Milwaukee Firm Demonstrates the Value of Mesh FSO

What to do when fiber is too expensive and WiMAX isn't good enough

By Stephen Walker ■ *Omnilux*

In June 2004, Jim Cadd, Network Director at Shoreline Real Estate Company, faced a dilemma. Shoreline owns more than 70 properties in downtown Milwaukee, including multi-dwelling unit (MDU) buildings, hotels, and commercial multi-tenant unit (MTU) buildings.

In today's rental property environment, small differentiators in services can lead to appreciable differences in occupancy rates and rent. Broadband Internet access is, of course, one service that tenants tend to value strongly. Cadd's strategy was to reap a strong financial return from increased occupancy rates by offering free high-speed Internet access in his company's properties. He had installed DSL lines to several buildings to test the concept, but the capacity of these lines was insufficient to support the network usage.

Having researched the cost of laying fiber to each of the buildings he wanted to serve, he realized that this solution was not financially viable. At that point, Cadd began researching alternatives. The dilemma Cadd faced is not unusual for MDU and MTU property owners. Many recognize the potential value of providing free or subsidized high-speed Internet access to their tenants. But finding an economic way to do it is often difficult.

In order to find economic solutions for building MDU and MTU access networks, it is important to first discuss the value of this particular application to property owners and then explore possible technology solutions that enable the application.

The Demand for Broadband

As early as 1999, 63 percent of MDU households indicated a strong interest in high-speed Internet access, according to a study by the Yankee Group. For small to mid-sized enterprises, access to inexpensive telecommunication services can be the difference between being competitive and being left behind. The incumbent telephone companies, however, tend to be focused primarily on urban downtown areas and have left suburban office parks and business districts under-served. The primary means of data access for businesses in suburban areas is copper – either as T-1 or as DSL. Businesses in these areas tend to pay $250 to $1,000 per month for 1.5 Mbps T-1 access. Higher speed services are prohibitively expensive.

Due to the importance of high speed data services to MTU and MDU tenants, and because these markets tend to be underserved in suburban areas, property owners who offer free or subsidized broadband access to tenants can differentiate their buildings and make them more marketable.

At a minimum, this reduces vacancy rates and significantly improves cash flow from MDU and MTU properties. In many cases, property owners can even charge higher rents in buildings in which they provide free broadband Internet access.

Given the strong business case for property owners to provide alternative data access, the challenge becomes finding an economic means of doing so. Fiber-to-the-premises (FTTP) is obviously the holy grail, as it is by far the superior technical solution. It provides high capacity, low latency and the best security available. In addition, as past advances in optical technologies have demonstrated, fiber is relatively future-proof – there seems to be almost no end in sight to the capacity of a strand of fiber.

More Money, More Time

There are two primary drawbacks to fiber, however. The first and most important drawback to FTTP is cost. According to a Render, Vanderslice & Associates (RVA) May 2005 report on Fiber To The Home, the cost of laying fiber in areas where trenching is not possible can range from $12 per linear foot for directional drilling up to $30 per linear foot for distribution lines running along streets (see chart, figure 1). For a property owner trying to connect ten buildings in a simple star topology with an average link length of 250 meters (measured from the central hub building to one of the end point buildings), this translates into a network

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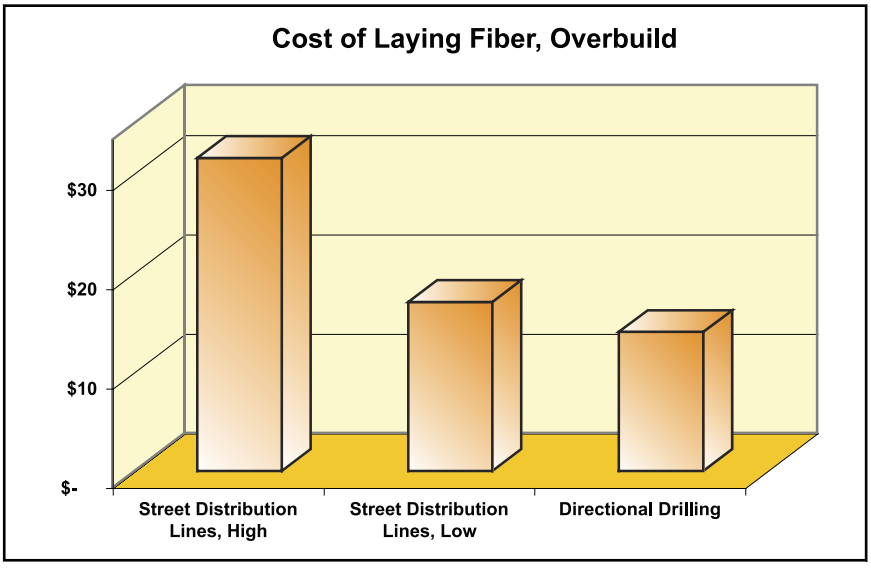

Figure 1. Cost of providing fiber, per linear foot laid, according to Render, Vanderslice survey, May 2005.

build-out cost of $100,000 to $250,000. Divided among many large tenants, each paying a premium, that can be acceptable if the up-front cash is available. But it adds an extra layer of risk to the developer's business plan.

The costs up-front could also be much higher. The RVA report acknowledges that other sources have cited costs of up to $200 per linear foot for deploying fiber, which would increase the cost of this hypothetical network to more than $1.6 million. These extreme cost ranges for deploying fiber reflect the large number of factors that must be considered in deploying a fiber network. Those factors include availability of rights-of-way, local fee schedules and the complexity and amount of any required trenching.

The second potential drawback to FTTP deployments is the protracted timeline required to deploy a network. Due to local permitting requirements and the complexity of the network planning and design process, deployment of a fiber network can take months. As is the case in estimating the cost of a fiber deployment, the range of potential times that it can take to deploy a fiber network is extremely uncertain due to the many factors that impact the deployment timeline. In fact, sometimes it is impossible to deploy fiber because the local municipality has grown tired of the disruption caused by trenching.

When WiMAX Works, and When it Doesn't

Despite all that, because of the technical advantages of fiber, including low maintenance cost as well as the high bandwidth, it is certainly worth considering for an MDU/MTU access network. But in cases where the cost or timeline of fiber deployment is not viable for a property owner, wireless technologies are great alternatives.

The most commonly discussed wireless technology today that is applicable to MDU/MTU access networks is WiMAX. It is difficult to gauge the real cost and capabilities of this emerging technology, as standards are just being finalized and consumer-level WiMAX equipment is not yet available. However, the clear advantage of WiMAX should be the cost per building deployed.

Based on the pre-WiMAX gear available on the market today, a ten node network as described above should be able to be deployed with a pre-WiMAX point-to-multipoint solution for around $10,000. At a minimum, this is a tenth the cost of a fiber deployment.

In addition, this solution can be deployed much more rapidly than building out a fiber network. The time required to obtain the appropriate roof, riser and spectrum rights for a WiMAX network can be counted in weeks.

In terms of network capabilities, pre-WiMAX gear available today can generally provide an aggregate realized throughput (often referred to as "goodput") of 30 Mbps per sector (using directional antennas) in a 10 MHz band of spectrum. This capacity would then be shared among the buildings in the deployment, implying a minimum guaranteed bandwidth of 3 Mbps per building, with burst rates likely to be available up to around 10 to 15 Mbps. This capacity is obviously sufficient for most applications today and is a good alternative to T-1 access over copper.

There are three deployment scenarios in which point-to-multipoint radio frequency solutions such as WiMAX are likely to come up short, however. The most common of these deployment scenarios is one in which the number of tenants in a particular building mandates more capacity than a pre-WiMAX solution can deliver.

For instance, going back to our ten building scenario described earlier, 3 Mbps committed bandwidth is likely to be sufficient if there is one tenant in the building. However, if there are ten tenants in the building, this bandwidth is clearly insufficient. This can be offset partially by sectorizing (having the WiMAX antennas handle different data streams, depending on the direction) and committing more spectrum to the network.

But this solution has limits. In particular, in cases where the density of buildings being serviced is high, it is often difficult to sectorize sufficiently to provide enough bandwidth.

Density alone can also cause the aggregate bandwidth of the network to be insufficient. As described earlier, the pre-standard WiMAX gear available today can generally provide 30 Mbps of aggregate capacity in a 10 Mhz band of spectrum. If there are 15 buildings with 3 tenants apiece attempting to share this capacity, the aggregate bandwidth will once again be inadequate.

Another instance in which point-to-multipoint solutions provide insufficient bandwidth is in a deployment where a significant amount of capacity is required at each customer premises due to the specific applications being delivered.

Figure 2. Four Omni-Nodes in a mesh configuration on four MDU properties in Milwaukee. Laying fiber in this congested area would have cost too much and taken too long. The saving over lease lines is $500 per line per month, giving a payback time of about eight months for the four-line solution shown here. Shoreline Real Estate owns 70 buildings in the area.

For instance, in medical corridors, tenants of commercial office space are often seeking burst rates up to 100 Mbps in order to quickly transfer large medical image files. As service providers increasingly emphasize the importance of offering a range of services beyond straight data services, such as Voice-over-IP (VoIP), data backup and recovery services, and additional communication services like video-conferencing, the bandwidth requirements of MTU and MDU buildings will continue to increase.

Based on the strengths and weaknesses of the technologies discussed thus far, the obvious question that arises is what should a property owner do if FTTP is too expensive and point-to-multipoint radio frequency solutions such as WiMAX fail to meet the deployment objectives?

Point-to-Point Networks

Fortunately, there are alternatives. Free space optics, which is based on fiber optic technology and beams light wirelessly from one point to another, and point-to-point radio frequency technologies, in particular those that use high frequency spectrum in the 10 – 60 GHz range, provide two possible alternative solutions.

Each solution can provide significant bandwidth (100 Mbps to 1 Gbps and even much higher). Both solve one of the two primary challenges of fiber, as they can be deployed relatively rapidly. These solutions are relatively expensive and fail to provide dramatic savings over fiber except in the most extreme of deployments, though. As an example, 100 Mbps free space optic systems that are capable of tracking generally start at around $12,000 to $15,000 per link. High frequency radio frequency systems are comparably priced.

Optical Mesh

Omnilux has a technology that can work in many situations. Its patented wireless optical mesh solution offers many of the benefits of both FTTP and radio frequency wireless, at a cost that can make sense when other solutions can't.

With network capacities of up to 100 Mbps to each customer premises and aggregate network capacity of 300 Mbps per egress node, the system can provide bandwidths closer to fiber than most other wireless solutions.

In addition, because the system is based on optical technology, it offers extremely low latency and high secu-

Mesh Networking Primer

There are several network topologies used today, including star, common backbone, ring, and mesh. Mesh networks provide more than two paths between any two nodes in the network. The benefits include shorter link lengths that are more reliable, greater redundancy in the event of a failure, and better coverage. The downside can include bandwidth sharing, spectrum allocation problems, and the added cost of the redundant transceivers and their management. Spectrum allocation problems are worst in multidirectional antenna deployments and are largely eliminated through the use of highly directional antennas. The Omnilux Mesh solution uses ultra bandwidth narrow beams of light to overcome the issues with mesh networks and deliver their benefits. –Carter Moursund

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rity. The system also offers the flexibility and fast deployment capability inherent in a wireless system. In fact, because the system uses unlicensed but non-interfering optical spectrum, it can often be deployed faster and with less network planning and permitting than is required of most other wireless systems.

Finally, at a list price of around $4,000 per network node, the system costs half to as little as a tenth the price tag for fiber (admittedly, in exchange for less future-proofing, slightly less reliability, and higher – although still low – maintenance). In short, the Omnilux Mesh system offers many of the benefits of both FTTP and RF (radio frequency) wireless at a price point only slightly higher than RF wireless.

It was this value proposition that Jim Cadd realized when he turned to the Omnilux Mesh solution for his deployment. In November 2004, his company deployed four Omni-Nodes in a mesh configuration on four MDU properties in Milwaukee (see figure 2).

As he had forecast, the Omnilux solution provided an immediate financial payback for Cadd and Shoreline. Installation of the Omnilux Mesh eliminated the need for costly SDSL and dedicated T-1 lines. That alone saved the firm approximately $500 per month per line (about $2,000 a month overall). That, in turn, translates into a sub-year payback for the Omnilux equipment.

Equally important to Cadd, though, was the upside data capacity provided by the Omnilux Mesh system. Cadd plans on adding additional services to his network in the future, some of which he will likely charge for.

He expects that each additional service he is able to add will also further enhance the value of his buildings to his tenants, thereby increasing their loyalty and decreasing churn.

Ultimately, the value of these services to his tenants could provide the largest financial benefit of all, as decreased vacancy rates will translate into a significant improvement in cash flow. "The Omnilux Mesh solution really delivered for me," said Cadd. "I looked closely at fiber, but just couldn't afford the capital outlay. And other wireless solutions wouldn't have allowed me to meet my deployment objectives. Omnilux provides a price-performance value proposition that is truly unique."

In the ultimate vote of confidence, Cadd is building on his initial success with the Omnilux Mesh by adding a second phase of rollout to his initial deployment. He intends to ultimately provide alternative broadband access solutions to a majority of the properties owned by Shoreline Real Estate. With paybacks of less than a year, deployment of alternative broadband access to MDU and MTU buildings is an opportunity that all property owners should consider. **BBP**

About the Author

Stephen Walker is Senior Vice President of Product Development and Operations for Omnilux, Inc., a wireless broadband equipment provider that he helped found in 2001. Steve has significant experience in product and business development from his roles at Omnilux, Idealab, The Walt Disney Company and General Electric. He can be reached at steve@omnilux.net or 877-OMNILUX.