Deploying Carrier-Grade Business Services over Cable Networks
Technology Overview & Deployment Considerations

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With proven success in the residential triple play market establishing MSOs as an emerging leader in telecom services, cable operators are preparing to offer business services as their next avenue of growth. It's a great fit – with telephony, data and video expertise, a scalable support infrastructure, and fiber-rich networks passing within reach of 80% of all US businesses, cable operators are well positioned to capture the under served small and medium business (SMB) communications market.

Independent research by Comcast and Time Warner cable estimate that there are 2.8 million SMBs in the US, accounting for $15 BUSD in telecom spending in 2007. Much of this market – about 75% - is voice revenue, provided for the most part by inflexible ILECs and CLECs who put their focus on larger enterprises at the expense of SMB service and support. With the door wide open, cable operators have a golden opportunity to develop the business services market the same way they introduced VoIP to the home.

Delivering SMB Services

SMBs are widespread adopters of IP-based communications, solutions that help them compete with their larger counterparts while making the most of limited telecom budgets. An effective portfolio of SMB business services includes multi-line phone service, Internet access, remote storage and backup, video and web conferencing, as well as reliable transparent LAN and virtual private networking services. This is a challenging line-up to deliver considering the mix of best-effort, real-time, and business critical applications and services, compounded by the varying bandwidth demands in SMBs that range from 5 to 50 employees, and can grow from one to the other almost overnight.

MSOs are addressing these challenges by leveraging the flexibility of Ethernet. All major US MSOs, including Comcast, Time Warner Cable, Charter, Cox and Cablevision are members of the Metro Ethernet Forum (MEF), an organization developing the standards that enable carrier-grade Ethernet services. It makes sense - Carrier Ethernet business access takes the notion of triple-play to the next level, providing a proven framework to deliver dozens of IP-based and emulated TDM services over a single managed connection. In every respect, Ethernet is a promising solution for business services – in reality, there are a few important considerations that ensure services are cost efficient to deploy and manage, and meet the performance demands expected by enterprise customers.
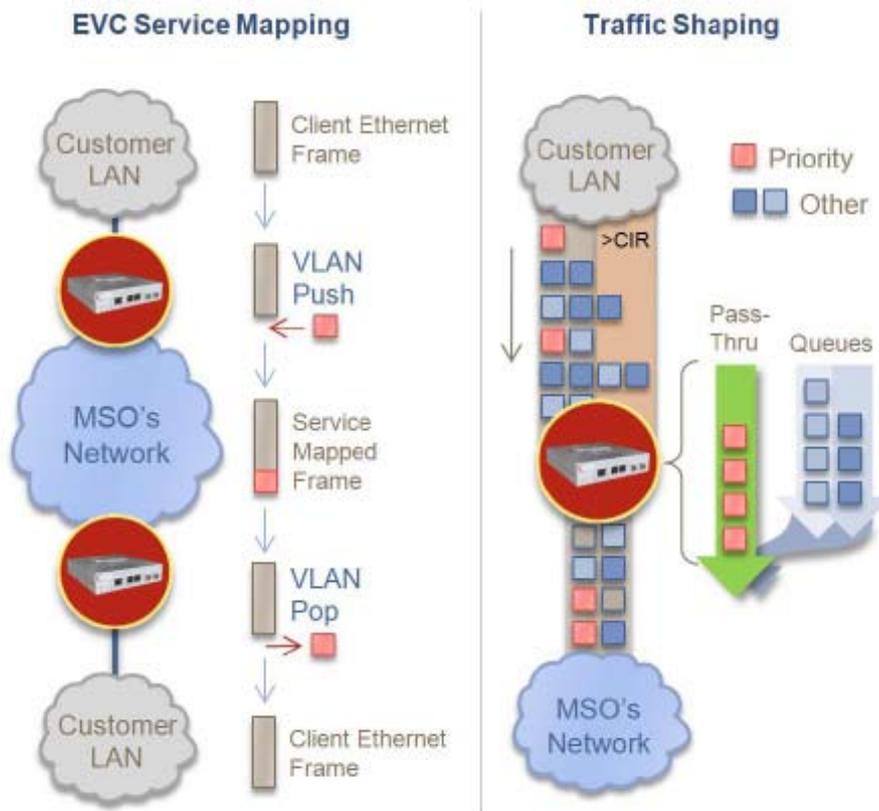
Creating Ethernet Services

In its simplest form, Ethernet is just a connection. The power of Carrier Ethernet is this connection's ability to carry multiple services at the same time, at different rates and priorities to multiple destinations. This carrier-grade, multi-service capability is provided by Ethernet Virtual Circuits (EVCs), established between service endpoints as a means to efficiently separate and transport traffic over shared access and core networks.

EVCs, which can be point-to-point or multi-point, are created by a technique known as Service Mapping – the tagging of application-specific customer traffic as it enters the provider's network with a specific VLAN ID, class of service (priority) and bandwidth profile that defines committed and excess throughput and burst performance for the EVC.

The end-points of the EVC are where the provider's service effectively hands-off from their network to the customer's network, also known as the service demarcation (demarc) point. A mix of traffic processing capabilities at the demarc point can help maintain EVC performance. The most common include:

- **Bandwidth policing** – also known as rate limiting, policing protects the MSO's network from excess traffic by regulating throughput per-flow (EVC) before it enters the network.

- **Traffic filtering** – selectively blocks traffic based on granular packet filtering criteria to protect management VLANs and prevent unwanted and malicious traffic from flooding the network.

- **Traffic shaping** – passes critical, real-time traffic through the demarc while buffering and priority-queuing lower-priority packets during bursty periods; reduces bandwidth demands and accelerates services by reducing network overhead.

Ethernet service mapping and traffic shaping

Managing Ethernet Services

Although cost-efficient from a capital perspective, Ethernet services can quickly become expensive to deploy and maintain without effective end-to-end management practices. A number of established Ethernet Operations, Administration and Maintenance (OAM) standards have been defined that enable cost-efficient service provisioning, remote troubleshooting and fault isolation for the service, connectivity and access-link layers, including IEEE 802.1ag, 802.3ah, and ITU-T Y.1731. End-to-end OAM can be established using compliant access platforms or by deploying OAM-enabling Ethernet Network Interface Devices (EtherNIDs) at the service demarc points.
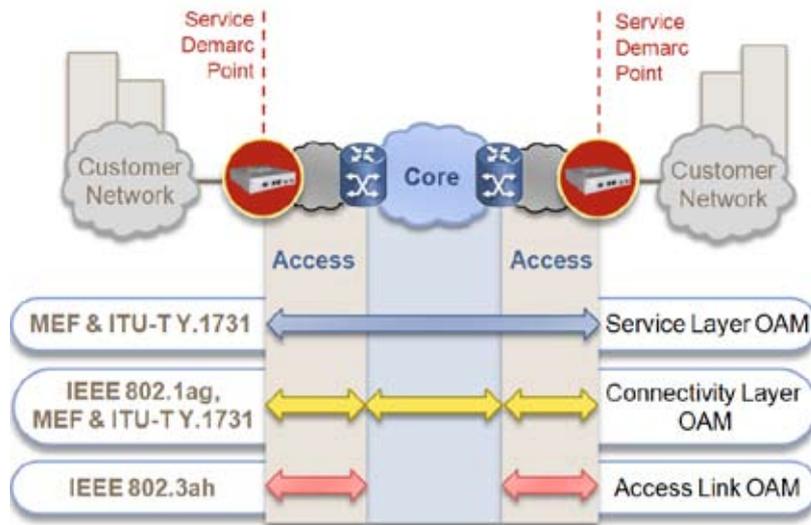
Ethernet OAM standards

Packet Performance Assurance

Defining Ethernet Services with specific performance requirements allows Cable MSOs to offer various service levels (e.g. standard, premium and critical) backed by revenue driving Service Level Agreements (SLAs). However, simply because a service was deployed to meet certain criteria doesn't guarantee its performance.

Changing traffic conditions, new services, network congestion and mis-configured network elements are some of the many reasons why a service may perform sub-par. Just as SLAs allow providers to charge service premiums, SLA violations often mean financial penalties to the service provider.

Assuring the performance of Ethernet services requires:

- The ability to monitor performance in-service without disturbing customer traffic or waiting for maintenance windows to test, since worst-case traffic conditions occur at peak hours;

- An end-to-end view of the service, from demarc-to-demarc;

- The ability to precisely measure common SLA performance KPIs: throughput, one-way delay and jitter, availability and packet-loss.

The most cost-effective solutions combine a centralized monitoring system with intelligent demarcation devices that can analyze 100% of the customer traffic flowing through them at the edge, generate and analyze test streams, and collect usage statistics without affecting customer traffic.

Put together, these capabilities create a type of "SLA-meter", allowing MSOs to backup their services with assured SLAs, and report this to their customers.
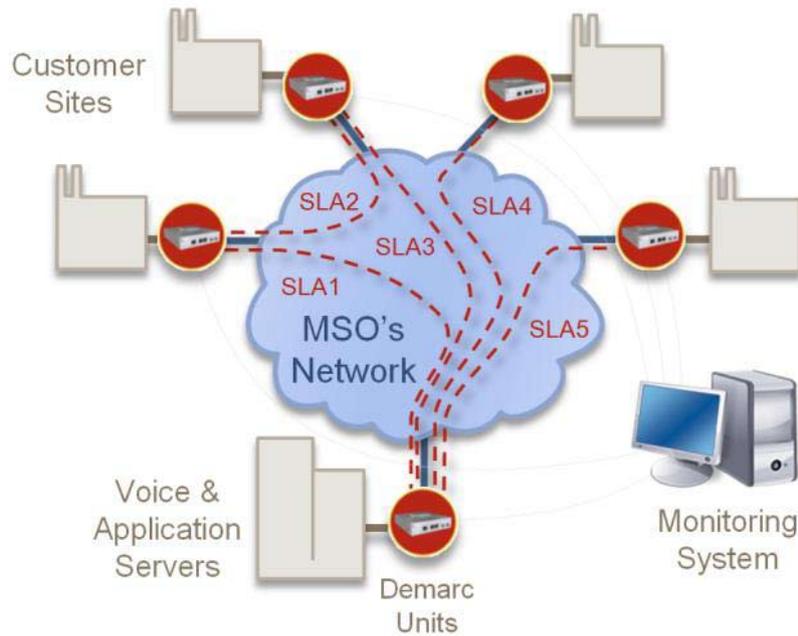
End-to-End Packet Performance Assurance