DATA SHEET

CISCO CATALYST 2950 SERIES SWITCHES WITH ENHANCED IMAGE SOFTWARE

PRODUCT OVERVIEW

Cisco® Catalyst® 2950 Series switches are fixed-configuration models that provide wire-speed Fast Ethernet and Gigabit Ethernet connectivity for small and medium-sized networks. The Cisco Catalyst 2950 Series is an affordable product line that brings intelligent services, such as enhanced security, high availability, and advanced quality of service (QoS), to the network edge—while maintaining the simplicity of traditional LAN switching.

Embedded in all Cisco Catalyst 2950 Series switches is the Cisco Device Manager software, which allows users to easily configure and monitor the switch using a standard Web browser, eliminating the need for more complex terminal emulation programs and knowledge of the command-line interface (CLI). Customers can easily initialize the switch with web-based Cisco Express Setup, without using the CLI. In addition, with Cisco Network Assistant, a standalone network management software, customers can simultaneously configure and troubleshoot multiple Cisco Catalyst desktop switches. Cisco Device Manager, Cisco Express Setup, and Cisco Network Assistant reduce the cost of deployment by enabling less-skilled personnel to set up switches quickly. Furthermore, Cisco Catalyst 2950 Series switches provide extensive management tools using Simple Network Management Protocol (SNMP) network management platforms such as CiscoWorks.

This product line offers two distinct sets of software features and several configurations to allow small, medium-sized, and enterprise branch offices to select the right combination for the network edge. Cisco Standard Image software offers Cisco IOS® Software capabilities for basic data, voice, and video services. For networks that require additional security, advanced QoS, and high availability, Cisco Enhanced Image software delivers intelligent services such as rate limiting, QoS reclassifying, and security filtering for deployment at the network edge.

Cisco Catalyst 2950 Series switches consist of the following devices, which are only available with Enhanced Image software for the Cisco Catalyst 2950 Series.

- **Cisco Catalyst 2950G 48**—48 10/100 ports and 2 Gigabit Interface Converter (GBIC)-based Gigabit Ethernet ports
- **Cisco Catalyst 2950G 24**—24 10/100 ports and 2 GBIC ports
- **Cisco Catalyst 2950G 24-DC**—24 10/100 ports, 2 GBIC ports, DC power
- **Cisco Catalyst 2950G 12**—12 10/100 ports and 2 GBIC ports
- **Cisco Catalyst 2950T 24**—24 10/100 ports and 2 fixed 10/100/1000BASE-T uplink ports
- **Cisco Catalyst 2950C 24**—24 10/100 ports and 2 fixed 100BASE-FX uplink ports

Figure 1. Cisco Catalyst 2950 Series Switches

This complete set of switches offers network managers flexibility when selecting a migration path to Gigabit Ethernet. The two built-in Gigabit Ethernet ports on the Cisco Catalyst 2950G-12, 2950G-24 and 2950G-48 accommodate several GBIC transceivers, including the Cisco GigaStack®, 1000BASE-SX, 1000BASE-LX/LH, 1000BASE-ZX, 1000BASE-T, and coarse wavelength-division multiplexing (CWDM) GBICs. The dual GBIC-based Gigabit Ethernet implementation provides customers with tremendous deployment flexibility—giving them increased availability with redundant uplinks. In sum, the configuration permits customers to implement one type of stacking and uplink configuration today, while preserving the option to migrate to another configuration in the future. High levels of stack resiliency can also be implemented by deploying dual-redundant Gigabit Ethernet uplinks, a redundant Cisco GigaStack GBIC loopback cable, UplinkFast and CrossStack UplinkFast technologies for high-speed uplink and stack interconnection failover, and Per-VLAN Spanning Tree Plus (PVST+) for uplink load balancing.

In addition, the Cisco Catalyst 2950T-24 offers small and medium-sized enterprises server connectivity and an easy migration path to Gigabit by using existing copper cabling infrastructure. Implementing Gigabit Ethernet over copper allows network managers to boost network performance and maximize infrastructure investments in Category 5 copper cabling.

Maximum power availability for a converged voice and data network is attainable when a Cisco Catalyst 2950 Switch is combined with the Cisco Redundant Power System 675 for protection against internal power supply failures and an uninterruptable power supply (UPS) system to safeguard against power outages.

ADDITIONAL CISCO CATALYST 2950 SERIES SWITCHES

Cisco Catalyst 2950 Series with Standard Image Software

The Cisco Catalyst 2950SX-48-SI, 2950T-48-SI, 2950SX-24, 2950-24 and 2950-12 are standalone, fixed-configuration, managed 10/100 switches providing basic workgroup connectivity for small to medium-sized companies. These wire-speed desktop switches come with Cisco Standard Image software features and offer Cisco IOS® Software functions for basic data, video, and voice services at the edge of the network.

Cisco Catalyst 2950 Series Long-Reach Ethernet (LRE) Switches

- *Cisco Catalyst 2950ST-24-LRE*—24 LRE ports, 2 fixed 10/100/1000BASE-T ports, and 2 Small Form-Factor Pluggable (SFP) ports (two of the four uplinks active at one time)
- *Cisco Catalyst 2950ST-8-LRE*—Eight LRE ports, two fixed 10/100/1000BASE-T ports, and two SFP ports (two of the four uplinks active at one time)

The Cisco Catalyst 2950 Series LRE solution delivers cost-effective, high-performance broadband access over existing phone wiring in enterprise campus environments and multi-tenant buildings (for example, hotels, apartment buildings, and office buildings). Cisco Catalyst 2950 LRE switches include the Cisco Enhanced Image software features, enabling enterprise and service provider customers to extend intelligent services over traditional wiring (Category 1/2/3) to distances up to 5000 feet. Cisco is the only company with the breadth of technologies that allows customers to deliver

intelligent network services across any combination of wired and wireless infrastructures. Refer to the Cisco Catalyst 2950 LRE Series Data Sheet for more information.

INTELLIGENCE IN THE NETWORK

Networks of today are evolving to address four new developments at the network edge:

- Increase in desktop computing power
- Introduction of bandwidth-intensive applications
- Expansion of highly sensitive data on the network
- Presence of multiple device types, such as IP phones and LAN access points

These new demands are contending for resources with many existing mission-critical applications. As a result, IT professionals must view the edge of the network as critical to effectively manage the delivery of information and applications.

As companies increasingly rely on the network as the strategic business infrastructure, it is more important than ever to ensure their high availability, security, scalability, and control. By adding Cisco intelligent functions to the wiring closet, customers can now deploy network-wide intelligent services that address these requirements in a consistent way, from the desktop to the core and through the WAN.

With Cisco Catalyst switches, Cisco enables companies to realize the full benefits of adding intelligent services into their networks. Capabilities that make the network infrastructure highly available to accommodate time-critical needs, scalable to accommodate growth, secure enough to protect confidential information, and capable of differentiating and controlling traffic flows are critical to further optimizing network operations.

Network Security Through Advanced Security Features

Cisco Catalyst 2950 Series switches offer enhanced data security through several security features. These features allow customers to enhance LAN security with capabilities to secure network management traffic through the protection of passwords and configuration information; to provide options for network security based on users, ports, and MAC addresses; and to enable more immediate reactions to intruder and hacker detection. These enhancements are available free of charge by downloading the latest software release for the Cisco Catalyst 2950 Series.

Secure Shell version 2 (SSHv2) and Simple Network Management Protocol version 3 (SNMPv3) protect information from being eavesdropped or being tampered with by encrypting information being passed on the network, thereby guarding administrative information. Private VLAN Edge isolates ports on a switch, ensuring that traffic travels directly from the entry point to the aggregation device through a virtual path and cannot be directed to another port. Local Proxy Address Resolution Protocol (ARP) works in conjunction with Private VLAN Edge to minimize broadcasts and maximize available bandwidth.

Port-based Access Control Parameters (ACPs) restrict sensitive portions of the network by denying packets based on source and destination MAC addresses, IP addresses, or TCP/UDP ports. ACP lookups are done in hardware; therefore, forwarding performance is not compromised when implementing this type of security in the network. In addition, Time-based Access Control Lists (ACLs) allow configuration of differentiated services based on time periods. ACLs can also be applied to filter traffic based on Differentiated Services Code Point (DSCP) values. Port security provides another means to ensure that the appropriate user is on the network, by limiting access based on MAC addresses.

For authentication of users with a Terminal Access Controller Access Control System (TACACS+) or RADIUS server, 802.1x provides port-level security. 802.1x, in conjunction with a RADIUS server, allows for dynamic port-based user authentication. 802.1x-based user authentication can be extended to dynamically assign a VLAN based on a specific user, regardless of where they connect on the network. With 802.1x with Guest VLAN, guests are allowed access to the Internet via the Guest VLAN but cannot access the customer's internal network. This intelligent adaptability allows IT departments to offer greater flexibility and mobility to their stratified user populations. By combining access control and user profiles with secure network connectivity, services, and applications, enterprises can more effectively manage user mobility and drastically reduce the overhead associated with granting and managing access to network resources.

With multilayer Cisco Catalyst 2950 Series switches, network managers can implement high levels of console security. Multilevel access security on the switch console and the Web-based management interface prevent unauthorized users from accessing or altering switch configurations. TACACS+ or RADIUS authentication enables centralized access control of the switch and restricts unauthorized users from altering the configuration. Security can be deployed through Cisco Network Assistant Software security wizards, which ease the deployment of security features that restrict user access to a server, a portion of the network, or access to the network.

Network Control Through Advanced Quality of Service and Rate Limiting

The Cisco Catalyst 2950 Series offers superior, highly granular QoS based on Layer 2 to 4 information, helping to ensure that network traffic is classified and prioritized, and that congestion is avoided in the best possible manner. Configuration of QoS is greatly simplified through automatic QoS (auto-QoS), a feature that detects Cisco IP phones and automatically configures the switch for the appropriate classification and egress queuing. This optimizes traffic prioritization and network availability without the challenge of a complex configuration.

Cisco Catalyst 2950 Series switches can classify, reclassify, police (determine if the packet is in or out of predetermined profiles and affect actions on the packet), and mark or drop the incoming packets before the packet is placed in the shared buffer. Packet classification allows the network elements to discriminate between various traffic flows and to enforce policies based on Layer 2 and Layer 3 QoS fields.

To implement QoS, these switches first identify traffic flows, or packet groups, and classify or reclassify these groups using the DiffServ Code Point (DSCP) field in the IP packet and/or the 802.1p class of service (CoS) field in the Ethernet packet. Classification and reclassification can also be based on criteria as specific as the source/destination IP address, source/destination MAC address, or the Layer 4 Transmission Control Protocol (TCP)/User Datagram Protocol (UDP) ports. At the ingress (incoming port) level, the Catalyst switches also perform policing and marking of the packet.

After the packet goes through classification, policing, and marking, it is assigned to the appropriate queue before exiting the switch. Cisco Catalyst 2950 Series switches support four egress (outgoing port) queues per port, which allows the network administrator to be more discriminating and specific in assigning priorities for the various applications on the LAN. At the egress level, the switch performs scheduling, which is an algorithm (process) that determines the order in which the queues are processed. The switches support Weighted Round Robin (WRR) scheduling or strict priority scheduling. The WRR scheduling algorithm ensures that lower-priority packets are not entirely starved for bandwidth and are serviced without compromising the priority settings administered by the network manager. Strict priority scheduling ensures that the highest priority packets will always get serviced ahead of all other traffic, and that the other three queues will be serviced using WRR best effort.

These features allow network administrators to prioritize mission-critical and/or bandwidth-intensive traffic, such as enterprise resource planning (ERP) (Oracle, SAP, and so on), voice (IP telephony traffic), and CAD/CAM over less time-sensitive applications such as FTP or e-mail (Simple Mail Transport Protocol [SMTP]). For example, it would be highly undesirable to have a large file download destined to one port on a wiring closet switch and have quality implications, such as increased latency in voice traffic, destined to another port on this switch. This condition is avoided by ensuring that voice traffic is properly classified and prioritized throughout the network. Other applications, such as Web browsing, can be treated as low-priority and handled on a best-effort basis.

Cisco Catalyst 2950 Series switches are capable of allocating bandwidth based on several criteria, including MAC source/destination address, IP source/destination address, and TCP/UDP port number. Bandwidth allocation is essential in network environments requiring service-level agreements, or when it is necessary for the network manager to control the bandwidth given to certain users. Cisco Catalyst 2950 Series switches support up to six policers per Fast Ethernet port and up to 60 policers on a Gigabit Ethernet port. This gives the network administrator granular control of LAN bandwidth.

Network Availability

To provide efficient use of resources for bandwidth-intensive applications like multicasts, Cisco Catalyst 2950 Series Intelligent Ethernet Switches support Internet Group Management Protocol Version 3 (IGMPv3) snooping in hardware. Through the support and configuration of IGMP snooping

through Cisco Network Assistant Software, Cisco Catalyst 2950 Series switches deliver outstanding performance and ease of use in administering and managing multicast applications on the LAN.

The IGMPv3 snooping feature allows the switch to "listen in on" the IGMP conversation between hosts and routers. When a switch hears an "IGMP join" request from a host for a given multicast group, the switch adds the host's port number to the Group Destination Address (GDA) list for that group. And, when the switch hears an "IGMP leave" request, it removes the host's port from the Content Addressable Memory (CAM) table entry.

PVST+ allows users to implement redundant uplinks while also distributing traffic loads across multiple links. This is not possible with standard Spanning-Tree Protocol implementations. Cisco UplinkFast technology helps to ensure immediate transfer to the secondary uplink; much better than the traditional 30-to-60 second convergence time. This is yet another enhancement of the Spanning Tree Protocol implementation. An additional feature that enhances performance is Voice VLAN. This feature 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.

Multicast VLAN Registration (MVR) is designed for applications using wide-scale deployment of multicast traffic across an Ethernet ring-based service provider network (for example, the broadcast of multiple television channels over a service-provider network). MVR allows a subscriber on a port to subscribe and unsubscribe to a multicast stream on the network-wide multicast VLAN.

Network Management

Customers can configure one switch at a time with the embedded Cisco Device Manager, or configure and troubleshoot multiple switches with Cisco Network Assistant, a standalone network management software application optimized for LANs of small and medium-sized businesses with up to 250 users. Cisco Device Manager offers a simple and intuitive GUI interface for configuring and monitoring the switch. The software is Web-based and embedded in Cisco Catalyst 3750, 3650, 3550, 2970, 2950, and 2940 Switches. Cisco Express Setup simplifies the switch initialization. Users now have the option to set up the switch through a Web browser, eliminating the need for more complex terminal emulation programs and knowledge of the CLI. Cisco Device Manager and Cisco Express Setup reduce the cost of deployment by enabling less-skilled personnel to quickly and simply set up switches.

Cisco Network Assistant Software provides an integrated management interface for delivering intelligent services, such as multilayer switching, QoS, multicast, and security ACLs. Cisco Network Assistant Software allows administrators to take advantage of benefits formerly reserved for only the most advanced networks without having to learn the CLI, or even the details of the technology. With Cisco Network Assistant, customers can configure multiple ports and switches simultaneously, perform software updates across multiple switches at once, and copy configurations to other switches for rapid network deployments. Bandwidth graphs and link reports provide useful diagnostic information, and the topology map gives network administrators a quick view of the network status. Cisco Network Assistant supports a wide range of Cisco Catalyst intelligent switches from Cisco Catalyst 2950 through Cisco Catalyst 4506. Through a user-friendly GUI, users can configure and manage a wide array of switch functions and start the device manager of Cisco routers and Cisco wireless access points.

The Cisco Network Assistant Software Guide Mode leads the user step-by-step through the configuration of advanced features and provides enhanced online help for context-sensitive assistance. Cisco AVVID (Architecture for Voice, Video and Integrated Data) Wizards provide automated configuration of the switch to optimally support video streaming or video conferencing, voice over IP (VoIP), and mission-critical applications. In addition, Smartports offers a set of verified feature macros per connection type in an easy-to-apply manner. With these macros, users can consistently and reliably configure essential security, availability, quality of service, and manageability features recommended for Cisco Business Ready Campus solutions with minimal effort and expertise. These Wizards and Smartports can save hours of time for network administrators, eliminate human errors, and ensure that the configuration of the switch is optimized for these applications.

In addition to Cisco Network Assistant Software, Cisco Catalyst 2950 Series switches provide extensive management tools using Simple Network Management Protocol (SNMP) network management platforms such as CiscoWorks. Managed with CiscoWorks, Cisco Catalyst switches can be configured and managed to deliver end-to-end device, VLAN, traffic, and policy management. Coupled with CiscoWorks, Cisco Resource Manager

Essentials, a Web-based management tool, offers automated inventory collection, software deployment, easy tracking of network changes, views into device availability, and quick isolation of error conditions.

PRODUCT FEATURES AND BENEFITS

Feature	Benefit
Availability	
Superior Redundancy for Fault Backup	• IEEE 802.1D Spanning Tree Protocol support for redundant backbone connections and loop-free networks simplifies network configuration and improves fault tolerance. • Support for Cisco Spanning Tree Protocol enhancements such as UplinkFast, BackboneFast, and PortFast technologies helps to ensure quick fail-over recovery, enhancing overall network stability and availability. • IEEE 802.1w Rapid Spanning Tree Protocol (RSTP) provides rapid convergence of the spanning tree, independent of spanning-tree timers. • 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 CrossStack UplinkFast technology extends UplinkFast to a stack to ensure quick fail-over recovery, enhancing network stability and availability. • Support for Cisco's optional RPS 675, 675-watt redundant AC power system, which provides a backup power source for one of six switches, for improved fault tolerance and network uptime. • Redundant stacking connections provide support for a redundant loopback connection for top and bottom switches in an independent stack backplane cascaded configuration. • Provides unidirectional link detection (UDLD) and Aggressive aggressive UDLD for detecting and disabling unidirectional links on fiber-optic interfaces caused by incorrect fiber-optic wiring or port faults.
Integrated Cisco IOS Software Features for Bandwidth Optimization	• Bandwidth aggregation up to 4 Gbps (two ports full duplex) through Gigabit EtherChannel technology and up to 16 Gbps (eight ports full duplex) through Fast EtherChannel technology enhances fault tolerance and offers higher-speed aggregated bandwidth between switches, to routers and individual servers. Port Aggregation Protocol (PAgP) is available to simplify configuration. • VLAN1 minimization allows VLAN1 to be disabled on any individual VLAN trunk link. • Per-port broadcast, multicast, and unicast storm control prevent faulty end stations from degrading overall systems performance. • Per virtual LAN (VLAN) Spanning Tree Plus (PVST+ allows for Layer 2 load sharing on redundant links, to efficiently use the extra capacity inherent in a redundant design. • IEEE 802.1s Multiple Spanning Tree Protocol (MSTP) allows a spanning-tree instance per VLAN, enabling Layer 2 load sharing on redundant links. • VLAN Trunking Protocol (VTP) pruning limits bandwidth consumption on VTP trunks by flooding broadcast traffic only on trunk links required to reach the destination devices. Dynamic Trunking Protocol (DTP) enables dynamic trunk configuration across all ports in the switch. • Internet Group Management Protocol version 3 (IGMPv3) snooping provides for fast client joins and leaves of multicast streams, and limits bandwidth-intensive video traffic to only the requestors. Multicast VLAN Registration MVR, IGMP filtering, and fast-join and immediate leave are available as enhancements. The number of IGMP groups can be limited with IGMP throttling. IGMP Snooping time can be adjusted to optimize the performance of multicast data flows • MVR continuously sends multicast streams in a multicast VLAN while isolating the streams from subscriber VLANs for bandwidth and security reasons. • Supports additional frame formats: Ethernet II (tagged and untagged) and 802.3 (Subnetwork Access Protocol [SNAP] encapsulated tagged and untagged frames).

Feature	Benefit
Security	
Network-Security Features	• Filtering of incoming traffic flows based on Layer 2, Layer 3 or Layer 4 access control parameters (ACPs) prevents unauthorized data flows. • The following Layer 2 ACPs or a combination can be used for security classification of incoming packets: source Media Access Control (MAC) address, destination MAC address, and 16-bit Ethertype. • The following Layer 3 and Layer 4 fields or a combination can be used for security classification of incoming packets: source/destination IP address, TCP source/destination port number, User Datagram Protocol (UDP) source, or destination port number. ACLs can also be applied to filter based on DSCP values. • Time-based ACLs allow configuration of differentiated services based on time-periods. • Private VLAN edge provides security and isolation between ports on a switch, ensuring 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. • Support for the IEEE 802.1x standard allows users to be authenticated regardless of which LAN port they are accessing, and provides unique benefits to customers who have a large base of mobile (wireless) users accessing the network. – 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 to permit an IP phone access to the voice VLANirrespective of the authorized or unauthorized state of the port. – IEEE 802.1x with port security for authenticating the port and managing network access for all MAC addresses, including that of the client. – IEEE 802.1x with Guest VLAN allows guests without 802.1x clients to have limited network access on the Guest VLAN. • SSHv2 and SNMPv3 provide network security by encrypting administrator traffic during Telnet and SNMP sessions. SSHv2 and the crypto version of SNMPv3 require a special crypto software image due to US export restrictions • Port Security and unicast MAC filtering secures the access to a port based on MAC addresses. The aging feature of port security removes the MAC address from the switch after a specific timeframe to allow another device to connect to the same port. Unicast MAC filtering allows non-IP packets to be filtered as well. • With unknown unicast/multicast port blocking, the switch will not flood packets with unknown destination MAC addresses to all Ethernet ports. Unknown unicast/multicast port blocking disables flooding on a per-port basis. (Catalyst 2950G24, 2950G48, 2950G12, 2950G24DC only) • MAC Address Notification allows administrators to be notified of new users added or removed from the network. • Spanning-tree root guard (STRG) prevents edge devices not in the network administrator's control from becoming Spanning-Tree Protocol root nodes. • The Spanning-Tree Protocol PortFast/bridge protocol data unit (BPDU) guard feature disables access ports with SpanningTree Protocol PortFastenabled upon reception of a BPDU, and increases network reliability, manageability, and security. • Multilevel security on console access prevents unauthorized users from altering the switch configuration. • TACACS+ and RADIUS authentication enable centralized control of the switch and restrict unauthorized users from altering the configuration. • The user-selectable address-learning mode simplifies configuration and enhances security. • Trusted Boundary provides the ability to trust the QoS priority settings if an IP phone is present, and to disable the trust settings in the event that the IP phone is removed. This prevents a rogue user from overriding prioritization policies in the network. • IGMP Filtering provides multicast authentication by filtering out nonsubscribers and limits the number of concurrent multicast streams available per port.

Feature	Benefit
	• Support for dynamic VLAN assignment through implementation of VLAN Membership Policy Server (VMPS) client provides flexibility in assigning ports to VLANs. Dynamic VLAN enables fast assignment of IP address. • SPAN support of Intrusion Detection Systems (IDSs) to monitor, repel, and report network security violations • Cisco Network Assistant Software Security Wizards ease the deployment of security features for restricting user access to a server, a portion of the network or access to the network.
Quality of Service (QoS)	
Overview	• Cisco Catalyst 2950 Series switches support the aggregate QoS model by enabling classification, policing/metering, and marking functions on a per-port basis at ingress and the queuing/scheduling function at egress. • The switches support configuring QoS ACPs on all ports to ensure proper policing and marking on a per-packet basis using ACPs. Up to four ACPs per switch are supported in configuring either QoS ACPs or security filters. • Auto-QoS greatly simplifies the configuration of QoS in VoIP networks by issuing interface and global switch commands that allow the detection of Cisco IP phones, the classification of traffic, and egress queue configuration.
QoS Classification Support at Ingress	• The switches support QoS classification of incoming packets for QoS flows based on Layer 2, Layer 3, and Layer 4 fields. • The following Layer 2 fields (or a combination) can be used for classifying incoming packets to define QoS flows: source/destination MAC address, or 16-bit Ethertype. • The switches support identification of traffic based on Layer 3 type of service (ToS) field DSCP values. • The following Layer 3 and Layer 4 fields (or a combination) can be used to classify incoming packets to define QoS flows: source/destination IP address, TCP source/destination port number, or UDP source/destination port number.
QoS Metering and Policing at Ingress	• Support for metering and policing of incoming packets restricts incoming traffic flows to a certain rate. • The switches support up to six policers per Fast Ethernet port, and 60 policers on a Gigabit Ethernet port. • The switches offer granularity of traffic flows at 1 Mbps on Fast Ethernet ports, and 8 Mbps on Gigabit Ethernet ports.
QoS Marking at Ingress	• The switches support marking and remarking packets based on the state of policers and meters. • The switches support marking and remarking based on the following mappings: from DiffServ Code Point (DSCP) to 802.1p, and 802.1p to DSCP. • The switches support 14 well-known and widely used DSCP values. • The switches support classifying or reclassifying packets based on default DSCP per port. They also support classification based on DSCP values in the ACL. • The switches support classifying or reclassifying frames based on default 802.1p value per port. • The switches support 802.1p override at ingress.
QoS Scheduling Support at Egress	• Four queues per egress port are supported in hardware. • The WRR queuing algorithm ensures that low-priority queues are not starved. • Strict-priority queue configuration via Strict Priority Scheduling ensures that time-sensitive applications such as voice always follow an expedited path through the switch fabric.
Sophisticated Traffic Management	• The switch offers the ability to limit data flows based on MAC source/destination address, IP source/destination address, TCP/UDP port numbers, or any combination of these fields. • The switch offers the ability to manage data flows asynchronously upstream and downstream from the end station or on the uplink.

Feature	Benefit
Management	
Superior Manageability	• An embedded Remote Monitoring (RMON) software agent supports four RMON groups (history, statistics, alarms, and events) for enhanced traffic management, monitoring, and analysis. • The switch supports all nine RMON groups through the use of a Cisco SwitchProbe® Analyzer (Switched Port Analyzer [SPAN]) port, permitting traffic monitoring of a single port, a group of ports, or the entire switch from a single network analyzer or RMON probe. • A SPAN port monitors traffic of a single port from a single network analyzer or RMON probe. • Remote SPAN (RSPAN) allows network administrators to locally monitor ports in a Layer 2 switch network from any other switch in the same network. Bidirectional RSPAN is supported when the switch is used as a source switch only. • DHCP Snooping Option 82 enables more sophisticated IP address assignment by the DHCP server. • The Domain Name System (DNS) provides IP address resolution with user-defined device names. • 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 time stamp to all switches within the intranet. • Layer 2 traceroute eases troubleshooting by identifying the physical path that a packet takes from the source device to a destination device. • Crash information support enables switches to generate a crash file for improved troubleshooting. • Show-interface-capabilities provide information on configuration capabilities of any interface. • RTTMON-MIB allows users to monitor network performance between a Cisco Catalyst switch and a remote device. • Multifunction LEDs per port for port status, half-duplex/full-duplex, 10BASE-T/100BASE-TX/1000BASE-T indication, as well as switch-level status LEDs for system, redundant power supply, and bandwidth utilization, provide a comprehensive and convenient visual management system.
Cisco Network Assistant Software	• Cisco Network Assistant Software is a free, standalone network management application software that simplifies the administration of networks of up to 250 users. . It supports a wide range of Cisco Catalyst intelligent switches from Cisco Catalyst 2950 through Cisco Catalyst 4506. With Cisco Network Assistant, users can manage Cisco Catalyst switches plus launch the device managers of Cisco integrated services routers (ISRs) and Cisco Aironet WLAN access points by simply clicking on its icon in the topology map. • Cisco Architecture for Voice, Video, and Integrated Data (AVVID) Wizards use just a few user inputs to automatically configure the switch to optimally handle different types of traffic: voice, video, multicast, and/or high-priority data. • A security wizard is provided to restrict unauthorized access to servers and networks, and to restrict certain applications on the network. • One-click software upgrades can be performed across multiple switches simultaneously, and configuration cloning enables rapid deployment of networks. • Cisco Network Assistant Software supports multilayer feature configurations such as ACPs and QoS parameters. • Cisco Network Assistant Software Guide Mode assists users in the configuration of powerful advanced features by providing step-by-step instructions. • Cisco Network Assistant Software provides enhanced online help for context-sensitive assistance. • Easy-to-use GUI provides both a topology map and front-panel view of the switches. • Multidevice and multiport configuration capabilities allow network administrators to save time by configuring features across multiple switches and ports simultaneously. • User-personalized interface allows users to modify polling intervals, table views, and other settings within Cisco Network Assistant Software, and to retain these settings the next time they use Cisco Network Assistant. • Alarm notification provides automated e-mail notification of network errors and alarm thresholds.

Feature	Benefit
Support for CiscoWorks	• Manageable through CiscoWorks network management software on a per-port and per-switch basis, providing a common management interface for Cisco routers, switches, and hubs. • Simple Network Management Protocol (SNMP v1, v2, and v3 (noncryptographic) and Telnet interface support delivers comprehensive in-band management, and a CLI-based management console provides detailed out-of-band management. • Cisco Discovery Protocol Versions 1 and 2 enable a CiscoWorks network management station to automatically discover the switch in a network topology. • Supported by the CiscoWorks 2000 LAN Management Solution.
Ease of Use and Ease of Deployment	• Cisco Device Manager is an embedded web-based software that allows the customer to easily configure and troubleshoot the switch, eliminating the need for more complex terminal emulation programs and CLI knowledge, and reducing the cost of deployment by enabling less-skilled personnel to quickly and simply set up switches. • Cisco Express Setup allows the customer to quickly and easily initialize a switch with a web browser. • Smartports offers a set of verified feature macros per connection type in an easy-to-apply manner. With these macros, users can consistently and reliably configure essential security, availability, quality of service, and manageability features recommended for Cisco Business Ready Campus solutions with minimal effort and expertise. • The Cisco GigaStack Gigabit Interface Converter (GBIC) delivers a hardware-based, independent stacking bus with up to 2 Gbps forwarding rate in a point-to-point configuration, or 1 Gbps of forwarding bandwidth when daisy-chained with up to nine switches. • Auto-configuration eases deployment of switches in the network by automatically configuring multiple switches across a network via a boot server. • Automatic QoS (Auto-QoS) greatly simplifies the configuration of QoS in VoIP networks by issuing interface and global switch commands that allow the detection of Cisco IP phones, the classification of traffic, and egress queue configuration. • Auto-sensing on each non-GBIC port detects the speed of the attached device and automatically configures the port for 10-, 100-, or 1000-Mbps operation, easing the deployment of the switch in mixed 10, 100, and 1000BASE-T environments. • Auto-negotiating on all ports automatically selects half- or full-duplex transmission mode to optimize bandwidth. • Cisco VTP supports dynamic VLANs and dynamic trunk configuration across all switches. • Voice VLAN simplifies telephony installations by keeping voice traffic on a separate VLAN for easier network administration and troubleshooting. • Dynamic Trunking Protocol (DTP) enables dynamic trunk configuration across all ports on the switch. • Port Aggregation Protocol (PAgP) automates the creation of Cisco Fast EtherChannel® or Gigabit EtherChannel groups, enabling linking 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 is similar to Cisco's EtherChannel and PAgP. • IEEE 802.3z-compliant 1000BASE-SX, 1000BASE-LX/LH, 1000BASE-ZX, and 1000BASE-T physical interface support through a field-replaceable GBIC module provides customers with unprecedented flexibility in switch deployment. • The default configuration stored in Flash helps to ensure that the switch can be quickly connected to the network and can pass traffic with minimal user intervention. • The switches support nonstandard Ethernet frame sizes (mini-giants) up to 1542 bytes (configurations with GBIC ports only).

PRODUCT SPECIFICATIONS

Feature	Description
Performance	• 13.6 Gbps switching fabric (Catalyst 2950G-48) • 8.8 Gbps switching fabric (Catalyst 2950G-24, 2950G-24-DC, 2950T-24, 2950C-24, 2950G-12) • Cisco Catalyst 2950G-48: 13.6 Gbps maximum forwarding bandwidth • Cisco Catalyst 2950G-24: 8.8 Gbps maximum forwarding bandwidth • Cisco Catalyst 2950G-24-DC: 8.8 Gbps maximum forwarding bandwidth • Cisco Catalyst 2950G-12: 6.4 Gbps maximum forwarding bandwidth • Cisco Catalyst 2950T-24: 8.8 Gbps maximum forwarding bandwidth • Cisco Catalyst 2950C-24: 5.2 Gbps maximum forwarding bandwidth (Forwarding rates based on 64-byte packets.) • Cisco Catalyst 2950G-48: 10.1 Mpps wire-speed forwarding rate • Cisco Catalyst 2950G-24: 6.6 Mpps wire-speed forwarding rate • Cisco Catalyst 2950G-24-DC: 6.6 Mpps wire-speed forwarding rate • Cisco Catalyst 2950G-12: 4.8 Mpps wire-speed forwarding rate • Cisco Catalyst 2950T-24: 6.6 Mpps wire-speed forwarding rate • Cisco Catalyst 2950C-24: 3.9 Mpps wire-speed forwarding rate • 8 MB memory architecture shared by all ports • Up to 16 MB SDRAM and 8 MB Flash memory • Configurable up to 8000 MAC addresses • Configurable maximum transmission unit (MTU) of up to 1530 bytes (Cisco Catalyst 2950G switches only)
Management	• BRIDGE-MIB • CISCO-BULK-FILE-MIB • CISCO-2900-MIB • CISCO-CDP-MIB • CISCO-CLASS-BASED-QOS-MIB • CISCO-CONFIG-COPY-MIB • CISCO-CONFIG-MAN-MIB • CISCO-ENVMON-MIB • CISCO-FLASH-MIB • CISCO-FTP-CLIENT-MIB • CISCO-IMAGE-MIB • CISCO-IPMROUTE-MIB • CISCO-MAC-NOTIFICATION-MIB • CISCO-MEMORY-POOL-MIB • CISCO-PAGP-MIB • CISCO-PING-MIB • CISCO-PORT-SECURITY-MIB • CISCO-PROCESS-MIB • CISCO-PRODUCTS-MIB • CISCO-RTTMON-MIB • CISCO-SMI

Feature	Description
	• CISCO-STACKMAKER-MIB • CISCO-STP-EXTENSIONS-MIB • CISCO-SYSLOG-MIB • CISCO-TC • CISCO-TCP-MIB • CISCO-VLAN-MEMBERSHIP-MIB • CISCO-VTP-MIB • ENTITY-MIB • IANAifType-MIB • IF-MIB (RFC 1573) • OLD-CISCO-CHASSIS-MIB • OLD-CISCO-CPU-MIB • OLD-CISCO-INTERFACES-MIB • OLD-CISCO-IP-MIB • OLD-CISCO-MEMORY-MIB • OLD-CISCO-SYSTEM-MIB • OLD-CISCO-TCP-MIB • OLD-CISCO-TS-MIB • RFC1213-MIB (MIB-II) • RFC1398-MIB (ETHERNET-MIB) • RMON-MIB (RFC 1757) • RS-232-MIB • SNMPv2-MIB • SNMPv2-SMI • SNMPv2-TC • TCP-MIB • UDP-MIB
Standards	• IEEE 802.1x support • IEEE 802.1w • IEEE 802.1s • IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports • IEEE 802.1D Spanning-Tree Protocol • IEEE 802.1p class-of-service (CoS) prioritization • IEEE 802.1Q VLAN • IEEE 802.3 10BASE-T specification • IEEE 802.3u 100BASE-TX specification • IEEE 802.3ab 1000BASE-T specification • IEEE 802.3ad • IEEE 802.3z 1000BASE-X specification • 1000BASE-X (GBIC) • 1000BASE-T (GBIC)

Feature	Description
	• 1000BASE-SX • 1000BASE-LX/LH • 1000BASE-ZX • 1000BASE-CWDM GBIC 1470nm • 1000BASE-CWDM GBIC 1490nm • 1000BASE-CWDM GBIC 1510nm • 1000BASE-CWDM GBIC 1530nm • 1000BASE-CWDM GBIC 1550nm • 1000BASE-CWDM GBIC 1570nm • 1000BASE-CWDM GBIC 1590nm • 1000BASE-CWDM GBIC 1610nm • RMON I and II standards • SNMPv1, SNMPv2c, SNMPv3 (planned future support for v3)
Y2K	• Y2K compliant
Connectors and Cabling	• 10BASE-T ports: RJ-45 connectors; two-pair Category 3, 4, or 5 unshielded twisted-pair (UTP) cabling • 100BASE-TX ports: RJ-45 connectors; two-pair Category 5 UTP cabling • 1000BASE-T ports: RJ-45 connectors; four-pair Category 5 UTP cabling • 100BASE-FX ports: MT-RJ connectors, 50/125 or 62.5/125 micron multimode fiber-optic cabling • 1000BASE-T, 1000BASE-SX, -LX/LH, -ZX GBIC-based ports: SC fiber connectors, single-mode or multimode fiber • Cisco GigaStack GBIC ports: copper-based Cisco GigaStack cabling • Management console port: 8-pin RJ-45 connector, RJ-45-to-RJ-45 rollover cable with RJ-45-to-DB9 adapter for PC connections; for terminal connections, use RJ-45-to-DB25 female data-terminal-equipment (DTE) adapter (can be ordered separately from Cisco, part number ACS-DSBUASYN=)
MT-RJ Patch Cables for the Cisco Catalyst 2950C-24 Switch	*Type of cable; Cisco part number:* • 1-meter, MT-RJ-to-SC multimode cable; CAB-MTRJ-SC-MM-1M • 3-meter, MT-RJ-to-SC multimode cable; CAB-MTRJ-SC-MM-3M • 5-meter, MT-RJ-to-SC multimode cable; CAB-MTRJ-SC-MM-5M • 1-meter, MT-RJ-to-ST multimode cable; CAB-MTRJ-ST-MM-1M • 3-meter, MT-RJ-to-ST multimode cable; CAB-MTRJ-ST-MM-3M • 5-meter, MT-RJ-to-ST multimode cable; CAB-MTRJ-ST-MM-5M

Feature	Description
Power Connectors	Customers can provide power to a switch by using the internal power supply, the Cisco RPS 675. The connectors are located at the back of the switch. • Internal Power Supply Connector – The internal power supply is an autoranging unit. – The internal power supply supports input voltages between 100 and 240 VAC. – Use the supplied AC power cord to connect the AC power connector to an AC power outlet. • Cisco RPS 675 Connector – The connector offers connection for an optional Cisco RPS 675 that uses AC input and supplies DC output to the switch. – The connector offers a 675-watt redundant power system that supports one of up to six external network devices and provides power to one failed device at a time. – The connector automatically senses when the internal power supply of a connected device fails and provides power to the failed device, preventing loss of network traffic. – Attach only the Cisco RPS 675 (model PWR675-AC-RPS-NI=) to the redundant power supply receptacle with this connector.
Indicators	• Per-port status LEDs: link integrity, disabled, activity, speed, and full-duplex indications. • System status LEDs: system, RPS, and bandwidth utilization indications.
Environmental Ranges	• Operating temperature: 32 to 113°F (0 to 45°C) • Storage temperature: -13 to 158°F (-25 to 70°C) • Operating relative humidity: 10 to 85 percent (noncondensing) • Operating altitude: Up to 10,000 ft (3000 m) • Storage altitude: Up to 15,000 ft (4500 m) • Not intended for use on top of desktops or in open office environments
Power Requirements	• Power consumption: 30W maximum, 102 BTUs per hour (Cisco Catalyst 2950T-24, 2950C-24, 2950G-12, and 2950G-24) • Power consumption: 45W maximum, 154 BTUs per hour (Cisco Catalyst 2950G-48) • AC input voltage: 100 to 127, 200 to 240 VAC (autoranging) • AC input frequency: 47 to 63 Hz • DC input voltages for Cisco RPS 675: +12V @ 4.5A
Acoustic Noise	• ISO 7779, bystander position, operating to an ambient temperature of 30°C: • WS-C2950-24, WS-C2950-12, WS-C2950C-24, and WS-C2950T-24: 46 dBa • WS-C2950G-12, WS-C2950G-24: 46 dBa • WS-C2950G-48: 48 dBa
Predicted Mean Time Between Failure (MTBF)	• 482,776 hours (Cisco Catalyst 2950G-12) • 475,184 hours (Cisco Catalyst 2950G-24) • 479,086 hours (Cisco Catalyst 2950G-24-DC) • 256,446 hours (Cisco Catalyst 2950G-48) • 574,284 hours (Cisco Catalyst 2950T-24) • 477,080 hours (Cisco Catalyst 2950C-24)

Feature	Description
Fiber Port Specifications for Cisco Catalyst 2950C-24 Switch	Fiber-port power levels: • Optical transmitter wavelength: 1300 nm • Optical receiver sensibility: -33.5 to -11.8 decibel milliwatt (dBm) • Optical transmitter power: -20 dBm to –14 dBm
Regulatory Agency Approvals	
Safety Certifications	• UL 1950/CSA 22.2 No. 950 • IEC 950-EN 60950 • AS/NZS 3260, TS001 • CE Marking
Electromagnetic Emissions Certifications	• FCC Part 15 Class A • EN 55022: 1998 Class A (CISPR22 Class A) • EN 55024: 1998 (CISPR24) • VCCI Class A • AS/NZS 3548 Class A • CE Marking • CNS 13438 • BSMI Class A • MIC
Network Equipment Building Standards (NEBS) (for WS-C2950G-24-EI-DC only)	• Bellcore • GR-1089-CORE • GR-63-CORE • SR-3580 Level 3
Warranty	• Limited lifetime warranty

SERVICE AND SUPPORT

The services and support programs described in the following table are available as part of the Cisco Desktop Switching Service and Support solution, and are available directly from Cisco and through resellers.

Service and Support	Features	Benefits
Advanced Services		
Total Implementation Solutions (TIS)—available direct from Cisco Packaged Total Implementation Solutions (Packaged TIS)—available through resellers	• Project management • Site survey, configuration deployment • Installation, text, and cutover • Training • Major MAC • Design review and product staging	• Supplements existing staff • Ensures that functions meet client needs • Mitigates risk

Service and Support	Features	Benefits
Technical Support Services		
Cisco SMARTnet® and SMARTnet Onsite—available direct from Cisco Packaged Cisco SMARTnet support—available through resellers	• 24x7 access to software updates • Web access to technical repositories • Telephone support through the Cisco Technical Assistance Center (TAC) • Advance replacement of hardware parts	• Enables proactive or expedited issue resolution • Lowers cost of ownership by using Cisco expertise and knowledge • Minimizes network downtime

ORDERING INFORMATION

Model Numbers	Configuration
WS-C2950G-48-EI	• 48 10/100 ports + two 1000BASE-X ports • Enhanced Image software installed
WS-C2950G-24-EI	• 24 10/100 ports + two 1000BASE-X ports • Enhanced Image software installed
WS-C2950G-24-EI-DC	• 24 10/100 ports + two 1000BASE-X ports, DC power • Enhanced Image software installed
WS-C2950G-12-EI	• 12 10/100 ports + two 1000BASE-X ports • Enhanced Image software installed
WS-C2950T-24	• 24 10/100 ports + two 1000BASE-T ports • Enhanced Image software installed
WS-C2950C-24	• 24 10/100 ports + two 100BASE-FX ports • Enhanced Image software installed
WS-C2950ST-24-LRE	• 24 LRE ports, two fixed 10/100/1000BASE-T ports, and two SFP ports • Enhanced Image software installed
WS-C2950ST-8-LRE	• Eight LRE ports, two fixed 10/100/1000BASE-T ports, and two SFP ports • Enhanced Image software installed

ADDITIONAL INFORMATION

For more information about Cisco Products, contact:

- United States and Canada: 800 553-NETS (6387)
- Europe: 32 2 778 4242
- Australia: 612 9935 4107
- Other: 408 526-7209
- http://www.cisco.com

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

Cisco Systems has more than 200 offices in the following countries and regions. Addresses, phone numbers, and fax numbers are listed on **the Cisco Web site at www.cisco.com/go/offices.**

Argentina • Australia • Austria • Belgium • Brazil • Bulgaria • Canada • Chile • China PRC • Colombia • Costa Rica • Croatia • Cyprus • Czech Republic Denmark • Dubai, UAE • Finland • France • Germany • Greece • Hong Kong SAR • Hungary • India • Indonesia • Ireland • Israel • Italy • Japan • Korea Luxembourg • Malaysia • Mexico • The Netherlands • New Zealand • Norway • Peru • Philippines • Poland • Portugal • Puerto Rico • Romania • Russia Saudi Arabia • Scotland • Singapore • Slovakia • Slovenia • South Africa • Spain • Sweden • Switzerland • Taiwan • Thailand • Turkey • Ukraine United Kingdom • United States • Venezuela • Vietnam • Zimbabwe

204108.ck_ETMG_MS_12.04

Printed in the USA