# *GLOSSARY*

## A

**Abilene network:** The Abilene network is the part of Internet 2 that is run by Indiana University.

**access layer:** The access layer is the part of a network that connects clients or servers to the rest of the network. It is often a LAN.

**access point (AP):** The part of the wireless LAN that connects the LAN to other networks.

**ACK:** *See* **acknowledgment (ACK)**.

**acknowledgment (ACK):** A character indicating a positive acknowledgment that a message has been received correctly.

**ACM:** Association for Computing Machinery. The ACM is an association of computer professionals.

**acronym:** A word formed from the initial letters or groups of letters of words in a phrase. An example is the word *laser*, which means *l*ight *a*mplification by *s*timulated *e*mission of *r*adiation.

**address:** A coded representation of the destination of data or of its originating source. For example, multiple computers on one communication circuit must each have a unique data link layer address.

**address resolution:** The process of determining the lower-layer address from a higher-layer address. For example, IP address resolution means determining the IP address from the application-layer address, whereas data link layer address resolution means determining the data link layer address from an IP address.

**Address Resolution Protocol (ARP):** The network-layer protocol standard for data link layer address resolution requests.

**ADSL:** *See* **asymmetric DSL (ADSL)**.

**Advanced Encryption Standard (AES):** A new single-key encryption standard authorized by NIST that replaces DES. It uses the Rijndael (pronounced "rain doll") algorithm and has key sizes of 128, 192, and 256 bits. NIST estimates that using the most advanced computers and techniques available today, it will require about 150 trillion years to crack AES by brute force.

**Advanced Research and Development Network Operations Center (ARDNOC):** The agency funded by the Canadian government to develop new Internet 2 technologies and protocols.

**AES:** *See* **Advanced Encryption Standard (AES).**

**American National Standards Institute (ANSI):** The principal standards-setting body in the United States. ANSI is a nonprofit, nongovernmental organization supported by more than 1,000 trade organizations, professional societies, and companies. It belongs to the ITU-T CCITT and the ISO.

**American Standard Code for Information Interchange:** *See* **ASCII**.

**amplifier:** A device used to boost the strength of a signal. Amplifiers are spaced at intervals throughout the length of a communication circuit to increase the distance a signal can travel. *See also* **repeater**.

**amplitude modulation:** *See* **modulation, amplitude**.

**analog:** Pertaining to representation by means of continuously variable quantity, such as varying frequencies. Physical quantities such as temperature are continuous variable, and therefore are "analog."

**analog signal:** A signal in the form of a continuously varying quantity such as amplitude, which reflects variations in the loudness of the human voice.

**analog transmission:** Transmission of a continuously variable signal as opposed to a discrete on/off signal. The traditional way of transmitting a telephone or voice signal is analog.

**ANI:** *See* **automatic number identification (ANI).**

**anonymous FTP:** *See* **File Transfer Protocol (FTP).**

**ANSI:** *See* **American National Standards Institute (ANSI).**

**AP:** *See* **access point (AP).**

**API:** Application Program Interface. API is the way IBM links incompatible equipment for microcomputer-to-mainframe links. API allows applications on micro-computers and mainframes to speak directly to each other at the application software level, even though the equipment is from different vendors.

**Apple Talk:** A set of communication protocols that defines networking for Apple computers. Rarely used today.

**application service provider (ASP):** An application service develops an application system (e.g., an airline reservation system, a payroll system) and companies purchase the service, without ever installing the software on their own computers. They simply use the service the same way you might use a Web hosting service to publish your own Web pages rather than attempting to purchase and operate your own Web server.

**ARCnet:** Attached Resource Computing network. A proprietary token-bus LAN developed by the Datapoint Corporation.

**ARDNOC:** *See* **Advanced Research and Development Network Operations Center (ARDNOC).**

**ARP:** *See* **Address Resolution Protocol (ARP)**.

**ARPANET:** One of the early packet-switching networks. ARPANET was developed by the U.S. Department of Defense Advanced Research Projects Agency. It was the predecessor of the Internet.

**ARQ:** Automatic Repeat reQuest. A system employing an error-detecting code so conceived that any error initiates a repetition of the transmission of the incorrectly received message.

**ASCII:** American Standard Code for Information Interchange. Pronounced "ask-e." An eight-level code for data transfer adopted by the ANSI to achieve compatibility among data devices.

**asymmetric DSL (ADSL):** A data link layer technology that provides high-speed ("broadband") communication over traditional telephone lines. A DSL modem is used to provide three channels: a traditional voice channel, an upstream channel for communicating from the client to the ISP (often at speeds of 64 to 640 Kbps), and a downstream channel for communicating from the ISP to the client (often at speeds of 640 Kbps to 6 Mbps).

**asynchronous transfer mode (ATM):** A communication switch that handles interface speeds ranging from 25 million to 622 million bps. It multiplexes data streams onto the same BN by using cell relay techniques. ATM switches can handle multimedia traffic, such as data, graphics, voice, and video.

**asynchronous transmission:** Transmission in which each information character is individually synchronized, usually by start and stop bits. The gap between each character is not a fixed length. *Compare with* **synchronous transmission**.

**ATM:** *See* **asynchronous transfer mode (ATM)**. In banking, an **automated teller machine**.

**attenuation:** As a signal travels through a circuit, it gradually attenuates, or loses power. Expressed in decibels, attenuation is the difference between the transmitted and received power caused by loss of signal strength through the equipment, communication circuits, or other devices.

**authentication:** A security method of guaranteeing that a message is genuine, that it has arrived unaltered, and that it comes from the source indicated.

**automatic number identification (ANI):** The process whereby a long-distance common carrier provides its customers with a visual display of an incoming caller's telephone number.

**Automatic Repeat reQuest:** *See* **ARQ.**

**B**

**backbone network (BN):** A large network to which many networks within an organization are connected. It usually is a network that interconnects all networks on a single site, but it can be larger if it connects all the organization's terminals, microcomputers, mainframes, LANs, and other communication equipment.

**BALUN:** balanced/unbalanced. An impedance-matching device to connect balanced twisted-pair cabling with unbalanced coaxial cable.

**bandwidth:** The difference between the highest and lowest frequencies in a band. For example, a voice-grade circuit has a 4,000-Hz bandwidth. In common usage, *bandwidth* refers to circuit capacity; when people say they need more bandwidth, they need a higher transmission speed.

**basic rate interface (BRI):** In ISDN, two 64,000-bps B circuits for data transmission and one 16,000-bps D circuit for signaling (2 B+D). Also called basic rate access. *See also* **primary rate interface (PRI)**.

**baud:** Unit of signaling speed. Now obsolete and replaced by the term *symbol rate*. The speed in baud is the number of signal elements per second, If each signal represents only 1 bit, *baud* is the same as *bits per second (bps)*. When each signal contains more than 1 bit, *baud* does not equal *bps*.

**BCC:** *See* **block check character (BCC)**.

**BER:** bit-error rate. The number of bits received in error divided by the total number of bits received. An indicator of circuit quality.

**BERT:** bit-error rate testing. Testing a data line with a pattern of bits that are compared before and after the transmission to detect errors.

**BGP:** *See* **Border Gateway Protocol (BGP).**

**binary:** A number system using only the two symbols 0 and 1 that is especially well adapted to computer usage because 0 and 1 can be represented as "on" and "off," respectively, or as negative charges and positive charges, respectively. The binary digits appear in strings of 0's and 1's.

**bipolar transmission:** A method of digital transmission in which binary 0 is sent as a negative pulse and binary 1 is sent as a positive pulse.

**bit:** 1. An abbreviation of the term *binary digit*. 2. A single pulse in a group of pulses. 3. A unit of information capacity.

**bit-error rate (BER):** *See* **BER.**

**bit-error rate testing (BERT):** *See* **BERT.**

**bit rate:** The rate at which bits are transmitted over a communication path, normally expressed in bits per second (bps). The bit rate should not be confused with the data signaling rate (*baud*), which measures the rate of signal changes being transmitted. *See also* **bps.**

**bit stream:** A continuous series of bits being transmitted on a transmission line.

**bits per second (bps):** *See* **bps.**

**BKER:** Block-error rate. The number of blocks received in error divided by the total number of blocks received.

**BKERT:** Block-error rate testing. Testing a data link with groups of information arranged into transmission blocks for error checking.

**block:** Sets of contiguous bits or bytes that make up a message, frame, or packet.

**block check character (BCC):** The character(s) at the end of a binary synchronous communications (BSC) message used to check for errors.

**block-error rate (BKER):** *See* **BKER.**

**block-error rate testing (BKERT):** *See* **BKERT.**

**Bluetooth:** A standard for short-distance wireless communication.

**BN:** *See* **backbone network (BN)**.

**BOC:** *See* **RBOC.**

**BONDING:** BONDING (Bandwidth on Demand Interoperatibility Networking Group) is an inverse multiplexing proposal for combining several 56-Kbps or 64-Kbps circuits into one higher-speed circuit.

**Border Gateway Protocol (BGP):** A network-layer standard protocol used to exchange route information between routers using dynamic decentralized routing. Used only between different TCP/IP autonomous systems (i.e., major sections of the Internet).

**bps:** Bits per second. The basic unit of data communication rate measurement. Usually refers to rate of information bits transmitted. *Contrast with* **baud** and **bit rate.**

**BRI:** *See* **basic rate interface (BRI)**

**bridge:** A device that connects two similar networks using the same data link and network protocols. *Compare with* **gateway, router**, and **brouter**.

**broadband circuit:** An analog communication circuit.

**broadband communications:** Originally, the term referred to analog communications, but it has become corrupted in common usage so that it now usually means high-speed communications networks, typically Internet access technologies with access speeds of 1 Mbps or higher.

**broadband Ethernet:** The 10Broad36 version of Ethernet IEEE 802.3, meaning that it transmits at 10 millions bps in broadband with a maximum distance of 3,600 meters.

**broadcast routing:** *See* **decentralized routing**.

**brouter:** A piece of hardware that combines the functions of a bridge and a router. *See also* **bridge** and **router**.

**brute-force attack:** A way of breaking an encrypted message by trying all possible values of the key.

**buffer:** A device used for the temporary storage of data, primarily to compensate for differences in data flow rates (for example, between a terminal and its transmission circuit) but also as a security measure to allow retransmission of data if an error is detected during transmission.

**burst error:** A series of consecutive errors in data transmission. Refers to the phenomenon on communication circuits in which errors are highly prone to occurring in groups or clusters.

**bus:** A transmission path or circuit. Typically an electrical connection with one or more conductors in which all attached devices receive all transmissions at the same time.

**byte:** A small group of data bits that is handled as a unit. In most cases, it is an 8-bit byte and it is known as a *character*.

**550**       **GLOSSARY**

## C

**call-back modem:** When a user calls a host computer, the modem disconnects the call after receiving the password and calls back to the caller's predefined telephone number to establish a connection.

**CA\*net:** CA\*net is the Canadian network that forms part of Internet 2.

**carrier:** An analog signal at some fixed amplitude and frequency that then is combined with an information-bearing signal to produce an intelligent output signal suitable for transmission of meaningful information. *Also called carrier wave* or **carrier frequency**.

**carrier frequency:** The basic frequency or pulse repetition rate of a signal bearing no intelligence until it is modulated by another signal that does impart intelligence.

**Carrier Sense Multiple Access:** *See* **CSMA/CA** and **CSMA/CD.**

**CCITT:** *See* **Consultative Committee on International Telegraph and Telephone (CCITT).** Now obsolete and renamed **International Telecommunications Union—Telecommunications (ITU-T).**

**CD:** 1. Collision detection in the CSMA (Carrier Sense Multiple Access) protocol for LANs. 2. Carrier detect occurs when a modem detects a carrier signal to be received.

**central office:** The switching and control facility set up by the local telephone company (common carrier) where the subscriber's local loop terminates. Central offices handle calls within a specified geographic area, which is identified by the first three digits of the telephone number. *Also called* an **end office** or **exchange office.**

**Central processing unit (CPU):** *See* **CPU.**

**CENTREX:** A widespread telephone company switching service that uses dedicated central office switching equipment. CENTREX CPE is where the user site also has customer premises equipment (CPE).

**CERT:** *See* **Computer Emergency Response Team (CERT)**.

**certificate authority (CA):** A CA is a trusted organization that can vouch for the authenticity of the person or organization using authentication (e.g., VeriSign). A person wanting to use a CA registers with the CA and must provide some proof of identify. CA issues a digital certificate that is the requestor's public key encrypted using the CA's private key as proof of identity that can be attached to the user's e-mail or Web transactions.

**channel:** 1. A path for transmission of electromagnetic signals. *Synonym for* **line** or **link**. *Compare with*

**circuit**. 2. A data communications path. Circuits may be divided into subcircuits.

**character:** A member of a set of elements used for the organization, control, or representation of data. Characters may be letters, digits, punctuation marks, or other symbols. *Also called* a **byte**.

**cheapnet:** *See* **thin Ethernet**.

**checking, echo:** A method of checking the accuracy of transmitted data in which the received data are returned to the sending end for comparison with the original data.

**checking, parity:** *See* **parity check**.

**checking, polynomial:** *See* **polynomial checking**.

**circuit:** The path over which the voice, data, or image transmission travels. Circuits can be twisted-wire pairs, coaxial cables, fiber-optic cables, microwave transmissions, and so forth. *Compare with* **channel, line**, and **link**.

**circuit switching:** A method of communications whereby an electrical connection between calling and called stations is established on demand for exclusive use of the circuit until the connection is terminated.

**cladding:** A layer of material (usually glass) that surrounds the glass core of an optical fiber. Prevents loss of signal by reflecting light back into the core.

**client:** The input–output hardware device at the user's end of a communication circuit. There are three major categories of clients: microcomputers, terminals, and special-purpose terminals.

**cluster controller:** A device that controls the input–output operations of the cluster of devices (microcomputers, terminals, printers, and so forth) attached to it. Also called a *terminal controller*. For example, the 3274 Control Unit is a cluster controller that directs all communications between the host computer and remote devices attached to it.

**CMIP:** *See* **Common Management Interface Protocol (CMIP)**.

**coaxial cable:** An insulated wire that runs through the middle of a cable. A second braided wire surrounds the insulation of the inner wire like a sheath. Used on LANs for transmitting messages between devices.

**code:** A transformation or representation of information in a different form according to some set of preestablished conventions. *See also* **ASCII** and **EBCDIC**.

**codec:** A codec translates analog voice data into digital data for transmission over computer networks. Two codecs are needed—one at the sender's end and one at the receiver's end.

**code conversion:** A hardware box or software that converts from one code to another, such as from ASCII to EBCDIC.

**collapsed backbone network:** In a collapsed BN, the set of routers in a typical BN is replaced by one switch and a set of circuits to each LAN. The collapsed backbone has more cable but fewer devices. There is no backbone cable. The "backbone" exists only in the switch.

**collision:** When two computers or devices transmit at the same time on a shared multipoint circuit, their signals collide and destroy each other.

**common carrier:** An organization in the business of providing regulated telephone, telegraph, telex, and data communications services, such as AT&T, MCI, Bell-South, and NYNEX. This term is applied most often to U.S. and Canadian commercial organizations, but sometimes it is used to refer to telecommunication entities, such as government-operated suppliers of communication services in other countries. *See also* **PTT**.

**Common Management Interface Protocol (CMIP):** CMIP is a network management system that monitors and tracks network usage and other parameters for user workstations and other nodes. It is similar to SNMP, but it is more complete and is better in many ways.

**communication services:** A group of transmission facilities that is available for lease or purchase.

**comparison risk ranking:** The process by which the members of a Delphi team reach a consensus on which network threats have the highest risk. It produces a ranked list from high risk to low risk.

**component:** One of the specific pieces of a network, system, or application. When these components are assembled, they become the network, system, or application. Components are the individual parts of the network that we want to safeguard or restrict by using controls.

**compression:** *See* **data compression.**

**Computer Emergency Response Team (CERT):** The job of CERT, located at Carnegie Mellon University, is to respond to computer security problems on the Internet, raise awareness of computer security issues, and prevent security breaches. It was established by the U.S. Department of Defense in 1988 after a virus shut down almost 10 percent of the computers on the Internet. Many organizations are starting their own computer emergency response teams, so the term is beginning to refer to any response team, not just the one at Carnegie Mellon University.

**concentrator:** A device that multiplexes several low-speed communication circuits onto a single high-speed trunk. A remote data concentrator (RDC) is similar in function to a multiplexer but differs because the host computer software usually must be rewritten to accommodate the RDC. RDCs differ from statistical multiplexes because the total capacity of the high-speed outgoing circuit, in characters per second, is equal to the total capacity of the incoming low-speed circuits. On the other hand, output capacity of a statistical multiplexer (stat mux) is less than the total capacity of the incoming circuits.

**conditioning:** A technique of applying electronic filtering elements to a communication line to improve the capability of that line so it can support higher data transmission rates. *See also* **equalization.**

**configuration:** The actual or practical layout of a network that takes into account its software, hardware, and cabling. Configurations may be multidrop, point-to-point, LANs, and the like. By contrast, a topology is the geometric layout (ring, bus, star) of the configuration. Topologies are the building blocks of configurations. *Compare with* **topology.**

**connectionless routing:** Connectionless routing means each packet is treated separately and makes its own way through the network. It is possible that different packets will take different routes through the network depending on the type of routing used and the amount of traffic.

**connection-oriented routing:** Connection-oriented routing sets up a virtual circuit (one that appears to use point-to-point circuit switching) between the sender and receiver. The network layer makes one routing decision when the connection is established, and all packets follow the same route. All packets in the same message arrive at the destination in the same order in which they were sent.

**Consultative Committee on International Telegraph and Telephone (CCITT):** An international organization that sets worldwide communication standards. Its new name is **International Telecommunications Union—Telecommunications (ITU-T).**

**content caching:** Storing content from other Web sites on your network to reduce traffic on your Internet connection. A content engine regularly stores incoming static content such as banners and graphics files so that future requests for those items can be processed internally.

**content delivery:** Storing content for your Web sites on the content delivery provider's servers spread around the Internet to reduce traffic on your Internet connection.

The content delivery provider's servers contain the static content on your pages such as banners and graphics files. Software on your Web server locates the nearest content delivery server to the user (based on his or her IP address) and changes the references on your Web pages to draw the static content from that server. Content delivery was pioneered by Akamai, which is one of the leading content delivery services on the Internet.

**contention:** A method by which devices on the same shared multipoint circuit compete for time on the circuit.

**control:** A mechanism to ensure that the threats to a network are mitigated. There are two levels of controls: system-level controls and application-level controls.

**control character:** A character whose occurrence in a particular context specifies some network operation or function.

**control spreadsheet:** A two-dimensional matrix showing the relationship between the controls in a network, the threats that are being mitigated, and the components that are being protected. The controls listed in each cell represent the specific control enacted to reduce or eliminate the exposure.

**core layer:** The core layer is the central part of a network that provides access to the distribution layer. It is often a very fast BN that runs through the center of a campus or office complex.

**COS:** Corporation for Open Systems. An organization of computer and communications equipment vendors and users formed to accelerate the introduction of products based on the seven-layer OSI model. Its primary interest is the application layer (layer 7) of the OSI model and the X.400 e-mail standard.

**CPE:** *See* **customer premises equipment (CPE).**

**CPU:** central processing unit.

**CRC:** Cyclical redundancy check. An error-checking control technique using a specific binary prime divisor that results in a unique remainder. It usually is a 16- to 32-bit character.

**CSMA/CA:** Carrier Sense Multiple Access (CSMA) with Collision Avoidance (CA). This protocol is similar to the Carrier Sense Multiple Access (CSMA) with Collision Detection (CD) protocol. Whereas CSMA/CD sends a data packet and then reports back if it collides with another packet, CSMA/CA sends a small preliminary packet to determine whether the network is busy. If there is a collision, it is with the small packet rather than with the entire message. CA is thought to be more

efficient because it reduces the time required to recover from collisions.

**CSMA/CD:** Carrier Sense Multiple Access (CSMA) with Collision Detection (CD). A system used in contention networks. The network interface unit listens for the presence of a carrier before attempting to send and detects the presence of a collision by monitoring for a distorted pulse.

**customer premises equipment (CPE):** Equipment that provides the interface between the customer's CENTREX system and the telephone network. It physically resides at the customer's site rather than the telephone company's end office. *CPE* generally refers to voice telephone equipment instead of data transmission equipment.

**cut through switching:** A type of switching in which messages are forwarded as they arrive, almost on a bit-by-bit basis.

**cyclical redundancy check (CRC):** *See* **CRC.**

### D

**data:** 1. Specific individual facts or a list of such items. 2. Facts from which conclusions can be drawn.

**data circuit terminating equipment (DCE):** *See* **DCE.**

**data compression:** The technique that provides for the transmission of fewer data bits without the loss of information. The receiving location expands the received data bits into the original bit sequence.

**Data Encryption Standard (DES):** *See* **DES.**

**Data over Cable System Interface Specification (DOCSIS):** A de facto data link layer standard for transmitting data via a cable modem using Ethernet-like protocols.

**Data-over-Voice (DOV):** When data and voice share the same transmission medium. Data transmissions are superimposed over the voice transmission.

**data terminal equipment (DTE):** *See* **DTE.**

**datagram:** A datagram is a connectionless service in packet-switched networks. Each packet has a destination and sequence number and may follow a different route through the network. Different routes may deliver packets at different speeds, so data packets often arrive out of sequence. The sequence number tells the network how to reassemble the packets into a continuous message.

**dB:** *See* **decibel (dB).**

**DCE:** Data circuit terminating equipment. The equipment (usually the modem) installed at the user's site that provides all the functions required to establish,

maintain, and terminate a connection, including the signal conversion and coding between the data terminal equipment (DTE) and the common carrier's line.

**DDoS attack:** *See* **distributed denial-of-service (DDoS) attack**.

**decentralized routing:** With decentralized routing, all computers in the network make their own routing decisions. There are three major types of decentralized routing. With static routing, the routing table is developed by the network manager and remains unchanged until the network manager updates it. With dynamic routing, the goal is to improve network performance by routing messages over the fastest possible route; an initial routing table is developed by the network manager but is continuously updated to reflect changing network conditions, such as message traffic. With broadcast routing, the message is sent to all computers, but it is processed only by the computer to which it is addressed.

**decibel (dB):** A tenth of a bel. A unit for measuring relative strength of a signal parameter such as power and voltage. The number of decibels is ten times the logarithm (base 10) of the ratio of the power of two signals, or ratio of the power of one signal to a reference level. The reference level always must be indicated, such as 1 milliwatt for power ratio.

**dedicated circuit:** A leased communication circuit that goes from your site to some other location. It is a clear, unbroken communication path that is yours to use 24 hours per day, 7 days per week. Also called a *private circuit* or **leased circuit**.

**delay distortion:** A distortion on communication lines that is caused because some frequencies travel more slowly than others in a given transmission medium and therefore arrive at the destination at slightly different times. Delay distortion is measured in microseconds of delay relative to the delay at 1,700 Hz. This type of distortion does not affect voice, but it can have a serious effect on data transmissions.

**delay equalizer:** A corrective device for making the phase delay or envelope delay of a circuit substantially constant over a desired frequency range. *See also* **equalizer**.

**Delphi group:** A small group of experts (three to nine people) who meet to develop a consensus when it may be impossible or too expensive to collect more accurate data. For example, a Delphi group of communication experts might assemble to reach a consensus on the various threats to a communication network, the potential dollar losses for each occurrence of each threat, and the estimated frequency of occurrence for each threat.

**denial of service (DoS) attack:** A DoS attempts to disrupt the network by flooding the network with messages so that the network cannot process messages from normal users.

**DES:** Data Encryption Standard. Developed by IBM and the U.S. National Institute of Standards, this widely used single-key encryption algorithm uses a 64-bit key.

**desktop videoconferencing:** With desktop videoconferencing, small cameras are installed on top of each user's computer so that participants can hold meetings from their offices.

**DHCP:** *See* **Dynamic Host Control Protocol (DHCP).**

**digital signal:** A discrete or discontinuous signal whose various states are discrete intervals apart, such as +15 volts and -15 volts.

**digital subscriber line (DSL):** A data link layer technology that provides high-speed ("broadband") communication over traditional telephone lines. A DSL modem is used to provide three channels: a traditional voice channel, an upstream channel for communicating from the client to the ISP (often at speeds of 64 to 640 Kbps), and a downstream channel for communicating from the ISP to the client (often at speeds of 640 Kbps to 6 Mbps).

**distortion:** The unwanted modification or change of signals from their true form by some characteristic of the communication line or equipment being used for transmission—for example, delay distortion and amplitude distortion.

**distortion types:** 1. *Bias:* A type of distortion resulting when the intervals of modulation do not all have exactly their normal durations. 2. *Characteristic:* Distortion caused by transient disturbances that are present in the transmission circuit because of modulation. 3. *Delay:* Distortion occurring when the envelope delay of a circuit is not consistent over the frequency range required for transmission. 4. *End:* Distortion of start–stop signals. The shifting of the end of all marking pulses from their proper positions in relation to the beginning of the start pulse. 5. *Jitter:* A type of distortion that results in the intermittent shortening or lengthening of the signals. This distortion is entirely random in nature and can be caused by hits on the line. 6. *Harmonic:* The resultant process of harmonic frequencies (due to nonlinear characteristics of a transmission circuit) in the response when a sinusoidal stimulus is applied.

**distributed denial of service (DDoS) attack:** With a DDoS attack, a hacker breaks into and takes control of

many computers on the Internet (often several hundred to several thousand) and uses them to launch the DoS attack from thousands of computers at the same time.

**distribution layer:** The distribution layer is the part of a network that connects the access layer to other access layers and to the core layer. It is often a BN in a building.

**DNS:** *See* **Domain Name Service (DNS)**.

**DOCSIS:** *See* **Data over Cable System Interface Specification (DOCSIS)**.

**Domain Name Service (DNS):** A server that provides a directory used to supply IP addresses for application-layer addresses—that is, a server that performs IP address resolution.

**DoS attack:** *See* **denial of service (DoS) attack**.

**download:** The process of loading software and data into the nodes of a network from the central node. Downloading usually refers to the movement of data from a host mainframe computer to a remote terminal or microcomputer.

**DPSK:** Differential phase shift keying. *See* **modulation, phase**.

**DSL:** *See* **digital subscriber line (DSL)**.

**DTE:** Data terminal equipment. Any piece of equipment at which a communication path begins or ends, such as a terminal.

**duplexing:** An alternative to the process of mirroring, which occurs when a database server mirrors or backs up the database with each transaction. In mirroring, the server writes on two different hard disks through two different disk controllers. Duplexing is more redundant and therefore even safer than mirroring, because the database is written to two different hard disks on two different disk circuits. *Compare with* **mirroring**.

**Dynamic Host Control Protocol (DHCP):** A network-layer protocol standard used to supply TCP/IP address information using dynamic address assignment.

**dynamic routing:** *See* **decentralized routing**.

## E

**e-mail:** *See* **electronic mail (e-mail)**.

**EBCDIC:** Extended Binary Coded Decimal Interchange Code. A standard code consisting of a set of 8-bit characters used for information representation and interchange among data processing and communication systems. Very common in IBM equipment.

**echo cancellation:** Used in higher-speed modems to isolate and filter out (cancel) echoes when half-duplex transmissions use stop and wait ARQ (Automatic Repeat reQuest) protocols. Needed especially for satellite links.

**echo checking:** *See* **checking, echo**.

**echo suppressor:** A device for use in a two-way telephone circuit (especially circuits over 900 miles long) to attenuate echo currents in one direction caused by telephone currents in the other direction. This is done by sending an appropriate disabling tone to the circuit.

**ECMA:** *See* **European Computer Manufacturers Association (ECMA)**.

**EDI:** *See* **Electronic Data Interchange (EDI)**.

**EIA:** *See* **Electronic Industries Association (EIA)**.

**Electronic Data Interchange (EDI):** Electronic Data Interchange for Administration, Commerce, and Transport. Standardizes the electronic interchange of business documents for both ASCII and graphics. Endorsed by the ISO. Defines major components of the ANSI X.12 EDI standard.

**Electronic Industries Association (EIA):** Composed of electronic manufacturers in the United States. Recommends standards for electrical and functional characteristics of interface equipment. Belongs to ANSI. Known for the RS232 interface connector cable standard.

**electronic mail (e-mail):** A networking application that allows users to send and receive mail electronically.

**electronic software distribution (ESD):** ESD enables network managers to install software on client computers over the network without physically touching each client computer. ESD client software is installed on each client and enables an ESD server to download and install certain application packages on each client at some predefined time (e.g., at midnight on a Saturday).

**emulate:** Computer vendors provide software and hardware emulators that accept hardware and software from other vendors and enable them to run on their hardware or software.

**encapsulation:** A technique in which a frame from one network is placed within the data field of the frame in another network for transmission on the second network. For example, it enables a message initiated on a coaxial cable-based Ethernet LAN to be transmitted over an ATM fiber-optic–based network and then placed onto another Ethernet LAN at the other end.

**encryption:** The technique of modifying a known bit stream on a transmission circuit so that to an

unauthorized observer, it appears to be a random se-
quence of bits.

**end office:** The telephone company switching office for
the interconnection of calls. *See also* **central office**.

**envelope delay distortion:** A derivative of the circuit
phase shift with respect to the frequency. This distor-
tion affects the time it takes for different frequencies to
propagate the length of a communication circuit so that
two signals arrive at different times.

**equalization:** The process of reducing frequency and
phase distortion of a circuit by introducing time differ-
ences to compensate for the difference in attenuation or
time delay at the various frequencies in the transmis-
sion band.

**equalizer:** Any combination (usually adjustable) of coils,
capacitors, or resistors inserted in the transmission cir-
cuit or amplifier to improve its frequency response.

**error control:** An arrangement that detects the presence
of errors. In some networks, refinements are added that
correct the detected errors, either by operations on the
received data or by retransmission from the source.

**ESD:** *See* **electronic software distribution (ESD)**.

**Ethernet:** A LAN developed by the Xerox Corporation. It
uses coaxial cable or twisted-pair wires to connect the
stations. It was standardized as IEEE 802.3.

**European Computer Manufacturers Association
(ECMA):** Recommends standards for computer compo-
nents manufactured or used in Europe. Belongs to the
International Organization for Standardization (ISO).

**exchange office:** *See* **central office**.

**exposure:** The calculated or estimated loss resulting from
the occurrence of a threat, as in "The exposure from
theft could be $42,000 this year." It can be either tangi-
ble and therefore measurable in dollars or intangible
and therefore not directly measurable in dollars. *See
also* **comparison risk ranking**.

**Extended Binary Coded Decimal Interchange Code
(EBCDIC):** *See* **EBCDIC**.

**extranet:** Using the Internet to provide access to informa-
tion intended for a selected set of users, not the public
at large. Usually done by requiring a password to ac-
cess a selected set of Web sites.

**F**

**FCC:** *See* **Federal Communications Commission
(FCC)**.

**FCS:** *See* **frame check sequence (FCS)**.

**FDDI:** *See* **fiber distributed data interface (FDDI)**.

**FDM:** Frequency division multiplexing. *See* **multiplexer**.

**feasibility study:** A study undertaken to determine the
possibility or probability of improving the existing sys-
tem within a reasonable cost. Determines what the
problem is and what its causes are and makes recom-
mendations for solving the problem.

**FEC:** *See* **forward error correction (FEC)**.

**Federal Communications Commission (FCC):** A board
of seven commissioners appointed by the U.S. president
under the Communication Act of 1934, having the power
to regulate all interstate and foreign electrical communi-
cation systems originating in the United States.

**FEP:** *See* **front-end processor (FEP)**.

**fiber distributed data interface (FDDI):** A token
ring–like LAN technology that permits transmission
speeds of 100 million bps using fiber-optic cables
(ANSI standard X3T9.5).

**fiber-optic cable:** A transmission medium that uses glass
or plastic cable instead of copper wires.

**fiber optics:** A transmission technology in which modu-
lated visible lightwave signals containing information
are sent down hair-thin plastic or glass fibers and de-
modulated back into electrical signals at the other end
by a special light-sensitive receiver.

**File Transfer Protocol (FTP):** FTP enables users to send
and receive files over the Internet. There are two types
of FTP sites: closed (which require users to have an ac-
count and a password) and anonymous (which permit
anyone to use them).

**firewall:** A firewall is a router, gateway, or special-purpose
computer that filters packets flowing into and out of a
network. No access to the organization's networks is per-
mitted except through the firewall. Two commonly used
types of firewalls are packet level and application level.

**firmware:** A set of software instructions set permanently
or semipermanently into read-only memory (ROM).

**flow control:** The capability of the network nodes to man-
age buffering schemes that allow devices of different data
transmission speeds to communicate with each other.

**forward error correction (FEC):** A technique that identi-
fies errors at the received station and automatically cor-
rects those errors without retransmitting the message.

**fractional T1 (FT1):** A portion of a T1 circuit. A full T1
allows transmission at 1,544,000 bps. A fractional T1
circuit allows transmission at lower speeds of 384,000,
512,000, or 768,000 bps. *See also* **T carrier**.

**fragment free switching:** A type of switching that is a cross between store and cut through. Messages are stored until the header has been checked for errors and then the message is forwarded without checking for errors in the rest.

**frame:** Generally, a group of data bits having bits at each end to indicate the beginning and end of the frame. Frames also contain source addresses, destination addresses, frame type identifiers, and a data message.

**frame check sequence (FCS):** Used for error checking. FCS uses a 16-bit field with cyclical redundancy checking for error detection with retransmission.

**frame relay:** Frame relay is a type of packet-switching technology that transmits data faster than the X.25 standard. The key difference is that unlike X.25 networks, frame relay does not perform error correction at each computer in the network. Instead, it simply discards any messages with errors. It is up to the application software at the source and destination to perform error correction and to control for lost messages.

**frequency:** The rate at which a current alternates, measured in Hertz, kilohertz, megahertz, and so forth. Other units of measure are cycles, kilocycles, or megacycles; *hertz* and *cycles per second* are synonymous.

**frequency division multiplexing (FDM):** *See* **multiplexer**.

**frequency modulation:** *See* **modulation, frequency**.

**frequency shift keying (FSK):** *See* **FSK**.

**front-end processor (FEP):** An auxiliary processor that is placed between a computer's CPU and the transmission facilities. This device normally handles housekeeping functions like circuit management and code translation, which otherwise would interfere with efficient operation of the CPU.

**FSK:** Frequency shift keying. A modulation technique whereby 0 and 1 are represented by a different frequency and the amplitude does not vary.

**FTP:** *See* **File Transfer Protocol (FTP)**.

**full duplex:** The capability of transmission in both directions at one time. *Contrast with* **half-duplex** and **simplex**.

## G

**gateway:** A device that connects two dissimilar networks. Allows networks of different vendors to communicate by translating one vendor's protocol into another. *See also* **bridge, router**, and **brouter**.

**Gaussian noise:** *See* **noise, Gaussian**.

**Gbps:** Gigabit per second; 1 Gbps is equal to 1 billion bps.

**GHz:** Gigahertz; 1 GHz is equal to 1 billion cycles per second in a frequency.

**gigabyte:** One billion bytes.

**G.Lite:** One de facto standard form of ADSL.

**guardband:** A small bandwidth of frequency that separates two voice-grade circuits. Also, the frequencies between subcircuits in FDM systems that guard against subcircuit interference.

## H

**hacker:** A person who sleuths for passwords to gain illegal access to important computer files. Hackers may rummage through corporate trash cans looking for carelessly discarded printouts.

**half-duplex:** A circuit that permits transmission of a signal in two directions but not at the same time. *Contrast with* **full duplex** and **simplex**.

**Hamming code:** A forward error correction (FEC) technique named for its inventor.

**handshaking:** Exchange of predetermined signals when a connection is established between two data set devices. This is used to establish the circuit and message path.

**HDLC:** *See* **high-level data link control (HDLC)**.

**Hertz (Hz):** Same as cycles per second; for example, 3,000 Hz is 3,000 cycles per second.

**high-level data link control (HDLC):** A bit-oriented protocol in which control of data links is specified by series of bits rather than by control characters (bytes).

**home page:** A home page is the main starting point or page for a World Wide Web entry.

**host computer:** The computer that lies at the center of the network. It generally performs the basic centralized data processing functions for which the network was designed. The host used to be where the network communication control functions took place, but today these functions tend to take place in the front-end processor or further out in the network. *Also called* a *central computer*.

**hotline:** A service that provides direct connection between customers in various cities using a dedicated circuit.

**HTML:** Web text files or pages use a structural language called HTML (Hypertext Markup Language) to store their information. HTML enables the author to define different type styles and sizes for the text, titles, and headings, and a variety of other formatting information. HTML also permits the author to define links to other

pages that may be stored on the same Web server or on any Web server anywhere on the Internet.

**hub:** Network hubs act as junction boxes, permitting new computers to be connected to the network as easily as plugging a power cord into an electrical socket, and provide an easy way to connect network cables. Hubs also act as repeaters or amplifiers. Hubs are sometimes also called concentrators, multistation access units, or transceivers.

**Hypertext Markup Language (HTML):** *See* **HTML**.

**Hz:** *See* **Hertz (Hz)**.

## I

**IAB:** *See* **Internet Architecture Board (IAB)**.

**IANA:** *See* **Internet Assigned Numbers Authority (IANA)**.

**ICMP:** *See* **Internet Control Message Protocol (ICMP)**.

**idle character:** A transmitted character indicating "no information" that does not manifest itself as part of a message at the destination point.

**IDS:** *See* **intrusion detection system (IDS)**.

**IEEE:** *See* **Institute of Electrical and Electronics Engineers (IEEE)**.

**IESG:** Internet Engineering Steering Group.

**IETF:** Internet Engineering Task Force.

**IMAP:** *See* **Internet Mail Access Protocol (IMAP)**.

**impulse noise:** *See* **noise, impulse**.

**in-band signaling:** The transmission signaling information at some frequency or frequencies that lie within a carrier circuit normally used for information transmission.

**Institute of Electrical and Electronics Engineers (IEEE):** A professional organization for engineers in the United States. Issues standards and belongs to the ANSI and the ISO. IEEE has defined numerous standards for networks; see Chapters 6–10.

**integrated services digital network (ISDN):** *See* **ISDN**.

**interexchange circuit (IXC):** A circuit or circuit between end offices (central offices).

**interLATA:** Circuits that cross from one LATA (local access and transport area) into another.

**intermodulation distortion:** An analog line impairment whereby two frequencies create a third erroneous frequency, which in turn distorts the data signal representation.

**International Organization for Standardization (ISO):** *See* **ISO**.

**International Telecommunications Union—Telecommunications (ITU-T):** An international organization that sets worldwide communication standards. Its old name was **Consultative Committee on International Telegraph and Telephone (CCITT)**.

**Internet:** The information superhighway. The network of networks that spans the world, linking more than 20 million users.

**Internet Architecture Board (IAB):** IAB provides strategic architectural oversight (e.g., top-level domain names, use of international character sets) that can be passed on as guidance to the IESG or turned into published statements or simply passed directly to the relevant IETF working group. The IAB does not produce polished technical proposals but rather tries to stimulate action by the IESG or the IETF that will lead to proposals that meet general consensus. The IAB appoints the IETF chair and all IESG members.

**Internet Assigned Numbers Authority (IANA):** IANA governs the assignment of IP numbers.

**Internet Control Message Protocol (ICMP):** A simple network layer protocol standard intended to exchange limited routing information between routers. Most commonly known as a ping, after the DOS and UNIX command.

**Internet Engineering Steering Group (IESG):** The IESG is responsible for technical management of IETF activities and the Internet standards process. It administers the process according to the rules and procedures and is directly responsible for the actions associated with entry into and movement along the Internet "standards track," including final approval of specifications as Internet standards. Each IETF working group is chaired by a member of the IESG.

**Internet Engineering Task Force (IETF):** IETF is a large, open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet. IETF operates through a series of working groups, which are organized by topic (e.g., routing, transport, security). The requests for comment (RFCs) that form the basis for Internet standards are developed by the IETF and its working groups.

**Internet Mail Access Protocol (IMAP):** An application-layer protocol standard that covers communication between an e-mail client and an e-mail server.

**Internet Research Task Force (IRTF):** IRTF operates much like the IETF, through small research groups focused on specific issues. Although IETF working groups focus on current issues, IRTF research groups work on long-term issues related to Internet protocols, applications, architecture, and technology. The IRTF chair is appointed by the IAB.

**Internet service provider (ISP):** ISPs offer connections to the Internet. Some access providers charge a flat monthly fee for unlimited access (much like the telephone company), whereas others charge per hour of use (much like a long-distance telephone call).

**Internet Society (ISOC):** ISOC is the closest the Internet has to an owner. ISOC is an open-membership professional society with more than 175 organizational and 8,000 individual members in over 100 countries and includes corporations, government agencies, and foundations that have created the Internet and its technologies.

**internetworking:** Connecting several networks together so workstations can address messages to the workstations on each of the other networks.

**Internet 2:** There are many different organizations currently working on the next generation of the Internet, including the Abilene network, vBNS, and CA*net. Although each is working in a slightly different fashion, they join together with each other and parts of the regular Internet at gigapops (gigabit points of presence).

**interoperability:** The interconnection of dissimilar networks in a manner that allows them to operate as though they were similar.

**IntraLATA:** Circuits that are totally within one LATA (local access transport area).

**intranet:** Using Internet protocols on a network internal to an organization so that information is accessible using a browser, for example, but only by employees, not the public at large. Usually done by requiring a password to access a selected set of Web sites and protecting the site by a firewall so no outsiders can access it.

**intrusion detection system (IDS):** An IDS monitors a network segment, a server, or an application on the server for signs of unauthorized access and issues an alarm when an intrusion is detected. A misuse detection IDS compares monitored activities with signatures of known attacks, whereas an anomaly detection IDS compares monitored activities with the "normal" set of activities.

**inverse multiplexer:** Hardware that takes one high-speed transmission and divides it among several transmission circuits.

**IPX/SPX:** Internetwork packet exchange/sequenced packet exchange (IPX/SPX), based on a routing protocol developed by Xerox in the 1970s, is the primary network protocol used by Novell NetWare. About 40 percent of all installed LANs use it.

**IRTF:** *See* **Internet Research Task Force (IRTF)**.

**ISDN:** Integrated services digital network. A hierarchy of digital switching and transmission systems. The ISDN provides voice, data, and image in a unified manner. It is synchronized so all digital elements speak the same "language" at the same speed. *See also* **basic rate interface (BRI)** and **primary rate interface (PRI)**.

**ISO:** International Organization for Standardization, in Geneva, Switzerland. The initials *ISO* stand for its French name. This international standards-making body is best known in data communications for developing the internationally recognized seven-layer network model called the Open Systems Interconnection (OSI) Reference model. *See also* **OSI model**.

**ISOC:** *See* **Internet Society (ISOC)**.

**ISP:** *See* **Internet Service Provider (ISP)**.

**ITU-T:** *See* **International Telecommunications Union—Telecommunications (ITU-T)**.

**IXC:** *See* **interexchange circuit (IXC)**.

## J

**jack:** The physical connecting device at the interface that mates with a compatible receptacle—a plug.

**jitter:** Type of analog communication line distortion caused by the variation of a signal from its reference timing positions, which can cause data transmission errors, particularly at high speeds. This variation can be in amplitude, time, frequency, or phase.

**jumper:** 1. A small connector that fits over a set of pins on a microcomputer circuit card. 2. A patch cable or wire used to establish a circuit for testing or diagnostics.

## K

**K:** A standard quantity measurement of computer storage. A K is defined loosely as 1,000 bytes. In fact, it is 1,024 bytes, which is the equivalent of $2^{10}$.

**Kbps:** Kilobits per second. A data rate equal to $10^3$ bps (1,000 bps).

**Kermit:** Kermit is a very popular asynchronous file trans-fer protocol named after Kermit the Frog. The Kermit protocol was developed by Columbia University, which released it as a free software communications package. Various versions of Kermit can be found on public bul-letin board systems for downloading to a microcomputer.

**key management:** The process of controlling the secret keys used in encryption.

**KHz:** Kilohertz; 1 KHz is equal to 1,000 cycles per sec-ond in a frequency.

**kilobits per second (Kbps):** *See* **Kbps**.

**kilometer:** A metric measurement equal to 0.621 mile or 3,280.8 feet.

<div align="center">

**L**

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**LAN:** *See* **local area network (LAN)**.

**laser:** *L*ight *a*mplification by *s*timulated *e*mission of *r*adi-ation. A device that transmits an extremely narrow and coherent beam of electromagnetic energy in the visible light spectrum. (*Coherent* means that the separate waves are in phase with one another rather than jum-bled as in normal light.)

**LATA:** Local access transport area. One of approximately 200 local telephone service areas in the United States roughly paralleling major metropolitan areas. The LATA subdivisions were established as a result of the AT&T/Bell divestiture to distinguish local from long-distance service. Circuits with both end points within the LATA (intraLATAs) generally are the sole responsi-bility of the local telephone company. Circuits that cross outside the LATA (interLATAs) are passed on to an interexchange carrier like AT&T, MCI, or US Sprint.

**latency:** The delay between when the first bits of a message arrive at a device and when it begins transmitting them.

**leased circuit:** A leased communication circuit that goes from your site to some other location. It is a clear, un-broken communication path that is yours to use 24 hours per day, 7 days per week. *Also called private cir-cuit* or **dedicated circuit**.

**line:** A circuit, channel, or link. It carries the data commu-nication signals. An early telephone technology term that may imply a physical connection, such as with a copper wire. *Compare with* **channel, circuit**, and **link**.

**link:** An unbroken circuit path between two points. *Some-times called* a **line, channel**, or **circuit**.

**Listserv:** A listserver (or Listserv) is a mailing list. One part, the Listserv processor, processes commands such

as requests to subscribe, unsubscribe, or to provide more information about the Listserv. The second part is the Listserv mailer. Any message sent to the Listserv mailer is resent to everyone on the mailing list.

**LLC:** The logical link control, or LLC, sublayer is just an interface between the MAC sublayer and software in layer 3 (the network layer) that enables the software and hardware in the MAC sublayer to be separated from the logical functions in the LLC sublayer. By sep-arating the LLC sublayer from the MAC sublayer, it is simpler to change the MAC hardware and software without affecting the software in layer 3. The most commonly used LLC protocol is IEEE 802.2.

**local access transport area (LATA)**: *See* **LATA**.

**local area network (LAN):** A network that is located in a small geographic area, such as an office, a building, a complex of buildings, or a campus, and whose commu-nication technology provides a high-bandwidth, low-cost medium to which many nodes can be connected. These networks typically do not use common carrier circuits, and their circuits do not cross public thorough-fares or property owned by others. LANs are not regu-lated by the FCC or state public utilities commissions.

**local exchange carrier:** The local telephone company, such as one of the seven regional Bell operating com-panies (RBOCs).

**local loop:** The part of a communication circuit between the subscriber's equipment and the equipment in the local central office.

**log:** 1. A record of everything pertinent to a system func-tion. 2. A collection of messages that provides a history of message traffic.

**logical link control (LLC)**: *See* **LLC**.

**longitudinal redundancy check (LRC)**: A system of error control based on the formation of a block check following preset rules. The check formation rule is ap-plied in the same manner to each character. In a simple case, the LRC is created by forming a parity check on each bit position of all characters in the block. (That is, the first bit of the LRC character creates odd parity among the 1-bit positions of the characters in the block.)

**LRC:** *See* **longitudinal redundancy check (LRC)**.

<div align="center">

**M**

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**M:** Mega. The designation for 1 million, as in 3 megabits per second (3 Mbit/s).

**MAC:** *See* **media access control (MAC)**.

**MAN:** *See* **metropolitan area network (MAN)**.

**management information base (MIB):** The extent of information that can be retrieved from a user microcomputer when using the Simple Network Management Protocol (SNMP) for network management. MIBs are sets of attributes and definitions that pertain to specific network devices.

**Manchester encoding:** The digital transmission technique used in the physical layer of Ethernet LANs. See Chapter 3.

**Mbps:** A data rate equal to $10^6$ bps. Sometimes called megabits per second (1,000,000 bps).

**mean times:** *See* **MTBF, MTTD, MTTF**, and **MTTR**.

**media access control (MAC):** A data link layer protocol that defines how packets are transmitted on a local area network. *See also* **CSMA/CD, token bus**, and **token ring**.

**medium:** The matter or substance that carries the voice or data transmission. For example, the medium can be copper (wires), glass (fiber-optic cables), or air (microwave or satellite).

**megabit:** One million bits.

**megabyte:** One million bytes.

**mesh network:** A network topology in which there are direct point-to-point connections among the computers.

**message:** A communication of information from a source to one or more destinations. A message usually is composed of three parts: (1) a heading, containing a suitable indicator of the beginning of the message together with some of the following information: source, destination, date, time, routing; (2) a body containing the information to be communicated; (3) an ending containing a suitable indicator of the end of the message.

**message switching:** An operation in which the entire message being transmitted is switched to the other location without regard to whether the circuits actually are interconnected at the time of your call. This usually involves a message store and forward facility.

**meter:** A metric measurement equal to 39.37 inches.

**metropolitan area network (MAN):** A network that usually covers a citywide area. Because MANs use LAN and fiber-optic technologies, transmission speeds can vary between 2 million and 100 million bps.

**MHz:** megahertz; 1 MHz is equal to 1 million cycles per second in a frequency.

**MIB:** *See* **management information base (MIB)**.

**MIME:** *See* **Multipurpose Internet Mail Extension (MIME)**.

**MIPS:** One million instructions per second. Used to describe a computer's processing power.

**mirroring:** A process in which the database server automatically backs up the disk during each database transaction. During this process, the computer writes on two different hard disks on the same disk circuit every time the hard disk is updated. This creates two mirror images of the database data. Disk mirroring can be accomplished only when the database server contains two physical disk drives, because the records or data structures are written to both disks simultaneously. Should a problem develop with one disk, the second disk is available instantly with identical information on it. *Compare with* **duplexing**.

**mnemonic:** A group of characters used to assist the human memory. A mnemonic frequently is an acronym.

**modem:** A contraction of the words *mo*dulator-**dem**odulator. A modem is a device for performing necessary signal transformation between terminal devices and communication circuits. Modems are used in pairs, one at either end of the communication circuit.

**modulation, amplitude:** The form of modulation in which the amplitude of the carrier is varied in accordance with the instantaneous value of the modulating signal.

**modulation, frequency:** A form of modulation in which the frequency of the carrier is varied in accordance with the instantaneous value of the modulating signal.

**modulation, phase:** A form of modulation in which the phase of the carrier is varied in accordance with the instantaneous value of the modulating signal. Phase modulation has two related techniques. Phase shift keying (PSK) uses a 180° change in phase to indicate a change in the binary value (0 or 1), Differential phase shift keying (DPSK) uses a 180° change in phase every time a bit is transmitted; otherwise, the phase remains the same.

**modulation, pulse code:** *See* **pulse code modulation (PCM)**.

**MTBF:** mean time between failures. The statistic developed by vendors to show the reliability of their equipment. It can be an actual calculated figure that generally is more accurate, or it can be a practical (theoretical) figure.

**MTTD:** Mean time to diagnose. The time it takes the network testing and problem management staff to diagnose a network problem.

**MTTF:** Mean time to fix. The time it takes vendors to remedy a network problem once they arrive on the premises.

**MTTR:** 1. Mean time to repair—the combination of mean time to diagnose, mean time to respond, and mean time to fix, indicating the entire length of time it takes to fix a fault in equipment. 2. Mean time to respond—the time it takes the vendor to respond when a network problem is reported.

**multidrop (multipoint):** A line or circuit interconnecting several stations/nodes in a sequential fashion.

**multiplexer:** A device that combines data traffic from several low-speed communication circuits onto a single high-speed circuit. The two popular types of multiplexing are FDM (frequency division multiplexing) and TDM (time division multiplexing). In FDM, the voice-grade link is divided into subcircuits, each covering a different frequency range in such a manner that each subcircuit can be employed as though it were an individual circuit. In TDM, separate time segments are assigned to each terminal. During these time segments, data may be sent without conflicting with data sent from another terminal.

**multiplexing (MUX):** The subdivision of a transmission circuit into two or more separate circuits. This can be achieved by splitting the frequency range of the circuit into narrow frequency bands (frequency division multiplexing) or by assigning a given circuit successively to several different users at different times (time division multiplexing).

**Multipurpose Internet Mail Extension (MIME):** An application-layer standard protocol that enables SMTP mail messages to transfer nontext characters such as graphics and software. The sending e-mail client translates the nontext characters into something that resembles text using MIME codes and attaches it to the message. The receiving e-mail client translates the MIME codes back into the original graphic or software file.

**MUX:** *See* **multiplexing (MUX)**.

## N

**NAK:** *See* **negative acknowledgment (NAK)**.

**nanosecond:** One billionth ($\frac{1}{1,000,000,000}$) of a second or $10^{-9}$.

**NAP:** *See* **network access point (NAP)**.

**NAT:** *See* **network address translation (NAT)**.

**National Institute of Standards and Technology (NIST):** Formerly the National Bureau of Standards. The agency of the U.S. government responsible for developing information processing standards for the federal government.

**NCO:** *See* **network cost of ownership (NCO)**.

**negative acknowledgment (NAK):** The return signal that reports an error in the message received. The opposite of **acknowledgment (ACK)**.

**network:** 1. A series of points connected by communication circuits. 2. The switched telephone network is the network of telephone lines normally used for dialed telephone calls. 3. A private network is a network of communication circuits confined to the use of one customer.

**network access point (NAP):** An "intersection" on the Internet where many national and regional ISPs connect to exchange data.

**network address translation (NAT):** NAT is the process of translating between one set of private IP addresses inside a network and a set of public IP addresses outside the network for use on the Internet. NAT is transparent in that no computer notices that it is being done.

**network cost of ownership (NCO):** NCO is a measure of how much it costs per year to keep one computer operating. NCO includes the cost of support staff to attach it to the network, install software, administer the network (e.g., create user IDs, back up user data), provide training and technical support, and upgrade hardware and software. NCO is often $1,500 to $3,500 per computer per year. *Compare with* **total cost of ownership (TCO)**.

**network interface card (NIC):** An NIC allows the computer to be physically connected to the network cable; the NIC provides the physical-layer connection from the computer to the network.

**network operating system (NOS):** The NOS is the software that controls the network. The NOS provides the data link and the network layers and must interact with the application software and the computer's own operating system. Every NOS provides two sets of software: one that runs on the network server(s) and one that runs on the network client(s).

**network operations center (NOC):** Any centralized network management control site.

**network profile:** Every LAN microcomputer has a profile that outlines what resources it has available to other microcomputers in the network and what resources it can use elsewhere in the network.

**network service:** An application available on a network—for example, file storage.

**NIC:** *See* **network interface card (NIC)**.

**NIST:** *See* **National Institute of Standards and Technology (NIST)**.

**NOC:** *See* **network operations center (NOC)**.

**node:** In a description of a network, the point at which the links join input–output devices. It could be a computer or a special-purpose device such as a router.

**noise:** The unwanted change in waveform that occurs between two points in a transmission circuit.

**noise, amplitude:** A sudden change in the level of power with differing effects, depending on the type of modulation used by the modem.

**noise, cross-talk:** Noise resulting from the interchange of signals on two adjacent circuits; manifests itself when it is possible to hear other people's telephone conversations.

**noise, echo:** The "hollow" or echoing characteristic that is heard on voice-grade lines with improper echo suppression.

**noise, Gaussian:** Noise that is characterized statistically by a Gaussian, or random, distribution.

**noise, impulse:** Noise caused by individual impulses on the circuit.

**noise, intermodulation:** Noise that occurs when signals from two independent lines intermodulate. A new signal forms and falls into a frequency band differing from those of both inputs. The new signal may fall into a frequency band reserved for another signal.

**NOS:** *See* **network operating system (NOS)**.

**NRZ:** Nonreturn to zero. A binary encoding and transmission scheme in which 1's and 0's are represented by opposite and alternating high and low voltages, and in which there is no return to a reference (zero) voltage between encoded bits.

**NRZI:** Nonreturn to zero inverted. A binary encoding scheme that inverts the signal on a 1 and leaves the signal unchanged for a 0, and in which a change in the voltage state signals a 1-bit value and the absence of a change denotes a 0-bit value.

**null character:** A control character that can be inserted into or withdrawn from a sequence of characters without altering the message.

**null modem cable:** A 6- to 8-foot RS232 cable that makes the two microcomputers connected at each end of the cable think they are talking through modems.

**O**

**office, central or end:** The common carrier's switching office closest to the subscriber.

**100Base-T:** An Ethernet LAN standard that runs at 100 million bps and uses unshielded twisted-pair wires.

**1000Base-T:** An Ethernet LAN standard the runs at 1 billion bps and uses unshielded twisted-pair wires.

**Open Shortest Path First (OSPF):** A network-layer standard protocol used to exchange route information between routers using dynamic decentralized routing.

**Open Systems Interconnection (OSI) Reference model:** *See* **OSI model**.

**optical fibers:** Hair-thin strands of very pure glass (sometimes plastic) over which light waves travel. They are used as a medium over which information is transmitted.

**OSI model:** The seven-layer Open Systems Interconnection (OSI) Reference model developed by the ISO subcommittee. The OSI model serves as a logical framework of protocols for computer-to-computer communications. Its purpose is to facilitate the interconnection of networks.

**OSPF:** *See* **Open Shortest Path First (OSPF)**.

**out-of-band signaling:** A method of signaling that uses a frequency that is within the passband of the transmission facility but outside of a carrier circuit normally used for data transmission.

**overhead:** Computer time used to keep track of or run the system, as compared with computer time used to process data.

**overlay network:** A network (usually a WLAN) used to supplement a primary network (usually a wired LAN).

**P**

**packet:** A group of binary digits, including data and control signals, that is switched as a composite whole. The data, control signals, and error-control information are arranged in a specific format. A packet often is a 128-character block of data.

**packet assembly/disassembly (PAD):** *See* **PAD**.

**Packet Layer Protocol (PLP):** *See* **PLP**.

**packet switching:** Process whereby messages are broken into finite-size packets that always are accepted by the

network. The message packets are forwarded to the other party over a multitude of different circuit paths. At the other end of the circuit, the packets are reassembled into the message, which is then passed on to the receiving terminal.

**packet switching network (PSN):** A network designed to carry data in the form of packets. The packet and its format are internal to that network. The external interfaces may handle data in different formats, and format conversion may be done by the user's computer.

**PAD:** Packet assembly/disassembly. Equipment providing packet assembly and disassembly between asynchronous transmission and the packet-switching network.

**PAM:** *See* **pulse amplitude modulation (PAM)**.

**parallel:** Describes the way the internal transfer of binary data takes place within a computer. It may be transmitted as a parallel word, but it is converted to a serial or bit-by-bit data stream for transmission.

**parity bit:** A binary bit appended to an array of bits to make the number of 1 bits always be odd or even for an individual character. For example, odd parity may require three 1 bits and even parity may require four 1 bits.

**parity check:** Addition of noninformation bits to a message to detect any changes in the original bit structure from the time it leaves the sending device to the time it is received.

**Pbps:** Petabits per second. A data rate equal to 1 quadrillion bits per second (1,000,000,000,000,000).

**PBX:** private branch exchange. Telephone switch located at a customer's site that primarily establishes voice communications over tie lines or circuits as well as between individual users and the switched telephone network. Typically also provides switching within a customer site and usually offers numerous other enhanced features, such as least-cost routing and call detail recording.

**PCM:** *See* **pulse code modulation (PCM)**.

**PDN:** *See* **public data network (PDN)**.

**peer:** A dictionary definition of *peer* is "a person who is equal to another in abilities." A peer-to-peer network, therefore, is one in which each microcomputer node has equal abilities. In communications, a peer is a node or station that is on the same protocol layer as another.

**peer-to-peer communications:** 1. Communication between two or more processes or programs by which both ends of the session exchange data with equal privilege. 2. Communication between two or more network nodes in which either side can initiate sessions because no primary–secondary relationship exists.

**peer-to-peer LAN:** A network in which a microcomputer can serve as both a server and a user. Every microcomputer has access to all the network's resources on an equal basis.

**permanent virtual circuit (PVC):** A virtual circuit that resembles a leased line because it can be dedicated to a single user. Its connections are controlled by software.

**phase modulation:** *See* **modulation, phase.**

**pirate:** A person who obtains the latest software programs without paying for them. A skilled software pirate is able to break the protection scheme that is designed to prevent copying.

**PKI:** *See* **public key infrastructure (PKI)**.

**plain old telephone network (POTS):** The nickname for the public switched telephone network. Often used when referring to dial-up Internet access using a modem.

**PLP:** Packet Layer Protocol (PLP) is the routing protocol that performs the network layer functions (e.g., routing and addressing) in X.25 networks.

**point of presence (POP):** The physical access location of an ISP or voice or data communications carrier.

**point-to-point:** Denoting a circuit or line that has only two terminals. A link. An example is a single microcomputer connected to a mainframe.

**polling:** Any procedure that sequentially queries several terminals in a network.

**polling, hub:** A type of sequential polling in which the polling device contacts a terminal, that terminal contacts the next terminal, and so on, until all the terminals have been contacted.

**polling, roll call:** Polling accomplished from a prespecified list in a fixed sequence, with polling restarted when the list is completed.

**polynomial checking:** A checking method using polynomial functions to test for errors in data in transmission. Also called **cyclical redundancy check (CRC)**.

**POP:** 1. *See* **Post Office Protocol (POP)** and **point-of-presence (POP)**.

**port:** One of the circuit connection points on a front-end processor or local intelligent controller.

**Post Office Protocol (POP)**: An application-layer standard used to communicate between the client and the e-mail server.

**POTS:** *See* **plain old telephone network (POTS)**.

**PPP:** PPP (multilink Point-to-Point Protocol) is an inverse multiplexing protocol for combining circuits of different speeds (e.g., a 64,000-bps circuit with a 14,400-bps circuit), with data allocated to each circuit is based on speed and need. PPP enables the user to change the circuits allocated to the PPP multiplexed circuit in mid-transmission so that the PPP circuit can increase or decrease the capacity. PPP is the successor to SLIP.

**primary rate interface (PRI):** In ISDN, twenty-three 64,000 bits per second D circuits for data and one 64,000 bits per second B circuit for signaling (23 B+D). See also **basic rate interface (BRI)**.

**private branch exchange (PBX):** *See* **PBX**.

**propagation delay:** The time necessary for a signal to travel from one point on the circuit to another, such as from a satellite dish up to a satellite or from Los Angeles to New York.

**protocol:** A formal set of conventions governing the format and control of inputs and outputs between two communicating devices. This includes the rules by which these two devices communicate as well as handshaking and line discipline.

**protocol stack:** The set of software required to process a set of protocols.

**PSK:** Phase shift keying; *see* **modulation, phase**.

**PSN:** *See* **packet switching network (PSN)**.

**PTT:** Postal, telephone, and telegraph. These are the common carriers owned by governments; the government is the sole or monopoly supplier of communication facilities.

**public data network (PDN):** A network established and operated for the specific purpose of providing data transmission services to the public. It can be a public packet-switched network or a circuit-switched network. Public data networks normally offer value-added services for resource sharing at reduced costs and with high reliability. These time-sharing networks are available to anyone with a modem.

**public key encryption:** Public key encryption uses two keys. The public key is used to encrypt the message and a second, very different private key is used to decrypt the message. Even though the sender knows both the contents of the outgoing message and the public encryption key, once it is encrypted, the message cannot be decrypted without the private key. Public key encryption is one of the most secure encryption techniques available.

**public key infrastructure (PKI):** The PKI is the process of using public key encryption on the Internet. PKI begins with a certificate authority (CA), which is a trusted organization that can vouch for the authenticity of the person or organization using authentication (e.g., VeriSign). The CA issues a digital certificate that is the requestor's public key encrypted using the CA's private key as proof of identity. This certificate is then attached to the user's e-mail or Web transactions. The receiver then verifies the certificate by decrypting it with the CA's public key—and must also contact the CA to ensure that the user's certificate has not been revoked by the CA.

**pulse amplitude modulation (PAM):** Amplitude modulation of a pulse carrier. PAM is used to translate analog voice data into a series of binary digits before they are transmitted.

**pulse code modulation (PCM):** Representation of a speech signal by sampling at a regular rate and converting each sample to a binary number. In PCM, the information signals are sampled at regular intervals and a series of pulses in coded form are transmitted, representing the amplitude of the information signal at that time.

## Q

**QAM:** Quadrature amplitude modulation. A sophisticated modulation technique that uses variations in signal amplitude, which allows data-encoded symbols to be represented as any of 16 states to send 4 bits on each signal.

**Quality of Service (QoS):** The ability of devices to give different priorities to different types of messages so that some messages (e.g., voice telephone data) are transmitted faster than other messages (e.g., e-mail).

**quantizing error:** The difference between the PAM signal and the original voice signal. The original signal has a smooth flow, but the PAM signal has jagged "steps."

## R

**RBOC:** Regional Bell operating company. One of the seven companies created after divestiture of the old Bell system to provide local communications. Includes Ameritech, Bell Atlantic, BellSouth, NYNEX, Pacific Telesis, Southwestern Bell, and US West.

**reclocking time:** *See* **turnaround time.**

**redundancy:** The portion of the total information contained in a message that can be eliminated without loss of essential information.

**regional Bell operating company (RBOC):** *See* **RBOC**.

**reliability**: A characteristic of the equipment, software, or network that relates to the integrity of the system against failure. Reliability usually is measured in terms of mean time between failures (MTBF), the statistical measure of the interval between successive failures of the hardware or software under consideration.

**repeater:** A device used to boost the strength of a signal. Repeaters are spaced at intervals throughout the length of a communication circuit.

**request for comment (RFC):** A proposed standard for the Internet on which anyone in the world is invited to comment.

**request for proposal (RFP):** A request for proposal is used to solicit bids from vendors for new network hardware, software, and services. RFPs specify what equipment, software, and services are desired and ask vendors to provide their best prices.

**response time:** The time the system takes to react to a given input; the time interval from when the user presses the last key to the terminal's typing the first letter of the reply. Response time includes (1) transmission time to the computer; (2) processing time at the computer, including access time to obtain any file records needed to answer the inquiry; and (3) transmission time back to the terminal.

**retrain time:** *See* **turnaround time**.

**RFC:** *See* **request for comment (RFC)**.

**RFP:** *See* **request for proposal (RFP)**.

**ring:** 1. The hot wire in a telephone circuit. 2. An audible sound used for signaling the recipient of an incoming telephone call. 3. A LAN topology having a logical geometric arrangement in the shape of a ring.

**RIP:** *See* **Routing Information Protocol (RIP)**.

**risk:** The level or amount of exposure to an item when compared with other items. It is a hazard or chance of loss. Risk is the degree of difference, as in, "What level of risk does one threat have when compared to the other threats?"

**risk assessment:** The process by which one identifies threats, uses a methodology to determine the tangible or intangible exposures, and develops a sequenced list of the threats from the one having the highest risk to the one having the lowest risk. The list may be in a se-

quence based on tangible dollar losses or on intangible criteria such as public embarrassment, likelihood of occurrence, most dangerous, most critical to the organization, and greatest delay. *Also called risk ranking* or *risk analysis*.

**RMON:** Remote monitoring. The definitions of what is stored and therefore retrievable from a remote user microcomputer when using the Simple Network Management Protocol (SNMP). It is referred to as the RMON MIB (management information base). *See also* **management information base (MIB)** and **Simple Network Management Protocol (SNMP)**.

**router:** A device that connects two similar networks having the same network protocol. It also chooses the best route between two networks when there are multiple paths between them. *Compare with* **bridge, brouter**, and **gateway**.

**Routing Information Protocol (RIP):** A network-layer standard protocol used to exchange route information between routers using dynamic decentralized routing.

**RS232:** A technical specification published by the Electronic Industries Association that specifies the mechanical and electrical characteristics of the interface for connecting data terminal equipment (DTE) and data circuit terminating equipment (DCE). It defines interface circuit functions and their corresponding connector pin assignments.

**RS449:** An Electronic Industries Association standard for data terminal equipment (DTE) and data circuit terminating equipment (DCE) connection that specifies interface requirements for expanded transmission speeds (up to 2 million bps), longer cable lengths, and 10 additional functions.

**S**

**SDLC:** *See* **synchronous data link control (SDLC)**.

**serial:** 1. Transmitting bits one at a time and in sequence. 2. The sequential or consecutive occurrence of two or more related activities in a single device or circuit.

**server:** A computer that provides a particular service to the client computers on the network. In larger LANs, the server is dedicated to being a server. In a peer-to-peer LANs, the server may be both a server and a client computer. There may be file, database, network, access, modem, facsimile, printer, and gateway servers.

**server farm:** A LAN segment containing many servers.

**service-level agreement (SLA):** An SLA specifies the exact type of performance and fault conditions that the organization will accept and what compensation the service provider must provide if it fails to meet the SLA. For example, the SLA might state that network availability must be 99 percent or higher and that the MTBF for T1 circuits must be 120 days or more.

**Service Set Identifier (SSId):** A simple, easily broken approach to WLAN security.

**session:** A logical connection between two terminals. This is the part of the message transmission when the two parties are exchanging messages. It takes place after the communication circuit has been set up and is functioning.

**signal:** A signal is something that is sent over a communication circuit. It might be a control signal used by the network to control itself.

**signal-to-noise ratio:** The ratio, expressed in dB, of the usable signal to the noise signal present.

**Simple Mail Transfer Protocol (SMTP):** An application-layer protocol standard used to transfer e-mail messages across the Internet.

**simplex:** A circuit capable of transmission in one direction only. *Contrast with* **full duplex** and **half-duplex**.

**Simple Network Management Protocol (SNMP):** An application-layer protocol standard used in network management for monitoring and configuring network devices. *See also* **management information base (MIB)** and **RMON**.

**single cable:** A one-cable system in broadband LANs in which a portion of the bandwidth is allocated for "send" signals and a portion for "receive" signals, with a guardband in between to provide isolation from interference.

**SLIP:** Serial Line Internet Protocol (SLIP) is a proposed standard for inverse multiplexing. It has been surpassed by PPP.

**SMTP:** *See* **Simple Mail Transfer Protocol (SMTP)**.

**SNA:** *See* **systems network architecture (SNA)**.

**SNMP:** *See* **Simple Network Management Protocol (SNMP)**.

**SONET:** *See* **synchronous optical network (SONET)**.

**spanning tree protocol:** A data link layer protocol used to prevent broadcast storm in networks that have redundant links providing multiple paths between LAN segments.

**spike:** A sudden increase of electrical power on a communication circuit. *Spike* is a term used in the communication industry. *Contrast with* **surge**.

**spread spectrum:** The U.S. military developed spread spectrum through-the-air radio transmission technology primarily to overcome the problem of intentional interference by hostile jamming and secondarily for security. A spread spectrum signal is created by modulating the original transmitted radio frequency (RF) signal with a spreading code that causes "hopping" of the frequency from one frequency to another. By contrast, conventional AM and FM radio uses only one frequency to transmit its signal.

**start bit:** A bit that precedes the group of bits representing a character. Used to signal the arrival of the character in asynchronous transmission.

**static routing:** *See* **decentralized routing**.

**statistical multiplexer:** Stat mux or STDM. A time division multiplexer (TDM) that dynamically allocates communication circuit time to each of the various attached terminals, according to whether a terminal is active or inactive at a particular moment. Buffering and queuing functions also are included. *See also* **concentrator**.

**stop bit:** A bit that follows the group of bits representing a character. Used to signal the end of a character in asynchronous transmission.

**store and forward switching:** A switching technique that accepts messages, stores them, and then forwards them to the next location after ensuring they contain no errors as addressed in the message header.

**STX:** A control character used in ASCII and EBCDIC data communications to mean start of text.

**surge:** A sudden increase in voltage on a 120-volt electrical power line. A term used in the electric utilities industry. *Contrast with* **spike**.

**switch:** Switches connect more than two LAN segments that use the same data link and network protocol. They may connect the same or different types of cable. Switches typically provide ports for 4, 8, 16, or 32 separate LAN segments, and most enable all ports to be in use simultaneously, so they are faster than bridges.

**switched circuit:** A dial-up circuit in which the communication path is established by dialing. If the entire circuit path is unavailable, there is a busy signal, which prevents completion of the circuit connection.

**Switched Multimegabit Data Service (SMDS):** *See* **SMDS**.

**switched network:** Any network that has switches used for directing messages from the sender to the ultimate recipient.

**switched network, circuit switched:** A switched network in which switching is accomplished by disconnecting and reconnecting lines in different configurations to set up a continuous pathway between the sender and the recipient. *See also* **circuit switching**.

**switched network, store and forward:** A switched network in which the store-and-forward principle is used to handle transmission between senders and recipients. *See also* **store-and-forward-switching**.

**switching:** Identifying and connecting independent transmission links to form a continuous path from one location to another.

**symbol rate:** The speed in baud is the number of symbols per second. If each signal represents only one bit, *symbol rate* is the same as *bits per second*. When each signal contains more than one bit, *symbol rate* does not equal *bits per second*.

**Synchronization character (SYN):** An 8-bit control character that is sent at the beginning of a message block to establish synchronization (timing) between the sender and the receiver. Term used for the characters preceding an Ethernet packet. Term used for a TCP open connection request.

**synchronous data link control (SDLC):** A protocol for managing synchronous, code-transparent, serial bit-by-bit information transfer over a link connection. Transmission exchanges may be full-duplex or half-duplex and over switched or nonswitched links. The configurations of the link connection may be point-to-point, multipoint, or loop. SDLC is the protocol used in IBM's systems network architecture.

**synchronous optical network (SONET):** The National Exchange Carriers Association standard for optical transmission at gigabits-per-second speeds. For example, digital signals transmit on T1 circuits at 1,544,000 bps and on T3 circuits at 44,376,000 bps. The slowest SONET OC-1 optical transmission rate of 51,840,000 bps is slightly faster than the T3 rate.

**synchronous transmission:** Form of transmission in which data is sent as a fixed-length block or frame. *Compare with* **asynchonous transmission**.

**systems network architecture (SNA):** The name of IBM's conceptual framework that defines the data communication interaction between computer systems or terminals.

**T**

**T carrier:** A hierarchy of digital circuits designed to carry speech and other signals in digital form. Designated T1 (1.544 Mbps), T2 (6.313 Mbps), T3 (44.736 Mbps), and T4 (274.176 Mbps).

**tariff:** The formal schedule of rates and regulations pertaining to the communication services, equipment, and facilities that constitute the contract between the user and the common carrier. Tariffs are filed with the appropriate regulatory agency (FCC or state public utilities commission) for approval and published when approved.

**TASI:** Time assisted speech interpolation. The process of interleaving two or more voice calls on the same telephone circuit simultaneously.

**Tbps:** Terabits per second. A data rate equal to 1 trillion bits per second (1,000,000,000,000).

**TCM:** Trellis-coded modulation (TCM) is a modulation technique related to QAM that combines phase modulation and amplitude modulation. There are several different forms of TCM that transmit 5, 6, 7, or 8 bits per signal, respectively.

**TCP/IP:** Transmission Control Protocol/Internet Protocol is probably the oldest networking standard, developed for ARPANET, and now used on the Internet. One of the most commonly used network protocols.

**TDM:** *See* **multiplexer**.

**telecommunications:** A term encompassing voice, data, and image transmissions that are sent over some medium in the form of coded signals.

**telecommuting:** Telecommuting employees perform some or all of their work at home instead of going to the office each day.

**teleconferencing:** With teleconferencing, people from diverse geographic locations can "attend" a business meeting in both voice and picture format. In fact, even documents can be shown and copied at any of the remote locations.

**telephony:** A generic term to describe voice communications. Pronounced "tel-ef-on-e," not "tel-e-fon-e."

**Telnet:** Telnet enables users on one computer to log in to other computers on the Internet.

**10Base-T:** An Ethernet LAN standard (IEEE 802.3) that runs at 10 million bps and uses unshielded twisted-pair wires.

**10Base2:** An Ethernet LAN standard that runs at 10 million bps, uses baseband transmission techniques, and allows 200 meters maximum cable length.

**10Base5:** An Ethernet LAN standard that runs at 10 million bps, uses baseband transmission techniques, and allows 500 meters maximum cable length.

**10Broad36:** An Ethernet LAN standard that runs at 10 million bps, uses broadband transmission techniques, and allows 3,600 meters maximum cable length.

**thick Ethernet:** Refers to the original Ethernet specification that uses thick coaxial cable that is both grounded and shielded. The many layers of shielding are of polyvinyl and aluminum, which make the cable wider in diameter than other Ethernet cables. The heavy shielding also makes the cable more expensive and less flexible; therefore, it is impractical for many installations.

**thin Ethernet:** Refers to the 10Base2 baseband Ethernet, meaning the version that transmits at 10 million bps in baseband at 200 meters maximum. It uses thin coaxial cable. *Also called* **cheapnet.**

**threat:** A potentially adverse occurrence or unwanted event that could be injurious to the network, the computing environment, the organization, or a business application. Threats are acts or events the organization wants to prevent from taking place, such as lost data, theft, disasters, virus infections, errors, illegal access, and unauthorized disclosure. In other words, threats are events no one wants to occur.

**3DES:** *See* **triple DES (3DES).**

**throughput:** The total amount of useful information that is processed or communicated during a specific time period.

**Time assisted speech interpolation (TASI):** *See* **TASI.**

**Time division multiplexing (TDM):** *See* **multiplexer.**

**token:** The special sequence of characters used to gain access to a token ring or token-bus network to transmit a packet.

**token bus:** A LAN with a bus topology that uses a token-passing approach to network access. In a token-bus LAN, the next logical node or station is not necessarily the next physical node because it uses preassigned priority algorithms. Message requests are not handled in consecutive order by stations. *Contrast with* **token ring.**

**token passing:** A method of allocating network access wherein a terminal can send a message only after it has acquired the network's electronic token.

**token ring:** A LAN with a ring topology that uses a token-passing approach to network access. In a token

ring LAN, the next logical station also is the next physical station because the token passes from node to node. *Contrast with* **token bus.**

**topology:** The basic physical or geometric arrangement of the network—for example, a ring, star, or bus layout. The topology is the network's logical arrangement, but it is influenced by the physical connections of its links and nodes. This is in contrast to its configuration, which is the actual or practical layout, including software and hardware constraints. Topologies are the building blocks of a network configuration. *Compare with* **configuration.**

**total cost of ownership (TCO):** TCO is a measure of how much it costs per year to keep one computer operating. TCO includes the cost of support staff to attach it to the network, install software, administer the network (e.g., create user IDs, back up user data), provide training and technical support, and upgrade hardware and software, along with the cost of "wasted time" when the network is down. TCO is often $10,000 per computer per year. *Compare to* **network cost of o-wnership (NCO).**

**transceiver:** A device that transmits and/or receives data to or from computers on an Ethernet LAN. Also a hub.

**transmission rate of information bits (TRIB):** *See* **TRIB.**

**tree:** A network arrangement in which the stations hang off a common "branch," or data bus, like leaves on the branch of a tree.

**TRIB:** Transmission rate of information bits. A TRIB is the network's throughput. It is the effective rate of data transfer over a communication circuit per unit of time. Usually expressed in bits per second.

**triple DES (3DES):** 3DES is a symmetric encryption technique that involves using DES three times, usually with three different keys, to produce the encrypted text, which produces a stronger level of security than DES, because it has a total of 168 bits as the key (i.e., $3 \times 56$ bits).

**trunk:** A voice communication circuit between switching devices or end offices.

**turnaround time:** The time required to reverse the direction of transmission from send to receive or vice versa on a half-duplex circuit.

**twisted pair:** A pair of wires used in standard telephone wiring. They are twisted to reduce interference caused by the other twisted pairs in the same cable bundle. Twisted-pair wires go from homes and offices to the telephone company end office.

**U**

**UDP:** *See* **User Datagram Protocol (UDP).**

**uniform resource locator (URL):** *See* **URL.**

**uninterruptible power supply (UPS):** Provides backup electrical power if the normal electrical power fails or if the voltage drops to unacceptably low levels.

**unipolar transmission:** A form of digital transmission in which the voltage changes between 0 volts to represent a binary 0 and some positive value (e.g., +15 volts) to represent a binary 1. *See also* **bipolar transmission.**

**unshielded twisted-pair (UTP) wires:** The type of wiring used in 10Base-T Ethernet networks. Same as **twisted pair.**

**upload:** The process of loading software and data from the nodes of a network (terminals or microcomputers), over the network media, and to the host mainframe computer.

**UPS:** *See* **uninterruptible power supply (UPS).**

**URL:** To use a browser to access a Web server, you must enter the server's addresses or URL (uniform resource locator). All Web addresses begin with seven characters: http://.

**USASCII:** *See* **ASCII.**

**User Datagram Protocol (UDP):** A connectionless transport layer protocol standard used by TCP to send short messages such as DNS requests.

**user profile:** The user profile specifies what data and network resources a user can access, and the type of access (read-only, write, create, delete, etc.).

**UTP:** *See* **unshielded twisted-pair (UTP) wires.**

**V**

**V.*nn*:** The V.*nn* series of ITU-T standards relating to the connection of digital equipment to the analog telephone network. Primarily concerned with the modem interface. See Chapter 3 for definitions.

**value-added network (VAN):** A corporation that sells services of a value-added network. Such a network is built using the communication offerings of traditional common carriers, connected to computers that permit new types of telecommunication tariffs to be offered. The network may be a packet switching or message switching network.

**VBNS:** *See* **very-high-performance backbone network service (vBNS).**

**VDSL:** *See* **very-high-data-rate digital subscriber line (VDSL).**

**VDT:** Video display terminal.

**vertical redundancy check (VRC):** *See* **parity check.**

**very-high-data-rate digital subscriber line (VDSL):** A form of DSL that provides very high speed transmission (e.g., up to 51 Mbps) over traditional telephone lines for very short distances.

**very-high-performance backbone network service (vBNS):** One part of Internet 2 run by MCI World-Com.

**video teleconferencing:** Video teleconferencing provides real-time transmission of video and audio signals to enable people in two or more locations to have a meeting.

**virtual:** Conceptual or appearing to be, rather than actually being.

**virtual circuit:** A temporary transmission circuit in which sequential data packets are routed between two points. It is created by the software in such a way that users think they have a dedicated point-to-point leased circuit.

**virtual private network (VPN):** A hybrid network that includes both public and private facilities. The user leases a bundle of circuits and configures the VPN on an as-needed basis so that some traffic travels on the private leased network and some travels on the common carrier's public network.

**virus:** Viruses are executable programs that copy themselves onto other computers. Most viruses attach themselves to other programs or to special parts on disks, and as those files execute or are accessed, the virus spreads. Viruses cause unwanted events—some are harmless (such as nuisance messages) and others are serious (such as the destruction of data). Some viruses change their appearances as they spread, making detection more difficult.

**voice-grade circuit:** A term that applies to circuits suitable for transmission of speech, digital or analog data, or facsimile, generally with a frequency range of about 300 to 3,300 Hz contained within a 4,000-Hz circuit.

**VPN:** *See* **virtual private network (VPN).**

**VRC:** Vertical redundancy check. Same as **parity check.**

**W**

**WAN:** *See* **wide area network (WAN).**

**WAP:** *See* **Wireless Application Protocol (WAP).**

**warchalk:** marking (usually using chalk on pavement) the location and information for unsecured WLANs.

**wardriving:** The act of finding unsecured WLAN access points (usually by driving around).

**weather map:** A network map showing real-time utilization on each circuit.

**Web:** *See* **World Wide Web.**

**Web browser:** A software package on the client computer that enables a user to access a Web server.

**Web crawler:** A Web crawler searches through all the Web servers it knows to find information about a particular topic.

**Web server:** A Web server stores information in a series of text files called pages. These text files or pages use a structured language called HTML (Hypertext Markup Language) to store their information.

**Wide Area Network (WAN):** A network spanning a large geographical area. Its nodes can span city, state, or national boundaries. WANs typically use circuits provided by common carriers. *Contrast with* **backbone network (BN), local area network (LAN)**, and **metropolitan area network (MAN)**.

**Wi-Fi:** The trademarked name for 802.11b.

**Wi-Fi Protected Access (WPA):** A technique for providing security in WLANs.

**Wired Equivalent Privacy (WEP):** A technique for providing security in WLANs that is not very effective.

**Wireless Application Protocol (WAP):** A de facto standard set of protocols for connecting wireless devices to the Web. WAP provides a variety of protocols at the application, transport, and network layers to enable devices with a very small display screen to display standard Web information.

**wire speed:** Operating at the same speed as the incoming circuit; having extremely low latency.

**wiring closet:** A central point at which all the circuits in a system begin or end, to allow cross-connection.

**World Wide Web:** The Web provides a graphical user interface and enables the display of rich graphical images, pictures, full-motion video, and sound clips.

**X**

**X.*nn*:** The X.*nn* series of ITU-T standards relating to transmission over public data networks.

**X.400:** An OSI standard that defines how messages are to be encoded for the transmission of e-mail and graphics between dissimilar computers and terminals. X.400 defines what is in an electronic address and what the electronic envelope should look like. Approved by the CCITT.

**X.500:** An OSI standard that defines where to find the address to put on the electronic envelope of a X.400 transmission. X.500 is the directory of names and addresses similar to the yellow pages of a telephone directory.

**Xmodem:** Xmodem is an asynchronous file transmission protocol that takes the data being transmitted and divides it into blocks. Each block has a start of header (SOH) character, a 1-byte block number, 128 bytes of data, and a 1-byte checksum for error checking.

**Y**

**Ymodem:** Ymodem is an asynchronous file transmission protocol. The primary benefit of the Ymodem protocol is CRC-16 error checking.

**Z**

**Zmodem:** Zmodem is a newer asynchronous file transmission protocol written to overcome some of the problems in older protocols. It uses CRC-32 with continuous ARQ and dynamically adjusts its packet size according to communication circuit conditions to increase efficiency. It usually is the preferred protocol of most bulletin board systems.