Telecom Developments Ring in New Data Needs

As a new wireless service called LMDS gains ground in the telecom market, data providers are challenged with finding ways to present building height and other non-traditional data.

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During the past five years, demand for wireless services in both the commercial and residential sectors has exploded. Wireless telecommunications service providers are responding to this demand by developing local multipoint distribution service (LMDS). The goal of LMDS is to enable customers to send and receive voice, video and data at high speeds, while keeping prices low and reliability high.

Currently, computers, telephones, fax machines and cable TV are wired services. They connect to the wider world through telephone lines or underground cables. With LMDS, these services connect via wireless radio transmissions.

LMDS requires a line of sight between transmitters and receivers; high-frequency radio waves are easily obstructed by buildings and trees. To ensure a clear path, telecommunications companies are turning to database providers that can offer information about natural and man-made obstructions.

The Need for Speed

Compared to wired telephone and cable, the relatively low cost and fast speed of deployment, and wide geographic coverage of wireless offer an advantage for carriers that want to serve businesses. According to WinStar Communications Inc., a wireless company in New York City, rising demand for high-speed data connections will be a major driver in its expansion of LMDS services, especially with regard to small and medium-size businesses that can't afford dedicated fiber links.

Although LMDS is not available nationwide, LMDS service providers are quickly adding new areas of coverage. For example, Teligent Inc., Vienna, Va., was serving 24 U.S. major metropolitan markets as of March and plans to serve an additional 16 markets by the end of this year; and WinStar's Wireless Fiber service was available in 30 markets as of the end of 1998.

Conventional data transmission speed is 120-160 kilobits per second. With LMDS, the transmission rate is closer to 50-150 megabits per second.

To fit into the LMDS market, data suppliers are having to* produce high-resolution *databases at very high accuracies.

LMDS is more reliable than mobile wireless, such as cell phones and pagers. Wireless service providers are beginning to design systems that transmit voice, data and video at rates equal to fiber optics on networks as reliable as fiber.

LMDS in the United States operates in the high-frequency 28-31 gigahertz range and is part of a product family called fixed broadband wireless. Fixed means that the receiver stays in one location, unlike a cell phone receiver that can travel through town with the user. Broadband refers to the amount of radio spectrum that may be needed to provide all the wireless services that a customer may want.

A good analogy for radio spectrum is a pipe. The pipes connecting the kitchen sink to the bathroom or outside sprinklers are narrow. But a water main pipe serving a whole neighborhood has a larger diameter, because more water must pass through it.

An LMDS service provider may have customers signed up for only data transmission service. For that customer, only a small amount of radio spectrum is needed. But another customer may want voice, video and data service; in this case, broadband or a large amount of radio spectrum is needed.

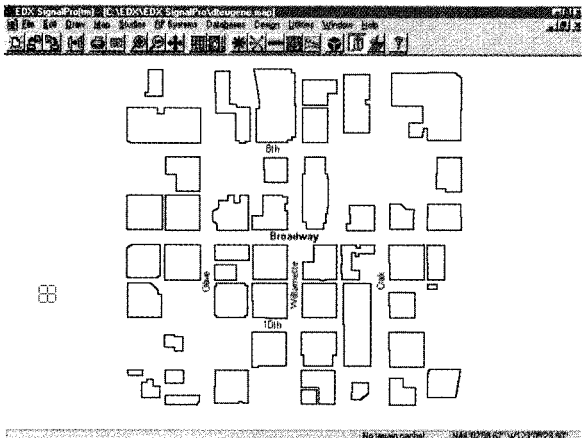
Coverage Challenges

There are some challenges in LMDS service, however. Besides being easily obstructed, high-frequency radio waves also travel a short distance (3-5 kilometers) before fading. This means that a fairly dense pattern of transmitters is required to cover a large area.

Telecommunications providers must rely on building and foliage databases, which describe the footprint and elevation of potential obstructions.

There are generally two types of high-resolution databases for LMDS work. The first is a canopy digital elevation model (DEM) with a resolution of 1, 2 or 5 meters, showing the aggregate elevations of terrain, plus anything on top of it, giving a shrinkwrap portrayal of the study area.

The second is a polygon file showing the exact footprints of individual buildings and trees with their associated heights. Canopy DEMs are generally less expensive to produce and are suitable when the engineer does not need information about individual buildings. A polygon database, on the other hand, gives an exact representation of the building footprint. A building can be identified so that important information can be tied to that building, such as address, tenants, number of phone lines and potential customers.



This sample vector polygon file defines the footprint of each building. Each polygon is given a unique number so that it can be tied to attribute information about that building, such as address, tenants and number of phone lines.

For both types, one must acquire current and suitable air photos, and large amounts of digital and manual processing are required to derive heights.

Changes in Database Offerings

Data suppliers, accustomed to providing lower resolution terrain elevation databases, are quickly trying to tailor their products to the needs of the rapidly growing telecom market. To fit into the LMDS market, data suppliers are having to produce high-resolution databases at very high accuracies — perhaps within 1 meter — to capture the heights and footprints of buildings, and any other features that may appear on the landscape, including towers and large overpasses. They must also offer competitive prices.

Paper maps, which can be excellent sources for bare earth terrain modeling, generally do not give the kind of detail required and quickly become out of date. Suppliers are looking to current aerial photographs and satellite imagery, but they are expensive to acquire. Plus, both must be in stereo to derive elevations and must have been acquired within the past two, or maybe three, years.

Various manual and automatic methods are being tested and used with mixed results. At this point, no one knows how good a database must be for LMDS. Another issue is database maintenance, which is not a concern for terrain because it rarely changes. If new structures are built in a particular area, how will these be added to a building database developed last year? Who pays for the costs of updating a massive database? Does this mean new air photos must be flown? What if the new photos have different flying specs than the old ones: Will the new buildings match up with the old? No one knows yet.

But several issues must be addressed by suppliers and engineers before a perfect fit is made and one can determine what kind of databases are needed for these projects.

An engineer for a service provider needs an accurate representation of the urban area for which he or she is designing a system. The most important thing engineers need to know is where they will have line of sight, which will determine the number and location of transmitters. It's important to be able to look at a database and place transmitters, knowing that the building heights are accurate.

After placing several transmitters, engineers can run a study to see where the signal is good or weak, and then move transmitters around, and change transmitter height and other parameters. They can rerun the study until an ideal configuration is determined. Large foliage would be nice to have, because a large tree can block the signal. Suppliers have not yet come up with a way of representing foliage with any accuracy, however.

Issues regarding resolution, accuracy and cost that need attention include:

- To what degree does a higher resolution database with better vertical and horizontal accuracies result in improved system performance prediction?
- Is one type of building database better for modeling signal propagation?
- What is the cost of producing a canopy DEM with 1-, 2- or 5-meter resolution?
- What makes the higher resolution canopies more expensive, such as scale of air photos or more manual processing?
- What costs are inherent to both canopy and polygon databases? What costs are unique to each one?

One option worth investigating is a combination of both types to provide detailed information and keep costs down. The canopy would provide elevations and the footprints (without height data) would allow individual buildings to be located and graphically queried.

Customer Demographics

As with any industry, wireless service providers need to know the location and characteristics of the customer base. The network must be configured so that enough channels are allocated to handle the demand. Radio and TV broadcasters must have information about where their customers live, so they often use Census demographics. LMDS providers, on the

other hand, will be looking at where their customers work because the initial deployment will be in areas of concentrated traffic, namely office buildings in dense urban areas.

As the networks are more broadly deployed, lifestyle segmentation and profiles for lower density areas, such as small offices/home offices (SOHOs) and residences, will be needed: Where are the SOHOs? How many phone and fax lines, computers with Internet connections and employees does each have? Where are the high-tech households that will embrace this new wireless technology?

For LMDS work in urban areas, high-resolution databases that include a representation of the buildings in that area are essential to a well-designed system. This geographic data market is very new, though, and data suppliers are in the early stages of deciding what database packages to produce in order to fit telecom needs. Issues regarding production costs, database pricing, resolution and accuracy need to be addressed. BG

Telecom Data Sources

The following providers are among those that supply building height data and other data tailored to the telecom market:

BKS Surveys Ltd.
47 Ballycairn Rd.
Coleraine, N. Ireland BT51 3HZ
[44 (0) 1265 52311; Web: *www.bks.co.uk*; e-mail: *sales@bks.co.uk*]

Global GeoData
11055 Flintkote Ave., Suite A
San Diego, CA 92121
[619-642-0188; Web: *www.global-geodata.com*]

The MapFactory Inc.
3000 Oak Rd., Suite 200
Walnut Creek, CA 94596
[925-280-8765; Web: *www.map-factory.com*]

Tobin International Ltd.
6565 West Loop South, Suite 115
Houston, TX 77401-3504
[800-662-9144; Web: *www.tobin.com*]

Several of the satellite data companies are targeting the telecom market to provide high-resolution terrain, land use/land cover and vector (streets, railroads, et cetera) data and are working on building height databases. These include:

i3
201 Linden St., 3rd Floor
Fort Collins, CO 80524
[970-482-4400; Web: *www.i3.com*]

Spot Image Corp.
1897 Preston White Dr.
Reston, VA 20191-4368
[703-715-3100; Web: *www.spot.com*]