



AboveNet™

## AboveNet White Paper

### Advantages of Ethernet vs. Sonet, A Compelling Choice

#### About AboveNet

AboveNet, Inc. provides high bandwidth connectivity solutions for business and carriers. Its private optical network delivers key network and IP services in and among top U.S. metro markets and globally.

AboveNet's network is widely used in demanding markets such as financial services, media, health care, retail and government.

#### Approximately 2.3 million fiber miles

Private, purpose-built networking providing end-to-end connectivity in and among top US markets and globally

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### Why Is Gigabit Ethernet (Gig E) The Choice Of Enterprises?

Ethernet technology is the most deployed technology for high-performance Local Area Network (LAN) environments. Enterprises around the world have invested network connectivity, equipment, processes, and training in Ethernet, with other protocol contenders seeing decreased IT mind-share. And while Gig E is popular as a LAN solution, the significant change is its role in the Metropolitan Area Network (MAN) market, which has historically used SONET (Synchronous Optical Networking) / SDH (Synchronous Digital Hierarchy).

### Why wouldn't the MAN market simply stay with SONET?

While SONET was previously considered superior to Ethernet in both general robustness, and in timing and synchronization - that has changed.

SONET scalability is far from simple; if an enterprise needed to double or triple the performance of a SONET ring, the challenge involved will be much more complex than for an Ethernet network of comparable initial performance. And SONET is expensive compared to Ethernet. Initial costs and operating expenses will vary by vendors and situations, but many IT organizations have found Ethernet to be roughly one-fourth the cost of SONET for a given set of services.

SONET was made to deliver widely varying data types, making it a respectable comparison to today's Ethernet, which handle oceans of IP traffic. With voice, SONET's future appears to be in some doubt. As voice-over-IP telephony products continue to evolve, and quality of service (QoS), performance and feature limitations are improved, the Ethernet/IP combination looks better, particularly at lower price points. We are seeing the emergence of companies which focus on Ethernet-over-fiber MAN/WAN (Wide Area Network) services exclusively, offering high-end performance at significantly lower costs than SONET alternatives.

### Language of the LAN

It is reasonable to call Ethernet the language of the LAN as it is typically how computers, printers, servers and other network devices communicate with each other. Previously enterprises had to convert their LAN communications from Ethernet to other protocols, such as SONET/SDH. This conversion process was inefficient in that it added latency and increased the risk for data loss. In addition, the conversion was often more costly, with Ethernet interfaces being much less expensive than comparable SONET/SDH interfaces.

If Gig E is already largely unchallenged as the LAN standard, and is driving and supporting MAN technology, what's in its future?

### The Future of Ethernet in the Data Center

A number of Standards groups working to further enhance Ethernet's effectiveness as a unified data center switching fabric, for example, the Higher Speed Study Group under IEEE 802.3 is developing the next generation of higher speed Ethernet at 40 Gbps (Gigabits) and 100 Gbps.

An Ethernet-based metro transport vehicle has emerged to take the place of SONET/SDH that has been dominant for more than a decade. The fact that many enterprises use Ethernet is driving this transition, along with the increasing use of IP/MPLS at the network core. Replacement of SONET/SDH in the metro area creates an end-to-end packet optical network that reduces complexity and cost while providing network resiliency and performance.

#### Why Ethernet?

Ethernet is attractive because it is a simpler technology than SONET/SDH, ATM and IP/MPLS and as the most common LAN technology Ethernet is widely used and understood. The significant amount of available Ethernet hardware makes it very cost effective compared to IP/MPLS, which has relatively low production volumes.



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#### Transport of Choice

Ethernet transport uses 1 GE (Gigabit Ethernet) and 10 GE interfaces instead of SONET/SDH interfaces and is designed to retain SONET/SDH's strengths while addressing its weaknesses.

- Bandwidth efficiency is improved through Ethernet's use of statistical multiplexing.
- Supports higher speed services than SONET-based DS-1 and Frame Relay services.
- Ethernet supports VoIP which is more cost effective and bandwidth efficient than voice circuit switching technology.
- Existing metro Ethernets employ simpler and cost-effective switched VLAN solutions
- Can reduce the cost of the metro network solution.

Ethernet transport uses a centralized management system (Control Plane) that takes the place of distributed management systems such as IP/MPLS. This permits use of the same low cost Ethernet switches used in the VLAN solution while providing network control that has functionality very like IP/MPLS. With centralized control network, operators can immediately invoke prepared contingency plans for network recovery rather than rely on individual network elements to make multiple attempts in search of a viable configuration.

#### High Bandwidth Low-Latency Data Center Switching Fabric

##### Low Latency Switching

The transition to 10 GbE is under way in the Data Center, with the ubiquity and reliability of Ethernet making it a desirable solution for delivering a high performance data center network, storage and computing fabric. The mass-market availability of 10 GbE adapters and switches enables Ethernet based networks to deliver high bandwidth, high throughput and low latency solutions for the rigorous demands of Data Center applications, as it does for Enterprises.

#### Traditional Advantages of Ethernet

- **Lower Cost Interconnect:**  
The Ethernet ecosystem is large, with many significant players, such as Cisco Systems, Intel, Broadcom, Juniper, Ciena, Alcatel-Lucent, Marvell, Tellabs, Hewlett-Packard, and Ericsson. Very high production volumes and a highly competitive market environment ensure that Ethernet will continue to offer the lowest cost switches and host adapters.
- **Ubiquitous Connectivity:**  
Virtually every computer system shipped today comes with Ethernet built in. An increasingly popular option for servers is to incorporate the LAN on the motherboard, with higher performance servers beginning to support on-board 10 GbE intelligent Network Interface Cards (NICs). And, Ethernet can and does run over SONET, MPLS, VPLS, copper and over wireless.

#### Security

Ethernet connectivity is highly secure in network configurations of two pairs of dedicated fiber, with associated equipment delivering Ethernet in the metro.

- Proven Interoperability:
  - » Ethernet networks have relied on interoperability between the products of multiple vendors of NICs, hubs, switches and routers. Interoperability across an array of vendors has continued to be a major strength of Ethernet through generations of increasing speeds, including 10 Gbps today and 40 Gbps/100 Gbps likely in coming years.
- Ease of Management:
  - » Ethernet-based interconnect can be readily assimilated into existing Ethernet network environments without additional management tools or training for special purpose switch fabric and protocols.

#### Benefits

- **Scalability for Business Growth**  
Enterprises can purchase the amount of capacity for their current requirements, and use extensive metro footprints to extend local network as their network grows. Metro Ethernet services enable them to meet intercity and IP requirements using a single provider across several different lit transport options.
- **Diversity and Disaster Recovery**  
Enterprises can protect their data and communications with Remote Storage – with many applications Ethernet-compatible, allowing data to be transported between facilities in the MAN and WAN. In addition, the distribution of applications to back-up servers for email and many other applications can be connected to the users via Ethernet MAN.
- **Simplicity and Cost-effectiveness**  
Network can be simplified by treating all connected LANs, MANs and WANs as a single network. Further simplification can reduce capital costs when highly efficient Ethernet ports and services replace legacy WAN interfaces and circuits.
- **High Performance and Availability**  
Enterprises can connect to fully redundant metro and intercity Ethernet for reliable transport of very large application data sets, such as huge CAD files, digital images or video streams, while supporting multiple high bandwidth applications across the network, such as teleconferencing, network storage backup and retrieval, and media-rich content.

#### Return On Investment

Enterprises can capture measurable ROI from Ethernet's ability to dramatically increase bandwidth without equipment upgrades, with minimum provisioning requirements, and typically less expensive router and switch optics.