

Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine Delivering Convergence in the Wiring Closet

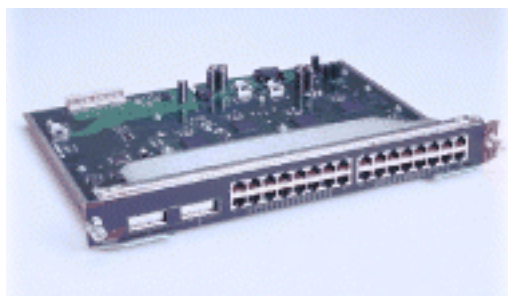
The Cisco® Catalyst® 4000 Series Integrated Layer 3 Services Engine is a cost-effective, high-performance, feature-rich, multiprotocol, modular Layer 3 solution (Figure 1). It is ideally suited for campus wiring closets that require Layer 3 services, such as quality of service (QoS) and route switching. The solution supports high-speed routing and switching of IP, Internet Packet Exchange (IPX), and IP Multicast across all interfaces, and enables all ports for Layer 3 switching with silicon-based acceleration that can scale in increment of 8-Gbps capacity. Perfect as a wiring closet desktop aggregator, the services engine provides fast, intelligent Layer 3 connections to core switches with wire-rate Layer 3 Gigabit Ethernet ports that support standard Gigabit interface converter (GBIC) technology, allowing network managers to quickly select and change interfaces in Cisco Catalyst 4000 Series switches.

A Cisco Catalyst 4000 Series switch with the Layer 3 services engine provides Layer 3 services for IP, IPX, and IP multicast while offering high-speed Layer 2 switching for nonroutable protocols such as NetBIOS and DECnet local-area transport (LAT). This allows network managers to augment their multiprotocol wiring closets with Cisco Catalyst 4000 Series switches without having to build parallel networks, as is often required with IP-only switches.

Cisco Catalyst 4000 Series Revolutionary Architectural Advantage

The Cisco Catalyst 4000 Series delivers a powerful breakthrough architecture advantage. A centralized, shared-memory fabric enables all line cards to be easily and inexpensively upgraded to higher-layer network functions, eliminating expensive forklift upgrades common with stackable products. Functionally transparent switching line cards deliver tremendous investment protection; installed Cisco Catalyst 4000 Series switches are protected and can grow into higher-layer capabilities—even as technology evolves. The new Layer 3 services engine allows Cisco Catalyst 4000 Series switches, even with legacy line cards, to be easily upgraded on all system ports to higher layer switching functions. This benefit is achieved without changing your legacy line cards—typical with other conventional switching products—and extends the usefulness of your Cisco Catalyst investment.

Figure 1
 Cisco Catalyst 4000
 Series Integrated Layer
 3 Services Engine





Cisco Catalyst 4000 Series with Integrated Layer 3 Services Features

- High-performance, scalable 6-Mpps Layer 3 services engine of IP, IPX, and IP multicast protocols
- Up to 224 ports of 10/100-Mbps Fast Ethernet and dual Gigabit Ethernet uplinks (GBIC slot), including previously deployed Cisco Catalyst 4000 Series line cards
- High-performance CPU with Cisco IOS[®] Software, system software
- QoS and multiple queues with Weighted Round Robin (WRR) scheduling
- Comprehensive management tools based on standard CiscoWorks applications
- Hardware-based access control list (ACL) support
- Inter-Switch Link (ISL) and 802.1Q trunking on dual Gigabit Ethernet uplinks

Introducing the Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine

The Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine is packaged on a switching line card with 32-port, 10/100-Mbps Fast Ethernet and 2-port, 1000-Mbps Gigabit Ethernet using modular GBIC flexibility. When this Layer 3 services engine is installed in a chassis, silicon-based multiprotocol routing and Layer 3 QoS is possible for all ports in the system (including legacy switching line cards). This solution is ideal for wiring closet deployment in small, medium-sized, or large networks that require wire-speed Layer 3 system uplink performance. Another application for the Cisco Catalyst 4003 is for server farm aggregation where Layer 3 services are required. The Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine supports IP, IPX, and AppleTalk (Phase 1 and Phase 2) routed protocols.

Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine Overview

The Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine provides an aggregate throughput of 6 mpps for Layer 3 switching that can scale higher by adding multiple Layer 3 services modules. This data rate applies to IP, IPX, IP Multicast, and bridged traffic, and is a result of using high-speed application-specific integrated circuit (ASIC) technology to perform true Layer 3 switching. The Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine supports a high-performance architecture with 8 Gbps bandwidth. The switch fabric can support all system ports with high-speed Layer 3 routing and QoS, and can support Layer 3 on dual Gigabit Ethernet uplinks simultaneously at wire rate.

The Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine is housed in a Cisco Catalyst 4003 or 4006 chassis and can be provisioned with an optional redundant power supply. It supports a high-performance RISC processor, which provides the routing intelligence and optimized Gigabit Ethernet ASICs for Layer 3 switching. The Layer 3 services engine uses Cisco Express Forwarding, a technology that provides Layer 3 switching based on a topology map of the entire network that is distributed to multiple ASICs, allowing autonomous switching decisions without the involvement of a centralized CPU.

QoS

The Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine enhances the Cisco Catalyst 4000 Series' centralized, nonblocking, 24-Gbps 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 network. The switching fabric supports Per-Flow Queuing (PFQ), differentiated



delay priorities using a 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, helps to ensure that time-sensitive traffic is handled properly with no packet loss. These thresholds and queuing weights can be dynamically adjusted with Cisco Assure policy networking, allowing an end-to-end QoS solution.

IP at Millions of Packets per Second

The Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine provides a complete IP routing solution without sacrificing any of the services required to build a scalable network. The Cisco Catalyst 4000 Series includes feature-rich switches with integrated full Cisco IOS Software implementations that allow network managers to continue to administer and manage their networks as they do today, while scaling their wiring closet QoS bandwidths to gigabit speeds. The Cisco Catalyst 4000 Series supports all the routing protocols that are used today in campus networks, including:

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

In addition to these routing protocols, the Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine supports the additional protocols necessary to build scalable, reliable networks, including:

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



IPX Switching Feature Set

The Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine is a full-fledged Cisco IPX router with the enhancements that only Cisco IOS Software can offer. It provides basic services such as Novell NetWork RIP and Service Advertising Protocols (SAPs), value-added routing protocols such as Netware Link Services Protocol (NLSP) and Novell Enhanced IGRP, and route distribution among these protocols. In addition, the Layer 3 services engine supports features that help scale a large Novell network, including:

- 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

The combination of this feature set and the wire-speed IPX switching uplinks makes the Cisco Catalyst 4000 Series Layer 3 unique in terms of wiring closet switching solutions.

IP Multicast Switching and Routing

Cisco Catalyst 4000 Series switches support IP Multicast at high speeds, across all ports. 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 Cisco Catalyst 4000 Series with Layer 3 services switching supports both Protocol Independent Multicast (PIM) sparse and dense modes and Distance Vector Multicast Routing Protocol (DVMRP) interoperability for legacy applications. The Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine provides support for IGMP Versions 1 and 2, and Cisco GMP server capabilities for integrating IP Multicast support. 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.

Security

The Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine has the ability to prevent security breaches via the use of both IP (standard and extended) and IPX (standard only) access lists. This is useful in preventing users from accessing certain applications or services. It supports both inbound and outbound access lists on both Gigabit Ethernet interfaces on the Layer 3 services switching line card. These access lists can be defined, similar to any Cisco IOS router, as standard IPX access lists or as standard and extended IP-based access lists. Having inbound and outbound control of packets on the line-card-based Gigabit Ethernet ports (two internal and two external ports) allows network managers to prevent traffic on egress and on ingress, and on all ports in the Cisco Catalyst 4000 Series chassis when subnetting is used.

VLAN Trunking

The Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine supports both ISL and 802.1Q trunking on the module's dual Gigabit Ethernet uplink ports. In addition, 802.1Q trunking is supported on all 10/100 ports.



Cisco Fast EtherChannel and Gigabit EtherChannel Technologies

The Cisco Catalyst 4000 Series Integrated Layer 3 Services Engine supports Cisco Fast EtherChannel[®] and Gigabit EtherChannel technologies, allowing network managers to group up to eight Ethernet ports into an intelligent high-speed channel.

Comprehensive Network Management of CiscoWorks

Cisco Catalyst 4003 and 4006 switches are managed by the powerful CiscoWorks network management suite. The Resource Manager Essentials product suite takes advantage of the power of the intranet with browser-based access anywhere within the network. Network managers can walk up to any browser console, identify who they are via the access control interface, and immediately begin checking on the uptime of each device and the active software versions that are running the Cisco Catalyst 4003 or 4006. For drill-down real-time device status information, network operations staff can launch the award-winning CiscoView application from their fault-management stations and, at a glance, check on power supplies, line cards, and the operational status of each port.

Technical Specifications

Integrated Layer 3 Services Engine Performance

- 8 Gbps capacity Layer 3 switching router engine
- Scalable 6 mpps wire-speed forwarding rate for 64-byte packets
- MIPS RISC CPU (R5000), 16 MB Flash, 64 MB DRAM
- Programmable microcoded routing engine
- Route entries: 12,000 (minimum); 24,000 (maximum)
- 3 MB memory architecture shared by all ports
- Packet forwarding rate for 64-byte packets
- 1,488,000 pps to each 1000BASE-X port
- 2,976,000 pps to the backplane

Management

- SNMP MIB II
- Standards
- IEEE 802.3 Ethernet
- IEEE 802.3u Fast Ethernet
- IEEE 802.3x full-duplex 1000BASE-X ports
- IEEE 802.1D Spanning-Tree Protocol
- IEEE 802.1Q VLAN
- IEEE 802.3z 1000BASE-X specification
- 1000BASE-X (GBIC)
- 1000BASE-SX
- 1000BASE-LX/LH
- 1000BASE-ZX



Connectors and Cabling

- 1000BASE-X GBIC ports: SC fiber connectors, single-mode or multimode fiber
- Console and auxiliary port: RJ-45 connectors, RJ-45 serial cabling

Switching Line Card

- 32-port 10/100 Ethernet plus 2-port Gigabit Ethernet Layer 3 Services Module
 - 32 10/100 Ethernet ports, RJ-45 interface, two 1000 Gigabit Ethernet ports, GBIC slots
 - Status: Green (operational)/red (faulty)
 - Link: Green (operational)/red (faulty)
 - Console (RJ-45 female) data terminal equipment (DTE): Green (operational)/red (faulty)
 - 10BASE-T management (RJ-45 female) DTE: Green (good)/orange (disabled)/off (not connected)

Indicators

- Per-port status LED—link up: illuminated (color: green); link down: not illuminated

Physical

Line card dimensions and weight (H x W x D)

- 1.75 x 17.5 x 11.8 in. (4.4 x 44.5 x 30 cm)
- One rack unit (RU)

Environmental Conditions and Power Requirements

- Operating temperature: 32 to 113 F (0 to 45 C)
- Storage temperature: -4 to 149 F (-20 to 65 C)
- Operating relative humidity: 10 to 85 percent noncondensing
- Operating altitude: Up to 10,000 ft (3000 m)
- Power consumption: 70W maximum; 239 BTU per hour

Safety Certifications

- UL 1950
- CSA 22.2 No. 950
- EN 60950
- IEC 950
- AS/NZS 3260, TS001
- CE

Electromagnetic Emissions Certifications

- FCC Part 15 Class A
- EN 55022B Class A (CISPR 22 Class A)
- VCCI Class A
- AS/NZS 3548 Class A
- BCIQ
- CE Marking

For More Information

United States and Canada: 800 553-NETS (6387)

Europe: 32 2 778 4242

Australia: 612 9935 4107

Other: 408 526-7209

URL: <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.
Capital Tower
168 Robinson Road
#22-01 to #29-01
Singapore 068912
www.cisco.com
Tel: +65 6317 7777
Fax: +65 6317 7799

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