Connectivity

Glossary

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10BASE-T

The most widely installed Ethernet local area networks (LANs) use ordinary telephone twisted-pair wire. When used on Ethernet, this carrier medium is known as 10BASE-T. 10BASE-T supports Ethernet's 10 Mbps transmission speed. In addition to 10BASE-T, 10 megabit Ethernet can be implemented with these media types:

10BASE-2 (Thin wire coaxial cable with a maximum segment length of 185 meters)

10BASE-5 (Thick wire coaxial cable with a maximum segment length of 500 meters)

10BASE-F (Fiber optic cable)

This designation is an IEEE shorthand identifier. The "10" in the media type designation refers to the transmission speed of 10 Mbps. The "BASE" refers to base band signaling, which means that only Ethernet signals are carried on the medium. The "T" represents twisted-pair; the "F" represents fiber optic cable; and the "2" and "5" refer to the coaxial cable segment length (the 185 meter length has been rounded up to "2" for 200).

Also see 100BASE-T and Gigabit Ethernet.

100BASE-T

In 100 Mbps (megabits per second) Ethernet (known as Fast Ethernet), there are three types of physical wiring that can carry signals:

100BASE-T4 (four pairs of telephone twisted pair wire)

100BASE-TX (two pairs of data grade twisted-pair wire)

100BASE-FX (a two-strand fiber optic cable)

This designation is an IEEE shorthand identifier. The "100" in the media type designation refers to the transmission speed of 100 Mbps. The "BASE" refers to base band signaling, which means that only Ethernet signals are carried on the medium. The "T4," "TX," and "FX" refer to the physical medium that carries the signal. (Through repeaters, media segments of different physical types can be used in the same system.)

The TX and FX types together are sometimes referred to as "100BASE-X." (The designation for "100BASE-T" is also sometimes seen as "100BaseT.")

A

ACTIVE MATRIX

Active Matrix, also known as TFT or thin film transistor, is a technology used in the flat panel liquid crystal displays of notebook and laptop computers. Active matrix displays provide a more responsive image at a wider range of viewing angle than dual scan (passive matrix) displays.

Desktop computer displays or monitors usually have cathode ray tube technology.

ACTIVEX

ActiveX is the name Microsoft has given to a set of "strategic" object-oriented program technologies and tools. The main technology is the Component Object Model (COM). Used in a network with a directory and additional support, COM becomes the Distributed Component Object Model (DCOM). The main thing that you create when writing a program to run in the ActiveX environment is a component, a self-sufficient program that can be run anywhere in your ActiveX network (currently a network consisting of Windows and Macintosh systems). This component is known as an ActiveX control. ActiveX is Microsoft's answer to the Java technology from Sun Microsystems. An ActiveX control is roughly equivalent to a Java applet.

If you have a Windows operating system on your personal computer, you may notice a number of Windows files with the "OCX" file name suffix. OCX stands for "Object Linking and Embedding control." Object Linking and Embedding (OLE) was Microsoft's program technology for supporting compound documents such as the Windows desktop. The Component Object Model now takes in OLE as part of a larger concept. Microsoft now uses the term "ActiveX control" instead of "OCX" for the component object.

One of the main advantages of a component is that it can be re-used by many applications (referred to as component containers). A COM component object (ActiveX control) can be created using one of several languages or development tools, including C++ and Visual Basic, or PowerBuilder, or with scripting tools such as VBScript.

Currently, ActiveX controls run in Windows 95/98/NT and in Macintosh. Microsoft plans to support ActiveX controls for UNIX.

An ActiveX control is a component program object that can be re-used by many application programs within a computer or among computers in a network. The technology for creating ActiveX controls is part of Microsoft's overall ActiveX set of technologies, chief of which is the Component Object Model (COM). ActiveX controls can be downloaded as small programs or animations for Web pages, but they can also be used for any commonly needed task by an application program in the latest Windows and Macintosh environments. In general, ActiveX controls replace the earlier OCXs (Object Linking and Embedding custom controls). An ActiveX control is roughly equivalent in concept and implementation to the Java applet.

An ActiveX control can be created in any programming language that recognizes Microsoft's Component Object Model (COM). An ActiveX control is a component or self-contained program package that can be created and reused by many applications in the same computer or in a distributed network. The distributed support for COM is called the Distributed Component Object Model (DCOM). In implementation, an ActiveX control is a Dynamic Link Library (DLL) module. An ActiveX control runs in what is known as a container, an application program that uses the Component Object Model program interfaces. This re-useable component approach to application development reduces development time and improves program capability and quality. Windows 95 and NT application development programs such as Powerbuilder and Microsoft Access take advantage of ActiveX controls.

Visual Basic and C++ are commonly used to write OCX or ActiveX controls.

ADO

ADO (ActiveX Data Objects) is an application program interface (API) from Microsoft that lets programmers writing Windows applications get access to relational and non-relational databases from both Microsoft and other database providers. For example, if you wanted to write a program that would provide users of your Web site with data from an IBM DB2 database or an Oracle database, you could include ADO program statements in an HTML file that you then identified as an Active Server Page (ASP). When a user requested the page from the Web site, the page sent back could include appropriate data from a database, obtained using ADO code.

Like Microsoft's other system interfaces, ADO is an object-oriented interface. It is also part of an overall data access strategy from Microsoft called Universal Data Access (UDA). Microsoft says that rather than try to build a universal database as IBM and Oracle have suggested, why not provide universal access to various kinds of existing and future databases? In order for this to work, Microsoft and other database companies provide a "bridge" program between the database and Microsoft's OLE DB, the low-level interface to databases. OLE DB is the underlying system service that a programmer using ADO is actually using. A feature of ADO, Remote Data Service, supports "data-aware" ActiveX controls in Web pages and efficient client-side caching. As part of ActiveX, ADO is also part of Microsoft's overall Component Object Model (COM), its component-oriented framework for putting programs together.

ADO evolved from an earlier Microsoft data interface, Remote Data Objects (RDO). RDO works with Microsoft's ODBC to access relational databases, but not non-relational databases such as IBM's ISAM and VSAM.

ARCNET

Attached Resource Computer Network

ARCnet is a widely installed local area network technology from the Datapoint Corporation, the originator of the local area network. ARCnet uses a token-bus scheme for managing line sharing among the workstations and other devices connected on the LAN. The LAN server continuously circulates empty message frames on a bus (a line in which every message goes through every device on the line and a device uses only those with its address). When a device wants to send a message, it inserts a "token" (this can be as simple as setting a token bit to 1) in an empty frame in which it also inserts the message. When the destination device or LAN server reads the message, it resets the token to 0 so that any other device can reuse the frame. The scheme is very efficient when traffic increases since all devices are afforded the same opportunity to use the shared network.

ARCnet can use coaxial cable or fiber optic lines. Cable lengths can be up to 2,000 feet per segment with a total network span of 20,000 feet without bandwidth loss. ARCnet's bandwidth or information flow capacity is 2.5 Mbps. Of the four major LAN technologies (which also include Ethernet, token ring, and FDDI), ARCnet is said to be the least expensive to install.

ASCII

American Standard Code for Information Interchange

ASCII is the most common format for text files in computers and on the Internet. In an ASCII file, each alphabetic, numeric, or special character is represented with a 7-bit binary number (a string of seven 0s or 1s). 128 possible characters are defined.

UNIX and DOS-based operating systems (except for Windows NT) use ASCII for text files. Windows NT uses a newer code, Unicode. IBM's System 390 servers use a proprietary 8-bit code called EBCDIC. Conversion programs allow different operating systems to change a file from one code to another.

ASCII was developed by the American National Standards Institute (ANSI).

ATM

ATM (Asynchronous Transfer Mode) is a dedicated-connection switching technology that organizes digital data into 53-byte cell units and transmits them over a physical medium using digital signal technology. Individually, a cell is processed asynchronously relative to other related cells and is queued before being multiplexed over the transmission path.

Because ATM is designed to be easily implemented by hardware (rather than software), faster processing and switching speeds are possible. The pre-specified bit rates are either 155.520 Mbps or 622.080 Mbps. Speeds on ATM networks can reach 10 Gbps. Along with SONET and several other technologies, ATM is a key component of broadband ISDN (BISDN).

B

BACKBONE

A backbone is a larger transmission line that carries data gathered from smaller lines that interconnect with it.

1) At the local level, a backbone is a line or set of lines that local area networks connect to for a wide area network connection or within a local area network to span distances efficiently (for example, between buildings).

2) On the Internet or other wide area network, a backbone is a set of paths that local or regional networks connect to for long-distance interconnection. The connection points are known as network nodes or telecommunication data switching exchanges (DSEs).

BASIC

Beginner's All-Purpose Symbolic Instruction Code, or BASIC, was an early programming language that is still among the simplest and most popular of programming languages. Originally designed as an interactive mainframe timesharing language by John Kemeney and Thomas Kurtz in 1963, it became widely used on personal computers everywhere. On IBM's first "family" computer, the PC Jr., a BASIC cartridge was a popular add-on. Because of its simplicity, BASIC has frequently been used in teaching the introductory concepts of programming with a working language.

BASIC continues to be widely used because it can be learned quickly, its statements are easy to read by other programmers, and support is available on most operating systems. BASIC's documentation has been translated into many national languages. It often comes with sound and graphics support. A popular version of BASIC today is QBASIC.

BASIC is used in many business applications and is still considered a valid choice as a programming language for some purposes. Microsoft's Visual Basic adds object-oriented features and a graphical user interface to the standard BASIC.

The following example of BASIC gets a number from a user, multiplies the number by 10, and prints or displays the result:

```
10 PRINT 'Enter a number'

20 INPUT NUM

30 PRINT 'Your number * 10 is ';NUM*10;
```

BAUD

Baud was the prevalent measure for data transmission speed until replaced by a more accurate term, bps (bits per second). One baud is one electronic state change per second. Since a single state change can involve more than a single bit of data, the bps unit of measurement has replaced it as a better expression of data transmission speed.

The measure was named after a French engineer, Jean-Maurice-Emile Baudot. It was first used to measure the speed of telegraph transmissions.

BROWSER

A browser is an application program that provides a way to look at and interact with all the information on the World Wide Web. The word "browser" seems to have originated prior to the Web as a generic term for user interfaces that let you browse text files online. By the time the first Web browser with a graphical user interface was invented (Mosaic, in 1992), the term seemed to apply to Web content, too. Technically, a Web browser is a client program that uses the Hypertext Transfer Protocol (HTTP) to make requests of Web servers throughout the Internet on behalf of the browser user. A commercial version of the original browser, Mosaic, is in use. Many of the user interface features in Mosaic, however, went into the first widely used browser, Netscape Navigator. Microsoft followed with its Internet Explorer. Today, these two browsers are highly competitive and the only two browsers that the vast majority of Internet users are aware of. Although the online services, such as America Online, CompuServe, and Prodigy, originally had their own browsers, virtually all now offer the Netscape or Microsoft browser. Lynx is a text-only browser for UNIX shell and VMS users. Another recently offered browser is Opera.

C

CAT 5

ANSI/EIA (American National Standards Institute/Electronic Industries Association) Standard 568 is one of several standards that specify "categories" (the singular is commonly referred to as "CAT")

of twisted pair cabling systems (wires, junctions, and connectors) in terms of the data rates that they can sustain. The specifications describe the cable material as well as the types of connectors and junction blocks to be used in order to conform to a category. These categories are:

Category	Maximum data rate	Usual application
CAT 1	Less than 1 Mbps	Analog voice (plain old telephone service)
		ISDN Basic Rate Interface
		Doorbell wiring
CAT 2	4 Mbps	Mainly used in the IBM Cabling System for
		Token Ring networks
CAT 3	16 Mbps	Voice and data on 10BASE-T Ethernet
CAT 4	20 Mbps	Used in 16Mbps Token Ring
		Otherwise not used much
CAT 5	100 Mbps	100 Mbps TPDDI
		155 Mbps ATM

CAT 5 is currently under consideration to be incorporated into the Gigabit Ethernet specification for short distance wiring. While longer connections using Gigabit Ethernet use optical fiber, the goal is to leverage the CAT 5 twisted-pair wiring most organizations already have in place for connections out to the desktop.

The two most popular specifications are CAT 3 and CAT 5. While the two cables may look identical, CAT 3 is tested to a lower set of specifications and can cause transmission errors if pushed to faster speeds. CAT 3 cabling is NEXT-certified for only a 16 MHz signal, while CAT 5 cable must pass a 100 MHz test.

CDMA

Code-Division Multiple Access

CDMA, one of the three wireless telephone transmission technologies, takes an entirely different approach from GSM and the similar TDMA. CDMA, after digitizing data, spreads it out over the entire bandwidth it has available. Multiple calls are overlaid over each other on the channel, with each assigned a unique sequence code.

The digital wireless personal communication service (PCS) is expected to use CDMA widely in the United States. A group called PCS PrimeCo that includes NYNEX, Bell Atlantic, USWest and Airtouch Communications has announced plans for PCS systems that use CDMA.

CLIENT / SERVER

Client/server describes the relationship between two computer programs in which one program, the client, makes a service request from another program, the server, which fulfills the request. Although the client/server idea can be used by programs within a single computer, it is a more important idea in a network. In a network, the client/server model provides a convenient way to

interconnect programs that are distributed efficiently across different locations. Computer transactions using the client/server model are very common. For example, to check your bank account from your computer, a client program in your computer forwards your request to a server program at the bank. That program may in turn forward the request to its own client program that sends a request to a database server at another bank computer to retrieve your account balance. The balance is returned back to the bank data client, which in turn serves it back to the client in your personal computer, which displays the information for you.

The client/server model has become one of the central ideas of network computing. Most business applications being written today use the client/server model. So does the Internet's main program, TCP/IP. In marketing, the term has been used to distinguish distributed computing by smaller dispersed computers from the "monolithic" centralized computing of mainframe computers. But this distinction has largely disappeared as mainframes and their applications have also turned to the client/server model and become part of network computing.

In the usual client/server model, one server, sometimes called a daemon, is activated and awaits client requests. Typically, multiple client programs share the services of a common server program. Both client programs and server programs are often part of a larger program or application. Relative to the Internet, your Web browser is a client program that requests services (the sending of Web pages or files) from a Web server (which technically is called a Hypertext Transport Protocol or HTTP server) in another computer somewhere on the Internet. Similarly, your computer with TCP/IP installed allows you to make client requests for files from File Transfer Protocol (FTP) servers in other computers on the Internet.

Other program relationship models included master/slave, with one program being in charge of all other programs, and peer-to-peer, with either of two programs able to initiate a transaction.

COM

COM (Component Object Model) is Microsoft's framework for developing and supporting program component objects. It is aimed at providing similar capabilities to those defined in CORBA (Common Object Request Broker Architecture), a framework for the interoperation of distributed objects in a network that is supported by other major companies in the computer industry. Whereas Microsoft's OLE provides services for the compound document that users see on their display, COM provides the underlying services of interface negotiation, life cycle management (determining when an object can be removed from a system), licensing, and event services (putting one object into service as the result of an event that has happened to another object).

CONTAINER

In Microsoft's Component Object Model (COM), a container is an application program or subsystem in which the program building block known as a component is run. For example, a component - such as a button or other graphical user interface or a small calculator or database requestor - can be developed using JavaBeans that can run in Netscape containers such as browsers and in Microsoft containers such as Internet Explorer, Visual Basic, and Word.

CONTROL NETWORK

Control network is a network of nodes that collectively monitor, sense, and control or enable control of an environment for a particular purpose. A home appliance network is a good example of a control network. In fact, thousands of control networks already exist in everyday life in automobiles, refrigerators, traffic light controls, city lighting systems, and on factory floors. Control networks vary enormously in the number of nodes (from three to thousands) in the network and in their complexity. Unlike networks that people use to communicate with each other, control networks tend to be invisible. In the future, control networks are expected to become an important aspect of what is sometimes called ubiquitous computing.

Communication between nodes in a control network may be peer-to-peer or master-slave. The nodes in some control networks contain three processors in one: two dedicated to moving data within the network and one for the specialized program associated with that node. This modularity makes it cheaper and faster to build new processors for control networks. Increasingly, control networks are being made from off-the-shelf hardware and software components.

One future role for control networks will be as the controllers of micro-electromechanical systems (MEMS), sometimes referred to as smart matter. Because it greatly expands the number of items in the world that can be uniquely addressed in a network, IPv6, a new version of the Internet Protocol (IP), is expected to make remote access and control of all kinds of devices possible, including every networked appliance at your office or at home. Sun Microsystem's Jini, will make it easy to plug new devices into a control network and have their characteristics immediately recognized by the system.

CSMA/CD

CSMA/CD (Carrier Sense Multiple Access/Collision Detect) is the protocol for carrier transmission access in Ethernet networks. On Ethernet, any device can try to send a frame at any time. Each device senses whether the line is idle and therefore available to be used. If it is, the device begins to transmit its first frame. If another device has tried to send at the same time, a collision is said to occur and the frames are discarded. Each device then waits a random amount of time and retries until successful in getting its transmission sent.

CSMA/CD is specified in the IEEE 802.3 standard.

CYBERPUNK

Cyberpunk is a sensibility or belief that a few outsiders, armed with their own individuality and technological capability, can fend off the tendencies of traditional institutions to use technology to control society. The term, combining "cyber" and punk, possibly originated in 1980 with Bruce Bethke's short story, "Cyberpunk." An editor of Isaac Asimov's Science Fiction Magazine, Gardner Dozois, is credited with associating the word with a literary movement that includes the science fiction of William Gibson and Neal Stephenson.

The alt.cyberpunk.FAQ lists several categories of groups associated with cyberpunk:

Hackers, who represent the best kind of cyberpunk

Crackers, who attempt to break into computer systems

Phreaks, who attempt to break into telephone systems

Cypher-punks, who attempt to break codes and foil security systems

Additional groups include "transhumans," who attempt to exploit technology to increase life expectancy and human potential and "extropians," a kind of libertarian group that believes in something called "spontaneous order." The writer of the alt.cyberpunk.FAQ indicates that some people believe cyberpunk to be (intrinsically) indefinable and that anyone claiming to be a "cyberpunk" will likely be laughed off their Usenet newsgroup.

D

DCOM

DCOM (Distributed Component Object Model) is a set of Microsoft concepts and program interfaces in which client program objects can request services from server program objects on other computers in a network. DCOM is based on the Component Object Model (COM), which provides a set of interfaces allowing clients and servers to communicate within the same computer (that is running Windows 95 or a later version).

For example, you can create a page for a Web site that contains a script or program that can be processed (before being sent to a requesting user) not on the Web site server but on another, more specialized server in the network. Using DCOM interfaces, the Web server site program (now acting as a client object) can forward a Remote Procedure Call (RPC) to the specialized server object, which provides the necessary processing and returns the result to the Web server site. It passes the result on to the Web page viewer.

DCOM can also work on a network within an enterprise or on other networks besides the public Internet. It uses TCP/IP and HTTP. DCOM comes as part of NT 4.0 and is a free upgrade for Windows 95. DCOM is or soon will be available on all major UNIX platforms and on IBM's large server products. DCOM replaces OLE Remote Automation.

DCOM is generally equivalent to the Common Object Request Broker Architecture (CORBA) in terms of providing a set of distributed services. DCOM is Microsoft's approach to a network-wide environment for program and data objects. CORBA is sponsored by the rest of the information technology industry under the auspices of the Object Management Group (OMG).

DDE

In the Windows, OS/2, and (with third-party development kits) other operating systems, DDE (Dynamic Data Exchange) allows information to be shared or communicated between programs. For example, when you change a form in your database program or a data item in a spreadsheet program, they can be set up to also change these forms or items anywhere they occur in other programs you may use. DDE is inter-process communication (IPC) that uses shared memory as a common exchange area and provides applications with a protocol or set of commands and message formats. DDE uses a client/server model in which the application requesting data is considered the client and the application providing data is considered the server.

Thousands of applications use DDE, including Microsoft's Excel, Word, Lotus 1-2-3, AmiPro, Quattro Pro, and Visual Basic.

Another facility, NetDDE, allows programs to converse across networks. For example, a Superbase program on one network node could be updated whenever an Excel program on a network node was updated. Both nodes must have NetDDE installed.

DHCP

DHCP (Dynamic Host Configuration Protocol) is a protocol that lets network administrators manage centrally and automate the assignment of Internet Protocol (IP) addresses in an organization's network. Using the Internet's set of protocols (TCP/IP), each machine that can connect to the Internet needs a unique IP address. When an organization sets up its computer users with a connection to the Internet, an IP address must be assigned to each machine. Without DHCP, the IP address must be entered manually at each computer and, if computers move to another location in another part of the network, a new IP address must be entered. DHCP lets a network administrator supervise and distribute IP addresses from a central point and automatically sends a new IP address when a computer is plugged into a different place in the network.

DHCP uses the concept of a "lease" or amount of time that a given IP address will be valid for a computer. The lease time can vary depending on how long a user is likely to require the Internet connection at a particular location. It is especially useful in education and other environments where users change frequently. Using very short leases, DHCP can dynamically reconfigure networks in which there are more computers than there are available IP addresses.

DHCP supports static addresses for computers containing Web servers that need a permanent IP address.

DHCP is an alternative to another network IP management protocol, BOOTP (Bootstrap Protocol). DHCP is a more advanced protocol, but both configuration management protocols are commonly used. Some organizations use both protocols, but understanding how and when to use them in the same organization is important. Some operating systems, including Windows NT, come with DHCP servers. A DHCP or BOOTP client is a program that is located in (and perhaps downloaded to) each computer so that it can be configured.

DNA

Distributed Internet Applications Architecture

In the computer industry, DNA (Distributed interNet Applications Architecture) is the Microsoft name for a group of technologies intended to make it possible for a company to build applications that take advantage of both the Windows platform and the distributed application and data possibilities of the Internet. In Microsoft's view, users and companies want both the capabilities of the Windows interface and applications on their PCs and the ability to locate and use other applications and data on the Internet. DNA is Microsoft's framework for fitting Windows and the PC into the 3-tier application concept in which presentation and local applications and data are performed on the PC while business processing and database management take place at other places in a network.

In addition to the Windows operating system and the Internet Explorer browser, Microsoft identifies these concepts, services, and products as part of its Distributed interNetwork Applications Architecture:

- The Component Object Model (COM), including both:
    - Microsoft's own COM and related technologies
    - Industry specifications based on COM
- Presentation Services (the mechanics of managing the user interface) including:
    - HTML and Dynamic HTML (DHTML)
    - Scripting
- Components (such as windows, icons, task bars, and so forth)
- Win32
- Application Services
- Data Access Services
- Universal Data Access (UDA)
- ActiveX Data Objects (ADO)
- OLE DB

DNS

Domain naming, and its most visible component, the Domain Name Service (DNS), is critical to the operation of the Internet. The average American phone number, with area code, is 10 digits in length and encodes 10^10, or 10,000,000,000 possibilities. The Internet IP address, at 32 bits, encodes 2^32 or 4,294,967,296 possibilities. For human engineering purposes, how can we build an effective directory of these difficult large numbers?

The telephone company solves this problem with lots of large paper directories, and operators you call and ask about numbers not in your directory. The Internet solves this problem with a hierarchy of simple, mnemonic names, called domain names. Instead of remembering 205.216.138.22, all I need to know is the host's domain name - ns.adnc.com. Some people think the dots in a domain name correspond to the dots in the numeric address. This is not the case. There are always three periods in an IP address, separating its four constituent bytes. There are a variable number of periods in a domain name.

The crucial DNS documentation is provided in RFC 1034 and RFC 1035. The Encyclopedia's Programmed Instruction Course has a DNS Section, and the Encyclopedia's software section has a Dig page, discussing use of this free software diagnostic tool. DNS also plays an important role in Internet mail delivery.

DSL

DSL (Digital Subscriber Line) is a technology for bringing high-bandwidth information to homes and small businesses over ordinary copper telephone lines.

E

EDI

EDI (Electronic Data Interchange) is a standard format for exchanging business data. The standard is ANSI X12 and it was developed by the Data Interchange Standards Association. ANSI X12 is either closely coordinated with or is being merged with an international standard, EDIFACT.

An EDI message contains a string of data elements, each of which represents a singular fact, such as a price, product model number, and so forth, separated by delimiters. The entire string is called a data segment. One or more data segments framed by a header and trailer form a transaction set, which is the EDI unit of transmission (equivalent to a message). A transaction set often consists of what would usually be contained in a typical business document or form. The parties who exchange EDI transmissions are referred to as trading partners.

EDI messages can be encrypted and decrypted. EDI is one form of e-commerce, which also includes e-mail and fax.

EMOTICON

(Also known as a "smiley")

On the Internet in e-mail, chatting, and posted messages, an emoticon (sometimes referred to as a "smiley") is a short sequence of keyboard letters and symbols, usually emulating a facial expression, expressing a feeling that supplements the message. Most of these emoticons use several symbols to create a small face with an expression such as a smile, wink, or turned-down mouth.

One of our contributors says that to read these you can either tilt your head or turn the monitor on its side.

:-)	Smile	=8O	Bug-eyed with fright
;-)	Smile with a wink	;-^)	Tongue in cheek
:<})	User with mustache, smiling	%*@:-(	Hung over
:-||	Mad	:-~~~	Drooling
:-(	Sad	[:-|]	Robot
:' -(	Crying	(:V)	Duck
:~	Also crying	3:-o	Cow
:-))	Really happy	:-[	Vampire
:-D	Big grin	(_8-(|)	Homer Simpson
:-o	Wow! or I am surprised	=|:-)=	Abe Lincoln
:-|	Grim	*<:-)	Santa Claus
:-P	Sticking out your tongue	>:-<	Mad

:-\	User happens to be Popeye	<:I	Dunce
:-/	Perplexed	:-|	"Have an ordinary day!" Smiley
=:O	Frightened (hair standing on end)	#.-o	"Oh, nooooooo Mr. Bill!!!"

ENCAPSULATION

In general, encapsulation is the inclusion of one thing within another thing so that the included thing is not apparent. Decapsulation is the removal or the making apparent a thing previously encapsulated.

1) In object-oriented programming, encapsulation is the inclusion within a program object of all the resources needed for the object to function - basically, the methods and the data. The object is said to "publish its interfaces." Other objects adhere to these interfaces to use the object without having to be concerned with how the object accomplishes it. The idea is "don't tell me how you do it; just do it." An object can be thought of as a self-contained atom. The object interface consists of public methods and instance data.

2) In telecommunication, encapsulation is the inclusion of one data structure within another structure so that the first data structure is hidden for the time being. For example, a TCP/IP-formatted data packet can be encapsulated within an ATM frame (another kind of transmitted data unit). Within the context of transmitting and receiving the ATM frame, the encapsulated packet is simply a stream of bits between the ATM data that describes the transfer.

ERP

ERP (Enterprise Resource Planning) is an industry term for the broad set of activities supported by multi-module application software that help a manufacturer or other business manage the important parts of its business, including product planning, parts purchasing, maintaining inventories, interacting with suppliers, providing customer service, and tracking orders. ERP can also include application modules for the finance and human resources aspects of a business. Typically, an ERP system uses or is integrated with a relational database system. The deployment of an ERP system can involve considerable business process analysis, employee retraining, and new work procedures.

In a recent trend, SAP, Peoplesoft, and J. D. Edwards are among ERP product providers offering ERP outsourcing.

ETHERNET

Ethernet is the most widely installed local area network technology. Now specified in a standard, IEEE 802.3, Ethernet was originally developed by Xerox and then developed further by Xerox, DEC, and Intel. An Ethernet LAN typically uses coaxial cable or special grades of twisted pair wires. The most commonly installed Ethernet systems are called 10BASE-T and provide transmission speeds up to 10 Mbps. Devices are connected to the cable and compete for access using a Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol.

Fast Ethernet, or 100BASE-T, provides transmission speeds up to 100 megabits per second and is typically used for LAN backbone systems, supporting workstations with 10BASE-T cards. Gigabit Ethernet provides an even higher level of backbone support at 1000 megabits per second (1 gigabit or 1 billion bits per second).

EXTRANET

An extranet is a private network that uses the Internet protocols and the public telecommunication system to securely share part of a business's information or operations with suppliers, vendors, partners, customers, or other businesses. An extranet can be viewed as part of a company's intranet that is extended to users outside the company. It has also been described as a "state of mind" in which the Internet is perceived as a way to do business with other companies as well as to sell products to customers. The same benefits that HTML, HTTP, SMTP, and other Internet technologies have brought to the Internet and to corporate intranets now seem designed to accelerate business between businesses.

An extranet requires security and privacy. These require firewall server management, the issuance and use of digital certificates or similar means of user authentication, encryption of messages, and the use of virtual private networks (VPNs) that tunnel through the public network.

Companies can use an extranet to:

- Exchange large volumes of data using Electronic Data Interchange (EDI)
- Share product catalogs exclusively with wholesalers or those "in the trade"
- Collaborate with other companies on joint development efforts
- Jointly develop and use training programs with other companies
- Provide or access services provided by one company to a group of other companies, such as an online banking application managed by one company on behalf of affiliated banks
- Share news of common interest exclusively with partner companies

Netscape, Oracle, and Sun Microsystems have announced an alliance to ensure that their extranet products can work together by standardizing on JavaScript and the Common Object Request Broker Architecture (CORBA). Microsoft supports the Point-to-Point Tunneling Protocol (PPTP) and is working with American Express and other companies on an Open Buying on the Internet (OBI) standard. The Lotus Corporation is promoting its groupware product, Notes, as well-suited for extranet use.

F

FAST ETHERNET

Fast Ethernet is a local area network (LAN) transmission standard that provides a data rate of 100 megabits per second (referred to as "100BASE-T"). Workstations with existing 10 megabit per second (10BASE-T) Ethernet cards can be connected to a Fast Ethernet network. (The 100 megabits per second is a shared data rate; input to each workstation is constrained by the 10 Mbps card.)

FDDI

Fiber Distributed Data Interface

FDDI is a standard for data transmission on fiber optic lines in a local area network that can extend in range up to 200 km (124 miles). The FDDI protocol is based on the token ring protocol. In addition to being large geographically, an FDDI local area network can support thousands of users.

An FDDI network contains two token rings, one for possible backup in case the primary ring fails. The primary ring offers up to 100 Mbps capacity. If the secondary ring is not needed for backup, it can also carry data, extending capacity to 200 Mbps. The single ring can extend the maximum distance; a dual ring can extend 100 km (62 miles).

FDDI is a product of American National Standards Committee X3-T9 and conforms to the open system interconnect (OSI) model of functional layering. It can be used to interconnect LANs using other protocols. FDDI-II is a version of FDDI that adds the capability to add circuit-switched service to the network so that voice signals can also be handled. Work is underway to connect FDDI networks to the developing Synchronous Optical Network SONET, which in turn is part of broadband ISDN.

FIREWALL

A firewall is a set of related programs, located at a network gateway server, that protects the resources of a private network from users from other networks. (The term also implies the security policy that is used with the programs.) An enterprise with an intranet that allows its workers access to the wider Internet installs a firewall to prevent outsiders from accessing its own private data resources and for controlling what outside resources its own users have access to.

Basically, a firewall, working closely with a router program, filters all network packets to determine whether to forward them toward their destination. A firewall also includes or works with a proxy server that makes network requests on behalf of workstation users. A firewall is often installed in a specially designated computer separate from the rest of the network so that no incoming request can get directly at private network resources.

There are a number of firewall screening methods. A simple one is to screen requests to make sure they come from acceptable (previously identified) domain names and IP addresses. For mobile users, firewalls allow remote access in to the private network by the use of secure logon procedures and authentication certificates.

A number of companies make firewall products. Features include logging and reporting, automatic alarms at given thresholds of attack, and a graphical user interface for controlling the firewall.

FLAT FILE

A flat file is a file containing records that have no structured inter-relationship. The term is frequently used to describe a textual document from which all word processing or other structure characters or markup have been removed. In usage, there is some ambiguity about whether such markings as line breaks can be included in a "flat file." In any event, many users would call a Microsoft Word document that has been saved as "text only" a "flat file." The resulting file contains

records (lines of text of a certain uniform length) but no information, for example, about what size to make a line that is a title or that a program could use to format the document with a table of contents.

Another form of flat file is one in which table data is gathered in lines of ASCII text with the value from each table cell separated by a comma and each row represented with a new line. This type of flat file is also known as a CSV (comma-separated values) file.

In SQL for Dummies, an introduction to SQL and relational databases, Allen G. Taylor notes that the advantage of a flat file is that it takes up less space than a structured file. However, it requires the application to have knowledge of how the data is organized within the file. By using SQL and a database (rather than a collection of files in a file system), a user or an application is free from having to understand the location and layout of data (for example, the length of each item of data, its type of data, and its relationship to other data items).

In relational databases, flat file is sometimes used as a synonym for a relation.

FTP

FTP (File Transfer Protocol), a standard Internet protocol, is the simplest way to exchange files between computers on the Internet. Like the Hypertext Transfer Protocol (HTTP), which transfers displayable Web pages and related files, and the Simple Mail Transfer Protocol (SMTP), which transfers e-mail, FTP is an application protocol that uses the Internet's TCP/IP protocols. FTP is commonly used to transfer Web page files from their creator to the computer that acts as their server for everyone on the Internet. It is also commonly used to download programs and other files to your computer from other servers.

As a user, you can use FTP with a simple command line interface (for example, from the Windows MS-DOS Prompt window) or with a commercial program that offers a graphical user interface. Your Web browser can also make FTP requests to download programs you select from a Web page. Using FTP, you can also update (delete, rename, move, and copy) files at a server. You need to log on to an FTP server. However, publicly available files are easily accessed using anonymous FTP.

Basic FTP support is usually provided as part of a suite of programs that come with TCP/IP. However, any FTP client program with a graphical user interface usually must be downloaded from the company that makes it.

G

GEEK

In computers and the Internet, a geek is a person who is inordinately dedicated to and involved with technology to the point of sometimes not appearing to be normal. Being a geek also implies a capability with the technology. Although historically, computer and Internet programming and hacking has been a male thing, there are now many "girl geeks." The term "hacker" generally connotes competence more strongly than "geek" does. The term "geek" emphasizes dedication and weirdness, although recent use of the term suggests greater social acceptance and tolerance for geeks. (Historically, a geek was a circus person whose role in the sideshow was to bite off

chicken's heads or perform other bizarre feats. Eric Raymond describes "computer geek" as "one who eats (computer) bugs for a living.")

The term seems to be used by many in the general populace for anyone who spends a lot of or too much time at a computer.

GIGABIT ETHERNET

Gigabit Ethernet is a local area network (LAN) transmission standard that provides a data rate of 1 billion bits per second (one gigabit). Gigabit Ethernet is defined in the IEEE 802.3 standard and the first product versions of it are now available. Gigabit Ethernet is used as an enterprise backbone.

Gigabit Ethernet is carried primarily on optical fiber (with very short distances possible on copper media). Existing Ethernet LANs with 10 and 100 Mbps cards can feed into a Gigabit Ethernet backbone. An alternative technology that competes with Gigabit Ethernet is ATM.

GROK

To grok (pronounced GRAHK) something is to understand something so well that it is fully absorbed into oneself. In Robert Heinlein's science-fiction novel of 1961, Stranger in a Strange Land, the word is Martian and literally means "to drink" but metaphorically means "to take it all in," to understand fully, or to "be at one with." Today, grok sometimes is used to include acceptance as well as comprehension - to "dig" or appreciate as well as to know.

As one character from Heinlein's novel says:

'Grok' means to understand so thoroughly that the observer becomes a part of the observed - to merge, blend, intermarry, lose identity in group experience. It means almost everything that we mean by religion, philosophy, and science - and it means as little to us [because we are from Earth] as color means to a blind man.

In common usage, "Do you grok?" seems close in meaning to "Do you get it?"

GUI

(Graphical user interface). Also see HCI (human-computer interaction).

A GUI (usually pronounced GOO-ee) is a graphical (rather than purely textual) user interface to a computer. As you read this, you are looking at the GUI or graphical user interface of your particular Web browser. The term came into existence because the first interactive user interfaces to computers were not graphical; they were text-and-keyboard oriented and usually consisted of commands you had to remember and computer responses that were infamously brief. The command interface of the DOS operating system (which you can still get to from your Windows operating system) is an example of the typical user-computer interface before GUIs arrived. An intermediate step in user interfaces between the command line interface and the GUI was the non-graphical menu-based interface, which let you interact by using a mouse rather than by having to type in keyboard commands.

Today's major operating systems provide a graphical user interface. Applications typically use the elements of the GUI that come with the operating system and add their own graphical user interface

elements and ideas. A GUI sometimes uses one or more metaphors for objects familiar in real life, such as the desktop, the view through a window, or the physical layout in a building. Elements of a GUI include such things as: windows, pull-down menus, buttons, scroll bars, iconic images, wizards, the mouse, and no doubt many things that haven't been invented yet. With the increasing use of multimedia as part of the GUI, sound, voice, motion video, and virtual reality interfaces seem likely to become part of the GUI for many applications. A system's graphical user interface along with its input devices is sometimes referred to as its "look-and-feel."

The GUI familiar to most of us today in either the Mac or the Windows operating systems and their applications originated at the Xerox Palo Alto Research Laboratory in the late 1970s. Apple used it in their first Macintosh computers. Later, Microsoft used many of the same ideas in their first version of the Windows operating system for IBM-compatible PCs.

When creating an application, many object-oriented tools exist that facilitate writing a graphical user interface. Each GUI element is defined as a class from which you can create object instances for your application. You can code or modify prepackaged methods that an object will use to respond to user stimuli.

H

HANDSHAKING

In telephone communication, handshaking is the exchange of information between two modems and the resulting agreement about which protocol to use that precedes each telephone connection. You can hear the handshaking in those crunching and other sounds when you make a dial-out call from your computer.

Since the modems at each end of the line may have different capabilities, they need to inform each other and settle on the highest transmission speed they can both use. At higher speeds, the modems have to determine the length of line delays so that echo cancellers can be used properly.

HCI

Human-Computer Interaction

Also see GUI (graphical user interface).

HCI is the study of how people interact with computers and to what extent computers are or are not developed for successful interaction with human beings. A significant number of major corporations and academic institutions now study HCI. Historically and with some exceptions, computer system developers have not paid much attention to computer ease-of-use. Many computer users today would argue that computer makers are still not paying enough attention to making their products "user-friendly." However, computer system developers might argue that computers are extremely complex products to design and make and that the demand for the services that a computers can provide has always outdriven the demand for ease-of-use.

One important HCI factor is that different users form different conceptions or mental models about their interactions and have different ways of learning and keeping knowledge and skills (different "cognitive styles" as in, for example, "left-brained" and "right-brained" people). In addition, cultural and national differences play a part. Another consideration in studying or designing HCI is that user

interface technology changes rapidly, offering new interaction possibilities to which previous research findings may not apply. Finally, user preferences change as they gradually master new interfaces.

HMI

Human Machine Interface

HTML

HTML (Hypertext Markup Language) is the set of "markup" symbols or codes inserted in a file intended for display on a World Wide Web browser. The markup tells the Web browser how to display a Web page's words and images for the user. The individual markup codes are referred to as elements (but many people also refer to them as tags).

HTML is a standard recommended by the World Wide Web Consortium (W3C) and adhered to by the major browsers, Microsoft's Internet Explorer and Netscape's Navigator, which also provide some additional non-standard codes. The current version of HTML is HTML 4. However, both Internet Explorer and Netscape implement some features differently and provide non-standard extensions. Web developers using the more advanced features of HTML 4 may have to design pages for both browsers and send out the appropriate version to a user. Significant features in HTML 4 are sometimes described in general as dynamic HTML. What is sometimes referred to as HTML 5 is an extensible form of HTML called XHTML.

HTTP

The Hypertext Transfer Protocol (HTTP) is the set of rules for exchanging files (text, graphic images, sound, video, and other multimedia files) on the World Wide Web. Relative to the TCP/IP suite of protocols (which are the basis for information exchange on the Internet), HTTP is an application protocol.

Essential concepts that are part of HTTP include (as its name implies) the idea that files can contain references to other files whose selection will elicit additional transfer requests. Any Web server machine contains, in addition to the HTML and other files it can serve, an HTTP daemon, a program that is designed to wait for HTTP requests and handle them when they arrive. Your Web browser is an HTTP client, sending requests to server machines. When the browser user enters file requests by either "opening" a Web file (typing in a Uniform Resource Locator or URL) or clicking on a hypertext link, the browser builds an HTTP request and sends it to the Internet Protocol address indicated by the URL. The HTTP daemon in the destination server machine receives the request and, after any necessary processing, the requested file is returned.

The latest version of HTTP is HTTP 1.1.

HUB

Also see stackable hub.

In general, a hub is the central part of a wheel where the spokes come together. The term is familiar to frequent fliers who travel through airport "hubs" to make connecting flights from one

point to another. In data communications, a hub is a place of convergence where data arrives from one or more directions and is forwarded out in one or more other directions. A hub usually includes a switch of some kind. (And a product that is called a "switch" could usually be considered a hub as well.) The distinction seems to be that the hub is the place where data comes together and the switch is what determines how and where data is forwarded from the place where data comes together. Regarded in its switching aspects, a hub can also include a router.

1) In describing network topologies, a hub topology consists of a backbone (main circuit) to which a number of outgoing lines can be attached ("dropped"), each providing one or more connection ports for devices to attach to. For Internet users not connected to a local area network, this is the general topology used by your access provider. Other common network topologies are the bus network and the ring network. (Either of these could possibly feed into a hub network, using a bridge.)

2) As a network product, a hub may include a group of modem cards for dial-in users, a gateway card for connections to a local area network (for example, an Ethernet or a Token Ring), and a connection to a T-1 line (the main line in this example).

HYPERLINK

On the Web or other hypertext systems, hyperlink is a synonym for both link and hypertext link. Possibly, the term originated because "link" was not felt to be specific enough. And it's shorter than "hypertext link."

I

I/O

I/O (input/output), pronounced "eye-oh," describes any operation, program, or device that transfers data to or from a computer. Typical I/O devices are printers, hard disks, keyboards, and mice. In fact, some devices are basically input-only devices (keyboards and mice); others are primarily output-only devices (printers); and others provide both input and output of data (hard disks, diskettes, writable CD-ROMs).

INTERNET

The Internet, sometimes called simply "the Net," is a worldwide system of computer networks - a network of networks in which users at any one computer can, if they have permission, get information from any other computer (and sometimes talk directly to users at other computers). It was conceived by the Advanced Research Projects Agency (ARPA) of the U.S. government in 1969 and was first known as the ARPANet. The original aim was to create a network that would allow users of a research computer at one university to be able to "talk to" research computers at other universities. A side benefit of ARPANet's design was that, because messages could be routed or rerouted in more than one direction, the network could continue to function even if parts of it were destroyed in the event of a military attack or other disaster.

Today, the Internet is a public, cooperative, and self-sustaining facility accessible to hundreds of millions of people worldwide. Physically, the Internet uses a portion of the total resources of the

currently existing public telecommunication networks. Technically, what distinguishes the Internet is its use of a set of protocols called TCP/IP (Transmission Control Protocol/Internet Protocol). Two recent adaptations of Internet technology, the intranet and the extranet, also make use of the TCP/IP protocol.

For many Internet users, electronic mail (e-mail) has practically replaced the Postal Service for short written transactions. Electronic mail is the most widely used application on the Net. You can also carry on live "conversations" with other computer users, using IRC (Internet Relay Chat). More recently, Internet telephony hardware and software allows real-time voice conversations.

The most widely used part of the Internet is the World Wide Web (often abbreviated "WWW" or called "the Web"). Its outstanding feature is hypertext, a method of instant cross-referencing. In most Web sites, certain words or phrases appear in text of a different color than the rest; often this text is also underlined. When you select one of these words or phrases, you will be transferred to the site or page that is relevant to this word or phrase. Sometimes there are buttons, images, or portions of images that are "clickable." If you move the pointer over a spot on a Web site and the pointer changes into a hand, this indicates that you can click and be transferred to another site.

Using the Web, you have access to millions of pages of information. Web "surfing" is done with a Web browser, the most popular of which are Netscape Navigator and Microsoft Internet Explorer. The appearance of a particular Web site may vary slightly depending on the browser you use. Also, later versions of a particular browser are able to render more "bells and whistles" such as animation, virtual reality, sound, and music files, than earlier versions.

INTRANET

An intranet is a private network that is contained within an enterprise. It may consist of many interlinked local area networks and also use leased lines in the wide area network. Typically, an intranet includes connections through one or more gateway computers to the outside Internet. The main purpose of an intranet is to share company information and computing resources among employees. An intranet can also be used to facilitate working in groups and for teleconferences.

An intranet uses TCP/IP, HTTP, and other Internet protocols and in general looks like a private version of the Internet. With tunneling, companies can send private messages through the public network, using the public network with special encryption/decryption and other security safeguards to connect one part of their intranet to another.

Typically, larger enterprises allow users within their intranet to access the public Internet through firewall servers that have the ability to screen messages in both directions so that company security is maintained. When part of an intranet is made accessible to customers, partners, suppliers, or others outside the company, that part becomes part of an extranet.

IP

The Internet Protocol (IP) is the method or protocol by which data is sent from one computer to another on the Internet. Each computer (known as a host) on the Internet has at least one address that uniquely identifies it from all other computers on the Internet. When you send or receive data (for example, an e-mail note or a Web page), the message gets divided into little chunks called packets. Each of these packets contains both the sender's Internet address and the receiver's

address. Any packet is sent first to a gateway computer that understands a small part of the Internet. The gateway computer reads the destination address and forwards the packet to an adjacent gateway that in turn reads the destination address and so forth across the Internet until one gateway recognizes the packet as belonging to a computer within its immediate neighborhood or domain. That gateway then forwards the packet directly to the computer whose address is specified.

Because a message is divided into a number of packets, each packet can, if necessary, be sent by a different route across the Internet. Packets can arrive in a different order than the order they were sent in. The Internet Protocol just delivers them. It is up to another protocol, the Transmission Control Protocol (TCP) to put them back in the right order.

IP is a connectionless protocol, which means that there is no established connection between the end points that are communicating. Each packet that travels through the Internet is treated as an independent unit of data without any relation to any other unit of data. (The reason the packets do get put in the right order is because of TCP, the connection-oriented protocol that keeps track of the packet sequence in a message.) In the Open Systems Interconnection (OSI) communication model, IP is in layer 3, the Networking Layer.

The most widely used version of IP today is Internet Protocol Version 4 (IPv4). However, IP Version 6 (IPv6) is also beginning to be supported. IPv6 provides for much longer addresses and therefore for the possibility of many more Internet users. IPv6 includes the capabilities of IPv4 and any server that can support IPv6 packets can also support IPv4 packets.

ISDN

Integrated Services Digital Network (ISDN) is a set of CCITT/ITU standards for digital transmission over ordinary telephone copper wire as well as over other media. Home and business users who install ISDN adapters (in place of their modems) can see highly graphic Web pages arriving very quickly (up to 128 Kbps). ISDN requires adapters at both ends of the transmission so your access provider also needs an ISDN adapter. ISDN is generally available from your phone company in most urban areas in the United States and Europe.

There are two levels of service: the Basic Rate Interface (BRI), intended for the home and small enterprise, and the Primary Rate Interface (PRI), for larger users. Both rates include a number of B (bearer) channels and a D (delta) channel. The B channels carry data, voice, and other services. The D channel carries control and signaling information.

The Basic Rate Interface consists of two 64 Kbps B channels and one 16 Kbps D channel. Thus, a Basic Rate user can have up to 128 Kbps service. The Primary Rate consists of 23 B channels and one 64 Kpbs D channel in the United States or 30 B channels and 1 D channel in Europe.

The typical cost for Basic Rate usage in a city like Kingston, New York is about $125 for phone company installation, $300 for the ISDN adapter, and an extra $20 a month for a line that supports ISDN.

Integrated Services Digital Network in concept is the integration of both analog or voice data together with digital data over the same network. Although the ISDN you can install is integrating these on a medium designed for analog transmission, broadband ISDN (BISDN) will extend the

integration of both services throughout the rest of the end-to-end path using fiber optic and radio media. Broadband ISDN will encompass frame relay service for high-speed data that can be sent in large bursts, the Fiber Distributed-Data Interface (FDDI), and the Synchronous Optical Network (SONET). BISDN will support transmission from 2 Mbps up to much higher, but as yet unspecified, rates.

ISP

An ISP (Internet service provider) is a company that provides individuals and other companies access to the Internet and other related services such as Web site building and hosting. An ISP has the equipment and the telecommunication line access required to have points-of-presence on the Internet for the geographic area served. The larger ISPs have their own high-speed leased lines so that they are less dependent on the telecommunication providers and can provide better service to their customers. Among the largest national and regional ISPs are AT&T WorldNet, IBM Global Network, MCI, Netcom, UUNet, and PSINet.

ISPs also include regional providers such as New England's NEARNet and the San Francisco Bay area BARNet. They also include thousands of local providers. In addition, Internet users can also get access through online service providers (OSPs) such as America Online and Compuserve.

The larger ISPs interconnect with each other through MAEs (ISP switching centers run by MCI WorldCom) or similar centers. The arrangements they make to exchange traffic are known as peering agreements. There are several very comprehensive lists of ISPs worldwide available on the Web.

An ISP is also sometimes referred to as an IAP (Internet access provider). ISP is sometimes used as an abbreviation for independent service provider to distinguish a service provider that is an independent, separate company from a telephone company.

L

LAN

(Local area network)

A LAN is a network of interconnected workstations sharing the resources of a single processor or server within a relatively small geographic area. Typically, this might be within the area of a small office building. However, FDDI extends a local area network over a much wider area. Usually, the server has applications and data storage that are shared in common by multiple workstation users. A local area network may serve as few as four or five users or, in the case of FDDI, may serve several thousand.

The main LAN technologies are:

- Ethernet
- Token ring
- ARCNET
- FDDI (Fiber Distributed Data Interface)

Typically, a suite of application programs can be kept on the LAN server. Users who need an application frequently can download it once and then run it from their local hard disk. Users can order printing and other services as needed through applications run on the LAN server. A user can share files with others at the LAN server; read and write access is maintained by a LAN administrator.

A LAN server may also be used as a Web server if safeguards are taken to secure internal applications and data from outside access.

Local Area Networks (LANs) and Wide Area Networks (WANs) are generic terms referring to two important basic types of networks. Let me try to summarize the characteristics of each, and then discuss their importance to the network engineer.

The Internet can be thought of as a bunch of LANs interconnected by WANs. An average packet will run across a company's local Ethernet (LAN), up an ISDN or leased line or PPP link (WAN) to an Internet Service Provider. The ISP has Ethernet too (LAN), that transports the packet to the right router for delivery to a cross-country provider (WAN). The packet begins bouncing from one LAN site to another over WAN links.

LATENCY

In a network, latency, a synonym for delay, is an expression of how much time it takes for a packet of data to get from one designated point to another. In some usages (for example, AT&T), latency is measured by sending a packet that is returned to the sender and the round-trip time is considered the latency.

The latency assumption seems to be that data should be transmitted instantly between one point and another (that is, with no delay at all). The contributors to network latency include:

Propagation: This is simply the time it takes for a packet to travel between one place and another at the speed of light.

Transmission: The medium itself (whether fiber optic cable, wireless, or some other) introduces some delay. The size of the packet introduces delay in a round trip since a larger packet will take longer to receive and return than a short one.

Router and other processing: Each gateway node takes time to examine and possibly change the header in a packet (for example, changing the hop count in the time-to-live field).

Other computer and storage delays: Within networks at each end of the journey, a packet may be subject to storage and hard disk access delays at intermediate devices such as switches and bridges. (In backbone statistics, however, this kind of latency is probably not considered.)

LEASED LINE

A leased line is a telephone line that has been leased for private use. In some contexts, it's called a dedicated line. A leased line is usually contrasted with a switched line or dial-up line.

Typically, large companies rent leased lines from the telephone message carriers (such as AT&T) to interconnect different geographic locations in their company. The alternative is to buy and

maintain their own private lines or, increasingly perhaps, to use the public switched lines with secure message protocols. (This is called tunneling.)

LED

An LED (light-emitting diode), pronounced by naming the three letters in succession, not as an acronym, is a semiconductor device that emits visible light when an electric current passes through it. The light is not particularly bright, but in most LEDs it is monochromatic, occurring at a single wavelength. The output from an LED can range from red (at a wavelength of approximately 700 nanometers) to blue-violet (about 400 nanometers). Some LEDs emit infrared (IR) energy (830 nanometers or longer); such a device is known as an infrared-emitting diode (IRED).

An LED or IRED consists of two elements of processed material called P-type semiconductor and N-type semiconductor. These two elements are placed in direct contact, forming a region called the P-N junction. In this respect, the LED or IRED resembles most other diode types, but there are important differences. The LED or IRED has a transparent package, allowing visible or IR energy to pass through. Also, the LED or IRED has a large PN-junction area whose shape is tailored to the application.

M

MAC

In a local area network (LAN) or other network, the MAC (Media Access Control) address is your computer's unique hardware number. (On an Ethernet LAN, it's the same as your Ethernet address.) When you're connected to the Internet from your computer (or host as the Internet protocol thinks of it), a correspondence table relates your IP address to your computer's physical (MAC) address on the LAN.

The MAC address is used by the Media Access Control sublayer of the Data-Link Control (DLC) layer of telecommunication protocols. There is a different MAC sublayer for each physical device type. The other sublayer level in the DLC layer is the Logical Link Control sublayer.

MAN

A MAN (metropolitan area network) is a network that interconnects users with computer resources in a geographic area or region larger than that covered by even a large local area network (LAN) but smaller than the area covered by a wide area network (WAN). The term is applied to the interconnection of networks in a city into a single larger network (which may then also offer efficient connection to a wide area network). It is also used to mean the interconnection of several local area networks by bridging them with backbone lines. The latter usage is also sometimes referred to as a campus network.

Examples of metropolitan area networks of various sizes can be found in the metropolitan areas of London, England; Lodz, Poland; and Geneva, Switzerland. Large universities also sometimes use the term to describe their networks.

MODEM

(Modulator/demodulator)

A modem modulates outgoing digital signals from a computer or other digital device to analog signals for a conventional copper twisted-pair telephone line and demodulates the incoming analog signal and converts it to a digital signal for the digital device.

In recent years, the 2400 bps modem that could carry e-mail has become obsolete. 14.4 Kbps and 28.8 Kbps modems were temporary landing places on the way to the much higher bandwidth devices and carriers of tomorrow. From early 1998, most new personal computers came with 56 Kbps modems. By comparison, using a digital ISDN adapter instead of a conventional modem, the same telephone wire can now carry up to 128 Kbps. With Digital Subscriber Line (DSL) systems, now being deployed in a number of communities, bandwidth on twisted-pair can be in the megabit range.

MDI

MDI (Multiple Document Interface) is a Microsoft Windows programming interface for creating an application that enables users to work with multiple documents at the same time. Each document is in a separate space with its own controls for scrolling. The user can see and work with different documents such as a spreadsheet, a text document, or a drawing space by simply moving the cursor from one space to another.

An MDI application is something like the Windows desktop interface since both include multiple viewing spaces. However, the MDI viewing spaces are confined to the application's window or client area. Within the client area, each document is displayed within a separate child window. MDI applications can be used for a variety of purposes - for example, working on one document while referring to another document, viewing different presentations of the same information, viewing multiple Web sites at the same time, and any task that requires multiple reference points and work areas at the same time.

N

NETBEUI

NetBEUI (NetBIOS Extended User Interface) is a new, extended version of NetBIOS, the program that lets computers communicate within a local area network. NetBEUI (pronounced net-BOO-ee) formalizes the frame format (or arrangement of information in a data transmission) that was not specified as part of NetBIOS. NetBEUI was developed by IBM for its LAN Manager product and has been adopted by Microsoft for its Windows NT, LAN Manager, and Windows for Workgroups products. Hewlett-Packard and DEC use it in comparable products.

NetBEUI is the best performance choice for communication within a single LAN. Because, like NetBIOS, it does not support the routing of messages to other networks, its interface must be adapted to other protocols such as IPX or TCP/IP. A recommended method is to install both NetBEUI and TCP/IP in each computer and set the server up to use NetBEUI for communication within the LAN and TCP/IP for communication beyond the LAN.

NETIQUETTE

Netiquette is etiquette on the Internet. Since the Internet changes rapidly, its netiquette does too, but it's still usually based on the Golden Rule. The need for a sense of netiquette arises mostly when sending or distributing e-mail, posting on Usenet groups, or chatting. To some extent, the practice of netiquette depends on understanding how e-mail, the Usenet, chatting, or other aspects of the Internet actually work or are practiced. So a little preliminary observation can help. Poor netiquette because you're new is one thing, but such practices as spam and flaming are another matter.

NTFS

NTFS (NT file system) is the system that the Windows NT operating system uses for storing and retrieving files on a hard disk. NTFS is the Windows NT equivalent of the Windows 95 FAT (file allocation table) and the OS/2 HPFS (high performance file system). However, NTFS offers a number of improvements over FAT and HPFS in terms of performance, extendibility, and security.

Notable features of NTFS include:

Use of a b-tree directory scheme to keep track of file clusters

Information about a file's clusters and other data is stored with each cluster, not just a governing table (as FAT is)

Support for very large files (up to 2 to the 64th power or approximately 16 billion bytes in size)

An access control list (ACL) that lets a server administrator control who can access specific files

Integrated file compression

Support for names based on Unicode

Support for long file names as well as "8 by 3" names

Data security on both removable and fixed disks

NULL MODEM

A null modem cable allows you to connect your PC to another nearby PC or serial device using its modem protocol. A popular use of null modem cables is for setting up "head-to-head" gaming between two players at different computers in the same room. (A null modem cable is limited to 30 feet in length.)

The standard RS-232C serial communications interface defines a signal protocol between a Data Terminal Equipment (DTE) - usually your PC - and a Data Communications Equipment (DCE) - or your modem. The signals are transmitted on a set of lines, each of which has a function in the "talk" that the DTE and DCE do back and forth. One line each way is for data; the other lines are for different "statements" that one end of the communication sends to the other. For example, the DTE sends the DCE (usually a modem) a "Request to Send" signal on the RTS line and the DCE replies with a "Clear to Send" signal on the CTS line. After a series of similar exchanges, the DTE sends data on the line devoted to transmitting data (which for the DCE is a line for receiving data from the DTE).

Since a modem or DCE is not really needed to interconnect your PC with another local serial device, the DTE interface can be used by both your PC and the attached serial device. However, the DTE interface is designed to work with a DCE device. What a null modem cable does is to make the other end of the PC or device's DTE interface look like a DCE interface.

A null modem cable is sometimes called a crossover cable.

O

OBJECT

In object-oriented programming, objects are the things you think about first in designing a program and they are also the units of code that are eventually derived from the process. In between, each object is made into a generic class of object and even more generic classes are defined so that objects can share models and reuse the class definitions in their code. Each object is an instance of a particular class or subclass with the class's own methods or procedures and data variables. An object is what actually runs in the computer.

ODBC

Open Database Connectivity (ODBC) is a standard or open application programming interface (API) for accessing a database. By using ODBC statements in a program, you can access files in a number of different databases, including Access, dBase, DB2, Excel, and Text. In addition to the ODBC software, a separate module or driver is needed for each database to be accessed. The main proponent and supplier of ODBC programming support is Microsoft.

ODBC is based on and closely aligned with the Open Group standard Structured Query Language (SQL) Call-Level Interface. It allows programs to use SQL requests that will access databases without having to know the proprietary interfaces to the databases. ODBC handles the SQL request and converts it into a request the individual database system understands.

ODBC was created by the SQL Access Group and first released in September 1992. Although Microsoft Windows was the first to provide an ODBC product, versions now exist for UNIX, OS/2, and Macintosh platforms as well.

OLE

OLE (Object Linking and Embedding) is Microsoft's framework for a compound document technology. Briefly, a compound document is something like a display desktop that can contain visual and information objects of all kinds: text, calendars, animations, sound, motion video, 3-D, continually updated news, controls, and so forth. Each desktop object is an independent program entity that can interact with a user and also communicate with other objects on the desktop. Part of Microsoft's ActiveX technologies, OLE takes advantage and is part of a larger, more general concept, the Component Object Model (COM) and its distributed version, DCOM). An OLE object is necessarily also a component (or COM object).

Some main concepts in OLE and COM are:

Microsoft terms are shown first; industry or alternative versions of those terms are shown in parentheses: Concept What it is

- **OLE - A set of APIs to create and display a (compound) document**
- **Document (compound document) - A presentation of different items in an "animated desktop"**
- **Item (object; also called a component) - An element in a document, such as an animated calendar, a video window, a sound player, a sound file...**
- **Container or container application - The program entity that holds a document or a control**
- **Server or server application - The program entity that holds an item within an OLE container**
- **Embedding - Adding the source data for an item to a document; use the Paste command in a container application**
- **Linking - Adding a link to the source data for an item to a document; use the Paste Link command in a container application**
- **Visual editing - Activating an item that is embedded in a document and "editing" it**
- **Automation - Having one container or server application drive another application**
- **Compound files (structured storage) - A standard file format that simplifies the storing of (compound) documents; consists of storages (similar to directories) and streams (similar to files)**
- **Uniform Data Transfer (UDT) - A single data transfer interface that accommodates drag-and-drop; clipboard; and dynamic data exchange (DDE)**
- **Component Object Model (COM) - Provides the underlying support for OLE items (objects) and ActiveX controls to communicate with other OLE objects or ActiveX controls**
- **ActiveX control - An item (object) that can be distributed and run on top of a COM**
- **Microsoft Foundation Class (MCF) library - A set of ready-made classes or templates that can be used to build container and server applications**

Orfali says that OLE contains about 660 new function calls or individual program interfaces in addition to those already in Win32. For this reason, Microsoft provides the Microsoft Foundation Class (MFC) Library, a set of ready-made classes that can be used to build container and server applications, and tools such as Visual C++.

In the "Introduction to OLE" on its Developer Site, Microsoft says that "OLE" no longer stands for "Object Linking and Embedding," but just for the letters "OLE."

OSI

OSI (Open Systems Interconnection) is a standard description or "reference model" for how messages should be transmitted between any two points in a telecommunication network. Its purpose is to guide product implementers so that their products will consistently work with other products. The reference model defines seven layers of functions that take place at each end of a communication. Although OSI is not always strictly adhered to in terms of keeping related functions together in a well-defined layer, many if not most products involved in telecommunication make an attempt to place describe themselves in relation to the OSI model. It is also valuable as a single

reference view of communication that furnishes everyone a common ground for education and discussion.

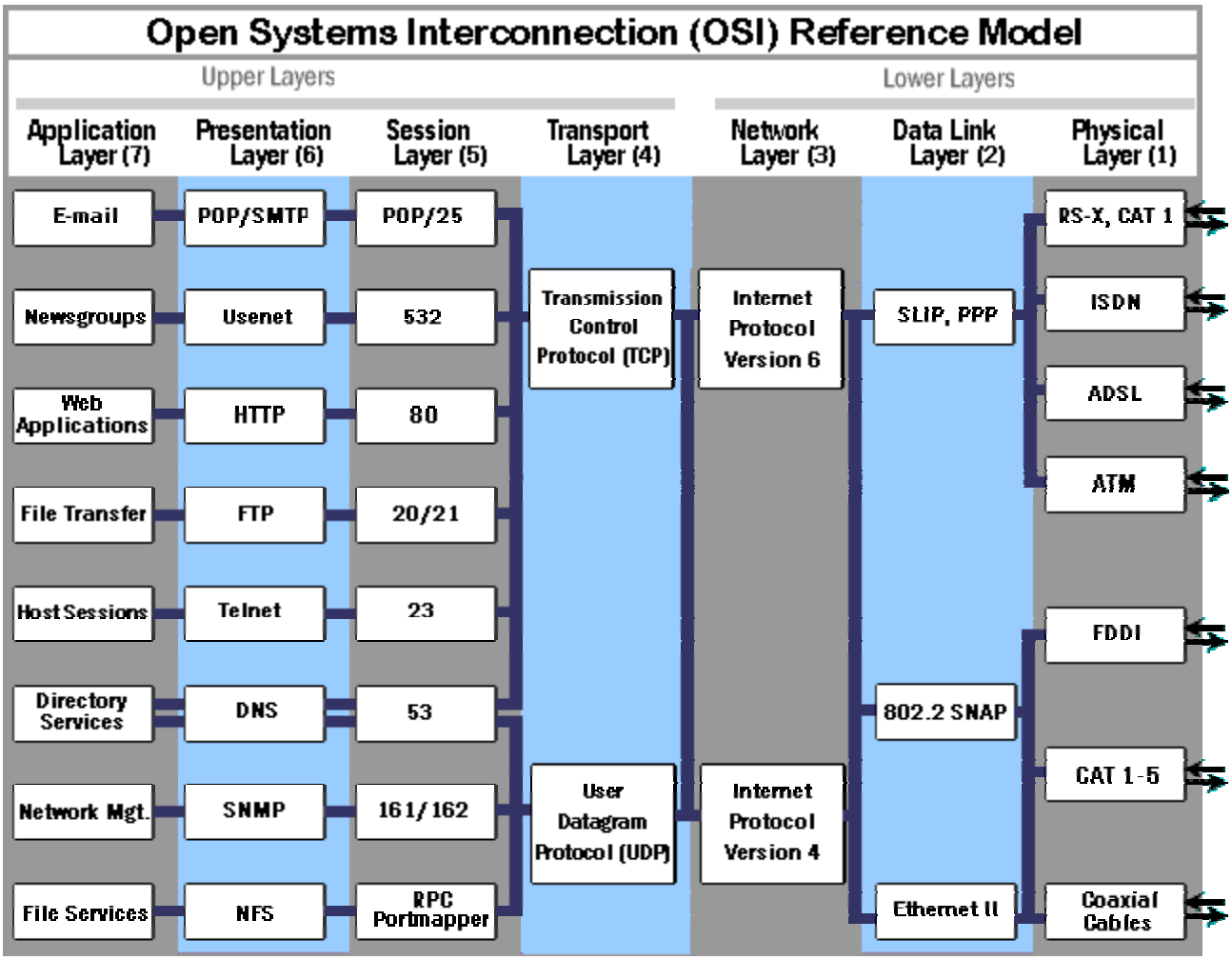
Developed by representatives of major computer and telecommunication companies beginning in 1983, OSI was originally intended to be a detailed specification of interfaces. Instead, the committee decided to establish a common reference model for which others could develop detailed interfaces that in turn could become standards. OSI was officially adopted as an international standard by the International Organization of Standards (ISO). Currently, it is Recommendation X.200 of the International Telecommunication Union.

The main idea in OSI is that the process of communication between two end users in a telecommunication network can be divided into layers, with each layer adding its own set of special, related functions. Each communicating user is at a computer equipped with these seven layers of function. So, in a given message between users, there will be a flow of data through each layer at one end down through the layers in that computer and, at the other end, when the message arrives, another flow of data up through the layers in the receiving computer and ultimately to the end user. The actual programming and hardware that furnishes these seven layers of function is usually a combination of the computer operating system, applications (such as your Web browser), TCP/IP or alternative transport and network protocols, and the software and hardware that enable you to put a signal on one of the lines attached to your computer.

OSI divides telecommunication into seven layers. The layers are in two groups. The upper four layers are used whenever a message passes from or to a user. The lower three layers (up to the network layer) are used when any message passes through the host computer. Messages intended for this computer pass to the upper layers. Messages destined for some other host are not passed up to the upper layers but are forwarded to another host. The seven layers are:

- Layer 7: The application layer...This is the layer at which communication partners are identified, quality of service is identified, user authentication and privacy are considered, and any constraints on data syntax are identified. (This layer is not the application itself, although some applications may perform application layer functions.)
- Layer 6: The presentation layer...This is a layer, usually part of an operating system, that converts incoming and outgoing data from one presentation format to another (for example, from a text stream into a popup window with the newly arrived text). Sometimes called the syntax layer.
- Layer 5: The session layer...This layer sets up, coordinates, and terminates conversations, exchanges, and dialogs between the applications at each end. It deals with session and connection coordination.
- Layer 4: The transport layer...This layer manages the end-to-end control (for example, determining whether all packets have arrived) and error checking. It ensures complete data transfer.
- Layer 3: The network layer...This layer handles the routing of the data (sending it in the right direction to the right destination on outgoing transmissions and receiving incoming transmissions at the packet level). The network layer does routing and forwarding.

- **Layer 2: The data link layer...This layer provides error control and synchronization for the physical level and does bit stuffing for strings of 1's in excess of 5. It furnishes transmission protocol knowledge and management.**
- **Layer 1: The physical layer...This layer conveys the bit stream through the network at the electrical and mechanical level. It provides the hardware means of sending and receiving data on a carrier.**



P

PDF

PDF (Portable Document Format) is a file format that has captured all the elements of a printed document as an electronic image that you can view, navigate, print, or forward to someone else. PDF files are created using Adobe Acrobat, Acrobat Capture, or similar products. To view and use the files, you need the free Acrobat Reader, which you can easily download. Once you've downloaded the Reader, it will start automatically whenever you want to look at a PDF file.

PDF files are especially useful for documents such as magazine articles, product brochures, or flyers in which you want to preserve the original graphic appearance online. A PDF file contains

one or more page images, each of which you can zoom in on or out from. You can page forward and backward. The PDF format is useful for:

- Graphic design development in which team members are working at a distance and need to explore design ideas online
- Help desk people who need to see the printed book that users are looking at
- The online distribution of any printed document in which you want to preserve its printed appearance

Acrobat's PDF files are more than images of documents. Files can embed type fonts so that they're available at any viewing location. They can also include interactive elements such as buttons for forms entry and for triggering sound and Quicktime or AVI movies. PDF files are optimized for the Web by rendering text before graphic images and hypertext links.

PEER-TO-PEER

Peer-to-peer is a communications model in which each party has the same capabilities and either party can initiate a communication session. Other models with which it might be contrasted include the client/server model and the master/slave model.

IBM's Advanced Peer-to-Peer Networking (APPN) is an example of a product that supports the peer-to-peer communication model.

PING

(Packet Internet or Inter-Network Groper)

Ping is a basic Internet program that lets you verify that a particular Internet address exists and can accept requests. The verb ping means the act of using the ping utility or command. Ping is used diagnostically to ensure that a host computer you are trying to reach is actually operating. If, for example, a user can't ping a host, then the user will be unable to use the File Transfer Protocol (FTP) to send files to that host. Ping can also be used with a host that is operating to see how long it takes to get a response back. Using ping, you can learn the number form of the IP address from the symbolic domain name.

Loosely, ping means "to get the attention of" or "to check for the presence of" another party online. Ping operates by sending a packet to a designated address and waiting for a response. The computer acronym was contrived to match the submariners' term for the sound of a returned sonar pulse.

Ping can also refer to the process of sending a message to all the members of a mailing list requesting an ACK (acknowledgement code). This is done before sending e-mail in order to confirm that all of the addresses are reachable.

PIXEL

A pixel (a word invented from "picture element") is the basic unit of programmable color on a computer display or in a computer image. Think of it as a logical - rather than a physical - unit. The physical size of a pixel depends on how you've set the resolution for the display screen. If

you've set the display to its maximum resolution, the physical size of a pixel will equal the physical size of the dot pitch (let's just call it the dot size) of the display. If, however, you've set the resolution to something less than the maximum resolution, a pixel will be larger than the physical size of the screen's dot (that is, a pixel will use more than one dot).

The specific color that a pixel describes is some blend of three components of the color spectrum - red, green, and blue. Up to three bytes of data are allocated for specifying a pixel's color, one byte for each color. A true color or 24-bit color system uses all three bytes. However, most color display systems use only eight-bits (which provides up to 256 different colors).

A bitmap is a file that indicates a color for each pixel along the horizontal axis or row (called the x coordinate) and a color for each pixel along the vertical axis (called the y coordinate). A GIF file, for example, contains a bitmap of an image (along with other data).

Screen image sharpness is sometimes expressed as dots per inch (dpi). (In this usage, the term dot means pixel, not dot as in dot pitch.) Dots per inch is determined by both the physical screen size and the resolution setting. A given image will have less resolution - fewer dots per inch - on a larger screen as the same data is spread out over a larger physical area. Or, on the same size screen, the image will have less resolution if the resolution setting is made larger - resetting from 800 by 600 pixels per horizontal and vertical line to 640 by 480 means fewer dots per inch on the screen and an image that is less sharp. (On the other hand, individual image elements such as text will be larger in size.)

Pixel has generally replaced an earlier contraction of picture element, pel.

POLLING

In electronic communication, 'polling' is the continuous checking of other programs or devices by one program or device to see what state they are in, usually to see whether they are still connected or want to communicate.

Specifically, in multipoint or multi-drop communication (a controlling device with multiple devices attached that share the same line), the controlling device sends a message to each device, one at a time, asking each whether it has anything to communicate (in other words, whether it wants to use the line).

POP3

POP3 (Post Office Protocol 3) is the most recent version of a standard protocol for receiving e-mail. POP3 is a client/server protocol in which e-mail is received and held for you by your Internet server. Periodically, you (or your client e-mail receiver) check your mailbox on the server and download any mail. POP3 is built into the Netmanage suite of Internet products and one of the most popular e-mail products, Eudora. It is also built into the Netscape and Microsoft Internet Explorer browsers.

An alternative protocol is IMAP (Interactive Mail Access Protocol). With IMAP, you view your e-mail at the server as though it was on your client computer. An e-mail message deleted locally is still on the server. E-mail can be kept on and searched at the server.

POP can be thought of as a "store-and-forward" service. IMAP can be thought of as a remote file server.

POP and IMAP deal with the receiving of e-mail and are not to be confused with the Simple Mail Transfer Protocol (SMTP), a protocol for transferring e-mail across the Internet. You send e-mail with SMTP and a mail handler receives it on your recipient's behalf. Then the mail is read using POP or IMAP.

POTS

(plain old telephone service)

POTS is a term sometimes used in discussion of new telephone technologies in which the question of whether and how existing voice transmission for ordinary phone communication can be accommodated. For example, ADSL and ISDN provide some part of their channels for "plain old telephone service" while providing most of their bandwidth for digital data transmission.

PPP

PPP (Point-to-Point Protocol) is a protocol for communication between two computers using a serial interface, typically a personal computer connected by phone line to a server. For example, your Internet server provider may provide you with a PPP connection so that the provider's server can respond to your requests, pass them on to the Internet, and forward your requested Internet responses back to you. PPP uses the Internet protocol (IP) (and is designed to handle others). It is sometimes considered a member of the TCP/IP suite of protocols. Relative to the Open Systems Interconnection (OSI) reference model, PPP provides layer 2 (data-link layer) service. Essentially, it packages your computer's TCP/IP packets and forwards them to the server where they can actually be put on the Internet.

PPP is a full-duplex protocol that can be used on various physical media, including twisted pair or fiber optic lines or satellite transmission. It uses a variation of High Speed Data Link Control (HDLC) for packet encapsulation.

PPP is usually preferred over the earlier de facto standard Serial Line Internet Protocol (SLIP) because it can handle synchronous as well as asynchronous communication. PPP can share a line with other users and it has error detection that SLIP lacks. Where a choice is possible, PPP is preferred.

PPTP

PPTP (Point-to-Point Tunneling Protocol) is a protocol (set of communication rules) that allows corporations to extend their own corporate network through private "tunnels" over the public Internet. Effectively, a corporation uses a wide-area network as a single large local area network. A company no longer needs to lease its own lines for wide-area communication but can securely use the public networks. This kind of interconnection is known as a virtual private network (VPN).

PPTP, a proposed standard sponsored by Microsoft and other companies, and Layer 2 Forwarding, proposed by Cisco Systems, are among the most likely proposals as the basis for a new Internet Engineering Task Force (IETF) standard. With PPTP, which is an extension of the

Internet's Point-to-Point Protocol (PPP), any user of a PC with PPP client support is able to use an independent service provider (ISP) to connect securely to a server elsewhere in the user's company.

PROPELLER HEAD

A propeller head (sometimes shortened to prop head or prophead) is jargon for someone who is exceptionally, perhaps weirdly bright or knowledgeable, especially in some technical field. In computers, according to The New Hacker's Dictionary, it's a synonym for computer geek. The term refers to the child's beanie cap that comes with a spinning propeller sticking out of the top.

The New Hacker's Dictionary says that the propeller cap somehow became a self-parody symbol of the out-of-this-world-ness of science fiction fans. It attributes the idea to science fiction writer Ray Faraday Nelson. We like this definition from The Web Developer's Journal:

The term 'prophead' is a holdover from the days when the nerdy kids on the block wore caps with little propellers on top. This fashion gave way to the pencil pocket protector. Here at the WDJ, 'propheads' refers to programmers, developers and other technically oriented types. The weeniest of all don't even use a regular keyboard, just a little one with two keys: 1 and 0. They talk among themselves in continuous data streams, which sound to mortal ears like a modem logging on."

PROTOCOL

In information technology, a protocol (pronounced PROH-tuh-cahl, from the Greek protocollon, which was a leaf of paper glued to a manuscript volume, describing its contents) is the special set of rules for communicating that the end points in a telecommunication connection use when they send signals back and forth. Protocols exist at several levels in a telecommunication connection. There are hardware telephone protocols. There are protocols between the end points in communicating programs within the same computer or at different locations. Both end points must recognize and observe the protocol. Protocols are often described in an industry or international standard.

PROXY SERVER

In an enterprise that uses the Internet, a proxy server is a server that acts as an intermediary between a workstation user and the Internet so that the enterprise can ensure security, administrative control, and caching service. A proxy server is associated with or part of a gateway server that separates the enterprise network from the outside network and a firewall server that protects the enterprise network from outside intrusion.

A proxy server receives a request for an Internet service (such as a Web page request) from a user. If it passes filtering requirements, the proxy server, assuming it is also a cache server, looks in its local cache of previously downloaded Web pages. If it finds the page, it returns it to the user without needing to forward the request to the Internet. If the page is not in the cache, the proxy server, acting as a client on behalf of the user, uses one of its own IP addresses to request the page from the server out on the Internet. When the page is returned, the proxy server relates it to the original request and forwards it on to the user.

To the user, the proxy server is invisible; all Internet requests and returned responses appear to be directly with the addressed Internet server. (The proxy is not quite invisible; its IP address has to be specified as a configuration option to the browser or other protocol program.)

An advantage of a proxy server is that its cache can serve all users. If one or more Internet sites are frequently requested, these are likely to be in the proxy's cache, which will improve user response time. In fact, there are special servers called cache servers. A proxy can also do logging.

The functions of proxy, firewall, and caching can be in separate server programs or combined in a single package. Different server programs can be in different computers. For example, a proxy server may in the same machine with a firewall server or it may be on a separate server and forward requests through the firewall.

R

RELATIONAL DATABASE

A relational database is a collection of data items organized as a set of formally-described tables from which data can be accessed or reassembled in many different ways without having to reorganize the database tables. The relational database was invented by E. F. Codd at IBM in 1970.

The standard user and application program interface to a relational database is the structured query language (SQL). SQL statements are used both for interactive queries for information from a relational database and for gathering data for reports.

In addition to being relatively easy to create and access, a relational database has the important advantage of being easy to extend. After the original database creation, a new data category can be added without requiring that all existing applications be modified.

A relational database is a set of tables containing data fitted into predefined categories. Each table (which is sometimes called a relation) contains one or more data categories in columns. Each row contains a unique instance of data for the categories defined by the columns. For example, a typical business order entry database would include a table that described a customer with columns for name, address, phone number, and so forth. Another table would describe an order: product, customer, date, sales price, and so forth. A user of the database could obtain a view of the database that fitted the user's needs. For example, a branch office manager might like a view or report on all customers that had bought products after a certain date. A financial services manager in the same company could, from the same tables, obtain a report on accounts that needed to be paid.

When creating a relational database, you can define the domain of possible values in a data column and further constraints that may apply to that data value. For example, a domain of possible customers could allow up to ten possible customer names but be constrained in one table to allowing only three of these customer names to be specifiable.

The definition of a relational database results in a table of metadata or formal descriptions of the tables, columns, domains, and constraints.

RJ-11/RJ-45

RJ (registered jacks, sometimes described as RJ-XX) is a series of telephone connection interfaces (receptacle and plug) that are registered with the U.S. Federal Communications Commission (FCC). They derive from interfaces that were part of AT&T's Universal Service Order Codes (USOC) and were adopted as part of FCC regulations (specifically Part 68, Subpart F. Section 68.502). The term jack sometimes means both receptacle and plug and sometimes just the receptacle.

RJ-11

The most common telephone jack is the RJ-11 jack, which can have six conductors but usually is implemented with four. The RJ-11 jack is likely to be the jack that your household or office phones are plugged into from the ordinary "untwisted" wire (sometimes called "gray satin" or "flat wire") people are most familiar with. In turn, the jacks connect to the "outside" longer wires known as twisted pair that connect to the telephone company central office or to a private branch exchange (PBX).

The four wires are usually characterized as a red and green pair and a black and white pair. The red and green pair typically carry voice or data. On an outside phone company connection, the black and white pair may be used for low-voltage signals such as phone lights. On a PBX system, they may be used for other kinds of signaling.

Your computer modem is usually connected to an RJ-11 jack.

RJ-45

The RJ-45 is a single-line jack for digital transmission over ordinary phone wire, either untwisted or twisted. The interface has eight pins or positions. For connecting a modem, printer, or a data PBX at a data rate up to 19.2 Kbps, you can use untwisted wire. For faster transmissions in which you're connecting to an Ethernet 10BaseT network, you need to use twisted pair wire. (Untwisted is usually a flat wire like common household phone extension wire. Twisted is often round.)

There are two varieties of RJ-45: keyed and unkeyed. Keyed has a small bump on its end and the female complements it. Both jack and plug must match.

ROUTER

Also see bridge, gateway, hub, and switch.

On the Internet, a router is a device or, in some cases, software in a computer, that determines the next network point to which a packet should be forwarded toward its destination. The router is connected to at least two networks and decides which way to send each information packet based on its current understanding of the state of the networks it is connected to. A router is located at any juncture of networks or gateway, including each Internet point-of-presence. A router is often included as part of a network switch.

A router creates or maintains a table of the available routes and their conditions and uses this information along with distance and cost algorithms to determine the best route for a given packet. Typically, a packet may travel through a number of network points with routers before arriving at its destination. An edge router is a router that interfaces with an asynchronous transfer mode (ATM) network. A brouter is a network bridge combined with a router.

RS-232C

RS-232C is a long-established standard ("C" is the current version) that describes the physical interface and protocol for relatively low-speed serial data communication between computers and related devices. It was defined by an industry trade group, the Electronic Industries Association (EIA), originally for teletype devices.

RS-232C is the interface that your computer uses to talk to and exchange data with your modem and other serial devices. Somewhere in your PC, typically on a UART chip on your motherboard, the data from your computer is transmitted to an internal or external modem (or other serial device) from its Data Terminal Equipment (DTE) interface. Since data in your computer flows along parallel circuits and serial devices can handle only one bit at a time, the UART chip converts the groups of bits in parallel to a serial stream of bits. As your PC's DTE agent, it also communicates with the modem or other serial device, which, in accordance with the RS-232C standard, has a complementary interface called the Data Communications Equipment (DCE) interface.

S

SAP

(Systemanalyse und Programmentwicklung)

(Systems, Applications and Products in Data Processing)

SAP, started in 1972 by five former IBM employees in Mannheim, Germany, states that it is the world's market and technology leader in business application software. The original SAP idea was to provide customers the ability to interact with a common corporate database for a comprehensive range of applications. Gradually, the applications have been assembled and today many corporations, including IBM and Microsoft, are using SAP products to run their own businesses.

SAP applications, built around their latest R/3 system, provide the capability to manage financial, asset, and cost accounting, production operations and materials, personnel, plants, and archived documents. The R/3 system runs on a number of platforms including Windows NT and uses the client/server model. The latest version of R/3 includes a comprehensive Internet-enabled package.

In May 1998, SAP, a publicly traded company, had 15,000 employees in over 50 countries, and more than 15,000 R/3 installations. SAP is turning its attention to small- and-medium sized businesses. A recent R/3 version was provided for IBM's AS/400 platform.

SERIAL

Serial means one event at a time. It is usually contrasted with parallel, meaning more than one event happening at a time. In data transmission, the techniques of time division and space division are used, where time separates the transmission of individual bits of information sent serially and space (on multiple lines or paths) can be used to have multiple bits sent in parallel.

In the context of computer hardware and data transmission, serial connection, operation, and media usually indicate a simpler, slower operation and parallel indicates a faster operation. This indication doesn't always hold since a serial medium (for example, fiber optic cable) can be much faster than a slower medium that carries multiple signals in parallel.

On your PC, the printer is usually attached through a parallel interface and cable so that it will print faster. Your keyboard and mouse are one-way devices that only require a serial interface and line. Inside your computer, much of its circuitry supports bits being moved around in parallel.

Your computer modem uses one of your PC's serial connections or COM ports. Serial communication between your PC and the modem and other serial devices adheres to the RS-232C standard.

Conventional computers and their programs operate in a serial manner, with the computer reading a program and performing its instructions one after the other. However, some of today's computers have multiple processors and can perform instructions in parallel.

SERVER

In general, a server is a computer program that provides services to other computer programs in the same or other computers.

The computer that a server program runs in is also frequently referred to as a server (though it may contain a number of server and client programs).

In the client/server programming model, a server is a program that awaits and fulfills requests from client programs in the same or other computers. A given application in a computer may function as a client with requests for services from other programs and a server of requests from other programs.

Specific to the Web, a Web server is the computer program (housed in a computer) that serves requested HTML pages or files. A Web client is the requesting program associated with the user. The Web browser in your computer is a client that requests HTML files from Web servers.

SLIP

Serial Line Internet Protocol

Serial Line IP (SLIP), documented in RFC 1055, was the first protocol for relaying IP packets over dial-up lines. It defines an encapsulation mechanism, but little else. There is no support for dynamic address assignment, link testing, or multiplexing different protocols over a single link. SLIP has been largely supplanted by PPP.

SMTP

SMTP (Simple Mail Transfer Protocol) is a TCP/IP protocol used in sending and receiving e-mail. However, since it's limited in its ability to queue messages at the receiving end, it's usually used with one of two other protocols, POP3 or IMAP that let the user save messages in a server mailbox and download them periodically from the server. In other words, users typically use a program that uses SMTP for sending e-mail and either POP3 or IMAP for receiving messages that have been received for them at their local server. Most mail programs such as Eudora let you specify both an SMTP server and a POP server. On UNIX-based systems, sendmail is the most widely used SMTP server for e-mail. A commercial package, Sendmail, includes a POP3 server and also comes in a version for Windows NT.

SMTP usually is implemented to operate over TCP port 25. The details of SMTP are in RFC 821 of the Internet Engineering Task Force (IETF). An alternative to SMTP that is widely used in Europe is X.400.

SNEAKERNET

Sneakernet is a jargon term for the method of transmitting electronic information by personally carrying it from one place to another on floppy disk or other removable medium. The idea is that someone is using their shoes (possibly sneakers) to move data around rather than using the telecommunications network.

SOCKETS

Sockets is a method for communication between a client program and a server program in a network. A socket is defined as "the endpoint in a connection." Sockets are created and used with a set of programming requests or "function calls" sometimes called the sockets application programming interface (API). The most common sockets API is the Berkeley UNIX C language interface for sockets. Sockets can also be used for communication between processes within the same computer.

This is the typical sequence of sockets requests from a server application in the "connectionless" context of the Internet in which a server handles many client requests and does not maintain a connection longer than the serving of the immediate request:

Sockets can also be used for "connection-oriented" transactions with a somewhat different sequence of C language system calls or functions.

SONET

(Synchronous Optical Network)

SONET is the U.S. (ANSI) standard for synchronous data transmission on optical media. The international equivalent of SONET is synchronous digital hierarchy (SDH). Together, they ensure standards so that digital networks can interconnect internationally and that existing conventional transmission systems can take advantage of optical media through tributary attachments.

SONET provides standards for a number of line rates up to the maximum line rate of 9.953 gigabits per second (Gbps). Actual line rates approaching 20 gigabits per second are possible. SONET is considered to be the foundation for the physical layer of the broadband ISDN (BISDN).

ATM runs as a layer on top of SONET as well as on top of other technologies.

SONET defines a base rate of 51.84 Mbps and a set of multiples of the base rate known as "Optical Carrier levels."

SPAM

(Junk e-mail)

Spam is unsolicited e-mail on the Internet. From the sender's point-of-view, it's a form of bulk mail, often to a list culled from subscribers to a Usenet discussion group or obtained by companies that

specialize in creating e-mail distribution lists. To the receiver, it usually seems like junk e-mail. In general, it's not considered good netiquette to send spam. It is generally equivalent to unsolicited phone marketing calls except that the user pays for part of the message since everyone shares the cost of maintaining the Internet.

Some apparently unsolicited e-mail is e-mail people agreed to receive when they registered with a site and checked a box agreeing to receive postings about particular products or interests. It is also possible that some spam occasionally does find a welcome audience.

A first-hand report indicates that the term is derived from a famous Monty Python sketch ("Well, we have Spam, tomato & Spam, egg & Spam, Egg, bacon & Spam...") that was current when spam first began arriving on the Internet. Spam is a trademarked Hormel meat product that was well-known in the U.S. Armed Forces during World War II.

SQL

SQL (Structured Query Language) is a standard interactive and programming language for getting information from and updating a database. Although SQL is both an ANSI and an ISO standard, many database products support SQL with proprietary extensions to the standard language. Queries take the form of a command language that lets you select, insert, update, find out the location of data, and so forth. There is also a programming interface.

T

T-CARRIER SYSTEM

The T-carrier system, introduced by the Bell System in the U.S. in the 1960s, was the first successful system that supported digitized voice transmission. The original transmission rate (1.544 Mbps) in the T-1 line is in common use today in Internet service provider (ISP) connections to the Internet. Another level, the T-3 line, providing 44.736 Mbps, is also commonly used by ISPs. Another commonly installed service is a fractional T-1 line, which is the rental of some portion of the 24 channels in a T-1 line, with the other channels going unused.

The T-carrier system is entirely digital, using pulse code modulation and time-division multiplexing. The system uses four wires and provides full-duplex capability (two wires for receiving and two for sending at the same time). The T-1 digital stream consists of 24 64-Kbps channels that are multiplexed. (The standardized 64 Kbps channel is based on the bandwidth required for a voice conversation.) The four wires were originally a pair of twisted-pair copper wires, but can now also include coaxial cable, optical fiber, digital microwave, and other media. A number of variations on the number and use of channels are possible.

In the T-1 system, voice signals are sampled 8,000 times a second and each sample is digitized into an 8-bit word. With 24 channels being digitized at the same time, a 192-bit frame (24 channels each with an 8-bit word) is thus being transmitted 8,000 times a second. Each frame is separated from the next by a single bit, making a 193-bit block. The 192-bit frame multiplied by 8,000 and the additional 8,000 framing bits make up the T-1's 1.544 Mbps data rate. The signaling bits are the least significant bits per frame.

TCP/IP

TCP/IP (Transmission Control Protocol/Internet Protocol) is the basic communication language or protocol of the Internet. It can also be used as a communications protocol in the private networks called intranets and in extranets. When you are set up with direct access to the Internet, your computer is provided with a copy of the TCP/IP program just as every other computer that you may send messages to or get information from also has a copy of TCP/IP.

TCP/IP is a two-layered program. The higher layer, Transmission Control Protocol, manages the assembling of a message or file into smaller packets that are transmitted over the Internet and received by a TCP layer that reassembles the packets into the original message. The lower layer, Internet Protocol, handles the address part of each packet so that it gets to the right destination. Each gateway computer on the network checks this address to see where to forward the message. Even though some packets from the same message are routed differently than others, they'll be reassembled at the destination.

TCP/IP uses the client/server model of communication in which a computer user (a client) requests and is provided a service (such as sending a Web page) by another computer (a server) in the network. TCP/IP communication is primarily point-to-point, meaning each communication is from one point (or host computer) in the network to another point or host computer. TCP/IP and the higher-level applications that use it are collectively said to be "connectionless" because each client request is considered a new request unrelated to any previous one (unlike ordinary phone conversations that require a dedicated connection for the call duration). Being connectionless frees network paths so that everyone can use them continuously. (Note that the TCP layer itself is not connectionless as far as any one message is concerned. Its connection remains in place until all packets in a message have been received.)

Many Internet users are familiar with the even higher layer application protocols that use TCP/IP to get to the Internet. These include the World Wide Web's Hypertext Transfer Protocol (HTTP), the File Transfer Protocol (FTP), Telnet (Telnet) which lets you logon to remote computers, and the Simple Mail Transfer Protocol (SMTP). These and other protocols are often packaged together with TCP/IP as a "suite."

Personal computer users usually get to the Internet through the Serial Line Internet Protocol (SLIP) or the Point-to-Point Protocol (PPP). These protocols encapsulate the IP packets so that they can be sent over a dial-up phone connection to an access provider's modem.

Protocols related to TCP/IP include the User Datagram Protocol (UDP), which is used instead of TCP for special purposes. Other protocols are used by network host computers for exchanging router information. These include the Internet Control Message Protocol (ICMP), the Interior Gateway Protocol (IGP), the Exterior Gateway Protocol (EGP), and the Border Gateway Protocol (BGP).

TECHNOBABBLE

In information technology and other specialized areas, technobabble is the use of technical or "insider" terms that, to the uninitiated, have no meaning. Technobabble can be divided into (1) technical terms with some formal standing in language such as new transmission or computer communication protocols, especially in their abbreviated or acronym forms, (2) marketing terms in

which terms with prior meaning are give new missions (for example, industrial strength), and (3) informal, colloquial, or jargon terms (of which technobabble itself would seem to be an example). The latter could be divided into those with technical meaning and those with social meaning. To the extent that change occurs in information technology and other technical or scientific fields in ways that affect non-technical people and require them to learn about the new technologies (for example, buying and maintaining a computer), the possibilities for the creation and further proliferation of technobabble increase.

Although this term primarily connotes words that discourage understanding, it is not always used in a negative sense, but often in the sense that "here is some technical information in the terms that have been invented for it."

Closely related terms include: neologisms, technospeak, and geekspeak.

TFT

A display screen made with TFT (thin film transistor) technology is a liquid crystal display (LCD), common in notebook and laptop computers, that has a transistor for each pixel (that is, for each of the tiny elements that control the illumination of your display). Having a transistor at each pixel means that the current that triggers pixel illumination can be smaller and therefore can be switched on and off more quickly.

TFT is also known as active matrix technology (and contrasted with "passive matrix" which does not have a transistor at each pixel). A TFT or active matrix display is more responsive to change. For example, when you move your mouse across the screen, a TFT display is fast enough to reflect the movement of the mouse cursor. (With a passive matrix display, the cursor temporarily disappears until the display can "catch up.")

THICKNET/THINNET

Thicknet and Thinnet (sometimes spelled ThickNet and ThinNet) are commonly used terms for the larger and smaller size of coaxial cable used in Ethernet local area networks. Thicknet, also known as Thickwire, is 0.4 inches in diameter and has 50 ohms of electromagnetic impedance. Thinnet, also known as Thinwire and Cheapernet, is 0.2 inches in diameter with the same impedance as Thickwire. Thicknet was the original Ethernet wiring, but Thinnet, which is cheaper and can be installed more easily, is the more commonly installed Ethernet wire. Thicknet continues to be used for backbone wiring. An alternative to Thinnet on an Ethernet network is twisted pair.

THREAD/MULTI-THREADING

In computer programming, a thread is placeholder information associated with a single use of a program that can handle multiple concurrent users. From the program's point-of-view, a thread is the information needed to serve one individual user or a particular service request. If multiple users are using the program or concurrent requests from other programs occur, a thread is created and maintained for each of them. The thread allows a program to know which user is being served as the program alternately gets re-entered on behalf of different users. (One way thread information is kept is by storing it in a special data area and putting the address of that data area in a register.

The operating system always saves the contents of the register when the program is interrupted and restores it when it gives the program control again.)

Multithreading and multitasking are similar and are often confused. Today's computers can only execute one program instruction at a time, but because they operate so fast, they appear to run many programs and serve many users simultaneously. The computer operating system (for example, Windows 95) gives each program a "turn" at running, and then requires it to wait while another program gets a turn. Each of these programs is viewed by the operating system as a "task" for which certain resources are identified and kept track of. The operating system manages each application program in your PC system (spreadsheet, word processor, Web browser) as a separate task and lets you look at and control items on a "task list." If the program initiates an I/O request, such as reading a file or writing to a printer, it creates a thread so that the program will be reentered at the right place when the I/O operation completes. Meanwhile, other concurrent uses of the program are maintained on other threads. Most of today's operating systems provide support for both multitasking and multithreading. They also allow multithreading within program processes so that the system is saved the overhead of creating a new process for each thread.

The POSIX.4a C language specification provides a set of application program interfaces that allow a programmer to include thread support in the program. Higher-level program development tools and application subsystems and "middleware" also offer thread management facilities. Object-oriented programming languages also accommodate and encourage multithreading in several ways. Java supports multithreading by including synchronization modifiers in the language syntax, by providing classes developed for multithreading that can be inherited by other classes, and by doing background "garbage collection" (recovering data areas that are no longer being used) for multiple threads.

TOKEN RING

A token ring network is a local area network (LAN) in which all computers are connected in a ring or star topology and a bit- or token-passing scheme is used in order to prevent the collision of data between two computers that want to send messages at the same time. The token ring protocol is the second most widely used protocol on local area networks after Ethernet. The IBM Token Ring protocol led to a standard version, specified as IEEE 802.5. Both protocols are used and are very similar. The IEEE 802.5 token ring technology provides for data transfer rates of either 4 or 16 megabits per second. Very briefly, here is how it works:

Empty information frames are continuously circulated on the ring.

When a computer has a message to send, it inserts a token in an empty frame (this may consist of simply changing a 0 to a 1 in the token bit part of the frame) and inserts a message and a destination identifier in the frame.

The frame is then examined by each successive workstation. If the workstation sees that it is the destination for the message, it copies the message from the frame and changes the token back to 0.

When the frame gets back to the originator, it sees that the token has been changed to 0 and that the message has been copied and received. It removes the message from the frame.

The frame continues to circulate as an "empty" frame, ready to be taken by a workstation when it has a message to send.

The token scheme can also be used with bus topology LANs.

The standard for the token ring protocol is IEEE 802.5. The Fiber Distributed-Data Interface (FDDI) also uses a token ring protocol.

TOPOLOGY

A topology (from Greek topos: place) is a description of any kind of locality in terms of its physical layout. In the context of communication networks, a topology describes pictorially the configuration or arrangement of a (usually conceptual) network, including its nodes and connecting lines. For example, in these pages, whatis describes the topology of bus, ring, and other networks. (Currently, our descriptions are verbal, but pictures are being prepared.)

TRANSACTION

In computer programming, a transaction usually means a sequence of information exchange and related work (such as database updating) that is treated as a unit for the purposes of satisfying a request and for ensuring database integrity. For a transaction to be completed and database changes to made permanent, a transaction has to be completed in its entirety. A typical transaction is a catalog merchandise order phoned in by a customer and entered into a computer by a customer representative. The order transaction involves checking an inventory database, confirming that the item is available, placing the order, and confirming that the order has been placed and the expected time of shipment. If we view this as a single transaction, then all of the steps must be completed before the transaction is successful and the database is actually changed to reflect the new order. If something happens before the transaction is successfully completed, any changes to the database must be kept track of so that they can be undone.

A program that manages or oversees the sequence of events that are part of a transaction is sometimes called a transaction monitor. Transactions are supported by SQL, the standard database user and programming interface. When a transaction completes successfully, database changes are said to be committed; when a transaction does not complete, changes are rolled back. In IBM's CICS product, a transaction is a unit of application data processing that results from a particular type of transaction request. In CICS, an instance of a particular transaction request by a computer operator or user is called a task.

Less frequently and in other computer contexts, a transaction may have a different meaning. For example, in IBM mainframe operating system batch processing, a transaction is a job or a job step.

U

UDP

User Datagram Protocol

UDP, documented in RFC 768, provides users access to IP-like services. UDP packets are delivered just like IP packets - connection-less datagrams that may be discarded before reaching their targets. UDP is useful when TCP would be too complex, too slow, or just unnecessary.

UDP provides a few functions beyond that of IP:

Port Numbers. UDP provides 16-bit port numbers to let multiple processes use UDP services on the same host. A UDP address is the combination of a 32-bit IP address and the 16-bit port number.

Checksumming. Unlike IP, UDP does checksum its data, ensuring data integrity. A packet failing checksum is simply discarded, with no further action taken.

URL

Universal Resource Locator

Uniform Resource Locators (URLs) are strings that specify how to access network resources, such as HTML documents. They are part of the more general class of Universal Resource Identifiers (URIs). The most important use of URLs is in HTML documents to identify the targets of hyperlinks. When using a Web browser such as Netscape, every highlighted region has a URL associated with it, which is accessed when the link is activated by a mouse click. Relative URLs specify only a portion of the full URL - the missing information is inferred though the context of the source document.

URLs are documented in RFC 1738. Relative URLs are documented in RFC 1808. URIs are documented in RFC 1630.

Here is a URL that describes the root page of the Internet Encyclopedia:

http://www.FreeSoft.org/Connected/index.shtml

USB

USB (Universal Serial Bus) is a "plug-and-play" interface between a computer and add-on devices (such as audio players, joysticks, keyboards, telephones, scanners, and printers). With USB, a new device can be added to your computer without having to add an adapter card or even having to turn the computer off. The USB peripheral bus standard was developed by Compaq, IBM, DEC, Intel, Microsoft, NEC, and Northern Telecom and the technology is available without charge for all computer and device vendors.

USB supports a data speed of 12 megabits per second. This speed will accommodate a wide range of devices, including MPEG-2 video devices, data gloves, and digitizers. It is anticipated that USB will easily accommodate plug-in telephones that use ISDN and digital PBXs.

Since October 1996, the Windows operating systems have been equipped with USB drivers or special software designed to work with specific I/O device types. USB is integrated into Windows 98. Today, most new computers and peripheral devices are equipped with USB.

A different "plug-and-play" standard, Firewire/IEEE 1394, is designed to support much higher data rates and devices such as video camcorders and digital video disk (DVD) players. Both standards are expected to exist together, serving different device types.

V

VAPORWARE

Vaporware is software or hardware that is either (1) announced or mentioned publicly in order to influence customers to defer buying competitors' products or (2) late being delivered for whatever reason. Most computer companies have from time to time delivered vaporware, either by calculation or unintentionally. The vaporware picture is now "clouded" by the existence of beta products, a kind of vaporware that is almost solid. There is a Vaporware Hall of Shame for games software.

Vaporware is also the name of a company that makes games and other products for Amiga users.

VGA

Also CGA, EGA, VGA, XGA, and SVGA

Displays for personal computers have steadily improved since the days of the monochrome monitors that were used in word processors and text-based computer systems in the 1970s. In 1981, IBM introduced the Color Graphics Adapter (CGA). This display system was capable of rendering four colors, and had a maximum resolution of 320 pixels horizontally by 200 pixels vertically. While CGA was all right for simple computer games such as solitaire and checkers, it did not offer sufficient image resolution for extended sessions of word processing, desktop publishing, or sophisticated graphics applications.

In 1984, IBM introduced the Enhanced Graphics Adapter (EGA) display. It allowed up to 16 different colors and improved the resolution to 640 pixels horizontally by 350 pixels vertically. This improved the appearance of the display and made it possible to read text more easily than with CGA. Nevertheless, EGA did not offer sufficient image resolution for high-level applications such as graphic design and desktop publishing.

In 1987, IBM introduced the Video Graphics Array (VGA) display system. This has become the accepted minimum standard for PC clones. Many VGA monitors are still in use today. The maximum resolution depends on the number of colors displayed. You can choose between 16 colors at 640 x 480 pixels, or 256 colors at 320 x 200 pixels. All IBM-compatible computers support the VGA standard.

In 1990, IBM introduced the Extended Graphics Array (XGA) display as a successor to its 8514/A display. A later version, XGA-2 offers 800 by 600 pixel resolution in true color (16 million colors) and 1,024 by 768 resolution in 65,536 colors.

Most PC displays sold today are described as Super Video Graphics Array (SVGA) displays. SVGA originally just meant "beyond "VGA" and was not a single standard. More recently, the Video Electronics Standards Association (VESA) has established a standard programming interface for SVGA displays, called the VESA BIOS Extension. Typically, an SVGA display can support a palette of up to 16,000,000 colors, although the amount of video memory in a particular computer may limit the actual number of displayed colors to something less than that. Image-resolution specifications vary. In general, the larger the diagonal screen measure of an SVGA monitor, the more pixels it can display horizontally and vertically. Small SVGA monitors (14-inch diagonal)

usually display 800 pixels horizontally by 600 pixels vertically. The largest monitors (20 inches or more diagonal measure) can display 1280 x 1024, or even 1600 x 1200, pixels.

VISUAL BASIC

Visual Basic is a programming environment from Microsoft in which a programmer uses a graphical user interface to choose and modify pre-selected chunks of code written in the BASIC programming language.

Since Visual Basic is easy to learn and fast to write code with, it's sometimes used to prototype an application that will later be written in a more difficult but efficient language. Visual Basic is also widely used to write working programs. Microsoft says that there are at least 3 million developers using Visual Basic.

W

WAN

A WAN (wide area network) is a geographically dispersed telecommunications network and the term distinguishes a broader telecommunication structure from a local area network (LAN). A wide area network may be privately owned or rented, but the term usually connotes the inclusion of public (shared user) networks. An intermediate form of network in terms of geography is a metropolitan area network (MAN).

WEB SERVER

A Web server is a program that, using the client/server model and the World Wide Web's Hypertext Transfer Protocol (HTTP), serves the files that form Web pages to Web users (whose computers contain HTTP clients that forward their requests). Every computer on the Internet that contains a Web site must have a Web server program (or else the site files must be sent to a computer that has a Web server program). The most popular Web servers are Apache, a Web server for both 32-bit Windows and UNIX-based operating systems; Microsoft's Internet Information Server (IIS), which comes with the Windows NT server; and Netscape's FastTrack and Enterprise servers. Other Web servers include Novell's Web Server for users of its NetWare operating system and IBM's family of Lotus Domino servers, primarily for IBM's OS/390 and AS/400 customers.

Web servers often come as part of a larger package of Internet- and intranet-related programs for serving e-mail, downloading requests for FTP files, and building and publishing Web pages. Considerations in choosing a Web server include how well it works with the operating system and other servers, its ability to handle server-side programming, and publishing, search engine, and site building tools that may come with it.

WORLD WIDE WEB

A technical definition of the World Wide Web is: all the resources and users on the Internet that are using the Hypertext Transfer Protocol (HTTP).

A broader definition comes from the organization that Web inventor Tim Berners-Lee helped found, the World Wide Web Consortium (W3C):

"The World Wide Web is the universe of network-accessible information, an embodiment of human knowledge."

WYSIWYG

(What You See Is What You Get)

A WYSIWYG (pronounced "wiz-ee-wig") editor or program is one that allows an interface or content developer to create a graphical user interface (GUI) or page of text so that the developer can see what the end result will look like while the interface or document is being created. A WYSIWYG editor can be contrasted with more traditional editors that require the developer to enter descriptive codes (or markup) and do not permit an immediate way to see the results of the markup.

For example, this page was created with a very handy tool, HTML Assistant Pro that assists in inserting markup but still requires that the developer think in terms of markup. (HTML Assistant Pro and similar editors do let you test your markup very readily with a browser.) A true WYSIWYG editor, such as Microsoft's FrontPage or Adobe's PageMill, conceals the markup and allows the developer to think entirely in terms of how the content should appear. (One of the trade-offs, however, is that a WYSIWYG editor does not always make it easy to fine-tune its results.

X

X.25

The X.25 protocol, adopted as a standard by the Consultative Committee for International Telegraph and Telephone (CCITT), is a commonly used network protocol. The X.25 protocol allows computers on different public networks (such as CompuServe, Tymnet, or a TCP/IP network) to communicate through an intermediary computer at the network layer level. X.25's protocols correspond closely to the data-link and physical-layer protocols defined in the Open Systems Interconnection (OSI) communication model.

XML

XML (Extensible Markup Language) is a flexible way to create common information formats and share both the format and the data on the World Wide Web, intranets, and elsewhere. For example, computer makers might agree on a standard or common way to describe the information about a computer product (processor speed, memory size, and so forth) and then describe the product information format with XML. Such a standard way of describing data would enable a user to send an intelligent agent (a program) to each computer maker's Web site, gather data, and then make a valid comparison. XML can be used by any individual or group of individuals or companies that wants to share information in a consistent way.

Currently a formal recommendation from the World Wide Web Consortium (W3C). XML is similar to the language of today's Web pages, HTML. Both XML and HTML contain markup symbols to describe the contents of a page or file. HTML, however, describes the content of a Web page (mainly text and graphic images) only in terms of how it is to be displayed and interacted with. For example, a <P> starts a new paragraph. XML describes the content in terms of what data is being

described. For example, a <PHONENUM> could indicate that the data that followed it was a phone number. This means that an XML file can be processed purely as data by a program or it can be stored with similar data on another computer or, like an HTML file, that it can be displayed. For example, depending on how the application in the receiving computer wanted to handle the phone number, it could be stored, displayed, or dialed.

XML is "extensible" because, unlike HTML, the markup symbols are unlimited and self-defining. XML is actually a simpler and easier-to-use subset of the Standard Generalized Markup Language (SGML), the standard for how to create a document structure. It is expected that HTML and XML will be used together in many Web applications.

Early applications of XML include Microsoft's Channel Definition Format (CDF), which describes a channel, a portion of a Web site that has been downloaded to your hard disk and is then is updated periodically as information changes. A specific CDF file contains data that specifies an initial Web page and how frequently it is updated. Another early application is ChartWare, which uses XML as a way to describe medical charts so that they can be shared by doctors. Applications related to banking, e-commerce ordering, personal preference profiles, purchase orders, litigation documents, part lists, and many others are anticipated.

XON/XOFF

Xon/Xoff (sometimes written "X-on/X-off" or "XON/XOFF" and pronounced eks-AWN eks-AWF) is a protocol for controlling the flow of data between computers and other devices on an asynchronous serial connection. For example, a computer typically sends data to a printer faster than the printer can print. The printer contains a buffer where data is stored until the printer catches up with the computer. If the buffer becomes full before the printer catches up, a small microprocessor in the printer sends back an X/off signal to stop sending data. When enough data is printed and buffer storage becomes free, the printer sends an X/on signal telling the computer to resume sending data.

The "X" stands for "transmitter" so the X/on and X/off are signals to turn a transmitter on or off. The actual signal for X/on is the same bit configuration as the ASCII Ctrl-Q keyboard combination. The X/off signal is the Ctrl-S character.

When you define your modem to your computer's operating system, you may need to specify the use of flow control with X/on/Xoff or with CTS/RTS (Clear to Send/Ready to Send). When sending binary data, Xon/Xoff may not be recognized because it is character-encoded.

Selected Links

This reference on the Extended AT Command Sets provides details on how modem communication works.