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January 15, 2008

## ***EDU-Metro Networks***

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## Overview

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Today, EDU-Metro networks can consist of large and expensive installations, which are operated by large cities or by telecommunication companies. These networks are routinely expensive for customers because the cost of implementation by these service entities is so high.

Why are these costs so high? Any company that has trenched large areas and buried fiber cables will say (if they are still in business) that the main cost is the fiber, other companies that have bought fiber for pennies on the dollar from failed fiber installers will say the cost of SONET systems for the Metro network are so high, and at a routine cost of \$100,000 or more for an OC-192 (10-Gigabit) port, that is indeed the case.

So what if a small metro network could be constructed using existing fiber, and with lower cost 10-Gigabit speeds and simpler management requirements, but could off some of the original capabilities that a SONET based system could? Would the price drop to reasonable levels? What is a reasonable level?

### **Anonymous Definition**

*Metropolitan area networks connect businesses to businesses, and businesses to WANs and the Internet.*

*A MAN is typically a backbone optical network that spans a metropolitan area, usually in a ring configuration.*

*The telephone companies have provided MAN services in the form of SONET rings for years.*

*These services are based on TDM (time division multiplexing), which is more suitable for voice than data.*

*Customers connect into the ring via ISDN, T1, fractional T1, and even T3 lines.*

*However, even for short distances, these connections are expensive.*

### **Raptor Comments**

*The demand for Ethernet based MAN systems is growing at around 800%/year.*

*Companies that own strategic fiber, and that are willing make the move, can be part of this escalation in business.*

*Such companies would become prime targets for acquisition when the large Telcos realize they are losing business to these mini-metro networks*

## Case Problem

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Consider the following problem.

T1 lines cost between \$800 to \$1200 per month and allow a maximum of 1.5 Mbps, although T1 lines are rarely capable of reaching this level resulting in the installation of multiple T1s. When the T1 count reaches 4 to 5 links, it is often cheaper to use a T3 or Fractional T3, which allows up to 45 Mbps of capability. When using T1s to link to a service provider the customer needs a relatively low cost WAN router to service the links, but the move to T3 often requires an upgrade to a more costly router, in either case a router is used to interface to the WAN connection. Multiple T1s or a T3 can cost as much as \$8,000 a month even when it is not always capable of producing a full 45 Mbps.

*If a company provides a system that allowed up to 192 Gigabit Ethernet ports and multiple (16) 10-Gigabit ports, using a 30-Gigabit (highly-meshed) backbone using a low-latency, Layer 2 system priced around \$220,000 for all hardware and software needed to implement the switching/routing of data, would costs fall? If this network could also support VoIP, Video delivery, and allow storage/IP facilities, would this be an attractive network to install?*

A number of clients have agreed that a Gigabit Ethernet link, which will guarantee at least 300 Mbps would be perfectly priced at \$3,000–\$4,000 per month and would directly cause many of them to switch quickly from existing services.

## Raptor Solution

Given the above to be true, if this network can also allow VPN-type services by creating point-to-point connections between customer sites using Virtual LAN technology with Quality of Service (QoS) that ensures the operability of VoIP, video conferencing, and storage for backups/replication/mirroring, then the attractiveness of this solution become irresistible.

EDU-Metro networks are seen as being highly robust and reliable. The Ether-Raptor "Eight-Pack" is an resilient design with multiple active-active links working at Layer 2 which keeps latency low and therefore allows VoIP to work correctly. The Ether-Raptor EDU-Metro network would also allow customers to effectively "Dual Attach" to its units using a simple industry standard called IEEE802.3ad (Link Aggregation), which would allow these Metro links to interface directly into the current switching structure of the client without the need for a routing system to be at the client side.

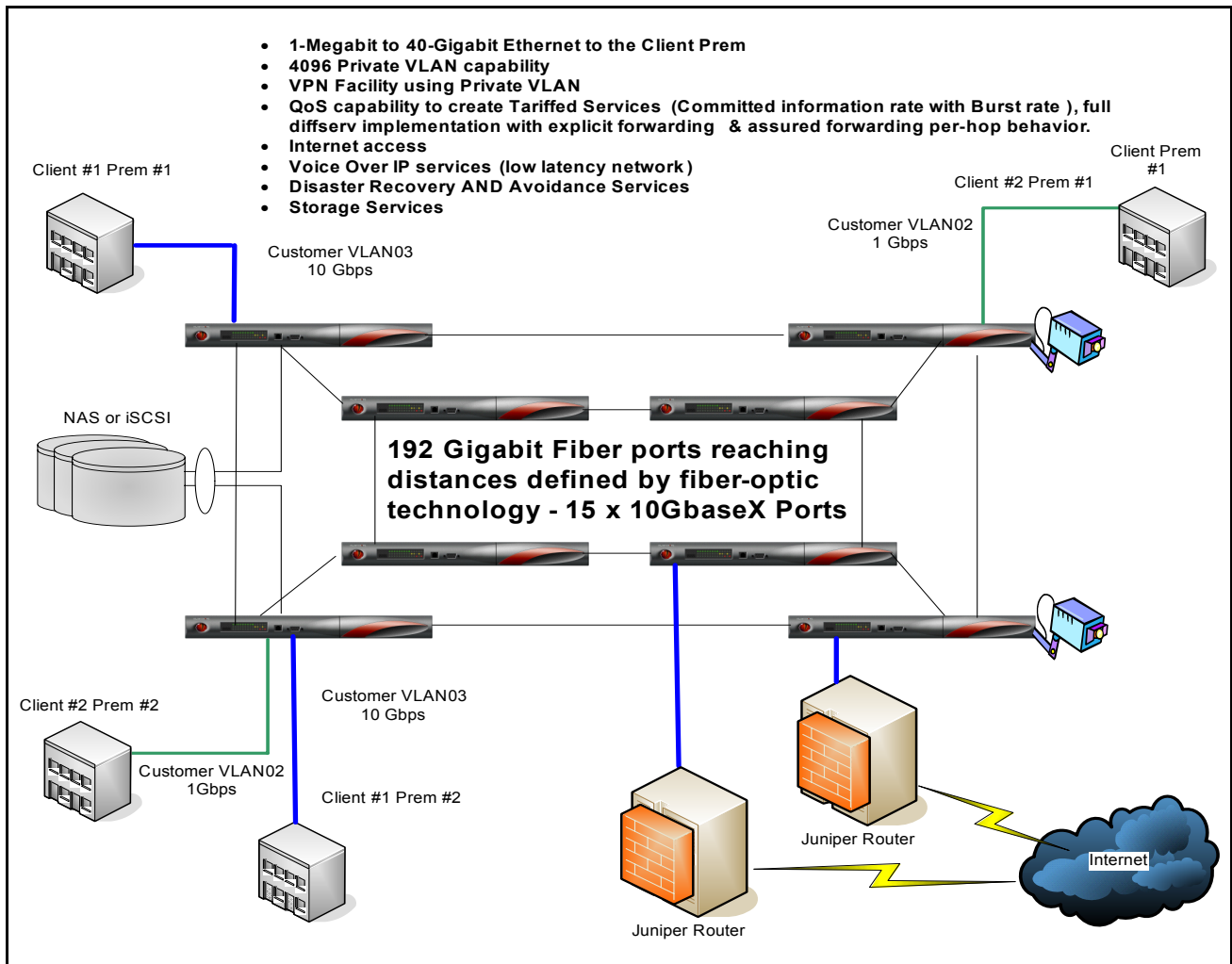


FIGURE 1. Raptor Metro Network Features

## Raptor Solution

All clients would be connected on separate Virtual LANs, which will allow a level of internal security and the Mini-Metro network would join the internet via two routers which would perform access control to the internet via 2 x 10 Gigabit (OC192) ports and will allow a redundant Internet connection with a secure internal private network for the entire EDU-Metro network. Each client gets a single (or for higher cost dual) Gigabit Ethernet Fiber link into their facility, and they are allowed to have a certain block of IP addresses from the pool created. They could even ask the Metro network to act as DHCP controller for them, in effect, outsourcing their IT to the provider.

### **Extract from a Light Reading Article “Building 10-Gig/DWDM MANs” issued October 27th 2000**

*Although it may not seem important when compared to the technical advantages, Ethernet can be relatively easily sold to most customers.*

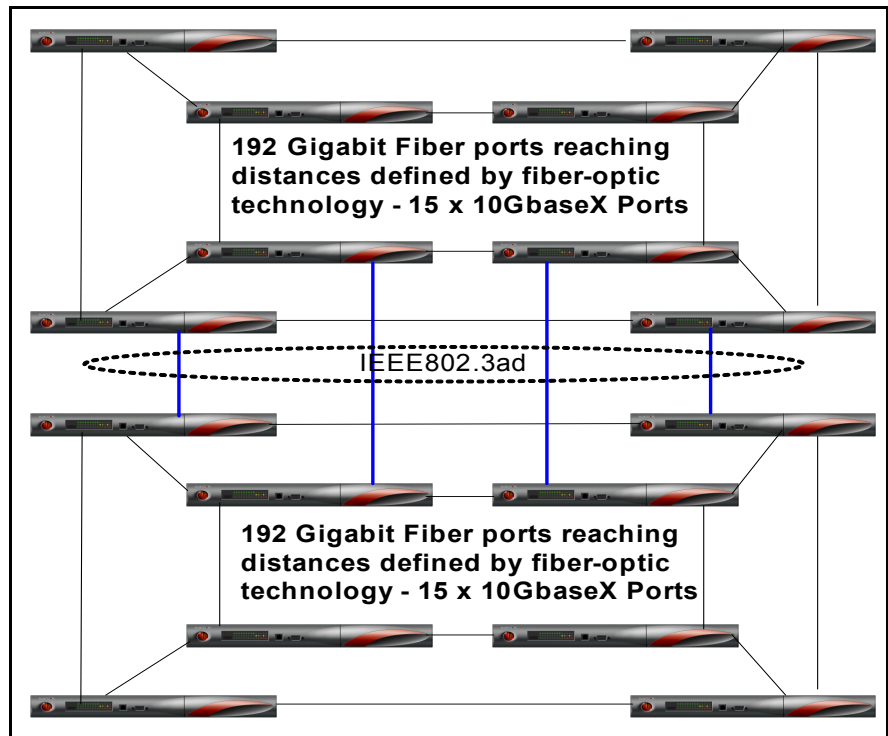
*Most enterprises already have experience with Ethernet and would be willing to accept its use by service providers, especially if outsourcing is a possible option.*

*The use of Ethernet across the MAN and WAN also expands its market penetration, increasing its popularity even further.*

*Ethernet also provides a means to avoid re-engineering an existing customer premises network; this leads to quicker implementation, lower implementation and management costs, all of which results in happier customers. A more simple management and billing structure for the provider, makes everyone happier.*

The provider can operate just as a simple ISP, and allow access to the Internet, or extend services to include VoIP, Video Conferencing/Delivery, and Storage backup/replication over the network. Clients/Users may wish to use their own firewalls or may rely on the provider to offer a complete solution.

EDU-Metro Network providers can interconnect these networks together with low-cost Ether-Raptor 10-Gigabit Ethernet links, creating larger Metro networks connected by 20–40 Gigabit aggregated links.



**FIGURE 2. Raptor “Eight-Pack” Gigabit Fiber Ports**

When EDU-Metro networks are connected this way, Internet connectivity redundancy is enhanced to allow multiple access points to the Internet and customer reach over distance from city to city, county to county, or even state to state limited only by fiber-optic technology.

## Cost Benefits

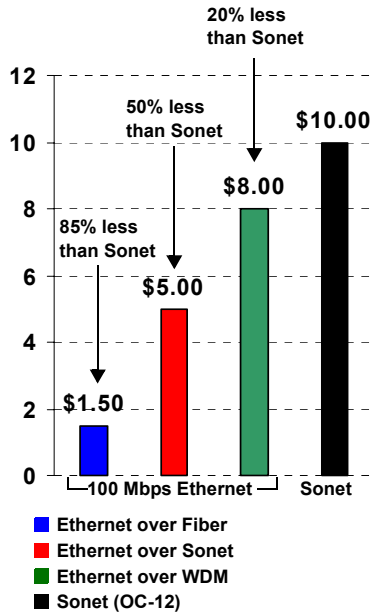
So how would a school district use this unique and affordable network?

A number (1–15) of existing buildings can be interconnected via RAST links, and from these building all schools and other buildings are connected by a Gigabit fiber link (which can be redundantly connected to the EDU-Metro network), providing high-bandwidth links into each facility. The school district could then use applications that enable all modern teaching methods and reduce costs by centralizing application, storage management functions, while also providing for VoIP support for the district, and therefore reducing costs for interdistrict phone services.

Distance learning and Video/IP support for IPTV services into each classroom, becomes a major learning aid. Surveillance video for special campuses is also possible with central video collection and storage is an extra benefit, as is physical security monitoring systems with central security control.

Network security is also a requirement in school districts, and Ether-Raptor supports high levels of security with IEEE802.1X, (Radius), SSL, SSH, and a unique form of super security that creates a highly secure network system. No special equipment is required in each district building, as the Gigabit fiber connection can be directly connected to any Layer 2 or Layer 2/3/4 switch on-site.

Finally, any unused ports could be offered to local commercial users, to defray costs and even make incremental funds for the school district by using VLANS to partition part of this metro network, and along with the other security facilities, create local metro connections that could offer districts free, or very low cost, connectivity. Other spare ports could be configured for city use, creating other savings for cash-strapped local government agencies.



*Notional cost of transporting 100 Mbps of traffic over various fiber technologies assuming \$10 per megabit for Sonet as a theoretical base to illustrate cost comparisons between transport technologies*

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