TECH ZONES:
Mobile & Wireless
Carrier Services
Broadband Access
Networks & Infrastructure
Backoffice & OSS

Broadband Access

To 4G or not to 4G: Supporting exponential mobile traffic growth

Examination of three challenges facing carriers

by Joe Schraml, BridgeWave Communications
Tues. August 25, 2009

How will carriers get there while keeping capital expenditure and operating costs at a minimum? This piece will examine the three challenges facing carriers with respect to backhaul and way to address them. How will we find sufficient spectrum for higher capacity services? And effectively scale networks for mobile backhaul? What about native yet simultaneous support for both 2G traffic alongside distinct IP-based 3 and 4G on the same network?

By addressing these issues, mobile operators and service providers will be well positioned to support 4G's exponential traffic — and revenue growth.

It is no secret that one single 3G smartphone such as a Blackberry or iPhone, growing in popularity by the day, can generate greater volumes of data traffic than 30 basic-feature cell phones.

With this being the case, mobile data traffic will double globally every year through 2013, reaching over 2 exabytes per month by 2013. While potential mobile growth is promising, bridging networks from 2G to 3G to 4G to deliver on

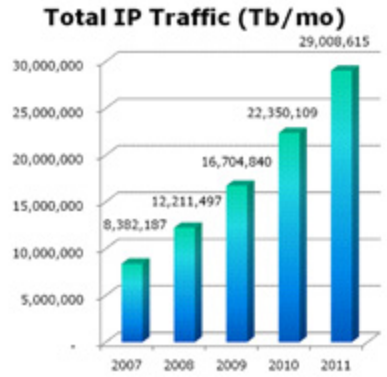
ARTICLE TOOLS:
E-MAIL THIS ARTICLE
PRINT THIS ARTICLE
RIGHTS & REPRINTS

this promise is essential to carriers.

Looking at the current state of backhaul, three specific challenges face carriers as they move towards 4G with reasonable capital expenditures and minimized operating costs. Such backhaul challenges include finding sufficient spectrum for high-capacity services, scaling networks to support future mobile backhaul, and IP/TDM support — all of which need to be solved in order for the future of mobile traffic to be sustainable.

The evolution of backhaul

A critical look at the evolution from 2G/3G mobile networks to 4G shows the many challenges for operators that go well beyond the adoption of new handset air-interface technologies. LTE and WiMAX capacity increases translate into aggregate base station capacities that grow from today's tens of megabits per second up to hundreds. In turn, this places demands on backhaul networks that drive a transition from copper and low-capacity microwave links to fiber and new gigabit wireless backhaul solutions. This growth in capacity is primarily driven by data services; therefore, operators also look to transition from circuit to packet based architectures to more efficiently adapt to the new data-centric world.



Source: Cisco Systems, Global IP Traffic Forecast and Methodology, 2006 – 2011 Values in Terabits per Month

Traditional 2G/3G wireless backhaul products have become highly standardized and commoditized over time; however, the 4G transition creates a discontinuity in backhaul requirements, due to exponential capacity growth and from a traffic mix transition from traditional voice to VoIP, and packet data, as well as multimedia video.

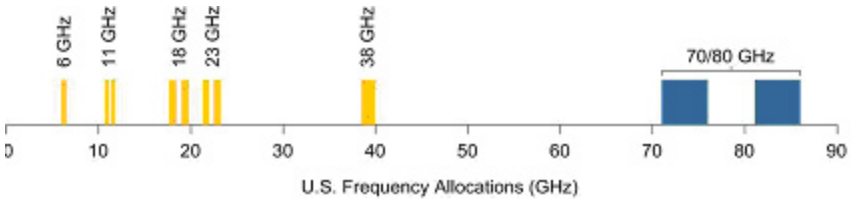
Though operators look forward towards a new IP data-driven future, most operators will still rely on legacy 2G/3G networks for years to come, meaning backhaul solutions that look forward to 4G must also support existing access technologies, namely native support for TDM circuit traffic, without imposing substantial cost or complexity on operators.

Sufficient spectrum: Removing the bottlenecks

Of all the challenges facing carriers, finding sufficient spectrum for higher capacity services tops the list as a most critical aspect that need attention. To date, lower-frequency (6-38 GHz) microwave radio solutions are limited to capacities of around 350 Mbps per RF channel due to limited spectrum allocations and narrow channel bandwidth limits. The only way to reach gigabit capacities using these links is to combine multiple RF channels and radio transceivers, multiplying link cost and making it increasingly difficult to obtain needed spectrum licenses, especially in dense urban settings.

So what type of capacity are we talking about? When taking future data growth projections into account that a 4G base station will need to support, networks must think about single radios with multi-gigabit data rates — to 2,600 Mbps (2.6 Gbps) and beyond to realistically account for anticipated capacity growth.

The costs of RF licenses vary across the world; however, 70/80 GHz spectrum is typically much less expensive to license than lower-frequency spectrum, ultimately providing 70/80 GHz links with a substantial total cost of ownership advantage — especially considering multiple lower-frequency licenses are needed to meet capacity requirements. Lower-frequency solutions will continue to play a key role in 4G networks, however operators will increasingly move to the new 70/80 GHz band, especially for dense urban, high capacity base station scenarios.



Removing backhaul as a network performance bottleneck means that network subscribers will experience the full potential of 4G access solutions — and that network operators can grow their 4G site capacity over time, without having to re-engineer their backhaul infrastructure. Removing these bottlenecks provide operators a truly "future-proof" solution, allowing them to migrate at their own pace.

Efficient spectrum utilization

As a result of the need for an efficient spectrum, the new 70/80 GHz frequency band offers five times more allocated spectrum than in any other licensed frequency band. Yet, operators are looking for solutions in this band that provide up to ten times more backhaul capacity than can be provided using the lower frequency bands. In many places where microwave backhaul has been extensively deployed (such as in many major European cities), operators are already facing shortages of licensable channels and without the use of 70/80 spectrum, the situation is likely to become untenable. Looking forward, it is clear that the 70/80 spectrum must be used efficiently in order to ensure that wireless backhaul solutions will be

available in dense urban environments for decades to come.

Antennas used for 70/80 GHz transmissions provide extremely narrow beamwidths and with this comes the ability to efficiently reuse RF channels. Given the dense urban deployments of these 70/80 GHz links, operators will be able to take advantage of inherently secure and interference-free transmissions.

Migration from circuit switched TDM to packet-based IP

Both LTE and WiMAX 4G standards are based on Ethernet packet transport through the backhaul and core networks. While "Greenfield" operators have the luxury of installing Ethernet-only networks, incumbent operators are generally planning on overlaying 4G services on top of existing 2G/3G services that use TDM (wired or wireless) circuits for backhaul. Support for native yet simultaneous 2G traffic alongside distinct IP-based 3 and 4G on the same network is ultimately the backhaul outcome that needs to be reached, with simultaneous TDM + IP connectivity in their native forms to next generation IP based transmission at their own pace.

Backhaul is one of the operators' greatest costs and deployment challenges, so there is a strong economic and logistical need to provision a single backhaul connection to transport both legacy 2G/3G traffic and new 4G traffic.

Solutions should address these needs head-on by offering operators both Ethernet packet and SONET/SDH circuit interfaces native on the platform, with the flexibility of multiple user-pluggable interfaces. This avoids the complexities of moving existing TDM traffic to pseudowire TDM-over-Ethernet solutions, or the inefficiencies involved with running Ethernet packet traffic over TDM circuits.

Native form IP/TDM isn't the only aspect to consider. Take network management — in a circuit switched TDM world, it is primarily a physical layer matter. Moving to the packet world, not only is the physical layer important, but packet layer information also becomes key to understanding network performance, congestion and connectivity as packets pass through Ethernet switch points. Solutions at 70/80 GHz will require more than just a simple SNMP interface. As these new networks are being built out, advanced network management features such as Ethernet CFM and OAM per 802.11ag and 802.11ah will become paramount to implementation.

Backhaul evolved

Carriers are facing a perfect storm in 2009 with growing mobile traffic, the need to support native TDM and IP, public pressures and costs of 4G, and an economy that has yet to rebound. This backdrop means carriers need a flexible product strategy that addresses the scalability and capacity issues for their networks today, while ultimately making their 4G initiatives competitive and profitable with a low total cost of ownership.

With innovations in higher frequencies driving multi-gigabit capacity and the tools mobile operators need to bridge the circuit and packet worlds.

If mobile operators and service providers heed the challenges head on, they will be well positioned to support 4G's exponential traffic ... while keeping capital expenditures reasonable and operating costs minimal to capitalize on 4G revenue promise.

Joe Schraml *is marketing director for Bridgewave. He has more than 24 years' experience in microwave radio systems, holding positions in manufacturing, network operations, sales engineering, and product marketing at a variety of microwave radio manufacturers. He also spent five years operating the largest private network in the U.S. for a major healthcare provider.*

Additional Resources:

Related articles:

U.S. wants to define broadband, opens wireless inquiry -- *August 21, 2009*

Microsoft takes next step in white-space for wireless service -- *August 19, 2009*
Develops a set of protocols for networks that will use this unlicensed spectrum

Blockbuster announces streaming movie service for Motorola -- *August 19, 2009*
Deal will bring thousands of Hollywood films to handsets

Verizon Wireless successfully completes LTE data call in Boston -- *August 18, 2009*
Utilizes 3GPP Release 8 infrastructure here and in Seattle test

RECENT UPDATES

Netbook pioneer Asustek eyes recovery; bets on China -- *August 25, 2009*

Sprint-Virgin Mobile deal gets U.S. antitrust nod -- *August 25, 2009*

To 4G or not to 4G: Supporting exponential mobile traffic growth -- *August 25, 2009*

Nokia to enter PC industry with first netbook -- *August 24, 2009*

Apple says Google Voice app alters iPhone -- *August 24, 2009*

Search Telecommagazine.com GO >> Advanced Search >>