



Broadband Backhaul

The necessary link for a successful 3G/4G strategy

Gene Beall
Senior Vice President, Strategy and Services

Gene Beall
Senior Vice President
Strategy and Services
gene@mobilitie.com

Gene spent 13 years with McCaw Cellular Communications Inc./AT&T Wireless in various senior leadership roles in network engineering and operations. Prior to joining Mobilitie, Gene was Head of Services for the U.S. Subregion at Nokia Siemens Networks. With more than 20 years in the telecom industry, Gene has extensive leadership experience with major wireless carriers and equipment vendors. He has managed the build-out of thousands of cell sites and deployed next-generation technologies to thousands more. He has led the development and deployment of enterprise network management systems; managed a portfolio of thousands of network and office properties; led teams to create technical standards, processes, training and documentation; and managed large capital and expense budgets. Gene holds a Bachelor of Science degree from Oregon State University and a Masters degree from the University of Washington.

As next-generation networks are built to handle the surging demand for data-intensive devices and applications, wireless carriers must consider alternative solutions to traditional T1 lines to carry traffic back to the switch. Fiber and microwave based backhaul solutions have the capacity to carry the load. Smart carriers will evaluate both technologies to best meet their needs in each market.

Surging demand

Wireless carriers are at a turning point in the evolution of their networks. For years, operators have been trying to entice subscribers to add data subscriptions to make up for waning voice revenues resulting from the ever increasing use of by the bucket-minute calling plans. These efforts are finally beginning to impact networks in a significant way. Today, data revenues account for more than 25% of average revenue per user (ARPU) for the nation's top three carriers. There is no sign consumer demand for these services is slowing down. Apple Inc. sold more than 1 million third-generation iPhone handsets in just three days! And research firm Nielson noted that 98% of AT&T iPhone customers use data applications. This success is compelling all wireless carriers to offer even more data-intense devices and applications. This success is also creating additional stress. Consumers have grown accustomed to virtually unlimited data usage plans for a fixed price. But the carrier's cost to deliver the bandwidth needed to support this usage is variable.

Fiber and Microwave Backhaul Solutions

By and large, today's wireless networks were built to handle voice communications, not mobile broadband content. As such, operators are rushing to build next-generation networks whose primary function will be to handle large volumes of data. These next-generation networks will be able to operate at 100 Megabits per second (Mbps); large enough to carry data-intensive applications like streaming video. The traditional backhaul solution, copper-based T1 lines, is not able to handle large volumes of data. One T1 line can carry data at 1.544 Mbps. A single strand of fiber, on the other hand, can offer up to 200 Mbps of bandwidth capacity. Microwave backhaul networks can also be designed to have operating characteristics similar to that of fiber. The logistics of serving broadband sites with T1 lines is not only prohibitive, so too are the costs.

Mobilitie \mō-bil-i-tee\ *verb*

1: the quality of being mobile **2:** the fastest growing tower company in the United States **3:** 50% revenue share and no equipment limits **4:** \$500 million on hand to invest in towers, DAS, and broadband backhaul networks

For more information, visit www.mobilitie.com

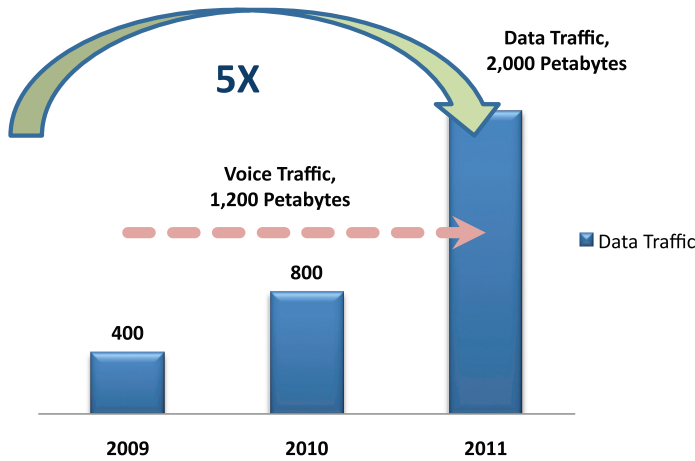
Fiber to the Site

Most carriers will choose fiber for much of their next-generation backhaul networks because they are familiar with its reliability and its tremendous capacity. Fiber is often the best choice for carriers offering service in large urban areas, where the landscape includes tall steel buildings and a lot of people simultaneously using the network. But fiber has some disadvantages as well. It can be expensive and time-consuming to deploy. Because fiber has to be hung overhead or installed underground, companies deploying fiber have to work closely with municipal governments for proper permitting. Depending on the situation, deploying fiber can be an expensive and a time-intensive process.

Microwave

U.S. carriers often view microwave as an interim solution rather than a long-term solution, even though their European counterparts have been using microwave based backhaul extensively for years. However, this mindset is changing as carriers become more familiar with large-scale, microwave based backhaul. One next-generation network operator, Clearwire Corp., is using microwave as its primary backhaul solution because it believes it can be deployed quickly and inexpensively. Microwave is sometimes well-suited to deployment in more rural areas, where there are few obstructions and where long dedicated fiber runs would be too expensive to lay. In some areas, due to zoning or permitting obstacles, microwave may be the only solution. Microwave has some disadvantages too, primarily that it can be disrupted during storms. However, with technological advances microwave has become an increasingly reliable solution, and

European counterparts have been using microwave based backhaul extensively for years.



Nokia Siemens Networks estimates that the growing popularity of mobile broadband services and even machine-to-machine applications will create an exponential rise in the number of bytes of data traffic carried by mobile packet core networks worldwide.

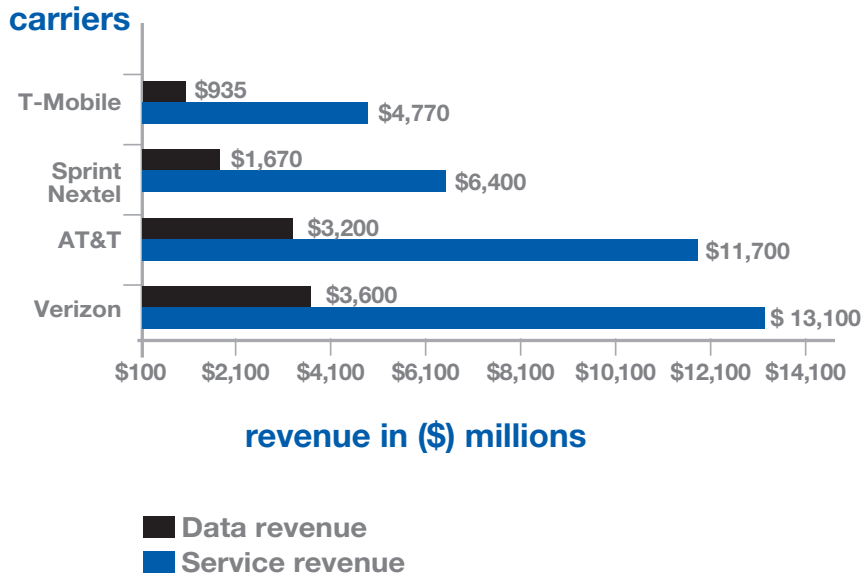
fiber is not immune to disruptions either. Earlier this year, a massive phone and internet outage occurred in Silicon Valley when vandals cut underground fiber lines.

Build or Buy

Carriers will have to decide whether to build their own backhaul networks or to lease the capacity from others. The largest carriers — AT&T Mobility and Verizon Wireless, which have local exchange carrier (LEC) operations — may decide to build much of their own backhaul solutions because they want to control the network. Carriers that own their own backhaul networks will not be subject to constraints on the network that third parties could impose. However, the capital required to build out a backhaul solution could take away funding from other network enhancement initiatives.

Carriers that don't have a large installed base of fiber may find it easier and more cost-effective to lease capacity from others.

First Quarter Service Revenues



Vendors

Carriers can lease fiber and microwave based backhaul from a variety of vendors. While LECs were the primary backhaul source for T1 lines, Alternative Access Vendors (AAVs) are selling fiber and microwave based backhaul to wireless operators.

LECs are well-equipped to provide fiber based backhaul to network operators and are best positioned to do so because they have fiber embedded throughout their networks as they have built out that capacity to get fiber to local businesses. As such, LECs can easily extend fiber to cell sites. Verizon Wireless, AT&T Mobility and Sprint Nextel Corp. each have sister businesses that can carry their backhaul. However, other wireless carriers may want to avoid buying services from these sister companies since they can be more expensive and because they compete with them on the wireless front.

Cable companies are also able to provide fiber to carriers because they have it in residential areas for cable TV and Internet access as well as cable-based telephony. Comcast, Time Warner and Cox Communications all sell fiber-based backhaul to carriers. However, cable operators are primarily in the business of providing service to individuals and are not as experienced in selling to multibillion-dollar wireless operators that demand a reliability and robustness not required by individuals. Wireless carriers will also demand diversity on their networks; that is they need more than one path back to the switch to ensure no major outages occur.

Other AAVs include smaller utility providers, data providers and companies that specifically have built out fiber and microwave backhaul to sell to wireless operators. Because these companies are usually smaller, carriers may be able to get better prices from these providers than LECs or cable operators. A few of these companies are DQE Communications, Duke Energy, Fiber Technologies L.L.C., FiberTower Corp., Florida Power & Light Co., NextLink Communications and Telecom Transport Management. Some of these companies only offer fiber, while some, like Telecom Transport Management, only offer microwave-based backhaul. Others offer a combination of fiber and microwave.

Estimating the Costs of the Technologies

While wireless carriers initially may be able to use T1 lines for backhaul as data applications ramp up, most carriers today are putting bandwidth restrictions on their networks in order to make sure data-heavy users don't take down the network with high-bandwidth applications like video streaming.

For comparison to T1 lines, fiber and microwave based backhaul can provide more than twice the capacity at half of the cost.

Presently, carriers estimate they initially need from 10 Mbps to 20 Mbps at each cell site. As demand grows, operators expect to need about 50 Mbps on each site, and some carriers have estimated needing as much as 300 Mbps per cell site during the next five years.

At roughly 1.5 Mbps per T1 line, a carrier would need seven T1 lines to get more than 10 Mbps of bandwidth for backhaul. T1 lines average \$300 per month, depending on the region of the country. In general, rural areas are more expensive and urban areas are less. If a T1 averages \$300 per month, using seven T1s to provide backhaul could cost more than \$25,000 a year for each site. Further, there is another problem with T1 lines: managing 10 or more T1 lines per site can be a logistical nightmare.

Fiber and microwave scale extremely well. Between 20 Mbps and 50 Mbps of fiber can be purchased for about \$1,000 per month, and microwave can be even cheaper than fiber on a per-megabit basis. For comparison to T1 lines, fiber and microwave based backhaul can provide more than twice the capacity at half of the cost.

Summary

Wireless subscribers are consuming more content than ever, both for business and personal use. Going forward, the industry is just at the beginning of increased mobile data adoption. While this gives wireless carriers a great opportunity to offset falling voice revenues with data earnings, carriers must address backhaul concerns brought about by the popularity of smartphones and laptops with wireless modems. T1 lines are not large enough pipes to carry traffic back to the switch, so carriers must look at solutions that use fiber or microwave. Each of these solutions has its own merits. Operators will need to make decisions on a market-by-market and site-by-site basis to find the most cost-effective way to deploy backhaul solutions.