license by browsing to the WLC Web Administration Page:

Management --> Software Activation --> Commands --> Action: Install License

Step 7. Browse to: [Cisco 5508 Wireless Controller Software Download Page](#)

<http://www.cisco.com/cisco/software/release.html?mdfid=282600534&release=7.0.230.0&relind=AVAILABLE&softwareid=280926587&rellifecycle=ED&reltype=latest>

Step 8. Choose the release that corresponds to the SW running on your WLC

Step 9. Choose the **NON LDPE** software release: AIR-CT5500-K9-X-X-XX.aes

Step 10. Complete the remaining steps to download the software

Service and Support

Realize the full business value of your wireless network and mobility services investments faster with intelligent, customized services from Cisco and our partners. Backed by deep networking expertise and a broad ecosystem of partners, Cisco professional and technical services enable you to successfully plan, build, and run your network as a powerful business platform. Our services can help you successfully deploy the Cisco 5500 Series Wireless Controller and integrate mobility solutions effectively to lower the total cost of ownership and secure your wireless network.

To learn more about Cisco Wireless LAN service offers, visit: <http://www.cisco.com/go/wirelesslanservices>.

Summary

The Cisco 5500 Series Wireless Controller is designed for 802.11n performance and offers maximum scalability for enterprise and service provider wireless deployments. It simplifies deployment and operation of wireless networks, helping to ensure smooth performance, enhance security, and maximize network availability. The Cisco 5500 Series Wireless Controller manages all the Cisco access points within campus environments and branch locations, eliminating complexity and providing network administrators with visibility and control of their wireless LANs.

For More Information

For more information about Cisco wireless controllers, contact your local account representative or visit:

<http://www.cisco.com/en/US/products/ps6366/index.html>.

For more information about the Cisco Unified Wireless Network framework, visit:

<http://www.cisco.com/go/unifiedwireless>.




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Cisco Catalyst 2960-X Series Switches

Cisco® Catalyst® 2960-X Series Switches are fixed-configuration, stackable Gigabit Ethernet switches that provide enterprise-class access for campus and branch applications (Figure 1). Designed for operational simplicity to lower total cost of ownership, they enable scalable, secure and energy-efficient business operations with intelligent services and a range of advanced Cisco IOS® Software features.

Figure 1. A Cisco Catalyst 2960-X Series Switch Family



Product Highlights

Cisco Catalyst 2960-X switches feature:

- 24 or 48 Gigabit Ethernet ports with line-rate forwarding performance
- Gigabit Small Form-Factor Pluggable (SFP) or 10G SFP+ uplinks
- FlexStack Plus for stacking of up to 8 switches with 80 Gbps of stack throughput (optional)
- Power over Ethernet Plus (PoE+) support with up to 740W of PoE budget
- Reduced power consumption and advanced energy management features
- USB and Ethernet management interfaces for simplified operations
- Application visibility and capacity planning with integrated NetFlow-Lite
- LAN Base or LAN Lite Cisco IOS® software features
- Enhanced limited lifetime warranty (E-LLW) offering next-business-day hardware replacement

Cisco Catalyst 2960-XR models also offer:

- Power resiliency with optional dual field-replaceable power supplies
- IP Lite Cisco IOS® software with dynamic routing and Layer 3 features

Switch Models and Configurations

Catalyst 2960-X switches include a single fixed power supply and are available with either the Cisco IOS LAN Base or LAN Lite feature set. Catalyst 2960-XR switch models include a field-replaceable modular power supply and can accommodate a second power supply. Catalyst 2960-XR is available only with the Cisco IOS IP Lite feature set.

Table 1. Cisco Catalyst 2960-X Configurations

Model	10/100/1000 Ethernet Ports	Uplink Interfaces	Cisco IOS Software Image	Available PoE Power	FlexStack-Plus Capability
Cisco Catalyst 2960X-48FPD-L	48	2 SFP+	LAN Base	740W	√
Cisco Catalyst 2960X-48LPD-L	48	2 SFP+	LAN Base	370W	√
Cisco Catalyst 2960X-24PD-L	24	2 SFP+	LAN Base	370W	√
Cisco Catalyst 2960X-48TD-L	48	2 SFP+	LAN Base	-	√
Cisco Catalyst 2960X-24TD-L	24	2 SFP+	LAN Base	-	√
Cisco Catalyst 2960X-48FPS-L	48	4 SFP	LAN Base	740W	√
Cisco Catalyst 2960X-48LPS-L	48	4 SFP	LAN Base	370W	√
Cisco Catalyst 2960X-24PS-L	24	4 SFP	LAN Base	370W	√
Cisco Catalyst 2960X-24PSQ-L	24 (8PoE)	2 SFP, 2 10/100/1000BT	LAN Base	92W	
Cisco Catalyst 2960X-48TS-L	48	4 SFP	LAN Base	-	√
Cisco Catalyst 2960X-24TS-L	24	4 SFP	LAN Base	-	√
Cisco Catalyst 2960X-48TS-LL	48	2 SFP	LAN Lite	-	-
Cisco Catalyst 2960X-24TS-LL	24	2 SFP	LAN Lite	-	-

Table 2. Cisco Catalyst 2960-XR Configurations

Model	10/100/1000 Ethernet Ports	Uplink Interfaces	Cisco IOS Software Image	Available PoE Power	Power Supply
Cisco Catalyst 2960XR-48FPD-I	48	2 SFP+	IP Lite	740W	1025WAC
Cisco Catalyst 2960XR-48LPD-I	48	2 SFP+	IP Lite	370W	640WAC
Cisco Catalyst 2960XR-24PD-I	24	2 SFP+	IP Lite	370W	640WAC
Cisco Catalyst 2960XR-48TD-I	48	2 SFP+	IP Lite	-	250WAC
Cisco Catalyst 2960XR-24TD-I	24	2 SFP+	IP Lite	-	250WAC
Cisco Catalyst 2960XR-48FPS-I	48	4 SFP	IP Lite	740W	1025WAC
Cisco Catalyst 2960XR-48LPS-I	48	4 SFP	IP Lite	370W	640WAC
Cisco Catalyst 2960XR-24PS-I	24	4 SFP	IP Lite	370W	640WAC
Cisco Catalyst 2960XR-48TS-I	48	4 SFP	IP Lite	-	250WAC
Cisco Catalyst 2960XR-24TS-I	24	4 SFP	IP Lite	-	250WAC

Catalyst 2960-X series Software Features

All Catalyst 2960-X Series Switches use a single Universal Cisco IOS Software Image for all SKUs. Depending on the switch model, the Cisco IOS image automatically configures either the LAN Lite, LAN Base, or IP Lite feature set.

LAN Lite models have reduced functionality and scalability for small deployments with basic requirements. Cisco Catalyst 2960-X Family of Switches are available with the LAN Base and LAN Lite feature sets and Catalyst 2960-XR Family of switches are available IP Lite feature sets.

Note that each switch model is tied to a specific feature level; LAN Lite cannot be upgraded to LAN Base and LAN Base cannot be upgraded to IP Lite.

For more information about the features included in the LAN Lite, LAN Base and IP Lite feature sets, refer to Cisco Feature Navigator: <http://tools.cisco.com/ITDIT/CFN/jsp/index.jsp>.

Cisco Catalyst 2960-XR IP-Lite High-Performance Routing

The Cisco hardware routing architecture delivers extremely high-performance IP routing in the Cisco Catalyst 2960-XR IP-Lite Switches:

- **IP unicast routing protocols (Static, Routing Information Protocol Version 1 [RIPv1], and RIPv2, RIPng)** are supported for small-network routing applications.
- **Advanced IP unicast routing protocols (OSPF for Routed Access)** are supported for load balancing and constructing scalable LANs. IPv6 routing (OSPFv3) is supported in hardware for maximum performance.
- **Equal-cost routing** facilitates Layer 3 load balancing and redundancy across the stack.
- **Policy-based routing (PBR)** allows superior control by facilitating flow redirection regardless of the routing protocol configured.
- **Hot Standby Routing Protocol (HSRP) and Virtual Router Redundancy Protocol (VRRP)** provides dynamic load balancing and failover for routed links.
- **Protocol Independent Multicast (PIM)** for IP multicast is supported, including PIM sparse mode (PIM-SM), PIM dense mode (PIM-DM), PIM sparse-dense mode and Source Specific Multicast (SSM).

Network Security

The Cisco Catalyst 2960-X Series Switches provide a range of security features to limit access to the network and mitigate threats, including:

- **Cisco TrustSec uses SXP** to simplify security and policy enforcement throughout the network. For more information about Cisco TrustSec security solutions, visit cisco.com/go/TrustSec.
- **Comprehensive 802.1X** Features to control access to the network, including Flexible Authentication, 802.1x Monitor Mode, and RADIUS Change of Authorization.
- **IPv6 First-Hop Security** enhances Layer-2 and Layer-3 network access from proliferating IPv6 devices especially BYOD devices. It protects against rogue router advertisements, address spoofing, fake DHCP replies and other risks introduced by IPv6 technology.
- **Device Sensor and Device Classifier** enable seamless versatile device profiles including BYOD devices. They also enable Cisco Identity Services Engine (ISE) to provision identity based security policies (ISE is supported in 2960-XR SKUs only).
- **Cisco Trust Anchor Technology (TAT)** enables easy distribution of a single universal image for all models of Catalyst 2960-X by verifying the authenticity of IOS images. This technology allows the switch to perform IOS integrity checks at boot-up by verifying the signature, verifying the Trusted Asset under Management (TAM) and authenticating the license.

- **Cisco Threat Defense** features including Port Security, Dynamic ARP Inspection, and IP Source Guard.
- **Private VLANs** restrict traffic between hosts in a common segment by segregating traffic at Layer 2, turning a broadcast segment into a nonbroadcast multi access like segment. This feature is available in IP-Lite feature set only.
 - **Private VLAN Edge** provides security and isolation between switch ports, which helps ensure that users cannot snoop on other users' traffic.
- **Unicast Reverse Path Forwarding (RPF)** feature helps mitigate problems caused by the introduction of malformed or forged (spoofed) IP source addresses into a network by discarding IP packets that lack a verifiable IP source address. This feature is available in IP-Lite feature set only.
- **Multidomain Authentication** allows an IP phone and a PC to authenticate on the same switch port while placing them on appropriate voice and data VLAN.
- **Access Control Lists** for Pv6 and IPv4 for security and QoS ACEs.
 - **VLAN ACLs** on all VLANs prevent unauthorized data flows from being bridged within VLANs.
 - **Router ACLs** define security policies on routed interfaces for control-plane and data-plane traffic. IPv6 ACLs can be applied to filter IPv6 traffic.
 - **Port-based ACLs** for Layer 2 interfaces allow security policies to be applied on individual switch ports.
- **Secure Shell (SSH) Protocol, Kerberos, and Simple Network Management Protocol Version 3 (SNMPv3)** provide network security by encrypting administrator traffic during Telnet and SNMP sessions. SSH Protocol, Kerberos, and the cryptographic version of SNMPv3 require a special cryptographic software image because of U.S. export restrictions.
- **Switched Port Analyzer (SPAN)**, with bidirectional data support, allows Cisco Intrusion Detection System (IDS) to take action when an intruder is detected.
- **TACACS+ and RADIUS authentication** facilitates centralized control of the switch and restricts unauthorized users from altering the configuration.
- **MAC Address Notification** allows administrators to be notified of users added to or removed from the network.
- **Multilevel security on console access** prevents unauthorized users from altering the switch configuration.
- **Bridge protocol data unit (BPDU) Guard** shuts down Spanning Tree Port Fast-enabled interfaces when BPDUs are received to avoid accidental topology loops.
- **Spanning Tree Root Guard (STRG)** prevents edge devices not in the network administrator's control from becoming Spanning Tree Protocol root nodes.
- **IGMP filtering** provides multicast authentication by filtering out nonsubscribers and limits the number of concurrent multicast streams available per port.
- **Dynamic VLAN assignment** is supported through implementation of VLAN Membership Policy Server client capability to provide flexibility in assigning ports to VLANs. Dynamic VLAN facilitates the fast assignment of IP addresses.

Redundancy and Resiliency

Cisco Catalyst 2960-X Series Switches offer a number of redundancy and resiliency features to prevent outages and help ensure that the network remains available:

- **Cross-stack EtherChannel** provides the ability to configure Cisco EtherChannel technology across different members of the stack for high resiliency.
- **Flexlink** provides link redundancy with convergence time less than 100 milliseconds.
- **IEEE 802.1s/w Rapid Spanning Tree Protocol (RSTP) and Multiple Spanning Tree Protocol (MSTP)** provide rapid spanning-tree convergence independent of spanning-tree timers and also offer the benefit of Layer 2 load balancing and distributed processing. Stacked units behave as a single spanning-tree node.
- **Per-VLAN Rapid Spanning Tree (PVRST+)** allows rapid spanning-tree reconvergence on a per-VLAN spanning-tree basis, without requiring the implementation of spanning-tree instances.
- **Cisco Hot Standby Router Protocol (HSRP)** is supported to create redundant, fail safe routing topologies in 2960-XR IP-Lite SKUs.
- **Switch-port auto-recovery (Error Disable)** automatically attempts to reactivate a link that is disabled because of a network error.
- **Power redundancy** with an optional second power supply on 2960-XR models, or with an external RPS on 2960-X models.

Enhanced Quality of Service

The Cisco Catalyst 2960-X Series Switches offers intelligent traffic management that keeps everything flowing smoothly. Flexible mechanisms for marking, classification, and scheduling deliver superior performance for data, voice, and video traffic, all at wire speed. Primary QoS features include:

- Up to **eight egress queues** per port (four on the 2960-X or when stacking the 2960-XR) and strict priority queuing so that the highest priority packets are serviced ahead of all other traffic.
- **Shaped Round Robin (SRR)** scheduling and **Weighted Tail Drop (WTD)** congestion avoidance.
- **Flow-based rate limiting** and up to 256 aggregate or individual policers per port.
- **802.1p class of service (CoS)** and **Differentiated Services Code Point (DSCP)** classification, with marking and reclassification on a per-packet basis by source and destination IP address, MAC address, or Layer 4 TCP/UDP port number.
- **Cross-stack QoS** to allow QoS to be configured across a stack of 2960-X series switches.
- **The Cisco committed information rate (CIR)** function provides bandwidth in increments as low as 8 Kbps.
- **Rate limiting** is provided based on source and destination IP address, source and destination MAC address, Layer 4 TCP/UDP information, or any combination of these fields, using QoS ACLs (IP ACLs or MAC ACLs), class maps, and policy maps.

Cisco FlexStack-Plus

Cisco FlexStack-Plus provides stacking of up to eight 2960-X switches with the optional FlexStack-Plus module ([Figure 2](#)).

The FlexStack-Plus module is hot swappable and can be added to any Cisco Catalyst 2960-X or Catalyst 2960-XR with a FlexStack-Plus slot. Switches connected to a stack will automatically upgrade to the stack's Cisco IOS Software version and transparently join the stack without additional intervention.

Cisco FlexStack-Plus and Cisco IOS Software offer true stacking, with all switches in a stack acting as a single switch unit. FlexStack-Plus provides a unified data plane, unified configuration, and single IP address for switch

management. The advantages of true stacking include lower total cost of ownership and higher availability through simplified management as well as cross-stack features including EtherChannel, SPAN, and FlexLink.

To provide investment protection, FlexStack-Plus is backwards-compatible with FlexStack. Cisco Catalyst 2960-X LAN Base switches equipped with a FlexStack-Plus module can be stacked with Catalyst 2960-S and 2960-SF LAN Base switches equipped with a FlexStack module (see [Table 5](#)).

Table 3. FlexStack and FlexStack Plus Supported Combinations

	2960-XR IP Lite	2960-X LAN Base	2960-S/SF LAN Base
2960-XR IP Lite	Yes	-	-
2960-X LAN Base	-	Yes	Yes
2960-S or 2960-SF LAN Base	-	Yes	Yes

Table 4. FlexStack-Plus Scalability and Performance

Stack Members	Stack Bandwidth	Stack Limit	Cisco IOS Feature Set
2960-XR IP Lite	80G	8	IOS IP Lite
2960-XLAN Base	80G	8	IOS LAN Base
2960-X LAN Base mixed with 2960-S/SF LAN Base	40G	4	IOS LAN Base

Figure 2. Cisco FlexStack-Plus Switch Stack



Power Supply

The Catalyst 2960-X switches comes with one fixed power-supply and options for an external redundant power supply source (RPS2300).

The Catalyst 2960-XR switches support dual redundant power supplies. The Catalyst 2960-XR ships with one power supply by default. The second power supply can be purchased at the time of ordering the switch or as a spare. These power supplies have in-built fans to provide cooling.

Figure 3. 2960-XR Family Power Supply



The following table shows the different power supplies available in these switches and the available PoE power.

Table 5. 2960-XR Default Power Supply Configurations

Models	Default Power Supply	Available PoE Power
WS-C2960XR-24TS-I WS-C2960XR-48TS-I WS-C2960XR-24TD-I WS-C2960XR-48TD-I	PWR-C2-250WAC	-
WS-C2960XR-24PD-I WS-C2960XR-48LPD-I WS-C2960XR-24PS-I WS-C2960XR-48LPS-I	PWR-C2-640WAC	370W
WS-C2960XR-48FPD-I WS-C2960XR-48FPS-I	PWR-C2-1025WAC	740W

Intelligent Power over Ethernet Plus

Cisco Catalyst 2960-Xseries switches support both IEEE 802.3af Power over Ethernet (PoE) and IEEE 802.3at PoE+ (up to 30W per port) to deliver lower total cost of ownership for deployments that incorporate Cisco IP phones, Cisco Aironet® wireless access points, or other standards-compliant PoE/PoE+ end devices. PoE removes the need to supply wall power to PoE-enabled devices and eliminates the cost of adding electrical cabling and circuits that would otherwise be necessary in IP phone and WLAN deployments.

The Catalyst 2960-X series PoE power allocation is dynamic and power mapping scale up to a maximum of 740W PoE+ power.

The 2960-XR switch configurations offer the additional benefit of dual redundant power supplies. If both power supplies are used, then the 2960-XR shares the load between the two power supplies for non stop power.

Table 6. 2960-X PoE and PoE+ Power Capacity

Switch Model	Maximum Number of PoE+ (IEEE 802.3at) Ports	Maximum Number of PoE (IEEE 802.3af) Ports	Available PoE Power (Single PS Source)
Cisco Catalyst 2960X-48FPD-L	24 ports up to 30W	48 ports up to 15.4W	740W
Cisco Catalyst 2960X-48LPD-L	12 ports up to 30W	24 ports up to 15.4W	370W
Cisco Catalyst 2960X-24PD-L	12 ports up to 30W	24 ports up to 15.4W	370W
Cisco Catalyst 2960X-48FPS-L	24 ports up to 30W	48 ports up to 15.4W	740W
Cisco Catalyst 2960X-48LPS-L	12 ports up to 30W	24 ports up to 15.4W	370W
Cisco Catalyst 2960X-24PS-L	12 ports up to 30W	24 ports up to 15.4W	370W
Cisco Catalyst 2960X-24PSQ-L	3 ports up to 15.4W	6 ports up to 15.4W	92W
Cisco Catalyst 2960XR-48FPD-I	24 ports up to 30W	48 ports up to 15.4W	740W
Cisco Catalyst 2960XR-48LPD-I	12 ports up to 30W	24 ports up to 15.4W	370W
Cisco Catalyst 2960XR-24PD-I	12 ports up to 30W	24 ports up to 15.4W	370W
Cisco Catalyst 2960XR-48FPS-I	24 ports up to 30W	48 ports up to 15.4W	740W
Cisco Catalyst 2960XR-48LPS-I	12 ports up to 30W	24 ports up to 15.4W	370W
Cisco Catalyst 2960XR-24PS-I	12 ports up to 30W	24 ports up to 15.4W	370W

* Intelligent power management allows flexible power allocation across all ports.

Table 7. 2960-XR Available PoE and Switch Power Capabilities with Different Combinations of Power Supplies

Primary Power Supply	Secondary Power Supply	Available Power for PoE+	Switch Power Redundancy	Available PoE Power When One PS fails
PWR-C2-250WAC	-	-	No	-
PWR-C2-250WAC	PWR-C2-250WAC	-	Yes	-
PWR-C2-640WAC	-	370W	No	-
PWR-C2-640WAC	PWR-C2-640WAC	370W	Yes	370W
PWR-C2-1025WAC	-	740W	No	-
PWR-C2-1025WAC	PWR-C2-1025WAC	740W	Yes	740W

Application Visibility

Catalyst 2960-X Series Switches support **NetFlow Lite**, which enables IT teams to understand the mix of traffic on their network and identify anomalies by capturing and recording specific packet flows. NetFlow Lite supports flexible sampling of the traffic, and exports flow data in the NetFlow Version 9 format for analysis on a wide range of Cisco and third-party collectors.

NetFlow Lite is included on all Catalyst 2960-X and 2960-XR LAN Base and IP Lite models.

Cisco Catalyst SmartOperations

Cisco Catalyst SmartOperations is a comprehensive set of capabilities that simplify LAN planning, deployment, monitoring, and troubleshooting. Deploying SmartOperations tools reduces the time and effort required to operate the network and lowers total cost of ownership (TCO).

- **Cisco Smart Install** services enable minimal-touch deployment by providing automated Cisco IOS Software image installation and configuration when new switches are connected to the network. This enables network administrators to remotely manage IOS image installs and upgrades.
- **Cisco Auto SmartPorts** services enable automatic configuration of switch ports as devices connect to the switch, with settings optimized for the device type resulting in zero-touch port-policy provisioning.
- **Cisco Auto QoS** is a service that automatic configuration of QoS that allows switch to manage QoS policies based on traffic types resulting in zero-touch traffic engineering.
- **Cisco Smart Troubleshooting** is an extensive array of diagnostic commands and system health checks within the switch, including Smart Call Home. The Cisco GOLD[®] (Generic Online Diagnostics) and Cisco online diagnostics on switches in live networks help predicting and detecting failures faster.

For more information about Cisco Catalyst SmartOperations, visit cisco.com/go/SmartOperations.

Operational Simplicity Features

- **Dynamic Host Configuration Protocol (DHCP)** autoconfiguration of multiple switches through a boot server eases switch deployment.
- **Stacking master configuration management** and Cisco FlexStack Plus technology helps ensure that all switches are automatically upgraded when the master switch receives a new software version. Automatic software version checking and updating help ensure that all stack members have the same software version.
- **Autonegotiation** on all ports automatically selects half- or full-duplex transmission mode to optimize bandwidth.

-
- **Dynamic Trunking Protocol (DTP)** facilitates dynamic trunk configuration across all switch ports.
 - **Port Aggregation Protocol (PAgP)** automates the creation of Cisco Fast EtherChannel[®] groups or Gigabit EtherChannel groups to link to another switch, router, or server.
 - **Link Aggregation Control Protocol (LACP)** allows the creation of Ethernet channeling with devices that conform to IEEE 802.3ad. This feature is similar to Cisco EtherChannel technology and PAgP.
 - **Automatic media-dependent interface crossover (MDIX)** automatically adjusts transmit and receive pairs if an incorrect cable type (crossover or straight-through) is installed.
 - **Unidirectional Link Detection Protocol (UDLD)** and Aggressive UDLD allow unidirectional links caused by incorrect fiber-optic wiring or port faults to be detected and disabled on fiber-optic interfaces.
 - **Switching Database Manager (SDM)** templates for access, routing, and VLAN deployment allow the administrator to easily maximize memory allocation to the desired features based on deployment-specific requirements.
 - **Local Proxy Address Resolution Protocol (ARP)** works in conjunction with Private VLAN Edge to minimize broadcasts and maximize available bandwidth.
 - **VLAN1 minimization** allows VLAN1 to be disabled on any individual VLAN trunk.
 - **Smart Multicast, with Cisco FlexStack-Plus technology**, allows the Cisco Catalyst 2960-X Series to offer greater efficiency and support for more multicast data streams such as video by putting each data packet onto the backplane only once.
 - **Internet Group Management Protocol (IGMP) Snooping** for IPv4 and IPv6 MLD v1 and v2 Snooping provide fast client joins and leaves of multicast streams and limit bandwidth-intensive video traffic to only the requestors.
 - **Multicast VLAN Registration (MVR)** continuously sends multicast streams in a multicast VLAN while isolating the streams from subscriber VLANs for bandwidth and security reasons.
 - **Per-port broadcast, multicast, and unicast storm control** prevents faulty end stations from degrading overall systems performance.
 - **Voice VLAN** simplifies telephony installations by keeping voice traffic on a separate VLAN for easier administration and troubleshooting.
 - **Cisco VLAN Trunking Protocol (VTP)** supports dynamic VLANs and dynamic trunk configuration across all switches.
 - **Remote Switch Port Analyzer (RSPAN)** allows administrators to remotely monitor ports in a Layer 2 switch network from any other switch in the same network.
 - For enhanced traffic management, monitoring, and analysis, the Embedded **Remote Monitoring (RMON)** software agent supports four RMON groups (history, statistics, alarms, and events).
 - **Layer 2 trace route** eases troubleshooting by identifying the physical path that a packet takes from source to destination.
 - **Trivial File Transfer Protocol (TFTP)** reduces the cost of administering software upgrades by downloading from a centralized location.
 - **Network Timing Protocol (NTP)** provides an accurate and consistent timestamp to all intranet switches.

Power Management

The 2960-X switches offer a range of industry leading features for effective energy efficiency and energy management.

Switch Hibernation Mode (SHM) is an industry first and available on all 2960-X series switches. This feature puts the switch in ultra low power mode during periods of non-operation such as nights or weekends. Switch Hibernation Mode on the 2960-X switches can be scheduled using EnergyWise compliant management software.

IEEE 802.3az EEE (Energy Efficient Ethernet) enables ports to dynamically sense idle periods between traffic bursts and quickly switch the interfaces into a low power idle mode, reducing power consumption.

Cisco EnergyWise policies can be used to control the power consumed by PoE-powered endpoints, desktop and data-center IT equipment, and a wide range of building infrastructure. EnergyWise technology is included on all Cisco Catalyst 2960-X Series Switches.

For more information about Cisco EnergyWise™, visit cisco.com/go/energywise.

Network Management

The Cisco Catalyst 2960-X Series Switches offer a superior CLI for detailed configuration and administration. 2960-X Series Switches are also supported in the full range of Cisco network management solutions.

Cisco Prime Infrastructure

Cisco Prime™ network management solutions provide comprehensive network lifecycle management. Cisco Prime Infrastructure provides an extensive library of easy-to-use features to automate the initial and day-to-day management of your Cisco network. Cisco Prime integrates hardware and software platform expertise and operational experience into a powerful set of workflow-driven configuration, monitoring, troubleshooting, reporting, and administrative tools.

For detailed information about Cisco Prime, visit cisco.com/go/prime.

Cisco Network Assistant

A Cisco network management application designed for small and medium-sized business (SMB) networks with up to 250 users that runs on PCs, Tablets and even SmartPhones, Cisco Network Assistant offers centralized network management and configuration capabilities. This application also features an intuitive GUI where users can easily apply common services across Cisco switches, routers, and access points.

For detailed information about Cisco Network Assistant, visit cisco.com/go/cna.

Security Management

Cisco Identity Services Engine (ISE) support enables the 2960-XR switches to offer security management for all devices connected to it.

Technical Specifications

Table 8. Cisco Catalyst 2960-X Series Hardware

Hardware Specifications	
Flash memory	128 MB for LAN Base & IP Lite SKUs, 64 MB for LAN Lite SKUs
DRAM	512 MB
CPU	APM86392 600MHz dual core
Console Ports	USB (Type-B), Ethernet (RJ-45)
Storage Interface	USB (Type-A) for external flash storage
Network Management Interface	10/100 Mbps Ethernet (RJ-45)

Table 9. Cisco Catalyst 2960-X Series Performance

Performance and Scalability			
	2960-X LAN Lite	2960-X LAN Base	2960-XR IP Lite
Forwarding bandwidth	50 Gbps	108 Gbps	108 Gbps
Switching bandwidth*	100 Gbps	216 Gbps	216 Gbps
Maximum active VLANs	64	1023	1023
VLAN IDs available	4096	4096	4096
Maximum transmission unit (MTU) - L3 packet	9198 bytes	9198 bytes	9198 bytes
Jumbo frame - Ethernet frame	9216 bytes	9216 bytes	9216 bytes

* Switching bandwidth is full-duplex capacity.

Table 10. Cisco Catalyst 2960-X Series Forwarding Performance

Forwarding Rate: 64-Byte L3 Packets	
Catalyst 2960-X Family	
Cisco Catalyst 2960X-48FPD-L	130.9 Mpps
Cisco Catalyst 2960X-48LPD-L	130.9 Mpps
Cisco Catalyst 2960X-24PD-L	95.2 Mpps
Cisco Catalyst 2960X-48TD-L	130.9 Mpps
Cisco Catalyst 2960X-24TD-L	95.2 Mpps
Cisco Catalyst 2960X-48FPS-L	107.1 Mpps
Cisco Catalyst 2960X-48LPS-L	107.1 Mpps
Cisco Catalyst 2960X-24PS-L	71.4 Mpps
Cisco Catalyst 2960X-24PSQ-L	71.4 Mpps
Cisco Catalyst 2960X-48TS-L	107.1 Mpps
Cisco Catalyst 2960X-24TS-L	71.4 Mpps
Cisco Catalyst 2960X-48TS-LL	104.2 Mpps
Cisco Catalyst 2960X-24TS-LL	68.5 Mpps
Catalyst 2960-XR Family	
Cisco Catalyst 2960XR-48FPD-I	130.9 Mpps
Cisco Catalyst 2960XR-48LPD-I	130.9 Mpps
Cisco Catalyst 2960XR-24PD-I	95.2 Mpps
Cisco Catalyst 2960XR-48TD-I	130.9 Mpps
Cisco Catalyst 2960XR-24TD-I	95.2 Mpps

Forwarding Rate: 64-Byte L3 Packets	
Cisco Catalyst 2960XR-48FPS-I	107.1 Mpps
Cisco Catalyst 2960XR-48LPS-I	107.1 Mpps
Cisco Catalyst 2960XR-24PS-I	71.4 Mpps
Cisco Catalyst 2960XR-48TS-I	107.1 Mpps
Cisco Catalyst 2960XR-24TS-I	71.4 Mpps

Table 11. Cisco Catalyst 2960-X Series Mechanical Specifications

Models		
Dimensions	Inches (H x D x W)	Centimeters (H x D x W)
WS-C2960X-48FPD-L	1.75 x 14.5 x 17.5	4.5 x 36.8 x 44.5
WS-C2960X-48LPD-L	1.75 x 14.5 x 17.5	4.5 x 36.8 x 44.5
WS-C2960X-48TD-L	1.75 x 11.0 x 17.5	4.5 x 27.9 x 44.5
WS-C2960X-24PD-L	1.75 x 14.5 x 17.5	4.5 x 36.8 x 44.5
WS-C2960X-24TD-L	1.75 x 11.0 x 17.5	4.5 x 27.9 x 44.5
WS-C2960X-48FPS-L	1.75 x 14.5 x 17.5	4.5 x 36.8 x 44.5
WS-C2960X-48LPS-L	1.75 x 14.5 x 17.5	4.5 x 36.8 x 44.5
WS-C2960X-48TS-L	1.75 x 11.0 x 17.5	4.5 x 27.9 x 44.5
WS-C2960X-24PS-L	1.75 x 14.5 x 17.5	4.5 x 36.8 x 44.5
WS-C2960X-24PSQ-L	1.75 x 14.5 x 17.5	4.5 x 36.8 x 44.5
WS-C2960X-24TS-L	1.75 x 11.0 x 17.5	4.5 x 27.9 x 44.5
WS-C2960X-48TS-LL	1.75 x 11.0 x 17.5	4.5 x 27.9 x 44.5
WS-C2960X-24TS-LL	1.75 x 11.0 x 17.5	4.5 x 27.9 x 44.5
Weights	Pounds	Kilograms
WS-C2960X-48FPD-L	12.9 lbs	5.8 Kg
WS-C2960X-48LPD-L	12.9 lbs	5.8 Kg
WS-C2960X-48TD-L	9.6 lbs	4.3 Kg
WS-C2960X-24PD-L	12.7 lbs	5.7 Kg
WS-C2960X-24TD-L	8.9 lbs	4.0 Kg
WS-C2960X-48FPS-L	12.9 lbs	5.8 Kg
WS-C2960X-48LPS-L	12.9 lbs	5.8 Kg
WS-C2960X-48TS-L	9.4 lbs	4.2 Kg
WS-C2960X-24PS-L	12.8 lbs	5.8 kg
WS-C2960X-24PSQ-L	12.8 lbs	5.8 kg
WS-C2960X-24TS-L	8.9 lbs	4.0 kg
WS-C2960X-48TS-LL	8.9 lbs	4.0kg
WS-C2960X-24TS-LL	8.2 lbs	3.7 kg

Table 12. Cisco Catalyst 2960-XR Series Mechanical Specifications

Models		
Dimensions	Inches (H x D x W)	Centimeters (H x D x W)
WS-C2960XR-48FPD-I	1.75 x 16.0 x 17.5	4.45 x 40.8 x 44.5
WS-C2960XR-48LPD-I	1.75 x 16.0 x 17.5	4.45 x 40.8 x 44.5
WS-C2960XR-48TD-I	1.75 x 16.0 x 17.5	4.45 x 40.8 x 44.5
WS-C2960XR-24PD-I	1.75 x 16.0 x 17.5	4.45 x 40.8 x 44.5
WS-C2960XR-24TD-I	1.75 x 16.0 x 17.5	4.45 x 40.8 x 44.5
WS-C2960XR-48FPS-I	1.75 x 16.0 x 17.5	4.45 x 40.8 x 44.5
WS-C2960XR-48LPS-I	1.75 x 16.0x 17.5	4.45 x 40.8 x 44.5
WS-C2960XR-48TS-I	1.75 x 16.0 x 17.5	4.45 x 40.8 x 44.5
WS-C2960XR-24PS-I	1.75 x 16.0 x 17.5	4.45 x 40.8 x 44.5
WS-C2960XR-24TS-I	1.75 x 16.0 x 17.5	4.45 x 40.8 x 44.5
Weights	Pounds	Kilograms
WS-C2960XR-48FPD-I	14.6	6.6
WS-C2960XR-48LPD-	14.0	6.4
WS-C2960XR-48TD-I	13.3	6.1
WS-C2960XR-24PD-I	13.6	6.2
WS-C2960XR-24TD-I	13.0	5.9
WS-C2960XR-48FPS-I	14.7	6.7
WS-C2960XR-48LPS-I	14.2	6.4
WS-C2960XR-48TS-I	13.2	6.0
WS-C2960XR-24PS-I	13.7	6.2
WS-C2960XR-24TS-I	13.0	5.9

Table 13. Cisco Catalyst 2960-X Series Environmental Specifications

Environmental Ranges		
	Fahrenheit	Centigrade
Operating temperature up to 5000 ft (1500 m)	23°F to 113°F	-5°C to 45°C
Operating temperature up to 10,000 ft (3000 m)	23°F to 104°F	-5°C to 40°C
Short-term exception at sea level*	23°F to 131°F	-5°C to 55°C
Short-term exception up to 5000 feet (1500 m)*	23°F to 122°F	-5°C to 50°C
Short-term exception up to 10,000 feet (3000 m)*	23°F to 113°F	-5°C to 45°C
Short-term exception up to 13,000 feet (4000 m)*	23° to 104°F	-5°C to 40°C
Storage temperature up to 15,000 feet (4573 m)	-13° to 158°F	-25° to 70°C
	Feet	Meters
Operating altitude	Up to 10,000	Up to 3000
Storage altitude	Up to 13,000	Up to 4000
Operating relative humidity	10% to 95% noncondensing	
Storage relative humidity	10% to 95% noncondensing	
Acoustic Noise		
<i>Measured per ISO 7779 and declared per ISO 9296.</i>		
<i>Bystander positions operating mode at 25°C ambient.</i>		

Environmental Ranges				
Model	Sound Pressure		Sound Power	
	LpA (Typical)	LpAD (Maximum)	LwA (Typical)	LwAD (Maximum)
Cisco Catalyst 2960X-48FPD-L	54dB	57dB	6.3B	6.6B
Cisco Catalyst 2960X-48LPD-L				
Cisco Catalyst 2960X-24PD-L				
Cisco Catalyst 2960X-48TD-L	40dB	43dB	4.9B	5.2B
Cisco Catalyst 2960X-24TD-L				
Cisco Catalyst 2960X-48FPS-L	54dB	57dB	6.3B	6.6B
Cisco Catalyst 2960X-48LPS-L				
Cisco Catalyst 2960X-24PS-L				
Cisco Catalyst 2960X-24PSQ-L	N/A	N/A	N/A	N/A
Cisco Catalyst 2960X-48TS-L	45dB	48dB	5.4B	5.7B
Cisco Catalyst 2960X-24TS-L				
Cisco Catalyst 2960X-48TS-LL	40dB	43dB	4.9B	5.2B
Cisco Catalyst 2960X-24TS-LL				
Cisco Catalyst 2960XR-48FPD-I	46dB	48dB	5.5B	5.7B
Cisco Catalyst 2960XR-48LPD-I	45dB	48dB	5.4B	5.7B
Cisco Catalyst 2960XR-24PD-I	45dB	48dB	5.4B	5.7B
Cisco Catalyst 2960XR-48TD-I	42dB	45dB	5.1B	5.4B
Cisco Catalyst 2960XR-24TD-I	42dB	45dB	5.1B	5.4B
Cisco Catalyst 2960XR-48FPS-I	46dB	48dB	5.5B	5.7B
Cisco Catalyst 2960XR-48LPS-I	45dB	48dB	5.4B	5.7B
Cisco Catalyst 2960XR-24PS-I	45dB	48dB	5.4B	5.7B
Cisco Catalyst 2960XR-48TS-I	42dB	45dB	5.1B	5.4B
Cisco Catalyst 2960XR-24TS-I	42dB	45dB	5.1B	5.4B
Predicted Reliability				
Model	MTBF in hours**			
Cisco Catalyst 2960X-48FPD-L	233,370			
Cisco Catalyst 2960X-48LPD-L	277,960			
Cisco Catalyst 2960X-24PD-L	325,780			
Cisco Catalyst 2960X-48TD-L	445,460			
Cisco Catalyst 2960X-24TD-L	569,520			
Cisco Catalyst 2960X-48FPS-L	232,610			
Cisco Catalyst 2960X-48LPS-L	276,870			
Cisco Catalyst 2960X-24PS-L	324,280			
Cisco Catalyst 2960X-24PSQ-L	462,680			
Cisco Catalyst 2960X-48TS-L	442,690			
Cisco Catalyst 2960X-24TS-L	564,910			
Cisco Catalyst 2960X-48TS-LL	476,560			
Cisco Catalyst 2960X-24TS-LL	622,350			
Cisco Catalyst 2960X-STACK	17,128,090			
Cisco Catalyst 2960XR-48FPD-I	231,590			
Cisco Catalyst 2960XR-48LPD-I	275,430			
Cisco Catalyst 2960XR-24PD-I	322,740			
Cisco Catalyst 2960XR-48TD-I	440,880			

Environmental Ranges	
Cisco Catalyst 2960XR-24TD-I	561,890
Cisco Catalyst 2960XR-48FPS-I	230,860
Cisco Catalyst 2960XR-48LPS-I	274,380
Cisco Catalyst 2960XR-24PS-I	321,290
Cisco Catalyst 2960XR-48TS-I	438,130
Cisco Catalyst 2960XR-24TS-I	557,320
Cisco PWR-C2-250WAC	1,000,000
Cisco PWR-C2-640WAC	1,000,000
Cisco PWR-C2-1025WAC	1,000,000

* Not more than the following in a 1-year period: 96 consecutive hours, or 360 hours total, or 15 occurrences.

** Currently estimates; Later will be Based on Telcordia SR-332 Issue 2 methodology.

Table 14. Connectors and Interfaces

Connectors and Interfaces
Ethernet Interfaces <ul style="list-style-type: none"> • 10BASE-T ports: RJ-45 connectors, 2-pair Category 3, 4, or 5 unshielded twisted-pair (UTP) cabling • 100BASE-TX ports: RJ-45 connectors, 2-pair Category 5 UTP cabling • 1000BASE-T ports: RJ-45 connectors, 4-pair Category 5 UTP cabling • 1000BASE-T SFP-based ports: RJ-45 connectors, 4-pair Category 5 UTP cabling
SFP and SFP+ Interfaces <p>For information about supported SFP/SFP+ modules, refer to the Transceiver Compatibility matrix tables at cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html.</p>
Indicator LEDs <ul style="list-style-type: none"> • Per-port status: Link integrity, disabled, activity, speed, and full duplex • System status: System, RPS, Stack link status, link duplex, PoE, and link speed
Stacking Interfaces <p>Cisco Catalyst 2960-XFlexStack-Plus stacking cables:</p> <ul style="list-style-type: none"> • CAB-STK-E-0.5M FlexStack-Plus stacking cable with a 0.5 m length • CAB-STK-E-1M FlexStack-Plus stacking cable with a 1.0 m length • CAB-STK-E-3M FlexStack-Plus stacking cable with a 3.0 m length
Console <p>Cisco Catalyst 2960-X console cables:</p> <ul style="list-style-type: none"> • CAB-CONSOLE-RJ45 Console cable 6 ft. with RJ-45 • CAB-CONSOLE-USB Console cable 6 ft. with USB Type A and mini-B connectors
Power <ul style="list-style-type: none"> • The internal power supply is an auto-ranging unit and supports input voltages between 100 and 240V AC • Use the supplied AC power cord to connect the AC power connector to an AC power outlet • The Cisco RPS connector offers connection for an optional Cisco RPS 2300 that uses AC input and supplies DC output to the switch • Only the Cisco RPS 2300 (model PWR-RPS2300) should be attached to the redundant-power-system receptacle

Table 15. Management and Standards Support

Category	Specification
Management	<ul style="list-style-type: none"> • BRIDGE-MIB • CISCO-CABLE-DIAG-MIB • CISCO-CDP-MIB • CISCO-CLUSTER-MIB • CISCO-CONFIG-COPY-MIB • CISCO-CONFIG-MAN-MIB • CISCO-DHCP-SNOOPING-MIB • CISCO-ENTITY-VENDORTYPE-OID-MIB • CISCO-ENVMON-MIB • CISCO-ERR-DISABLE-MIB • CISCO-FLASH-MIB • CISCO-FTP-CLIENT-MIB • CISCO-IGMP-FILTER-MIB • CISCO-IMAGE-MIB • CISCO-IP-STAT-MIB • CISCO-LAG-MIB • CISCO-MAC-NOTIFICATION-MIB • CISCO-MEMORY-POOL-MIB • CISCO-PAGP-MIB • CISCO-PING-MIB • CISCO-POE-EXTENSIONS-MIB • CISCO-PORT-QOS-MIB • CISCO-PORT-SECURITY-MIB • CISCO-PORT-STORM-CONTROL-MIB • CISCO-PRODUCTS-MIB • CISCO-PROCESS-MIB • CISCO-RTTMON-MIB • CISCO-SMI-MIB • CISCO-STP-EXTENSIONS-MIB • CISCO-SYSLOG-MIB • CISCO-TC-MIB • CISCO-TCP-MIB • CISCO-UDLD-MIB • CISCO-VLAN-IFTABLE • RELATIONSHIP-MIB • CISCO-VLAN-MEMBERSHIP-MIB • CISCO-VTP-MIB • ENTITY-MIB • ETHERLIKE-MIB • IEEE8021-PAE-MIB • IEEE8023-LAG-MIB • IF-MIB • INET-ADDRESS-MIB • OLD-CISCO-CHASSIS-MIB • OLD-CISCO-FLASH-MIB • OLD-CISCO-INTERFACES-MIB • OLD-CISCO-IP-MIB • OLD-CISCO-SYS-MIB • OLD-CISCO-TCP-MIB • OLD-CISCO-TS-MIB • RFC1213-MIB • RMON-MIB • RMON2-MIB • SNMP-FRAMEWORK-MIB • SNMP-MPD-MIB • SNMP-NOTIFICATION-MIB • SNMP-TARGET-MIB • SNMPv2-MIB • TCP-MIB • UDP-MIB • ePM MIB • CISCO-FLEXSTACK-PLUS-MIB (2960-X)
For an updated list of supported MIBs, refer to the MIB Locator at cisco.com/go/mibs .	
Standards	<ul style="list-style-type: none"> • IEEE 802.1D Spanning Tree Protocol • IEEE 802.1p CoS Prioritization • IEEE 802.1Q VLAN • IEEE 802.1s • IEEE 802.1w • IEEE 802.1X • IEEE 802.1ab (LLDP) • IEEE 802.3ad • IEEE 802.3af and IEEE 802.3at • IEEE 802.3ah (100BASE-X single/multimode fiber only) • IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports • IEEE 802.3 10BASE-T • IEEE 802.3u 100BASE-TX • IEEE 802.3ab 1000BASE-T • IEEE 802.3z 1000BASE-X • RMON I and II standards • SNMP v1, v2c, and v3 • IEEE 802.3az • IEEE 802.3ae 10Gigabit Ethernet • IEEE 802.1ax

Category	Specification
RFC compliance	<ul style="list-style-type: none"> • RFC 768 - UDP • RFC 783 - TFTP • RFC 791 - IP • RFC 792 - ICMP • RFC 793 - TCP • RFC 826 - ARP • RFC 854 - Telnet • RFC 951 - Bootstrap Protocol (BOOTP) • RFC 959 - FTP • RFC 1112 - IP Multicast and IGMP • RFC 1157 - SNMP v1 • RFC 1166 - IP Addresses • RFC 1256 - Internet Control Message Protocol (ICMP) Router Discovery • RFC 1305 - NTP • RFC 1492 - TACACS+ • RFC 1493 - Bridge MIB • RFC 1542 - BOOTP extensions • RFC 1643 - Ethernet Interface MIB • RFC 1757 - RMON <ul style="list-style-type: none"> • RFC 1901 - SNMP v2C • RFC 1902-1907 - SNMP v2 • RFC 1981 - Maximum Transmission Unit (MTU) Path Discovery IPv6 • RFC 2068 - HTTP • RFC 2131 - DHCP • RFC 2138 - RADIUS • RFC 2233 - IF MIB v3 • RFC 2373 - IPv6 Aggregatable Addr • RFC 2460 - IPv6 • RFC 2461 - IPv6 Neighbor Discovery • RFC 2462 - IPv6 Autoconfiguration • RFC 2463 - ICMP IPv6 • RFC 2474 - Differentiated Services (DiffServ) Precedence • RFC 2597 - Assured Forwarding • RFC 2598 - Expedited Forwarding • RFC 2571 - SNMP Management • RFC 3046 - DHCP Relay Agent Information Option • RFC 3376 - IGMP v3 • RFC 3580 - 802.1X RADIUS

Table 16. Voltage and Power Ratings

Input Voltage and Current			
Model	Voltage (Auto ranging)	Current	Frequency
Cisco Catalyst 2960X-48FPD-L	100 to 240 VAC	9A-4A	50 to 60Hz
Cisco Catalyst 2960X-48LPD-L		5A-2A	
Cisco Catalyst 2960X-24PD-L		5A-2A	
Cisco Catalyst 2960X-48TD-L		1A - 0.5A	
Cisco Catalyst 2960X-24TD-L		1A to 0.5A	
Cisco Catalyst 2960X-48FPS-L		9A - 4A	
Cisco Catalyst 2960X-48LPS-L		5A - 2A	
Cisco Catalyst 2960X-24PS-L		5A - 2A	
Cisco Catalyst 2960X-24PSQ-L		2A - 4A	
Cisco Catalyst 2960X-48TS-L		1A-0.5A	
Cisco Catalyst 2960X-24TS-L		1A - 0.5A	
Cisco Catalyst 2960X-48TS-LL		1A - 0.5A	
Cisco Catalyst 2960X-24TS-LL		1A - 0.5A	
Cisco Catalyst 2960XR-48FPD-I		100 to 240 VAC	
Cisco Catalyst 2960XR-48LPD-I	6A to 3 A		
Cisco Catalyst 2960XR-24PD-I	6A to 3 A		
Cisco Catalyst 2960XR-48TD-I	1A to 0.5 A		
Cisco Catalyst 2960XR-24TD-I	1A to 0.5 A		
Cisco Catalyst 2960XR-48FPS-I	10A to 5 A		
Cisco Catalyst 2960XR-48LPS-I	6A to 3 A		
Cisco Catalyst 2960XR-24PS-I	6A to 3 A		
Cisco Catalyst 2960XR-48TS-I	1A to 0.5 A		
Cisco Catalyst 2960XR-24TS-I	1A to 0.5 A		

Power Rating (Switch maximum consumption values)	
Cisco Catalyst 2960X-48FPD-L	0.89 kVA
Cisco Catalyst 2960X-48LPD-L	0.48 kVA
Cisco Catalyst 2960X-24PD-L	0.47 kVA
Cisco Catalyst 2960X-48TD-L	0.049 kVA
Cisco Catalyst 2960X-24TD-L	0.034 kVA
Cisco Catalyst 2960X-48FPS-L	0.89 kVA
Cisco Catalyst 2960X-48LPS-L	0.49 kVA
Cisco Catalyst 2960X-24PS-L	0.49 kVA
Cisco Catalyst 2960X-24PSQ-L	0.16 kVA
Cisco Catalyst 2960X-48TS-L	0.051 kVA
Cisco Catalyst 2960X-24TS-L	0.039 kVA
Cisco Catalyst 2960X-48TS-LL	0.46KVA
Cisco Catalyst 2960X-24TS-LL	0.035KVA
Cisco Catalyst 2960XR-48FPD-I	0.89KVA
Cisco Catalyst 2960XR-48LPD-I	0.48KVA
Cisco Catalyst 2960XR-24PD-I	0.46KVA
Cisco Catalyst 2960XR-48TD-I	0.047KVA
Cisco Catalyst 2960XR-24TD-I	0.039KVA
Cisco Catalyst 2960XR-48FPS-I	0.89KVA
Cisco Catalyst 2960XR-48LPS-I	0.47KVA
Cisco Catalyst 2960XR-24PS-I	0.46KVA
Cisco Catalyst 2960XR-48TS-I	0.046KVA
Cisco Catalyst 2960XR-24TS-I	0.038KVA

DC Input Voltages (RPS Input) - Only for 2960-X LAN Base Switches		
	12V	53V
Cisco Catalyst 2960X-48FPD-L	4A	15A
Cisco Catalyst 2960X-48LPD-L	4A	8A
Cisco Catalyst 2960X-24PD-L	3A	8A
Cisco Catalyst 2960X-48TD-L	4A	N/A
Cisco Catalyst 2960X-24TD-L	3A	N/A
Cisco Catalyst 2960X-48FPS-L	4A	15A
Cisco Catalyst 2960X-48LPS-L	4A	8A
Cisco Catalyst 2960X-24PS-L	3A	8A
Cisco Catalyst 2960X-24PSQ-L	N/A	N/A
Cisco Catalyst 2960X-48TS-L	5A	N/A
Cisco Catalyst 2960X-24TS-L	4A	N/A

Note: The wattage rating on the power supply does not represent actual power draw. It indicates the maximum power draw possible by the power supply. This rating can be used for facility capacity planning. For PoE switches, cooling requirements are smaller than total power draw as a significant portion of the load is dissipated in the endpoints.

Table 17. Power Consumption¹

Measured Power Consumption in Watts ²				
Model	0% Traffic ³	10% Traffic	100% Traffic	Weighted Average
Cisco Catalyst 2960X-48FPD-L	50.8	65.9	66.7	66.0
Cisco Catalyst 2960X-48LPD-L	45.7	61.1	62.0	61.2
Cisco Catalyst 2960X-24PD-L	44.7	52.3	53.1	52.3
Cisco Catalyst 2960X-48TD-L	32.9	47.0	47.8	47.1
Cisco Catalyst 2960X-24TD-L	24.9	32.2	33.1	32.3
Cisco Catalyst 2960X-48FPS-L	51.9	66.6	66.8	66.6
Cisco Catalyst 2960X-48LPS-L	46.7	60.8	61.1	60.9
Cisco Catalyst 2960X-24PS-L	41.4	49.0	49.2	49.0
Cisco Catalyst 2960X-24PSQ-L	28.5	32.8	34.8	33.0
Cisco Catalyst 2960X-48TS-L	34.9	49.5	49.7	49.5
Cisco Catalyst 2960X-24TS-L	28.0	36.8	37.1	36.9
Cisco Catalyst 2960X-48TS-LL	31.4	44.3	44.5	44.4
Cisco Catalyst 2960X-24TS-LL	25.2	32.0	32.0	32.0
Cisco Catalyst 2960XR-48FPD-I	46.7	61.8	62.5	61.9
Cisco Catalyst 2960XR-48LPD-I	40.7	54.6	55.9	54.8
Cisco Catalyst 2960XR-24PD-I	36.1	42.9	43.7	43.0
Cisco Catalyst 2960XR-48TD-I	29.7	44.7	45.6	44.8
Cisco Catalyst 2960XR-24TD-I	29.3	37.2	38.1	37.3
Cisco Catalyst 2960XR-48FPS-I	44.8	58.5	58.8	58.5
Cisco Catalyst 2960XR-48LPS-I	37.9	52.8	53.0	52.9
Cisco Catalyst 2960XR-24PS-I	36.5	43.2	43.4	43.2
Cisco Catalyst 2960XR-48TS-I	30.0	44.8	45.0	44.8
Cisco Catalyst 2960XR-24TS-I	28.8	36.0	36.2	36.0

Table 18. Safety and Compliance

Specification	Description
Safety	UL 60950-1 Second Edition CAN/CSA-C22.2 No. 60950-1 Second Edition EN 60950-1 Second Edition IEC 60950-1 Second Edition AS/NZS 60950-1
EMC - Emissions	47CFR Part 15 (CFR 47) Class A AS/NZS CISPR22 Class A CISPR22 Class A EN55022 Class A ICES003 Class A VCCI Class A EN61000-3-2 EN61000-3-3 KN22 Class A CNS13438 Class A

¹ Disclaimer: All power consumption numbers were measured under controlled laboratory conditions and are provided as estimates.

² ATIS Methodology

³ All Traffic measured with EEE enabled.

Specification	Description
EMC - Immunity	EN55024 CISPR24 EN300386 KN24
Environmental	Reduction of Hazardous Substances (RoHS) including Directive 2011/65/EU
Telco	Common Language Equipment Identifier (CLEI) code
US Government Certifications	USGv6 and IPv6 Ready Logo

Cisco Enhanced Limited Lifetime Hardware Warranty

Cisco Catalyst 2960-X Series Switches come with an enhanced limited lifetime warranty (E-LLW). The E-LLW provides the same terms as Cisco's standard limited lifetime warranty but adds next business day delivery of replacement hardware, where available, and 90 days of 8X5 Cisco Technical Assistance Center (TAC) support.

Your formal warranty statement, including the warranty applicable to Cisco software, appears in the Cisco information packet that accompanies your Cisco product. We encourage you to review carefully the warranty statement shipped with your specific product before use.

Cisco reserves the right to refund the purchase price as its exclusive warranty remedy. For further information about warranty terms, visit <http://www.cisco.com/go/warranty>.

Table 19. Warranty Terms

Cisco Enhanced Limited Lifetime Hardware Warranty	
Device covered	Applies to all Cisco Catalyst 2960-X Series Switches.
Warranty duration	As long as the original end user continues to own or use the product, provided that: fan and power supply warranty is limited to five (5) years.
End-of-life policy	In the event of discontinuance of product manufacture, Cisco warranty support is limited to five (5) years from the announcement of discontinuance.
Hardware replacement	Cisco or its service center will use commercially reasonable efforts to ship a Cisco Catalyst 2960-X replacement part for next business day delivery, where available. Otherwise, a replacement will be shipped within ten (10) working days after the receipt of the RMA request. Actual delivery times may vary depending on customer location.
Effective date	Hardware warranty commences from the date of shipment to customer (and in case of resale by a Cisco reseller, not more than ninety [90] days after original shipment by Cisco).
TAC support	Cisco will provide during customer's local business hours, 8 hours per day, 5 days per week basic configuration, diagnosis, and troubleshooting of device-level problems for up to 90 days from the date of shipment of the originally purchased Cisco Catalyst 2960-X product. This support does not include solution or network-level support beyond the specific device under consideration.
Cisco.com Access	Warranty allows guest access only to Cisco.com.

Software Policy

Customers with Cisco Catalyst IP Lite, LAN Base and LAN Lite software feature sets will be provided with maintenance updates and bug fixes designed to maintain the compliance of the software with published specifications, release notes, and industry standards compliance as long as the original end user continues to own or use the product or up to one year from the end-of-sale date for this product, whichever occurs earlier.

This policy supersedes any previous warranty or software statement and is subject to change without notice.

Technical Support and Services

Table 20. Technical Services Available for Cisco Catalyst 2960-X Series Switches

Technical Services
<p>Cisco SMARTnet Service</p> <ul style="list-style-type: none"> • Around-the-clock, global access to the Cisco TAC • Unrestricted access to the extensive Cisco.com knowledge base and tools • Next-business-day, 8x5x4, 24x7x4, or 24x7x2 advance hardware replacement and onsite parts replacement and installation available¹ • Ongoing operating system software updates within the licensed feature set² • Proactive diagnostics and real-time alerts on Smart Call Home enabled devices
<p>Cisco Smart Foundation Service</p> <ul style="list-style-type: none"> • Next-business-day advance hardware replacement as available • Access to SMB TAC during business hours (access levels vary by region) • Access to Cisco.com SMB knowledge base • Online technical resources through Smart Foundation Portal • Operating system software bug fixes and patches
<p>Cisco Smart Care Service</p> <ul style="list-style-type: none"> • Network-level coverage for the needs of small and medium-sized businesses • Proactive health checks and periodic assessments of Cisco network foundation, voice, and security technologies • Technical support for eligible Cisco hardware and software through Smart Care Portal • Cisco operating system and application software updates and upgrades² • Next-business-day advance hardware replacement as available, 24x7x4 option available¹
<p>Cisco SP Base Service</p> <ul style="list-style-type: none"> • Around-the-clock, global access to the Cisco TAC • Registered access to Cisco.com • Next-business-day, 8x5x4, 24x7x4, and 24x7x2 advance hardware replacement. Return to factory option available¹ • Ongoing operating system software updates²
<p>Cisco Focused Technical Support Services</p> <p>Three levels of premium, high-touch services are available:</p> <ul style="list-style-type: none"> • Cisco High-Touch Operations Management Service • Cisco High-Touch Technical Support Service • Cisco High-Touch Engineering Service <p>Valid Cisco SMARTnet or SP Base contracts are required on all network equipment</p>

¹ Advance hardware replacement is available in various service-level combinations. For example, 8x5xNBD indicates that shipment will be initiated during the standard 8-hour business day, 5 days a week (the generally accepted business days within the relevant region), with next-business-day (NBD) delivery. Where NBD is not available, same day shipping is provided. Restrictions apply; please review the appropriate service descriptions for details.

² Cisco operating system updates include the following: maintenance releases, minor updates, and major updates within the licensed feature set.

Ordering Information

Table 21. Cisco Catalyst 2960-X Series Switches Ordering Information

Part Number	10/100/1000 Ethernet Interfaces	Uplink Interfaces	Cisco IOS Software Feature Set	Available PoE Power	FlexStack-Plus Stacking
WS-C2960X-48FPD-L	48	2 SFP+	LAN Base	740W	Optional
WS-C2960X-48LPD-L	48	2 SFP+	LAN Base	370W	Optional
WS-C2960X-24PD-L	24	2 SFP+	LAN Base	370W	Optional
WS-C2960X-48TD-L	48	2 SFP+	LAN Base	-	Optional
WS-C2960X-24TD-L	24	2 SFP+	LAN Base	-	Optional
WS-C2960X-48FPS-L	48	4 SFP	LAN Base	740W	Optional

Part Number	10/100/1000 Ethernet Interfaces	Uplink Interfaces	Cisco IOS Software Feature Set	Available PoE Power	FlexStack-Plus Stacking
WS-C2960X-48LPS-L	48	4 SFP	LAN Base	370W	Optional
WS-C2960X-24PS-L	24	4 SFP	LAN Base	370W	Optional
WS-C2960X-24PSQ-L	24	2 SFP, 2 10/100/1000BT	LAN Base	92W	Optional
WS-C2960X-48TS-L	48	4 SFP	LAN Base	-	Optional
WS-C2960X-24TS-L	24	4 SFP	LAN Base	-	Optional
WS-C2960X-48TS-LL	48	2 SFP	LAN Lite	-	No
WS-C2960X-24TS-LL	24	2 SFP	LAN Lite	-	No

Table 22. Cisco Catalyst 2960-XR Configurations Ordering Information

Part Number	10/100/1000 Ethernet Interfaces	Uplink Interfaces	Cisco IOS Software Feature Set	Available PoE Power	Second FRU Power Supply Option	FlexStack-Plus Stacking
WS-C2960XR-48FPD-I	48	2 SFP+	IP Lite	740W	1025W	Optional
WS-C2960XR-48LPD-I	48	2 SFP+	IP Lite	370W	640W	Optional
WS-C2960XR-24PD-I	24	2 SFP+	IP Lite	370W	640W	Optional
WS-C2960XR-48TD-I	48	2 SFP+	IP Lite	-	250W	Optional
WS-C2960XR-24TD-I	24	2 SFP+	IP Lite	-	250W	Optional
WS-C2960XR-48FPS-I	48	4 SFP	IP Lite	740W	1025W	Optional
WS-C2960XR-48LPS-I	48	4 SFP	IP Lite	370W	640W	Optional
WS-C2960XR-24PS-I	24	4 SFP	IP Lite	370W	640W	Optional
WS-C2960XR-48TS-I	48	4 SFP	IP Lite	-	250W	Optional
WS-C2960XR-24TS-I	24	4 SFP	IP Lite	-	250W	Optional

Table 23. Cisco Catalyst 2960-X Accessories

Part Numbers	Description
C2960X-STACK	FlexStack-Plus hot-swappable stacking module
CAB-STK-E-0.5M	FlexStack-Plus stacking cable with a 0.5 m length
CAB-STK-E-1M	FlexStack-Plus stacking cable with a 1.0 m length
CAB-STK-E-3M	FlexStack-Plus stacking cable with a 3.0 m length
CAB-CONSOLE-RJ45	Console cable 6 feet with RJ45
CAB-CONSOLE-USB	Console cable 6 feet with USB Type A and mini-B connectors
PWR-CLP	Power cable restraining clip
RCKMNT-1RU-2KX=	Spare rack-mount kit for Cisco Catalyst 2960-X and 2960-XR Series for 19-inch racks
RCKMNT-REC-2KX=	1 RU recessed rack-mount kit for Cisco Catalyst 2960-X and 2960-XR Series

Table 24. Cisco Catalyst 2960-X Redundant Power Supply Options

Part Numbers	Description
PWR-RPS2300	Cisco Redundant Power System 2300 and blower, no power supply
BLNK-RPS2300=	Spare bay insert for Cisco Redundant Power System 2300 for Cisco Catalyst 2960 and Cisco Catalyst 2960-X switches
CAB-RPS2300-E=	Spare RPS2300 cable for Cisco Catalyst 2960-X switches
BLWR-RPS2300=	Spare 45 CFM blower for RPS 2300
C3K-PWR-750WAC=	RPS 2300 750W AC power supply spare for Cisco Catalyst 2960-X

For more information about the RPS-2300, visit cisco.com/en/US/products/ps7130/index.html.

Table 25. Cisco Catalyst 2960-XR Power Supply Options

Part Numbers	Description
PWR-C2-250WAC⁴	Second FRU power supply and fan for all non-PoE 2960-XR switches, provides 250W AC of power
PWR-C2-640WAC⁴	Second FRU power supply and fan for all 370W PoE+ 2960-XR switches, provides 640W AC of power
PWR-C2-1025WAC⁴	Second FRU power supply and fan for all 740W PoE+ 2960-XR switches, provides 1025W AC of power
PWR-C2-250WAC=	Spare FRU power supply and fan for all non-PoE 2960-XR switches, provides 250W AC of power
PWR-C2-640WAC=	Spare FRU power supply and fan for all 370W PoE+ 2960-XR switches, provides 640W AC of power
PWR-C2-1025WAC=	Spare FRU power supply and fan for all 740W PoE+ 2960-XR switches, provides 1025W AC of power

Table 26. Cisco Catalyst 2960-X and 2960-XR SFP/SFP+ Modules

SFP and SFP+ Modules
For the list of supported SFP and SFP+ modules, visit http://www.cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html .

Table 27. Power Cords for Cisco Catalyst 2960-X Product Family

Part Numbers	Description
CAB-16AWG-AC	AC power cord, 16AWG
CAB-ACE	AC power cord (Europe), C13, CEE 7, 1.5M
CAB-L620P-C13-US	Power cord, 250VAC, 15A, NEMA L6-20 to C13, US
CAB-ACI	AC power cord (Italy), C13, CEI 23-16, 2.5m
CAB-ACU	AC power cord (UK), C13, BS 1363, 2.5m
CAB-ACA	AC power cord (China/Australia), C13, AS 3112, 2.5m
CAB-ACS	AC power cord (Switzerland), C13, IEC 60884-1, 2.5m
CAB-ACR	AC power cord (Argentina), C13, EL 219 (IRAM 2073), 2.5m
CAB-ACC	CORD, PWR, CHINA, 10A, IEC 320, C13 (APN=CS-PWR-CH)
CAB-JPN-12A	CABASY, POWER CORD, JAPAN 2P, PSE, 12A @125VAC
CAB-L620P-C13-JPN	Power cord, 250VAC, 15A, NEMA L6-20 to C13, JAPAN
CAB-IND	Power cable for India
CAB-C15-ISR	Power cable for Israel
CAB-ACSA	Power cable for South Africa
CAB-AC15A-90L-US	15A AC power cord, left angle (United States)
CAB-ACE-RA	Power cord Europe, right angle
CAB-ACI-RA	Power cord Italian, right angle
CAB-ACU-RA	Power cord UK, right angle
CAB-ACC-RA	Power cord China, right angle
CAB-ACA-RA	Power cord, Australian, right angle
CAB-ACS-RA	Power cord for Switzerland, right angle
CAB-ACR-RA	Power cord, Argentina, right angle
CAB-JPN-RA	Power cord, Japan, right angle
CAB-C15-CBN	Cabinet jumper power cord, 250 VAC 13A, C14-C15 connectors

⁴ The first FRU power supply and fan module is configured automatically when the switch is ordered. The second redundant FRU power supply and fan module is an option while configuring the order.

Part Numbers	Description
CAB-ACBZ-12A	AC power cord (Brazil) 12A/125V BR-3-20 plug for less than 12A device

Table 28. Power Cords for Cisco Catalyst 2960-XR Product Family

Part Numbers	Description
CAB-3KX-AC	AC Power Cord for Catalyst 2960-XR (North America)
CAB-3KX-AC-AP	AC Power Cord for Catalyst 2960-XR (Australia)
CAB-3KX-AC-AR	AC Power Cord for Catalyst 2960-XR (Argentina)
CAB-3KX-AC-SW	AC Power Cord for Catalyst 2960-XR (Switzerland)
CAB-3KX-AC-UK	AC Power Cord for Catalyst 2960-XR (United Kingdom)
CAB-3KX-AC-JP	AC Power Cord for Catalyst 2960-XR (Japan)
CAB-3KX-AC-EU	AC Power Cord for Catalyst 2960-XR (Europe)
CAB-3KX-AC-IT	AC Power Cord for Catalyst 2960-XR (Italy)
CAB-3KX-AC-IN	AC Power Cord for Catalyst 2960-XR (India)
CAB-3KX-AC-CN	AC Power Cord for Catalyst 2960-XR (China)
CAB-3KX-AC-DN	AC Power Cord for Catalyst 2960-XR (Denmark)
CAB-3KX-AC-IS	AC Power Cord for Catalyst 2960-XR (Israel)
CAB-3KX-250VAC-JP	Japan 250V AC Power Cord
CAB-C15-CBN	Cabinet Jumper Power Cord, 250 VAC 13A, C14-C15 Connectors
CAB-ACBZ-10A	AC Power Cord (Brazil) 10A/250V BR-3-10 plug for <10A device
CAB-ACBZ-12A	AC Power Cord (Brazil) 12A/125V BR-3-20 plug for <12A device

Contact Cisco

For more information about Cisco products, contact:

- Phone: +1 800 553-NETS (6387)
- [Worldwide Product Support](#)
- Company Website: cisco.com



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Cisco Aironet 2600 Series Access Point



Industrial Design

- Sleek design with internal antennas, ideal for office environments
- Rugged metal housing and extended operating temperature, ideal for factories, warehouses, and other indoor industrial environments
- Versatile RF coverage with optional external antennas
- UL 2043 plenum-rated for above-ceiling installation options or suspended from drop ceilings

Cisco ClientLink 2.0™ Beamforming

- Faster mobile client connections
- Support for all client types without any client requirements or dependencies
- More efficient use of mobile device batteries
- Accelerates one-, two-, and three spatial stream devices

Cisco CleanAir™ Spectrum Intelligence

- Classifies over 20 different types of interference, including non-Wi-Fi interference, within 5 to 30 seconds
- Automatic remedial action and less manual intervention
- 24/7 monitoring with remote access reduces travel and speeds resolution
- Locates and visualizes interference and zone of impact
- Historic interference information for back-in-time analysis and faster problem solving
- Air Quality Index provides a snapshot of network performance and the impact of interference

Cisco VideoStream Technology

- Efficient multicast-to-unicast conversion
- Video call admission control to prevent oversubscription
- Queue prioritization to ensure best user experience for corporate videos
- Perfect 5.0 mean opinion scores (MOS scores) in testing
- Double the client session scalability of competitors



The new Cisco® Aironet® 2600 Series Access Point delivers the most advanced features in its class - with great performance, functionality, and reliability at a great price. The 802.11n based Aironet 2600 Series includes 3x4 MIMO, with three spatial streams, plus Cisco CleanAir™, ClientLink 2.0™, and VideoStream technologies, to help ensure an interference-free, high-speed wireless application experience. Second only to the Cisco Aironet 3600 Series in performance and features, the Aironet 2600 Series sets the new standard for enterprise wireless technology.

Designed with rapidly evolving mobility needs in mind, the Aironet 2600 Series access point is packed with more Bring Your Own Device (BYOD)-enhancing functionality than any other access point at its price point. The new Cisco Aironet 2600 Series sustains reliable connections at higher speeds farther from the access point than competing solutions resulting in more availability of 450-Mbps data rates. Optimized for consumer devices, the Aironet 2600 Series

accelerates client connections and consumes less mobile device battery power than competing solutions.

RF Excellence

The Cisco Aironet 2600 Series is ideal for enterprise networks of any size that need high-performance, secure, and reliable Wi-Fi connectivity for consumer devices, high-performance laptops, and specialized industry equipment such as point-of-sale devices and wireless medical equipment. Enterprise-class silicon and optimized radios deliver a robust mobility experience that includes:

- 802.11n with 3x4 multiple-input multiple-output (MIMO) technology with three spatial streams, which sustains 450-Mbps rates over a greater range for more capacity and reliability than competing access points.
- Cisco ClientLink 2.0 technology to improve downlink performance and range for all mobile devices, including one-, two-, and three- spatial stream devices on 802.11n, while improving battery life on mobile devices such as smartphones and tablets.
- Cisco CleanAir technology, which provides proactive, high-speed spectrum intelligence to combat performance problems due to wireless interference for a self-healing, self-optimized network.

All of these features help ensure the best possible end-user experience on the wireless network.

Cisco also offers the industry's broadest selection of [802.11n antennas](#) delivering optimal coverage for a variety of deployment scenarios.

Scalability

The Cisco Aironet 2600 Series is a component of the Cisco Unified Wireless Network, which can scale to up to 18,000 access points with full Layer 3 mobility across central or remote locations on the enterprise campus, in branch offices, and at remote sites. The Cisco Unified Wireless Network is the industry's most flexible, resilient, and scalable architecture delivering secure access to mobility services and applications, and offering the lowest total cost of ownership and investment protection by integrating seamlessly with the existing wired network.

Cisco Network Assistant

For quick and easy setup of your access points, [Cisco Network Assistant](#) provides a centralized network view with a user-friendly GUI that simplifies configuration, management and troubleshooting. Using Cisco Network Assistant you can easily discover and initialize your network of stand-alone access points.

Cisco Network Assistant is available free, and can be downloaded here: <http://www.cisco.com/go/cna>.

Product Specifications

Table 1 lists the product specifications for Cisco Aironet 2600 Series Access Points.

Table 1. Product Specifications for Cisco Aironet 2600 Series Access Points

Item	Specification
Part Numbers	The Cisco Aironet 2600i Access Point: Indoor environments with internal antennas <ul style="list-style-type: none">• AIR-CAP2602I-x-K9: Dual-band controller-based 802.11a/g/n• AIR-CAP2602I-xK910: Eco-pack (dual-band 802.11a/g/n) 10 quantity access points• AIR-SAP2602I-x-K9: Dual-band autonomous 802.11a/g/n• AIR-SAP2602I-x-K95: Eco-pack (dual-band 802.11a/g/n) 5 quantity access points The Cisco Aironet 2600e Access Point: Indoor, challenging environments with external antennas <ul style="list-style-type: none">• AIR-CAP2602E-x-K9: Dual-band controller-based 802.11a/g/n• AIR-CAP2602E-xK910: Eco-pack (dual-band 802.11a/g/n) 10 quantity access points• AIR-SAP2602E-x-K9: Dual-band autonomous 802.11a/g/n

Item	Specification																																																																																				
	<ul style="list-style-type: none"> AIR-SAP2602E-x-K95: Eco-pack (dual-band 802.11a/g/n) 5 quantity access points <p>Cisco SMARTnet® Service for the Cisco Aironet 2600i Access Point with internal and External antennas</p> <ul style="list-style-type: none"> CON-SNT-y - SMARTnet 8x5xNBD 2600i/e access point (dual-band 802.11 a/g/n) (e.g. CON-SNT-C262IE for AP2600 internal antenna for E Domain) <p>Cisco Wireless LAN Services</p> <ul style="list-style-type: none"> AS-WLAN-CNSLT - Cisco Wireless LAN Network Planning and Design Service AS-WLAN-CNSLT - Cisco Wireless LAN 802.11n Migration Service AS-WLAN-CNSLT - Cisco Wireless LAN Performance and Security Assessment Service <p>Regulatory Domains: (x = regulatory domain)</p> <p>Customers are responsible for verifying approval for use in their individual countries. To verify approval and to identify the regulatory domain that corresponds to a particular country, visit: http://www.cisco.com/go/aironet/compliance.</p> <p>Not all regulatory domains have been approved. As they are approved, the part numbers will be available on the Global Price List.</p>																																																																																				
Software	Cisco Unified Wireless Network Software Release 7.2.110 or later.																																																																																				
Supported Wireless LAN Controllers	<ul style="list-style-type: none"> Cisco 2500 Series, Cisco Wireless LAN Controller Module (WLCM) on Cisco Services Ready Engine (SRE) for Integrated Services Router Generation 2 (ISR G2), Cisco Wireless Services Module 2 (WiSM2), Cisco 5500 Series, Cisco Flex 7500 Series 																																																																																				
802.11n Version 2.0 (and Related) Capabilities	<ul style="list-style-type: none"> 3x4 multiple-input multiple-output (MIMO) with three spatial streams Maximal ratio combining (MRC) 802.11n and 802.11a/g beamforming 20- and 40-MHz channels PHY data rates up to 450 Mbps (40-MHz with 5 GHz) Packet aggregation: Aggregated MAC Protocol Data Unit (A-MPDU) (Tx/Rx), Aggregated MAC Protocol Service Unit (A-MSDU) (Tx/Rx) 802.11 dynamic frequency selection (DFS) Cyclic shift diversity (CSD) support 																																																																																				
Data Rates Supported	<p>802.11a: 6, 9, 12, 18, 24, 36, 48, and 54 Mbps</p> <p>802.11bg: 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, and 54 Mbps</p> <p>802.11n data rates (2.4 GHz¹ and 5 GHz):</p> <table border="1"> <thead> <tr> <th rowspan="2">MCS Index²</th> <th colspan="2">GI³ = 800ns</th> <th colspan="2">GI = 400ns</th> </tr> <tr> <th>20-MHz Rate (Mbps)</th> <th>40-MHz Rate (Mbps)</th> <th>20-MHz Rate (Mbps)</th> <th>40-MHz Rate (Mbps)</th> </tr> </thead> <tbody> <tr><td>0</td><td>6.5</td><td>13.5</td><td>7.2</td><td>15</td></tr> <tr><td>1</td><td>13</td><td>27</td><td>14.4</td><td>30</td></tr> <tr><td>2</td><td>19.5</td><td>40.5</td><td>21.7</td><td>45</td></tr> <tr><td>3</td><td>26</td><td>54</td><td>28.9</td><td>60</td></tr> <tr><td>4</td><td>39</td><td>81</td><td>43.3</td><td>90</td></tr> <tr><td>5</td><td>52</td><td>108</td><td>57.8</td><td>120</td></tr> <tr><td>6</td><td>58.5</td><td>121.5</td><td>65</td><td>135</td></tr> <tr><td>7</td><td>65</td><td>135</td><td>72.2</td><td>150</td></tr> <tr><td>8</td><td>13</td><td>27</td><td>14.4</td><td>30</td></tr> <tr><td>9</td><td>26</td><td>54</td><td>28.9</td><td>60</td></tr> <tr><td>10</td><td>39</td><td>81</td><td>43.3</td><td>90</td></tr> <tr><td>11</td><td>52</td><td>108</td><td>57.8</td><td>120</td></tr> <tr><td>12</td><td>78</td><td>162</td><td>86.7</td><td>180</td></tr> <tr><td>13</td><td>104</td><td>216</td><td>115.6</td><td>240</td></tr> <tr><td>14</td><td>117</td><td>243</td><td>130</td><td>270</td></tr> </tbody> </table>	MCS Index ²	GI ³ = 800ns		GI = 400ns		20-MHz Rate (Mbps)	40-MHz Rate (Mbps)	20-MHz Rate (Mbps)	40-MHz Rate (Mbps)	0	6.5	13.5	7.2	15	1	13	27	14.4	30	2	19.5	40.5	21.7	45	3	26	54	28.9	60	4	39	81	43.3	90	5	52	108	57.8	120	6	58.5	121.5	65	135	7	65	135	72.2	150	8	13	27	14.4	30	9	26	54	28.9	60	10	39	81	43.3	90	11	52	108	57.8	120	12	78	162	86.7	180	13	104	216	115.6	240	14	117	243	130	270
MCS Index ²	GI ³ = 800ns		GI = 400ns																																																																																		
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¹ 2.4 GHz: 2 GHz **does not** support 40 MHz.

² MCS Index: The Modulation and Coding Scheme (MCS) index determines the number of spatial streams, the modulation, the coding rate, and data rate values.

³ GI: A guard interval (GI) between symbols helps receivers overcome the effects of multipath delays.

Item	Specification				
	15	130	270	144.4	300
	16	19.5	40.5	21.7	45
	17	39	81	43.3	90
	18	58.5	121.5	65	135
	19	78	162	86.7	180
	20	117	243	130	270
	21	156	324	173.3	360
	22	175.5	364.5	195	405
	23	195	405	216.7	450
Frequency Band and 20-MHz Operating Channels	A (A regulatory domain - FCC): <ul style="list-style-type: none"> • 2.412 to 2.462 GHz; 11 channels • 5.180 to 5.320 GHz; 8 channels • 5.500 to 5.700 GHz, 8 channels (excludes 5.600 to 5.640 GHz) • 5.745 to 5.825 GHz; 5 channels C (C regulatory domain): <ul style="list-style-type: none"> • 2.412 to 2.472 GHz; 13 channels • 5.745 to 5.825 GHz; 5 channels E (E regulatory domain - ETSI): <ul style="list-style-type: none"> • 2.412 to 2.472 GHz; 13 channels • 5.180 to 5.320 GHz; 8 channels • 5.500 to 5.700 GHz, 8 channels (excludes 5.600 to 5.640 GHz) I (I regulatory domain): <ul style="list-style-type: none"> • 2.412 to 2.472 GHz, 13 channels • 5.180 to 5.320 GHz; 8 channels K (K regulatory domain): <ul style="list-style-type: none"> • 2.412 to 2.472 GHz; 13 channels • 5.180 to 5.320 GHz; 8 channels • 5.500 to 5.620 GHz, 7 channels • 5.745 to 5.805 GHz, 4 channels 		N (N regulatory domain - Non FCC): <ul style="list-style-type: none"> • 2.412 to 2.462 GHz; 11 channels • 5.180 to 5.320 GHz; 8 channels • 5.745 to 5.825 GHz; 5 channels Q (Q regulatory domain): <ul style="list-style-type: none"> • 2.412 to 2.472 GHz; 13 channels • 5.180 to 5.320 GHz; 8 channels • 5.500 to 5.700 GHz; 11 channels R (R regulatory domain): <ul style="list-style-type: none"> • 2.412 to 2.472 GHz; 13 channels • 5.180 to 5.320 GHz; 8 channels • 5.660 to 5.805 GHz, 7 channels S (S regulatory domain): <ul style="list-style-type: none"> • 2.412 to 2.472 GHz; 13 channels • 5.180 to 5.320 GHz; 8 channels • 5.500 to 5.700 GHz; 11 channels • 5.745 to 5.825 GHz; 5 channels T (T regulatory domain): <ul style="list-style-type: none"> • 2.412 to 2.462 GHz; 11 channels • 5.280 to 5.320 GHz; 3 channels • 5.500 to 5.700 GHz, 8 channels (excludes 5.600 to 5.640 GHz) • 5.745 to 5.825 GHz; 5 channels Z (Z regulatory domain): <ul style="list-style-type: none"> • 2.412 to 2.462 GHz; 11 channels • 5.180 to 5.320 GHz; 8 channels • 5.500 to 5.700 GHz, 8 channels (excludes 5.600 to 5.640 GHz) • 5.745 to 5.825 GHz; 5 channels 		
Note: Customers are responsible for verifying approval for use in their individual countries. To verify approval and to identify the regulatory domain that corresponds to a particular country, visit: http://www.cisco.com/go/aironet/compliance .					
Maximum Number of Nonoverlapping Channels	2.4 GHz <ul style="list-style-type: none"> • 802.11b/g: <ul style="list-style-type: none"> ◦ 20 MHz: 3 • 802.11n: <ul style="list-style-type: none"> ◦ 20 MHz: 3 		5 GHz <ul style="list-style-type: none"> • 802.11a: <ul style="list-style-type: none"> ◦ 20 MHz: 21 • 802.11n: <ul style="list-style-type: none"> ◦ 20 MHz: 21 ◦ 40 MHz: 9 		
Note: This varies by regulatory domain. Refer to the product documentation for specific details for each regulatory domain.					
Receive Sensitivity	<ul style="list-style-type: none"> • 802.11b (CCK) <ul style="list-style-type: none"> ◦ -100 dBm @ 1 Mb/s ◦ -99 dBm @ 2 Mb/s ◦ -92 dBm @ 5.5 Mb/s ◦ -88 dBm @ 11 Mb/s 	<ul style="list-style-type: none"> • 802.11g (non HT20) <ul style="list-style-type: none"> ◦ -91 dBm @ 6 Mb/s ◦ -91 dBm @ 9 Mb/s ◦ -91 dBm @ 12 Mb/s ◦ -90 dBm @ 18 Mb/s ◦ -87 dBm @ 24 Mb/s 	<ul style="list-style-type: none"> • 802.11a (non HT20) <ul style="list-style-type: none"> ◦ -92 dBm @ 6 Mb/s ◦ -92 dBm @ 9 Mb/s ◦ -92 dBm @ 12 Mb/s ◦ -92 dBm @ 18 Mb/s ◦ -89 dBm @ 24 Mb/s 		

Item	Specification		
		<ul style="list-style-type: none"> ◦ -85 dBm @ 36 Mb/s ◦ -80 dBm @ 48 Mb/s ◦ -78 dBm @ 54 Mb/s 	<ul style="list-style-type: none"> ◦ -86 dBm @ 36 Mb/s ◦ -81 dBm @ 48 Mb/s ◦ -79 dBm @ 54 Mb/s
	2.4-GHz <ul style="list-style-type: none"> ● 802.11n (HT20) <ul style="list-style-type: none"> ◦ -91 dBm @ MCS0 ◦ -90 dBm @ MCS1 ◦ -90 dBm @ MCS2 ◦ -88 dBm @ MCS3 ◦ -85 dBm @ MCS4 ◦ -80 dBm @ MCS5 ◦ -78 dBm @ MCS6 ◦ -75 dBm @ MCS7 ◦ -90 dBm @ MCS8 ◦ -90 dBm @ MCS9 ◦ -89 dBm @ MCS10 ◦ -86 dBm @ MCS11 ◦ -82 dBm @ MCS12 ◦ -78 dBm @ MCS13 ◦ -77 dBm @ MCS14 ◦ -75 dBm @ MCS15 ◦ -90 dBm @ MCS16 ◦ -89 dBm @ MCS17 ◦ -87 dBm @ MCS18 ◦ -84 dBm @ MCS19 ◦ -81 dBm @ MCS20 ◦ -76 dBm @ MCS21 ◦ -75 dBm @ MCS22 ◦ -74 dBm @ MCS23 	5-GHz <ul style="list-style-type: none"> ● 802.11n (HT20) <ul style="list-style-type: none"> ◦ -92 dBm @ MCS0 ◦ -91 dBm @ MCS1 ◦ -90 dBm @ MCS2 ◦ -87 dBm @ MCS3 ◦ -84 dBm @ MCS4 ◦ -80 dBm @ MCS5 ◦ -78 dBm @ MCS6 ◦ -75 dBm @ MCS7 ◦ -92 dBm @ MCS8 ◦ -90 dBm @ MCS9 ◦ -88 dBm @ MCS10 ◦ -85 dBm @ MCS11 ◦ -81 dBm @ MCS12 ◦ -77 dBm @ MCS13 ◦ -76 dBm @ MCS14 ◦ -74 dBm @ MCS15 ◦ -91 dBm @ MCS16 ◦ -89 dBm @ MCS17 ◦ -86 dBm @ MCS18 ◦ -83 dBm @ MCS19 ◦ -80 dBm @ MCS20 ◦ -75 dBm @ MCS21 ◦ -74 dBm @ MCS22 ◦ -73 dBm @ MCS23 	5-GHz <ul style="list-style-type: none"> ● 802.11n (HT40) <ul style="list-style-type: none"> ◦ -89 dBm @ MCS0 ◦ -88 dBm @ MCS1 ◦ -87 dBm @ MCS2 ◦ -84 dBm @ MCS3 ◦ -81 dBm @ MCS4 ◦ -76 dBm @ MCS5 ◦ -74 dBm @ MCS6 ◦ -73 dBm @ MCS7 ◦ -89 dBm @ MCS8 ◦ -87 dBm @ MCS9 ◦ -85 dBm @ MCS10 ◦ -81 dBm @ MCS11 ◦ -78 dBm @ MCS12 ◦ -74 dBm @ MCS13 ◦ -72 dBm @ MCS14 ◦ -71 dBm @ MCS15 ◦ -88 dBm @ MCS16 ◦ -85 dBm @ MCS17 ◦ -83 dBm @ MCS18 ◦ -79 dBm @ MCS19 ◦ -76 dBm @ MCS20 ◦ -72 dBm @ MCS21 ◦ -70 dBm @ MCS22 ◦ -69 dBm @ MCS23
Maximum Transmit Power	2.4 GHz <ul style="list-style-type: none"> ● 802.11b <ul style="list-style-type: none"> ◦ 22 dBm: 3 Antennas ● 802.11g <ul style="list-style-type: none"> ◦ 22 dBm: 3 Antennas ● 802.11n (HT20) <ul style="list-style-type: none"> ◦ 22 dBm: 3 Antennas 	5 GHz <ul style="list-style-type: none"> ● 802.11a <ul style="list-style-type: none"> ◦ 23 dBm: 4 Antennas ● 802.11n (HT20) <ul style="list-style-type: none"> ◦ 23 dBm: 4 Antennas ● 802.11n (HT40) <ul style="list-style-type: none"> ◦ 23 dBm: 4 Antennas 	
<p>Note: The maximum power setting will vary by channel and according to individual country regulations. Refer to the product documentation for specific details.</p>			
Available Transmit Power Settings	2.4 GHz <ul style="list-style-type: none"> ● 22 dBm (160 mW) ● 19 dBm (80 mW) ● 16 dBm (40 mW) ● 13 dBm (20 mW) ● 10 dBm (10 mW) ● 7 dBm (5 mW) ● 4 dBm (2.5 mW) 	5 GHz <ul style="list-style-type: none"> ● 23 dBm (200 mW) ● 20 dBm (100 mW) ● 17 dBm (50 mW) ● 14 dBm (25 mW) ● 11 dBm (12.5 mW) ● 8 dBm (6.25 mW) ● 5 dBm (3.13 mW) 	
<p>Note: The maximum power setting will vary by channel and according to individual country regulations. Refer to the product documentation for specific details.</p>			
Integrated Antenna	<ul style="list-style-type: none"> ● 2.4 GHz, Gain 4 dBi, internal omnidirectional, horizontal beamwidth 360° ● 5 GHz, Gain 4 dBi, internal omnidirectional, horizontal beamwidth 360° 		
External Antenna (Sold Separately)	<ul style="list-style-type: none"> ● Certified for use with antenna gains up to 6 dBi (2.4 GHz and 5 GHz) ● Cisco offers the industry's broadest selection of 802.11n antennas delivering optimal coverage for a variety of deployment scenarios 		

Item	Specification
Interfaces	<ul style="list-style-type: none"> • 10/100/1000BASE-T autosensing (RJ-45) • Management console port (RJ-45)
Indicators	<ul style="list-style-type: none"> • Status LED indicates boot loader status, association status, operating status, boot loader warnings, boot loader errors
Dimensions (W x L x H)	<ul style="list-style-type: none"> • Access point (without mounting bracket): 8.69x8.69x2.11 in. (22.1x22.1x5.4)
Weight	<ul style="list-style-type: none"> • 2.3 lbs (1.04 kg) (2.7 lbs for external)
Environmental	<p>Cisco Aironet 2600i</p> <ul style="list-style-type: none"> • Nonoperating (storage) temperature: -22 to 158°F (-30 to 70°C) • Nonoperating (storage) Altitude Test 25°C, 15,000 ft. • Operating temperature: 32 to 104°F (0 to 40°C) • Operating humidity: 10 to 90% percent (noncondensing) • Operating Altitude Test: 40°C, 9843 ft. <p>Cisco Aironet 2600e</p> <ul style="list-style-type: none"> • Nonoperating (storage) temperature: -22 to 158°F (-30 to 70°C) • Nonoperating (storage) Altitude Test: 25°C, 15,000 ft. • Operating temperature: -4 to 131°F (-20 to 55°C) • Operating humidity: 10 to 90 % (noncondensing) • Operating Altitude Test: 40°C, 9843 ft.
System Memory	<ul style="list-style-type: none"> • 256 MB DRAM • 32 MB flash
Input Power Requirements	<ul style="list-style-type: none"> • AP2600: 44 to 57 VDC • Power Supply and Power Injector: 100 to 240 VAC; 50 to 60 Hz
Powering Options	<ul style="list-style-type: none"> • 802.3af Ethernet Switch • Cisco AP2600 Power Injectors (AIR-PWRINJ4=) • Cisco AP2600 Local Power Supply (AIR-PWR-B=)
Power Draw	<ul style="list-style-type: none"> • AP2600: 12.95W <p>Note: When deployed using Power over Ethernet (PoE), the power drawn from the power sourcing equipment will be higher by some amount depending on the length of the interconnecting cable. This additional power may be as high as 2.45W, bringing the total system power draw (access point + cabling) to 15.4W.</p>
Warranty	Limited Lifetime Hardware Warranty
Compliance Standards	<ul style="list-style-type: none"> ◦ UL 60950-1 ◦ CAN/CSA-C22.2 No. 60950-1 ◦ UL 2043 ◦ IEC 60950-1 ◦ EN 60950-1 ◦ EN 50155 • Radio approvals: <ul style="list-style-type: none"> ◦ FCC Part 15.247, 15.407 ◦ RSS-210 (Canada) ◦ EN 300.328, EN 301.893 (Europe) ◦ ARIB-STD 66 (Japan) ◦ ARIB-STD T71 (Japan) ◦ EMI and susceptibility (Class B) ◦ FCC Part 15.107 and 15.109 ◦ ICES-003 (Canada) ◦ VCCI (Japan) ◦ EN 301.489-1 and -17 (Europe) ◦ EN 60601-1-2 EMC requirements for the Medical Directive 93/42/EEC • IEEE Standard: <ul style="list-style-type: none"> ◦ IEEE 802.11a/b/g, IEEE 802.11n, IEEE 802.11h, IEEE 802.11d • Security: <ul style="list-style-type: none"> ◦ 802.11i, Wi-Fi Protected Access 2 (WPA2), WPA ◦ 802.1X ◦ Advanced Encryption Standards (AES), Temporal Key Integrity Protocol (TKIP)

Item	Specification
	<ul style="list-style-type: none"> • EAP Type(s): <ul style="list-style-type: none"> ◦ Extensible Authentication Protocol-Transport Layer Security (EAP-TLS) ◦ EAP-Tunneled TLS (TTLS) or Microsoft Challenge Handshake Authentication Protocol Version 2 (MSCHAPv2) ◦ Protected EAP (PEAP) v0 or EAP-MSCHAPv2 ◦ Extensible Authentication Protocol-Flexible Authentication via Secure Tunneling (EAP-FAST) ◦ PEAPv1 or EAP-Generic Token Card (GTC) ◦ EAP-Subscriber Identity Module (SIM) • Multimedia: <ul style="list-style-type: none"> ◦ Wi-Fi Multimedia (WMM™) • Other: <ul style="list-style-type: none"> ◦ FCC Bulletin OET-65C ◦ RSS-102

Limited Lifetime Hardware Warranty

The Cisco Aironet 2600 Series Access Point comes with a Limited Lifetime Warranty that provides full warranty coverage of the hardware for as long as the original end user continues to own or use the product. The warranty includes 10-day advance hardware replacement and ensures that software media is defect-free for 90 days. For more details, visit: <http://www.cisco.com/go/warranty>.

Cisco Wireless LAN Services

Realize the full business value of your technology investments faster with intelligent, customized services from Cisco and our partners. Backed by deep networking expertise and a broad ecosystem of partners, Cisco Wireless LAN Services enable you to deploy a sound, scalable mobility network that enables rich media collaboration while improving the operational efficiency gained from a converged wired and wireless network infrastructure based on the Cisco Unified Wireless Network. Together with partners, we offer expert plan, build, and run services to accelerate your transition to advanced mobility services while continuously optimizing the performance, reliability, and security of that architecture after it is deployed. For more details, visit:

<http://www.cisco.com/go/wirelesslanservices>.

For More Information

For more information about the Cisco Aironet 2600 Series, visit <http://www.cisco.com/go/wireless> or contact your local account representative.



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Cisco Mobility Services Engine Data Sheet

Overview

Ten billion mobile devices will be in use by 2016.¹ People love their smartphones, tablets, and other devices, and they want to stay connected at home, at work, and on the go. This gives you a great opportunity to engage customers and visitors with an exciting, innovative mobile experience. But how can you provide the dependable, high-quality access people want and create unique, revenue-generating services, yet keep your network safe and manageable? The Cisco® Mobility Services Engine (MSE) makes it easy to roll out new Wi-Fi-based solutions and services - safely and securely. This flexible platform gives you a centralized, scalable way to deliver rich mobility services:

- Get deeper network insight. Base Location services capture and bring together key network information such as device location, RF spectrum details, and sources of RF interference. They also let you support a rich set of real-time location services (RTLS).
- Give people the mobile experience they want with location-based services. Cisco Connected Mobile Experiences (CMX) lets enterprises and service providers deliver customized location-based mobile services to people in retail stores, hospitals, hotels, and other environments. You can offer a personalized mobile experience at the right time and the right place - and understand users better with onsite, online, and social analytics.
- Keep wireless users and your network safe. Cisco Wireless Intrusion Prevention System (wIPS) helps protect the network from wireless threats, rogue wireless devices, and denial-of-service (DoS) attacks. It provides the tools you need to strengthen security and improve compliance.

Product Benefits

The Cisco MSE with Base Location, CMX, and wIPS lets companies of all kinds unlock the benefits of mobility (Table 1).

Table 1. MSE Benefits

Industry	Solution
Retail	<ul style="list-style-type: none"> • Engage shoppers with compelling mobile services such as retail apps with way-finding services • Stop “showrooming” and close more sales with context-sensitive web-based campaigns • Track online, onsite, and social customer trends and identify high-value shoppers • Help meet Payment Card Industry (PCI) requirements
Healthcare	<ul style="list-style-type: none"> • Increase patient satisfaction with way-finding apps and mobile location services • Track equipment anywhere with connected medical devices • Help meet Health Insurance Portability and Accountability Act (HIPAA) requirements
Transportation	<ul style="list-style-type: none"> • Understand aggregate traveler trends and serve them better through planning and efficiency with tracking and location analytics • Captivate passengers with augmented reality applications such as interactive maps and way-finding services
Hospitality	<ul style="list-style-type: none"> • Improve the guest experience with business-friendly, highly secure Wi-Fi, location-based visitor services, and other engaging hospitality offerings • Learn more about guests with location and social analytics, for better planning and efficiency

Technology Overview

Designed as an open platform, the Cisco MSE supports mobility services software with a modular approach. So you can set up options based on your network topology or the types of services you offer. But the true value of the MSE is delivered through its support for mobility services applications. Table 2 provides an overview of the APIs, services, and platforms available.

Table 2. Mobility Services Overview

Feature	Benefits
Mobility Services API	<ul style="list-style-type: none"> Lets developers create location-based applications and services
Services	<p>Base Location license</p> <ul style="list-style-type: none"> Track and locate interferers, rogues, Wi-Fi clients, and RF tags Detect presence and receive geo-fenced or zone-based alerts Show systemwide interferer details and correlation Visualize interferer zone of impact Develop custom applications with open location API w/IPS Discover and stop security penetration and DoS attacks <p>Connected Mobile Experiences (CMX) license</p> <ul style="list-style-type: none"> Manage visitors and increase brand presence with location-aware onboarding and visitor management Engage customers through location-enabled mobile web and social campaigns Analyze online, onsite, and social customer behavior Develop and measure targeted, location-based web campaigns
Platform	<ul style="list-style-type: none"> Physical appliance Virtual appliance

Cisco Base Location License: Advanced Spectrum Services

Cisco CleanAir® technology makes it easy to monitor and manage your network's RF conditions. The Cisco MSE extends CleanAir's capabilities (Table 3).

Table 3. CleanAir with MSE Offers

	CleanAir Access Points with Wireless LAN Controller (WLC)	CleanAir Access Points with WLC and MSE
Detect, classify, and mitigate interferers	Yes	Yes
Provide systemwide interferer and event correlation	No	Yes
Perform zone-of-impact analysis	No	Yes
Locate interferers on a map	No	Yes

Cisco Base Location License: Real-Time Location Services (RTLS)

The Cisco MSE provides presence detection and real-time location tracking, including track and trace of rogue devices, interferers, Wi-Fi clients, smartphones, and RFID tags.

Cisco Base Location License: Mobility Services API

The Mobility Services API with support for representational state transfer (REST) and Simple Object Access Protocol (SOAP)/XML enables customers and partners to tightly integrate MSE location information into applications, such as location-aware equipment tracking, guest access, device-based services, browser-based services, mobile apps, online and onsite analytics, social analytics, and ads and offers.

Cisco Connected Mobile Experiences: Advanced Business Platform for Wi-Fi Services

CMX uses location data to create detailed business analytics and customer engagement applications, including:

- **CMX Connect:** This location-enabled captive portal enables you to create a custom onboarding and landing experience for your customers and better understand visitor behavior while in the venue. Web or social authentication enables easy onboarding to the Wi-Fi network.
- **CMX Analytics:** Onsite analytics show you how, where, and when customers and visitors are moving throughout a venue. Online analytics shows you top visited websites and metrics for online mobile promotions. Social analytics deliver valuable insight into your customer base through demographic data from users who check in, such as age, gender, city (origin), and language.
- **CMX Browser Engage:** Revolutionize the mobile experience with location and context-aware mobile browser marketing capabilities. Customers and visitors can benefit from nearby services, indoor navigation, targeted promotions, and other informational services just by using their mobile device browser.
- **CMX Dashboard:** This location services management tool enables organizations to build and measure context-aware, targeted marketing campaigns. They can view authentications, browser campaign adoption (click-throughs) by particular zones, device types, top websites visited per zone, and more.
- **CMX for Facebook Wi-Fi** allows organizations to extend a seamless Wi-Fi sign-on experience to guests and analyze their in-venue behavior using the Cisco and Facebook Wi-Fi platforms. It uses a software connector to enable end users to authenticate to the Cisco Wi-Fi network and automatically “check-in” to the venue’s Facebook profile to increase brand recognition. Solution benefits include:
 - Increased brand exposure through automated Facebook venue check-in with news feed streaming and increased rankings for the Graph Search and Nearby Facebook features.
 - Ability to gain valuable insight into your customer base through demographic data from users who check in.
 - Ability to deliver targeted advertisements to users who check in and to increase conversion with venue relevancy and social context.

Table 4 provides a detailed comparison of the features offered with the Base Location and CMX licenses.

Table 4. MSE Licenses Comparison

Feature	Base Location License	CMX License
Advanced spectrum, location tracking, presence detection, API	Yes	Yes
CMX Connect, Analytics, Browser Engage, Dashboard, Facebook Wi-Fi	No	Yes

Cisco WIPS

Adding more devices to the network means new compliance concerns and unknown risks. The Cisco WIPS monitors, mitigates, and reports malicious activity on the wireless network, including rogue access points, security penetration attacks, and DoS threats. It helps you reduce liability, protect your reputation, and stay in regulatory compliance. Part of the WIPS solution is available through the wireless LAN controller (WLC). Add the MSE for more features and value.

Table 5 compares the capabilities of the WLC and the WLC plus MSE.

Table 5. Cisco wIPS Comparison

Feature	Base wIPS (WLC)	MSE wIPS (WLC plus MSE)
Rogue access point and ad hoc rogue detection, classification, location tracking, and containment	Yes	Yes
Switch port tracing and disabling	Yes	Yes
DoS attack identification and classification	No	Yes
Wireless intrusion attack identification and classification	No	Yes
Active attack mitigation	No	Yes

MSE Product Specifications

Table 6 provides the specifications of the physical Cisco MSE appliance. Table 7 provides the specifications of the virtual MSE.

Table 6. Cisco MSE Product Specifications (Physical Appliance)

Feature	Cisco MSE 3355
Supported services	<ul style="list-style-type: none"> • Base Location license: 2500 access points • CMX license: 2500 access points • wIPS license: 5000 monitor mode or enhanced local mode (ELM) access points • Maximum number of tracked devices: 25,000 (regardless of number of access point licenses) • Separate MSE appliance is recommended for running wIPS
Evaluation support	MSE: Physical or virtual appliance ships with the following evaluation licenses: <ul style="list-style-type: none"> • Base Location: 100 access points • CMX: 100 access points • wIPS: 20 monitor mode or enhanced local mode access points
Processor	2 quad-core Intel® Nehalem processors, 2.0 GHz, 4-MB cache
Memory	16-GB DDR3 (two 8 GB)
Hard disk	Four hot-swappable 146-GB SAS drives with up to 6-Gbps transfer rate
Removable media	DVD-RO drive
Ports	<ul style="list-style-type: none"> • Four USB ports: Two in front, two in back • Two VGA ports: One in front and one in back • One RJ-45 management port for out-of-band management • RJ-45: Two rear RJ-45 connectors for connection to two Gigabit Ethernet network adapters
Connectivity	Network: Two embedded multifunction Gigabit Ethernet network adapters with TCP/IP offload engine
Management	SNMP v1, v2c, and v3
Management interface	Cisco Prime™ Infrastructure
Network devices	<ul style="list-style-type: none"> • All WLCs • All 802.11n access points
System specifications	<ul style="list-style-type: none"> • Number of MSEs per Prime Infrastructure: 20
Programming interfaces	REST and SOAP/XML APIs
Form factor	1 rack unit (1RU)
Physical dimensions	<ul style="list-style-type: none"> • Height: 1.69 in. (43 mm) • Width: 17.3 in. (440 mm) • Depth: 28.0 in. (711.4 mm) • Weight: 28 (minimum) to 35.1 lb (maximum) (12.7 to 15.9 kg)

Feature	Cisco MSE 3355
Power	<ul style="list-style-type: none"> • AC power supply wattage: 625W • AC power supply voltage: 100 to 120V at 50 to 60 Hz; 200 to 240V at 50 to 60 Hz • 92% efficient • Autoswitching, hot-swappable • Redundant power supplies
Cooling fans	Total of six fans, 3+3 redundant configuration
Environmental	<ul style="list-style-type: none"> • Operating temperature: <ul style="list-style-type: none"> ◦ 50° to 95°F (10° to 35°C) up to 3000 ft (914.4 m) ◦ 50° to 90°F (10° to 32°C) 3000 to 7000 ft (914.4 to 2133 m) • Non-operating temperature: <ul style="list-style-type: none"> ◦ -40° to 140°F (-40° to 60°C) ◦ Maximum rate of change is 36°F/hr (20°C/hr) • v air temperature, server on: <ul style="list-style-type: none"> ◦ 50° to 95°F (10° to 35°C) ◦ Altitude: 3000 ft (0 to 914.4 m), decrease system temperature by 1.0°C (1.8°F) for every 1000-foot (304.8 m) increase in altitude • v air temperature, server off: <ul style="list-style-type: none"> ◦ 41° to 113°F (5° to 45°C) ◦ Maximum altitude: 10,000 ft (3048 m) • Shipment: <ul style="list-style-type: none"> ◦ -40° to 140°F (-40° to 60°C) ◦ Maximum altitude: 10,000 ft (3048 m) • v humidity, server on: <ul style="list-style-type: none"> ◦ 20% to 80% ◦ Maximum dewpoint: 70°F (21°C) ◦ Maximum rate of change: 9°F/hr (5°C/hr) • v humidity, server off: <ul style="list-style-type: none"> ◦ 8% to 80% ◦ Maximum dewpoint: 81°F (27°C)
Approvals and compliance	<ul style="list-style-type: none"> • Safety UL 60950 • CAN/CSA -C22.2 No. 60950 • EN60950 • IEC 60950: EMC FCC Part 15 (CFR 47) Class A • ICES-003 Class A • EN 55022 Class A • CISPR22 Class A • AS/NZS 3548 Class A • VCCI Class A • EN 55024 • EN 50082-1 • Energy Star compliant

All listed server resources should be reserved/dedicated for the virtual machine running the MSE virtual appliance. For hard drive configuration, a thick configuration should be used.

All listed specs are minimum requirements.

Table 7. Cisco MSE Virtual Appliance Product Specifications

Feature	Cisco MSE Virtual Appliance
VMware ESXi version (virtual appliance on a customer-supplied server)	VMware ESXi/ESX version 4.1 or 5.0
Minimum server requirements	Cisco MSE High-End Virtual Appliance <ul style="list-style-type: none"> • Base Location license: 5000 access points • CMX license: 5000 access points • wIPS license: 10,000 access points • Maximum number of tracked devices: 50,000 (regardless of number of access point licenses) • Minimum RAM: 24 GB • Minimum hard disk space allocation: 500 GB with SAS drivers and 1600 I/O operations per second (IOPS) • Processors: 16 vCPUs at 2.0 GHz or faster and a passmark (cpubenchmark.net) no less than 4000 • Cisco UCS® ref: Cisco UCS C240 M3 Rack Server or C460 M2 High-Performance Rack Server
	Cisco MSE Standard Virtual Appliance <ul style="list-style-type: none"> • Base Location license: 2500 access points • CMX license: 2500 access points • wIPS license: 5000 access points • Maximum number of tracked devices: 25,000 (regardless of number of access point licenses) • Minimum RAM: 16 GB • Minimum hard disk space allocation: 500 GB with SAS drivers and 1000 IOPS • Processors: 8 vCPUs at 2.0 GHz or faster and a passmark (cpubenchmark.net) no less than 4000 • Cisco UCS ref: Cisco UCS C240 M3 Rack Server
	Cisco MSE Low-End Virtual Appliance <ul style="list-style-type: none"> • Base Location license: 200 access points • CMX license: Does not support CMX license • wIPS license: 2000 access points • Maximum number of tracked devices: 2000 (regardless of number of access point licenses) • Minimum RAM: 8 GB • Minimum hard disk space allocation: 250 GB with SAS drives and 900 IOPS • Processors: 4 vCPUs at 2.0 GHz or faster and a passmark (cpubenchmark.net) no less than 4000

MSE Virtual Appliance Reference Hardware Configurations

Table 8. Reference Hardware Configurations

	MSE Low-End Virtual Appliance	MSE Standard Virtual Appliance	MSE High-End Virtual Appliance
Processor	UCS-CPU-E5-2609 (qty 1)	UCS-CPU-E5-2660 (qty 1)	UCS-CPU-E5-2660 (qty 2)
RAM	UCS-MR-1X082RX-A (qty 1) - 8 GB	UCS-MR-1X082RX-A (qty 2) - 16 GB	UCS-MR-1X041RX-A (qty 4) - 24 GB
Disk	UCS-HDD300G12F208 (qty 2, in RAID 1 config)	UCS-HDD300G12F208 (qty 4, in RAID 10 config)	UCS-HDD300G12F208 (qty 4, in RAID 10 config)
RAID	UCS-RAID-9266CV	UCS-RAID-9266CV	UCS-RAID-9266CV
Example Cisco Unified Computing System™ (Cisco UCS) configurations that match the minimum requirements:			
	UCSC-C240-M3L UCS C240 M3 LFF w/o CPU, mem, HD, PCIe, PSU w/ rail kit, expdr	UCSC-C240-M3L UCS C240 M3 LFF w/o CPU,mem, HD, PCIe,PSU w/ rail kit, expdr	UCSC-C240-M3L UCS C240 M3 LFF w/o CPU,mem, HD, PCIe, PSU w/ rail kit, expdr
	UCS-CPU-E5-2609 2.4 GHz E5-2609/80W 4C/10MB Cache/DDR3 1066MHz	UCS-CPU-E5-2660 2.20 GHz E5-2660/95W 8C/20MB Cache/DDR3 1600MHz	UCS-CPU-E5-2660 2.20 GHz E5-2660/95W 8C/20MB Cache/DDR3 1600MHz
	UCS-MR-1X082RX-A 8GB DDR3-1333-MHz RDIMM/PC3-10600/2R/1.35v	UCS-MR-1X082RX-A 8GB DDR3-1333-MHz RDIMM/PC3-10600/2R/1.35v	UCS-MR-1X041RX-A 4GB DDR3-1333-MHz RDIMM/PC3-10600/1R/1.35v

	MSE Low-End Virtual Appliance	MSE Standard Virtual Appliance	MSE High-End Virtual Appliance
	UCS-HDD300GI2F208 300GB SAS 15K RPM 3.5 inch HDD/hot plug/drive sled mounted	UCS-HDD300GI2F208 300GB SAS 15K RPM 3.5 inch HDD/hot plug/drive sled mounted	UCS-HDD300GI2F208 300GB SAS 15K RPM 3.5 inch HDD/hot plug/drive sled mounted
	UCS-RAID-9266CV MegaRAID 9266CV-8i w/TFM + Super Cap	UCS-RAID-9266CV MegaRAID 9266CV-8i w/TFM + Super Cap	UCS-RAID-9266CV MegaRAID 9266CV-8i w/TFM + Super Cap
	UCSC-PSU-650W 650W power supply for C-Series rack servers	UCSC-PSU-650W 650W power supply for C-Series rack servers	UCSC-PSU-650W 650W power supply for C-Series rack servers
	R2XX-DMYPWRCORD No power cord option	R2XX-DMYPWRCORD No power cord option	R2XX-DMYPWRCORD No power cord option

CMX for Facebook Wi-Fi Product Specifications

1. All listed server resources should be reserved/dedicated for the virtual machine running the virtual instance of CMX for Facebook Wi-Fi. For hard drive configuration a thick configuration should be used.
2. All listed specs are minimum requirements.
3. CMX for Facebook Wi-Fi will be provided as a single OVA file.
4. One VM running a CMX for Facebook Wi-Fi instance is required per location or store, as Facebook social analytics are tied to a physical location.
5. CMX for Facebook Wi-Fi needs a Cisco IOS[®] Software router configured for Policy-Based Routing (PBR) to redirect guest Wi-Fi traffic. PBR performance varies depending on the router model.
6. CMX for Facebook Wi-Fi can run centrally if guest Internet breakouts are from the data center, or alternately, it can run on the Cisco UCS E-Series blades on branch office Cisco ISR G2 routers in a distributed fashion if Internet breakouts are local.

Table 9. Cisco CMX for Facebook Wi-Fi Product Specifications

Feature	Cisco MSE Virtual Appliance for CMX for Facebook Wi-Fi
VMware ESXi version (virtual appliance on a customer-supplied server)	VMware ESXi version 4.1 or 5.0 or 5.1
Minimum server requirements	<ul style="list-style-type: none"> • Minimum RAM: 4GB • Minimum hard disk space allocation: 250 GB with SAS drivers and 900 IOPS • Processors: 4 vCPUs at 1.0 GHz or faster and a passmark (cpubenchmark.net) no less than 4000

For More Information

- To learn more about how the Cisco MSE can help you unleash the potential of mobility, visit <http://www.cisco.com/go/mse>.
- For more information about Cisco Connected Mobile Experiences, visit <http://www.cisco.com/go/cmxe>.




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