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Table of Contents

If you're viewing this document online, you can click any of the topics below to link directly to that section.

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WHAT IS A LAN?

A Local Area Network (LAN) allows computing equipment to share information from any device on a network with other devices on the same network, and includes cabling, network transmission devices, network interfaces, and computing devices. Some examples of computing devices on a LAN include:

File Servers--Computers which "serve" as central storage facilities for data and program files.

Print Servers--Computers with one or more printers attached that provide printing "services" to other computers on the LAN. Some printers have special interfaces which allow the printer itself to act as a print server on a network.

Modem/Fax/Communications Servers--Devices which allow computers on the LAN to communicate outside the network through a standard local telephone system. It is also possible, with appropriate communications servers and software, to allow external computers to "dial-in" to a LAN and communicate (data and/or faxes) with devices on the LAN.

COMPUTER COMMUNICATIONS

Different kinds of computers use different methods, or protocols, to communicate with each other. Macintosh computers use the AppleTalk protocol. Macintosh as well as PCs can use TCP/IP to share information on the Internet. Some PCs require a Network Operating System (NOS) to communicate. For example, Novell Netware is a popular NOS with PC users.

SERVERS AND CLIENTS

A server computer provides a special service (examples described above) while a client computer requests and receives a service from a server. The same computer could be a client or a server, depending upon the type of data communications taking place. For example, a computer could serve one of its files to another computer, but it could also receive a file from that computer.
USES FOR LANS IN A SCHOOL BUILDING

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-- sharing printers

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-- electronic mail

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-- sharing programs

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-- school bulletin boards

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-- centralized file sharing

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-- access to library databases

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-- access to the library card catalog

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-- sending and receiving faxes

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-- cost-effective connection to external networks

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-- school information system for administrators, teachers,

students, parents and the community

USES FOR LANS DISTRICT WIDE

District uses for LANs include all of the above, but in particular:

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-- file sharing (student information)

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-- transmission of records (attendance, grades, discipline)

-- electronic mail

-- shared use of one district connection to the Internet

Note: The interconnection of multiple building LANs is often accomplished by Wide Area Networking (WAN) through radio transmission or through leased data lines from a telephone company.

TYPES OF LANS

Common types of LAN hardware are Ethernet and Token Ring. Ethernet predominates because it is easily designed and is composed of data transfer devices which are less expensive than similar Token Ring devices. The performance of Ethernet and Token Ring are roughly the same in most situations. While it is possible to interconnect Ethernet and Token Ring networks in the same location, it adds to cost and complexity. It is best to keep the configuration of a school's data communication infrastructure as simple as possible. Another standard for data communication is ATM (Asynchronous Transfer Mode). It is more expensive than Ethernet or Token Ring but allows higher speeds and will eventually allow better integration of computer-data, digitized voice (telephone), and video. Some suggestions for choosing a LAN include:
If a school does not have an existing high speed data network, choose Ethernet.

If a school has an extensive Ethernet or Token Ring LAN, continue with that standard.

If a school has a small Token Ring LAN and a significant extension of the LAN is being proposed, two cost projections should be made. One estimate should include costs for extending the existing Token Ring LAN, and another for replacing the entire LAN with Ethernet.

If a school or district receives maintenance assistance from an organization which only supports Token Ring, it is sometimes appropriate, if not necessary, to choose Token Ring.

DESIGN CONSIDERATIONS

Cabling medium. The most cost-effective cabling is Category 5 twisted-pair cable. This cable works with standard Ethernet (10 Million bits per second, 10 Mbps) and "fast" Ethernet (100 Mbps), and is capable of speeds up to 150 Mbps with existing technology. This has become the cable of choice in most LAN designs. Fiber-optic cable transmits more data, but materials and installation are much more expensive.

Proper installation of fiber-optic cable is difficult in an old building because the cable should not be bent during installation or when finally terminated (an 8" minimum bending radius is allowed).

Wiring plan. The location of wiring cabinets/closets is dependent on suitable locations in the building and distances between computers. The maximum distance between a computer and a network wiring cabinet/closet is 10 meters. A refrigerator-sized cabinet where cables come together and network transmission equipment (and sometimes servers) are stored can be enclosed with doors and stand in a large room, or it can be placed as an open rack in a small room or closet. Wiring cabinets/closets can be interconnected with twisted-pair cable, but fiber-optic cable is a better choice for a variety of reasons, especially higher speed.

Number of network connections (plug-in points) per room. Every computer needs a network connection and each connection is comprised of (1) a plug-in point in the wall of the room, and (2) wiring from this point to the wiring cabinet/closet. Short and long term technology goals need to be considered when planning the number of network connections per room.

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-- Regular classrooms: Provide from one to six network connections per regular classroom.

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-- Special classrooms: A minimum of one network connection should be provided in home economics, physical education, music, and art rooms. Some schools equip these rooms, and special education and reading rooms, just like regular classrooms and provide up to six network connections.

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-- Technology classrooms: This room could be equipped like a regular classroom, but some districts place emphasis on computer and communication technology in their technology curricula, especially at the middle school level, and may often provide a network connection ratio of one connection per two students (15 connections in a room which holds up to 30 students).

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-- Computing classrooms: It is advantageous to maintain at least one classroom per school which provides one computer per student (30 network connections for classes of up to 30 students).

-- Library: The library can become an even more versatile center for access to information, research, and creative endeavors if it is wired with network connections. Networked computers can be used to access an online card catalog within the school, or online catalogs from other schools in the district. If the school has a connection to external networks, a LAN allows every computer in the library (and in the school) to access online catalogs and databases from a variety of locations. A connection to the Internet, for example, provides access to college, university, and government libraries throughout the world. Networked multimedia workstations in libraries, allow students to access multimedia databases, encyclopedias, and other graphic/visual-oriented resources. Many school libraries locate network connections in as many places as possible in the library. Librarians recognize that computers will become increasingly prevalent in libraries as cost-effective replacements for expensive and space-consuming resources like serials, periodicals, newspapers, an reference books.

* Administrative offices: At least one network connection per person should be provided for administrative purposes. Two connections per person will allow for the connection of printers and other network devices.

* Other offices: The offices of school nurses, psychologists, career/guidance counselors, home/school counselors, and other academic support personnel should have at least one network connection per person.

ADDITIONAL THINGS TO REMEMBER WHEN DESIGNING A SCHOOL'S LAN

Network outlets. Locate near the area where the computers are/will be located. Electrical outlets. Locate near the network outlets. If electrical outlets are installed for future use, be sure the building's power supply and power distribution infrastructure is adequate to handle the added computers. Because the cost of providing electrical service can be substantial (as much as half of the cost of a LAN itself), it is prudent to consider this cost at the same time as estimating the cost of the LAN.

Furniture and fixtures location. When developing a wiring plan, consider the placement of furniture and stationary fixtures.

Wiring. When wiring for a LAN, run additional cabling for other purposes at the same time because the cost benefits are often substantial. The installation of cabling for the

following purposes should be considered when installing LAN cabling:

* cable TV

* telephone and intercom

* alarms/security

* environmental sensors

Potential use of space. Include every room in the LAN design which might ever house a class, group, or office. It is much less expensive to design and install a network for an entire building than it is to "modularize" into smaller LAN projects (classrooms in one project and offices in another project). Room use may change over the years (large closets may become offices or small classrooms, for example).

SUMMARY

There are many aspects of LAN design to consider when developing a technology plan for a school building or school district. This digest has indicated several key design issues, however one should contact an experienced consultant or network designer before finalizing a LAN design.

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