Cisco Enhanced EtherSwitch Service Modules for Cisco 2900 and 3900 Series Routers

Cisco® Enhanced EtherSwitch® Service Modules can reduce your company's total cost of ownership by integrating Gigabit Ethernet (GE) and Fast Ethernet (FE) switch ports within Cisco 3900 and 2900 Series Integrated Services Routers. This integration allows network administrators to manage a single device using Cisco management tools orthe router command-line interface (CLI) for LAN and WAN management needs. This approach reduces network complexity, lowers maintenance contract costs, lessens staff training needs, simplifies software qualification efforts, increases availability, and delivers a consistent user experience at branch offices and headquarters.

Product Overview

The Cisco Enhanced EtherSwitch Service Modules (Figure 1) greatly expands the router's capabilities by integrating industry-leading Layer 2 and Layer 3 switching with feature sets identical to those found in the Cisco Catalyst® 3560-E and Catalyst 2960 Series Switches. The new Cisco Enhanced EtherSwitch Service Modules are the first modules to take advantage of the increased capabilities on the Cisco 3900 and 2900 Series Integrated Services Routers. Additionally, these service modules enable Cisco's industry-leading power initiatives, Cisco EnergyWise®, Cisco Enhanced Power over Ethernet (ePoE), and per-port PoE power monitoring—all of which enhance the ability of the branch office to scale to next-generation requirements and still meet important initiatives for IT teams to operate a power efficient network. Furthermore, the Cisco Enhanced EtherSwitch Service Modules not only perform local line-rate switching and routing but also support direct service module-to-service module communication through the Integrated Services Router Generation 2 multigigabit fabric (MGF) which separates LAN traffic from WAN resources.

Figure 1. Cisco Enhanced EtherSwitch Service Modules

Cisco Enhanced EtherSwitch Service Module Types

Two types of Cisco Enhanced EtherSwitch Service Modules are available (Table 1): Entry Level (ES2) and Advanced (ES3).

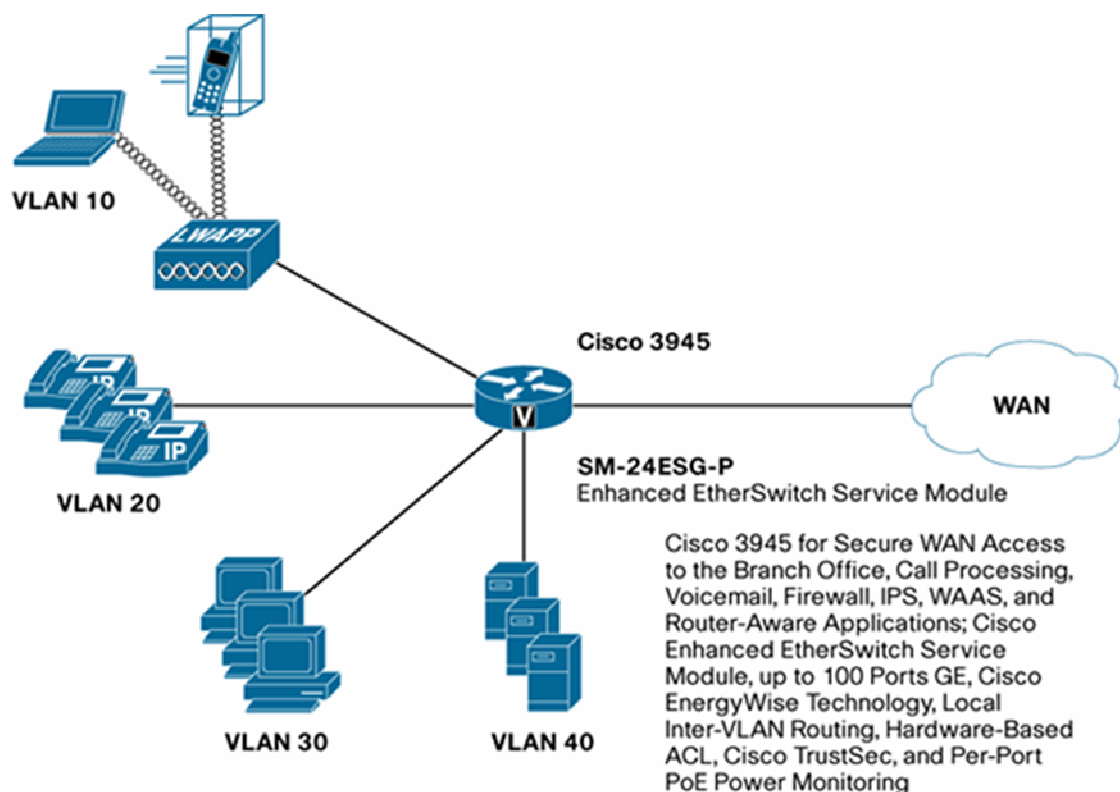**Table 1.** Entry-Level and Advanced Cisco Enhanced EtherSwitch Service Modules

Cisco Enhanced EtherSwitch Service Module	Description
Cisco ES3 Enhanced EtherSwitch Service Module	- Best-of-class Ethernet switching - High-density Gigabit Ethernet support - Layer 2/3 switching in hardware - Multicast routing - IPv6 routing, and access control list (ACL) in hardware - Full feature parity with the Cisco Catalyst 3560-E IP Base and IP Services Universal images - IP Base feature set, which includes advanced quality of service (QoS), a suite of security features, rate limiting, ACLs, basic static and Routing Information Protocol (RIP) routing capability, and Hot Standby Router Protocol (HSRP) - The IP Services feature set provides a richer set of enterprise-class features, including advanced hardware-based IP Unicast and IP Multicast routing; Enhanced Interior Gateway Routing Protocol (EIGRP), Open Shortest Path First (OSPF), Border Gateway Protocol (BGP), Protocol Independent Multicast (PIM), and IPv6 routing; OSPFv3; EIGRPv6; IP Service-Level Agreement (IPSLA) packet monitoring; Cisco Port Security; and Virtual Route Forwarding Lite (VRF Lite) - Cisco EnergyWise technology, an innovative architecture that promotes companywide sustainability by reducing energy consumption across an entire corporate infrastructure; Cisco EnergyWise technology can help your company measure the power consumption of network infrastructure and network-attached devices and manage power consumption with specific policies, reducing power consumption to realize increased cost savings; potentially any powered device is affected - Power over Ethernet; up to 1014 watts per chassis on a Cisco 3900 Series router - Cisco Enhanced PoE (ePoE), up to 20 watts per port - IEEE 802.3af PoE support, up to 15.4 watts per port - Cisco pre-standard PoE
Cisco ES2 Enhanced EtherSwitch Service Module	- Entry-level, lower-cost solution - Layer 2 switching in hardware - Full feature parity with the Cisco Catalyst 2960 LAN Base image - Cisco EnergyWise - Power over Ethernet; up to 1014 watts per chassis on Cisco 3900 Series router - IEEE 802.3af PoE support, up to 15.4 watts per port - Cisco pre-standard PoE

Secure Network Connectivity for Data, Voice, and Video

When inserted within a Cisco 2900 or 3900 Series Integrated Services Router, such as the Cisco 3945 (Figure 2), the Cisco Enhanced EtherSwitch Service Modules provide a fully integrated, secure networking and converged IP communications solution. From a single platform with an integrated switch, you can connect IP phones, wireless access points, and IP-based video cameras to your network and power them using the IEEE 802.3af, Cisco ePoE, or Cisco pre-standard PoE. With the optional integration of Cisco Unified Communications Manager Express, the router can also provide call-processing for the phones. As users attempt network access through the Cisco Enhanced EtherSwitch Service Module, the module can use IEEE 802.1x and a large number of Cisco 802.1x extensions to validate the credentials of the end device and place the user in the appropriate VLAN or Cisco TrustSec group. As the end-user data leaves the LAN, the router can encrypt the traffic and place it on a multitude of VPNs, securing communications between branch offices and central sites.

This high degree of convergence simplifies the network architecture and allows for cost-effective deployment of advanced services at the branch-office level. Furthermore, because the Cisco Enhanced EtherSwitch Service Modules support the same feature sets as the Cisco Catalyst 2960 and Catalyst 3560-E Switches, you can provide a ubiquitous configuration at headquarters and at the branch office to create a consistent experience throughout your network.

Figure 2. Cisco EtherSwitch Service Module with a Cisco 3945 Integrated Services Router

Features and Benefits

Architecture Features and Benefits

The Cisco Enhanced EtherSwitch Service Module helps ensure maximum availability, high performance, ease of upgrade, and expandability. The modules have their own processors, switching engines, and flash memory that run independently of host router resources, helping ensure maximum concurrent switching and routing performance as well as providing integrated PoE, security, and increased ease of management. Additionally, Cisco Enhanced EtherSwitch Service Modules run their own Cisco IOS® Software, independent of the router Cisco IOS Software image, allowing for easy upgrades and ongoing software and feature commonality with Cisco Catalyst 2960 and Catalyst 3560-E Series Switches. Table 2 lists some of the features and benefits of this architecture.

Table 2.   Cisco Enhanced EtherSwitch Service Module Addresses Customer Needs

Customer Needs	How Addressed by Cisco Enhanced EtherSwitch Service Module
Green IT	
• Cisco EnergyWise technology • Single power supply for Cisco EtherSwitch device and router	• Cisco EnergyWise technology helps enable Cisco EtherSwitch devices to automatically reduce off-peak use of PoE. • The modules offer two to eight times lower power consumption than standalone switches. • Because no additional rack space or power supply is needed, there is less to rack, stack, and cool.
Total Cost of Ownership (TCO)	
• Scaling network infrastructure across multiple sites • Increasing costs of operating multiple devices at the branch office • Maximizing IT resources	• An integrated switch solution lowers operations costs, simplifies troubleshooting, and enables businesses to scale. • Cisco Catalyst 2960 and Catalyst 3560-E software parity enables IT to certify and deploy the same services at the main office and branch office. • The modules offer lower mean time to repair (MTTR). One vendor means one support center to decrease troubleshooting time and eliminate finger pointing among vendors. • Cisco SMARTnet® support covers both integrated services routers and Cisco EtherSwitch devices.
Investment Protection	
• Ensuring compatibility of your network with future networks to deliver leading technology	• The Cisco Enhanced EtherSwitch Service Module and Cisco Catalyst 2960 and Catalyst 3560-E features, schedule, and roadmap are aligned to provide a consistent user experience and to ensure no new hardware is required to support the latest innovations.
High Availability	
• Minimizing downtime that affects business operations	• Cisco Enhanced EtherSwitch Service Modules run their own Cisco IOS Software images and can be upgraded independent of the host router image. • A single-box solution simplifies remote management and improves services interoperability to help ensure the highest reliability for all users. • End-to-end testing for standards-based and innovative Cisco proprietary features provides superior services interoperability and excellent value. • The modules offer optional redundant power supplies, including an integrated redundant power system (RPS) on the Cisco 3900 Series and external RPS 2300 support on the Cisco 2911 through Cisco 2951 Integrated Services Routers. • Fewer components (for example, power supplies and fans) results in fewer failures and less downtime. • Mean time between failure (MTBF) is at least two times higher than that for a standalone switch.
Scalability with High-Performance IP Routing for the LAN (ES3)	
• Isolation of LAN traffic and route between VLANs on the Cisco Enhanced EtherSwitch Service Module	• Cisco Express Forwarding hardware routing architecture delivers extremely high-performance IP routing and promotes scalability. • The modules offer inter-VLAN IP routing with full local Layer 3 switching between two or more VLANs. • Traffic can be forwarded between service modules over the MGF without affecting the router CPU.

Cisco EnergyWise Technology

Cisco EnergyWise technology is an innovative architecture added to a large number of Cisco Catalyst switches, the Cisco 2900 and 3900 Series Integrated Services Routers, and the Cisco ES2 and ES3 Enhanced EtherSwitch Service Modules to promote companywide sustainability by reducing energy consumption across an entire network infrastructure.

Cisco EnergyWise technology encompasses a highly intelligent network-based approach to communicate messages that measure and control energy between network devices and endpoints. The network discovers Cisco EnergyWise manageable devices, monitors their power consumption, and takes action based on business rules to reduce power consumption. The technology uses an innovative domain-naming system to query and summarize information from large sets of devices, making it simpler than traditional network management capabilities. The management interfaces of this technology allow facilities and network management applications to communicate with endpoints and each other using the network as a unifying fabric. The management interface uses standard Simple Network Management Protocol (SNMP) or Secure Sockets Layer (SSL) to integrate Cisco and third-party management systems.

Cisco EnergyWise technology extends the network as a platform for the power control plane for gathering, managing, and reducing power consumption of all devices, resulting in companywide optimized power delivery and reduced energy costs.

Advanced PoE Support

Although Power over Ethernet (PoE) has been employed for more than a decade, it is still an evolving technology. New and innovative applications continue to raise expectations for power requirements. The Cisco Enhanced EtherSwitch Service Modules are the first EtherSwitch modules to take advantage of the increased power capabilities of the Cisco 2900 and 3900 Series routers. Table 3 gives information about total PoE power output. Depending on the Cisco 2900 and 3900 Series router model, the available PoE power ranges from 200 to 1014 watts. The Cisco Enhanced EtherSwitch Service Module supports not only IEEE 802.1af (15.4 watts), but also Cisco ePoE (20 watts, ES3 only) as well as Cisco pre-standard PoE. The support of both new and old power levels demonstrates Cisco's commitment to protection of your initial investment while planning for the future. Additional PoE features include:

- Per-port power consumption control allows you to specify a maximum power setting on an individual port.
- Per-port PoE power sensing measures the actual power being drawn, enabling more intelligent control of powered devices.
- The Cisco PoE MIBs provide proactive visibility into power usage and allow you to set different power-level thresholds.
- Cisco Discovery Protocol Version 2 allows the Cisco Enhanced EtherSwitch Service Modules to negotiate a more granular power setting than IEEE classification provides when connecting to a Cisco powered device such as IP phones or access points.
- The Link Layer Discovery Protocol Media Endpoint Discovery (LLDP-MED) link layer discovery protocol and MIB enable interoperability in multivendor networks. Switches exchange speed, duplex, and power settings with end devices such as IP phones.

Power over Ethernet requires the PoE versions of the router power supplies. The Cisco 2900 and 3900 Series routers support multiple PoE powering modes:

- **Normal:** One PoE power supply
- **Redundant:** Two PoE internal power supplies (Cisco 3925 and 3945) or one PoE power supply plus an external Cisco RPS 2300 Redundant Power Supply Unit (Cisco 2911, 2921, and 2951), where one is active and one is standby
- **Boost:** Two PoE internal power supplies (Cisco 3925 and 3945) or one PoE power supply plus an external Cisco RPS2300 (Cisco 2900), where both are actively supplying PoE power

Table 3.   Power Output

Router	Normal PoE with Single POE Power Supply (Watts)	Maximum Number of Ports Running at 15.4W in Normal Mode	Maximum Number of Ports Running at 20W in Normal Mode	Maximum Power with Dual POE Supplies in Boost Mode (Watts)	Maximum Number of Ports Running at 15.4W in Boost Mode	Maximum Number of Ports Running at 20W in Boost Mode
Cisco 3945	520	33	16	1040	65	50
Cisco 3925	520	33	16	1040	65	50
Cisco 2951	370	24	18	750	48	37
Cisco 2921	280	18	16	750	48	37
Cisco 2911	200	12	10	750	48	37

Secure Networking

Because security needs to be embedded throughout the network, routers and Cisco EtherSwitch devices play a critical role in any network defense strategy. Cisco Enhanced EtherSwitch Service Modules provide a rich set of security features and can be a crucial component of your secure network strategy. The modules support a comprehensive set of security features for connectivity and access control, including ACLs, authentication, port-level security, and identity-based network services with 802.1x and extensions. This set of comprehensive features not only helps prevent external attacks, but defends the network against "man-in-the-middle" attacks, a primary concern in today's business environment. Table 4 highlights the benefits of the Enhanced EtherSwitch Service Module LAN security features.

Table 4.   LAN Security Features

Feature	Benefit
Dynamic ARP Inspection (DAI)	• DAI helps ensure user integrity by preventing malicious users from exploiting the insecure nature of the Address Resolution Protocol (ARP).
DHCP Snooping	• This feature prevents malicious users from spoofing a Dynamic Host Configuration Protocol (DHCP) server and sending out bogus addresses. It is used by other primary security features to prevent numerous other attacks such as ARP poisoning.
IP Source Guard	• IP Source Guard prevents a malicious user from spoofing or taking over another user's IP address by creating a binding table between the client's IP and MAC address, port, and VLAN.
Private VLANs	• Private VLANs restrict traffic between hosts in a common segment by segregating traffic at Layer 2, turning a broadcast segment into a nonbroadcast multiaccess-like segment; this feature is available in the ES3 only. • Private VLAN Edge provides security and isolation between switch ports, helping ensure that users cannot snoop on other users' traffic; this feature is available in the ES3 only.
Unicast Reverse Path Forwarding (RPF)	• This 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; it is available in the ES3 only.
IEEE 802.1x	• IEEE 802.1x allows dynamic, port-based security, providing user authentication. • IEEE 802.1x with VLAN assignment allows a dynamic VLAN assignment for a specific user regardless of where the user is connected. • IEEE 802.1x with voice VLAN permits an IP phone to access the voice VLAN irrespective of the authorized or unauthorized state of the port. • IEEE 802.1x and port security are provided to authenticate the port and manage network access for all MAC addresses, including that of the client. • IEEE 802.1x with an ACL assignment allows for specific identity-based security policies regardless of where the user is connected. • IEEE 802.1x with guest VLAN allows guests without 802.1x clients to have limited network access on the guest VLAN. • Web authentication for non-802.1x clients allows non-802.1x clients to use an SSL-based browser for authentication.
Multidomain Authentication	• Multidomain authentication allows an IP phone and a PC to authenticate on the same switch port while placing them on the appropriate voice and data VLAN.
MAC Authentication Bypass	• MAC Auth Bypass (MAB) for voice allows third-party IP phones without an 802.1x supplicant to get authenticated using the MAC address; it is available in the ES3 only.
Advanced ACLs	• Cisco security VLAN ACLs on all VLANs prevent unauthorized data flows from being bridged within VLANs; this feature is available in the ES3 only. • Cisco standard and extended IP Security router ACLs define security policies on routed interfaces for control- and data-plane traffic. IPv6 ACLs can be applied to filter IPv6 traffic; this feature is available in the ES3 only. • Port-based ACLs for Layer 2 interfaces allow security policies to be applied on individual switch ports.
Administrative Traffic Protection	• Secure Shell (SSH) Protocol, Kerberos (ES3 only), and SNMPv3 provide network security by encrypting administrator traffic during Telnet and SNMP sessions. SSH, Kerberos (ES3 only), and the cryptographic version of SNMPv3 require a special cryptographic software image because of U.S. export restrictions.
Switched Port Analyzer (SPAN)	• Bidirectional data support on the SPAN port allows the Cisco Intrusion Detection System (IDS) to take action when an intruder is detected.
Centralized Authentication	• TACACS+ and RADIUS authentication facilitates centralized control of the switch and restricts unauthorized users from altering the configuration.
MAC Address Authentication	• MAC address notification allows administrators to be notified of users added to or removed from the network.
Port Security	• Port security secures the access to an access or trunk port based on MAC address.

Feature	Benefit
Console Security	• Multilevel security on console access prevents unauthorized users from altering the switch configuration.
Bridge Protocol Data Unit (BPDU) Guard	• BPDU guard shuts down Spanning Tree PortFast-enabled interfaces when BPDUs are received to avoid accidental topology loops.
Spanning-Tree Root Guard (STRG)	• STRG prevents edge devices not in the network administrator's control from becoming Spanning Tree Protocol root nodes.
Internet Group Management Protocol (IGMP) Filtering	• IGMP filtering provides multicast authentication by filtering out nonsubscribers and limits the number of concurrent multicast streams available per port.
Dynamic VLAN Assignment	• 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.

Ease of Management and Troubleshooting

Cisco EtherSwitch Service Modules offer many ease-of-management advantages. For instance, administrators can manage the service modules through the host router CLI, providing one point of management for the LAN and WAN. Because the Cisco Enhanced EtherSwitch Service Modules run the same software image as the Cisco Catalyst 2960 and Catalyst 3560-E Series, the CLI commands are identical to those used on these Cisco Catalyst switches. This setup greatly simplifies management across the LAN and WAN, resulting in lower training costs, lower software qualifications costs, and a reduction in the possibility of configuration errors. Additionally, the Cisco Enhanced EtherSwitch Service Modules can be managed using one of Cisco's advanced GUI management tools. This provides an easy to use Web-based management interfaces can be accessed through a standard Web browser. Table 5 lists other management and troubleshooting features.

Table 5. Management and Troubleshooting Features

Feature	Description
CLI	• The modules have a single CLI for configuring branch-office and headquarters switches—reducing management challenges and easing troubleshooting if network downtime occurs, significantly reducing operating expenses (OpEx), and increasing network uptime. You can access the CLI through the router CLI without additional Telnet sessions or an extra console cable.
Cisco Configuration Professional	• This application is a GUI device-management tool for Cisco IOS Software-based access routers, including the Cisco 2900 and 3900 Series. In the case of the Cisco Enhanced EtherSwitch Service Module, Cisco Configuration Professional can be configured to spawn the Enhance EtherSwitch Service Module's embedded device manager GUI.
Cisco Network Assistant	• This easy-to-use, GUI-based management interface provides management specifically for the Cisco Enhanced EtherSwitch Service Modules and Cisco Catalyst 2960, Catalyst 3560, and Catalyst 3560 Switches. Cisco Unified Communications wizards need just a few user inputs to automatically configure the service module to optimally manage different types of traffic, including voice, video, multicast, and high-priority data. A security wizard is provided to restrict unauthorized access to applications, servers, and networks. You can also use Cisco Network Assistant to manage Cisco Catalyst switches connected to the Cisco Enhanced EtherSwitch Service Module.
CiscoWorks LAN Management System (LMS)	• CiscoWorks LMS provides a robust set of applications for maintaining, monitoring, and troubleshooting a broad range of devices in an end-to-end Cisco network. Built upon popular Internet-based standards, CiscoWorks LMS applications enable network operators to manage the network through a simplified browser-based interface that can be accessed anytime from anywhere within the network.
CiscoView	• CiscoView, available from CiscoWorks LMS, provides a graphical "front-panel" interface for managing Cisco devices. It allows you to easily interact with device components for at-a-glance port status and easy device configuration and monitoring.
Auto Spartports	• Cisco Auto Smartports can simplify the configuration of advanced capabilities, encapsulating years of Cisco networking expertise. As devices connect to the switch, automatic port configurations are enabled, rendering devices operational as soon as they are connected to the network.
Cisco CNS Configuration Engine	• The Cisco CNS Configuration Engine supports the activation of CPE-based network services through centralized template-based configuration management for zero-touch deployment, inventory, configuration, and image management.

Feature	Description
Additional Troubleshooting Features	• Cisco Express setup simplifies initial configuration with a web browser, eliminating the need for more complex terminal emulation programs and CLI knowledge. • AutoInstall uses DHCP-based autoconfiguration and image upgrade. This feature automatically downloads the configuration file and Cisco IOS Software image, and allocates an IP address and hostname for the switch. You can use AutoInstall to implement a zero-touch deployment. • Time Domain Reflectometry (TDR) is used to diagnose and resolve cabling problems on copper Ethernet ports. • Automatic medium-dependent interface crossover (Auto-MDIX) automatically adjusts transmit and receive pairs if an incorrect cable type (crossover or straight-through) is installed on a copper port. • Unidirectional Link Detection (UDLD) is a Layer 2 protocol that enables devices connected through fiber-optic or twisted-pair Ethernet cables to monitor the physical configuration of the cables and detect when a unidirectional link occurs. • IPSLA is used to send IP or Ethernet-based probes to monitor and validate traffic flow levels; it is available in the ES3 only.

Summary

As companies strive to lower the costs of running their networks and to increase the productivity of their end users with network applications, more intelligent branch-office solutions are required. Cisco Enhanced EtherSwitch Service Modules enable a higher level of security and offer enhanced PoE power levels, advanced features for IP communications, easy expandability, and simplified management at the branch-office level. By minimizing OpEx without sacrificing any advanced switching features, Cisco Enhanced EtherSwitch Service Modules can help you maximize your return on investment for the network infrastructure and accelerate the deployment of productivity-enhancing services to your enterprise branch offices or small to midsize business offices.

Product Specifications

Table 6 gives specifications of the Cisco Enhanced EtherSwitch Service Modules. Please note that all Fast Ethernet ports support 10/100 Mbps, all Gigabit Ethernet ports support 10/100/1000 Mbps and all SFP ports support 100/1000 Mbps.

Table 6.   Product Specifications

Model	Fast Ethernet Ports	Gigabit Ethernet Ports	Small Form-Factor Pluggable (SFP) Uplinks	Layer 2 Switching	Layer 2/3 Switching	PoE	Service Module Width
SM-D-ES3G-48-P		48	2		X	X	Double
SM-D-ES3-48-P	48		2		X	X	Double
SM-D-ES2-48	48		2	X			Double
SM-ES3G-24-P		24			X	X	Single
SM-ES3-24-P	23	1			X	X	Single
SM-ES2-24-P	23	1		X		X	Single
SM-ES2-24	23	1		X			Single
SM-ES3G-16-P		16			X	X	Single
SM-ES3-16-P	15	1			X	X	Single
SM-ES2-16-P	15	1		X		X	Single

Table 7 outlines the number of Cisco Enhanced EtherSwitch Service Modules supported per platform. Traffic between modules is switched by the router MGF switch. Each module has a 1-Gbps-per-second link to the MGF.

You can mix and match ES2 and ES3 modules. The numbers in the following tables do not include onboard Ethernet ports or Ethernet ports available on HWIC and EHWIC modules.

Table 7.   Module Support

Model	Maximum ES2 and ES3 Ports Using Service Modules	One Single	One Double	Two Single	One Single + One Double	Two Single + One Double	Three Single	Four Single
Cisco 3945	98	X	X	X	X	X	X	X
Cisco 3925	74	X	X	X	X			
Cisco 2951	50	X	X	X				
Cisco 2921	50	X	X					
Cisco 2911	24	X						

Software Support

Table 8 details the minimum software needed for Enhanced EtherSwitch support, as well as the default software license. Enhanced EtherSwitch Service Modules are supported on all Cisco 2900 and 3900 software images.

Table 8.   Cisco IOS Software Release Module Support

Model	Default Software	Minimum Cisco EtherSwitch and Cisco IOS Software Release	Minimum Router Cisco IOS Software Release
SM-D-ES3G-48-P	Universal Image: IP Base	12.2(52)EX	15(0).1M
SM-D-ES3-48-P	Universal Image: IP Base	12.2(52)EX	15(0).1M
SM-D-ES2-48	LAN Base	12.2(52)EX	15(0).1M
SM-ES3G-24-P	Universal Image: IP Base	12.2(52)EX	15(0).1M
SM-ES3-24-P	Universal Image: IP Base	12.2(52)EX	15(0).1M
SM-ES2-24-P	LAN Base	12.2(52)EX	15(0).1M
SM-ES2-24	LAN Base	12.2(52)EX	15(0).1M
SM-ES3G-16-P	Universal Image: IP Base	12.2(52)EX	15(0).1M
SM-ES3-16-P	Universal Image: IP Base	12.2(52)EX	15(0).1M
SM-ES2-16-P	LAN Base	12.2(52)EX	15(0).1M

Physical and Environmental Specifications

Table 9 gives product specifications.

Table 9.   Module Specifications

Model	Dimensions: Wide x Deep x High (cm.)	Weight (kg.)	Operational Temperature	Nonoperational Temperature	Operational Humidity	Nonoperational Humidity
SM-D-ES3G-48-P	41.2 x 20.7 x 4.0	5.0	0 to 40 °C	-40 to 70 °C	5 to 90%	5 to 95%
SM-D-ES3-48-P	41.2 x 20.7 x 4.0	5.0	0 to 40 °C	-40 to 70 °C	5 to 90%	5 to 95%
SM-D-ES2-48	41.2 x 20.7 x 4.0	5.0	0 to 40 °C	-40 to 70 °C	5 to 90%	5 to 95%
SM-ES3G-24-P	20.6 x 20.7 x 4.0	2.5	0 to 40 °C	-40 to 70 °C	5 to 90%	5 to 95%
SM-ES3-24-P	20.6 x 20.7 x 4.0	2.5	0 to 40 °C	-40 to 70 °C	5 to 90%	5 to 95%
SM-ES2-24-P	20.6 x 20.7 x 4.0	2.5	0 to 40 °C	-40 to 70 °C	5 to 90%	5 to 95%
SM-ES2-24	20.6 x 20.7 x 4.0	2.5	0 to 40 °C	-40 to 70 °C	5 to 90%	5 to 95%
SM-ES3G-16-P	20.6 x 20.7 x 4.0	2.2	0 to 40 °C	-40 to 70 °C	5 to 90%	5 to 95%
SM-ES3-16-P	20.6 x 20.7 x 4.0	2.2	0 to 40 °C	--40 to 70 °C	5 to 90%	5 to 95%
SM-ES2-16-P	20.6 x 20.7 x 4.0	2.2	0 to 40 °C	-40 to 70 °C	5 to 90%	5 to 95%

Regulatory Compliance, Safety, EMC, Telecommunications, and Network Homologation

When installed in a Cisco 2900 or 3800 Series router, the Cisco EtherSwitch Service Module does not change the standards (regulatory compliance, safety, EMC, telecom, or network homologation) of the router itself. For more information about these routers, please visit:

- http://www.cisco.com/en/US/products/hw/routers/ps282/index.html

- http://www.cisco.com/en/US/products/hw/routers/ps259/index.html

- http://www.cisco.com/en/US/products/ps5855/products_data_sheet0900aecd8016a8e8.html

- http://www.cisco.com/en/US/products/ps5854/index.html

Ordering Information

Table 10 provides ordering information for Cisco EtherSwitch Service Modules. To place an order, visit the Cisco Ordering Home Page.

Table 10.   Ordering Information

Part Number	Description
	ES3 Modules
SM-D-ES3G-48-P	Enhanced EtherSwitch SM, Layer 2/3 switching, 48 ports GE, 2 ports Small Form factor Pluggable (SFP), POE capable
SM-D-ES3-48-P	Enhanced EtherSwitch SM, Layer 2/3 switching, 48 ports Fast Ethernet (FE), 2 ports SFP, POE capable
SM-ES3G-24-P	Enhanced EtherSwitch SM, Layer 2/3 switching, 24 ports GE, POE capable
SM-ES3G-16-P	Enhanced EtherSwitch SM, Layer 2/3 switching, 16 ports GE, POE capable
SM-ES3-16-P	Enhanced EtherSwitch SM, Layer 2/3 switching, 15 ports FE, 1 port GE, POE capable
	ES2 Modules
SM-D-ES2-48	Enhanced EtherSwitch SM, Layer 2 switching, 48 ports FE and 2 ports SFP
SM-ES3-24-P	Enhanced EtherSwitch SM, Layer 2 switching, 23 ports FE, 1 port GE, POE capable
SM-ES2-16-P	Enhanced EtherSwitch SM, Layer 2 switching, 15 ports FE, 1 port GE, POE capable
SM-ES2-24	Enhanced EtherSwitch SM, Layer 2 switching, 23 ports FE, 1 port GE
	Software License SKUs
SL-ES3=	Upgrade Quantity License
SL-ES3-16-IPS	IP Services License Upgrade 16 Port FE ES3 Enhanced EtherSwitch
SL-ES3G-16-IPS	IP Services License Upgrade 16 Port GE ES3 Enhanced EtherSwitch
SL-ES3-24-48-IPS	IP Services License Upgrade 24/48 Port FE ES3 Enhanced EtherSwitch
SL-ES3G-24-48-IPS	IP Services License Upgrade 24/48 Port GE ES3 Enhanced EtherSwitch
SL-ES3-16-IPS=	IP Services License Upgrade 16 Port FE ES3 Enhanced EtherSwitch Spare
SL-ES3G-16-IPS=	IP Services License Upgrade 16 Port GE ES3 Enhanced EtherSwitch Spare
SL-ES3-24-48-IPS=	IP Services License Upgrade 24/48 Port FE ES3 Enhanced EtherSwitch Spare
SL-ES3G-24-48-IPS=	IP Services License Upgrade 24/48 Port GE ES3 Enhanced EtherSwitch Spare
L-ES3=	Upgrade Quantity License eDelivery
L-ES3-16-IPS	IP Services License Upgrade 16 Port FE ES3 Enhanced EtherSwitch eDelivery
L-ES3G-16-IPS	IP Services License Upgrade 16 Port GE ES3 Enhanced EtherSwitch eDelivery
L-ES3-24-48-IPS	IP Services License Upgrade 24/48 Port FE ES3 Enhanced EtherSwitch eDelivery
L-ES3G-24-48-IPS	IP Services License Upgrade 24/48 Port GE ES3 Enhanced EtherSwitch eDelivery
L-ES3-16-IPS=	IP Services License Upgrade 16 Port FE ES3 Enhanced EtherSwitch eDelivery Spare
L-ES3G-16-IPS=	IP Services License Upgrade 16 Port GE ES3 Enhanced EtherSwitch eDelivery Spare
L-ES3-24-48-IPS=	IP Services License Upgrade 24/48 Port FE ES3 Enhanced EtherSwitch eDelivery Spare
L-ES3G-24-48-IPS=	IP Services License Upgrade 24/48 Port GE ES3 Enhanced EtherSwitch eDelivery Spare

Part Number	Description
	SFPs for 48-port Switch Service Modules
GLC-GE-100FX=	100FX SFP on GE SFP ports for DSBU switches
GLC-LH-SM=	GE SFP, LC connector LX/LH transceiver
GLC-SX-MM=	GE SFP, LC connector SX transceiver
GLC-T=	1000BASE-T SFP
GLC-ZX-SM=	1000BASE-ZX SFP
GLC-BX-D=	1000BASE-BX SFP, 1490NM
GLC-BX-U=	1000BASE-BX SFP, 1310NM

Cisco and Partner Services for the Branch

Services from Cisco and our certified partners can help you transform the branch experience and accelerate business innovation and growth in the Borderless Network. We have the depth and breadth of expertise to create a clear, replicable, optimized branch footprint across technologies. Planning and design services align technology with business goals and can increase the accuracy, speed, and efficiency of deployment. Technical services help improve operational efficiency, save money, and mitigate risk. Optimization services are designed to continuously improve performance and help your team succeed with new technologies.

For More Information

This document describes information about Cisco EtherSwitch Service Modules only. For more information about these modules, contact your local Cisco account representative.

For more information regarding software features, please consult the Cisco Catalyst 2960 (ES2) and Catalyst 3560-E (ES3) web pages at: http://www.cisco.com/en/US/products/ps7078/products_data_sheets_list.html and http://www.cisco.com/en/US/products/ps6406/products_data_sheets_list.html

For more information about Cisco 2900 and 3900 Series Integrated Services Routers, please visit: http://www.cisco.com/go/2900 and http://www.cisco.com/go/3900