

HOME POWER LINE NETWORKING



Have you ever been troubled by your little sister who wants to surf the net exactly at the same time you are neck deep in completing an important assignment? You have a cable modem at home but you cannot connect your second computer to use it simultaneously. The most reliable solution is to build a LAN using Cat-5 cable, but the installation involves extensive rewiring and purchasing new equipment. Another solution is to use systems based on the IEEE 802.11b standard. They don't need wires but instead expensive user and control modules and transceivers for every computer. For a while it seemed that networking at home would prove to be a very expensive affair.

Not any more. There are many technologies that allow you to network your house. These include but are not limited to power line and phone line networking. Of these, the simplest and most efficient method is power line networking. In this, computers are connected to one another through the same outlet. The convenience is very obvious in this case because while not every room has a phone jack, there will always be an electrical outlet near a computer. Since it requires no new wiring, and the network doesn't add to the electricity bill, power line networking is the cheapest method of connecting computers in different rooms.

Power line was devised for transmission of power at 50-60 Hz, the use of this medium for data transmission presents some technically challenging problems. Besides large attenuation, power line is one of the most electrically contaminated environments, which makes communication extremely difficult. Further more the restrictions imposed on the use of various frequency bands in the power line spectrum limit the achievable data rates.

There are two competing power line technologies. The original technology is called Passport, by a company named **Intelogis**. A new technology called **PowerPacket**, developed by **Intellon**, has been chosen by the **HomePlug** Alliance as the standard for power line networking. Devices conforming to the HomePlug standard are easy to setup and use.

Power line technologies have many advantages. It is compatible with many operating systems. It works independent of line voltage and frequency of current. Even printers can be connected to the network and in no way are the features limited.

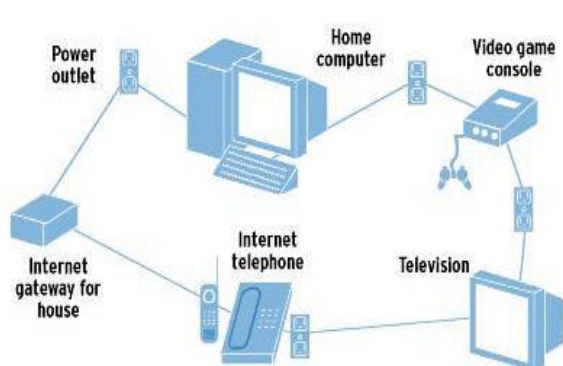
Devices based on Intellon's use a technology called Orthogonal Frequency Division Multiplexing (**OFDM**). This is very similar to the technology found in DSL modems. OFDM modulates the digital information onto multiple carriers with each carrier having its own frequency. The available range of frequencies on the electrical subsystem (4.3 MHz to 20.9 MHz) is split into 84



separate carriers. Multiple bits are sent on multiple channels at the same time, thereby making efficient use of the available spectrum. Each frequency is continuously monitored for interference and consequent data loss. If the channel's SNR is degraded, communication slows down but doesn't stop. The PowerPacket chip will sense this degradation and switch that data to another carrier. This rate-adaptive design allows it to maintain an Ethernet-class connection throughout the power line network without losing any data.

The latest generation of PowerPacket technology is rated at 14 Mbps, which is faster than existing phone-line and wireless solutions. However, as broadband access and Internet-based content like streaming audio and video and voice-over-IP become more commonplace, speed requirements will continue to increase. Along these lines, Intellon's OFDM approach to power-line networking is highly scalable, eventually allowing the technology to surpass 100 Mbps.

The older power-line technology used by Intelogis relies on Frequency Shift Keying (FSK) to send data back and forth over the electrical wires. FSK uses two frequencies, one for 1s and the other for 0s, to send digital information between the computers on the network. The frequencies used are in a narrow band just above the level where most line noise occurs. Anything noise that impinges on either frequency can disrupt the data flow, causing the transmitting computer to resend the data. This can affect the performance of the network. For example, when more electricity is used in the house, such as running the washer and dryer, the network slows down.



PowerPacket devices connect via a USB or Ethernet cord from the computer to a small wall adapter. Other devices will have the circuitry built in, meaning the only connection needed would be the power cord. Once the physical connections are made, installation of the software is easy. The software automatically detects all nodes (computers and printers) on the network. The proxy server software

enables sharing the Internet connection with the other computers. New computers can easily be added plugging a new adapter in and installing the software. Additional printers can be added using the printer plug-in adapter. File and printer sharing is done through Windows. Intelogis Passport technology uses a client/server network whereas Intellon's PowerPacket technology uses a peer-to-peer network. The problem here is that ISP's don't allow more than one computer to access the Internet using the same connection because only one IP address is associated with a connection. Hence a router with Network Address Translation (NAT) will also have to be purchased. NAT lets multiple computers to share one IP address.

Power line networking can also be used as a complement to wireless networking, which gets weaker and slower as the distance from the transmitter increases. Instead, moving the access point to a central location can spread the wireless signal. Plug a Power line adapter to the wall and add the wireless access point.

Power line networking sounds very rosy but it does have some disadvantages. It might not work where the outlets are far apart or on separate phases of a power line. Other devices using the power line may cause some interference resulting in lower throughput.

In any case, building these home networks using AC electrical wiring is easier than running wires, more secure and reliable than radio wireless system and the least expensive amongst them all. For home and small office applications this is an excellent solution to the networking problems.