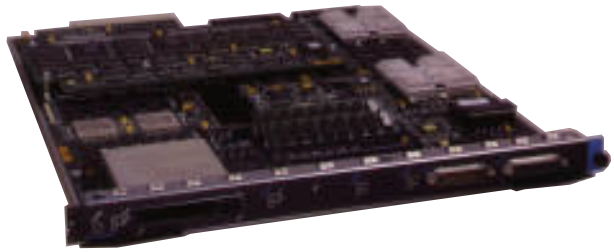
The Catalyst 5000 Route Switch Module—Multiprotocol Switching for the Catalyst 5000 Series

The WS-X5302 route switch module, the latest member of the Catalyst® 5000 series of line modules, provides the performance, scalability, and sophisticated multiprotocol capabilities of Cisco IOS™ software integrated into the award-winning Catalyst 5000 switch series. With the introduction of the route switch module, the Catalyst 5000 becomes the first truly multiprotocol, multilayer switch available today, and allows network managers the option to deploy cost-effective distributed Layer 3 services from the wiring closet to the data center. The route switch module provides high-performance, multilayer switching and routing services between switched virtual LANs (VLANs), emulated LANs (ELANs) within an Asynchronous Transfer Mode (ATM) fabric, or across mixed media via an optional Versatile Interface Processor (VIP) and port adapters.

Figure 1 The route switch module offers integrated, high-performance, multiprotocol switching.



Multiprotocol Switching with Cisco IOS Software

The Cisco Catalyst 5000 series route switch module builds upon the Route Switch Processor (RSP) featured in Cisco's premier multiprotocol routing platform, the Cisco 7500. It combines Cisco Systems' proven software technology with the exceptional performance features of the Catalyst 5000 series of LAN switches to meet the requirements of today's mission-critical networks. The route switch module delivers the full suite of Cisco IOS software services, which includes the widest set of protocols available on any multilayer switch:

- IP—Interior Gateway Routing Protocol (IGRP), Enhanced IGRP, Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol Version 4 (BGP4)
- IPX—RIP, SAPs, NetWare Link Services Protocol (NLSP), Enhanced IGRP
- AppleTalk
- DECnet
- VINES
- Xerox Network Systems (XNS)
- Systems Network Architecture (SNA)
- Multimedia services—Protocol Independent Multicast (PIM), Resource Reservation Protocol (RSVP), Cisco Group Management Protocol (CGMP)
- Security Services—access lists, encryption, Lock and Key
- Class of service (CoS)—RSVP, Weighted Fair Queuing (WFQ), Random Early Detection (RED)

CISCO SYSTEMS

The Catalyst 5000 series route switch module offers multiple software feature sets and feature licenses, which allow the selection of a package that best meets the users' network needs. Network managers can select from multiple feature sets, which can be enhanced with additional feature licenses. If requirements change in the future, an easy software change can be made to upgrade to a higher-level feature set or add another feature license. Feature licenses include encryption, network address translation (NAT) and interdomain routing.

Installable in any Catalyst 5000 series switch chassis, the route switch module will support one optional VIP. The VIP is optimized for distributed switching, and one or two port adapters can be attached to it. The port adapters will provide additional media-specific interfaces to the route switch module such as High-Speed Serial Interface (HSSI), packet over Synchronous Optical Network (SONET), or ATM.

NetFlow Switching delivers high-performance Layer 3 Services

The route switch module introduces NetFlow™ Switching to the Catalyst 5000 switch series providing "per-flow" switching between VLANs or subnets. NetFlow Switching enables today's networks to perform more network services on a larger scale and at higher bandwidths. NetFlow Switching provides the following benefits:

- *High performance*—NetFlow Switching provides low-latency, high-throughput Layer 3 switching performance while still providing sophisticated network services such as per-flow statistics, security screening, and accounting information.
- *Security Services*—NetFlow Switching provides robust security while dramatically reducing the overhead required for security processing. Enterprises can deploy multiple access lists to create security firewalls with no significant impact on network performance. NetFlow Switching enhances the performance of not only existing Cisco IOS security services, but also other security-related capabilities. A major enhancement in network security is provided by the network encryption service of the route switch module, which allows IP traffic to be encrypted at the network layer on a session-by-session basis. NetFlow Switching also boosts the performance of Cisco's Lock and Key security service, which allows dynamic access permissions based on user authentication to be set up within the network.
- *Class of service*—Based upon the recognition of flows, the route switch module using NetFlow Switching can provide flow processing as an enabler for CoS across the network. This ability is based on RSVP, which enables applications to request a specific CoS and advanced queuing techniques such as WFQ, which enables the route switch module to meet these CoS guarantees.
- *Flow Management*—One of the most valuable aspects of NetFlow Switching is that its flow orientation allows detailed traffic statistics to be collected and accumulated in tandem with its switching functions, with no significant performance impact. As part of its basic operation, NetFlow Switching generates a convenient display of traffic flows with data on numbers of flows, packets per flow, bytes per packet, and other useful traffic information—all summarized on a per-application basis. This gives network administrators insights into the traffic characteristics of specific applications. NetFlow Switching also generates detailed information on each flow or session as a readily accessible by-product of its basic switching function. This detail includes packet and byte counts, duration, and time stamps.

Route Switch Module: Key Advantages

Cisco IOS Software

Cisco IOS software is one of the key features that separates the route switch module and the Catalyst 5000 series of switches from other multilayer switch alternatives. By providing the broad support for multiprotocol routing and switching that Cisco IOS software is capable of, network managers can not only deploy multilayer switching for IP or IPX networks but can also offer support for the full complement of commonly used desktop protocols in use today, including IP, IPX, AppleTalk, DECnet, VINES, XNS, NetBIOS, and SNA. When this broad protocol support in coupled with the Cisco IOS value-added features such as NetFlow Switching, PIM, RSVP, NAT, RED, and WFQ, the Catalyst 5000 series with the route switch module offers capabilities far beyond any other multilayer switch offered today.

Resilient Architecture

Another distinct advantage of the route switch module is the ability to run the Hot Standby Router Protocol (HSRP) to provide resiliency while scaling Layer 3 forwarding performance. Using HSRP, two route switch modules can load share across multiple VLANs or ATM-based ELANs, and in the event of a failure of one route switch module, the remaining route switch module takes on the load without any end station session loss.

Scalable Performance

The Catalyst 5000 series architecture allows for installation of multiple route switch modules into one system chassis. As Layer 3 Forwarding requirements increase, network managers can easily add multiple route switch modules to a Catalyst 5000 or 5500 chassis to increase Layer 3 switching capacity. This scenario provides a flexible, scalable solution, as network managers add route switch modules only as needed.

The route switch module adds multilayer switching to the awarding-winning one million packets per second Layer 2 performance of the Catalyst 5000 and the multimillion packet per second capabilities of the Catalyst 5500. As NetFlow Switching, multimedia, and security services are integrated into the Catalyst 5000 series with the route switch module, wire speed performance and the consistent latencies of switching are maintained.

The route switch module has been designed to seamlessly integrate in the Catalyst 5000 series chassis. It is compatible with all existing line cards and interfaces directly with the multigigabit backplane. As a result, the route switch module can be used with Ethernet and Fast Ethernet line modules, the Fiber Distributed Data Interface (FDDI) and ATM backbone uplink cards, and in the future will support Token Ring and Gigabit Ethernet. Installable in any Catalyst 5000 family chassis, the route switch module supports all the advanced features of the Catalyst 5000 architecture such as packet retry, packet prioritization on the backplane, consistent latencies for both unicast and multicast traffic and application-specific integrated circuit (ASIC)-based packet queuing, dynamic linked list buffering, and hardware assisted packet integrity checks. Another advantage of the tight integration of the route switch module with the Catalyst 5000 architecture is the ability of the route switch module to take advantage of the Fast EtherChannel® technology, where it can use two- or four-port Fast EtherChannel devices for high-speed uplinks.

Interoperable

The route switch module supports industry-standard routing protocols such as RIP, OSPF, and BGP to ensure a seamless integration into existing networks of all sizes and equipment types. As a value-add to existing Cisco router customers, the route switch module supports IGRP, Enhanced IGRP, and HSRP.

Production Ready

The route switch module is based upon the proven architecture of the RSP featured in Cisco's premier multiprotocol routing platform, the Cisco 7500. From a software perspective, the Cisco IOS code that runs on the route switch module has evolved over many years and has been proven in mission-critical networks worldwide.

Easily Managed

In order to ease device management and troubleshooting, the route switch module has interface LEDs for visual status, and supports Telnet, Trivial File Transfer Protocol (TFTP), and BOOTP protocols to allow for remote configuration and software download. Simple Network Management Protocol (SNMP) monitoring and configuration, invoked through the CiscoView graphical user interface (GUI) and CiscoWorks system management applications, allow for comprehensive network management. Modeling tools provided by the Netsys Technology™ application provide configuration checking and consistency tools as well as "what if" scenarios.

The route switch module supports all standard Router Information Bases (MIBs), together with Cisco extensions for the advanced switching capabilities of the device. By building upon the Cisco IOS software, the route switch module offers the same, familiar command-line interface (CLI) as that found on the Cisco routers, with its advanced scripting and online help capabilities. This feature will greatly reduce training and deployment times for current Cisco customers. Furthermore, the route switch module offers the same standard dual EIA/TIA-232 serial ports found on the RSP for manageability, and supports the same DRAM memory and PC Flash Card memory upgrade options, allowing for future growth and investment protection.

Positioning

The route switch module is designed for customers that require high-performance, multiprotocol switching between VLANs or subnets. With its optional VIP interface, the route switch module provides customers with a convenient way for integration into existing FDDI or Token Ring backbones or for low-density serial connections to a central site. The Cisco 7200 and 7500 series provide high-density and high-end aggregate performance, with a wider range of network configurations and environments possible.

For installations requiring high-density Ethernet and Fast Ethernet connectivity, the route switch module will be a cost-effective solution with port densities of 240 or more ports; however, where high-density ATM, FDDI, Token Ring, LAN, or WAN connectivity is required, the Cisco 7200 or 7500 series routers provide a more cost-effective solution with densities up to 176 serial ports. The following chart contrasts the maximum port densities achievable with the Cisco 7200 and 7500 series routers and the route switch module.

Table 1 Maximum Network Interfaces

—	Cisco 7204	Cisco 7206	Cisco 7505	Cisco 7507	Cisco 7513	Route Switch Module
Ethernet 10BaseT	32	48	64	80	175	240[1]
Ethernet 10BaseF	20	30	40	50	110	120[1]
Fast Ethernet 10BaseTX	5	7	8	10	22	120[1]
Fast Ethernet 10BaseFX	4	6	8	10	22	120[1]
100 VG-AnyLAN	4	4	6	8	10	2
Token Ring	16	24	16	20	44	8
FDDI	4	6	8	10	22	4
Serial	32	48	64	80	176	16
HSSI	8	12	16	20	44	4
ATM	4	6	4	5	11	2
IBM Channel	—	—	4	5	11	—
ISDN PRI	240 channels	360 channels	192/240	256/256	256/256	256/256
ISDN BRI	32	48	—	-—	—	—

[1] Includes all Layer 2 switch ports available.

Features and Benefits

The route switch module offers a rich set of capabilities that address the need for performance, reliability, and multiprotocol switching support that is required for networks both today and in the future.

Table 2 Route Switch Module Features

Feature	Benefit
Cisco IOS Software	• Multiprotocol switching • Support for IP, IPX, AppleTalk, DECnet, VINES, XNS, SNA • Multiple routing protocols—RIP, IGRP, Enhanced IGRP, OSPF, NLSP • Value-added features such as NAT, RED, WFQ • Scalability, security, resiliency • Feature set upgrades on regularly scheduled release cycle • Well-known CLI and command structure
NetFlow Switching	• High-performance Layer 3 switching with network services: – Security services – CoS enablement – Flow management
Hot Standby Routing Protocol	• Redundancy, resiliency, load sharing
PIM, CGMP, RSVP	• Integrated multimedia support
Consistent Architecture	• Compatible with Catalyst 5000, 5002, 5500 • Compatible with all existing line cards
Multiple Route Switch Modules per Chassis	• Load balancing, scalable Layer 3 performance
Slot Independent, Hot-Swappable	• Ease of use, no downtime during maintenance
Route Switch Module Design Based on RSP Design	• Supports RSP standard DRAM SIMMs, Flash memory, and PC Card modules
System Flash Memory	• Enables fast, reliable software and microcode updates
Web-Browser Interface	• Provides an easy navigation tool through the CLI and allows the user to check status through an easy point-and-click interface
Versatile Interface Processor	• Non-LAN media support—HSSI, Packet over SONET, Integrated Services Digital Network (ISDN), T1, E1
Common Port Adapters with Cisco 7000, 7200, 7500 VIPs	• Simplifies sparing • Protects customer investment
CiscoView and Netsys Support	• Consistent management across platforms, Layer 2 and Layer 3 “what if” analysis

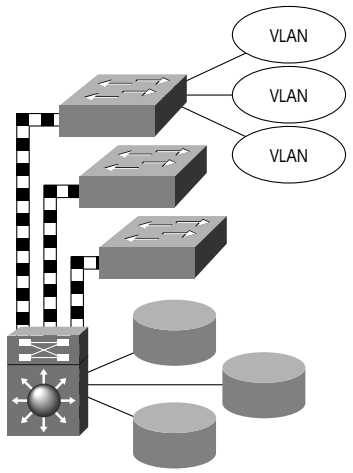
Applications

The route switch module offers high-performance multilayer switching, which is ideal for data center backbones. Using trunking, VLANs can extend from the wiring closet to the data center, where the route switch module can be located to provide high-speed, low-latency connectivity.

Using HSRP, two route switch modules can provide:

- Redundancy
- Resiliency
- Load sharing across the VLANs

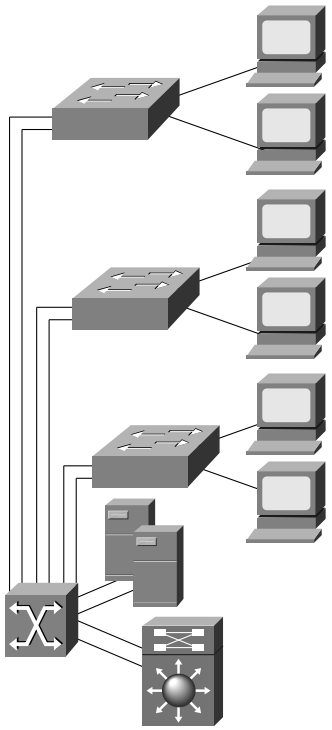
Figure 2 Route Switch Module and Catalyst 5500 in the data center provide redundancy, resilience, and high performance



The Catalyst 5500 can be used in the data center to provide redundant supervisors and power supplies to increase resiliency while offering a high concentration of Fast Ethernet, ATM, and FDDI uplink options. Fast EtherChannel technology can be used with the route switch module as high-capacity uplinks or as high-speed links to the data center servers. Finally, as Layer 3 requirements grow, network managers can add route switch modules to increase packet throughput.

Another application for the route switch module is routing between ELANs in high-performance ATM backbones. The route switch module with its capacity to switch over 170,000 packets per second provides wire-speed OC-3 inter-ELAN routing performance.

Figure 3 Route switch module and the Catalyst 5000 ATM LAN Emulation Card provide wire-speed OC-3 services.



Redundancy is always a requirement for mission-critical networks, and the route switch module can be used in this design to provide LANE HSRP for redundancy and load sharing across the ELANs as well as to provide either primary or backup LANE services via the Simple Server Redundancy Protocol (SSRP). In the future, the route switch module can be used in an ATM backbone as a Tag Switching edge router or a Multiprotocol Over ATM (MPOA) server.

Table 3 Route Switch Module Roadmap

Catalyst 5000 Feature	Availability	Comments
Versatile Interface Processor (VIP 2)	CQ4 '97	VIP 2 Model 15 / Model 40
VIP 2 Port Adapters	CQ4 '97	Use Cisco 7500 part numbers when ordering (maximum of 2)
Software Feature Set	CQ4 '97	Includes IP, IPX, AT, DecNet, Vines, XNS and transparent bridging
Enterprise	CQ1 '98	Source route, translational, source route translational bridging
Enterprise and APPN	CQ1 '98	—

Ordering Information

The Catalyst 5000 route switch module (WS-X5302) is orderable immediately and will be generally available in CQ3 '97.

The Catalyst 5000 Versatile Interface Processor module (WS-X5303) will be orderable CQ4 '97.

The Catalyst 5000 route switch module and VIP combination module (WS-X5304) will be orderable CQ4 '97.

Port adapters can be ordered using the existing Cisco 7500 part numbers.

Default Configuration Information

The default configuration for the route switch module is 32-MB DRAM, 8-MB onboard Flash, 16-MB PC Flash Card, IP routing, and NetFlow Software License.

Software Orderability Information

One additional software image is available for the route switch module at this time, which includes IPX, AppleTalk, and DECnet routing. This image also includes the default IP routing and the NetFlow Software License.

In the future, the route switch module will offer additional software images, including:

- Desktop
- Enterprise
- Enterprise and Advanced Peer-to-Peer Networking (APPN)
- Desktop and IBM feature set

In addition, software feature licenses are required as applicable to license specific features within software subsets.

Table 4 Software Feature Licenses

Category	Software Feature
Interdomain Routing	BGP, EGP for Internet scale routing
Network Address Translation	Network address translation
Encryption	40 or 56 Feature Set Packet Encryption
WAN Packet Protocols	X.25, Frame Relay, Switched Multimegabit Data Service (SMDS)

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