



## Home and Small Office Networking Basics

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Many of our readers have two or more computers and have asked how to set up an inexpensive network for their home or small office. This tech note will guide you through the details of hardware you'll need and suggest settings for your computer's Windows operating system that will get your network up and running. The benefits of a local area network (LAN) include the ability to share files, share printers, share Internet access, play games, etc. Once your LAN is operational, it's quite easy to share your cable or DSL Internet access with all the computers on your network. For details, please see my tech note on Computer Networking - High Speed Internet Setup.

The first decision you'll need to make is to install a wired LAN or wireless LAN. If your computers are in close proximity to each other and the wires are not a bother, then a wired LAN is for you. Even if the computers are located in separate rooms, a wired LAN may still be a wise choice if you can run the network cables against the walls, behind the walls, or through the attic, subfloor, or basement. The advantage of a wired LAN is high-speed data transfer using the 100baseT standard: 100 megabits per second (Mbps). When the wire runs are too difficult to install or too unsightly, then a wireless LAN may be right for you. One disadvantage of a wireless system is the significantly slower data transfer, typically 11 Mbps. Since wireless LAN's use radio signals for data transfers it is possible that someone with the right technical skills can intercept your data. Data encryption reduces this probability but the decision of an acceptable level of risk is your personal choice.

### Hardware

For either choice (wired or wireless) you will need to install one network interface card (NIC) in each computer. Many new computers have a network jack built into the motherboard. Older computers without network jacks will require installation of a NIC. A common network card for older computers using the PCI bus is the 3COM 3C905C-TX, available on line for about \$35. Older computers using the ISA bus will need an ISA network card such as the 3COM 3C595C-TX. Follow the installation instructions carefully and don't install the network card until instructed to do so! Hint (this one always gets me!): your Windows 98 network drivers are located on the Windows installation CD under the folder \Win98.

Many printers intended for business users include network cards that enable them to be connected directly to your network. There may be other devices that you wish to connect to your network as well. In this tech note, the collection of printer and "other" devices will be collectively be referred to as printers.

Next, choose the technology you wish to use. For a wired network, purchase a hub or router that suits your anticipated needs. If you presently have four computers, select a hub or router with six or eight ports so you have room to grow. (Note: A port is a jack for the network cable and is found on the hub or computer). A hub uses switching technology and shares the bandwidth of your network between the ports. For example, if all eight computers are conducting network data transfers, the data rate available to each computer is the LAN speed (100 Mbps) divided by the number of ports (100 Mbps / 8 ports = 12.5 Mbps). For only a few dollars more, we recommend that you purchase a router, which will permit full data rate for each port. Another advantage of a wired router is that many come with uplinks for connecting to your cable or DSL modem. We use the Linksys BEFSR81 router, which provides full data rate for each port and includes a cable/DSL port. Typical cost is about \$80.00 for an 8-port router. If

you require more than eight ports or wish to choose from a different manufacturer, there are a number of excellent products available from brands such as Linksys, Netgear, SMC, Cisco, etc.

For a wireless network, you'll need a central wireless access point and a wireless network adapter for each computer and printer. There are many fine products on the market. One we have experience with is the Linksys BEFW11S4 access point and the WUSB11 adapter. Simply plug the wireless network adapters into each computer and printer and the network connections will be completed via radio waves. If you need more than four ports, use conventional wired hubs in combination with the wireless adapters. The older standard, 802.11B (11 Mbps) will provide 11 Mbps at a price of about \$210 for 4 remote PC's, using the above Linksys models. The new standard, 802.11G, provides 54 Mbps at a price of about \$270 for 4 remote PC's, using the WRT54G access point and WUSB54G adapter. Wireless network PCI cards and PC cards for notebook computers are also available.

### Software

Four settings need to be entered for your computer to communicate over the network.

First, select a workgroup name. This can be any combination of letters and numbers but all computers on the network must have this same workgroup. You can use your family name, street number, or something simple like Office.

Second, select a computer name for each computer. The computer name identifies your computer on the network. This is a personal choice but you may enter something like "Mike's Dell" or "Room 101".

To enter these names, navigate to the Network Identification page on your computer. The location of this page varies with each operating system, so if you're not sure then open the Start menu, open Help, and search on "computer name". Enter the workgroup and computer name.

Third, enter the network settings. From the control panel, open network connections, double-click on Local Area Connection, then double-click on Internet Protocol (TCP-IP). If your hub or router automatically assigns the IP address then check the box "Obtain an IP address automatically" (DHCP mode). Otherwise use the Microsoft Internet Connection Sharing standard for IP addresses: enter 192.168.000.001 for the first computer, 192.168.000.002 for the second computer, etc. Note: If the Internet Protocol (TCP-IP) option is not visible, your network card drivers are not installed.

Fourth, (skip if using DHCP mode) enter the subnet mask: 255.255.255.000.

You can leave the gateway, DNS server, and advanced settings blank. When the above settings have been entered, you will need to reboot your computer. Repeat this procedure for each computer on your network taking care to ensure the last three digits of the IP is a unique number between 1 and 255.

### System Check

Upon booting up, your firewall (if installed) will detect the network and ask if you wish to join the network. Click yes to accept. Open your firewall's network settings and add an IP range for the computers on your network. For example, enter 192.168.000.001 to 192.168.000.255. Double-click on network neighborhood to see other computers on the network. They will be listed by the computer name you entered in Software step 2. If your network uses DHCP it will take ten minutes or so to build the name service. Note: The Windows XP firewall is pretty basic and will not give you access to network settings.

### File And Printer Sharing

Now comes the fun part! To share a folder on the network, open Windows Explorer and navigate to the desired folder. Right click and select sharing from the drop-down menu. Enable sharing and give it a share name.

For earlier versions of Windows (95, 98, and ME), you can require a password for a networked computer to access a shared folder. Users of these versions will be required to enter this password when they start Windows or they will receive a prompt when they attempt to access this folder over the network.

Windows NT, 2000, and XP operating systems employ tighter network access security. In order to use file and printer sharing, create accounts for all users on all computers. For example, if Mike wants his computer to access a folder on Nancy's computer, then Mike must have an account on Nancy's computer and his user name and password must be the same on both computers. Shared folders and printers on Nancy's computer will then be available over the network from Mike's computer. Using this technique, file sharing is easy and the password security is transparent to the user.

If you attempt file access on another computer and receive the name/password window, then your name/password combination is not set up on that computer. You will need to add a user account or enter another user's name and password who has an account on that computer and for whom the folder has been shared.

To share a printer on the network, open Control Panel and double-click on Printers. Right click on the local printer (the one that is connected to your computer) and open Properties. Go to the Sharing tab and enable sharing. This process may be slightly different depending on operating system. To access this printer from a networked computer, use the Add Printer wizard. Select Network Printer option and then search for the printer. A list of printers (if available) will be displayed. Select the desired printer and continue. Select the printer model and, if not listed, load drivers from the printer driver disk. If the installation fails, remove the printer and install the printer driver from the printer installation disk. During the install process select networked connection. As with folder sharing, for advanced versions of Windows you'll need an account on the host computer to use its printer.

Setting up network printers (and other network devices) can be tricky. Follow the manufacturers directions for settings. You will need a port on your hub or router for the printer and you'll need to assign an IP either automatically (using DHCP) or manually. In addition, your network printer may require settings for protocol and queue. Use these settings when adding the printer via a networked connection.

#### Network Installation Notes For Technicians

1. When installing network wires behind the walls you will encounter two wiring methods for the wall jacks – type A wiring and type B wiring. Stay with type B wiring since the CAT5 cables you purchase are almost always type B.
2. Use the Ping command to check network communications. Open a command prompt and enter ping [IP address]. (You can also ping the computer name.) For example use the command ping 192.168.000.001. If this computer is on the network you will receive a reply. If not, then the computer is off, disconnected from the network, or not set up properly.
3. Use the IPCONFIG command to read out your computer's network settings. Open a command prompt and enter ipconfig /all to list the computer's IP address, subnet mask, computer name, physical address, etc.

#### Conclusion

Setting up a network is fairly straightforward and will not interfere with other communication functions such as Internet access via modem. Assistance is readily available via search engine requests on the Internet and if all else fails chances are good that you've got a local computer store with a guru that can assist you. Take your time, read the directions carefully, and you'll be up and running in just a few hours.