

Foundation for Innovation Powered by Cisco Intelligent Ethernet with Cisco Catalyst 3750 Series Switches

The Cisco® Catalyst® 3750 Series switches are innovative switches that improve LAN operating efficiency by combining industry-leading ease of use and high resiliency for stackable switches. This switch series represents the next generation in desktop switches and features Cisco StackWise™ technology, a 32 Gbps stack interconnect that allows users to build a unified, highly resilient switching system—one switch at a time.

The Cisco Catalyst 3750 Series includes IEEE 802.3af and Cisco Systems® prestandard Power over Ethernet (PoE) functionality in Fast Ethernet and Gigabit Ethernet configurations. The Cisco Catalyst 3750 Series is an ideal access layer switch for small enterprise LAN access or branch-office environments, combining both 10/100/1000 and PoE configurations for maximum productivity and investment protection while enabling the deployment of new applications such as IP telephony, wireless access, video surveillance, building management systems, and remote video kiosks. Customers can deploy networkwide intelligent services—for example, advanced quality of service (QoS), rate limiting, access control lists (ACLs), multicast management, and high-performance IP routing—while maintaining the simplicity of traditional LAN switching.

Figure 1. Foundation for Innovation Powered By Cisco



PRODUCT BENEFITS

Cisco StackWise Technology

Cisco StackWise technology is a premium stacking architecture optimized for Gigabit Ethernet. This technology is designed to respond to additions, deletions, and redeployment while maintaining constant performance. Cisco StackWise technology unites up to nine individual Cisco Catalyst 3750 Series switches into a single logical unit, using special stack-interconnect cables and stacking software. The stack behaves as a single switching unit that is managed by a master switch elected from one of the member switches. The master switch automatically creates and updates all the switching and optional routing tables. A working stack can accept new members or delete old ones without service interruption.

The Cisco Catalyst 3750 Series stacks up to nine switches as a single logical unit, for a total of 468 Ethernet or PoE 10/100 ports, or 468 Ethernet 10/100/1000 ports or PoE 10/100/1000 ports, or nine 10 Gigabit Ethernet ports. Individual 10/100, 10/100/1000, and 10 Gigabit Ethernet units can be joined in any combination to evolve with network needs. Each Cisco Catalyst 3750 Series stack is managed as a single object and has a single IP address. Single IP management is supported for activities such as fault detection, VLAN creation and modification, network security, and QoS controls.

The automatic Cisco IOS® Software release checking and loading of the global configuration parameters provide the first level of operational time saving. When switches are added or removed, the master switch automatically loads the Cisco IOS Software release running on the stack to the new switch, loads the global configuration parameters, and updates all the routing tables to reflect changes. Upgrades are applied universally and simultaneously to all members of the stack.

The second level of operational time saving is added during the event of an outage. When a troubled switch is removed from an existing stack of switches and replaced with another switch, the master switch will recognize this as a maintenance outage and automatically reload the port-level configuration that was on the previous switch without user intervention. This allows IT managers to have local personnel in remote locations perform maintenance tasks instead of sending costly technicians out for a few minutes of work, thus saving thousands of dollars in operational costs.

IEEE 802.3af and Cisco Prestandard Power over Ethernet

The Cisco Catalyst 3750 Series can provide a lower total cost of ownership (TCO) for deployments that incorporate Cisco IP phones, Cisco Aironet® WLAN access points, or any IEEE 802.3af-compliant end device. PoE removes the need for wall power to each PoE-enabled device and eliminates the cost for additional electrical cabling that would otherwise be necessary in IP phone and WLAN deployments. The Cisco Catalyst 3750 Series 24-port PoE configurations can support 24 simultaneous full-powered PoE ports at 15.4W for maximum powered-device support. Using Cisco Catalyst intelligent power management, the 48-port PoE configurations can deliver the necessary power to support 24 ports at 15.4W, 48 ports at 7.7W, or any combination in between through the sophisticated power management features in Cisco IOS Software. Maximum power availability for a converged voice and data network is attainable when a Cisco Catalyst 3750 Series switch is combined with the Cisco RPS 675 Redundant Power System for transparent protection against internal power supply failures and an uninterruptible power supply (UPS) system to safeguard against power outages.

Gigabit Ethernet

At speeds of 1000 Mbps, Gigabit Ethernet provides the bandwidth to meet new and evolving network demands, alleviate bottlenecks, and boost performance while increasing the return on existing and new infrastructure investments. Today's workers are placing higher demands on networks, running multiple concurrent applications. For example, a worker joins a team conference call through an IP videoconference, sends a 10-MB spreadsheet to meeting participants, broadcasts the latest marketing video for the team to evaluate, and queries the customer relationship management database for the latest real-time feedback. Meanwhile, a multigigabyte system backup starts in the background, using simple and affordable network-attached storage (NAS) to comply with regulatory record-keeping requirements such as Sarbanes-Oxley. The Cisco Catalyst 3750 Series switches can scale the access network to 1 gigabit per second over existing Category 5 copper cabling while simultaneously making the most of the desktops and notebooks that are now shipping with Gigabit Ethernet network interface cards and higher PC bus speeds for full bandwidth utilization. In addition to being easy to deploy, Gigabit Ethernet networks are simpler to maintain with the new Cisco time domain reflectometry (TDR), which helps verify existing cabling. The Gigabit Ethernet models of the Cisco Catalyst 3750 Series switches also enable high-performance grid and distributed computing in addition to preparing your network to deploy and use next-generation software applications such as Microsoft Exchange as well as Microsoft Vista's remote imaging, data synchronization, and computer-to-computer search capabilities.

ENHANCED SECURITY

With the wide range of security features that the Cisco Catalyst 3750 Series offers, businesses can protect important information, keep unauthorized people off the network, guard privacy, and maintain uninterrupted operation. The Cisco Catalyst 3750 Series supports a comprehensive set of security features for connectivity and access control, including network admission control (NAC), ACLs, dynamic ARP inspection, and IP source guard, Virtual Private Network Routing/Forwarding Lite (VRF Lite), port-level security, and identity-based network services with 802.1x and extensions. These features **increase LAN security with capabilities that secure network management traffic; protect passwords and configuration information; offer options for network security based on users, ports, or MAC addresses; and enable more immediate responses to intruder and hacker detection.** NAC enables organizations to limit damage from viruses and worms by enforcing security policy compliance on endpoint devices.

AVAILABILITY AND SCALABILITY

The Cisco Catalyst 3750 Series increases availability for stackable switches. Each switch can operate as both master controller and forwarding processor. Each switch in the stack can serve as a master, creating a 1:N availability scheme for network control. In the unlikely event of a single unit failure, all other units continue to forward traffic and maintain operation.

The Cisco Catalyst 3750 Series is equipped with other robust features that allow for network scalability and higher availability through IP routing as well as a complete suite of Spanning Tree Protocol enhancements aimed to maximize availability in a Layer 2 network. Enhancements to the standard Spanning Tree Protocol, such as Per-VLAN Spanning Tree Plus (PVST+), Uplink Fast, and Port Fast, as well as innovations such as Flex Links maximize network uptime. PVST+ allows for Layer 2 load sharing on redundant links to efficiently use the extra capacity inherent in a redundant design. Uplink Fast, Port Fast, and Backbone Fast all greatly reduce the standard 30-second to 60-second Spanning Tree Protocol convergence time. The Cisco Catalyst 3750 Series switches also deliver high-performance, hardware-based IP routing for either unicast or multicast traffic. The Cisco Express Forwarding–based routing architecture allows for increased scalability and performance. This architecture allows for very high-speed lookups while also helping to ensure the stability and scalability necessary to meet the needs of future requirements. Implementing routed uplinks to the core will improve network availability by enabling faster failover protection and simplifying the Spanning Tree Protocol algorithm by terminating all Spanning Tree Protocol instances at the aggregator switch. Additionally, routed uplinks allow better bandwidth utilization by implementing equal cost routing (ECR) on the uplinks to perform load balancing. Routed uplinks optimize the utility of uplinks out of the wiring closet by eliminating unnecessary broadcast data flows into the network backbone.

With Cisco StackWise technology, the Cisco Catalyst 3750 Series offers greater efficiency for multicast applications such as video. Each data packet is put onto the backplane only once, which provides more effective support for more data streams.

Private VLANs improve scalability and provide IP address management benefits and Layer 2 security by partitioning a regular VLAN domain into subdomains. Support for the IPv6 industry standard in the Cisco Catalyst 3750 Series also alleviates address space problems.

INTEGRATED WIRELESS LAN

The Cisco[®] Catalyst[®] 3750G Integrated Wireless LAN Controller integrates wireless LAN controller functions into the Cisco Catalyst 3750G Series Switches and delivers improved operating efficiency and WLAN security, mobility and ease of use for business-critical wireless LANs. The Cisco Catalyst 3750G Integrated Wireless LAN Controller delivers centralized security policies, wireless intrusion prevention system (IPS) capabilities, award-winning RF management, QoS, and Layer 3 fast secure roaming for WLANs. As a core component of the [Cisco Unified Wireless Network](#), the Cisco Catalyst 3750G Integrated Wireless LAN Controller provides the control, security, redundancy, and reliability that network managers need to scale and manage their wireless networks as easily as they scale and manage their traditional wired networks.

The Cisco Catalyst 3750G Integrated Wireless LAN Controller is a member of the Cisco Wireless LAN Controller family. It works in conjunction with Cisco Aironet® lightweight access points, the Cisco Wireless Control System (WCS), and the Cisco Wireless Location Appliance to support mission-critical wireless data, voice, and video applications. It provides real-time communication between lightweight access points and other wireless LAN controllers to deliver a secure and unified wireless solution.

ADVANCED QUALITY OF SERVICE

The Cisco Catalyst 3750 Series offers Gigabit Ethernet speed with intelligent services that keep everything flowing smoothly—even at 10 times the normal network speed. Industry-leading mechanisms for marking, classifying, and scheduling deliver high-quality performance for data, voice, and video traffic—all at wire speed. Important features include Shaped Round Robin (SRR) scheduling and policing/rate limiting as well as innovations such as Scavenger Traffic queuing.

Multiple Software Options

The Cisco Catalyst 3750 Series can be purchased with the IP Base license or IP Services license preinstalled. The IP Base license (formerly called the Standard Multilayer Image, or SMI) offers advanced QoS, rate limiting, ACLs, and basic static and Routing Information Protocol (RIP) routing functions. The IP Services license (formerly called the Enhanced Multilayer Image, or EMI) provides a richer set of enterprise-class features, including advanced hardware-based IP unicast and IP Multicast routing as well as policy-based routing (PBR). The Advanced IP Services license, although not available as a preinstalled option, upgrades Cisco Catalyst 3750 Series switches to include IPv6 routing and IPv6 ACL support. Upgrade licenses are available to upgrade a switch from the IP Base license to the IP Services license or Advanced IP Services license as well as from the IP Services license to the Advanced IP Service license.

ENHANCED SECURITY

Enhanced security protects sensitive data and network resources from internal and external threats:

- NAC, supported by the Cisco Catalyst 3750 Series, is an industry initiative sponsored by Cisco that uses the network infrastructure to enforce security policy compliance on all devices seeking to access network computing resources, thereby limiting damage from viruses and worms. Using NAC, organizations can provide network access to endpoint devices such as PCs, personal digital assistants (PDAs), and servers that are verified to be fully compliant with established security policy. NAC can also identify noncompliant devices and deny them access, place them in a quarantined area, or give them restricted access to computing resources.
- Dynamic ARP inspection and IP source guard are security features in the Cisco Catalyst 3750 Series that protect the network from certain man-in-the-middle attacks. Dynamic ARP inspection is a security feature that validates ARP packets in a network and helps ensure that only valid ARP requests and responses are relayed. IP source guard restricts IP traffic from untrusted sources.
- VRF Lite in Cisco Catalyst 3750 Series switches enables unique VPNs without having the need to deploy additional equipment at the customer site.
- The IEEE 802.1x standard supported by the Cisco Catalyst 3750 Series prevents unauthorized clients from connecting to a LAN through publicly accessible ports unless they are properly authenticated.
- Cisco Identity-Based Networking Services (IBNS) in the Cisco Catalyst 3750 Series prevents unauthorized access and helps ensure that users get only their designated privileges. It provides the ability to dynamically administer granular levels of network access.
- Secure Shell Protocol Version 2 (SSHv2) and Simple Network Management Protocol Version 3 (SNMPv3) provide network security by encrypting administrator traffic—preventing unauthorized users from accessing passwords or configuration information.
- ACLs can be used to restrict access to sensitive portions of the network by denying packets based on source and destination MAC addresses, IP addresses, or TCP/(User Datagram Protocol) UDP ports. ACLs can be used to guard against denial-of-service (DoS) and other attacks, and because ACL processing is done in hardware, forwarding performance of the switch is not compromised when implementing ACL-based security.
- A private VLAN edge provides security and isolation between ports on a switch, helping ensure that voice traffic travels directly from its entry point to the aggregation device through a virtual path and cannot be directed to a different port.

- Port security can be used to limit access on an Ethernet port based on the MAC address of the device that is connected to it. It also can be used to limit the total number of devices plugged into a switch port, thereby reducing the risks of rogue wireless access points or hubs.
- MAC Address Notification can be used to monitor the network and track users by sending an alert to a management station so that network administrators know when and where users entered the network. The Dynamic Host Configuration Protocol (DHCP) Interface Tracker (Option 82) feature tracks where a user is physically connected on a network by providing both switch and port ID to a DHCP server. Additionally, the DHCP Snooping Option 82 feature enables granular control over IP address assignment by a DHCP server by augmenting a host IP address request so that the DHCP server can make a more sophisticated address assignment.
- TACACS+ or RADIUS authentication enables centralized access control of switches and restricts unauthorized users from altering the configurations. Alternatively, a local username and password database can be configured on the switch itself. Fifteen levels of authorization on the switch console and two levels on the Web-based management interface provide the ability to give different levels of configuration capabilities to different administrators.

AVAILABILITY AND SCALABILITY

Availability and scalability help ensure that all employees can access data at all times, locally and remotely.

Scalable Stacking

Cisco StackWise stacking creates a 32 Gbps switch interconnection. Stacking does not require user ports. Up to 9 units can be stacked together for a maximum of 468 10/100 ports, 468 10/100/1000 ports, 108 optical aggregation ports, nine 10 Gigabit Ethernet ports, or any mix thereof.

REDUNDANCY

- 1:N master redundancy allows each stack member to serve as a master, providing the highest reliability for forwarding.
- Cisco CrossStack UplinkFast (CSUF) technology provides increased redundancy and network resiliency through fast spanning-tree convergence (less than 2 seconds) across a switch stack with Cisco StackWise technology.
- Cross-Stack EtherChannel[®] technology provides the ability to configure Cisco EtherChannel technology across different members of the stack for high resiliency.
- 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.
- Flex Links are a pair of Layer 2 interfaces (switch ports or port channels), where one interface is configured to act as a backup to the other. This feature provides an alternative solution to the Spanning Tree Protocol, allowing users to turn off Spanning Tree Protocol and still provide basic link redundancy.
- 802.1s Multiple Spanning Tree Protocol enables load balancing and improves network fault tolerance by providing multiple forwarding paths for data traffic. 802.1w Rapid Spanning Tree Protocol provides rapid recovery of uplink connectivity following failure.
- Cisco Hot Standby Router Protocol (HSRP) is supported to create redundant, failsafe routing topologies.
- ECR provides load balancing and redundancy. Basic IP unicast routing protocols (static, RIPv1, and RIPv2) are supported for small-network routing applications. Advanced IP unicast routing protocols (Open Shortest Path First [OSPF], Interior Gateway Routing Protocol [IGRP], Enhanced IGRP [EIGRP], and Border Gateway Protocol Version 4 [BGPv4]) are supported for load balancing and constructing scalable LANs. IP Services or Advanced IP Services is required.
- Switch port autorecovery (errdisable) automatically attempts to reenab a link that is disabled because of a network error.
- The Cisco RPS 675 Redundant Power System provides transparent protection against internal power supply failures (optional).

MANAGEMENT

- Autoconfiguration of new stack units eliminates reconfiguration.
- Automatic Cisco IOS Software version checking and updating help ensure that all stack members have the same software version.
- Master configuration management helps ensure that all switches are automatically upgraded when the master switch receives a new software version.

- IEEE 802.3af and Cisco prestandard PoE support come with automatic discovery to detect a Cisco prestandard or IEEE 802.3af endpoint, negotiate the power to be budgeted for that device, and provide the necessary power, all done by Cisco Catalyst 3750 Series switches without any user configuration.
- **Smartport macros offer a set of verified feature templates per connection type in an easy-to-apply manner. With these templates, users can consistently and reliably configure essential security, IP telephony, availability, QoS, and manageability features with minimal effort and expertise. Smartport macros simplify the configuration of critical features for Ethernet networks.**
- All Cisco Catalyst 3750 Series switches are managed by the CiscoWorks LAN Management Solutions (LMS) applications such as Resource Manager Essentials, Campus Manager, Device Fault Manager, and CiscoView. LMS is a suite of powerful management tools that simplify the configuration, administration, monitoring, and troubleshooting of large Cisco networks. It integrates these capabilities into a world-class solution for improving the accuracy and efficiency of operations staff, increasing the overall availability of networks through proactive planning, and maximizing network security.
- Cisco Network Assistant software can manage a small network consisting of a diverse array of network devices, such as Cisco routers and Cisco Aironet wireless access points. A few mouse clicks enable the security, availability, and QoS features recommended by Cisco without the need to consult a detailed design guide. The security wizard automatically restricts unauthorized access to servers with sensitive data. Smartports and wizards save hours of time for network administrators, eliminate human errors, and help ensure that the configuration of the switch is optimized for these applications. Available at no cost, Cisco Network Assistant can be downloaded from Cisco.com.
- The Cisco Express Setup feature simplifies initial configuration, eliminating the need for more complex terminal emulation programs and knowledge of the command-line interface (CLI). This reduces the cost of deployment by enabling less-skilled personnel to quickly and simply set up switches.
- DHCP Server enables a convenient deployment option for the assignment of IP addresses in networks that do not have a dedicated DHCP server.

BANDWIDTH OPTIMIZATION

- Voice VLAN allows network administrators to assign voice traffic to a VLAN dedicated to IP telephony, simplifying phone installations and providing easier network traffic administration and troubleshooting.
- Cisco Fast EtherChannel and Gigabit EtherChannel technology allows for aggregating ports for up to 2 Gbps full duplex on network or server connections. Use Port Aggregation Protocol (PAgP) for automatic configuration. Similarly, Link Aggregation Group Protocol (LACP) allows creation of Ethernet channeling with devices that conform to the IEEE 802.3ad standard.
- Internet Group Management Protocol (IGMP) allows monitoring and management of multicast applications (e-learning and videoconferencing) while minimizing effect on performance to manage group membership information.

IPv6

- The Cisco Catalyst 3750 Series switches support the IPv6 standard, which increases the Internet global address space to accommodate the rapidly increasing number of users and applications that require unique global IP addresses.
- In addition to the larger address space, the Cisco Catalyst 3750 Series switches also make the most of other IPv6 features such as address autoconfiguration, embedded IP Security (IPSec, for encrypted security), routing optimized for mobile devices, and Duplicate Address Detection (DAD).

ADVANCED QUALITY OF SERVICE

Advanced QoS prioritizes critical traffic and applications to avoid bottlenecks:

- Cisco Catalyst intelligent switches offer industry-leading QoS features, bringing new levels of control, predictability, and adaptability to networks of all sizes. The Cisco Catalyst 3750 Series can identify traffic flows or traffic groups and can classify or reclassify these groups using DiffServ Code Point (DSCP) in the IP packet and/or the 802.1p class of service (CoS) field in the Ethernet packet.
- Cross-stack QoS allows QoS to be configured across the entire stack.
- Users of the Cisco Catalyst 3750 Series can mitigate DoS attacks by assigning a minimal bandwidth queue to “scavenger traffic” or unimportant traffic used for peer-to-peer media sharing, gaming, or any entertainment video applications. This reduces scavenger traffic during periods of congestion, but allows it to be available if bandwidth is not being used for business purposes, such as might occur during off-peak hours.

- Rate limiting allows control of the amount of bandwidth across any configured interface, helping ensure appropriate distribution of available bandwidth.
- Four egress queues allow network administrators to be more discriminating and specific in assigning priorities for the various applications on the LAN. Scheduling is performed in egress to assign the appropriate queues to the outgoing packets.
- SRR scheduling helps ensure differential prioritization of packet flows by intelligently servicing the ingress queues and egress queues.
- Weighted Tail Drop (WTD) provides congestion avoidance at the ingress and egress queues before a disruption occurs.
- 64 policers per 10/100 or Gigabit Ethernet port are used to allocate bandwidth based on source/destination (IP address, MAC address) or TCP/UDP port numbers.

CISCO CATALYST 3750 SERIES SWITCHES PRODUCT MODELS

Table 1 lists the Cisco Catalyst 3750 Series switches. Each model is available with the IP Base or the IP Services software loaded on it. All models can later be updated to the IP Advanced Services software.

Table 1. Cisco Catalyst 3750 Series Switches

Product	Port Speed	Number of Ports	Uplinks	When to Buy
Cisco® Catalyst® 3750-24TS	10/100	24	2 Small Form-Factor Pluggable (SFP) uplinks	For networks requiring low-density access with switch-stacking capability, Layer 2+ and Layer 3 features, and one or more fiber uplinks
Cisco Catalyst 3750-24FS	100BASE-FX	24	2 SFP uplinks	For networks requiring low-density access using 100BASE-FX fiber connections with switch-stacking capability, Layer 2+ features, and one or more fiber uplinks
Cisco Catalyst 3750-24PS	10/100 with 802.3af and Cisco predraft PoE	24	2 SFP uplinks	For networks requiring low-density access with switch-stacking capability, inline power, Layer 2+ and Layer 3 features, and one or more fiber uplinks
Cisco Catalyst 3750-48TS	10/100	48	4 SFP uplinks	For networks requiring medium-density access with switch stacking, Layer 2+ and Layer 3 features, and one or more fiber uplinks
Cisco Catalyst 3750-48PS	10/100 with 802.3af and Cisco predraft PoE	48	4 SFP uplinks	For networks requiring medium-density access with switch stacking, inline power, Layer 2+ and Layer 3 features, and one or more fiber uplinks
Cisco Catalyst 3750G-24T	10/100/1000	24	None	For networks requiring Layer 2+ and Layer 3 Gigabit to the Desktop (GTDD) or Gigabit Ethernet aggregation without any uplinks
Cisco Catalyst 3750G-24TS	10/100/1000	24	4 SFP uplinks	For networks requiring Layer 2+ and Layer 3 GTDD or Gigabit Ethernet aggregation with stacking, and one or more fiber uplinks
Cisco Catalyst 3750G-24TS-1U	10/100/1000	24	4 SFP uplinks	For networks requiring basic Layer 3 GTDD or Ethernet aggregation with stacking and fiber uplinks
Cisco Catalyst 3750G-24PS	10/100/1000 with IEEE 802.3af PoE	24	4 SFP	For networks requiring basic Layer 3 GTDD or Ethernet aggregation with stacking, fiber uplinks, and 802.3af PoE
Cisco Catalyst 3750G-48TS	10/100/1000	48	4 SFP	For networks requiring basic Layer 3 GTDD or Ethernet aggregation with stacking and fiber uplinks
Cisco Catalyst 3750G-48PS	10/100/1000 with IEEE 802.3af PoE	48	4 SFP	For networks requiring basic Layer 3 GTDD or Ethernet aggregation with stacking, fiber uplinks, and 802.3af PoE

Product	Port Speed	Number of Ports	Uplinks	When to Buy
Cisco Catalyst 3750G-12S	10/100/1000 1000 only	12	12 SFP	For aggregation of wiring closet switches with optical connectivity and stacking at Layer 2 and Layer 3
Cisco Catalyst 3750G-12S-SD	10/100/1000 1000 only	12	12 SFP	For aggregation of wiring closet switches with optical connectivity and stacking at Layer 2 in a DC power environment
Cisco Catalyst 3750G-16TD	10/100/1000	16	1 XENPAK	For networks requiring basic Layer 3 routing GTTD or Ethernet aggregation with stacking capability and a 10 Gigabit Ethernet uplink
Cisco Catalyst 3750G-24WS	10/100/1000 with IEEE 802.3af PoE and Cisco prestandard PoE	24	2 SFP	For networks requiring an integrated wireless LAN controller with support for up to 50 access points

FOR MORE INFORMATION

For more information, go to <http://www.cisco.com/go/catalyst3750>



Corporate Headquarters

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

European Headquarters

Cisco Systems International BV
Haarlerbergpark
Haarlerbergweg 13-19
1101 CH Amsterdam
The Netherlands
www-europe.cisco.com
Tel: 31 0 20 357 1000
Fax: 31 0 20 357 1100

Americas Headquarters

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-7660
Fax: 408 527-0883

Asia Pacific Headquarters

Cisco Systems, Inc.
168 Robinson Road
#28-01 Capital Tower
Singapore 068912
www.cisco.com
Tel: +65 6317 7777
Fax: +65 6317 7799

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