An Access Alternative?

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We'll soon see whether carriers have the will—and money—for broadband fixed wireless.

When choosing high-speed broadband access technologies, the first criterion has to be availability, but for many network managers, that eliminates many of the options right off the bat. Geographic limitations eliminate DSL, cost acts as a barrier to installing leased lines or fiber, and cable, where it's available, is not secure enough. This leaves no choice but to access the Internet via painfully slow and inefficient dialup.

To address this issue, a handful of service providers and equipment vendors have developed fixed wireless networks for high-speed broadband access. The basic premise has been around for more than a decade; fixed wireless is a staple for point-to-point back haul links for cellular towers and utility companies. But when the FCC licensed spectrum in the 28–40 GHz and 2.5 GHz frequencies to fixed wireless access providers, the promise emerged of new solutions to the last-mile bottleneck (Table 1). The three basic flavors are Local Multipoint Distribution System (LMDS), Multichannel Multipoint Distribution Service (MMDS) and Unlicensed National Information Infrastructure (UNII). The first two are more carrier-class services than the third.

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UNII

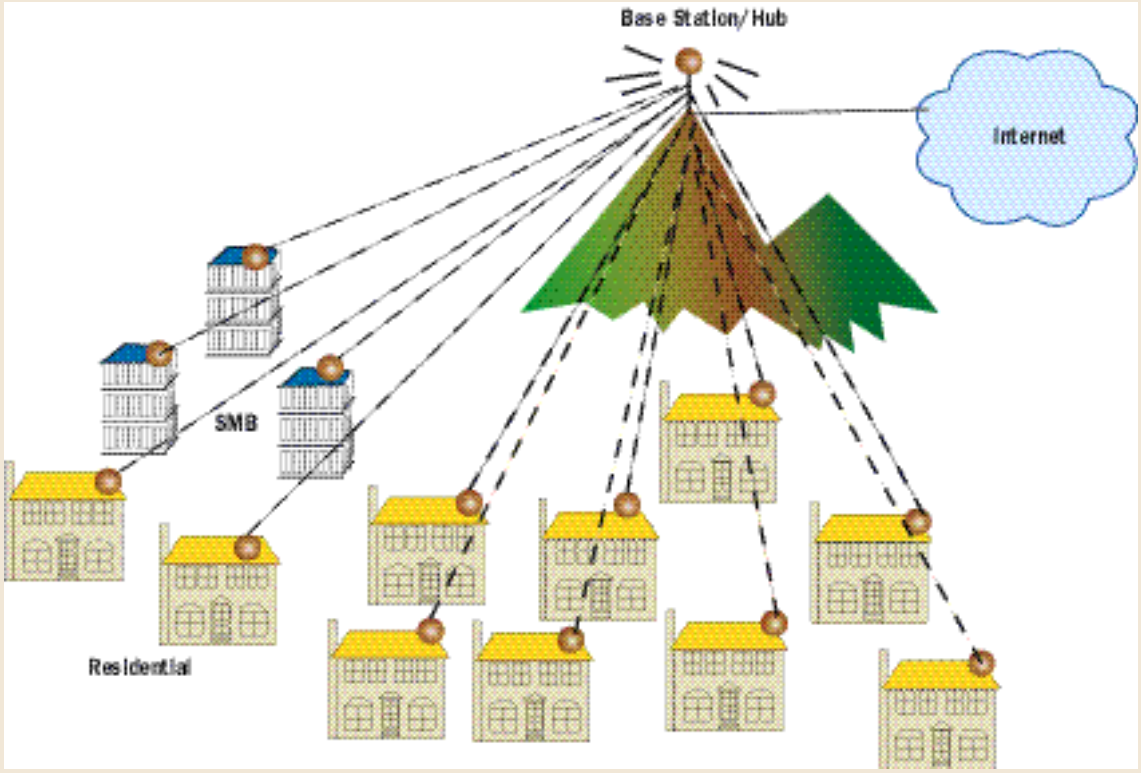
Unlicensed National Information Infrastructure operates in the unlicensed band (2.4 GHz and 5.8 GHz), and therefore is less expensive to provide than LMDS or MDDS. Because they don't have to pay to purchase expensive spectrum, service providers such as Air2LAN and Fuzion can keep upfront costs relatively low, and equip their networks with readily-available products from the likes of Adaptive Broadband, Breezecom, Cisco and Western Multiplex. UNII equipment typically ranges from 128 kbps to 2 Mbps.

The drawback is that UNII is susceptible to interference. UNII service providers share the spectrum, and once the band becomes saturated, transmissions suffer packet loss and poor reliability.

TABLE 1 Services Available via MMDS and LMDS

	MMDS		LMDS
Video Conferencing			X Small/Medium/Large/MTU/MDT
Video Distribution			X
Video on Demand			X
IP-VPN	Trials	Telecommuter/SOHO	X
VOIP	N/A	Residential	X
Ecommerce	N/A		X
High-speed Internet Access	X		X
Email	X		X
Web Hosting	X		X
Domain Name	X		X
Fax	X		X
Voice (POTS)	X		X

FIGURE 1 MMDS Point-to-Multipoint



Since the bandwidth is unlicensed, there's nothing to keep service providers out of each other's markets, and meaningful SLAs are tough to create because the service provider doesn't control the spectrum.

Thus, the vendors try to be the first to market, and they've targeted small and medium-sized businesses that do not have access to cable or DSL. Still, service is spotty across the U.S., with some deployments in Houston, New Orleans, Montgomery, AL, Jackson, MS, and parts of South Florida.

MMDS

Multichannel Multipoint Distribution Service (MMDS) operates at 2.5 GHz in the U.S. and is typically offered in a point-to-multipoint (PTMP) fashion (Figure 1). With PTMP, users access the same base station and share bandwidth from that tower; networks are designed to limit the number of users such that each receives a predetermined download speed, typically 384–512 kbps and upstream speeds of 256-384 kbps, with bursts up to 10 Mbps.

The MMDS providers are targeting small and medium-sized businesses and residential users, and while SLAs are available, they're not standard. Subscribers must be located within 35 miles of the base station.

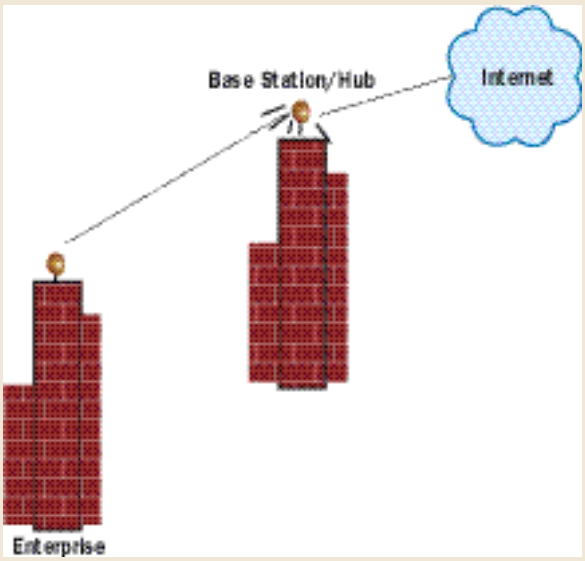
The drawback to MMDS is line-of-sight (LOS)—the subscriber's rooftop must have an uncluttered air path to the base station. Trees, buildings and terrain can all clutter the air-path. Equipment that can overcome some LOS problems—e.g., penetrate light tree foliage—is being developed and tested, but actual deployment is six to 12 months away (this "next-generation" technology is discussed in more detail below).

LMDS

Local Multipoint Distribution System (LMDS) operates at 28–40 GHz, and is often referred to as "wireless fiber." Compared to MMDS and UNII, LMDS's higher frequency allows for more robust applications and more bandwidth. Speeds range from T1 (1.5 Mbps) to OC-12 (622 Mbps), and it can deliver up to four 9's of reliability. Of course, there's no free lunch even in the world of fixed wireless; LMDS's robustness and higher bandwidth are attained with more expensive equipment. The combination of its operational characteristics and cost structure tend to make LMDS oriented to larger enterprise customers.

While some recent LMDS deployments have been point-to-multipoint (PTMP), it is more typically deployed point-to point (PTP), enabling dedicated access to a building or concentrated group of businesses (Figure 2, next page). PTMP configurations allow several businesses to share a very robust pipe and lowers the cost to each subscriber, but it is a relatively new architecture for LMDS and very little product has been commercially

FIGURE 2 LMDS Configuration



shipped. Among the LMDS vendors with PTMP technology are Ensemble, Nortel Networks, Alcatel, DMC Stratex, Netro, FloWare, Harris (via its acquisition of WavTrace) and P-Com.

The drawback to LMDS is its sensitivity to weather conditions, particularly rain, and distance limitations—a building must be within a couple of miles of the base station. Although vendors are advancing on the attenuation front, the distance limitations still favor deployment within urban areas. LMDS is more expensive than MMDS, but still cheaper than installing fiber cables (Table 2).

Deployment Forecast And Pricing

Synergy Research Group is bullish on fixed-wireless access technology, estimating that licensed equipment shipments worldwide will exceed $7 billion by 2006 (Figure 3). Currently, deployments for UNII have surpassed MMDS and LMDS in the U.S., but we expect that UNII's interference problems will enable MMDS to ultimately win. MMDS will outpace LMDS in deployments, because its target market—households and small/mid-size businesses—is broader than LMDS's appeal to enterprises.

To be competitive, the MMDS providers will have to price their services at a level comparable to DSL or cable. The three main MMDS providers —WorldCom, Sprint and Nucentrix—own more than 80 percent of the spectrum in the U.S., with WorldCom and Sprint controlling the bulk.

Sprint has the largest number of rollouts, with commercial service in 14 cities. Although Sprint is targeting the residential market, it also has a sizeable percentage of business customers, most of whom pay $100–$200/month for bursts of up to 5 Mbps downstream and 256 kbps upstream. Sprint does not offer SLAs for guaranteed bandwidth or uptime.

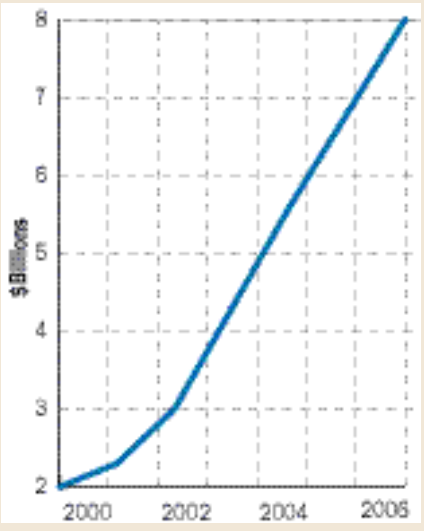
WorldCom's list prices for its business services range between $199 per month (for 384 kbps upstream/downstream) and $599 per month (1 Mbps downstream and 512 kbps upstream). WorldCom's SLAs include guarantees for uptime and speed, and at the end of 1Q01, WorldCom had commercial deployments in Memphis, Jackson, MS and Baton Rouge, LA. Trials were running in Boston and Dallas, with more planned throughout 2Q01.

With both Sprint and WorldCom, installation fees are directly tied to the contract length, and range from $99 to $1,000. The good news: Installation is quick—just days, compared to weeks for DSL or cable.

TABLE 2 Business Class Pricing—For Up To 20 Employees

Technology	Monthly Service Rate	Speed
DSL	$220	384 kbps/384 kbps
Cable	$375	3 Mbps/256 kbps
MMDS	$200	384 kbps/384 kbps

FIGURE 3 Forecast Broadband Fixed Wireless Access



Up to this point, high-speed broadband offerings have competed basically on price, but with so many DSL providers in financial trouble, one has to ask whether the current high-speed bandwidth pricing model is realistic. And if it's not, who will be the first to price at a level that can sustain profitability?

In this regard, MMDS has an important advantage over DSL: There's no need to lease the last mile from phone companies. This gives MMDS providers more control over their costs, but even so, buildouts can be costly.

Promising New Technologies

A handful of vendors is working to provide more efficient frequency usage on fixed-wireless access systems, but two in particular, Ensemble Communications and BeamReach Networks, are significantly advancing the state of the art. Ensemble is working to provide new approaches to the LMDS spectrum; BeamReach is doing the same for MMDS.

Ensemble has begun shipping a unique LMDS PTMP solution, that relies on the company's patented adaptix time-division duplexing (ATDD) technology to dynamically provision upstream and downstream bandwidth. Unlike traditional frequency-division duplexing (FDD), which separates upstream and downstream traffic based on frequencies, Ensemble uses the entire frequency, allocating downstream and upstream bandwidth as bursty data patterns demand. The bottom line: ATDD increases capacity, by allowing for more efficient spectrum usage. Ensemble's system offers QOS support, and it can interconnect with IP, TDM, Frame Relay, ATM and SONET networks.

BeamReach Networks has developed a new technology to address frequencies below 6 GHz. Its patented Adaptive MultiBeam OFDM technology combines a variety of techniques— OFDM, adaptive modulation, adaptive antenna arrays, spectral and spatial diversity, and time-division duplexing (TDD)—to use spectrum efficiently. BeamReach is planning to start commercial deployments by the end of this year□

Conversely, LMDS has few pricing issues, and is generally sold as a last-mile alternative to fiber. With monthly prices for fiber service high and installation even more costly, LMDS promises to deliver fiber-like speeds to the 95+ percent of buildings not currently served by fiber.

Most of the biggest owners of LMDS spectrum (28–40 GHz) in the U.S.—Winstar, Teligent, XO and Adelphia—also sell DSL, fiber and frame relay services as well as local and long distance telephone service. To these service providers, fixed wireless is but another weapon in their service arsenals, an attitude that makes sense given the technology-agnostic character of the vast majority of customers. Buyers tend to emphasize three decision criteria—reliability, speed of access and low cost—which play well with fixed-wireless access.

And as noted above, most of the LMDS providers own a nationwide fiber network that bypasses the telephone's network, which enables them to sell fixed-wireless access service as back-up to their existing access service(s). If a switch goes down at a telco's central office, the wireless service kicks in and puts data and voice onto the provider's metro fiber ring.

LMDS point-to-point (PTP) configuration is a proven technology, is widely available from a host of vendors, and can be used for everything from trunking to access. When compared to fiber, point-to-multipoint (PTMP) fixed-wireless service is even more cost efficient than PTP, as several customers share the bandwidth from one radio tower. While PTMP requires a higher upfront investment, once a network gets a critical mass of customers, network costs are dramatically lower than on a PTP network. Indeed, Ensemble Communications claims that PTMP becomes cost effective if just nine PTP links are replaced. In addition, unlike PTP, PTMP systems allow for over-subscription, which enables the frequency to be used more efficiently.

CLEC Troubles

The pros and cons of the alternative fixed-wireless access technologies will be largely academic unless financial health returns to the carrier/service provider industry. LMDS carriers are primarily CLECs, and at the end of first quarter, only two of the five principal LMDS carriers were (relatively) healthy financially—XO Communications and Adelphia. ART went out of business and Winstar filed for Chapter 11, although as of early May it continued to maintain that its service would remain unaffected. In the aftermath of a fiscal crisis, Teligent's top management was replaced, and the company was taken over by IDT Corp.

Although LMDS is solid technology, it is expensive to build out. The equipment for both LMDS and MMDS is proprietary, so there are few if any off-the-shelf ASICs, keeping equipment costs high. Moreover, the LMDS providers, like cellular providers before them, have had to pay very high sums for roof rights. Meanwhile, LMDS subscribers remain few.

MMDS is facing its own potential calamity as the FCC waffles over whether to let 3G mobile wireless players share the 2.5-GHz spectrum. This would cripple MMDS, since both service providers and equipment vendors would have to either design or redesign equipment to coexist with 3G. Still, the FCC's recent rejection of Verizon's request for mobile 3G data in the 2.5-GHz spectrum suggests that this struggle may yet be won by the MMDS folks.

Given the well-publicized reduction of capital expenditures, service providers are rethinking their roll-out strategies. For example, Sprint has become less aggressive with its roll-out plans and, instead, will focus on upgrading its networks with the second-generation equipment that will mitigate the LOS problem and use the spectrum more

The pros and cons of the technologies won't matter unless carriers get financially healthy

Sprint has been a pioneer—with the attendant problems

efficiently. Much of the second-generation equipment is based on derivatives of orthogonal frequency division multiplexing (OFDM), and the companies working on products include Cisco, Alcatel, Ericsson, BeamReach and Andrew Corp

Despite Sprint's claims that its deployments have been a roaring success, however, negative rumblings continue to be heard. For example, in some areas oversubscription has resulted in spotty delivery of the promised 256-kbps upload speeds. Sprint, however, deserves credit for pioneering these services and, hopefully, once the "pioneer" phase has ended, these problems will disappear.

Conclusion

Fixed-wireless access for the masses has yet to prove itself, but it is a forward-looking technology for serving customers in locations where cable, DSL or fiber either are not available or prohibitively priced. As a new technology and service, business customers would do well to consider the following:

- Look for SLAs to guarantee bandwidth and uptime.
- Longer-term contracts generally mean more savings.
- Start by using fixed-wireless as a back-up technology, or inquire if trial service is available before switching access providers□

Companies Mentioned In This Article

Adaptive Broadband www.adaptivebroadband.com
Adelphia www.adelphia-abs.com
Air2LAN www.air2lan.com
Alcatel www.alcatel.com
Andrew Corp. www.andrew.com
BeamReach www.beamreachnetworks.com
Breezecom www.breezecom.com
Cisco www.cisco.com
DMC Stratex www.dmcstratexnetworks.com
Ensemble www.ensemblecom.com
Ericsson ericsson.com/US-CA/
FloWare www.floware.com
Fuzion www.gofuzion.com
Harris www.microwave.harris.com
IDT Corporation (www.idt.net)
Netro www.netro-corp.com
Nortel Networks www.nortelnetworks.com
Nucentrix www.nucentrix.com
P-Com www.p-com.com
Sprint www.sprintbroadband.com
Teligent www.teligent.com
Western Multiplex www.wmux.com
Winstar www.winstar.com
WorldCom www.wcom.com
XO www.xo.com