



cheap and available!

Given its appeal, it's amazing that point-to-point wireless is such a wallflower. Sure, it's not sexy, but it works, it saves money and it can be deployed almost anywhere. **BY DAVE MOLTA**

IF YOU'RE LOOKING for lightning-quick ROI and aren't afraid to try off-the-beaten-track technology, make a date to check out fixed point-to-point wireless. You'll find a cost-effective solution for inter-building connectivity, and while this approach is a bit riskier than stringing fiber, the latest generation of fixed wireless offerings will meet most organizations' reliability needs.

Furthermore, when it comes to ROI, we're not talking about the soft gains mobile wireless technologies promise—such as enhanced productivity, employee time savings and more rapid customer response. We're talking about saving cold hard cash on monthly T1 and T3 circuits. As a bonus, you'll be able to deliver broadband access to locations that till now have been crippled with dial-up network access.

Best of all is that, though the underlying technology may seem like magic, fixed-access microwave wireless systems have been around for years serving telecommunications carriers that need to deliver

service to remote areas. And all the engineering that went into making those systems possible is available to your enterprise, at a cost that will elicit reverse sticker shock.

Where Have You Been All My Life?

FIXED-ACCESS WIRELESS has flown under the radar for several years while its flashy sibling, mobile wireless, has basked in the media spotlight. It's understandable: Mobility is sexy. Mobility can make workers more productive. IT managers understand WLAN and 2.5G/3G mobile systems. But when it comes to the bottom line, many mobile wireless technologies are deployed as much for convenience as they are for ROI.

Conversely, fixed wireless services are confusing. Many veteran IT professionals were scared away years ago by the high costs and complex installation schemes associated with licensed microwave systems. However, today's most popular offerings operate in the unlicensed 2.4-GHz and 5-GHz ISM (Industrial, Scientific and Medical) bands or in one of the several 5-GHz UNII (Unlicensed National Information Infrastructure) bands. These systems are inexpensive and easy to deploy and maintain, and a growing cadre of wireless-capable systems integrators is available in most areas.

Another source of confusion relates to the distinc-

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tion between point-to-point and multipoint fixed wireless services. Multipoint products hold great promise not only for linking multiple sites in a metropolitan enterprise but also as a long-term alternative for providing broadband Internet access to homes and businesses, offering credible local-loop competition to LECs (local exchange carriers). However, multipoint wireless systems are notoriously difficult to engineer, and the market has been hit hard during the past year with the high-visibility bankruptcies of Teligent, Winstar and Advanced Radio Telecom Corp., which played in the LMDS (local multipoint distribution service) market, and a decision by Sprint to freeze new installations of its consumer-oriented MMDS (multipoint multichannel distribution service) offerings. But don't jump to the conclusion that multipoint is dead! Second-generation technology, which addresses many early-system deficiencies, coupled with more rational business models, will likely lead to a re-emergence of the broadband wireless services market in 2003. You'll also see an increasing array of unlicensed multipoint wireless offerings targeted at private enterprise MAN (metropolitan area network) deployments.

In short, while multipoint wireless has considerable long-term appeal, point-to-point wireless solves real problems, right now. With systems available that span distances of 35 miles or more, and with performance for many products breaking the 100-Mbps barrier, there's considerable value. The sweet spot is a cost-effective 10-Mbps link that spans a mile or so. You'll get better performance than you can through T1 lines, and system reliability that approaches 99.999 percent.

Going to Market

WHEN COMPARED WITH WLANS, fixed wireless doesn't draw much attention from the analyst community, so it's difficult to determine precisely how large the market is. However, based on our interaction with vendors and network professionals, we know the market is growing significantly, particularly as relates to enterprise applications.

by the numbers

IN OUR READER SURVEY ON POINT-TO-POINT WIRELESS ...

60%

of you said the performance of today's point-to-point systems is adequate for most large organizations.

35%

consider 1 to 2 years an acceptable payback period, measured in leased-line savings, for a fixed wireless system; 31% say 2 to 3 years, and 23% say 6 to 12 months.

41%

have had your point-to-point systems less than 12 months.

Source: Network Computing E-Mail Poll, 190 respondents

The most visible application for point-to-point fixed wireless is cellular backhaul. As mobile system operators push coverage beyond their metropolitan cores, unlicensed fixed wireless provides the most flexible and cost-effective means of providing connections from outlying cell towers back to mobile switching centers. Not surprisingly, many fixed wireless systems are designed to emulate T1 connections. Even in newer products geared toward enterprise LAN interconnections, it's common for vendors to supply both Ethernet and T1 interfaces. That's a big convenience when you have a combination of LAN interconnection and PBX or videoconference applications.

Three key point-to-point fixed wireless markets are education, health care and government. Universities, which are known for expanding their footprints into locations adjacent to their campuses, often use short-range fixed wireless to provide services to locations where conduit and fiber don't exist and the costs to deploy fiber would be high. Similar situations exist in large and expanding health-care complexes. Govern-

Executive Summary

point-to-point wireless

We can see the personal ad now: "Sick of sexy mobile technologies taking your money then leaving you vulnerable? Tired of T3 leased lines that squeeze your budget dry? Consider hooking up with a cheap and available fixed wireless link. You won't be disappointed."

OK, so maybe we've gotten too much dating-service spam lately, but fixed point-to-point wireless is undeniably underappreciated. Consider some of its many charms: ROI that just won't quit, reliability, security, and the ability to free your branch offices from the pain of dial-up connections without running fiber or forking over big bucks to LECs. And for those IT veterans who remember the high costs and complex installation of yesteryear's licensed microwave systems, today's offerings are affordable and operate in the unlicensed 2.4-GHz and 5-GHz ISM bands or a 5-GHz UNII band. You can deploy and maintain them yourself, or take advantage of many experienced systems integrators that have set up shop. What's not to love?

We gathered six enterprise-level 5-GHz fixed wireless systems in our Syracuse University Real-World Labs®. After putting wares from Airaya, BitRage, Proxim, RadioLAN, Wi-LAN and Young Design through their paces, we singled out Proxim's QuickBridge 60 as our Editor's Choice, but your mileage may vary depending on your need for speed, budget and manageability requirements. Check out our findings beginning on page 46, and if you decide to take the plunge, let us know how things turn out.

ment and corporate applications tend to be more MAN-oriented, with typical link lengths of 5 miles or more.

Fixed wireless is also popular for providing temporary network connections, particularly when disaster strikes. Much has been written about the role fixed wireless played in restoring communication services to lower Manhattan following the terrorist attacks on the World Trade Center. Indirectly related to those applications are installations where fixed wireless is installed in conjunction with terrestrial links as a redundancy mechanism to ensure high availability.

Cost vs. Benefit

WE'LL ADMIT THAT, AS APPEALING as fixed wireless is, guided media—most often fiber—is almost always a better solution in terms of raw performance and reliability. But many times it's difficult or impossible to get fiber to a facility, either across the street or across town. That's when most organizations turn to leased-line services, usually T1 or T3 links.

A recent study by Proxim Corp. of 18 urban and suburban areas in the Eastern, Midwestern and Western United States showed that the nationwide monthly average cost of a T1 local loop circuit is \$382, while a T3 circuit runs \$3,550 (see "Make Your Case: Determining Real ROI," page 42). At those prices, many fixed wireless offerings can pay for themselves in less than

one year. That's the kind of compelling ROI that makes bean-counters sit up and take notice.

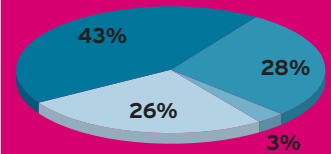
You can get many a fixed wireless system for less than \$1,000. Most of these operate at 2.4 GHz and leverage commodity WLAN chipsets to deliver a maximum data rate of 11 Mbps. While these systems can be appealing, they often lack features important for enterprise implementations, including Power-over-Ethernet and flexible management and monitoring capabilities. In addition, because they're based on LAN protocols, they tend to require higher overhead, resulting in throughput that is as low as half the stated rate. Finally, the duty cycle of these products often fails to meet enterprise standards.

That's why many enterprise- and carrier-grade point-to-point products are migrating toward the 5-GHz bands. These systems are typically designed from the ground up for fixed wireless applications. As such, their feature sets, performance and overall reliability are better than lower-cost alternatives. The downside is that many of these systems will cost more than \$10,000, though lower-cost options are starting to emerge.

When considering total system cost, factor in not only the cost of the wireless bridges and antennas but costs of components, installation charges and maintenance required for a production system. In the past, system integrators have charged a healthy premium for

E-MAIL POLL

Does your organization have a point-to-point wireless system?



● Yes
● No, but it is under consideration
● No, but it is included in 2003 IT budget
● No

Source: NETWORK COMPUTING E-Mail Poll, 190 respondents

a spectrum of choice

MICROWAVE RADIO SYSTEMS, which operate at frequencies over 1 GHz, have been around since the 1940s. Use of most of this spectrum requires a license by the FCC, but key blocks of spectrum—from 2.4 to 2.4835 GHz, from 5.150 to 5.35 GHz, and from 5.725 to 5.85 GHz—have been allocated by the FCC for unlicensed operation. Vendors producing systems operating in these frequency bands must employ protocols that minimize potential interference, and systems must be certified by the FCC before they can be sold.

The rules governing radio operation in the unlicensed ISM and UNII bands are complex, and some of these bands, especially 2.4 GHz, have become heavily used, thus increasing the potential for interference, particularly in densely populated areas. While

most interference-related problems can be mitigated, it's not surprising that many companies seek to minimize their exposure by implementing systems that operate in the 5-GHz bands. These bands less congested and more spectrum is available, which results in better performance and more implementation flexibility. However, many point-to-point products that run in the 2.4-GHz band are based on WiFi WLAN chipsets, making these products significantly less expensive than 5-GHz offerings.

Although most of today's 5-GHz systems are based on custom radio implementations, it is likely that future products will leverage the cost-economies of commodity 802.11a chipsets. Standards are critical for WLAN products, but not so important for point-to-point systems

because interoperability is not a critical requirement. In fact, a lack of interoperability can be a benefit to the extent that proprietary radio designs and modulation schemes add to system security.

Finally, it's worth noting that wireless point-to-point systems aren't always based on radios. Second-generation FSO (free space optical) systems based on lasers and LEDs are an option for some applications. These systems provide significantly greater bandwidth than radio systems, but are vulnerable to adverse weather conditions, particularly fog. Vendors are working to overcome these vulnerabilities, but for now, applications are limited to short-distance connections and environments where high-availability is not required or redundant systems make sense.

installation and maintenance, though the trend these days is toward self-installation, at least in enterprise environments where adequate expertise exists (for particulars on six 5-GHz systems see "The Point-to-Point of Wireless Bridging," page 46).

Assessing the Risks

GIVEN THAT ROI MODELS for fixed wireless almost always look good, why isn't the market exploding? It's all about risk management. IT professionals understand the security and reliability attributes of traditional network technologies, but wireless opens up a new set of concerns. Stop worrying—for the most part, the risk is manageable.

In many respects, fixed wireless is the victim of the well-documented security and reliability problems that gave those sexier mobile wireless systems their bad reputations. For example, security problems commonly associated with WLANs have not only garnered lots of attention, they've created a whole industry with companies focused on that specific need. However, the security issues surrounding WLANs, which are intended to propagate signals throughout a building or campus, are not applicable to fixed wireless, where direc-

tional antennas mounted high on buildings focus a narrow radio signal between two locations. Even if a snoop could somehow intercept these signals, all the major vendors support sophisticated encryption systems. And because the number of connections is small and centrally managed, key management is not the issue it is with WLANs. In short, don't let security concerns dissuade you from implementing a point-to-point fixed wireless system.

Reliability, on the other hand, is a legitimate concern, though it, too, is usually manageable. Because radio-based fixed-wireless systems operate at relatively low frequencies, you won't experience the weather-related problems with them that are typical of home-satellite systems, which work at much higher frequencies. You can further mitigate risk by turning to a professional installer, who can conduct a thorough path analysis prior to installation. By using directional antennas and building in an appropriate fade margin, professionals can guarantee 99.99 percent reliability in most areas.

Interference is the other side of the reliability coin, and this is a concern, particularly for devices operating in the 2.4-GHz band. WLAN systems, cordless phones

make your case: determining real roi

CALCULATING ROI for fixed wireless systems is relatively simple. For example, to compare the cost with fiber, calculate the total cost of installing fiber, add the cost of any electronics required to implement the connection and compare that number to the cost of a fixed wireless system.

Because one of the most popular fixed wireless applications is as a replacement for T1 or T3 leased-line services, we asked Proxim to estimate the ROI from fixed wireless versus leased lines. Information on leased-line costs was acquired through Telco Exchange (www.telcoexchange.com), a Web-based information service that tracks telecommunication circuit costs nationwide. We selected 18 representative locations from three geographic regions: East, Midwest and West. Half of the locations were urban; the other half, suburban. We considered both circuit-installation costs and recurring monthly charges. After spreading the installation costs over a three-year peri-

od, the average monthly cost of a T1 was \$382, with a total three-year cost of \$13,768. For T3 service, the average monthly cost was \$3,550; total three-year cost, \$127,824.

We then selected appropriate systems offered by Proxim, using street prices provided by the vendor. For T1 comparisons, we used the Proxim QuickBridge 20, which has a raw data rate of 20 Mbps and a street price of approximately \$2,500. We added installation costs of \$1,000 per end, leading to a total system cost of \$4,500. Over a three-year period, the monthly cost would be \$125. In comparison with T1, the wireless system would pay for itself within one year, while providing LAN-interconnection performance that would far exceed a T1 line. And if you consider that the wireless bridge's Ethernet connection makes it easier to integrate into a LAN backbone (no need for special serial routers or CSU/DSUs), the payback period can be reduced to less than one year.

For our T3 comparison, we used Proxim's QuickBridge 60 (see page 46 for our review), which has a raw data rate of up to 54 Mbps. With an estimated street price of \$4,000 and installation costs of \$1,000 per end, the monthly cost is \$167. Although a T3 link is likely to provide slightly better overall performance than the QuickBridge 60, in comparison to T3 service, the system pays for itself in less than two months.

While the above scenarios are representative of typical environments, accurate ROI calculations must consider your organization's unique needs and installation costs. For example, the cost to install a wireless bridge may be substantially higher than the \$1,000 estimate we have provided. On the other hand, given efforts by Proxim and others to simplify installation by using such features as Power-over-Ethernet, integrated antennas, flexible mounting brackets and functional antenna-aiming software, installation costs may be even lower.

and myriad other low-cost radio devices can affect a fixed-wireless system. Again, these problems can often be managed by using alternate radio channels or through antenna polarization, but there's always the risk of DoS (denial of service) attacks being mounted using inexpensive, easy-to-conceal radios and antennas. In fairness, motivated criminals can mount DoS attacks on most information systems, so in that sense, wireless isn't unique. Nonetheless, an increasing number of organizations are choosing to implement their fixed-wireless systems in the 5-GHz bands, where more channels are available and the risk of interference is lower.

Some of the reliability risk of point-to-point systems is associated with these systems' dependence on LoS

(line of sight) communications. If LoS is broken, the link will go down. Syracuse University, one of our Real-World Labs® partners, recently experienced just such an outage when a crane being used to construct a new parking garage was parked directly between two buildings connected via wireless. Those situations can be dicey to manage, so as with any mission-critical system, put contingency plans in place before you dive in.

Future Prospects

WIRELESS TECHNOLOGY IS EVOLVING RAPIDLY, and technical breakthroughs that enhance performance and reliability are likely. Much of the innovation that is occurring in the WLAN space is bleeding over into both multipoint and point-to-point fixed wireless. For example, use of new 5-GHz WLAN chipsets will likely spawn a clutch of low-cost, high-performance fixed wireless systems. Significant progress is also being made to deliver more sophisticated mesh topologies that improve overall system reliability. In addition, the requirements that LoS be available between antennas is likely to be relaxed with the release of near-LoS and, eventually, non-LoS systems. These developments are particularly important for the evolution of multipoint fixed wireless but will likely expand the possibilities for point-to-point systems as well.

more by the **num bers**

IN OUR READER SURVEY ON POINT-TO-POINT WIRELESS ...

44%

of you cite inadequate security as the biggest barrier to adopting point-to-point wireless systems.

94%

of point-to-point wireless initiatives are initiated solely by IT or with your input.

Source: Network Computing E-Mail Poll, 190 respondents