

## Tech briefing: Carrier Ethernet: Making the grade

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**Carriers and enterprises have been moving towards Ethernet network services for some time. Now that trend is accelerating.**

Ask carriers why they are betting on Ethernet for their enterprise and subscriber services and two main drivers emerge: cost savings and scalability. Add the benefits of a standard platform, and analysts' predictions of stellar growth look attainable. But for this to happen additions need to be added continually to Ethernet to make it carrier grade.

Infonetics forecasts that the metro Ethernet equipment market will nearly double between 2006 and 2010 to reach US\$18.8 billion. Asia Pacific accounted for 37% of all metro Ethernet equipment revenue in 2007, North America for 30%, EMEA 28% and CALA 5%.

"IP routers and carrier Ethernet switches made up over half of the total metro Ethernet equipment market sold in 2007," says Michael Howard, principal analyst at Infonetics Research.

Driving metro Ethernet growth, says Infonetics, are rocketing broadband subscriber numbers forcing network upgrades, and rapid uptake in video and IPTV services that require more bandwidth and more stringent QoS.

"Service providers are facing massive cost pressures and are looking to reduce capital and operational costs," says Eylon Sorek, strategy and portfolio manager, carrier switches and IP transport, at Nokia Siemens Networks. "We see Ethernet as a technology that will be used by operators due to its scalability and cost savings."

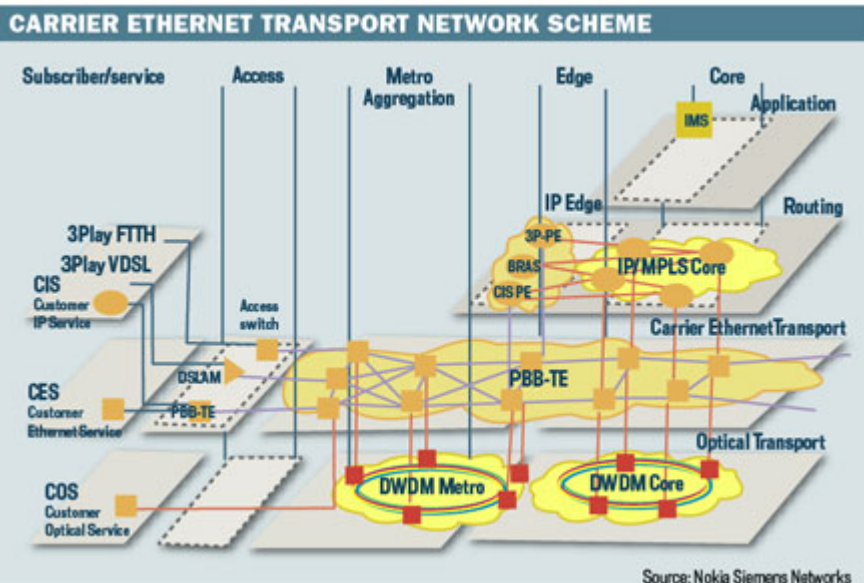
That is a common view. "Cost [benefits of Ethernet] is a no brainer," says Jason Weil, design engineer at US cable operator, Cox Communications, which is standardising on Ethernet. "[Ethernet] will also allow us to use standard platforms across all our networks."

Infonetics attributes the interest in carrier Ethernet as part of the larger trend of carriers moving to packet-based transport and to address rising bandwidth demands. "The cost of basic transport has to get cheaper," says Howard.

Carriers are settling on three data service layer technologies: IP, MPLS and Ethernet, while at the transport layer they are using SONET/SDH, Ethernet and WDM. "The end goal [for carriers] is to take SONET/SDH out [of the network]," says Howard.

"SONET/SDH will still be around for the next 15 to 20 years but carriers have told us that they are decreasing investment [in SONET/SDH] each year while increasing spending on WDM, Ethernet, and IP and MPLS."

Ciena, for example, is one vendor that has added ports to its platforms that can be



reprogrammed from a time division multiplexed interface to one supporting Ethernet. "This allows carriers to continue to build [SONET/SDH] today and migrate to Ethernet without having to buy new line cards," says John-Paul Hemingway, chief technologist for Ciena EMEA.

To meet operator requirements, several features are needed to achieve carrier-grade Ethernet. Carrier Ethernet must be scalable and match reliability requirements operators have long associated with SONET/SDH, such as 50-millisecond network restoration. Other carrier-enabling additions to Ethernet include connection-based schemes such as transport-MPLS (T-MPLS) and traffic-engineered provider backbone bridging (PBB-TE), and the creation of network-to-network interfaces for service hand-off between carriers (Total Telecom, October 2007, p.32).

Hierarchical quality of service (QoS) is a further attribute of carrier Ethernet and is used for Ethernet enterprise services and residential triple-play service delivery. For triple-play, an Ethernet switch commonly aggregates traffic from up to 500 homes. Hierarchical QoS is used to control the port's bandwidth, the bandwidth delivered to each residential user, and even to control each user's triple-play services.

But Jan Hof, director of field marketing for EMEA-SAM at equipment vendor Extreme Networks, says it is important that carrier Ethernet does not develop in completely different ways to native Ethernet. "[Carrier Ethernet] has benefited hugely from the economies of scale that have come from enterprise Ethernet." Too many additions could ultimately result in two independent camps, LAN and carrier, where currently the strength of Ethernet is the huge industry movement behind it.

For Yipes, the US managed Ethernet service provider that uses Extreme Networks' platforms, there are two important aspects of Ethernet scalability: raw bandwidth and the ability to provision services to multiple sites. Yipes' customers want the bandwidth increments and flexibility associated with Ethernet as they upgrade from T1 and E1 links: Ethernet enables them to scale to 1 Gbps and even 10 Gbps with the minimum of disruption.

It is also easier to connect an enterprise's multiple sites using Ethernet. "Provisioning five sites with full mesh frame relay using ATM requires 10 permanent circuits and it becomes much more complex as more sites are added," says Keao Caindec, Yipes' chief marketing officer. "With Ethernet it is simply five different connections and it is easier to configure and to scale."

Orange Business Services also highlights Ethernet's ease of scaling. "A good example is Air France which wanted to add 50 megabits per second to 100 Mbps to one of its links, and we managed to do it in 24 hours," says Dennis Kruse, vice president of network solutions, Orange Business Services.

He believes Ethernet scaling is more a business model challenge than a technical one. "Each time a customer wants more bandwidth they shouldn't have to sign a new contract," says Kruse. Like mobile Internet services, customers should be able to burst to higher speeds, says Kruse, and if they exceed their allocation they should have an incentive to subscribe to the next higher-speed increment.

Where bandwidth scaling is technically challenging is when two or more operators' networks are involved. Kruse hopes that emerging Metro Ethernet Forum (MEF) External Network-to-Network Interface (E-NNI) standards could be used to define service levels and especially class of service attributes and rules. The E-NNI standards are being developed to enable end-to-end services with guaranteed performance across multiple operator networks.

"The opportunity of telcos and cable operators to sell Ethernet Services to each other and IP service providers and integrators is quite large," says Kruse. But such wholesale business could grow dramatically if telcos were to provide a clear baseline level. "Then service providers or even enterprise customers could add value by defining and configuring customer premises switches and routers."

Yipes is upbeat regarding the MEF E-NNI work. The operator has partnership deals with a dozen operators that enable it to provide services globally. Yipes has developed custom interfaces with each of its partners

given that the MEF E-NNI standards work is still ongoing. “[The availability of] E-NNI standards will certainly help here,” says Caindec.

Colt Telecom views E-NNI as an enabler for the uptake of Ethernet services as well as being an important aspect of network resilience. “Resilience is a critical factor both in terms of reliable equipment and enabling diverse routes,” says Henry Bohannon, Colt’s product manager, Ethernet services. “The issue is not so much how to achieve this, as the services and products. The key is to enable NNIs so that all are talking the same language end-to-end.”

Another element of work close to completion that enhances Ethernet’s operations, administration and maintenance (OAM) support are the IEEE 802.1ag and ITU-T Y.1731 standards that provide Ethernet with service assurance by monitoring the health of a connection and noting any degradation or failure.

Another issue to promote the uptake of carrier Ethernet is its deployment at the network edge. “It is an area of worry,” says Ciena’s Hemingway. “How do we guarantee the service right out to the edge, getting the access piece right?” This includes extending carrier Ethernet attributes to more cost sensitive Ethernet platforms and ensuring support for the various network technologies such as SONET/SDH, ATM and Ethernet, and various communications media such as wireless, copper and fibre.

Ciena has added pseudo-wire services—that emulate native services—to its CN5060 multiservice Ethernet platform to aid operators when migrating from SONET/SDH, ATM and frame relay services to carrier Ethernet.

Start-up equipment vendor Ceterus Networks focuses on carrier Ethernet platforms for the network edge. It is also seeing growing demand from small to medium-sized enterprises. “Ethernet is moving down-market in terms of speed here,” becoming more attractive for lower speed connectivity and replacing T1s, says Mark McDonald, vice president of product management at Ceterus Networks.

“Operators are more and more comfortable providing services [at the edge],” says McDonald. That’s because there is money to be made for customers wanting more bandwidth but are reluctant to lease several DS1 lines. “Leasing a DS1 link—at 3 Mbps—costs \$600 a month while a local exchange carrier can get \$800 to \$1,000 a month for a 10-Mbps link,” says McDonald. So with 10-Mbps Ethernet the customer gets three times the bandwidth for just two times the cost.

The biggest part of Ceterus’s business is serving demand for higher capacity links for wireless backhaul. “There is a big demand for [mobile] cell-site backhaul,” says McDonald.

For BT, the connection-oriented PBB-TE for point-to-point connections such as for wireless backhaul, is of particular interest. “PBB-TE is likely to be cheaper [than native Ethernet],” Matt Beal, CTO of BT Wholesale, told Total Telecom (October 2007, p.32). “There is extra cost in the [PBB-TE] hardware and software, but the total cost of ownership is less by avoiding the over-engineering otherwise required.”

Ethos Networks is one start-up that believes it can significantly enhance network usage when using connection-oriented schemes such as PBB-TE. Its platforms are still being tested in several operators’ labs and are six months from market launch, but Ethos claims that as well as improving network usage, operators can offer new services, not previously possible, through the use of as many classes of service as required.

“We have absolute control of the traffic at the edge on a per-flow basis,” says Yuval Davidor, CEO of Ethos. The company adds a combination of techniques to its platforms such that through a global view of the network, local devices are optimised in terms of the traffic burstiness they experience. Ethos’ platforms uses traffic-shaping and admission control on a session basis, and instead of several queues for the traffic, each platform uses thousands.

Ethos’ technology is still to be proven, but for Davidor it shows how connection-oriented schemes such as PBB-TE can address key next-generation requirements such as multi-point connectivity and near total

network utilisation.

“The whole carrier Ethernet is still a very young market,” says Davidor. But it is widely seen as an attractive option.

“Carrier Ethernet is the most compelling technology around,” says Danny Lauber, solutions manager for carrier Ethernet in emerging markets at Cisco Systems. “It allows carriers and countries to leapfrog to the latest technology with nice savings in operational expenses and [in newer markets] time in setting up the infrastructure.”