

The Secret to Ethernet Success: Older Technologies Must Play Nicely with New Ones

Ethernet Wide Area Network (WAN) access has become the connection service of choice for businesses. Why? Ethernet's history inside Local Area Networks (LANs), economics, speed, and its ability to converge applications over a single network single it out as the best connection method. While Ethernet seems to be enjoying a healthy run, Ethernet WAN access could stumble if it fails to exceed the capabilities of legacy technologies or if it fails to put buyers in charge of the pace and method of deployment.

For example, look at the history of VCRs and DVD players. While you might expect the adage, "out with the old, in with the new" to apply, statistics show otherwise. Industry estimates put almost 100 million VCRs still in use, even as DVD and TiVO constantly threaten VCR obsolescence. Newer, better technologies rarely find overnight acceptance. Older technologies — especially functioning, familiar ones — tend to live longer than expected.

In this light, broad marketplace penetration for Ethernet access services requires accommodation of legacy technologies. In addition to offering buyers new options and better results, new technologies must easily integrate with existing ones.

Ethernet over Anything

Many enterprises are now sold on the benefits of Ethernet access for their WANs. Yet they also know they are well-served by investments in heterogeneous legacy infrastructure and services with proven reliability, quality and flexibility. From the enterprise point of view, it is the service provider's task to leverage existing network resources while opening a path to high-quality, lower-cost Ethernet services. Doing so keeps the enterprise in charge of the evolution of services and avoids forklift replacement decisions for both enterprises and service providers.

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Legacy investments in access infrastructure are impossible to overlook. A typical regional or national service provider has a wide range of infrastructure in place, including SONET copper, direct fiber or wavelength and Internet Protocol/Multi-Protocol Label Switching (IP/MPLS). As of December 2004, approximately 42% of Ethernet services were delivered over SONET, with significant percentages also being delivered over MPLS, Wavelength Division Multiplexing (WDM), copper loop and other means.

In short: Service providers are challenged to offer "Ethernet over anything" to maximize their market reach. Further, they must also guarantee consistent Ethernet service availability, quality and management over disparate access and metro networks.

The Bar is High

Enterprises may give up some "nice to haves" to take advantage of new services, but there are two requirements they will not sacrifice, regardless of savings:

(1) The ability of all of their office locations to communicate seamlessly with one another, and

(2) the guaranteed Quality of Service (QoS) they enjoy from legacy Asynchronous Transfer Mode (ATM), Frame Relay and Time Division Multiplex (TDM) infrastructure. Enterprises will not forfeit mission-critical service quality for the sake of price. For example, despite its high costs, many enterprises and service providers have employed ATM transport based on three highly valued virtues of ATM:

- carrying any type of data, voice or video media;
- delivering end-to-end, circuit-like connections for each data transmission; and

■ guaranteeing delivery of mission-critical applications with highly specific quality metrics on a per-session level. As a bonus, ATM can run over copper as well as fiber-access infrastructure, making it the underlying transport and QoS mechanism for both high-end enterprise and residential DSL services alike.

These same virtues mark the bar that Ethernet WAN service must reach. On several counts, it already does so. Ethernet matches ATM's ability to converge media. With help from a now mature traffic engineering technology known as Multi-Protocol Label Switching (MPLS), Ethernet also can deliver end-to-end connections not previously possible in 'connectionless' IP or Ethernet environments.

However, Ethernet WAN technologies have lacked the ability to serve copper-connected business locations and the ability to offer per-session, deterministic QoS mechanisms. Additionally, Ethernet equipment has failed to offer management visibility across multiple underlying transport mechanisms ... until now.

Multi-service edge router technologies now enable service providers to overcome the flexibility, QoS, manageability and ubiquity challenges by offering Ethernet services that:

- Protect legacy services and revenues by providing interworking between new Ethernet and IP services and disparate legacy transport media;
- Match legacy service quality and reliability and security with assured Ethernet QoS across those access protocols, and
- Travel over copper as well as fiber access connections.

"Over Anything" Interworking

Enterprises with mixed protocol access need to have all offices communicate seamlessly with one another. Since few enterprises will agree to replace all of their Frame Relay, TDM or ATM access services overnight, Ethernet service providers must offer both pure Ethernet WAN access and services over legacy access protocols.

Multi-service edge routers enable service interworking by incorporating access-side interfaces to legacy protocols. Furthermore, multi-service interworking eliminates multiple overlay backbone networks, collapsing multiple network elements into a single edge router that aggregates all traffic onto a single MPLS backbone.

As a result, service interworking empowers enterprise customers to retain their legacy access as long as they wish, while flexibly migrating to Ethernet access over time.

The multi-service access approach enables not only Ethernet over any transport, but also maximum private networking flexibility. Layer 3 Virtual Private Network (VPN) services offered via standard Ethernet services are highly flexible. However, the partitioning of one VPN from another is, as the name denotes, virtual only, raising security and shared capacity concerns. The multi-service edge router solves this dilemma by offering Layer 3 VPN and Layer 2 Virtual Private LAN Service (VPLS) for customers that demand private network separation at the transport layer.

By solving multi-protocol access interworking, the multi-service edge router can offer the best of both worlds: Layer 2 switching and QoS capabilities with the flexibility and intelligence of Layer 3 routing. This combination makes Ethernet WAN services more secure, reliable and flexible from the enterprise point of view.

Deterministic QoS

To match or exceed existing quality and reliability, Ethernet access service must support both any-to-any connectivity and deterministic QoS. ATM technology set the bar for service guarantees with its per-session QoS mechanisms. Not only does ATM address bandwidth reservation, it guarantees delivery of each session with regard to latency, jitter and availability promises.

Premium enterprise customers are accustomed to choosing various ATM QoS tiers according to the application they wish to transport. These tiers include:

- **Constant Bit Rate (CBR) for high-end applications such as real-time video;**
- **Variable Bit Rate (VBR) for bursty but critical applications such as financial transactions, voice or videoconferencing;**
- **Available Bit Rate (ABR) for bursty but less critical applications; and**
- **Unspecified Bit Rate (UBR) for applications such as file transfers that can tolerate delays.**

These deterministic QoS mechanisms are analogous to passengers on a commuter train. They guarantee that each passenger will arrive whole (without jitter or missing packets) and at the specific time promised. This result is far more deterministic than IP/MPLS guarantees, which employ only IP/Ethernet class of service (CoS) mechanisms, such as IP Precedence or DiffServ packet tagging. In essence: CoS mechanisms do no more than assure that one train car will arrive sooner than another, whether late or on time.

Ask any business to choose between guaranteed on-time, quality arrival and priority position on a potentially "late train." Most will choose the route that offers the

equivalent of CBR, VBR, ABR and UBR guaranteed service levels on a per-application, per-session basis.

The service provider also gains a distinct advantage from multi-service edge architecture. By passing all traffic through the same edge device, the provider gains a position in the network that unifies visibility and controls to manage all Ethernet services, regardless of how they enter the router.

Service Ubiquity

Finally, at the physical access network layer, optical connections remain the exception to the rule in enterprise access. Millions of commercial locations are served by mere 1.5-Megabit T-1 connections and the majority of those locales will not have access to fiber any time soon. T-1 access remains dominated by Frame Relay or integrated Frame Relay and TDM traffic.

The Ethernet access trend cannot afford to overlook this largely copper-connected market segment (approximately 80% of business) if it is to have widespread impact. Whether targeting small and medium-sized businesses or large enterprises with remote locations, fiber-only Ethernet service proposals simply will not suffice.

Circuit bonding is emerging as a viable solution to the Ethernet-over-copper requirement. Now near standardization by the International Telecommunications Union (ITU), circuit bonding enables the joining of multiple twisted pairs to deliver multi-megabit services. This innovation means that remote or smaller branch offices now can enjoy Ethernet services without the capacity and distance limits associated with DSL.

Multi-service access equipment that offers interfaces to both copper and optical access media enhances customer options. Such equipment empowers larger enterprises to migrate one copper-connected branch office at a time while offering smaller customers a full range of access choices.

The success of Ethernet WAN services lies at the service provider edge, which must offer more than super high-capacity Ethernet access. The Ethernet-in-every-access-line dream, like the DVD in-every-living-room dream, will become reality only to the degree that its purveyors place the customer in charge of embracing the best of both the new and the old.

About the Author

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Previously, O'Malley held a variety of positions in marketing, product management, and product planning across Tellabs data, access and transport products. Prior to his current position, O'Malley held domestic and international marketing positions across Tellabs IP/MPLS, VOIP, SONET, DWDM, digital cross-connect and cable telephony products. O'Malley has more than 12 years of telecommunications industry experience and holds a Master of Business Administration degree, a master's degree in electrical engineering and a bachelor's degree in electrical engineering from the University of Illinois.

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