

Value-added IP Services for Ethernet Metropolitan Area Networks

Broadband is the future of network access, and Ethernet will play an increasingly important role. In the Metropolitan Area Network (MAN), subscribers can get a 10 Mbps Ethernet connection for about the same price as a T1 (1.5 Mbps) service. The Ethernet-based service can be just as profitable for Service Providers (SPs). According to the Dell'Oro Group, the cost to provision a 100 Mbps Ethernet MAN connection is the same per port as traditional access technologies that provide a fraction of Ethernet's bandwidth. And the reason is simple: because of the nearly half a *billion* Ethernet connections in the Local Area Network (LAN), there are substantial economies of scale that drive technology development costs down. SPs can also leverage enterprise IT staff expertise to install Ethernet switches on site. So, as fiber becomes more ubiquitous, so too will Ethernet in the MAN.

The need for speed is causing the optical network build-out to continue at a rapid pace. In North America over 56,000 miles (90,000 km) of fiber optic cabling was installed in 2000, and over 50% of all buildings in the U.S. with more than 500 users now have access to fiber. Citing "a lot more bandwidth for a lot less money," Gartner predicts that 80% of enterprises will use Ethernet in the MAN by 2005. The result is a huge market for value-added services that is expected to grow from \$5 billion today to over \$20 billion by 2004, according to Pioneer Consulting.

Ethernet MANs are ideal for two popular services: public Internet access and private intranets. Both services can bypass traditional local access services and benefit tremendously from Ethernet's high performance. Within Ethernet's distance limitation of 47 miles (75 km), Ethernet MANs provide an attractive alternative to traditional local connectivity solutions, like leased lines, by eclipsing their price/performance benchmarks. Additionally, the value of Ethernet can be extended out across the WAN by using Virtual Private Networks (VPNs) to securely connect Ethernet MANs.

Today, SPs use Customer Premises Equipment (CPE) to deploy firewalls for Internet access and VPNs for inter-MAN connectivity. But the many operational challenges associated with CPE—separate devices per subscriber site, truck rolls per subscriber site, code upgrades per device, security policy updates per subscriber and/or user—conspire to reduce IP service offering profitability. Additionally, the CPE model conflicts with the centralized business model adopted by nearly all SPs deploying Ethernet MANs, eating away the economies of scale that drive profitability.

Finally, most standalone security devices have been designed to support data rates that are much lower than Ethernet's. So why bother to offer secure Internet access over Ethernet at 10-100 Mbps when the CPE firewall device limits throughput to a fraction of those speeds? A CPE-based deployment also inhibits an SP's ability to provision IP services on demand without having to upgrade hardware as devices reach their maximum throughput levels.

Challenge

Profitably deploy and operate a MAN value-added services infrastructure that delivers high-speed Ethernet access and IP services on demand to hundreds of thousands of subscriber sites without compromising performance or requiring special CPE.

Goals

Provide a rapidly deployable and centrally manageable high-performance solution; deliver a portfolio of IP services over Ethernet without using CPE; offer the scalability to deliver access capacity and IP services on demand; minimize SP capital and operational expenditures.

Solution

The CoSine IP Service Delivery Platform, consisting of three distributed elements:

- **IPSX™ Service Processing Switch Family:** Carrier-class solutions that marry switching, routing and computing capabilities with an open operating system to deliver computationally-intensive IP services at industry-leading scalability rates.
- **InVision™ Service Management System (SMS):** A comprehensive operational support system that allows SPs to easily deploy, provision, manage and account for value-added services in the MAN.
- **InGage™ Customer Network Management (CNM) system:** A browser-based customer care portal for the subscriber, giving visibility of and control over MAN-based IP services.

Description

Rather than proliferate CPE, SPs can deploy the CoSine IP Service Delivery Platform to deliver managed IP services from within the MAN. The combined IPSX with Scalable High-rate Architecture for Routing and Computing (SHARC™) Gigabit Ethernet Service Generator solution integrates and consolidates value-added services in the metro POP, giving SPs the ability to support hundreds of thousands of metropolitan subscriber sites profitably without special CPE. Network-based service provisioning means no more truck rolls, time-to-market delays or troubleshooting headaches. The result is a higher return on the SP's MAN infrastructure investment.

The first step in the process of establishing a network-based value-added IP service delivery architecture is for the MAN SP to incorporate the CoSine IP Service Delivery Platform into its metro POP infrastructure (Figure 1). The IPSX/SHARC solution seamlessly integrates with the

pre-existing infrastructure elements, including high-density Ethernet switches and core routers. Via InVision, the Network Operating Center (NOC) administrator then provisions a private Virtual Router (VR) for each MAN subscriber network. In the process, Virtual Interfaces (VIs) are defined for each subscriber network, and each VI is mapped as a channel to the Service Provider VR (SP VR), which provides connectivity to the core router. The VR is the building block to which value-added services are added and is the logical equivalent of a physical router with its own distinct routing protocols, forwarding table and defined interfaces. Each IPSX 9500™ fully loaded with 12 SHARC Service Generators supports up to 40,000 VRs; an IPSX 3500™ fully loaded with 3 SHARC Service Generators supports up to 10,000 VRs.

The SP then partitions each subscriber's network over a shared infrastructure in the MAN using Virtual Local Area Networks (VLANs), which are defined by the IEEE in the 802.1Q standard and can be applied to all Ethernet speeds. Each VLAN is designated by a VLAN ID that is determined by the Ethernet switch residing in the metro POP. In the IPSX, the VLAN ID is bound to the Logical Interface (LI) that is mapped to the VI defined on the access side of the Subscriber's VR (Sub VR). VLANs run on a SHARC Gigabit Ethernet port connecting to a high-density Ethernet switch in the SP's metro POP. As traffic from multiple subscribers traverses the same switch port, a VLAN tag identifying the VLAN ID enables the IPSX to determine to which VR the traffic is destined.

The IPSX supports both IPsec and MultiProtocol Label Switching (MPLS) VPNs. With IPsec, a company can get Internet access, secure site-to-site communication and dial-in remote access—all with a single, high-speed Ethernet MAN connection. MPLS VPNs deliver superior end-to-end service levels for the subscriber traffic partitioned over the shared IP network.

Any connection to the Internet requires a firewall. The IPSX offers packet filtering, application proxy and stateful firewall solutions developed by CoSine or its strategic partners. The IPSX also performs Network Address Translation (NAT) to shield a subscriber's internal IP addresses.

A major advantage of the IPSX/SHARC solution is its unprecedented IP services processing scalability driven by the SHARC Service Generators. Each Service Generator is a self-contained, distributed subsystem that supports customizable managed services at multi-gigabit data rates. Combined with bandwidth management and rate control capabilities, such system scalability allows SPs to sell access

capacity and IP services on demand. If a subscriber wants to upgrade from 2 Mbps to 10 Mbps, not only does the IPSX enable SPs to dynamically change data rates, but it allows them to ratchet up the IP services like managed firewall at matching rates in mere minutes, compared to weeks or months for leased lines.

SPs use CoSine's InVision to provision the platform's value-added IP services. Pre-configured templates get customers up and running quickly. Each subscriber's service suite can be customized to meet its unique needs. InVision also provides a flexible accounting model that lets SPs invoice based on flat-rate or usage-based billing models.

To give subscribers the same visibility into and control of their IP network services that they have grown accustomed to with private networks, SPs can deploy CoSine's InGage at the subscriber's headquarters. InGage allows subscribers to monitor Service Level Agreement (SLA) guarantees, provision access capacity and IP services on demand and configure security policies. This helps eliminate the trust issue that many subscribers have with network-based managed services.

Benefits

Service Provider Benefits

- The network-based services accelerate time-to-revenue and deliver scalable access capacity and IP services on demand without special CPE.

- The IP Service Delivery Platform protects and leverages an SP's investment in fiber with value-added services that can be provisioned and managed centrally.
- Centralized integration drives capital and operational cost savings by consolidating services delivered to tens of thousands of MAN subscriber networks in a single platform.
- CoSine's broad array of application services enables a continual stream of incremental revenue previously impractical—or impossible—with CPE.
- Value-added services enable seamless, secure connectivity from the subscriber's LAN to the MAN and onto the WAN.
- SHARC's processing scalability and InVision's management features allow SPs to control access capacity and IP services dynamically and bill customers on a fixed rate or usage basis.

Enterprise Subscriber Benefits

- Network-based services for Ethernet MANs give subscribers broadband access at a price/performance far superior to traditional access technologies.
- On-demand provisioning of access capacity and IP services delivers greater responsiveness to subscriber needs.
- Subscribers receive value-added services that seamlessly and securely integrate Internet access with inter-MAN and WAN communications.
- InGage permits a degree of visibility and control that enterprises often forfeit with other managed services.

Figure 1. Secure Ethernet MAN Services

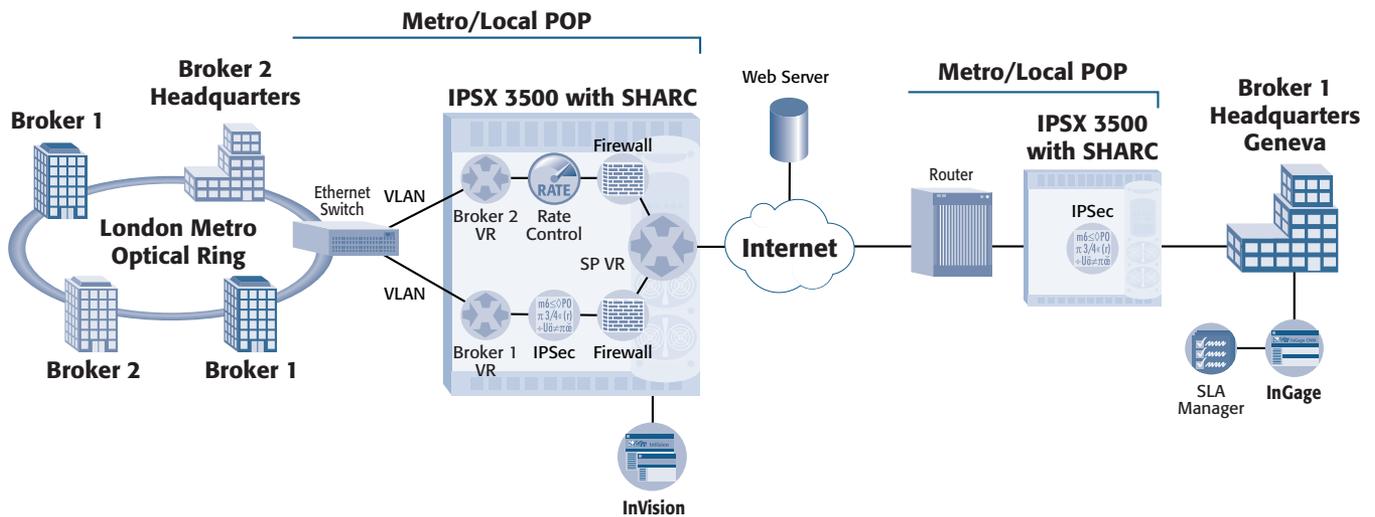


Figure 1. The network-based IP Service Delivery Platform provides a highly scalable, multi-gigabit solution for delivering IP services over Ethernet MANs.

Summary

The CoSine IP Service Delivery Platform overcomes the many challenges of profitably deploying value-added services in the MAN environment through a scalable, network-based platform that allows for centralized provisioning and control. The flexibility, scalability and manageability of the IPSX combine to yield a low total cost of ownership and a high return on investment. The fully integrated CoSine solution enables SPs to satisfy their metropolitan subscribers' needs for security services quickly and cost-effectively, ensuring improved customer satisfaction and a continual stream of incremental revenue.

The Right Platform for the Future of Gigabit Ethernet MANs

The CoSine IP Service Delivery Platform enables SPs to quickly, reliably and profitably deliver value-added services to their MAN subscribers. Designed to handle the intensive processing requirements of Gigabit Ethernet MANs today and tomorrow, the CoSine solution scales readily and affordably to support the full spectrum of high-value IP services needed for seamless integration of metropolitan and wide area networking. These ser-

vices include managed firewall, VPNs and VLANs among others. The CoSine IPSX is designed for rapid integration of new applications developed by CoSine or its third-party partners. Service Blades and SHARC Service Generators include multiple high-performance CPUs, patented integrated circuits and encryption accelerators to drive the diverse security services at multi-gigabit data rates. The InVision SMS allows management and maintenance of new services to be gracefully integrated into the SP's portfolio of managed services. InGage CNM presents control and management of these new services instantly to the subscriber, satisfying customer demands for visibility and control of its managed services.

The CoSine IP Service Delivery Platform allows SPs to offer profitable network-based services that are fully integrated and centrally managed from the subscriber site through the core of the SP network. Built specifically for carrier-class environments, the CoSine solution enables SPs to satisfy MAN subscriber demands for managed security services today, and provides a clear migration path to an extensive set of processing-intensive IP services well into the future.

Table 1. Summary of CoSine IP Service Delivery Platform Features

Requirement	CoSine IP Service Delivery Platform Feature
Operational cost savings	Platform-level integration, centralized provisioning and management, and customer self-care capabilities combine to give the IPSX its low cost of ownership
Scalability for performance	The IPSX 9500 supports up to 40,000 VRs, 150,000 managed firewall sites and 500,000 encrypted VPN tunnels
Value-added security	Managed firewall, NAT and VPN services provide a total security solution for enterprise subscribers—without special CPE
Non-stop network availability	Robust reliability derives from a fully-redundant, hot-swappable design that offers automatic failover, dual homing, a self-healing midplane fabric and NEBS-3 compliance for dependable service
Fast and flexible deployment	As a fully integrated and extensible platform with pre-defined and customizable application service templates in the InVision SMS, the IPSX enables rapid, centralized service provisioning
Complete customer care	InGage gives subscribers the same visibility and control they would have in a private network



CoSine
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CoSine Communications, founded in 1998, develops and delivers a new class of managed, network-based IP Service Delivery Platforms "purpose-built" for the deployment of high-value IP services such as Virtual Private Networks (VPNs). CoSine's platform provides Business IP Service Providers with the service processing, service management and customer capabilities required for offering highly differentiated IP services to subscribers with a high return on investment.

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