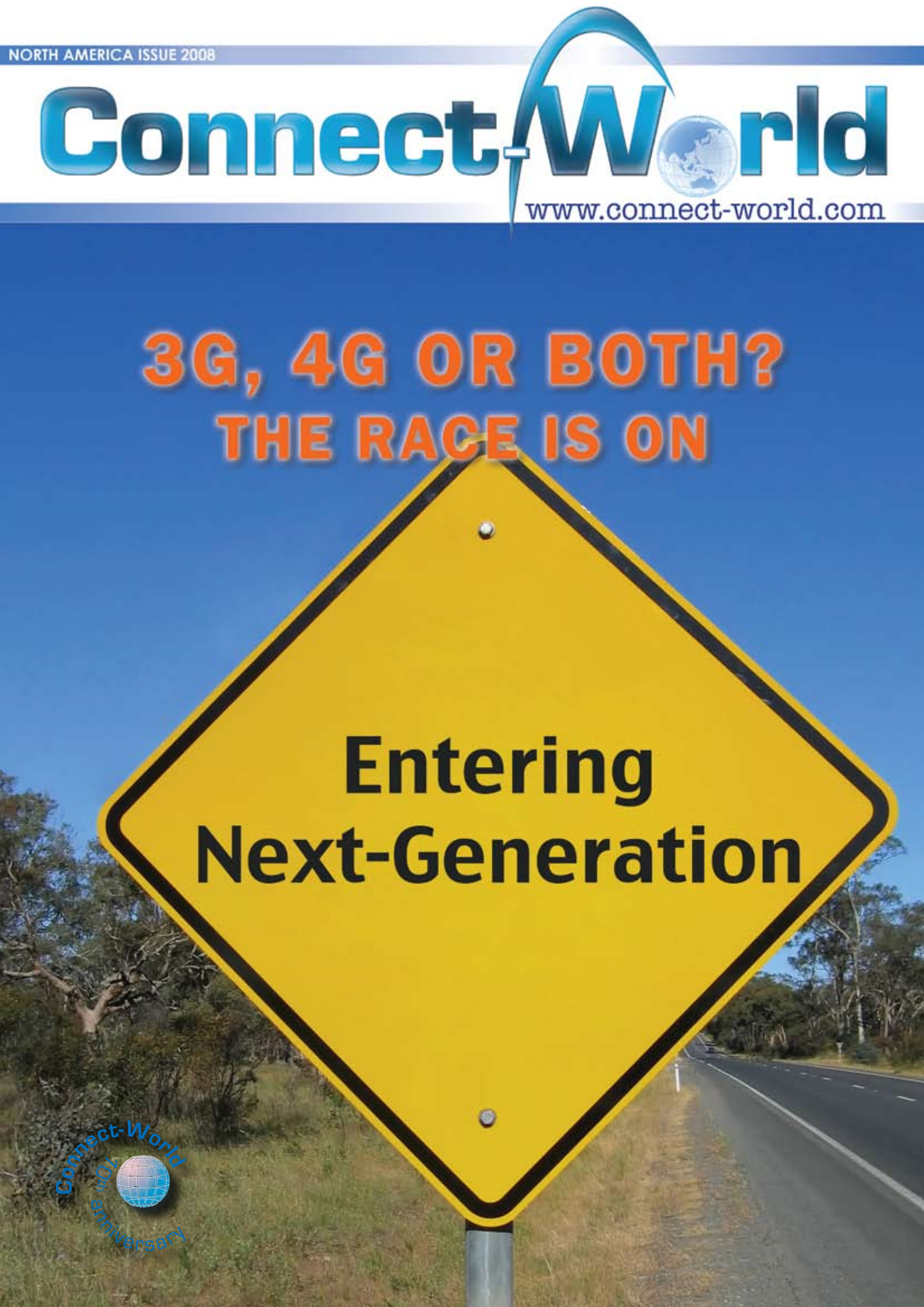
NORTH AMERICA ISSUE 2008

Connect-World

www.connect-world.com

3G, 4G OR BOTH?
THE RACE IS ON



The backhaul bandwidth secret weapon

by Michail Tsatsanis, Co-Founder & Chief Scientist, &
Nina Grooms Lee, Director of Marketing, Aktino

Next generation - 3G and 4G - mobile networks are bandwidth intensive. Today's mobile, radio-based, technologies can easily handle the broadband traffic, but the fixed networks that backhauls traffic from the radio base station at the heart of each cell will need greatly increased capacity to handle the traffic. High-speed fibre networks would be ideal, but are hard to justify economically. Advanced bonded copper-based solutions such as Multi-Input-Multi-Output (MIMO) on Discrete Multi-Tone (DMT) can economically handle the traffic using just eight copper pairs.

Michail Tsatsanis is the Co-Founder and Chief Scientist at Aktino. Prior to founding Aktino, Dr Tsatsanis served as the Chief Scientist and Chief Technical Officer at Voyan Technology. He has also served as an Associate Professor of Electrical Engineering at the Stevens Institute of Technology in New Jersey. Dr Tsatsanis is the author of more than 80 peer-reviewed papers, two book chapters and several patents. He has received a number of distinctions including the National Science Foundation CAREER Award and two IEEE Best Paper Awards. Dr Tsatsanis has served the IEEE in various capacities including as the Associate Editor for two IEEE Transactions and as the Chair of workshop organizing committees.

Dr.Tsatsanis holds a M.Sc. and a Ph.D. in Electrical Engineering from the University of Virginia.

Nina Grooms Lee is the Director of Marketing at Aktino. Before joining Aktino, she served as Director of Product Marketing at ClearMesh Networks and managed a business planning and product management group at Alcatel-Lucent.

The advent of 3G and 4G mobile networks is bringing far greater bandwidth to the radio network for mobile data applications, but is also shifting the network bottleneck to the backhaul segment. How service providers resolve this infrastructure challenge may well determine whether the 3G and 4G-based services they introduce to their customers are profitable.

The bandwidth allotted to these new generation mobile networks reflects the hunger among consumers for sophisticated, bandwidth-intensive applications. For instance, in 3G networks bandwidth ranges from 300 Kbps to 7.2 Mbps, depending on the service involved and the carrier's network. 4G, which was developed specifically to support streaming multimedia as well as voice and data, provides a high quality and secure end-to-end IP-based solution. It is projected to allot about five Mbps per user for mobile and utilize up to 100 Mbps downstream and 50 Mbps upstream stationary per base station.

The challenge for service providers who need to backhaul this traffic is that while bandwidth may be making a great leap forward, ARPU - average revenue per user - is not climbing at the same rate, nor will it in the foreseeable

future. As a result, providers must examine ways to make the backhaul portion of their network as efficient as possible, minimizing the capital and operating expenditures necessary to handle their ever-increasing traffic load.

While a brand-new, all-fibre Gigabit Ethernet backhaul infrastructure would be the ideal choice for the backhaul infrastructure, the high cost of building such a network rules it out as a realistic solution. While there may be a few situations where it would pay to deploy this type of network, for the hundreds of thousands of existing cell sites, providers need to concentrate on making the best of their existing fibre, copper, microwave, etc.

Successful backhaul infrastructures will be those that can map most effectively to the traffic requirements generated by 3G and 4G networks. Because the nature of current wireless data applications involves far more traffic moving downstream than upstream, an asymmetric network approach is the better solution.

The unbalanced traffic load has not been given a great deal of attention by service providers, but it is important to consider because it matches the nature and capabilities of both the copper and the cable access networks. For example, the copper DSL access network was designed to be highly asymmetric, supporting much greater downstream bandwidth.

Typical ADSL services offered today provide three to ten Mbps downstream, but less than one Mbps upstream. Higher-bandwidth IPTV services over DSL provide 25 Mbps downstream, yet less than two Mbps upstream.

When technology such as MIMO on DMT (multiple-in, multiple-out on discrete multi-tone) - a VDSL2-based bonded copper solution - is used to provide 80 Mbps downstream bandwidth at relatively short distances and up to 55 Mbps at Carrier Serving Area (CSA) distances, it provides ample bandwidth for 3G or 4G backhaul. This capacity can be achieved by using just eight copper pairs.

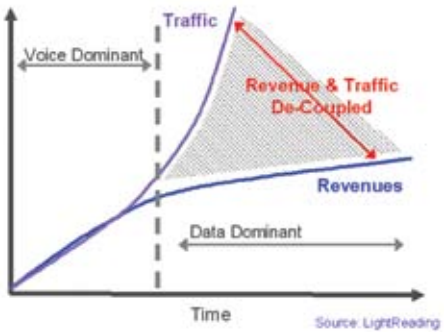


Figure 1: The Cell Site Traffic-Revenue Disconnect

Backhaul dilemma

Specific approaches to the 3G/4G backhaul challenge will vary based on the service provider and the location of the mobile network. One thing is clear, for most providers, the business case related to investments in backhaul equipment is becoming more and more challenging. As shown in Figure 1, there is a disconnect between mobile backhaul traffic and revenue growth. This underscores the importance of finding the most cost-effective price-per-Mbps to reduce the risk of profit erosion.

As analyst Joe Kestel of New Paradigm Resources Group (NPRG) observes, "Service providers are poised to deploy 4G wireless technologies that will unleash a slew of exciting mobile applications, including mobile streaming video and Internet access that performs as well as today's desktop access. To do so, providers need to beef up the backhaul capacity to cell sites and mobile switching centres, while avoiding the high cost of fibre deployment as much as possible.

NPRG has researched wireless backhaul extensively over the past year, and carriers currently need 20 or 30 Mbps to their towers to deliver content, and soon will be desperate for much more as consumers start signing up for these broadband wireless services in significant numbers".

Similarly, a member of the AT&T management team, speaking at the CTIA conference in 2007, expressed dismay at a situation in which "cell site backhaul bandwidth demand is increasing exponentially, while the revenue per bit is eroding, and the current T1 backhaul infrastructure doesn't scale".

Secret weapon

Of nearly 200,000 cell sites in North America, more than 90 per cent are linked to the core network by copper-based T1s. Because T1s provide a symmetric service, it points to how much bandwidth is going to waste because it doesn't map on to the asymmetric bandwidth environment of today's network, an environment that will only become more asymmetric in a 4G world.

Service providers are increasingly acknowledging these realities, and are now beginning to exploit the true nature of mobile backhaul traffic. Figure 2, reflecting data compiled by Ericsson, shows how data has overtaken voice traffic and continues to grow at a faster pace. When you consider that the data traffic profile is asymmetric by ratios as high as 3:1, the handwriting is on the wall for network infrastructure planners.

The seemingly obvious choice for a backhaul solution would be fibre, with its virtually limitless bandwidth, but providers struggle to make the business case for fibre to the cell site. This is because although fibre is the best choice in those instances where providers can spread its cost over a wide range of applications and users, cell sites are typically located in relatively remote locations, so the fibre runs are virtually dedicated to those sites.

Fortunately, those providers who are exploiting the asymmetric nature of their traffic can leverage existing copper pairs and advanced technologies such as MIMO on DMT. In most cases, copper is plentiful and available. Coupled with recent major advances in equipment that enhances its bandwidth potential, particularly from an asymmetric standpoint, it becomes a rich resource. The 55 Mbps downstream, ten Mbps upstream rates that MIMO on DMT-based asymmetric transmission makes possible reflects performance that is five times greater than is available with symmetric G.SDHSL technologies.

The 3G/4G challenge cannot be fully met without considering the backhaul requirements and the types of infrastructure investments needed to support backhauled traffic. Understanding the asymmetric nature of that traffic, and how to configure their backhaul infrastructure accordingly, will be the key - and in many cases a secret weapon - for the service providers that exploit this. As many service providers have already found and many more will soon find, leveraging technologies like MIMO on DMT asymmetric bandwidth minimizes costs and maximizes revenue in such a way that it paves the way to providing profitable backhaul while their competitors struggle to achieve this.

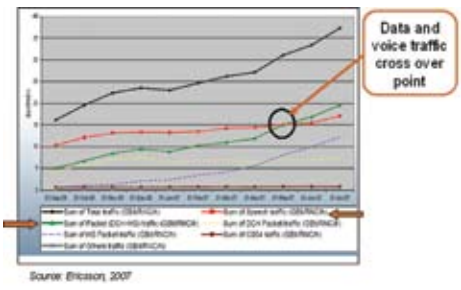


Figure 2: Trends in Cell Site Data and Voice Traffic