

How Phone-line Networking Works

by [Jeff Tyson](#)

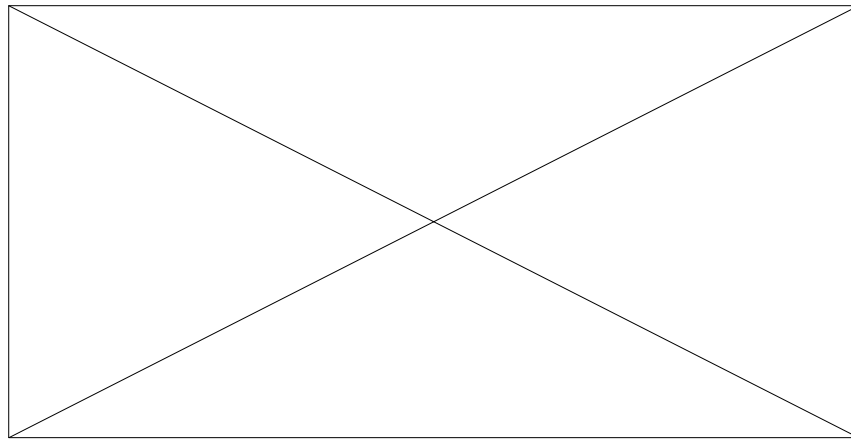
Phone-line networking is one of several ways to connect the computers in your home. If your computers are in different rooms, then phone line networking could be a good solution for you.

Be sure to read the companion article [How Home Networking Works](#), which provides information about configuring your computers, [routers](#) and [firewalls](#), Ethernet networking and sharing an Internet connection. There are also companion articles about [power-line networking](#) and [wireless networking](#). By the time you finish this series of articles, you'll be able to choose a network technology that suits your needs and then configure the whole thing!

In this article, we'll talk about phone-line networking and the technology used to make it happen. We'll also discuss the advantages and disadvantages of using a phone-line network.

Phone-line Networking

Phone-line networking is easy to install, inexpensive and fast, and it doesn't require any additional wiring.



Phone-line networking, most commonly referred to as HomePNA, is based on the specifications developed by the [Home Phone Networking Alliance](#) (HPNA). The HPNA is a consortium of key networking technology companies that created a phone-line standard for the networking industry. HPNA 1.0, the original version of the standard, operated at a rather slow 1 megabit per second (Mbps). The current specification, HPNA 2.0, is based on technology developed by Broadcom and operates at a faster 10 Mbps. Cards using HPNA 1.0 are still being sold, so make sure that the cards you buy are HPNA 2.0!

Pros and Cons of Phone Line Networking

HomePNA has several distinct advantages:

- It's easy to install.
- It's inexpensive.
- It's standardized.
- It's reliable.
- It operates at a constant 10 Mbps, even when the phone is in use.
- It requires no additional networking equipment (such as hubs or routers).
- It supports up to 25 devices.
- It is fast enough for bandwidth-intensive applications, such as video.
- It is compatible with other networking technologies.
- It works on Macs and older PCs (in addition to Windows systems).

HomePNA does have some drawbacks, though. You need a phone jack close to each computer. Otherwise, you will have to run phone extension cords or install new wiring. Even though it operates at a very reasonable 10 Mbps, it is still 10 times slower than fast [Ethernet](#) (100 Mbps). Therefore, if you are going to be sending huge amounts of data between your computers, you may want more speed. There is a physical limit of 1,000 feet (304.8 m) of wiring between devices, and the overall area of coverage should not exceed 10,000 square feet (929 m²). Rarely (in fewer than 1 percent of U.S. homes), HomePNA will not work on the existing wiring. And while this author did not notice any interference with voice use, there have been reports of voices sounding "funny" or of a lot of noise on the phone once HomePNA is installed. Later, we will look at these issues and possible solutions.

How HomePNA Works

HomePNA uses a method known as **frequency-division multiplexing (FDM)**. FDM puts computer data on separate frequencies from the voice signals being carried by the phone line. FDM separates the extra signal space on a typical phone line into distinct data channels by splitting it into uniform chunks of bandwidth. To better understand FDM, think of radio stations -- each station sends its signal at a different frequency within the available band.

In HomePNA, voice and data travel on the same wires without interfering with each other. In fact, a standard phone line has enough room to support voice, a high-speed [DSL](#) modem and a home phone-line network.

How Much Does It Cost?

HomePNA adapters come in two versions: internal card ([PCI](#)) or [USB](#). You can buy kits consisting of HomePNA cards for two computers, an installation CD and all the necessary cables for about \$90 to \$110. The actual cost of implementing HomePNA depends primarily on the type of interface you buy for each computer: PCI cards cost about \$45 to \$55, while USB adapters range from \$75 to \$85. If you plan to use a laptop computer that does not have a [USB port](#), you can either buy a USB-to-PCMCIA adapter (\$50) or get a [parallel-port](#) USB adapter.

In the next section, we'll learn more about HPNA technology.

Broadcom Technology

Two custom chips designed using the HPNA specifications were developed by Broadcom and make up the core of the HomePNA card's architecture:



The small 4100 chip on the left acts as a transceiver between the larger chip and the signal being received over the phone line from another computer. It can send and receive signals over 1,000 ft (305 m) on a typical phone line. Think of it as an interpreter, translating the analog messages it gets from the phone line into a digital format that the PCI/MSI controller chip can understand. The

4100 does not try to understand what it interprets, it just sends it along.

Since many phone lines in existing homes vary greatly in length and signal quality, the larger 4210 controller chip on the right has to be able to adapt to a variety of challenges. Because the 4210 does this so well, the HPNA estimates that more than 99 percent of U.S. homes have phone wiring that can support HomePNA. Basically, it works this way: First, the controller chip takes the unfiltered content it receives from the smaller chip and strips away all the noise. It then takes what is left and passes it on to the computer for processing. Once the computer processes the information, it returns an acknowledgment to the sending computer so it knows that the data was received. This happens thousands of times each second as the computers communicate.

In the next section, we'll discuss installing HomePNA and some of the problems you might face.

How to Install HomePNA

If you decide that HomePNA is best for you, here are the basic steps:

- Buy a kit, making sure you have a HomePNA card or external adapter for each computer in your home.
- Install the hardware (internal card or external adapter).
- Plug the included cable into the hardware and into the phone jack.
- Install the software.

Troubleshooting

There are a few things you should keep in mind when you set up a HomePNA network. First, most analog communication devices, such as telephones and fax machines, create signal noise. Think of signal noise as debris on a major highway. A little debris probably won't affect traffic, but a lot of it could slow down or even stop traffic in one or more lanes. If you install a HomePNA network and your computers have trouble communicating, try inserting a low-pass filter between any phones or fax machines and their respective jacks. The low-pass filter will block noise without impeding the performance of your fax or phone. You can find these filters at most electronics stores.

Also, electrical fields generated by powered communication devices, such as cordless phones or fax machines, can introduce another type of signal noise. A different type of low-pass filter, inserted between the electrical wall outlet and the power cord for the device, can fix this problem.

The last potential issue is rare but much harder to fix. If you have a very large home, or one that has been renovated several times, you may have too much wiring between computers. All of this wiring will weaken the signal, causing it to fade out and lose strength. The result is that not enough of the signal remains if and when it reaches the other computer for that machine to process it. If this is the case, then you will either have to move the computers closer together or redo the wiring, at which point you may want to consider learning about [wireless networking](#).

Many home computer users will find that connecting computers through their phone lines is a good solution, but there are still two other networking technologies to discuss: power-line and wireless networks. For information on these networking technologies, and to learn more about phone-line networks, check out the links on the next page.