

## Carrier Ethernet to LTE's rescue

by Thomas Mock, Senior Vice President, Corporate Marketing and Communications, Ciena

Mobile network operators are transferring their wireless infrastructure to the Long Term Evolution (*LTE*) standard to obtain the low latency and high bandwidth needed to deliver rich content to smart mobile devices. The number of global subscribers should reach 6.5 billion by 2014, so wireless operators will face an enormous challenge dealing with backhaul on their networks. Carrier Ethernet-based backhaul from cell sites can help them in the design of their LTE network and reduce total cost of ownership (*TCO*).



*Thomas Mock is the Senior Vice President of Corporate Marketing and Communications for Ciena Corporation; he oversees a variety of functions, including experiential marketing, Web and community marketing, public and industry analyst relations and internal communications. Prior to assuming this position, Mr Mock served as the Company's Senior Vice President, Strategic Planning; Vice President of Portfolio Management; and Senior Director of Product Management. He also served as Product Marketing Director for Ciena's short haul and access product lines after joining the company as the International Product Marketing Manager. Prior to Ciena, Mr Mock managed the product development organization for a T1 multiplexer company.*

*Thomas Mock received his B.S.E.E. from the Georgia Institute of Technology.*

As the popularity of smartphones and other intelligent mobile devices increases, mobile network operators (*MNOs*) recognize that revenue growth hinges upon their ability to deliver a wider range of mobile broadband applications and services, which require higher bandwidth and lower latency, to deliver the expected service quality. For example, to achieve the consistent video download required for smooth playback, a video stream viewed on a tablet computer might require HD-quality bandwidth with rapid access to large content files. Delivering such applications and services will, of course, quickly overwhelm the capacity of current 3G wireless networks - and the backhaul networks associated with them.

This ubiquitous trend drives *MNOs* worldwide to adopt new wireless

technologies, including WiMAX and LTE. These next-generation technologies address the limitations of mobile radio access, enabling the high throughput and low latency necessary to carry the new bandwidth-hungry services. For instance, the LTE 3GPP (Release 8) specification provides downlink peak rates of at least 100Mb/s, with future LTE releases offering rates up to 1 Gb/s. If needed, this specification also provides support for seamless interworking with older network technology such as GSM, cdmaOne, UMTS, and CDMA2000.1.

*MNOs* can certainly benefit from the higher spectral efficiency of 4G to support more users and higher usage rates. Although the cost per base station should be similar to 3G, LTE's higher spectral efficiency will allow operators to realize significant cost

savings (according to Booz & Co., up to 75 per cent on a per-bit basis). The lower cost is critical to offering wireless service plans at reasonable rates. Early deployments of LTE also suggest that it leads to much higher usage rates per month, with the amount of bandwidth consumed by intelligent mobile devices quickly catching up with the levels of consumption characteristic of wired broadband connections.

Deploying next-generation mobile access technologies, operators are facing significant pressure on the critical wireless backhaul portion of the network, which ensures that the traffic flows between cell towers and the terrestrial core network. Legacy networks cannot cost-effectively meet the demand for data backhaul as they have been built with lower bandwidth voice services in mind.

To take advantage of LTE, operators need hundreds of Mb/s per cell site for backhaul, compared to multiples of T1s ( $n$  times 1.5 Mb/s) or E1s ( $n \times 2$  Mb/s) for earlier generations. This paradigm shift in backhaul calls for networking options that scale cost-effectively - the only way to minimize total cost of ownership when migrating to LTE base stations.

#### How Carrier Ethernet fits in

The number of base stations (called evolved NodeB, or eNB) deployed can grow tremendously as LTE services are rolled out. When scaling an LTE network, connectivity can be optimized and associated costs reduced in line with the simplicity and reliability of the backhaul network. Deploying a packet backhaul network, mobile network operators and backhaul suppliers usually consider two technology options: IP/MPLS (Layer 3) and Carrier Ethernet (Layer 2).

A main problem with IP-routed Layer 3 (L3) IP/MPLS network solutions is that they force backhaul providers to extend complex forwarding paradigms (data plane) and complex dynamic routing and signalling protocols (control plane) all the way from the metro and aggregation network into the access domain. Moreover, with leased IP backhaul services, the IP-based backhaul provider often must coordinate IP information with the mobile network operator.

The added complexity of IP/MPLS solutions can dramatically increase both CAPEX and OPEX. This is most evident with regard to operating, troubleshooting and maintaining the network. Each protocol-specific forwarding plane has its own associated suite of OAM (*operations, administration and maintenance*) functionality. This introduces additional complexity when coordinating and managing OAM services across complex protocol stacks, often with partial OAM support (such as with IP), leading to higher operating costs. The complexity can also lead to higher hardware costs, as the processing power at the backhaul routers must support computation and storage of statistical data related to the performance and fault management planes.

A simpler option that offers far lower total cost of ownership is a Layer 2 (L2) Carrier Ethernet network for cell site backhaul. L2-VPNs can efficiently provide point-to-point, point-to-multipoint or multipoint connectivity. Layer 2 switching

offers stability and simplicity, and fewer protocol layers mean simpler provisioning, management and restoration. An Ethernet network, enhanced with carrier-class attributes, not only provides the right connectivity, but also enables backhaul providers to offer a rich suite of OAM functionality to provision, measure and troubleshoot their networks. By leaving the IP functionality to the mobile endpoints that actually need it (such as the eNB and the Evolved Packet Core), and avoiding it in the backhaul portion of the network, carriers can manage backhaul costs much more efficiently, using simpler forwarding rules that are based on subscriber policies to facilitate or constrain connectivity as required.

The OAM functionality is particularly interesting to look at, as Carrier Ethernet has a rich set of measurements and tests that a network manager can tap into for crucial information. For instance, using the standardised Ethernet OAM toolkit you can measure the latency and throughput in real time, and so see how the network is really doing against the SLAs. This, of course, means that you can address issues on your network as soon as they arise.

Scalability of the technology is also key - a national LTE network will have thousands, if not tens of thousands, of cell sites, so it is critical that the backhaul rollout keep up with the pace of the network's growth. Essential to achieving this kind of scale is automation, which allows for zero-touch provisioning - where installing a device and setting it up does not require days and an army of highly skilled specialists, because once connected to the network, the node is able to seamlessly configure itself. When you are scaling at a pace of hundreds of cell sites per week (as many of the large operators do), this feature is critical to the successful rollout of your LTE network.

When adopting a packet backhaul model, Ethernet acts as more than just an interface between the wireless network elements and the transport network elements. Ethernet's popularity as the transport layer for IP packets in LANs is well documented. Additional Carrier Ethernet functionality makes it perfectly suited for transport across a WAN. Interfaces compliant with the Metro Ethernet Forum (*MEF*) standards can provide the interoperable demarcation for mobile network operators to use the packet backhaul network. At the same time, MEF-compliant services enable virtualized bandwidth resources to

support point-to-point, multipoint and point-to-multipoint connectivity with traffic engineering functions, which guarantees network resource allocation that enhances performance.

Carrier Ethernet's cost advantages are quantifiable. Customers using it for mobile backhaul show savings of as much as 30 per cent in both CAPEX and OPEX, compared with the costs of using a Layer 3 solution. A Carrier Ethernet-based mobile backhaul network, whether fibre, microwave radio or millimetre radio-based, also permits strong levels of control and robust functionality, making it a truly cost-efficient LTE backhaul solution. With the help of Carrier Ethernet, operators can scale their networks quickly and achieve the lowest cost per bit as they increase bandwidth to meet growing user demand. It also enables network operators to match the connectivity provisioned across the network with the data traffic seeking to use that capacity, and helps backhaul providers avoid costly over-provisioning of the network, even as MNOs demand multiple classes of service across it.

The advent of LTE is an excellent opportunity for both mobile network operators and backhaul providers. Residential users have demonstrated tremendous demand for mobile bandwidth, while enterprises worldwide seek to leverage wireless connectivity to access new business applications flexibly. Thanks to the fourth generation technologies, MNOs can deliver SaaS, cloud computing, and other services over high-speed mobile broadband connections. Satisfying the growing demand for these services and the voracious consumption of bandwidth that they bring about, while holding the line on cost, requires a smart approach to solving backhaul bottleneck - Carrier Ethernet is the epitome of that smart approach. ●

