

Networking Essential

Introduction: - Nobody wants a network. But, a network is something you must have in order to share access to the Internet, check e-mail, easily move music and picture files, or simply share a printer. A local area network (LAN) allows you to do all of these things and more, but the network itself functions in the background and is effectively invisible. Because networks operate silently and out of sight, it's more thrilling to buy and use a new laptop or a powerful desktop system, but without a network and the services it brings, those devices can't do many of the things you want them to do. Nobody wants a network, but most people want what a network can bring with it.

Overview: - In networking, the size of the facility matters, but not as much as you might think. A 3-computer network attached to the Internet has exactly the same fundamental pieces and parts as a 1,000-computer enterprise network. The differences become apparent in the features you need to manage and secure the bigger network. Generally, network components are designed for one of four types of use: small office and home, small and medium enterprise, large enterprise, and carrier. The differences among these classes of products are in what we call the "-ties"--availability, capacity, manageability, reliability, scalability, and security.

The highest grade of products provides reliability of 99.9999 percent uptime per year. They support expansion, monitor their own operation and report their problems, and possess many flexible security functions. The least expensive products carry one-year warranties and function as "black boxes"--you plug them in and they work. But black boxes offer little flexibility or scalability.

People don't want networks, specifically; they want the benefits that networks provide. So, although this buying guide will clearly differentiate the pieces and parts of networking, it will focus more on the benefits of the technology rather than the technology itself. We'll also provide references for helpful technology discussions on the PC Magazine and ExtremeTech Web sites. We'll introduce the basic pieces and parts of a network, describe how they scale in functions and features, offer a guide to costs, and discuss the reality behind some networking myths.

Choice: - Networking offers the best example of the double-edged nature of commercial standards. Networking products from different companies are practically guaranteed to interoperate, because they conform to the same standards. But because they conform to the same detailed standards, there is little that companies can do to differentiate their individual products. Standardization is a great leveler. So companies try to distinguish their products by combining multiple features in one device, as well as by offering different pricing and support strategies. They also do so by stressing the different "-ties" mentioned above.

There is a tendency to group features based on the size of the network, but size is a superficial measurement. A small brokerage office or medical office needs fast response, high security, and extremely high reliability. A large title search company needs high reliability and tremendous storage capacity, but probably doesn't need to pay for the fastest network speed. Here are some general and specific features to look for in your networking products. The level at which you implement the following capabilities (if at all) should be associated closely with the reply to one very important question: How much am I willing to pay for:

- **Availability:** - Availability is a single term that combines reliability and throughput. It's often used to identify servers designed with these attributes.
- **Reliability:** - If you measure your revenue in dollars per minute, you need high reliability. Equipment designers primarily gain reliability by using redundant components. High-reliability servers, routers, storage devices, and switches feature multiple power supplies, redundant connections, and even multiple CPUs. You can also cluster servers and routers together so that each device monitors the operations of the others and is ready to pick up the load for a device that fails. You can even arrange a print server so it sends print jobs to a ready printer if the destination printer fails.
- **Throughput:** - Throughput, or network capacity, is related to speed. Fast connections can offer high throughput if they're properly configured, but high throughput also means that there are no constrictions or contentions for network services (such as access to Internet or intranet connections, to DHCP services, to DNS, and so forth). The design of high-throughput systems begins with sufficient transmission and processing speed and extends to optimal addressing and network organization.

- **Manageability:** - Do you have branch offices where there is no on-site IS support? Do you have a large campus environment or warehouses that are more than a minute or two walk from the IS offices? If so, then your networked devices should be equipped with management capabilities. The Simple Network Management Protocol (SNMP) describes specific monitoring and management capabilities for different kinds of devices. If you invest in products with internal SNMP services, then you can remotely monitor and manage their operation. You can also receive notification of problems and detailed operation reports over time.
- **Scalability:** - Invest in scalable equipment so you won't have to replace devices if your network grows. Companies offer switches and other components in stackable and chassis-based configurations that allow added devices to become part of a larger single device. If the size of your network is fixed and you don't require scalability, though, then you can consider less expensive closed systems consisting of a single cabinet with no expansion capability. Is scalability an issue in a home or in home-office network configurations? Interestingly, yes. Some home-networking routers come with 4-port switches and some come with 8- or 12-port switches. If you choose a more affordable 4-port device, then you'll face another investment and reconfiguration of cables if you add a fifth computer or a printer, a wireless access point, or some other networked device.
- **Security:**-Generally, security features are like insurance. You should have all that you need, but you shouldn't pay for more than you need. The best way to gauge your need for network security is to look at the security of the building housing your network. Do you have a high fence and uniformed guards controlling building access? Do you grant access to specific areas based on possession of a key card or through more rigorous techniques, such as fingerprint scanning? Your investment in network security should complement your investment in building security.

Networking products offer many types of optional security features. For example, some Ethernet adapters can encrypt the data traveling among networked devices. Switches can keep lists of authorized Ethernet adapters and allow only specific adapters to access designated servers or services. Specialized certificate servers will only allow certain individuals to access preapproved applications.

Authentication techniques, such as fingerprint or retinal scanning, ensure that people are who they claim to be.

- **Warranties and upgrades:** - One-year warranties are common on networking equipment, but many products need periodic upgrades. Companies selling high-capacity and high-reliability products often offer better warranties. Devices such as firewalls, routers, and antivirus software need frequent and regular upgrades.

Budget: - The cost of any networking product is driven as much by the optional features as by the basic functions of the device. For example, you can get a 16-port workgroup-quality switch with no management or scalability features for around \$170. On the flip side, a 12-port switch with management capabilities and the option to add Gigabit Ethernet connections can run as much as \$680. Add on even more expansion and the cost of that same switch may soar to \$1,850.

The least expensive Ethernet adapter you're likely to find costs about \$15. If you want managed devices, so you'll have the ability to remotely query adapters about their health and activities, you'll pay about \$59. Adapters that can encrypt data going across the network cost about \$99. Wireless LAN adapters range from \$100 to \$140 depending on the brand.

The routers or gateways used in homes or small businesses to share a cable modem or DSL connection carry prices of \$90 to \$250 depending on the optional features you add--capabilities such as a virtual private networking, firewall protection, URL filtering, and wireless LAN connectivity. In contrast, a quality branch-office router, with good capacity, management features, flexibility, and scalability can cost over \$2,000. Higher-capacity routers tend to cost tens of thousands of dollars.

In order to put all of this in perspective, let's take a look at sample budgets for three different types of networks. This will give you an approximation of what you'll need to spend today to get your network up and running.

Sample network budgets

- **Example:** - A home network with two desktops and two laptops designed to share an Internet connection, disk space, and printer connections.

Cable/DSL router with an integrated 8-port switch	\$200
2 16-bit, 10-Mbps Ethernet adapters for a desktop PC	\$35
2 16-bit, 10/100 Ethernet PC Card adapters	\$100
4 20-foot Ethernet cables with connectors	\$45
<u>Total:</u>	<u>\$380</u>

Note: - If you created the same network using wireless LAN connections for the two laptops, you would replace the two Ethernet PC Card adapters and two cables with an integrated wireless router and two wireless PC Cards, increasing the total cost by about \$200

Reality Check

Myth

You should install Category 5e or Category 6 cabling so you can be ready for Gigabit Ethernet and services, such as streaming video.

Applications like Microsoft Office can find and automatically install printers across the network.

Any electrician can install network cabling.

Reality

Using high-quality cables is critically important, but it is not necessary to buy cables meeting so-called advanced CAT 5e or CAT 6 standards. Even Gigabit Ethernet runs over Category 5 standard cabling.

People have zero tolerance for printer problems. You should take the time to carefully plan the way your applications address network printers. Print servers can help to improve reliability by spooling print jobs and directing them to available printers.

Actually, few electricians know anything about network cabling. Cable installation is a specialized trade. Ideally you'll install Category 5 cabling during initial building or renovation. Otherwise, a nice installation is expensive and an

For the most part, setting up a network is a matter of connecting a bunch of boxes with cables. Anyone comfortable around a PC can make a network happen.

If the network products have internal fans, they can handle ambient room temperatures.

If I provide backup power for the servers, the network will stay operational.

inexpensive installation is messy. Building a network of more than a dozen PCs requires the help of a professional cable installer.

A good network VAR (value-added reseller) is a valuable friend. Using a local reseller to install and manage your network can mean that you'll be operational faster and with fewer problems. Make sure, though, that the VAR will be there the instant you have a problem. If networking is core to your business, or if you measure revenue in terms of dollars per minute, then you need to build in-house expertise.

Corporate data centers provide environmental control and backup power for all networking equipment. Smaller companies often can't dedicate the space to a data center, so they put the networking devices in closets. Remember that these devices create heat and that heat kills electronics. Adding even a single air conditioning outlet can increase the life of your equipment and protect your investment.

You provided UPS standby power for your desktop computers and your servers, but did you give backup power to every hub, switch, and router? If these devices don't have power, your network is down.