New Carrier Ethernet Services

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Abstract

In today’s communications market, incumbent service providers are looking for ways to grow revenues. Carrier Ethernet can be deployed and priced to complement existing Frame Relay, ATM and private line services, with the intent of migrating medium and large customers from legacy data services so that average revenue per data subscriber increases. With over 189,000 DS3 and above connections in the United States served by fiber, incumbent service providers can entice these subscribers to move to 100 BaseT or Gigabit Ethernet at higher overall prices, but lower price per bit basis.

Carrier Ethernet services can be deployed using next-generation SONET platforms and carrier-grade Layer 2/3 Ethernet over MPLS switches. This offers an evolutionary approach to building a network that keeps capital expenditures in check while simultaneously growing revenues.

Evolving Ethernet Services

As with ATM and Frame Relay, Carrier Ethernet services have generated strong interest from enterprises as a high-performing and cost-effective data transport service. With bandwidth from 1 Mbps to 1 Gbps, these services have been deployed by competitive service providers and some incumbent providers. They are viewed as a means to deliver not only bandwidth, but a pipe where several other services can flow: LAN to LAN (TLS) services based on QoS, storage management, internet access and virtual private networks (VPNs).

New Carrier Ethernet services deployed in the last five years offered a price advantage as well as the opportunity for enterprises to obtain bandwidth with finer granularity. New Ethernet competitive providers offered service at lower prices to capture customers from the local RBOC; sometimes at less than comparable RBOC DS3 pricing for a 100 Mbps service. In response, incumbent providers delivered their own Carrier Ethernet such as a Gigabit Ethernet MAN in select cities.

In building these networks, incumbent service providers deployed Ethernet switches using Packet over SONET interfaces or ran Ethernet directly over dark fiber. Now that RBOCs have experience in deploying and pricing these services, they are in a position to expand deployment to a point where prices would be complementary with existing data services.

Customers are looking for high bandwidth services that fill the TDM bandwidth gaps. Even with attractive Carrier Ethernet pricing from competitive carriers, enterprise customers have not broadly accepted these services. Attractive pricing, although a benefit, is only one reason for an enterprise to adopt a new service. High availability, footprint and reliability are equally important. Due to their brand recognition, footprint and record deliverability of reliable services, incumbent providers are in a position to charge more than competitive carriers for similar Carrier Ethernet services.

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For the incumbent provider, a strategic approach would be to devise their Carrier Ethernet pricing based on quality of service and bandwidth. They can define a Platinum level service complementary to existing Private Line business prices and a Gold and Economy Levels complementary to existing Frame Relay and ATM pricing models. Table 1 illustrates the range of point-to-point Carrier Ethernet pricing based on this approach for a metro service (prices based on RBOC tariff information).

Bandwidth	Economy Level	Gold Level	Platinum Level	Example **List Price**/Month
50 Mbps	5 Mbps	25 Mbps	50 Mbps	$1000 to $5000
100 Mbps	10 Mbps	50 Mbps	100 Mbps	$2000 to $7000
400 Mbps		200 Mbps	400 Mbps	$8000 to low teens
1 Gbps		500 Mbps	1 Gbps	$8,000 to $20,000

Table1: Example Carrier Ethernet Services Pricing Model

This table illustrates that a 100 Mbps service can be offered in three forms: a Platinum level private line at full 100 Mbps line rate at the higher end of the price range starting at $4000 per month, a Gold level service with a committed rate of 50 Mbps (50% CIR) starting at $3000 per month per end, and an Economy level service with a committed rate of 10 Mbps priced at the lowest end of the scale starting at $2000 per end. For both Gold and Economy levels, the customer can burst to 100 Mbps.

In contrast, an existing data service like DS3 can be priced from $2600 to over $4000 per end, and an OC-3 from $5000 per end. Prices are based on location and distance from a serving central office. Additional charges may apply for fiber laterals.

Business Opportunity

The incumbent service provider faces challenges caused by today's economy and increasing competition from other service providers. As incumbent providers seek to increase revenues per subscriber, a viable alternative would be to look at their existing medium to large enterprise customer base. According to a recent RHK report, there are expected to be 189,000 total fiber ports deployed in 2003 for DS3 and above. This existing installed base could be the targeted preliminary customers for the following reasons:

- These customers can be enticed to migrate to 100 BaseT or metered Gigabit Ethernet services.
- Fiber laterals are installed which minimize capital expense per customer, and build cash flow to fund installations to new customers without fiber connections.
- These customers value high reliability and the resiliency of SONET/SDH infrastructure.

The service provider's objective would be to increase the average revenue per customer and keep customers from moving to other operators. Carrier Ethernet can be offered at an overall lower price per bit than DS3 or OC-n with the intent of migrating data customers to these new services.

If a DS3 private line costs $2600 per end, a Platinum 100 BaseT service would start at $4000 (see Table 1). When the customer switches to 100 BaseT, the carrier would see revenues for that subscriber increase by 54%. Recent discussions with an RBOC reveal that they intend to price 100 BaseT in this manner to encourage users to switch from DS3.

But, would this be enough to build an on going business?

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For Carrier Ethernet to flourish, it needs to reach new customers. The lower-price per bit would likely interest new subscribers, engaging the carrier to deploy new fiber laterals as they do today for new DS3 customers. Fiber laterals can vary from $32,000 per mile to over $320,000 depending on location.

As a consequence, the success of Carrier Ethernet would increase capital expenditures as new customers sign up. Depending on the type of customer and location, some of the capital cost can be offset by charging the subscriber. This is common practice today with DS3 installations. Alternatively, the carrier can sign the customer to a longer-term contract of a minimum of 3 years. This would provide a predictable revenue stream for the life of the contract from which the carrier can decide to fully absorb the cost. Some competitive carriers have adopted this practice.

New Carrier Ethernet services can achieve an acceptable ROI by passing some lateral costs to customers, engaging in longer term contracts, and penetrating more existing data services.

A follow-up article is planned that will discuss this business case more in depth for a Carrier Ethernet network spanning five cities.

Creating a Cost-Effective Infrastructure

Since Carrier Ethernet services were built by the incumbent service provider to gain experience these early deployments have their limitations:

- Lack of scalability
- Limited QoS functionality
- Adopted from Enterprise applications
- Limited footprint

Addressing these issues requires new network solutions that allow for carrying TDM traffic, because incumbent carriers derive significant revenues from TDM services. Solutions that transport existing voice and data services and Carrier Ethernet across city, metro, regional and long-haul networks would improve the carrier's ROI model. The appropriate network solutions should have the ability to deliver both TDM and Ethernet services across the same platforms. Many incumbents have chosen next-generation SONET multi-service provisioning platform (MSPP) for city and metro deployments. They are attracted to MSPPs for the following reasons:

- Capacity to provide point-to-point Ethernet services in the 1 Mbps, n x 10 and n x 100 Mbps up to 1 Gbps using Generalized Framing Protocol (GFP) or X.86 standards.
- Capability to offer QoS in form of committed information rate and peak information rate for all Ethernet services.
- Capacity to transport private line Ethernet, VLAN switched Ethernet (Gold and Economy levels) over a concatenated STS-1 SONET trunk across the access, city and metro rings.
- System vendors have launched new and attractively priced products in the past 2 years that can transport and cross-connect T1, DS3, and OC-n.

Diagram 1 illustrates a typical MSPP network. In addition to the MSPP, new Service Provisioning Management Systems are becoming available that simplify provisioning of TDM and Ethernet circuits across an MSPP network, saving valuable time and expense.

MSPP rings can be deployed in stages in network locations where TDM traffic and demand for Ethernet services would be strong. Incumbent carriers can save capital and operational expenses by installing Ethernet line cards and provisioning circuits with new Ethernet service provisioning systems

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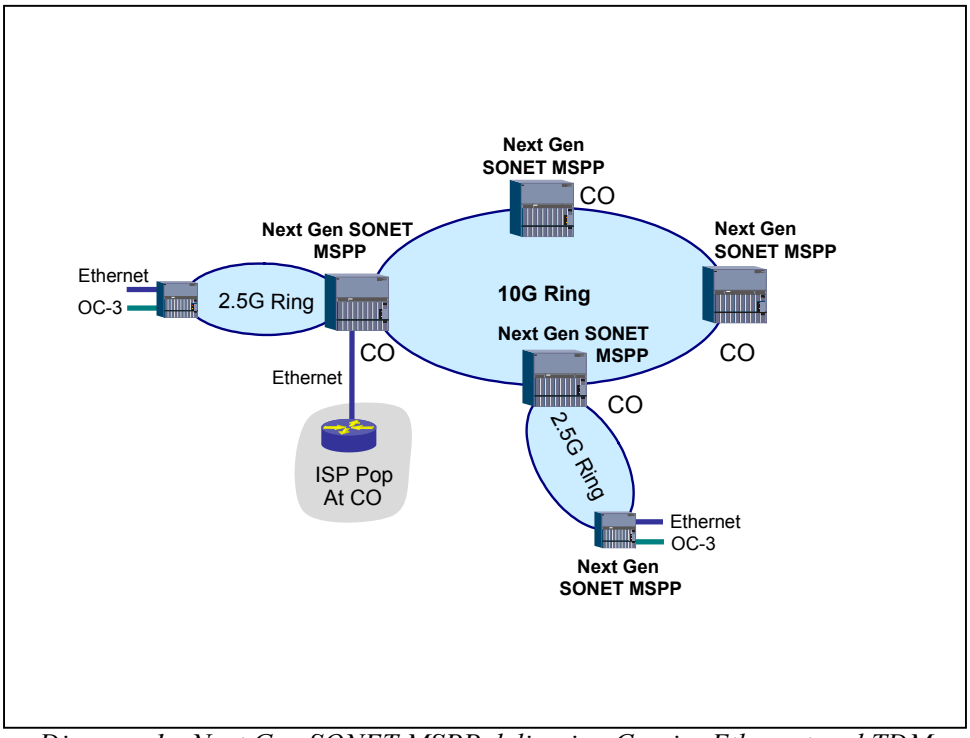

Diagram 1: Next Gen SONET MSPP delivering Carrier Ethernet and TDM services can be deployed to replace existing SONET ADMs or in parallel to expand services within a given area.

In situations where deploying MSPPs would be not be economical, service providers can enhance their existing SONET ADM network by deploying Ethernet over Sonet switches. These solutions would drop 10/100 BaseT connections to an enterprise and connect over an OC-n link to the SONET ADM ring. These networks could also form the core network for Ethernet services in advance of MSPP deployments.

It is necessary to expand the network beyond the city / metro ring and into the regional and long haul. Therefore, an infrastructure with high availability is required to carry Ethernet's Gold and Economy traffic efficiently. Platinum traffic as it is a private line would ride directly on the SONET/SDH layer. The existing transport networks of ATM switches and IP routers where MPLS can be enabled to switch Ethernet traffic would not be efficient to transport the kind of Ethernet traffic envisioned. ATM switches support bandwidth based on the TDM hierarchy with their inherent gaps and lack of granularity. IP routers, although able to transport Ethernet and support VLAN switching, are optimized for delivering Internet access and other services such as IP VPNs.

What is needed is a network of newer, carrier-class Layer 2/3 Ethernet switches that transport Ethernet over SONET using MPLS (Layer 2/3 EoM switches). Optimized for Carrier Ethernet, the overall capital and operational costs for these switches are less than ATM equipment or existing IP/MPLS core routers.

New Layer 2/3 EoM switches would have a minimum support for 80 Gbps running at 10 Gbps line rates, and can scale beyond 320 Gbps at 40 Gbps line rates for future capacity. Diagram 2 illustrates such a network.

EoM switches are designed to aggregate traffic from MSPP rings, apply QoS policies per subscriber and switch the traffic to an appropriate label switch path across the metro core, regional or long haul network. They offer these important functions:

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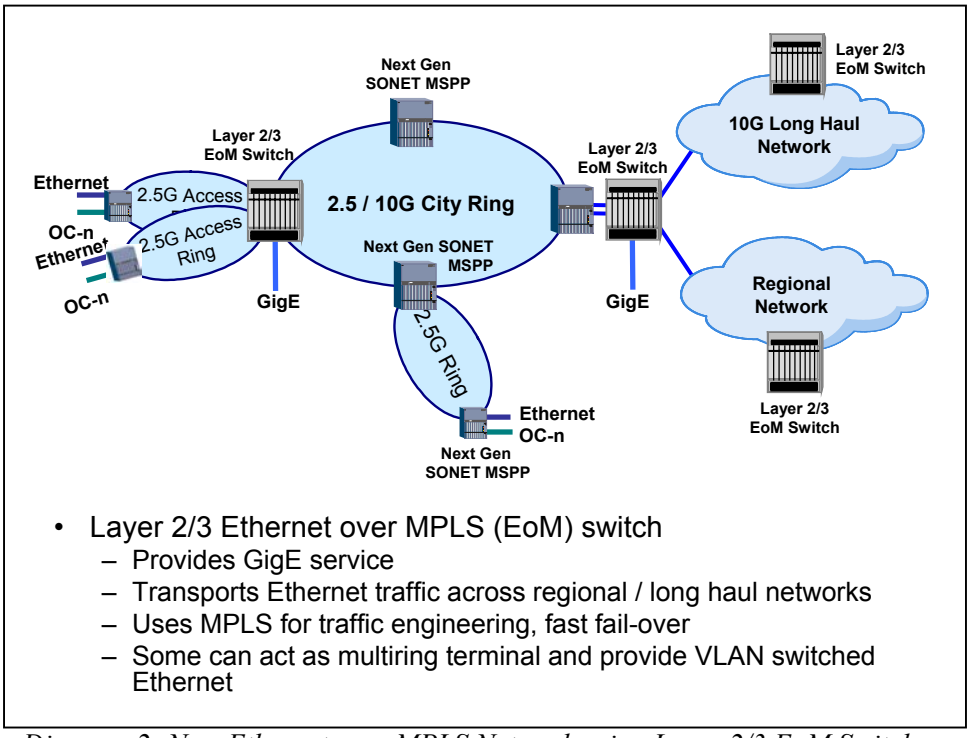

Diagram 2: New Ethernet over MPLS Network using Layer 2/3 EoM Switches.

- Ability to oversubscribe portions of the network reduces overall cost per subscriber.
- Uses MPLS for traffic engineering to simplify creation of logical circuits across the network with fast fail over within 50 ms.
- Enables management of services during periods of high loads.
- Deploys Gigabit Ethernet services within the central office and customer premise for customers who need ultra high bandwidth services.

These switches in each ingress port (typically GigE or OC-n) can classify traffic (private line with concatenated STS or VT1.5s and VLAN tagged with specific CIR or PIR) down to the subscriber level and provide QoS policies. Traffic is policed, switched and shaped as it goes through the switch and out the egress port at speeds up to 10 Gbps or 40 Gbps SONET/SDH onto the appropriate label switch path to the intended destination. Label switch paths offer rapid failover and restoration providing the needed high reliability between two end points.

Some Layer 2/3 Ethernet switches provide additional functionality such as multi-ring support, connecting multiple access or Interoffice rings (UPSR or 2 fiber BLSR as needed), segmenting the Ethernet traffic from the TDM traffic, even providing cross connect functionality to shape Ethernet and groom TDM traffic for handoff to a DWDM system or other SONET/SDH rings.

In certain situations where the incumbent carrier may not wish to deploy MPLS in the beginning, these EoM switches can offer stacked-tagged VLANs and fast spanning tree protocol to transport effectively VLAN switched traffic from MSPP rings across the regional or long-haul network.

Additionally, new features such as Virtual Private LAN Service (VPLS) are being developed to offer multipoint-to-multipoint VPN Ethernet services that ride on top of MPLS. VPLS allows multiple sites to be connected in a bridged mode to the same LAN.

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Deployment expense for these Layer 2/3 EoM switches would be cost-effective for the following reasons:

- Lower capital cost than existing data equipment optimized to carry Ethernet traffic effectively
- Less switches necessary; primarily in points that connect metro MSPP rings with regional or long-haul networks.
- An ability to over-subscribe Gold and Economy Ethernet traffic minimizes the amount of equipment required.

Incumbent Carrier Plans

In recent discussions with an incumbent provider, the RBOC revealed that Carrier Ethernet services will be announced in 2003. These services would be deployed over several network solutions, depending on the geographic location and customer need. The configuration planned is as follows:

- Use of Layer 2/3 switches running Ethernet over SONET over an existing SONET network.
- Use of MSPPs primarily for TDM services, then Ethernet in the future.
- Gigabit Ethernet running directly over fiber and, in the near future, over DWDM for protection for customers who need ultra-high bandwidth.

Several RBOCs and some incumbent inter-exchange providers (IXCs) have selected their MSPP vendors to replace existing SONET ADMs. These MSPPs are expected to ultimately deliver both TDM and Ethernet services. One RBOC has selected a Layer 2/3 Ethernet switch vendor to form the foundation of their Ethernet services network to complement existing SONET ADM rings.

In the core, the carrier plans to deploy MPLS to switch VLAN-tagged Ethernet traffic (as opposed to Private Line Ethernet traffic which stays in the SONET/SDH layer) in addition to existing data services traffic. There is an interest in new Layer 2/3 EoM switches. These switches will potentially deliver some Gold and Economy level Gigabit Ethernet services (n x 100 Mbps), in addition to transporting VLAN-tagged MSPP Ethernet traffic across the regional or long haul network.

Conclusion

Incumbent carriers can deploy Ethernet services to generate new data revenues and profit from growing enterprise data traffic. New Ethernet services can complement existing Frame Relay, ATM and Private Line and encourage customers to switch to these services. Since the price per bit would be lower, enterprise customers would see an economic benefit. The switch from DS3 or OC-n to Carrier Ethernet would increase the carrier's average revenues for that user.

Carrier Ethernet deployments can use new Layer 2/3 EoM switches to deliver GigE services in the central office and switch Ethernet traffic across the regional and long haul networks. In city and metro areas, next-generation SONET MSPPs provide Platinum, Gold and Economy Ethernet services. These new solutions are optimized for Carrier Ethernet, provide attractive deployment cost per subscriber. Incumbent carriers have solidified plans to use MSPPs for yet to be announced new Carrier Ethernet services.

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International Orange Strategies:

International Orange Strategies (IOS) helps clients develop the marketing and business initiatives to grow their revenues. IOS designs and executes programs to generate leads, enter new markets and develop new customers and partners. Services include strategic marketing, sales tools development, product marketing, sales and channel development, international marketing and new venture fund raising.

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