

## Cisco Catalyst 4500 Series Switches For Metro Ethernet Networks

### Optimal Control for Voice, Video, and Data Services

#### PRODUCT OVERVIEW

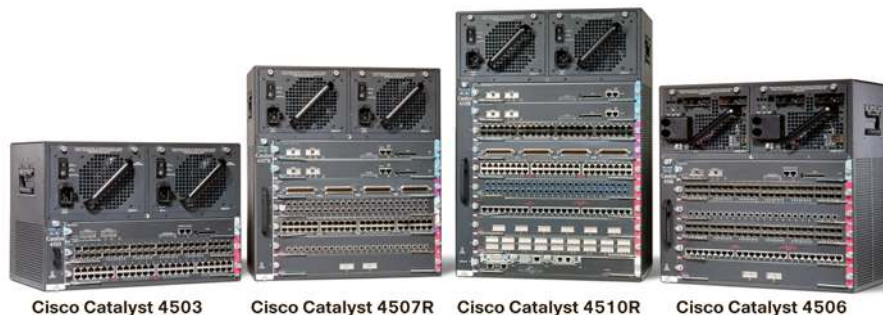
The Cisco® Catalyst® 4500 Series switches with integrated resiliency are designed for business services aggregation and subscriber access in metropolitan-area networks (MANs) that use the simplicity and flexibility of optical Ethernet in the first mile. These switches offer high-density Fast and Gigabit Ethernet for both fiber and copper combined with mechanisms for per-subscriber traffic management, security, performance, and quality of service (QoS). The Cisco Catalyst 4500 Series also offers nonblocking switching in Layers 2 through 4 with integrated resiliency, further enhancing control of “triple-play” voice, video, and data metro services.

The Cisco Catalyst 4500 Series includes four Cisco Catalyst chassis: the Cisco Catalyst 4510R Switch (10 slots), the Cisco Catalyst 4507R Switch (7 slots), Cisco Catalyst 4506 Switch (6 slots), and Cisco Catalyst 4503 Switch (3 slots). Integrated resiliency enhancements offered in the Cisco Catalyst 4500 Series include 1+1 supervisor-engine redundancy (Cisco Catalyst 4507R and Cisco Catalyst 4510R), software-based fault tolerance, and 1+1 power-supply redundancy. Integrated resiliency in both hardware and software minimizes network downtime, helping to ensure profitable services.

Compatible with all Cisco Catalyst 4500 Series line cards and supervisor engines, the Cisco Catalyst 4500 Series reduces the cost of ownership by minimizing recurring operational expenses, improving return on investment (ROI).

With the Cisco Catalyst 4500 Series, a primary member of the comprehensive Cisco Metro Ethernet portfolio, network operators can extend control and intelligence to large and small sites at the MAN edge. The Cisco Metro Ethernet portfolio encompasses a variety of routing, switching, and optical products and a range of technologies, including IP/Multiprotocol Label Switching (MPLS), Ethernet, SONET/SDH, and dense wavelength-division multiplexing/coarse wavelength-division multiplexing (DWDM/CWDM). Cisco Systems® offers network operators a flexible, service-oriented approach for delivering profitable and differentiated metropolitan and broadband services.

**Figure 1.** Cisco Catalyst 4500 Series Switches for Metro Ethernet Networks



## THE ETHERNET ADVANTAGE IN MANS

Because of the cost, speed, and flexibility advantages of Ethernet, service providers are looking to offer Metro Ethernet as a connectivity option to their business and residential customers. Enterprise customers are asking providers to standardize on Ethernet as the User-Network Interface (UNI) everywhere on their networks to reduce expenses. Ethernet is familiar to enterprise customers and their IT staffs. It can scale to deliver bandwidth up to 10 Gbps to support demanding applications, and its bandwidth can be tailored to deliver performance that meets the needs of specific business applications. Providers of residential Internet, voice over IP (VoIP), and video services can also take advantage of this flexibility using advanced security and rich quality of service (QoS) capabilities delivered on the Cisco Catalyst 4500 Series via sophisticated control features of Cisco IOS® Software and specialized hardware. Whether in MAN access or aggregation, Ethernet technology offers the most effective transport for service requirements today and in the future. By offering Ethernet-based services that can support more advanced applications, service providers can differentiate their offerings from competitors, improve their profit margins, and improve their revenue potential over the long term.

## OPTIMAL CONTROL

The Cisco Catalyst 4500 Series provides Metro Ethernet edge networks optimal control, from managing network and subscriber security to service differentiation. The Cisco Catalyst 4500 Series delivers this control with the following:

- **Integrated resiliency**—Network downtime is minimized with redundant supervisor-engine capability (on the Cisco Catalyst 4507R and 4510R), software-based fault tolerance, and 1+1 power-supply redundancy across the Cisco Catalyst 4500 Series. Nonstop Forwarding (NSF) with Stateful Switchover (SSO) offers continuous data packet forwarding during switchover. With time-sensitive traffic, including voice and video, running over the Metro Ethernet edge network, integrated resiliency is essential for maintaining profitability.
- **Sophisticated QoS**—Integrated QoS and traffic-management capabilities based on Layers 2 through 4 classify and prioritize mission-critical and time-sensitive traffic based on 32,000 QoS policy entries. The Cisco Catalyst 4500 Series can shape and rate-limit bandwidth-intensive traffic with mechanisms such as input and output policers based on host, network, and application information. The QoS mechanisms are delivered without performance impact.
- **Predictable performance**—The Cisco Catalyst 4500 Series offers up to a 72-million packets per second (mpps) wire-speed forwarding rate in hardware for traffic in Layers 2 through 4. Switching performance is independent of the number of route entries, QoS mechanisms enabled, and active VLANs. MANs need to respond reliably to meet end customer service-level agreements (SLAs).
- **Advanced network security**—The Cisco Catalyst 4500 Series supports up to 32,000 wire-rate Layer 2 through 4 access-list entries, Dynamic Host Configuration Protocol (DHCP) interface tracker (option 82) for subscriber tracking, DHCP snooping to prevent malicious or misconfigured DHCP servers, and includes other advanced security capabilities such as user authentication, client security, and control plane policing.

## SCALABLE SERVICE-ORIENTED ARCHITECTURE

The modular architecture of the Cisco Catalyst 4500 Series provides the scalability and flexibility to grow the network as a provider's service portfolio and customer base expand. With up to 4096 VLANs and private VLANs, service providers can easily address mixed networks with both residential and business customers. The switches can be configured for high-density access with up to 384 10-, 100-, or 1000-Mbps interfaces, or for gigabit aggregation with 32 unshared Gigabit Ethernet ports. In addition, the Cisco Catalyst 4500 Series, with the Cisco Catalyst 4503, 4506, 4507R, and 4510R, offers different entry points for deployments in low- and high-volume customer environments. The 10-slot Cisco Catalyst 4510R is especially ideal for higher-density deployments with support of up to 384 fiber or copper ports and increased high availability with 1+1 redundant supervisor engine support with subminute failover time.

## Cisco Catalyst 4500 Series Benefits

The Cisco Catalyst 4500 Series provides advanced, high-performance solutions for service-driven metro networks. Benefits include the following:

- **Performance**—Delivering advanced switching solutions that scale bandwidth as ports are added, the Cisco Catalyst 4500 Series is powered by leading-edge, application-specific integrated circuit (ASIC) technology that offers wire-speed Layer 2 and 3 10/100 or gigabit switching. Offering modular supervisor flexibility with complete line-card compatibility, Layer 2 switching can scale up to 96 Gbps, 72 mpps. Based on Cisco Express Forwarding, Layer 3 and 4 switching can also scale up to 96 Gbps, 72 mpps.

- **Port density**—The Cisco Catalyst 4500 Series meets network-subscriber connectivity requirements of up to 384 copper or fiber Fast Ethernet or Gigabit Ethernet ports in a chassis. The Cisco Catalyst 4500 Series supports density requirements for both business and residential service environments.
- **Supervisor engine redundancy**—The Cisco Catalyst 4507R and 4510R support 1+1 supervisor-engine redundancy for integrated resiliency. Redundant supervisor engines help to ensure that network downtime is minimized. Minimal network downtime facilitates reduced operational expense and increased customer satisfaction.
- **Advanced security**—Enabling security features such as DHCP Snooping, access control lists (ACLs), Secure Shell (SSH) Protocol, Port Security, Control Plane Policing, Dynamic ARP Inspection (DAI), IP Source Guard, and Private Virtual LANs (PVLANS) on the Cisco Catalyst 4500 Series enhances control and flexibility in the network. By enabling these features selectively or collectively, a network administrator can prevent unauthorized access the network, prevent hackers from disrupting services, or prevent a deliberate or accidental broadcast storm.
- **Hardware-based multicast**—Protocol Independent Multicast (PIM), dense and sparse mode, Internet Group Management Protocol (IGMP), and Cisco Group Management Protocol provide efficient standards-based and Cisco product-enhanced broadcast video service deployment without compromising performance. Source Specific Multicast (SSM) and SSM Mapping (mapping IGMPv2 joins to Source Specific PIM joins) provide additional scale and control of multicast.
- **Bidirectional Fast and Gigabit Ethernet fiber support**—The Cisco Catalyst 4500 Series 48-port 100BASE-BX10-D bidirectional Fast and Gigabit Ethernet line cards providing IEEE 802.3ah standard-compatible technology for network operators building next-generation Metro Ethernet access networks. Bidirectional Fast and Gigabit Ethernet interfaces operate over a single strand of fiber, providing significant savings in fiber, cable management, and other installation costs as well as long-term operating expenses. Fast and Gigabit Ethernet over single-mode fiber supports compelling data, voice, and video services affordably while creating a fiber plant that can support higher-bandwidth services in the future.
- **Cisco IOS Software network services**—Cisco Catalyst 4500 Series provides mature service provider Layer 2 and 3 features capable of enhancing metro networks. These features meet the advanced networking demands of service providers because they have been improved based on years of experience in different geographic regions and with large-scale deployments.
- **Investment protection**—The flexible modular architecture of the Cisco Catalyst 4500 Series provides cost-effective interface upgrades for metro access and aggregation deployments. Customers deploying the Cisco Catalyst 4503 and Cisco Catalyst 4506 with the Cisco Catalyst 4000 Supervisor Engine II who desire higher performance and enhanced features can easily upgrade to the Cisco Catalyst 4500 Series Supervisor Engine II-Plus, or the Cisco Catalyst 4000/4500 supervisor engines IV or V. Compatible sparing between Cisco Catalyst 4003, Cisco Catalyst 4006, and Cisco Catalyst 4500 Series chassis provides commonality of power supplies and switching line cards, lowering the overall deployment, migration, and support costs.
- **Functionally transparent line cards**—Cisco Catalyst 4500 Series system administrators can easily upgrade all system ports to higher-layer switching functions by simply adding a new supervisor engine such as the Cisco Catalyst 4500 Series Supervisor Engine II-Plus, or the Cisco Catalyst 4000/4500 supervisor engines IV or V. Higher-layer functional enhancements are possible on all system ports without replacing existing line cards and wiring, unlike conventional switching products where complete equipment upgrades are typical during migration. This architectural advantage extends the useful deployment life of Cisco Catalyst 4500 Series line cards.
- **Shared-memory architecture**—The low-latency, centralized, shared-memory switching fabric architecture delivers leading-edge, wire-speed broadcast and multicast capabilities, eliminating any possibility of head-of-line blocking.
- **Cisco NetFlow Services**—The Cisco NetFlow Services Card for the Supervisor Engine IV supports statistics capture in hardware for flow-based and VLAN-based statistics monitoring. This data can be exported, collected, and analyzed for network traffic accounting, usage-based network billing, network planning, network monitoring, and data mining capabilities for service provider customers.
- **Bandwidth protection for mission-critical applications**—When deploying the Supervisor Engine II-Plus, IV, or V, there is no degradation of forwarding performance with QoS or Security features enabled; the Cisco Catalyst 4500 Series platform continues to forward at full line rate.

## APPLICATIONS

### One Network for All Types of Customers

With Cisco Metro Ethernet solutions, no compromise is needed when building your next-generation broadband network. One network can offer a full range of business services to small and medium-sized businesses, and triple-play services (voice, video, and data) to residential consumers. Based on available infrastructure and existing revenue streams, service providers have the flexibility to choose the appropriate access method. A Cisco Powered network delivers consistent services and security across any access media—asymmetric DSL (ADSL), very-high-bit-rate DSL (VDSL), passive optical network (PON), fiber to a building basement or fiber direct to the customer.

**Figure 2.** Next-Generation Broadband Network

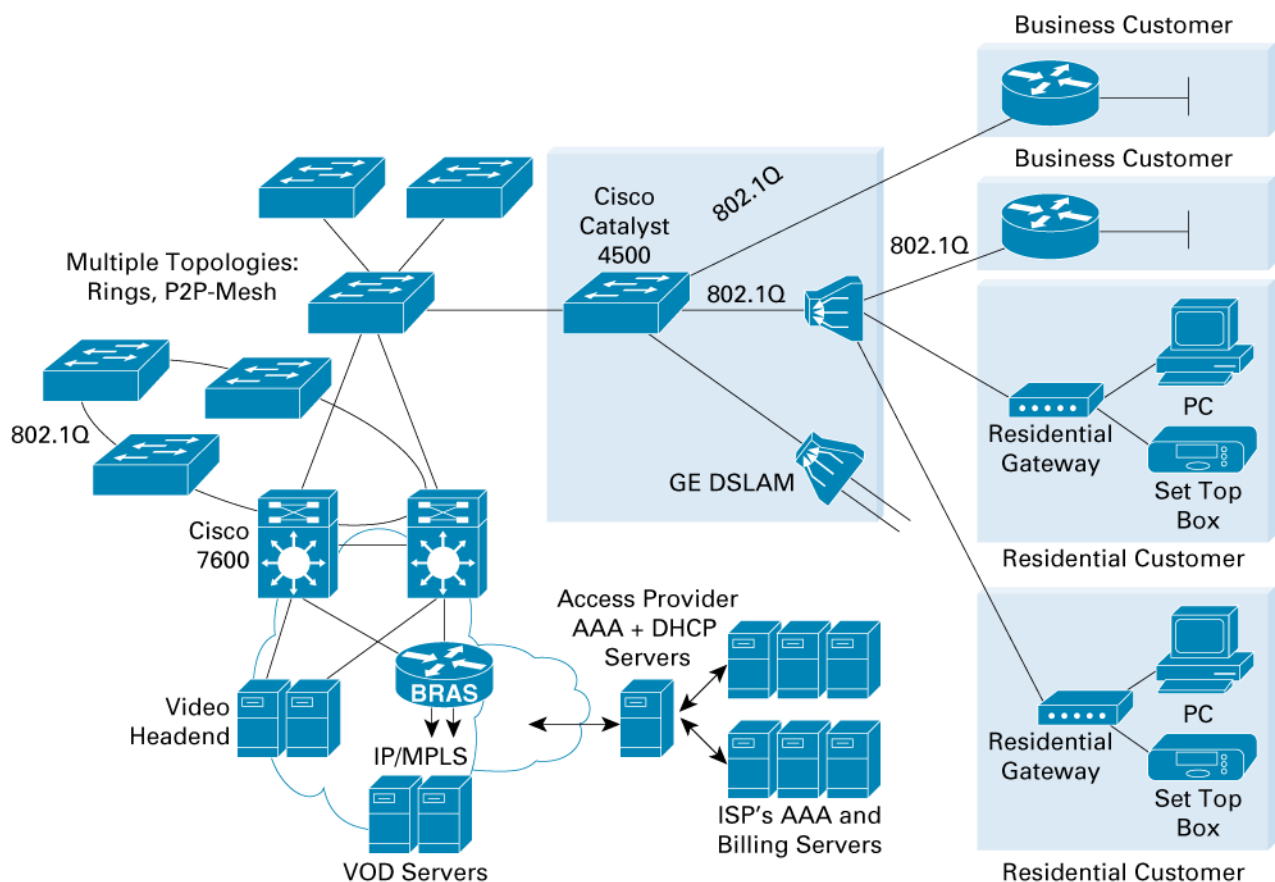


Figure 2 shows a typical example of a next-generation broadband network. The Cisco Catalyst 4500 Series directly connects the customer with fiber or aggregates them through DSL and PON. The Cisco 7600 Series Router forwards the residential traffic to Internet and voice gateways and business traffic to the core MAN for connectivity to other business sites. Per-VLAN, per-flow, and per-traffic-type management on the Cisco Catalyst 4500 Series and Cisco 7600 Series simplify delivery of Layer 2 and Layer 3 VPN services with residential voice, video, and data.

## FOR MORE INFORMATION

For more information about the Cisco Catalyst 4500 Series switches, including important features, configuration alternatives, product specifications, and ordering information, please see the Cisco Catalyst 4500 Series data sheet at <http://www.cisco.com/go/catalyst4500> or contact your local account representative.



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