

Catalyst 8510 Multiservice Switch Router

THE CATALYST[®] 8500 FAMILY OF MULTISERVICE SWITCH ROUTERS INTEGRATES MULTISERVICE ATM SWITCHING WITH WIRE-SPEED MULTIPROTOCOL ROUTING FOR GIGABIT ETHERNET INTO A SINGLE PLATFORM THAT ALSO SUPPORTS ADVANCED CISCO IOS[®] SERVICES FOR QUALITY OF SERVICE (QoS) AND SECURITY. THE CATALYST 8500 FAMILY DELIVERS CAMPUS AND METROPOLITAN NETWORK SOLUTIONS WITH SCALABLE PERFORMANCE, LOWER COST OF OWNERSHIP, AND THE FEATURES NEEDED BY INTRANET-BASED APPLICATIONS TO DELIVER INCREASED BUSINESS PRODUCTIVITY.

Historically, enterprise network managers faced a choice of several different technologies when building or upgrading campus network backbones. Today, the choice is between Fast Ethernet/Gigabit Ethernet on one hand, which provides high performance, low cost, and familiarity (relative to Ethernet), and ATM on the other hand, with its high performance, advanced QoS capabilities, support for multiservice voice/data integration and metro/wide area extendability. The network designer must also think about the role of routing in the backbone, which is required for network scalability. The Catalyst 8500 Family takes the risk out of this choice by supporting Fast Ethernet/Gigabit Ethernet, ATM, and wire-speed multiprotocol routing in a single platform. This combination enables network designers to combine multiple technologies in a single network, using each to its best advantage. It also greatly simplifies future migration from one technology to the other, if the needs of the network backbone change over time.

High-Performance Campus Core Switch Routing

The Catalyst 8500 Family provides the high bandwidth and performance that is required for a campus backbone and it is ideal for aggregating multiprotocol traffic from multiple wiring closets or from workgroup switches such as the Catalyst 5000 or distribution/server aggregation switches such as the Catalyst 6000 Family.

The Catalyst 8500 Family can be deployed as a Layer 3 switch, providing nonblocking routing for IP, IPX[®] router, and IP multicast. This capability allows network managers to augment

their multiprotocol backbones with the Catalyst 8500 without having to build parallel networks, as is often required with IP-only switches.

The Catalyst 8500 Family can also be deployed as a multiservice ATM switch or as an integrated Layer 3 and multiservice ATM switch. This unique ability allows the deployment of hybrid networks implementing the best of both technologies while eliminating the need to choose one technology over another.

Catalyst 8510 Overview

The Catalyst 8510 provides a 10-Gbps switching fabric with aggregate throughput of six million packets per second (pps) for both Layer 2 and Layer 3 switching. These data rates apply not only to IP and IPX traffic but also to IP multicast and bridged traffic and are a result of using high-speed application-specific integrated circuit (ASIC) technology on each line card to perform true Layer 3 routing. Deployed as an ATM switch, the Catalyst 8510 provides wire-speed nonblocking switching on all interfaces.

The Catalyst 8510 uses a five-slot, modular chassis with optional dual, fault-tolerant, load-sharing power supplies. The central slot in the Catalyst 8510 is dedicated to a single, field-replaceable processor module that supports the 10-Gbps shared-memory, fully nonblocking switch fabric, and the high-performance RISC processor that provides the routing intelligence for this architecture.

Catalyst 8510 Layer 3 Highlights

The section below summarizes the Layer 3 features.

IP at Millions of Packets per Second

The Catalyst 8500 provides a complete IP routing solution without sacrificing any of the services that are required to build a scalable network. The Catalyst 8500 Family is a feature-rich campus switch router with full Cisco IOS implementation that allows network managers to continue to administer and manage their networks much as they do today while scaling their backbone bandwidths to gigabit speeds. The Catalyst 8500 Family supports all the routing protocols that are used today in enterprise and Internet environments. These protocols include:

- Interior Gateway Routing Protocol (IGRP)
- Enhanced IGRP (EIGRP)
- Open Shortest Path First (OSPF)
- Border Gateway Protocol Version 4 (BGP4)
- Routing Information Protocol (RIP) Versions 1 and 2
- Static routes
- Route redistribution

In addition to these routing protocols, the Catalyst 8500 Family supports all the additional protocols necessary to build scalable, reliable networks, including:

- Hot Standby Router Protocol (HSRP)
- Internet Group Management Protocol (IGMP) 1 and 2
- Dynamic Host Configuration Protocol (DHCP) Relay
- Cisco Group Management Protocol (CGMP)
- Internet Control Message Protocol (ICMP)
- Gateway Discovery Protocol (GDP)
- ICMP Router Discovery Protocol (IRDP)
- Bootstrap Protocol (BOOTP) Relay

The Catalyst 8500 Family uses Cisco Express Forwarding (CEF), which has been developed for the Cisco 12000 gigabit switch router (GSR), Cisco 7500, and the Catalyst 5000 route switch module (RSM). This technology provides Layer 3 switching based on a topology map of the entire network that is distributed to each line card, allowing the line card to make autonomous switching decisions without the involvement of a centralized CPU.

IPX Switching with Enhanced Feature Set

The Catalyst 8500 Family with its IPX wire-speed performance is also a full-fledged IPX router with the enhancements only Cisco IOS can offer. The Catalyst 8500 provides basic services such as Novell NetWork RIP and Service Advertising Protocols (SAPs),

as well as route distribution among all of these protocols. In addition, the Catalyst 8500 supports those features that help to make a large Novell network scale. These features include:

- Get Nearest Server (GNS) response filtering and round-robin GNS support
- Novell RIP
- SAP, protocol, and NetBIOS name filtering
- Equal-cost path load sharing
- Variable RIP and SAP timers
- Novell NetBIOS type 20 propagation support for legacy applications that continue to be mission critical
- Novell-compliant IPX ping utility

This feature set as well as the wire-speed IPX switching make the Catalyst 8500 unique in terms of campus switch router platforms.

IP Multicast Switching and Routing

The Catalyst 8500 Family supports IP multicast at wire speeds across all its line cards. As multicast applications such as Microsoft NetShow and NetMeeting become more widely deployed, end-to-end multicast support becomes increasingly important with multicast routing protocols that are integral to a consistent end-to-end multicast solution. The Catalyst 8500 supports both Protocol Independent Multicast (PIM) sparse and dense modes, and Distance Vector Multicast Routing Protocol (DVMRP) interoperability for legacy applications. The Catalyst 8500 provides support for IGMP, Versions 1 and 2, and CGMP server capabilities for integrating IP multicast support with Catalyst wiring closet switches. These protocols are necessary not only for IP multicast clients to join groups but also for efficient leave processing, which saves bandwidth and end-station CPU cycles.

Flexible Modularity with Fast EtherChannel and Gigabit EtherChannel Technologies, ATM, and Packet over SONET

The Catalyst 8500 Family of multilayer modular switches offers a wide range of interfaces and uplink technologies. As with the award-winning Catalyst 5000 Family of switches, the Catalyst 8500 Family supports both Fast EtherChannel[®] and Gigabit EtherChannel technologies, and all line-card modules are hot-swappable. Both 100-FX full duplex and 10/100 full/half duplex cards are supported. Table 1 outlines the maximum configurations for the Catalyst 8510 when equipped with Layer 3 interfaces.

Table 1 Catalyst 8510 Layer 3 Interfaces

Catalyst 8510 Interface Type	Density and Description	Maximum Switch Density
10/100-Mbps Fast Ethernet with Fast EtherChannel Technology	8 ports, RJ-45 connectors	32
100-Mbps Fast Ethernet with Fast EtherChannel Technology	8 ports, fiber-optic, SC connector	32
1-Port Gigabit Ethernet	1 port, GBIC interface	4

Quality of Service

The Catalyst 8500 Family incorporates a nonblocking, centralized, shared-memory switching fabric. The rich QoS capabilities of the switching fabric enable network managers to protect mission-critical applications by supporting delay-sensitive traffic, while managing bandwidth in the campus backbone. The switching fabric supports Per-Flow Queuing (PFQ), differentiated delay priorities using a Weighted Round Robin (WRR) scheduler for delay-sensitive applications, and differentiated loss priorities for managing congestion and traffic policing and shaping. The fast packet memory embedded in the switching fabric is allocated dynamically on a per-queue (flow) basis. This dynamic allocation used in conjunction with user-defined queue thresholds and configurable queue scheduling weights ensures that time-sensitive traffic is handled properly with no packet loss. When CiscoAssure Policy Networking is used, these thresholds and queuing weights can be dynamically adjusted, allowing an end-to-end QoS solution.

Nonroutable Protocols

Networks today incorporate many protocols that will continue to be strategic because the business applications built with them are important to the corporation. Unfortunately, these protocols are often not routable and, therefore, must be bridged. The Catalyst 8500 is fully compliant with the IEEE 802.1d specifications. In addition, the Catalyst 8500 supports integrated routing and bridging (IRB), which allows network managers to route packets between routed interfaces, create bridge groups, and bridge the nonroutable packets among those interfaces.

Catalyst 8510 ATM Highlights

When deployed with the C8515-MSRP, the Catalyst 8510 is equipped as a multiservice ATM switch. Future software enhancements and the addition of an ATM router module will allow the deployment of multiservice ATM and Layer 3 interfaces in a single chassis. The section below gives details of the ATM interfaces available.

The multiservice switch route processor module supports all the defined traffic classes in the ATM Forum Traffic Management 4.0 specification and offers the flexibility needed for bursty client/server traffic patterns. For service provider or customer premises deployments, PFQ, which can support greater traffic-shaping granularity and can service individual QoS contracts for several thousand flows at once, makes it perfect for wide-area environments that demand more unique and granular QoS features.

The remaining slots support up to four hot-swappable carrier modules (CAMs), each of which in turn can support up to two hot-swappable port adapter modules (PAMs), for a maximum of eight PAMs per switch. This configuration supports a wide variety of desktop, backbone, and wide-area ATM and circuit emulation interfaces. All PAMs from the LightStream® 1010 can be deployed in the Catalyst 8510. Table 2 gives details of the multiservice ATM interfaces available for the Catalyst 8510.

Table 2 Catalyst 8510 Multiservice ATM Interfaces

Catalyst 8510 Interface Type	Density and Description	Maximum Switch Density
SONET STS-12/STM-4 622 Mbps	1-port MMF, SMF, SMF LR	8
SONET STS-3/STM-1 155 Mbps	4-port UTP, MMF, SMF, SMF IR+, SMF LR	32
ATM 25	4-port UTP	32
DS3	4-port BNC	32
E3	4-port BNC	32
E1 ATM	4-port RJ-48c or BNC	32
T1 ATM	4-port RJ-48c	32
E1 CES	4-port RJ-48c or BNC	32

Catalyst 8510 Interface Type	Density and Description	Maximum Switch Density
T1 CES	4-port RJ-48c	32

The Catalyst 8510 offers the sophistication and depth of functionality required for true ATM production deployment. Advanced traffic management mechanisms allow for the support of bursty client/server traffic, while also delivering the QoS guarantees required for voice and video applications. The unique intelligent packet-handling mechanisms of the Catalyst multiservice switch router family allow the switches to discard entire packets (early packet discard) or the remaining cells of a packet that has experienced loss (partial or tail packet discard), or to merge packets from different incoming connections onto the same outgoing connection (virtual circuit [VC] merge), increasing the effective goodput and scalability. The Catalyst multiservice switch router family supports all the ATM Forum-defined traffic classes, plus the first of many unique traffic classes. These classes include:

- Constant bit rate (CBR)
- Real-time variable bit rate (RT-VBR)
- Non-real time variable bit rate (NRT-VBR)
- Available bit rate (ABR) and minimum cell rate (MCR)

- Unspecified bit rate (UBR) and MCR
- UBR

With support for the ATM Forum Private Network- Network Interface (PNNI) V1.0 protocol and with hierarchical PNNI routing and tag switching, networks of Catalyst 8500, LightStream 1010, and Catalyst 5500s can scale to several hundred ATM switch nodes with QoS-based routing. Value-added PNNI and User-Network Interface (UNI) signaling capabilities from Cisco provide for ATM access lists, load sharing across parallel links, and PNNI closed user groups (CUGs) used to construct virtual private networks at the ATM layer. All this sophistication does not result in complexity for the user, because the Catalyst 8500 Family, LightStream 1010, and Catalyst 5500 support standards-based, “plug-and-play,” and autodiscovery capabilities. Advanced ATM management functions in the Catalyst 8500, LightStream 1010, and Catalyst 5500 allow for unprecedented levels of network visibility and control, including support for two specifications first introduced to the industry by Cisco and a few partners, specifically the ATM Remote Monitoring (RMON) Management Information Base (MIB) and ATM Accounting MIB.

Table 3 Catalyst 8510 ATM Features

Feature	Detail
Traffic Classes	CBR, RT-VBR, NRT-VBR, ABR (EFCI and RR) and MCR, UBR and MCR, UBR
Output Queuing	Per VC or per VP
Shaping	Per CBR VC or CBR VP (128 shaped VPs total)
Queue Scheduling	Strict priority, rate, Weighted Round Robin
Intelligent Early Packet Discard (EPD) and Selective Cell Marking	Multiple, weighted (dynamic) thresholds

Feature	Detail
Intelligent Tail (Partial) Packet Discard	Supported
Policing (UPC) Algorithm	Dual leaky bucket (ITU-T I.371 and ATM Forum UNI specs)
Frame Mode, VC Merge	Supported
Point-to-Point VCs	Up to 32,000
Point-to-Multipoint VCs	Up to 32,000 Up to 32,000 roots Up to 254 leafs per root Maximum 32,000 leafs total
Logical Point-to-Multipoint VCs	Multiple leafs per output port with multiple VP tunnels for each point-to-multipoint connection
Network Clock Switchover	Programmable clock selection criteria
Nondisruptive Snooping	Per VC or VP
Standard Processor	64 MB

Network Management

Network management must be considered when enhancing the performance of the campus backbone. The Catalyst 8500 Family is supported by CiscoAssure networking services, which include CiscoWorks for planning, troubleshooting, and analyzing campus networks and Cisco Resource Manager (CRM) for automated scheduling of software upgrades. From a security perspective, TACACS+, Message Digest 5 (MD5) route authentication, Kerberos, encrypted passwords, and lock and key features will be available for the Catalyst 8500. The Catalyst 8500 Family provides access list control of routing updates and supports route redistributions, and future enhancements will provide access lists

and extended access lists for data traffic. The architecture is flexible and future proof; each line module ASIC can be upgraded in the future by a simple microcode upgrade to support IPv6 as it becomes more prevalent in the Internet and in campus environments.

The wide variety of CiscoAssure Policy Networking management tools and applications enable fault management, configuration management, performance management, security management, and other functions. CiscoWorks for Switched Internet work (CWSI) leverages the power of the CiscoWorks applications for managing and maintaining an internetwork of Catalyst Family switching products. The CiscoWorks features provide the following capabilities:

- To simplify administration tasks from network management platforms, the Catalyst 8500 Family offers full Simple Network Management Protocol (SNMP) functions that allow it to be managed from any SNMP-based management station.
- To provide protection against unauthorized configuration changes, the administration interface requires a password for local access or remote access via Telnet.
- To allow more flexibility for network administrators, remote (out-of-band) management through SNMP (sets and gets) or Telnet connections is accessible through any interface, allowing the Catalyst 8500 to be managed from anywhere in the network.
- To reduce the costs of administering software upgrades, Flash memory allows remote downloads using Trivial File Transfer Protocol (TFTP) of new revisions of operating systems without hardware changes.
- To simplify diagnosis and switch troubleshooting, status LEDs allow the user to visually monitor operation of power supplies, fans, switches, and backbone interfaces.

Migration and Investment Protection

The Catalyst 8500 Family is future-proof and serves as a platform that provides network managers with investment protection for their Catalyst Family switches. The line modules each contain ASIC technology that enables the wire-speed Layer 3 switching, and these ASICs are field upgradable with a simple microcode update. This feature allows the Catalyst 8500 to be used today in networks that are primarily IPv4 and Novell IPX, but also in the future as IPv6 becomes more prevalent. To provide existing Catalyst 5500 customers with a migration path, the Catalyst 8510 switch fabric and line cards can be installed in the Catalyst 5500 chassis. This scenario allows a network manager to deploy the RSM/NetFlow feature card combination where high-performance IP switching, per-flow statistics gathering, and multiprotocol services are required, while also having the option to deploy the Catalyst 8510 in the same chassis. This solution provides a powerful combination of the industry-leading Catalyst 5000 LAN switch with the next generation of ATM or Layer 3 switch routing in one platform. Additionally, the Catalyst 8500 Family switches support Fast EtherChannel technology, virtual LANs (VLANs) and ISL, allowing the Catalyst 8500 to seamlessly integrate into the network.

Catalyst 8500 Family Components

Catalyst 8510 Multiservice Switch Router

- Five-slot chassis and fan tray
- Optional redundant AC or DC, autosensing, load-sharing power supplies, each with its own power cord
- C8510-SRP module running Layer 3 Cisco IOS software or C8515-MSRP module running ATM and in the future ATM and Layer 3 Cisco IOS software
- 10-Gbps shared-memory, nonblocking fabric
- 8 MB of Flash memory standard, internally expandable up to 16 MB, plus up to 20 MB through PC Flash cards
- 64-MB DRAM system memory
- Ethernet port for out-of-band management
- Dual EIA/TIA-232 serial ports (console, auxiliary port)

Indicators

- Ethernet ports: RX and TX LEDs, link state, 10/100 indicator
- ATM ports: RX and TX LEDs, link state

- Route processor: Status LED, fan and power supply, operational LEDs PC card slot 0/1 LEDs, Ethernet RX and TX LEDs, link state

Chassis Specifications

- Chassis H x W x D: 10.5 x 17.2 x 18.14 in. (26.7 x 43.7 x 46.1 cm); standard 19-inch rack-mount
- Empty weight: 43 lb (19.5 kg)
- Fully loaded weight: depends upon loading; approximately 85 lb (39 kg)
- ATM switch processor and CAM H x W x D: 1.2 x 14.4 x 16.0 in. (3.0 x 36.6 x 40.6 cm)
- PAM H x W x D: 1.2 x 6.5 x 10 in. (3.0 x 16.5 x 25.4 cm)
- Maximum power budget: 9.8A @ 115 VAC, 60 Hz 4.9A @ 230 VAC, 50 Hz
- Autosensing limits: 100-127/200-240 VAC, 8/4A, 47-63 Hz
- Maximum power budget: 14.0A maximum @ -48V

Safety Certifications

- UL 1950
- EN 60950
- CSA-C22.2 No. 950-93

Electromagnetic Emissions Certifications

- FCC Class A (Part 15)
- EN 55022 Class B
- CE Mark
- VCCI Class II

Network Equipment Building Systems (NEBS)

Electromagnetic Emissions Certifications

- FCC Part 15 (CFR 47) Class A
- VCCI Class A with UTP and Class B with shielded cables
- EN55022 Class A with UTP and Class B with shielded cables
- CISPR 22 Class A with UTP and Class B with shielded cables
- AS/NZS 3548 Class A with UTP and Class B with shielded cable

Operating Conditions

- Altitude: -500 to 10,000 ft (-52 to 304 m)
- 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



Corporate Headquarters

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

European Headquarters

Cisco Systems Europe s.a.r.l.
Parc Evolic, Batiment L1/L2
16 Avenue du Quebec
Villebon, BP 706
91961 Courtaboeuf Cedex
France
<http://www-europe.cisco.com>
Tel: 33 1 69 18 61 00
Fax: 33 1 69 28 83 26

Americas Headquarters

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

Asia Headquarters

Nihon Cisco Systems K.K.
Fuji Building, 9th Floor
3-2-3 Marunouchi
Chiyoda-ku, Tokyo 100
Japan
<http://www.cisco.com>
Tel: 81 3 5219 6250
Fax: 81 3 5219 6001

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