FEATURE

MMDS Struggles to Find a Foothold

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By Peter Rysavy

We all want broadband Internet access, the broader the better. But for many, the service options are limited--the option you "choose" may be the only one available, and for some customers, dial-in is as good as it gets. Those in this sad state may be saved by a new wireless technology: multipoint multichannel distribution system (MMDS).

Wireless DSL

Although it has become the broadband technology of choice for many small businesses, home offices and even residential customers, DSL is not universally available. Network upgrades to support DSL are progressing more slowly than expected, service providers are falling by the wayside, and many would-be users are too far (more than 18,000 feet) from the closest central office. Cable modems are another option, but such service generally is targeted at home users who have cable television. So what's left for small businesses not near central offices? MMDS, a broadband wireless technology that's sometimes referred to as wireless DSL or by the more generic term broadband wireless, is a third low-cost option. Sprint Corp. and WorldCom are the two biggest providers.

Haven't heard about MMDS? That's probably because service is available in only a small number of areas. Both Sprint and WorldCom, however, say they plan to increase the number of regions served within the next year, especially as next-generation wireless technology becomes available.

MMDS, which operates in the United States and Canada at 2.5 GHz and in many international markets at 3.5 GHz, is not the only broadband wireless technology available. Smaller ISPs are using the 2.4-GHz unlicensed band with wireless LAN-based technologies successfully. There are also services operating above 10 GHz--frequencies referred to as millimeter wave, including LMDS (local multipoint distribution service) at 28 GHz and 38 GHz. However, these are fiber-replacement technologies intended for higher-density urban areas. Millimeter wave signals can propagate only a couple of miles reliably; hubs typically are located on top of buildings. In contrast, an MMDS hub can serve a radius of up to 35 miles, with hubs typically located on top of mountains or other high points.

Just one tower can provide coverage to a huge, heavily populated area at relatively low cost to the service provider. But since a large number of users may share the same radio channels, data throughputs will be lower than they are for other broadband wireless options. The net result is practical data throughput of 500 Kbps to 1 Mbps, ideal for small and midsize business customers as well as consumers. As for pricing, Sprint Broadband is providing business MMDS service in the San Jose, Calif., area for $200 per month, which includes support for six computers, six e-mail accounts and 6 MB of Web space. For residential customers, Sprint charges $50 per month, though prices may vary depending on geographic location. As networks mature, prices should drop.

While using the service is straightforward, network managers must keep a number

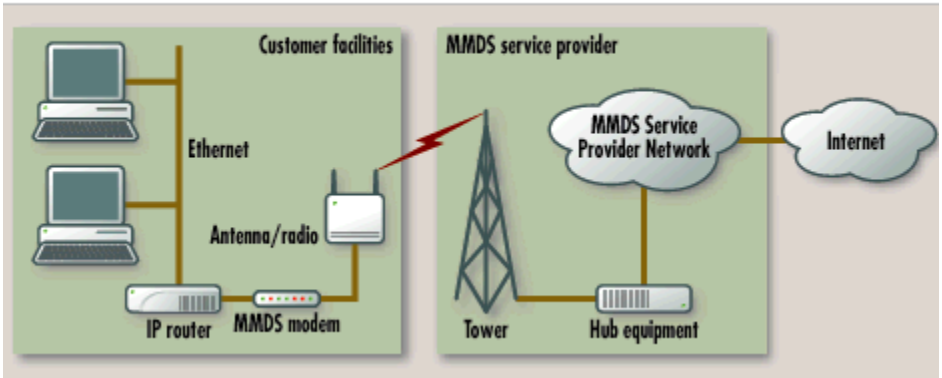
of factors in mind, including availability of service, network capacity and QoS (Quality of Service).

Using MMDS

The hot application for MMDS is Internet access; this differs from MMDS' original application of one-way "wireless cable" service to deliver television programming. This application never proved popular, and most license holders are concentrating on data service.

An MMDS connection is just like any other ISP connection: normally a router port with a connection for the external ISP network (see "MMDS Architecture"). In the case of MMDS, this is typically an Ethernet connection to a wireless modem. Alternatively, some vendors, including Cisco Systems, are providing wireless modem cards for their routers. A cable runs from the modem to a radio, which connects to the antenna. The radio and antenna can be combined in one compact unit. Sprint's dish is diamond shaped, 13.5 by 13.5 inches, about the size of a pizza box. This antenna is mounted directly on your building or on a pole and points at the service provider's tower. Future versions of the technology will omit the line-of-sight requirement.

MMDS ARCHITECTURE



The ISP's tower is a hub in a point-to-multipoint architecture that multiplexes communications from multiple users. This approach differs from many other broadband wireless connections that operate on a point-to-point basis. The tower has a backhaul connection to the carrier's network, and the carrier network interconnects with the Internet. This architecture is fundamentally the same as other ISP connections, with the wireless link directly replacing a DSL, dedicated T1 or frame-relay link.

The wireless link is a dedicated, always-on type of connection, just like DSL. The network layer is IP, and the radio interface consists of physical and link-layer protocols designed specifically for the wireless medium. These are derived from the specification used by cable modems, DOCSIS (Data Over Cable Service Interface Specification), with enhancements to the physical and MAC (Media Access Control) layers to address the wireless medium. The MAC layer governs how multiple users share the same radio channel, whereas the physical layer handles radio modulation.

Current deployments use conventional modulation techniques, but forthcoming

technology will be based on VOFDM (Vector Orthogonal Frequency Division Multiplexing), where the receiver combines reflected signals to produce a stronger signal. This allows non-line-of-sight operation and, according to Sprint, will increase coverage from 60 percent to 90 percent of buildings in a coverage area. It will also simplify the installation of antennas because they will no longer need to be aligned precisely. OFDM (Orthogonal Frequency Division Multiplexing) also has significant speed advantages, which it derives by dividing the radio carrier signal into multiple subcarriers. Because each subcarrier carries only a portion of the data load, it can do so using longer symbol periods, which makes the signal less susceptible to multipath interference (signal reflections). OFDM's magic is also the basis of other high-performance wireless technologies, such as IEEE 802.11a, a new wireless LAN standard that delivers a raw speed of 54 Mbps. Although a much better technical approach, next-generation MMDS equipment based on OFDM is not yet mature, and carriers will perform trials before wide-scale deployment.

Wireless connections do raise some security considerations. Providers do not encrypt the airlink--your data is broadcast in the clear. Although only a highly sophisticated hacker could intercept traffic, customers deploying sensitive applications should consider end-to-end security methods, such as VPN tunnels, just as they would for other types of Internet connections, most of which are not secure either.

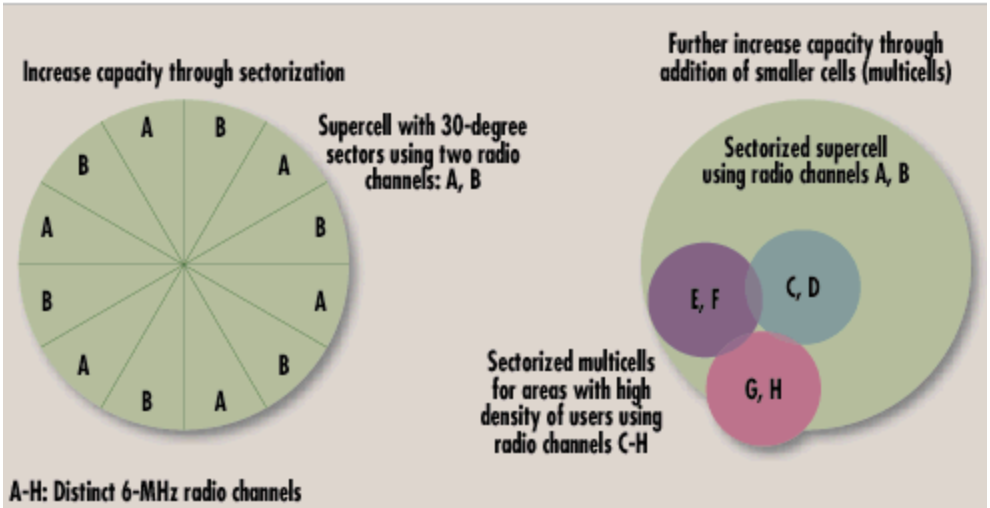
Quality of Service

Users should pay particular attention to QoS. The wireless link employs forward error correction, and the frequencies used are largely immune to the weather. Bit-error rates are comparable to wireline alternatives. Where QoS gets interesting, however, is with guaranteed throughput. The DOCSIS specification, and hardware vendor implementations, provide for guaranteed throughput mechanisms. However, carriers don't always supply these. MMDS uses a point-to-multipoint architecture, with one radio beam servicing many users. The carrier depends on the statistical nature of traffic to essentially oversubscribe its customer base.

Sprint Broadband quotes its service as a 10-Mbps link, with a maximum downlink throughput of 5 Mbps and typical throughputs of 500 Kbps to 1.5 Mbps, depending on other customer traffic. (The maximum uplink speed is 256 Kbps.) The key question is: How many other customers? Until carriers implement QoS measures in the radio link, actual throughput rates are at risk, and customers will need to monitor their connection speeds.

What can the service provider do to manage its capacity and bandwidth? Plenty, including using narrower and more focused radio beams, adding radio channels, adding cells and employing more efficient radio technologies (see "Sectoring and Frequency Management Can Increase Capacity").

SECTORING AND FREQUENCY MANAGEMENT CAN INCREASE CAPACITY



Deployment

OK, you're excited about MMDS. But can you get it? Unfortunately, because the technology is offered in a limited number of markets, the likely answer is no. Sprint and WorldCom have invested about a billion dollars each in MMDS licenses, and both say they are committed to deploying service. Sprint offers service in Chicago; Colorado Springs, Colo.; Denver; Detroit; Fresno, Calif.; Houston; Melbourne, Fla.; Oklahoma City; Phoenix; Salt Lake City; San Francisco; San Jose, Calif.; Tucson, Ariz.; and Wichita, Kan. For its part, WorldCom offers service only in Baton Rouge, La.; Jackson, Miss.; and Memphis, Tenn. Another carrier, Nucentrix Broadband Networks, offers service in the southwest and midwest United States. However, next-generation equipment has yet to stabilize, so don't expect significant increases in coverage until late next year. Long term, however, broadband wireless technologies like MMDS remain an important alternative for those geographical areas where wireline technologies such as DSL are not available.

(For a list of vendors that sell multipoint multichannel distribution systems and providers that offer MMDS services, plus other organizations involved in MMDS, see "Stepping Stones to MMDS.")

Stepping Stones to MMDS

Here is a list of vendors that sell multipoint multichannel distribution systems and providers that offer MMDS services, plus other organizations involved in MMDS. These vendors are representative of the industry and do not constitute a complete list.

- **Broadband Wireless Internet Forum:** Forum developing airlink standards for MMDS systems

- **Cisco Systems:** MMDS equipment provider
- **Hybrid Networks:** MMDS equipment provider supplying Sprint
- **Iospan Wireless:** MMDS equipment provider
- **IPWireless:** MMDS equipment provider
- **NextNet Wireless:** MMDS equipment provider
- **Nucentrix Broadband Networks:** MMDS service provider
- **OFDM Forum:** Forum for the advancement of OFDM technology
- **Sprint Broadband Direct:** Leading MMDS service provider
- **Vyyo** MMDS equipment provider supplying WorldCom
- **Wireless Communications Association International:** Represents the fixed broadband wireless access industry worldwide
- **WorldCom:** MMDS service provider