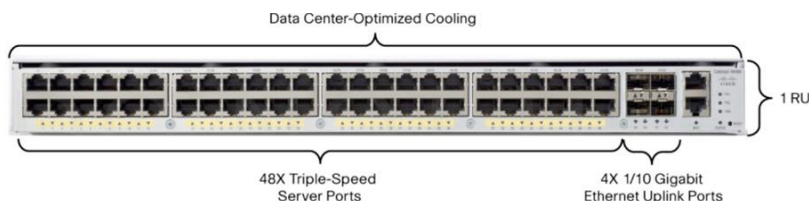


## Cisco Catalyst 4948E and 4948E-F Ethernet Switches

### Product Overview

The Cisco Catalyst® 4948E and 4948E-F Ethernet Switches are the Cisco Catalyst 4900 Series data center switches built from the start to deliver best-in-class, full-featured server-access switching. The switches include identical features except that the Cisco Catalyst 4948E offers front-to-back cooling, and the Cisco Catalyst 4948E-F offers back-to-front cooling. Each switch offers forty-eight 10/100/1000-Gbps RJ45 downlink ports and four 1 and 10 Gigabit Ethernet uplink ports. The switches are designed to simplify data center architecture and operations by offering service provider-grade hardware and software in a one-rack-unit (1RU) form factor optimized for full-featured top-of-rack (ToR) data center deployments (Figure 1).

**Figure 1.** Cisco Catalyst 4948E and 4948E-F Front Panel



The Cisco Catalyst 4948E and 4948E-F build on the advanced technology of the Cisco Catalyst 4948 Switches, the most widely deployed ToR switch in the industry, with more than 10 million ports deployed worldwide. The Cisco Catalyst 4948E and 4948E-F double the uplink bandwidth and offer true front-to-back and back-to-front airflow with no side or top venting. The airflow direction is controlled by the changing of fans. Optional front-to-back and back-to-front airflow management reduces data center operating costs by providing strict hot-aisle and cold-aisle isolation.

Hot-aisle and cold-aisle deployment remains the widely adopted best practice for data center cabinet layouts today. Networking switches and computing servers mounted in a single cabinet need to maintain the separation of the inlet cold air and the exhaust hot air for efficient use of cooling resources. The Cisco Catalyst 4948E and 4948E-F switches provide the option of front-to-back airflow (Cisco Catalyst 4948E) and back-to-front airflow (Cisco Catalyst 4948E-F) for ToR switch deployments.

Exceptional reliability and serviceability are delivered with optional internal AC and DC 1+1 hot-swappable power supplies and a hot-swappable fan tray with redundant fans (Figures 2 and 3).

**Figure 2.** Cisco Catalyst 4948E Front-to-Back Air-Cooled Switch Rear Panel



**Figure 3.** Cisco Catalyst 4948E-F Back-to-Front Air-Cooled Switch Rear Panel



The Cisco Catalyst 4948E and 4948E-F switches offer:

### Scalability and Performance

- Nonblocking server-to-server traffic with 176-Gbps aggregate throughput
- Ease of migration from Gigabit Ethernet to 10 Gigabit Ethernet upstream with support for SFP and SFP+ optics
- Large buffers optimized to handle microbursts with 17.5 MB of centralized buffering, helping ensure that business-critical packets are not lost due to insufficient buffering
- Active queue management through dynamic buffer limiting for TCP throughput optimizations
- Investment protection through data center design with dual-stack IP Versions 4 and 6 (IPv4 and v6) support
- Advanced quality of service (QoS) with eight configurable queues for each port
- Data center server virtualization support for larger Layer 2 domains with scalable MAC addresses
- Support for a wide variety of optics connecting to the aggregation layer
- Front-to-back and back-to-front airflow options

### Enhanced Manageability

- Pay as you grow with software feature packages, from Layer 2 only (LAN Base) to full Layer 3 capability (Enterprise Services)
- Reduced operating expenses (OpEx) with tools such as AutoInstall and Cisco IOS® Embedded Event Manager (EEM) that enable immediate availability
- Data center automation with IP service-level agreement (SLA) and Smart Call Home
- Data center optimization with true front-to-back and back-to-front airflow, including power supply cooling
- Enhanced application visibility with smart flow logging
- Enhanced manageability through eight bidirectional Switched Port Analyzer (SPAN) and Remote SPAN (RSPAN) sessions
- Network visibility through Cisco® NetFlow-Lite (future support)

### Resiliency

- 1+1 AC or DC power supplies and hot-swappable fan tray with redundant fans for high availability for mission-critical applications
- Optimized forwarding across all four uplinks with equal-cost multipath (ECMP) load sharing
- Improved resiliency with protection from attacks with access control lists (ACLs), Control Plane Policing (CoPP), Address Resolution Protocol (ARP) inspection, and Dynamic Host Configuration Protocol (DHCP) snooping
- Active queue management using dynamic buffer limiting (DBL) for increased security and network control

### Cisco IOS Software

Cisco IOS Software is a proven network OS that offers best-in-class availability, manageability, and scalability.

The Cisco Catalyst 4948E and 4948E-F support three levels of Cisco IOS Software. The basic level is LAN Base, developed for deployments that require data center-class hardware along with Layer 2 switching but not advanced features such as routing and Cisco IOS EEM. The next level of software is IP Base; this level supports static routes, Routing Information Protocol (RIP) Versions 1 and 2, and Enhanced Interior Gateway Routing Protocol Stub (EIGRP-Stub) for limited routing. The top level of software is Enterprise Services; this level adds support for advanced routing protocols such as Border Gateway Protocol (BGP), Open Shortest Path First (OSPF), Intermediate System-to-

Intermediate System (IS-IS) Protocol, and EIGRP. For a detailed list of supported software features, please refer to the software release notes at

[http://www.cisco.com/en/US/docs/switches/lan/catalyst4500/release/note/OL\\_23985.html](http://www.cisco.com/en/US/docs/switches/lan/catalyst4500/release/note/OL_23985.html).

### Smart Top-of-Rack Design

Historically, data center design engineers have had to trade off access-layer features such as QoS, network visibility, and security when moving from an end-of-row (EoR) to a ToR data center design. The Cisco Catalyst 4948E and 4948E-F offer the same features found on large EoR data center switches in a 1RU form factor optimized for ToR deployments.

A few of the features specific to smart ToR switches are:

- Server-rack-optimized switches with the option of front-to-back or back-to-front airflow
- Nonblocking hardware-based switching and routing
- Full support for access- and distribution-level Layer 3 routing
- Advanced QoS including a modular QoS command-line interface (CLI)
- Advanced security
- Extended MAC address support for virtual environments
- Network visibility (future support)

Data centers focused on the following applications should deploy smart ToR switches:

- High-performance technical computing (grid)
- Enterprise and service provider cloud
- Virtual desktop environments
- Network and server virtualized data centers
- Web services
- Enterprise IT

### Cisco IOS Embedded Event Manager

Cisco IOS EEM is a unique subsystem within Cisco IOS Software that allows customers to create and asynchronously run scripts directly on a router or switch. Scripts can be programmed using a simple CLI. Cisco IOS EEM responds to real-time events to automate tasks or to take automatic action based on condition detection. Customers can also use Cisco IOS EEM to create custom commands to reduce deployment and management complexity. Scripts can enable simple to complex automated actions, such as entering a log item or changing a port configuration in response to a security threat.

Visit the open Cisco IOS EEM scripting community, [Cisco Beyond](#), for sample Cisco IOS EEM scripts.

### Optimized for Multimedia Applications

The Cisco Catalyst 4948E and 4948E-F are optimized for multimedia applications, with advanced multicast support. The switches support Protocol-Independent Multicast (PIM), Source-Specific Multicast (SSM), and Bidirectional PIM (bidir-PIM), providing end users with additional scalability to support multimedia applications. Also supported are Internet Group Management Protocol (IGMP) snooping and Multicast Listener Discovery (MLD) snooping in hardware, enhancing performance and reducing network traffic by allowing a switch to dynamically add and remove hosts from a multicast group.

## Intelligent Network Services with QoS and Sophisticated Traffic Management

The Cisco Catalyst 4948E and 4948E-F offer superior per-port QoS features to help ensure that network traffic is classified, prioritized, and scheduled optimally to efficiently manage bandwidth-intensive multimedia and time-sensitive and mission-critical applications. The Cisco Catalyst 4948E and 4948E-F can classify, monitor, and mark incoming packets, allowing the administrator to differentiate traffic flows and enforce policies. Sharing, shaping, and strict-priority configurations determine the scheduling of egress traffic. The Cisco Catalyst 4948E and 4948E-F also support DBL, a congestion-avoidance feature. For details about the QoS features, including active queue management through DBL on the Cisco Catalyst 4948E and 4948E-F, refer to the Cisco Catalyst 4500 Series Supervisor Engine QoS overview at

[http://www.cisco.com/en/US/prod/collateral/switches/ps5718/ps4324/prod\\_white\\_paper0900aecd8041691c.html](http://www.cisco.com/en/US/prod/collateral/switches/ps5718/ps4324/prod_white_paper0900aecd8041691c.html).

## Cisco Catalyst 4900 Series Features

Table 1 summarizes the main features of the Cisco Catalyst 4900 Series Switches.

**Table 1.** Main Features of Cisco Catalyst 4900 Series Switches

Feature and Description	Cisco Catalyst 4948 Switch	Cisco Catalyst 4948 10 Gigabit Ethernet Switch	Cisco Catalyst 4900M Switch	Cisco Catalyst 4948E and 4948E-F Switches
<b>Environmental</b>				
<b>Height</b>	1RU	1RU	2RU	1RU
<b>Dimensions (H x W x D)</b>	1.71 x 17.3 x 16.1 in. (4.3 x 43.9 x 40.9 cm)	1.71 x 17.3 x 16.1 in. (4.3 x 43.9 x 40.9 cm)	3.5 x 17.2 x 17.9 in. (8.9 x 43.7 x 45.5 cm)	1.75 x 17.5 x 19.4 in. (4.4 x 44.4 x 49.3 cm)
<b>Power redundancy</b>	1+1 AC or DC	1+1 AC or DC	1+1 AC or DC	1+1 AC or DC
<b>Unit weight</b>	16.5 lb (7.48 kg)	16.5 lb (7.48 kg)	34.0 lb (15.4 kg)	19 lb (8.62 kg)
<b>Hot-swappable fan</b>	Yes	Yes	Yes	Yes
<b>Average and maximum power consumption (in watts [W])</b>	176W average 300W maximum	212W average 300W maximum	300W average 446W maximum	230W average 275W maximum
<b>Airflow</b>	Side to back	Side to back	Side to back	Front to back (Cisco Catalyst 4948E) Back to front (Cisco Catalyst 4948E-F)
<b>Rack-mounting options</b>	Front and rear mount	Front and rear mount High-performance rear mount	Four-post rack-side rail mount High-performance mount	Front and rear mount High-performance rear mount
<b>Uplink optic types</b>	Four Small Form-Factor Pluggable (SFP) optics	Two X2 (10 Gigabit Ethernet) optics	Eight X2 (10 Gigabit Ethernet) optics	SFP and SFP+
<b>Cisco® TwinGig Converter Module support</b>	No	No	Yes (WS-X4908-10GE only)	No
<b>Cisco OneX Converter Module support (X2 to SFP+)</b>	No	No	Yes	No
<b>Optics</b>	LH, SX, ZX, and CWDM	LR, CX4, LX4, SR, ER, LRM, ZR, and DWDM	X2: LR, CX4, LX4, SR, ER, LRM, ZR, and DWDM SFP+: SR	CWDM, DWDM, SR, LR, LRM, and CX4
<b>Modular half-card slots</b>	0	0	2	0
<b>Ports</b>				
<b>Maximum 10/100/1000-Gbps ports</b>	48	48	40	48
<b>Maximum Gigabit Ethernet (fiber) ports</b>	4	0	32 (Cisco TwinGig Converter Module)	4
<b>Maximum 10 Gigabit Ethernet (10GBASE-T) ports</b>	0	0	16	0
<b>Maximum 10 Gigabit Ethernet (fiber) ports</b>	0	2 (X2)	24 (X2)*	4 (SFP+)

Feature and Description	Cisco Catalyst 4948 Switch	Cisco Catalyst 4948 10 Gigabit Ethernet Switch	Cisco Catalyst 4900M Switch	Cisco Catalyst 4948E and 4948E-F Switches
<b>Performance and Scalability</b>				
<b>Switching capacity</b>	96 Gbps	136 Gbps	320 Gbps	176 Gbps
<b>Throughput</b>	72 million packets per second (mpps)	102 mpps	250 mpps for IPv4 125 mpps for IPv6	131 mpps for IPv4 110 mpps for IPv6
<b>Routes supported</b>	32,000	32,000	256,000	57,000
<b>MAC addresses</b>	32,000	55,000	55,000	55,000
<b>Per-VLAN Spanning Tree (PVST) Protocol and VLAN IDs</b>	4094	4094	4094	4094
<b>Spanning Tree Protocol instances</b>	4094	4094	4094	4094
<b>Switched virtual interfaces (SVIs)</b>	2000	2000	4094	4094
<b>Active VLANs</b>	4094	4094	4094	4094
<b>Multicast routes</b>	28,000	28,000	28,000	28,000
<b>Security and quality-of-service (QoS) hardware entries</b>	32,000	32,000	128,000	32,000
<b>Switched Port Analyzer (SPAN)</b>	2 ingress and 4 egress	2 ingress and 4 egress	8 ingress and 8 egress	8 ingress and 8 egress
<b>Shared buffer</b>	16 MB	16 MB	17.5 MB	17.5 MB
<b>CPU</b>	266 MHz	666 MHz	1.3 GHz	1 GHz
<b>Synchronous dynamic RAM (SDRAM)</b>	256 MB	256 MB	512 MB	1 GB
<b>Multilayer switching</b>	LAN Base, IP Base, and Enterprise Services options	LAN Base, IP Base, and Enterprise Services options	LAN Base, IP Base, and Enterprise Services options	LAN Base, IP Base, and Enterprise Services options
<b>IPv6 support</b>	Software switched	Software switched	Hardware switched	Hardware switched
<b>USB port</b>	No	No	Yes	No
<b>Compact flash memory support</b>	No	No	Yes	No
<b>System reset button</b>	No	No	Yes	Yes
<b>Minimum software requirements</b>	Cisco IOS® Software Release 12.2(20)EWA or later	Cisco IOS Software Release 12.2(25)EWA or later	Cisco IOS Software Release 12.2(46)SG or later	Cisco IOS Software Release 12.2(54)SG or later (Cisco Catalyst 4948E) Cisco IOS Software Release 12.2(54)WO or later (Cisco Catalyst 4948E-F)

\* X2 can be converted to SFP+ using the Cisco OneX Converter Module.

### Supported Small Form-Factor Pluggable Optics and Copper Media

The Cisco Catalyst 4948E and 4948E-F supports 10 Gigabit Ethernet SFP and SFP+ on all the four uplinks. For more information about Cisco transceiver modules compatible with the Cisco Catalyst 4948E and 4948E-F, visit [http://www.cisco.com/en/US/products/hw/modules/ps5455/products\\_device\\_support\\_tables\\_list.html](http://www.cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html).

## Switch Indicators and Ports

- System status: Green (operational) or red (faulty)
- Console: RJ-45 socket
- Reset (switch recessed for protection)
- Uplinks: Link and active
- Image management port: 10/100/1000BASE-TX (RJ-45 socket) data terminal equipment (DTE); green (good), orange (disabled), or off (not connected)

## Physical and Environmental Characteristics

Table 2 lists the physical and environmental characteristics of the Cisco Catalyst 4948E and 4948E-F switches.

**Table 2.** Physical and Environmental Characteristics

Feature	Specification
<b>Environmental</b>	
Operating temperature	32 to 104°F (0 to 40°C)
Storage temperature	-40 to 167°F (-40 to 75°C)
Relative humidity	10 to 90%, noncondensing
Operating altitude	-196 to 6561 ft (-60 to 2000m)
Mean time between failure (MTBF)	<ul style="list-style-type: none"> <li>• Cisco Catalyst 4948E-F : 149,261 hours</li> <li>• Cisco Catalyst 4948E: 145,422 hours</li> </ul>
Airflow	<ul style="list-style-type: none"> <li>• 28 cubic feet per minute (CFM) at low speed</li> <li>• 44 CFM at full speed</li> </ul>
<b>Physical</b>	
Dimensions	1.75 x 17.5 x 19.4 in. (4.4 x 44.4 x 49.3 cm)
Weight	<ul style="list-style-type: none"> <li>• 19 lb (8.62 kg) (fully loaded with 2 power supplies and fan tray)</li> <li>• 14 lb (6.35 kg) (base system only; no power supply or fan tray)</li> </ul>
<b>Power</b>	
AC input voltage range	90 to 264 VAC
DC input voltage range	-40.5 to -72 VDC
Maximum current	<ul style="list-style-type: none"> <li>• AC: 4 amperes (A) at 120 VAC; 2A at 240 VAC input</li> <li>• DC: 8A at -48 VDC input</li> </ul>
Typical operating power	230W at 25°C
Maximum power	275W at 55°C
RoHS compliant	RoHS-6 compliance
Heat dissipation (maximum)	<ul style="list-style-type: none"> <li>• AC Input: 1173 BTU per hour</li> <li>• DC Input: 1251 BTU per hour</li> </ul>

For Cisco Catalyst 4948E and 4948E-F mounting options, please refer the installation guide at <http://www.cisco.com/en/US/docs/switches/lan/catalyst4900/4948E/installation/guide/4948E.pdf>

## Industry Standards

Table 3 summarizes the supported industry standards on Cisco Catalyst 4948E and 4948E-F switches. For a detailed list of supported software features, please refer to the software release notes at [http://www.cisco.com/en/US/docs/switches/lan/catalyst4500/release/note/OL\\_23985.html](http://www.cisco.com/en/US/docs/switches/lan/catalyst4500/release/note/OL_23985.html).

**Table 3.** Industry Standards

Feature	Standard
<b>Industry standards</b>	<ul style="list-style-type: none"> <li>• Ethernet: IEEE 802.3 and 10BASE-T</li> <li>• Fast Ethernet: IEEE 802.3u, 100BASE-TX, and 100BASE-FX</li> <li>• Gigabit Ethernet: IEEE 802.3z and 802.3ab</li> <li>• IEEE 802. 1D Spanning Tree Protocol</li> <li>• IEEE 802.1w rapid reconfiguration of spanning tree</li> <li>• IEEE 802. 1s multiple VLAN instances of spanning tree</li> <li>• IEEE 802.3 ad LACP</li> <li>• IEEE 802. 1p CoS prioritization</li> <li>• IEEE 802.1Q VLAN</li> <li>• IEEE 802. 1x user authentication</li> <li>• RMON I and II standards</li> </ul>

### Regulatory Standards Compliance

Table 4 provides regulatory compliance information for the Cisco Catalyst 4948E and 4948E-F.

**Table 4.** Regulatory Standards Compliance

Standard	Compliance
<b>Regulatory compliance</b>	Products bear CE Marking, indicating compliance with the 89/336/EEC and 73/23/EEC directives, which include the safety and EMC standards listed here.
<b>Safety</b>	<ul style="list-style-type: none"> <li>• UL 60950-1</li> <li>• CAN/CSA-C22.2 No. 60950-1</li> <li>• EN 60950-1</li> <li>• IEC 60950-1</li> <li>• AS/NZS 60950</li> <li>• IEC 60825-1</li> <li>• IEC 60825-2</li> <li>• EN 60825-1</li> <li>• EN 60825-2</li> <li>• 21 CFR 1040</li> </ul>
<b>EMC</b>	<ul style="list-style-type: none"> <li>• FCC Part 15 (CFR 47) Class A</li> <li>• ICES-003 Class A</li> <li>• EN55022 Class A</li> <li>• CISPR22 Class A</li> <li>• AS/NZS 3548 Class A</li> <li>• VCCI Class A</li> <li>• EN55024</li> <li>• ETS300 386</li> <li>• EN50082-1</li> <li>• EN61000-3-2</li> <li>• EN61000-3-3</li> </ul>
<b>Network Equipment Building Standards (NEBS)</b>	<ul style="list-style-type: none"> <li>• GR-63-Core NEBS Level 3</li> <li>• GR-1089-Core NEBS Level 3</li> </ul>
<b>ETSI</b>	<ul style="list-style-type: none"> <li>• ETS 300 019 Storage Class 1.1</li> <li>• ETS 300 019 Transportation Class 2.3</li> <li>• ETS 300 019 Stationary Use Class 3.1</li> </ul>

### Warranty Information

Find warranty information at Cisco.com on the [Product Warranties page](#).

## Ordering Information

Help customers understand all the components or parts they need to purchase to install and use the product. Table 5 lists part numbers for customer convenience. To place an order, visit the [Cisco Ordering homepage](#). To download software, visit the Cisco Software Center at <http://www.cisco.com/cisco/software/navigator.html>.

**Table 5.** Ordering Information

Description	Part Number	
<b>Hardware</b>		
	<b>Front-to-Back Cooling</b>	<b>Back-to-Front Cooling</b>
48x 10/100/1000(RJ45)+4x 10GbE(SFP+), no p/s	WS-C4948E	WS-C4948E-F
48x 10/100/1000(RJ45)+4x10GbE(SFP+), IP Base IOS, AC p/s	WS-C4948E-S	WS-C4948E-F-S
48x 10/100/1000(RJ45)+4x10GbE(SFP+), Ent Ser IOS, AC p/s	WS-C4948E-E	WS-C4948E-F-E
Green Bundle 10x WS-C4948E	WS-C4948E-BDL	WS-C4948E-F-BDL
Catalyst 4948E 300WAC power supply (spare)	PWR-C49E-300AC-R(=)	PWR-C49E-300AC-F(=)
Catalyst 4948E 300WAC redundant power supply	PWR-C49E-300AC-R/2	PWR-C49E-300AC-F/2
Catalyst 4948E 300WDC power supply (spare)	PWR-C49-300DC(=)	Not Available at this time
Catalyst 4948E 300WDC redundant power supply (spare)	PWR-C49-300DC/2	Not Available at this time
<b>Software</b>		
Cisco IOS Software for Cisco Catalyst 4948E Series Switches (LAN Base image)	S49ELB-12254SG(=)	S49ELB-12254WO(=)
Cisco IOS Software for Cisco Catalyst 4948E Series Switches (LAN Base image with Triple Data Encryption)	S49ELBK9-12254SG(=)	S49ELBK9-12254WO(=)
Cisco IOS Software for Cisco Catalyst 4948E Series Switches (IP Base image)	S49EIPB-12254SG(=)	S49EIPB-12254WO(=)
Cisco IOS Software for Cisco Catalyst 4948E Series Switches (IP Base image with Triple Data Encryption)	S49EIPBK9-12254SG(=)	S49EIPBK9-12254WO(=)
Cisco IOS Software for Cisco Catalyst 4948E Series Switches (Enterprise Services image with BGP support)	S49EES-12254SG(=)	S49EES-12254WO(=)
Cisco IOS Software for Cisco Catalyst 4948E Series Switches (Enterprise Services image with 3DES and BGP support)	S49EESK9-12254SG(=)	S49EESK9-12254WO(=)
Catalyst 4948 IP Base Upgrade License for LAN Base IOS	WS-C4900-SW-LIC	WS-C4900-SW-LIC
<b>Accessories</b>		
Cisco Catalyst 4948E spare fan tray rear exhaust	WS-X4993(=)	WS-X4993-F(=)
<b>Power Cables</b>		
AC Power cord, 110V North America, Japan	CAB-US515-C15-US(=)	
AC Power cord, 220V North America	CAB-N5K6A-NA(=)	
AC Power cord (Australia, New Zealand)	CAB-AS3112-C15-AU(=)	
AC Power cord (Europe)	CAB-CEE77-C15-EU(=)	
AC Power cord CD12 (Italy)	CAB-C2316-C15-IT(=)	
AC Power cord (Argentina)	CAB-IR2073-C15-AR(=)	
AC Power cord (South Africa, India)	CAB-SABS-C15-IND(=)	
AC Power cord (United Kingdom)	CAB-BS1363-C15-UK(=)	
AC Power cord (Switzerland)	CAB-9K10A-SW(=)	

## Cisco Services

Cisco Technical Support Services helps ensure that your Cisco products operate efficiently, remain highly available, and benefit from current system software to help you effectively manage your network services while controlling operating costs.



Cisco Technical Support Services (Table 6) provides significant benefits that go beyond what is offered under the Cisco warranty policy. Services available under a Cisco SMARTnet<sup>®</sup> service contract that are not covered under a warranty include the following:

- Latest software updates
- Rapid replacement of hardware with next-day, 4-hour, or 2-hour dispatch options
- Ongoing technical support through the Cisco Technical Assistance Center (TAC)
- Registered access to Cisco.com

**Table 6.** Cisco Technical Support Services Components

Feature	Benefits
<b>Software support</b>	Software support offers maintenance and minor and major updates for licensed feature sets. Downloading new maintenance releases, patches, or updates of Cisco IOS Software helps enhance and extend the useful life of Cisco devices. Through major software updates, organizations can extend the life of equipment and get the most from application technology investments by: <ul style="list-style-type: none"> <li>• Adding new functions that, in many cases, require no additional hardware investment</li> <li>• Increasing the performance of current functions</li> <li>• Enhancing network or application availability, reliability, and stability</li> </ul>
<b>Cisco TAC support</b>	With more than 1000 highly trained customer support engineers, 390 Cisco Certified Internetwork Expert (CCIE <sup>®</sup> ) experts, and access to 13,000 research and development engineers, Cisco TAC complements your in-house staff with a high level of knowledge about data, voice, and video communications networking technology. Its sophisticated call-routing system quickly routes calls to the correct technology personnel. Cisco TAC is available 24 hours a day, 365 days a year.
<b>Cisco.com</b>	This award-winning website provides 24-hour access to an extensive collection of online product and technology information, interactive network management and troubleshooting tools, and knowledge-transfer resources that can help customers reduce costs by increasing staff self-sufficiency and productivity.
<b>Advance hardware replacement</b>	Advance replacement and onsite field engineer options supply fast access to replacement hardware and field resources for installing hardware, reducing the risk of potential network downtime.
<b>Smart Call Home</b>	Cisco Smart Call Home is a proactive, connected service capability of Cisco SMARTnet Service that is available at no additional cost on Cisco Catalyst 4500 Series Switches. Smart Call Home devices can continuously monitor their own health using Cisco Generic Online Diagnostics (GOLD) technology and automatically notify you of potential problems using secure transmissions. If a serious problem arises, Smart Call Home automatically detects it and generates a Cisco TAC service request that is routed to the team appropriate for a particular problem.

## For More Information

<http://www.cisco.com/go/4900>



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