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NATIONAL TELECOMMUNICATIONS COOPERATIVE ASSOCIATION

THE BUSINESS CASE FOR MOBILE BACKHAUL

by Jesse Ward, Telecommunications Industry Analyst, NTCA

The success of Apple's iPhone, the Palm Pre and Blackberry Storm are testament to the end user's demand for mobile data services. Web surfing, VoIP and multimedia messaging service (MMS) are a few of the bandwidth-hungry services gaining popularity, while early adopters are embracing mobile TV and multimedia content streaming.

Consumer demand for mobile broadband is fueled by the operator's desire for new revenue streams. As voice revenue levels off, mobile network operators (MNOs) are looking for new ways to boost average revenue per user. Further, mobile operators are beginning to deploy 4G technologies, which will enable new data-intensive applications.

It's the perfect storm of sorts, many factors uniting to cause increased strain on the mobile network infrastructure, particularly the backhaul facilities. Rural telcos are ideally positioned to assist with this problem, create a revenue stream and, in the process, perhaps gain a piece of the wireless market.

Mobile Broadband

By 2010 the number of worldwide mobile broadband phone subscribers is expected to pass the 1 Billion mark, and data traffic will surpass voice traffic on mobile networks, this according to a May 2009 release by Infonetics Research. Cisco's Mobile Forecast supports this projection, reporting that mobile data traffic will increase a thousand-fold over the seven years from 2005 through 2012.

In comparison with a simple voice call, data uses more network resources, hundreds of times the amount of bytes traversing the network in the same time period. Cisco's Mobile Forecast noted that a single high-end data phone today generates more data traffic than 30 basic-feature cell phones, while a single laptop air card generates more data traffic than 450 basic-feature cell phones. Mobile broadband subscribers are using more network resources for applications that require greater bandwidth, and proper quality of service.

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AT&T, which has the sole contract for Apple's iPhone, is witnessing the transformation first hand. In fact, 50% of the data on AT&T's mobile backhaul network is iPhone generated, despite the fact that only a few million of their 78 million total cellular subscribers are iPhone users.

"Overnight we're seeing a radical shift in how people are using their phones," John Donovan, the chief technology officer of AT&T told The New York Times in September 2009. "There's just no parallel for the demand." Indeed, or any historical reference to look to for advice. The popularity of mobile broadband has staggering implications for the infrastructure of a cellular network.

Evolving the Mobile Network

In an effort to boost the quality and quantity of mobile data traffic, MNOs are investing heavily in the access network, utilizing spectrum more efficiently to support higher data rates.

In September 2009, AT&T announced plans to deploy a 3G technology upgrade, high-speed downlink packet access (HSPA), in six major U.S. cities by the end of the year. The upgraded network platform allows for theoretical downstream peak speeds of 7.2 Mbps, with actual download speeds around 3 Mbps-5 Mbps down, and 1 Mbps-3 Mbps on the uplink.

Meanwhile, major operators are planning for 4G networks which are IP end-to-end, enabling new services and a larger number of users. Clearwire/Sprint's WiMax service will be available in 25 markets by year-end 2009. Clearwire's CLEAR WiMAX network has claimed speeds ranging from 3 Mbps-6 Mbps on the downlink. Verizon Wireless announced that it will launch long-term evolution (LTE) in up to 30 markets by 2010. The wireless provider has been quoted as offering 7 Mbps-12 Mbps downstream, and 3 Mbps-5 Mbps upstream, although actual results will not be determined until the commercial launch.

It's important to remember that in order to achieve these speeds in the access network, the transport network must support the increase in bandwidth.

In a cellular network, traditional mobile backhaul facilities encompass the transport network, carrying traffic between the base stations (cell towers), mobile switching center and the core of the wireline network for interconnection with the public switched telephone network (PSTN) or Internet. As subscribers utilize additional capacity for bandwidth-intensive data services, the backhaul infrastructure is under increasing strain, creating a bottleneck which causes latency and decreases network performance.

The Backhaul Bottleneck

Although there is no standard that specifies how a cellular backhaul network should be defined and implemented, traditionally it was designed to carry voice traffic, and built on time-division multiplexing (TDM). In North America, 75% of cellular networks are backhauled using copper, this according to Infonetics Research. Nearly 10% utilize microwave technology and the remaining 15% are on fiber.

Today's cellular base stations typically use leased T1 lines over copper, which deliver 1.5 Mbps per line. The transport protocols supported are mostly TDM, high-level data link control (HDLC) and asynchronous transfer mode (ATM), which were chosen for their support of narrowband 2G and 3G traffic.

This traditional reliance on T1 physical interfaces has, up to this point, driven mobile backhaul transport requirements. However, TDM-based backhaul is not optimal for transmitting large volumes of packet voice and data from a performance and cost perspective.

To support the world's cellular and emerging 4G networks, 90,000 Gbps of capacity in the last mile of the backhaul network will be needed by year-end 2013, this according to market intelligence firm In-Stat.

T-Mobile currently is providing 6 Mbps per cell site. "Tomorrow I think the first steps are going to be something more like 20 Mbps-25 Mbps, quickly followed by 50 Mbps, and eventually getting to 100 Mbps+," T-Mobile Chief Technology Officer Cole Brodman said to tech magazine GigaOM in May 2009. In fact, MNOs are planning for at least 30 Mbps per cell site by 2010. TDM over T1 cannot efficiently meet this level of demand.

From a cost perspective, the leased-circuit business model quickly will become unsustainable as mobile data traffic increases. Leased-line operating expense already is the single largest area of spending for wireless operators, estimated at $22 billion per year globally, according to the Yankee Group. Backhaul costs often are quoted as 25-30% of a mobile operator's operating expenses, this according to RAD Data Communications. Simply adding new leased lines is not economically feasible as doubling the capacity equates to doubling this cost.

It is critical that mobile operators optimize their networks, and find lower cost, more scalable backhaul solutions.

A Hybrid Solution

4G networks will simplify the network by using all-packet (Ethernet/IP) end-to-end architecture in the access and the transport portions of the network.

However, it will be many years before the entire network is transitioned to this new architecture. Given that most cell sites will continue to support 2G and 3G architectures for years to come, the addition of LTE and WiMAX means backhaul transport carriers need to implement systems that can support both native T1 TDM and packet-based services.

Many wireless service providers are uncomfortable with the latency, jitter and efficiency issues related to T1 circuit emulation service (CES), where circuit switches are carried across a packet-based network. As a result, many carriers are insisting on an intermediate backhaul strategy, a hybrid architecture which supports both native T1 TDM and packet-based service. Voice traffic will continue to be transmitted on dependable T1 lines, while mobile broadband will be transmitted over a packet-based architecture with quality of service mechanisms.

From the perspective of a backhaul transit provider, cell towers can support several different wireless providers. The advantage of a hybrid strategy is that it provides flexibility to meet the needs of carriers who require native TDM transport, and carriers who desire a TDM/packet mix.

To Build or to Buy

It's clear that mobile carriers must support higher bandwidth requirements per subscriber, at a reasonable cost. In an effort to meet the growing need, MNOs are heavily investing in infrastructure. Mobile backhaul equipment investments increased 19% in 2008 to $4.6 Billion worldwide, and that spending is expected to more than double to $11 Billion by 2013.

Clearly there is growing demand for backhaul solutions. The question facing the mobile operator now: To build or to buy?

Pure mobile operators are inexperienced at building, operating and maintaining wired connections and backhaul facilities. For these reasons, building the infrastructure is not typically an MNO's first choice.

Therein lies an opportunity for local exchange carriers to service a wireless operator—or several operators—and gain a piece of the ballooning wireless market. To be successful, wholesale transport providers need to offer reliable, affordable and scalable backhaul solutions, which fulfill the performance criteria required by the MNO.

Indiana Fiber Network (IFN), an independent, statewide network, successfully negotiated with a major wireless provider to backhaul a majority of its mobile traffic within the state. In essence, IFN's member telcos build fiber to the wireless provider's remote towers in and around the telcos' service areas and backhaul the traffic to their central offices. IFN then collects and transports the traffic within the state to one central collection point, straight into the wireless provider's mobile switching center (MSC) in Indianapolis. IFN also serves as the middleman, interfacing with its individual member telcos, acquiring and negotiating rates, and taking and processing orders. IFN builds directly to the towers themselves outside of the telcos' areas.

As the project has progressed, it has taken on multiple phases. "We got our foot in the door by approaching the wireless provider and offering an easy migration path from TDM to fiber and Ethernet backhaul," said Kelly Dyer, IFN president/chief executive officer. "We established an excellent track record and relationship with them and, as their needs have changed, now all they want to discuss is fiber-based backhaul."

Unfortunately there are some cases where an IFN member cannot economically build out the infrastructure. In these instances the wireless provider is either wirelessly backhauling the traffic to another tower, or contracting with the local exchange carrier's (LEC) competitor for fiber-based backhaul, a situation which is not ideal for IFN or the LEC.

Indeed, the wireless backhaul market is ripe with new competitors. Nationwide cable companies such as Comcast, Time Warner and Cox Communications are re-selling fiber-based backhaul to MNOs. In the fourth quarter of 2009, both Qwest and Level 3 Communications declared entry into the burgeoning backhaul market. However, it's important to remember that in rural markets, the incumbent LEC is best equipped to buildout the infrastructure.

Independent telcos are wise to be proactive, approach wireless operators and

open a discussion about future backhaul needs. If the LEC does not plan for and provide the necessary backhaul infrastructure, it's only a matter of time before another vendor meets the need, perhaps even the mobile operator itself.

Dyer recommends that independent rural telcos openly communicate with mobile carriers, and work together to meet their needs. "The biggest thing is to listen to what the wireless carriers want. Be as open minded and flexible as you can be," he said. "Don't bury your head in the sand; this could be a long-term customer."

"Remember that building out the network is a long-term commitment and it will take time to recoup your investment. Be receptive to their needs, because, in our experience, the first one to the tower wins."

Resources

3rd Generation Partnership Project (3GPP): Information on long-term evolution (LTE)

Cisco: Cisco(R) Visual Networking Index (VNI) Mobile Forecast for 2008-2013

The Foundation for Rural Service: Wireless Needs Wires: The Vital Role of Rural Networks in Completing the Call

GigaOM: The GigaOM Interview: Cole Brodman, CTO, T-Mobile USA

Infonetics Research: IP/Ethernet in Mobile Backhaul Networks: Global Service Provider Survey

Indiana Fiber Network

In-Stat: Big Pipes—The Global Market for Cellular/WiMAX Backhaul

The New York Times: Customers Angered as iPhones Overload AT&T

Nortel: Mobile Backhaul Evolves with Carrier Ethernet

RAD Data Communications: Mobile Backhaul: Challenges and Opportunities

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