

Meeting Customer Demands with Cisco Metro Ethernet Switching

Corporate enterprise customers are often “choice constrained” by their limited Wide Area Network (WAN) connectivity options. As their bandwidth needs increase, they can only go from T1/E1 to T3/E3 to OC3. At the same time, smaller business and residential customers are unable to receive the high-quality data, voice and video services they demand. Service Providers can meet these customer demands by offering self-provisioned Metro Ethernet services with scalable granularity. Cisco Metro Ethernet Switching provides a flexible solution for service providers to deliver profitable, comprehensive Ethernet services.

Today's increasing demands for metropolitan-area network (MAN or metro) services have led to a very diverse marketplace of customers, services, topologies, and technologies. Service provider solutions must address multiple customer types across a variety of environments from business parks to downtown office buildings to multiunit structures such as apartment buildings. Many of your business customers may be extremely interested in new offerings such as Layer 2 Virtual Private Networks (VPN) that “stretch” Ethernet across the WAN—but you also need to maintain existing Frame Relay services. Meanwhile, to profitably serve your residential and

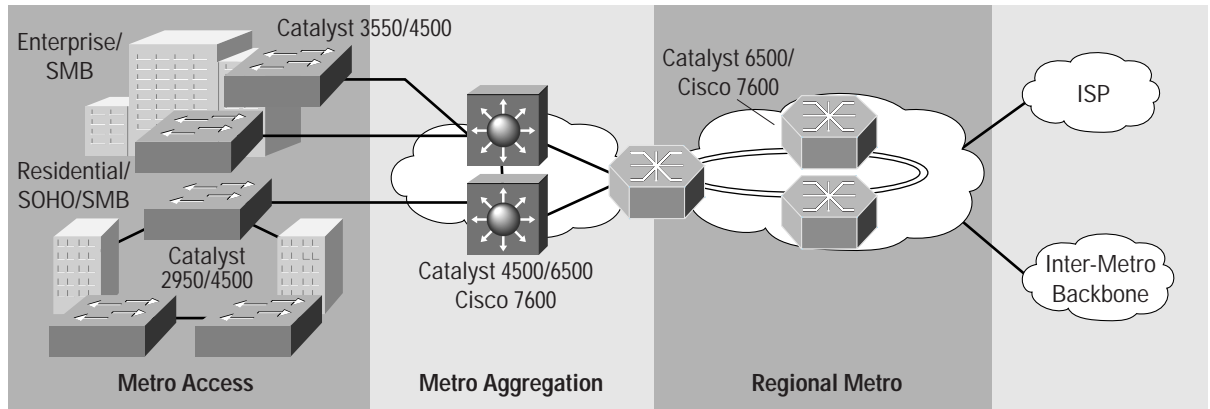
small-business customers, you need cost-effective network architectures and scalable service delivery mechanisms.

Cisco Metro Ethernet Switching solutions can help you quickly build the capability to deliver profitable, comprehensive Ethernet services that will generate new revenue opportunities in a market anticipated to be \$4 Billion by 2006 for North American Service Providers alone. (RHK, 2002)

By effectively integrating with existing WAN services such as Frame Relay and ATM, Cisco Metro Ethernet Switching offers an unmatched breadth of service delivery mechanisms and can help you minimize the total cost of ownership for new services.



Figure 1
Cisco Metro Ethernet Switching



Deliver Profitable, Comprehensive Ethernet Services

Cisco Metro Ethernet Switching helps service providers, like your company, deliver a full range of profitable Layer 2 and Layer 3 Ethernet services to meet the diverse needs of your customers.

Layer 2 Services include:

- **Ethernet Relay Service (ERS).** Based on a virtual point-to-point connection between two end-points, ERS is a virtual circuit service that you can provision and manage with an SLA guaranteed back to the enterprise. Like Frame Relay, the customer accesses multiple connections through a single physical port attached to your network. This service can be used to construct intersite connectivity among large campuses, as well as traditional hub-and-spoke networks.
- **Ethernet Wire Service.** Applications such as data mirroring require full transparency of virtual LANs (VLANs) and bridging control protocols. Ethernet Wire Service supports a fully transparent, point-to-point circuit that allows similar capability to a private-line service.
- **Ethernet Multipoint Services.** If you currently offer transparent LAN services based on ATM LAN emulation, you can replace or augment your offerings with a native, end-to-end Ethernet service. Ethernet Multipoint Services allow you to provide transparent bridged communications between multiple sites, in support of such non-routed protocols as Net BEUI.

With Cisco Metro Ethernet Switching, you can also offer Layer 3 services to enterprises, small and medium-sized businesses, and residential subscribers. They include:

- **IP VPN.** If you have a Multiprotocol Label Switching (MPLS)-enabled core network, you can offer MPLS VPN services, whereby each business customer has a virtual routing and forwarding (VRF) instance for connectionless transport within your network cloud.
- **Internet Access.** Ethernet is a cost-effective means of delivering high-speed, always-on Internet access to both business and residential customers. These customers can then use IPSec VPNs for a secure connection to a corporate site.



In addition to Layer 2 and 3 services, Cisco Metro Ethernet Switching enables the delivery of integrated voice over IP and broadcast video services over secure and scalable Ethernet connectivity. This combination of data, voice and video enables the creation of attractive, innovative service bundles for both business and residential customers.

Integration with Existing WAN Services Protect Investments

Cisco recognizes that you need a way to realize the potential of new Ethernet services while continuing to serve customers who use traditional WAN services. For example, many customers have branch and regional offices that are well-served by TDM, Frame Relay, or ATM service at T1/E1 speeds or less, but face bandwidth constraints in WAN connections to their headquarters. It can be expensive and time-consuming for you and your customers to upgrade those headquarter links from T1/E1 to T3/E3, or from T3/E3 to OC-3.

With Cisco Metro Ethernet Switching, you can offer Ethernet service at speeds up to 1 Gbps, which interwork with all of the traditional WAN services at branch locations. This means you can protect your investments in—and revenue from—existing ATM, Frame Relay, and TDM infrastructures by seamlessly interconnecting them with metro Ethernet services. With support for service interworking and Ethernet over MPLS, Cisco Metro Ethernet Switching provides service providers with a solution for effective WAN service integration and in-service migration. By using the same network equipment platform for metro Ethernet and traditional services, you can achieve greater efficiencies in equipment management, provisioning, and service assurance.

Multiple Service Delivery Mechanisms Provide Service Richness

Cisco Metro Ethernet Switching supports the physical topologies and technical service delivery mechanisms that you need to profitably offer rich Ethernet services. Physical topologies supported by Cisco Metro Ethernet Switching include Ethernet point-to-point, Ethernet ring, and coarse wavelength-division multiplexing (CWDM) rings. Within these topologies, Cisco supports a variety of technical service delivery mechanisms including:

- *High Availability*—Cisco EtherChannel[®] technology for increased bandwidth and 20 ms failover; Cisco dual-homing via PVST+ for uplink load balancing; Cisco 802.1w with 802.1s for rapid Spanning Tree Protocol convergence; Cisco CWDM GBIC solution for scalable, easy-to-deploy Gigabit Ethernet services.
- *Security*—Wire-speed access control lists for secure traffic management without decreased performance; port security and DHCP snooping to protect your network against malicious attacks; DHCP Option 82 for subscriber management.
- *Quality of Service (QoS)*—Advanced classification and queuing based on Layer 2-Layer 4 marking to support voice and video services; bandwidth policing as granular as 8 kbps to support different-bandwidth service levels.

In addition, Cisco offers service delivery mechanisms that scale Ethernet with intelligent control and scalable forwarding, including:

- *Tag Stacking*. Also known as 802.1Q tunneling or QinQ, tag stacking is a cost-effective way to achieve VLAN transparency between you and your enterprise customer, or between two enterprise endpoints, by providing a means of tunneling one set of VLAN tags inside a second VLAN tag. Thus if you run a native VLAN network—one built entirely on Ethernet and spanning tree without IP or MPLS—you can transparently tunnel a customer's VLANs from one site through your “cloud” to another site. Your VLAN tags do not need to match your customer's, which makes VLAN management and distribution easier for you. Plus, the approach is inherently multipoint, so the service looks like an Ethernet segment to the customer.



- *Ethernet over MPLS (EoMPLS)*. Regarded by service providers worldwide for its superior scalability, MPLS is an ideal way to provide Ethernet transport services to enterprise customers at Layer 2, while continuing to scale your core architectures. The Cisco EoMPLS solution, based on the draft IETF standard, is an extension of MPLS that complements the VLAN functionality inherent in Layer 2 architectures. When used in conjunction with a Layer 2 architecture, the Cisco EoMPLS solution can scale an entire network beyond 4096 VLAN limitations to the inherent scalability of a Layer 3 control plane. At its simplest, it provides a tunneling mechanism for Layer 2 traffic through an MPLS-enabled Layer 3 core. You get the best of both worlds: the scalability of an MPLS core, without concern about spanning tree, and a Layer 2 transparent service offering.

Minimizing Total Cost of Ownership

In today's difficult economic climate, your company needs to improve cash flow and minimize total cost of ownership (TCO) for the metro services you provide. A common approach is to manage TCO by reducing capital expenditures (CapEx). While this is the fastest lever for easing cash flow pressure, it is not always sustainable because of the need to continually upgrade your networks. An alternative, but still aggressive, approach is to reduce operating expenses (OpEx) by automating operations support. Cisco responds to the TCO challenge with Cisco Internet OSS.

In conjunction with Cisco Metro Ethernet Switching, Cisco Internet OSS increases the value of operations by allowing you to divert personnel from routine management tasks and toward more revenue-generating activities. Cisco does this by placing rich intelligence and robust, automated management capabilities into the network itself. A common-object model ultimately facilitates the broad use of common services across all components of Cisco Internet OSS, resulting in a tightly integrated, responsive network infrastructure that is directly tied to business policies. Provisioning processes are streamlined via Cisco Internet OSS, and service enhancements such as web-based self-provisioning become a reality.

Because Cisco Internet OSS is based on industry standards for protocols, links, and application programming interfaces (APIs), any Cisco ecosystem partner can build products or write applications that integrate easily with an existing Internet OSS framework. You can then select the Internet OSS components you need for a custom OSS that meets your specific business model and integrates easily with your existing business-management, customer-service, and billing systems. Equally important, the Internet OSS architecture enables a gradual transition of TDM-based operations to accommodate managed growth of metro services.

Cisco Metro Ethernet Switching Addresses Metro Ethernet Requirements

Cisco Metro Ethernet Switching enables you to deliver profitable, comprehensive Ethernet services. By effectively integrating with existing WAN services, Cisco Metro Ethernet Switching offers an unmatched breadth of service delivery mechanisms. Cisco can also help you minimize total cost of ownership for new services with its extensive automated operations support.

Products in the Cisco Metro Ethernet Switching portfolio include:

- **Cisco 7600 Series Internet Router.** Ideal for regional metro and metro Ethernet aggregation, Cisco 7600 Series Internet routers deliver MAN aggregation with high-touch Layer 2 and Layer 3 IP services. The routers provide Gigabit Ethernet, Dynamic Packet Transport (DPT), and SONET DS0-to-OC-48/STM-16 WAN connectivity, plus 10-Mbps Ethernet to 10-Gigabit Ethernet LAN connectivity for high-performance network-edge aggregation, in metro SONET, Ethernet switched, or IP environments. MPLS protocol support includes EoMPLS, MPLS VPN, and MPLS QoS, so customers benefit from highly secure connectivity, differentiated services, and quality guarantees, as well as scalable, flexible, unified networks that can meet different requirements.



- Cisco Catalyst® 6500 Series Switch. Ideal for regional metro and metro Ethernet aggregation, the Catalyst 6500 Series delivers high-performance, multilayer switching solutions for service provider networks. Designed to address increased requirements for gigabit scalability, high availability, and multilayer switching, the Catalyst 6500 Series has exceptional scalability and price/performance. It supports a wide range of interface densities, while providing an infrastructure for delivering secure, converged network services. The addition of intelligent service modules offers unprecedented control and granularity of services in high-performance networking environments.
- Cisco Catalyst 4500 Series Switch. Ideal for business services aggregation and subscriber access in MANs, the new Cisco Catalyst 4500 Series switches take advantage of the simplicity and flexibility of optical Ethernet in the First Mile (EFM). These switches combine integrated resiliency with the per-subscriber traffic management, security, performance, and QoS mechanisms needed to deliver profitable data, voice, and video services. With the introduction of the Catalyst 4000 Supervisor Engine IV, network operators can extend control and intelligence to large and small sites at the MAN edge of their EFM networks.
- Cisco Catalyst 3550 Series Switch. Ideal for providing metro access to enterprise and small- and medium-sized business customers, the Catalyst 3550 Series is a line of powerful, yet cost-effective fixed-configuration switches. Featuring 802.1Q tunneling, high-performance IP routing, and subsecond STP convergence, these switches enable a variety of metro services, such as transparent LAN services and business-class Internet access. The Catalyst 3550 Series is available in a range of Fast Ethernet, Gigabit Ethernet, DC power, and fiber configurations.
- Cisco Catalyst 2950 Series Switch. Ideal for providing metro access to residential customers, the Catalyst 2950 Series is an affordable line of fixed-configuration Fast Ethernet and Gigabit Ethernet switches. Featuring advanced rate-limiting, voice VLAN support, and multicast management, these switches enable a variety of residential metro services such as Internet access, voice-over-IP, and broadcast video.
- Cisco CWDM GBIC Solution. The Cisco CWDM GBIC solution facilitates straightforward deployment and scaling of Gigabit Ethernet services. The CWDM gigabit interface converters (GBICs) and CWDM optical add/drop modules (OADMs) enable flexible, highly available, multiservice network design.

Proven Leadership from Cisco Systems

Cisco Systems, Inc. is the worldwide leader in networking for the Internet and in switched Ethernet across all platforms, from modular to fixed-configuration to gigabit. Cisco Metro Solutions deliver the most comprehensive multilayer service portfolio for providers to quickly scale their customer base and revenues. This portfolio, which includes Carrier IP/MPLS, Metro Ethernet Switching and Metro Optical Transport platforms and technologies, can ensure a flexible and efficient foundation for profitable metro services.

If you are interested in delivering new business and residential services and capturing your share of the metro opportunity, Cisco Metro Ethernet Switching can help. By integrating with your existing WAN services, Cisco Metro Ethernet Switching solutions allow you to protect your investments and existing revenue base while cost-effectively building and delivering a range of data, voice and video services that benefit your demanding customers.

For more information about the Cisco Metro Ethernet Switching portfolio, contact your Cisco account manager today, or go to <http://www.cisco.com/go/metroethernetswitching>.



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