

Low-Cost Plug-and-Play Broadband Access for Multi-Unit Business and Residential Structures

Fiber to the Basement? The electrical system can be the network for high-speed broadband.

By John Butler ■ *Motorola*

- ❖ **You own and operate** a late 19th-century multi-unit office building with 18-foot-thick, solid granite walls that rise from the sub-basement, and you want to provide your commercial tenants with high-speed broadband. The only thing stopping you is the cost of pulling cable or fiber through walls that resemble those of a medieval fortress.
- ❖ **Your 65-story mixed-use**, multi-tenant building seems ideally suited for high-speed broadband. Better yet, there's live fiber buried in the city right-of-way less than 20 feet from your back door. But 65 stories can be a long and expensive way to go with more fiber, especially when you take into account the cost of running connections into every unit.
- ❖ **As an Internet service provider (ISP)**, you're trying to figure out how to make money by bringing service to a 4-story, 60-unit apartment building. There is no cable or fiber within cost-effective reach of the building. And to make matters even more challenging, the building is too far from a telco's central office or point of presence for DSL. Leasing T1 lines is simply too expensive.

All three of these multi-unit scenarios appear void of a solution, but none of the scenarios includes mention of an untapped, potential communications network permeating every floor and virtually every space of every building: The electrical system.

BPL Background

Delivery of electricity has been enhanced and expanded to keep pace with consumer demand. Electrical systems in multi-unit buildings, even ones that date back to the late 19th century, have been upgraded over time as mandated by local and national electrical codes. Proponents of Broadband over Power Line (BPL) technology have maintained

for quite some time that a multi-unit building's internal power grid can play a dual role, delivering both high-speed broadband and electricity with relative

ease and efficiency.

BPL is a network-based communication technology that can use low voltage or a combination of medium- and low-voltage electric power lines to distribute broadband signals. Power

lines offer an expanded opportunity to create and extend broadband coverage because the electric grid is the most pervasive network, and in some countries easily surpasses the existence of phone lines

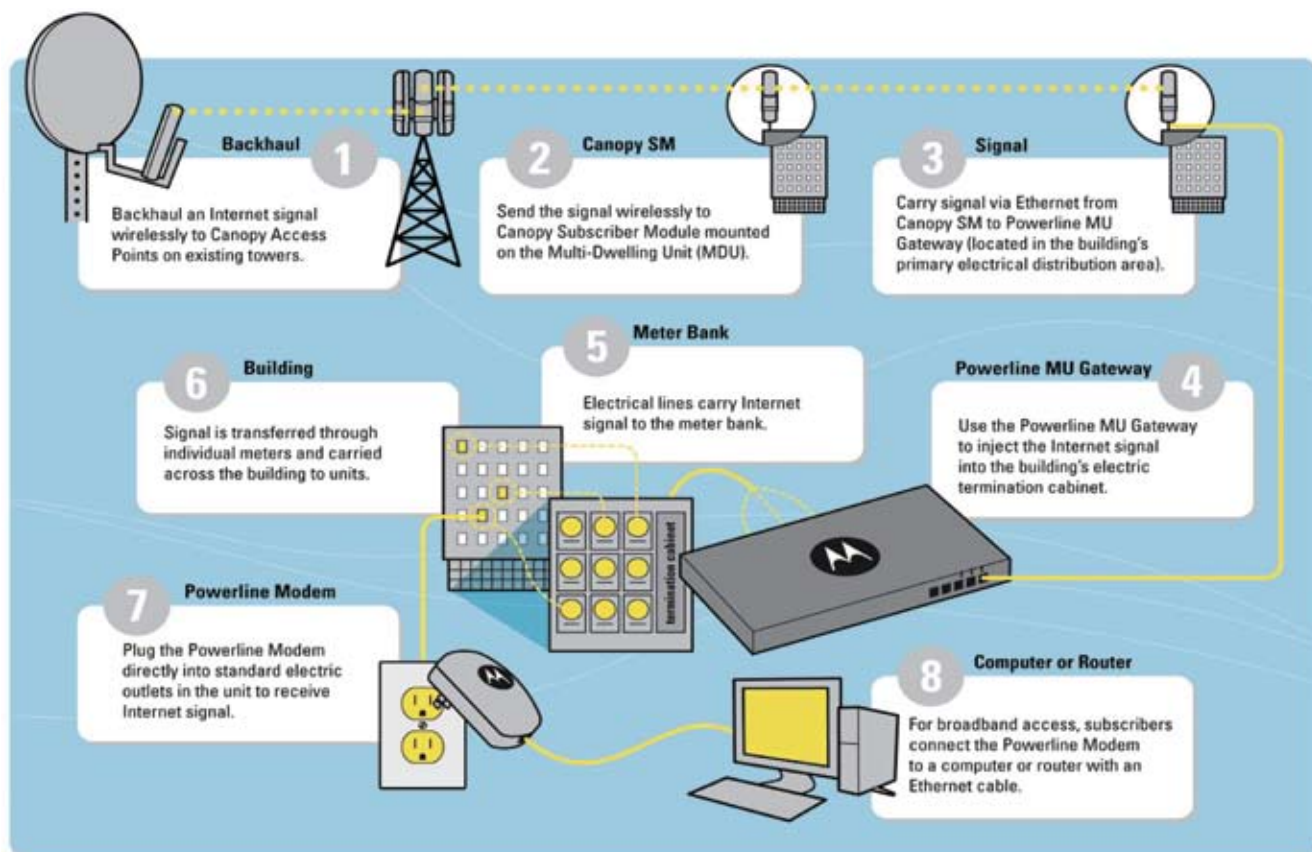
Motorola's vision of multiple complementary technologies that support broadband coverage and connectivity – MOTOwi4™ – is being realized by its product expansion into the BPL arena because this type of solution creates coverage opportunities in new spaces by complementing other networks to extend and/or complete coverage. MOTOwi4 is a portfolio of wireless broadband solutions and services that complements and completes Internet protocol networks. Delivering IP coverage to virtually all spaces, MOTOwi4 includes fixed broadband, mesh, BPL and WiMAX solutions for private and public networks.

Within the BPL arena, Motorola has developed a proprietary solution

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called Powerline MU for ISPs, telcos, cable providers, building owner-operators and managers who want a low-cost, plug-and-play broadband access solution that is scalable, easy to deploy and can work with existing technologies.

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Schematic display beginning with wireless backhaul and concluding with end-user HomePlug connection.

ISPs with an eye on offering broadband connections to a 60-unit apartment building or an owner of the fortress-like granite office building mentioned in the examples above now have this option. The Powerline MU solution, when optimized by Motorola's wireless Canopy[®] platform, works when a fiber, cable, T1 leased line or other hard-wire connection is not available or is simply not affordable.

How the Powerline MU Solution Works

Powerline MU uses the equipment from Motorola's globally proven Canopy wireless system, including point-to-point Ethernet radios for backhaul, access points and subscriber modules. A broadband signal originates with the network backhaul, or in this example, a Motorola Canopy point-to-point Ethernet radio. The point-to-point radio connects with another type of Motorola Ethernet radio known as an access point. The Canopy access point establishes broadband connectivity with a

third Ethernet radio – a Canopy subscriber module.

Subscriber modules typically are mounted on the rooftop of a multi-unit building or wherever a wireless, clear

form or has affordable access to fiber, cable, DSL or a T1 line, the MU Gateway plays a key role in the delivery of broadband over power lines.

The MU Gateway provides the

Delivering IP coverage to virtually all spaces, Motorola's MOTOwi4 includes fixed broadband, mesh, BPL and WiMAX solutions for private and public networks.

line-of-sight connection is readily available. The subscriber module uses unlicensed radio spectrum and delivers the broadband signal to a Powerline MU Gateway via Ethernet cable or an ordinary phone line. Since the installation is confined to the building premises, typically there is no need to involve the local utility in the installation process.

Whether a multi-unit building owner-operator, manager or ISP opts for first-mile wireless broadband delivery vis-à-vis Motorola's Canopy plat-

form technology responsible for injecting the broadband signal into a building's electrical system. But before the injection process can begin, the MU Gateway must first convert the Ethernet signal into HomePlug protocol. MU Gateways typically are installed in a building's basement within close proximity to an electric distribution cabinet. From there the broadband signal is distributed to individual units throughout the building by way of either a master electric meter or individual tenant meters.



Powerline MU Gateway using capacitive coupling into a 3-phase breaker panel.

its BPL MU solution to support a number of critical elements, beginning with a proprietary initialization sequence. Standard HomePlug modems cannot gain access to the network due to their inability to support proprietary authentication and VLAN assignment protocol because each Powerline MU Modem is assigned to a separate virtual local area network (VLAN) identification (ID). Modems are designed to reject any packet received that does not have their assigned VLAN ID. In addition, each packet is encrypted using the 56-bit data encryption standard (DES). Gateways and modems all share a key, and each modem is authenticated by the Gateway.

Underpinning much of the BPL MU solution is a network management automation tool called Prizm 2.1. Many service providers use Prizm to manage their Canopy wireless networks today. In doing so, they can reduce operational expenses of their on-going network operations. Prizm 2.1 addresses many other network operator-oriented needs including network failure notification, user authentication, centralized and automated network configuration, bandwidth management and network access privileges.

Even without a Canopy wireless network as part of the mix, a service

Motorola Powerline MU Gateways are compact and can accommodate up to 50 subscribers. More MU Gateways can be added as needed, depending on the number of subscribers in a multi-unit building and on transformer placement within the building. For larger, more complex installations, an accessory Powerline MU Panel Extender can be installed to couple as many as four separate three-phase electric distribution panels. Installation by a licensed electrician is recommended to inject the broadband signal into the electric lines via capacitive or inductive couplers.

The final connection to the high-speed broadband network is the easiest of all. A tenant is provided with a Powerline Modem that plugs into a standard electric outlet virtually anywhere in the tenant space. These plug-and-play devices, which convert the broad-

An accessory Powerline MU Panel Extender can be installed to couple as many as four separate three-phase electric distribution panels... to inject the broadband signal into the electric lines via capacitive or inductive couplers.

band signal back to Ethernet protocol, are fitted with RJ-45 jacks to accept standard Ethernet cables. Subscribers can connect their computers directly to the Powerline Modem or to a router device of their own choosing. Either way, subscribers can enjoy high-speed, always-on broadband connectivity.

Motorola also is sensitive to network security issues and has designed

provider can use Prizm 2.1 software because it has been designed to integrate smoothly into an operator's existing support systems – it supports multiple industry-standard interfaces.

Making the Business Case for BPL MU

Without crunching a single number,

the idea that a building's existing electrical system can double as a communications network immediately suggests the possible existence of a far more affordable alternative to pulling cable or fiber through a multi-unit commercial structure. Furthermore, many ISPs and building owners and managers agree

stallation costs still are only part of the story. The cost of connecting subscribers is the other part. In the digital subscriber line (DSL) example, there is a fairly substantial added cost involved as new subscribers sign up for a high-speed broadband connection. That's because the connection must be made by

installation process or the need to enter the tenant's premises. ISPs, building owner-operators and managers can realize other benefits with a BPL MU solution, beginning with new revenue opportunities. Popular customer applications like voice over Internet protocol (VoIP) service can be sold to tenants in addition to their initial high-speed broadband connection. Building owner-operators and managers can take advantage of their new networks by deploying applications like centralized energy management systems, video surveillance and even advanced fire and security alarm systems.

The benefits of BPL MU are compelling when taking into account the new revenue potential from a low-cost, secure multi-unit broadband service deployment. With the potential for more satisfied tenants, a commercial property with BPL MU has a competitive advantage over other properties that do not offer their tenants high-speed broadband access. No other technology offers users ubiquitous coverage in their dwelling without the use of a router. Installation is fast, easy and non-invasive, and with leading-edge management applications like video surveillance and energy management, BPL for MDU's is breathing new life into a building's broadband future. **BBP**

Underpinning much of the BPL MU solution is a network management automation tool called Prizm 2.1. Many service providers use Prizm to manage their Canopy wireless networks today. But Prizm does not require the wireless network to run.

that to be technology poor with respect to broadband offerings is to miss out on opportunities to cash in on a high-potential market of high-speed broadband customers that live or work in high-rises and other multiple-unit structures. However, it's also a market that is willing to pay only for what is perceived as a competitively priced service, which is why the affordability of a technology like BPL for MDUs makes it attractive.

When the numbers are crunched, the affordability picture becomes much clearer. For example, it can cost an average of \$178 per unit to pull CAT5/Ethernet cable through a multi-dwelling unit building. For an all-DSL cable install, the cost is lower, but still averages \$149 per office or dwelling unit. The Powerline MU story is about lowering costs even further. Given this same example, the Powerline MU cost-per-unit is under \$120.

Equipment and infrastructure in-

licensed or certified technicians, which translates into a truck roll for every new subscriber or group of subscribers.

By contrast using the Powerline MU, every new subscriber becomes an immediate and direct source of new revenue because there is no need for a truck roll. New subscribers either are handed the Powerline MU Modem when they sign up for service, or it can be mailed to them. All a subscriber has to do to begin surfing the Web is plug the modem into virtually any outlet, connect a computer to the modem, and make a few keystrokes. Typically, new subscribers with an Ethernet port on their computer do not have to change computer settings, install drivers or download special software. Best of all, subscribers do not have to take a day off from work to wait for an installation technician.

The Powerline MU approach eliminates other challenges, too, like expensive drilling involved in the cable

About the Author

John Butler is Product Manager for Motorola's MOTOwi4 BPL solutions. He is responsible for the development of Motorola's Broadband over Powerline solutions that combine the power and flexibility of wireless broadband with the pervasive reach of the electric grid. He holds a Bachelor's and a Master's degree in Electrical Engineering and a Master's degree in Management. John has been with Motorola for 14 years and has a total of 25 years of experience in the telecommunications industry. He has held a variety of positions in engineering and product management. Before working on Powerline solutions, he spent 10 years developing wireless data and broadband solutions for cellular networks. For more information visit www.motorola.com.

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Profiting From the Power of Wireless Broadband

How one savvy Internet service provider is using a Motorola Powerline System to cost-effectively deliver better broadband communications to tenants in multi-dwelling units in Chicagoland

Gunnar Kauke, co-founder and president of the Chicago-based ISP American Wireless Broadband (AWB), was looking for an economical way to deliver broadband wireless to multi-dwelling units (MDUs) in the Chicago area. As a veteran of the telecommunications industry who founded AWB in 2001, Kauke was familiar with broadband over power line technology, which he knew could provide a cost-effective means of delivering broadband to a large group of users within one building.

But he had some concerns. AWB had tested a BPL product out of Canada several years ago and was not happy with the results. In fact, the BPL technology only supported first-floor tenants, leaving users on higher floors without service.

But Kauke had been working with Motorola's Canopy team to deliver broadband wireless to customers for years, and he was confident of the quality of Canopy products. So when he discovered that the proven Canopy Wireless Broadband Platform served as the foundation for Motorola's Powerline technology, he decided to try it.

He's very glad that he did. Not

only was the system incredibly easy to install, it has worked flawlessly since its installation. Best yet, Kauke estimates that using BPL technology will allow him to reduce his current operational costs by 50 percent by eliminating the need to send a truck roll to deploy each individual new customer.

“We offer our residents six months of free Internet service. We also advertise the availability of broadband in all of our ads and brochures, and it definitely helps us attract residents,” said Stephanie Saladino, leasing agent at the Colonial Village Apartments.

A Powerful Technology

Kauke began by installing a Motorola Canopy subscriber module on the roof of the Colonial Village Apartment building, which is located just outside of Chicago and houses about 60 tenants. He then ran a cable from the

subscriber module to the Powerline MU Gateway in the basement of the building. The Gateway then automatically delivers the broadband connection throughout the whole building via the electrical wiring.

His first pleasant surprise was the ease of installation of the Motorola system. “Installation took just a few hours,” Kauke said.

Kauke first beta tested the system by providing service to four tenants on several different floors. His second surprise was how well the system worked – and how easy it was to set up end users. “To access the service, users simply plug a modem into an electrical outlet,” Kauke said. “It doesn't matter where they plug it in – it can be in the kitchen, the bedroom or anywhere. And they always get comparable speeds.”

And although the specifications for the Canopy system promise network speeds of 8 to 12 Mbps, one test showed the network in the Colonial Village apartment building was supporting speeds of 15 Mbps, Kauke said. And AWB is in the process of delivering more bandwidth to the building, which will enable it to

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serve even more customers.

As a bonus to residents, Colonial Village is providing free Internet service in the laundry room so that residents can surf while washing their clothes. Building management is now considering using the system for video surveillance as well.

"Through AWB, we offer our residents six months of free Internet service. We also advertise the availability of broadband in all of our ads and brochures, and it definitely helps us attract residents," said Stephanie Saladino, leasing agent at the Colonial Village Apartments. "I'm a user myself, and I've been extremely pleased with the reliability, speed and flexibility of the service. I can plug in anywhere in my home and start surfing the Internet immediately."

BPL Technology Eliminates the Truck Roll

By far the biggest benefit of Motorola's BPL system, Kauke said, is

the savings it provides over "standard" broadband delivery systems. "First of all, one point-to-point antenna can support 60 people or more," Kauke said. "But that's not the best part. The best part is that I can take an order over the phone, FedEx the modem to the customer and have that customer up and running the next day. And that means no truck rolls for installation. This saves me about 50 percent of my operational costs.

"Prior to relying on BPL technology, AWB had to send out a technician to set up broadband service for each new user – a process that could take hours, not only because of Chicago traffic but because of the many steps involved in the installation. "Before, to set up a user, we would have to go into the apartment and tone the lines. Then we would have to go to the basement, find the customer's line and hook it up to special equipment. Then we would have to install and test the modem," Kauke said. "Now the customer opens

up his mail, plugs in the modem and he's connected."

Plans for expansion already underway

Kauke is already planning to expand AWB's use of BPL technology by installing it in the multi-dwelling units that it already serves. Under AWB's business model, AWB installs, owns and maintains the network in each building. AWB's lowest-priced package is \$9.95, but prices can reach into the several hundred dollar range for business installations, such as a retail store in a building. And, thanks to the cost savings offered by Motorola's Powerline system, AWB can now apply a lot more of this revenue to profits, not operations.

"Motorola's Powerline system is an amazing technology that saves us both time and money. It can open new doors for us – and dramatically change our future with MDUs," Kauke said. "We are excited by the possibilities." *John Butler*

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