

Broadband Over Powerlines

BPL is going beyond the lab and technical trials and into production rollouts

By Bruce Bahlmann ■ *Birds-Eye Services*

The day of ubiquitous broadband services is perhaps much closer than people realize. However, which service providers can step up to the plate and hit a home run by delivering truly ubiquitous broadband services remains to be seen. Broadband over Power Lines (BPL) was just a pipe dream only a few short years ago, but during the past year it has made enormous strides in moving beyond lab trials and technical trials and into production rollouts. This article is an overview of the progress of BPL according to key individuals in the industry, including electric utility companies who are actively planning a technical trial, vendors actively involved in ongoing trials, software and hardware vendors sourcing these trials, and consultants providing integration and deployment expertise to these trials.

What is Driving BPL?

A new Federal Communications Commission (FCC) ruling that will go into effect January 1, 2005 states that Local Exchange Carriers (LECs) don't have to provide lines at a discounted rate to resellers (3rd parties). The ruling will leave thousands of Internet Service Providers (ISPs) with no means to deliver cost effective broadband services to their customers. For such ISPs, their only alternatives for survival are a diminishing dialup subscriber base, wireless, and/or BPL. Dan Capello of Amperion explains, "Additional drivers for BPL include increasing demand from other parties (e.g. CLECs, universities, and small to medium sized ISPs) who seem to be looking for alternatives for broadband



delivery." Interestingly, electric utilities seriously looking into BPL are not doing it to compete with telephone or cable companies – they are deploying this to better service their customers. Unlike telephone or cable, electricity is a necessity so it services 100% of its homes passed however, servicing residential consumers is just the beginning. Electric utilities also service every library, government office, school, university, business, park, road, intersection, and pretty much any public facility such as roadside rest areas, national monuments, subways, etc. As Thomas Blair of Omaha Public Power District (OPPD) puts it, "Electric utilities have no intention to become a retail provider of broadband services, rather we just want to use the BPL connection to provide new/improved services to our

customers." Such a statement is music to the ears of broadband-hungry ISPs. Having ISPs take over the management of offering Internet as a "service" on BPL allows electric utilities to focus on core competencies, such as building-out and servicing power lines rather than worrying about constructing data centers, hiring specialized technical staff, or negotiating peering agreements. In other words, this represents a huge time-to-market savings over trying to build an ISP from scratch.

There are also cost savings and service improvements driving the rollout of BPL. Electric utilities believe they can save money by implementing automated meter reading using BPL. In addition, BPL could be used to monitor distribution equipment and power quality as well as outages within the home. From

a billing perspective, electric utilities can easily offer consumption-based billing or flat rate billing depending on what customers prefer. Finally, electric utilities are increasingly realizing that there are fewer impediments to rolling out BPL than originally thought. The most common misperception — that BPL is only possible in a laboratory — has been proven wrong to the point where market trials are now turning into production roll outs.

How is BPL Done?

Beyond providing power for urban and rural customers, some electric utilities also offer other services such as water, sewer, waste removal, and recycling. So it is not too much of a stretch for electric utilities to also deliver basic Internet Protocol (IP) connectivity — especially as the infrastructure to connect the public is easily within their reach (see Figure 1.0).

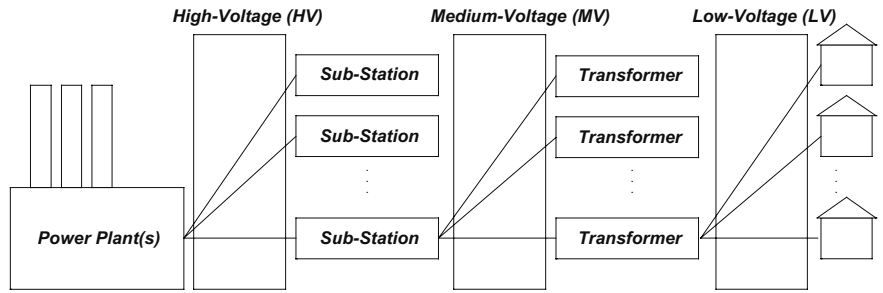



Figure 1.0 Overview of Electrical Infrastructure

Electricity is delivered as shown in Figure 1.0 (which is a greatly simplified). Essentially, you have power plants that generate electricity. For example the greater Omaha Nebraska area (population of around 600,000) is serviced by three power plants. These power plants service a number of substations connecting them with high voltage lines. Each substation services between three to eight medium-voltage circuits. Each such circuit services 20-25 transformers

which convert the medium voltage down to usable levels acceptable to consumer electronics (110v/220v). Between one and six homes are connected to each transformer, which translates to about 100 homes passed per circuit.

The actual delivery of BPL starts by interconnecting all the substations (many of which already have some type of fiber interconnecting them). At the substation, broadband is injected or coupled onto the circuits feeding the


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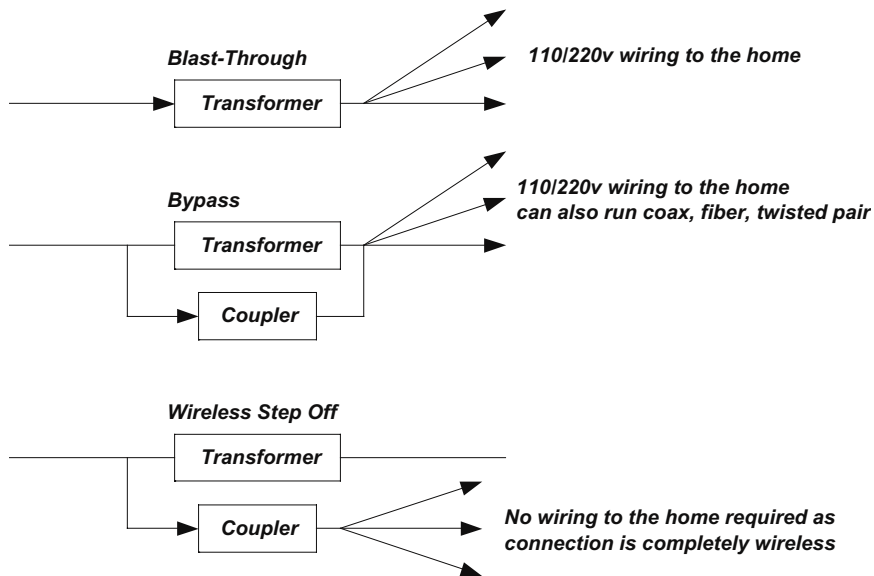


Figure 2.0 Three different ways to feed broadband to consumers using BPL

communities. At the transformer (which is nearest to the consumer) one of three things happens (see Figure 2.0).

The first option is to “blast-through” the transformer. In this case, there are no additional electronics required to connect consumer homes to the broadband service. The end user merely needs some type of device capable of interacting with the broadband being supplied through the electricity lines. The drawback of using this approach is that existing transformers limit the usable bandwidth delivered to the home. The second option is called “bypass,” which involves a type of bridging device that is co-located near the transformer. This bypass can re-route broadband signals around the transformer and deliver increased bandwidth to each endpoint. Connectivity between the bypass and the end user could be coax, fiber, twisted pair, or even the power lines. The third option is to use something called a “wireless step off”. This option allows the utility to create a wireless hotspot near each transformer. Depending on the strength of the wireless transmitter within the step off, this method can effectively create a mesh wireless network capable of interconnecting end users with multiple overlapping wireless service areas.

If power lines are used to connect a

service end point (e.g. residential home, business, public facility, city, university, or local government) to broadband, some kind of device is required to extract the broadband from power lines. Within any end point we have seen everything from fiber, coax, and twisted pair to wireless options that provide interconnectivity among various broadband-capable devices. One standard evolving within this “last inch” space is called HomePlug. HomePlug (www.homeplug.org) allows devices to network using the very wires that carry the electricity that operates the device. It is important to note that HomePlug and BPL are two different things. BPL carries broadband over the electric power lines to transformers, whereas HomePlug merely allows devices with embedded HomePlug chip sets to network within an endpoint (home or business). Cameron McCaskill from Intellon says, “HomePlug technology can act as an extension cord or as a home networking backbone. Many new HomePlug-embedded products are hitting the market, including desktop computers, residential gateways, and set-top-boxes, as well as broadband extension applications such as online gaming, music, and home security.” Such interconnection flexibility allows increasingly more devices to leverage

broadband connections. While traditional appliances (e.g. refrigerator, washer, dryer, furnace) have yet to embrace and implement HomePlug, over 55 companies actively participate, many of which are shipping products with embedded HomePlug support.

Accessing Ubiquitous Broadband

Providing broadband services that are ubiquitous presents some interesting challenges for BPL because its end users roam around within the system (they take their BPL, or wireless-enabled laptops to the library, parks, work, home, public meetings). Rather than invent their own technologies to solve this, utility companies have found that they can rely on proven access technology, namely Point to Point Protocol over Ethernet (PPPoE), to manage access of end users. Henry Quintin of Fine Point Technologies, who is one of the authorities on BPL, explains that “utility’s use of proven PPPoE clients and servers has allowed lab trials to quickly evolve into technical trials, market trials, and to move into full scale product launches.” Interestingly, the back office infrastructure used by PPPoE closely resembles that used by most dialup ISPs, which further streamlines the technical barrier to entry. PPPoE is predominantly the preferred access technology for BPL since in most cases there is no terminating device so the Customer Premise Equipment (CPE) such as personal computers and home appliances are required to negotiate access with the service provider. The result of using the PPPoE access method enables BPL to leverage the feature-rich dialup functionality used by thousands of ISPs to manage subscriber access, limit time, simultaneous sessions, level of service, or specific users.

BPL Decision Points

During the trials, the following decision points have been investigated:

- What line of business do we want to go into (e.g., voice, video, data)?
- What architecture should we use (e.g. wireless, BPL, satellite, DSL, etc.)?

- What business model works best for us?

In investigating the decision of which line of business, electric utilities have elected to build out an all-Internet Protocol (IP) network. By going "All IP" it makes the first decision point mute, as all three lines of business are able to transmit over IP. The overall architecture that works best for each electric utility seems to vary slightly but as deployments increase in size and scope, successful implementations will provide direction to other electric utilities with similar outlay. The following business models are actively being explored:

- Wholesale - Where the electric utility maintains the line in a type of "landlord model" but ISPs manage the services.
- Conjoined (mixed) - The utility owns half of the service and the ISP owns the other half
- Owner - Where the electric utility becomes an Exempt Telecommunications Company (ETC)

The wholesale model has become the dominant business model thus far. It is anticipated that AOL and Earthlink will buy up these opportunities. Unlike cable and telephone companies, in the electric utility model there does not seem to be a conflict of interest involved should the ISP own the customer. So long as the electric utility is able to use the high-speed data line for its own purposes (such as automated electronic meter reading and outage detection) independently of how ISPs use it, the value of this connectivity can be justified, while perhaps not entirely by cost savings but a considerable portion of the operating costs can be saved by maintaining this broadband connection.

As a rule of thumb, most electric utilities have maintained that costs for such a system must remain below \$100 per home or business passed to justify the business case. Clearly, hardware vendors have already resonated with this requirement, which explains why so many electric utilities have begun preparations for their own trials. In fact, second generation BPL equipment is nearing widespread availability with

reductions in costs from first generation equipment between 30-50%.

One other note about costs is the fact that electric utilities generally maintain a wealth of infrastructure. Sure there are power plants, substations, transformers, and such. But they also maintain thousands of utility poles, the

rights for which both telephone and cable operators pay the utility company. Both cable and telephone companies pay between \$2-7 a month for the rights to keep their services on these poles. While the electric utility bears the expense of maintaining and replacing these poles, the situation demonstrates the

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extent and completeness of the utility's infrastructure. Essentially, cable and telephone companies could not provide service without using the utility poles and right of way.

BPL Speeds

The amount of bandwidth that BPL is able to deliver to the home is mainly limited to the newness of the technology. Today, BPL is capable of delivering up to 10 Mbps to individual endpoints. However, if present-day penetration rates are applied to this, then in practice the actual rate is more like 2-4 Mbps. Second-generation chip sets are being tested right now that can provide throughput of up to 200 Mbps. However, from the perspective of an individual user and under normal operating conditions and penetration rates, the perceived speed of

such connection would be within 10-20 Mbps, more than enough to deliver high-quality digital video over IP.

Final Note on BPL

On a final note, you may have noticed that I conveniently side-stepped some of the more public "issues" supposedly hindering the progress of BPL. The purpose of this article was not to play devil's advocate and second-guess what more than 80 electric utilities in more than 40 countries worldwide are actively doing. Popular investment communities would predict that BPL is at least 3 years away. However, in talking to these electric utilities and the vendors involved, my sense is very different. With these 80 initiatives spending tens of thousands of dollars to over \$140,000 apiece in equipment alone, BPL is

already happening to the tune of about \$15 million annually. With take rates reported between 10-15 percent, along with a rapidly improving technology, I predict that there will be around one million BPL paying customers globally by the end of next year and this trend will continue, especially since BPL serves a much larger audience than any of its competing technologies. With that kind of potential, BPL should be able to sustain a growth rate of two to three times that of either cable or telephone companies. Now, that's eye opening. ❖

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