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NEWTON'S TELECOM DICTIONARY

**The Official Dictionary
of Telecommunications
Networking and
the Internet**

**16th
EXPANDED
& UPDATED
EDITION**

BY HARRY NEWTON

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The Official Dictionary of Telecommunications
Networking and Internet

**16th and a Half Updated, Expanded and Much
Improved Edition**

Association Control Service Element ACSE. The International Standards Organization's Open Systems Interconnect (OSI) application layer services used, for example, in Manufacturing Automation Protocol V3.0 (MAP).

ASSP Application Specific Standard Product. An integrated circuit that performs functions for a single application (e.g., keyboard controller). ASSP is a more precise term for a device often referred to as an ASIC.

Assurance Level Probability expressed as a percent. Example: There is 90% Assurance (probability) that the mean holding time on the trunk group is between 168.5 and 191.5 seconds.

AST Automatic Scheduled Testing. A method of testing switched access service (Feature Groups B, C, and D) where the customer provides remote office test lines and 105 test lines with associated responders or their functions' equivalent; consists of monthly loss and C-message noise tests and annual balance test.

ASTM American Society for Testing and Materials, a non-profit industry-wide organization which publishes standards, methods of test, recommended practices, definitions and other related material.

ASU Application-Specific Unit.

ASWC Alternate Serving Wire Center, when a building or customer is served by two different Central Offices. The one that is not his main central office is called the ASWC. It also means that the customer or building has two different NNXs (i.e. phone numbers). E.g. 691 (18th Street central office) and 240 (West Street central office).

Asymmetric Not symmetric, i.e., unbalanced. A asymmetric telecom channel has more bandwidth (i.e. speed) in one direction than in the other. Its bandwidth is unbalanced. There are reasons for this. Take the Internet. Grabbing stuff from the Internet to your PC needs more bandwidth than sending stuff back from your PC. At least that's one theory. To accommodate this theory, for example, there's ADSL (Asymmetric Digital Subscriber Line). ADSL provides asymmetric bandwidth, as the downstream (from the network to the user premises) bandwidth of as much as 6.144 Mbps, and a return channel (from the user premises to the central office) of something like 608 Kbps. Asymmetric can also refer to the physical topology of the network. For example, a point-to-multipoint circuit might connect one device on the East Coast directly to three devices on the West Coast through the use of a bridge. For example, Miller Freeman might lease a multipoint circuit which connects its New York office to its office in San Francisco. At the San Francisco office is a bridge which has three drops, 1 for the San Francisco office and one for each of its two offices in Menlo Park. All communications between the sites take place through the multidrop bridge. The circuit is asymmetric as it lacks symmetry. There is one site connected on the East Coast and there are three sites connected on the West Coast. Multipoint circuits also are known as multi-drop circuits and fan-tail circuits, as they fan out like the tail of a fish on the distant end. See the next several definitions. See also ADSL, Full Duplex and Symmetric.

Asymmetric Digital Subscriber Line See ADSL and Asymmetric Digital Subscriber Line Transceiver.

Asymmetric Digital Subscriber Line Transceiver A microprocessor chip that is the crux of asymmetric digital subscriber line service. I found the following description of just such a chip in Motorola literature describing their MC145650 144-pin transceiver. "The MC145650 is a single integrated circuit transceiver device for ANSI (American

National Standard Institute) T1.413 category 2 ADSL modems, based on the Discrete Multi-Tone (DMT) line code. The category 2 specification requires payload rates of (6.144 Mbps + 640 Kbps) downstream and 640 Kbps upstream, with crosstalk, over carrier serving area (CSA) range loops, and to achieve (1.544 Mbps + 176 Kbps) downstream and 176 Kbps upstream with crosstalk, over selected ANSI integrated services digital network (ISDN) loops. The payload makeup is flexible, thereby allowing multiple data streams to be multiplexed and demultiplexed. The MC145650 is capable of data rates up to 8 Mbps downstream and 1 Mbps bidirectionally; however, actual data rates obtained in any system are dependent on loop length, impairments, and transmitted power. The ADSL and DMT techniques are adaptive, changing system parameters based on loop characteristics in order to optimize the data route."

Asymmetrical Compression Techniques where the decompression process is not the reverse of the compression process. Asymmetrical compression is more computer-intensive on the compression side so that the decompression of video images can be easily performed at the desktop or in applications where sophisticated codecs are not cost effective. In short, any compression technique that requires a lot of processing on the compression end, but little processing to decompress the image. Used in CD-ROM creation, where time and costs can be incurred on the production end, but playback must be inexpensive and easy. See ASYN.

Asymmetrical Modem A type of modem which uses most of the available bandwidth for transmission and only a small part for reception.

Asymmetrical Modulation A duplex transmission technique which splits the communications channel into one high speed channel and one slower channel. During a call under asymmetrical modulation, the modem with the greatest amount of data to transmit is allocated the high speed channel. The modem with less data is allocated the slow, or back channel. The modems dynamically reverse the channels during a call if the volume of data transfer changes.

Asymmetrical Multiprocessing A relatively simple implementation of multiprocessing in which the operating system kernel runs on one dedicated CPU and assigns tasks as they come in to other "slave processors." It is also known as "master/slave" processing.

Asymmetrical PVC Refers to a PVC (Private Virtual Circuit) which supports simplex, or asymmetrical, assignments of committed information rate in each direction of transmission. A PVC transmission path is duplex, meaning that there must be a communications path in each direction between the two points being connected. However with an asymmetrical PVC, the network capacity in each direction does not necessarily have to be equal.

Asyn Greek prefix meaning "not."

Asynchronous See Asynchronous Transmission.

Asynchronous Binned Mode ABM. Used in the IBM Token Ring's Logical Link Control (LLC), ABM operates at the SNA data link control and allows devices on a Token Ring to send data link commands at any time and to initiate responses independently.

Asynchronous Completion A Versit definition. A domain issues a service request and need not wait for it to complete. If the application waits for this completion, this is known as synchronous, but if it is sent off to another system entity and the domain goes on to other activities before the service request completes (and the system later sends a mes-

user (Feature Class of Service) access to mailbox features, operations and options. Feature Classes of Service (FCOS) are entirely independent of Limits Classes of Service (LCOS).
FCOT See Fiber Control Office Terminal.

FCS 1. Frame Check Sequence. Any mathematical formula which derives a numeric value based on the bit pattern of a transmitted block of information and uses that value at the receiving end to determine the existence of any transmission errors. In bit-oriented protocols, a frame check sequence is typically a 16-bit field that contains transmission error checking information, usually appended to the end of the frame. See Frame Check Error and Frame Check Sequence.

2. Federation of Communications Services.

3. An MCI term for Fraud Control System.

FCS Error A Frame Check Sequence error occurs when a packet is involved in a collision or is corrupted by noise.

FD See Floor Distributor.

FDCCH Forward Digital Control Channel. A digital cellular term defined by IS-136, which addresses cellular standards for networks employing TDMA (Time Division Multiple Access). The FDCCH includes all signaling and control information passed downstream from the cell site to the user terminal equipment. The FDCCH acts in conjunction with the RDCCH (Reverse Digital Control Channel), which includes all such information sent upstream from the user terminal equipment to the cell site. The FDCCH includes the BCCH, SCF and SPACH. See also BCCH, IS-136, SCF, SPACH and TDMA.

FDD 1. Floppy Disk Drive. A Hard Disk Drive is a HDD.

2. Frequency Division Duplex. A method used to achieve full duplex communications in wireless systems. The principle is that forward and reverse directions each use a separate and equally large frequency band. FDD is appropriate for symmetrical services such as voice and bidirectional data transfers. See also TDD.

FDDI Fiber Distributed Data Interface. FDDI is a 100 million bits per second fiber optic LAN. It is an ANSI standard. It uses a "counter-rotating" token ring topology. FDDI is ANSI X3T12 standard for a dual-ring LAN operating at 100 Mbps and using token passing; FDDI rings may use up to 200 km of optical fiber, or may employ twisted copper pairs for short hops. FDDI is compatible with the standards for the physical layer of the OSI model. An FDDI LAN is often known as a "backbone" LAN. It is used to join file servers together and to join LANs together. The theoretical limit of Ethernet, measured in 64 byte packets, is 14,800 packets per second (PPS). By comparison, Token Ring is 30,000 and FDDI is 170,000 pps. See FDDI TERMS and FDDI-II.

FDDI Follow-On LAN A faster FDDI. Said to operate at up to 2.4 gigabits per second.

FDDI Terms DAC Dual Attachment Concentrator DAS Dual Attachment Station ECF Echo Frames ESF Extended Service Frames LER Link Error Rate LLC Logical Link Control MAC Media Access Control MIC Media Interface Connector NIF Neighborhood Information Frame NSA Next Station Addressing PDU Protocol Data Unit PHY Physical Protocol PMD Physical Media Department PMF Parameter Management Frames RAF Resource Allocation Frames RDF Request Denied Frames SAC Single Attachment Concentrator SAS Single Attachment Station SDU Service Data Unit SIF Station Information Frames SMT Station Management SRF Status Report Frame THT Token Holding Timer TRT Token Rotation Timer TTRT Target Token Rotation Timer TRX Valid Transmission Timer UNA Upstream Neighbor Address

FDDI-II Fiber Distributed Data Interface-II is a recently stan-

dardized enhancement to FDDI. It still runs at 100 million bits per second on fiber or on twisted copper pairs, but in addition to transporting conventional packet data like other LANs, FDDI-II allows portions of the 100 Mbps bandwidth to carry low delay, constant bit rate, isochronous data like 64 Kbps telephone channels. This means the same LAN that carries computer packet data can carry live voice or live video calls. Some additional terms used with FDDI-II are: I-MAC which stands for Isochronous Media Access Control; P-MAC which stands for Packet Media Access Control; and WBC which stands for Wide Band Channel. See FDDI, FDDI Terms, Isochronous and Isoethernet.

FDL Facilities Data Link. A T-1 term, specifically relating to Extended SuperFrame (ESF). ESF extends the superframe from 12 to 24 consecutive and repetitive frames of information. The framing overhead of 8 Kbps in previous T-1 versions was used exclusively for purposes of synchronization. ESF takes advantage of newer channel banks and multiplexers which can accomplish this process of synchronization using only 2 Kbps of the framing bits, with the framing bit of only every fourth frame being used for this purpose. As a result, 6 Kbps is freed up for other purposes. This allows 2 Kbps to be used for continuous error checking using a CRC-6 (Cyclic Redundancy Check-6), and 4 Kbps to be used for a FDL which supports the communication of various network information in the form of in-service monitoring and diagnostics. ESF, through the FDL, supports non-intrusive signaling and control, thereby offering the user "clear channel" communications of a full 64 Kbps per channel, rather than the 56 Kbps offered through older versions as a result of "bit robbing." See also ESF and T-1. The FDL is embedded in the framing bits, using half the bits or 4000 bit/s. It is over this channel that two schemes operate:

1. In the original Bell System scheme, the repair station in the CO queries the CSU at the customer site, which responds with error statistics for the last 24 hours (in 15-min increments). The repairman uses this info to diagnose line condition.

2. The more modern ANSI method has the CSU broadcast the error statistics for the last three seconds, every second (with overlap). Automatic monitoring equipment in the CO can tell when the line is going bad. Both systems can co-exist and operate on the same link, but that's unlikely in reality.

FDM Frequency Division Multiplexing. A technique in which the available transmission bandwidth of a circuit is divided by frequency into narrower bands, each used for a separate voice or data transmission channel. This means you can carry many conversations on one circuit. The conversations are separated by "guard channels." At one point, FDM was the most used method of multiplexing long haul conversations when they were transmitted in analog microwave signals. No more. Fiber optic transmission (today's preferred method) uses TDM — Time Division Multiplexing.

FDMA Frequency Division Multiple Access. One of several technologies used to separate multiple transmissions over a finite frequency allocation. FDMA refers to the method of allocating a discrete amount of frequency bandwidth to each user to permit many simultaneous conversations. In cellular telephony, for example, each caller occupies approximately 25 kHz of frequency spectrum. The cellular telephone frequency band, allocated from 824 MHz to 849 MHz and 869 MHz, consists of 416 total channels, or frequency slots, available for conversations. Within each cell, approximately 48 channels are available for mobile users. Different channels are allocated for neighboring cell sites, allowing for re-use of fre-

quencies with a minimum of interference. This technique of assigning individual frequency slots, and re-using these frequency slots throughout the system, is known as FDMA. See CDMA, TDMA.

FDP Fiber Optic Distribution Panel.

FDS Frequency Division Switching. Seldom used for voice switching. Primarily used for radio and TV broadcasting.

FDX See Full Duplex.

FE Extended Framing ("F sub E"). An old name for ESF, also known as Extended SuperFrame, a T-1 carrier framing format that provides a 64 Kbps clear channel, error checking, 16 state signaling and some other nice data transmission features.

FE D4 Superframe Extended Another designation for AT&T's ESF (Extended SuperFrame).

Feather An imaging term. An effect in which the edges of a pasted selection or paint tool fade progressively at the edges for a seamless blend with the background.

Feathers A pound of feathers weighs more than a pound of gold. Feathers are weighed by "avoirdupois" weight measure, which has 16 ounces to a pound, while gold is weighed in "troy" measure, which only has 12 ounces to a pound.

Feature A feature is one of the many tasks a piece of equipment can accomplish. In the old days of selling telephone systems, there used to be an expression among salespeople that "The one with the biggest list of features wins." As a result many salespeople used to inflate their list of features by calling one feature by many names. Do not confuse a feature with the word "function," which is a much higher level word. The function of a telephone system is to be a phone system. While a phone system can have many features, it can have only one function.

Feature Buttons Think of a feature button on a telephone as a collection of numbers stored in a bin. When you hit the button, the bin quickly disgorges all the numbers one after another. Feature buttons are fast ways of doing things. You have a feature button labelled "Conference." Hit the button, set up a conference call. Without a feature button, you'd probably have to hit the switch hook and some numbers on your touchtone pad. In computer terms, a feature button on a phone is the same as a macro — an easy way of doing something. On most phones with feature buttons, the feature buttons are "programmable." This means you can assign different features to different buttons, i.e. the ones you want. For example, I always assign "Last Number Redial," "Saved Number Redial" and "Conference Call" to the buttons of any phone I'm programming. Some phones have many feature buttons. Some don't.

Feature Cartridge A replaceable software cartridge containing software features. The Feature Cartridge is inserted into the central cabinet, or Key Service Unit (if it's a key system). Several small phone systems (under 100 lines) use cartridges to upgrade their software. The manufacturers find cartridges are cheaper than equipping their phone systems with a floppy drive and the associated electronics.

Feature Code This is a number that is used to activate a particular feature on a phone system.

Feature Creep Occupational hazard The enemy of the good is the better. A term to show how features tend to get added to telecom equipment as time passes and new models appear. The term "feature creep" makes no judgments about whether the new features are actually useful. In book called "Startup: A Silicon Valley Adventure Story," Jerry Kaplan, the author, describes "Feature creep as 'the irresistible temptation for engineers to load a product down with their favorite special features.'"

Feature Function Testing Feature/function testing is designed to assure that everything a system is supposed to do is done correctly, e.g. calls are switched to the correct destination, messages are left and deleted, billing records collected accurately, and so on. Feature/function testing is the most detailed portion of the test process. The people who perform functional testing must be extremely detail oriented and have the discipline to test every feature to their written functional requirement. No function of the system should be overlooked. Definition courtesy Steve Gladstone, from his book "Testing Computer Telephony Systems."

Feature Group A, B, C, D FGA, FGB, FGC, FGD, are four separate switching arrangements available from local exchange carrier (LEC) end central offices to interexchange (long distance) carriers. These switching arrangements allow the LECs' end-users to make toll calls via their favorite long distance carrier. Feature groups are described in a tariff filed by the National Exchange Carrier Association with the FCC. The feature group used by each IX (InterExchange, also called long distance) carrier together with any special access surcharge determines the service they can provide their customers and the carrier common line access fee they will pay to the local exchange carrier involved. The most common Feature Group now is D. See the next four definitions. See Feature Group A, Feature Group B, Feature Group C, Feature Group D.

Feature Group A Offers access to the local exchange carrier's network through a subscriber-type line connection rather than a trunk. It is a continuation of the ENFIA arrangement used in the early days of OCCs, until equal access using an access tandem central office is available. Remember, without equal access the IX carrier had to require its customers to dial a local number to reach their long distance facilities, then dial an identification number, then dial long distance numbers of the called party desired. This service handicap, compared to AT&T's superior connections, qualifies the OCC for a discount off the FGA rate until access is equal. The IX carrier is billed by the LEC based upon actual monthly use rather than the ENFIA method of projected "minutes of use" rate.

Feature Group B Is similar to FGA, but provides a higher quality trunk line connection from end CO to the IX carrier's facilities, instead of the subscriber-type line. The IX customer can originate a call from anywhere within the LATA, while FGA requires customers to initiate the call from within the local exchange of the exchange carrier connecting to the IXC. FGB billings to the IX are on a flat usage basis, and a discount is applicable. To access a long distance carrier with Feature Group B capability, you dial 950-XXXX (XXXX is the Carrier Identification Code, or CIC), and then 1+ the number. Feature Group D is better. See also 950-XXXX and CIC.

Feature Group C Is the traditional toll service arrangement offered by LECs to AT&T prior to breakup of the Bell System. Quality is superior, and the service includes automatic number identification of the calling party, answerback, and disconnection supervision, and the subscribers can use either a dial or touchtone pad. This FGC service is offered only to AT&T without a discount.

Feature Group D FGD. The class of service associated with equal access arrangements. All facilities based IXCs (InterExchange Carriers) and resellers of significance pay extra for Feature Group D terminations (connections), which is a trunk-side connection provided by the ILECs (Incumbent Local Exchange Carriers). Feature Group D is required for equal access, which allows phone users in the United States

FQDN Fully Qualified Domain Name. An Internet term. The FQDN is the full site name of an Internet computer system, rather than just its hostname. For example, the system lisa at Widener University has a FQDN of lisa.cs.widener.edu.

FR See Flat Rate Service.

FR-1 A flammability rating established by Underwriters Laboratories for wires and cables that pass a specially designed vertical flame test. This designation has been replaced by VW-1.

Fractal A word coined in 1975 by Benoit B. Mandelbrot from the Latin fractus ("to break"). One fractal creator called fractals a shape with the property of "self-similarity."

Fractal Compression An asymmetrical compression technique that shrinks an image into extremely small resolution-independent files by storing it as a mathematical equation as opposed to storing it as pixels. The process starts with the identification of patterns within an image and results in collection of shapes that resemble each other but that have different sizes and locations within an image. Each shape-pattern is summarized and reproduced by a formula that starts with the largest shape and repeatedly displaces and shrinks it. These patterns are stored as equations and the image is reconstructed by iterating the mathematical model. Fractal compression can store as many as 60,000 images on one CD-ROM. One disadvantage of fractal compression is that it is time consuming, taking as long as four minutes to convert a 1.3 MB TIFF file to a 228 KB file. See Fractals.

Fractal Geometry The underlying mathematics behind fractal image compression, discovered by two Georgia Tech mathematicians, Michael Barneley and Alan Sloan.

Fractal Image Format FIF. A compression technique that uses on-board ASIC chips to look for patterns. Exact matches are rare and the process works on finding close matches using a function known as an affine map.

Fractals Along with raster and vector graphics, fractals are a way of defining graphics in a computer. Fractal graphics translate the natural curves of an object into mathematical formulas, from which the image can later be constructed. See Fractal Compression.

Fractional Services A British term. Bandwidth available from carriers in increments of 64Kbit/s such as Mercury's Switchband. See Fractional T-1 for the North American definition.

Fractional T-1 FT-1. Fractional T-1 refers to any data transmission rate between 56/64 Kbps (DSO rate) and 1.544 Mbps (T-1). Fractional T-1 is a four-wire (two copper pairs) digital circuit that's not as fast as a T-1. Fractional T-1 is popular because it's typically provided by a LEC (Local Exchange Carrier) or IXC (InterExchange Carrier) at less cost than a full T-1, and in support of applications that don't require the level of bandwidth provided by a full T-1. While FT-1 is less costly than a full T-1, it is more costly on a channel-by-channel basis, as you would expect. Users love FT-1, but carriers hate it. FT-1 costs the carriers just as much to provision as does a full T-1, they just turn down some of the channels. FT-1 is typically used for LAN interconnection, videoconferencing, high-speed mainframe connection and computer imaging.

Fractional T-3 A telephone company service in which portions of a T-3 (44.7364 Mbps) transmission service are leased to provide a service similar to a T-1 (1.544 Mbps) or T-2 (3.152 Mbps) channel, but normally at a lower cost.

FRAD Frame Relay Access Device, also sometimes referred to as a Frame Relay Assembler/Disassembler. Analogous to a PAD (Packet Assembler/Disassembler) in the X.25 world, a

FRAD is responsible for framing data with header and trailer information prior to presentation of the frame to a Frame Relay switch. On the receiving end of the communication, the FRAD serves to strip away the Frame Relay control information in order that the target device is presented with the data packaged in its original form. On the receiving end, the FRAD also generally is responsible for detecting errors in the payload data created during the process of network switching and transmission; error correction generally is accomplished through a process of retransmission. A FRAD may be a stand-alone device, although the function generally is embedded in a router.

Fragment The pieces of a frame left on an FDDI ring, caused by a station stripping a frame from the ring.

Fragmentation 1. In messaging it is the process in which an IP (Internet Protocol) datagram is broken into smaller pieces to fit the requirements of a given physical network. The reverse process is termed "reassemble."

2. ATM and SMDS networks routinely perform a process of Segmentation and Reassembly (SAR), segmenting the native PDU into 48-octet payloads which are carried in 53-octet cells. The process is reversed on the receiving end.

3. A condition that affects data stored on a disk. Adding and deleting records in a file, creates what is sometimes called the Swiss cheese effect. The operating system stores the data for an individual file in many different physical locations on the disk, leaving large holes between records. Fragmented files slow system performance because it takes time to locate all parts of a file.

Frame 1. A frame is a packet. It's a generic term specific to a number of data communications protocols. A frame of data is a logical unit of data, which commonly is a fragment of a much larger set of data, such as a file of text or image information. As the larger file is prepared for transmission, it is fragmented into smaller data units. Each fragment of data is packaged into a frame format, which comprises a header, payload, and trailer. The header prepends (prepend means added to the front of) the payload and includes a beginning flag, or set of framing bits, which are used for purposes of both frame delineation (beginning of the frame) and synchronization of the receiving device with the speed of transmission across the transmission link. Also included in the header are control information (frame number), and address information (e.g., originating and terminating addresses). Following the header is the payload, which is the data unit (fragment) being transmitted. Appending the payload is the trailer, which comprises data bits used for error detection and correction, and a final set of framing bits, or ending flag, for purposes of frame delineation (ending of the frame). This frame format, in the broader generic sense, also is known as a data packet. Frame, therefore, is a term specific to certain bit-oriented data transmission protocols such as SDLC (Synchronous Data Link Control) and HDLC (High-level Data Link Control), with the latter being a generic derivative of SDLC. In the case of SDLC, a frame is very similar to a block, which would be employed in a character-oriented protocol such as IBM's BSC (Binary Synchronous Communications), also known as Bisync. See also BSC, HOLC, Packet, and SDLC.

2. In TV video, a frame is a single, complete picture in video or film recording. A video frame consists of two interlaced fields of either 525 lines (NTSC) or 625 lines (PAL/SECAM), running at 30 frames per second (NTSC) or 25 frames per second (PAL/SECAM). 24 frames are sent in moving picture films and a variable number, typically between 8 and 30, sent

in videoconferencing systems, depending on the transmission bandwidth available. Up to about 12 frames a second looks "jerky."

3. One complete cycle of events in time division multiplexing. The frame usually includes a sequence of time slots for the various sub channels as well as extra bits for control, calibration, etc. T-Carrier makes use of such a framing convention for packaging data. Channelized T-1, for instance, frames 24 time slots with a framing bit which precedes each set of sampled data.

4. A unit of data in a Frame Relay environment. The frame includes a payload of variable length, plus header and trailer information specific to the operation of a Frame Relay network service.

5. A metal framework, such as a relay rack, on which equipment is mounted. A distribution frame. A rectangular steel bar framework having "verticals and horizontals" which is used to place semipermanent wire cross connections to permanent equipment. Found in telephone rooms and central offices. See Distribution Frame.

Frame Alignment The extent to which the frame of the receiving equipment is correctly phased (synchronized) with respect to that of the received signal.

Frame Alignment Errors A frame alignment error occurs when a packet is received but not properly framed (that is, not a multiple of 8 bits).

Frame Alignment Sequence See Frame Alignment Signal.

Frame Alignment Signal FAS. Frame Alignment Signal or Frame Alignment Sequence.

The distinctive signal inserted in every frame or once in n frames that always occupies the same relative position within the frame and is used to establish and maintain frame alignment, i.e. synchronization. See Frame Alignment Errors.

Frame Buffer A section of memory used to store an image to be displayed on screen as well as parts of the image that lie outside the limits of the display. Some systems have frame buffers that will hold several frames, in which case they should be called "frames buffers." But they're not.

Frame Check Sequence Bits added to the end of a frame for error detection. Similar to a block check character (BCC). In bit-oriented protocols, a frame check sequence is a 16-bit field added to the end of a frame that contains transmission error-checking information. In a token ring LAN, the FCS is a 32-bit field which follows the data field in every token ring packet. This field contains a value which is calculated by the source computer. The receiving computer performs the same calculation. If the receiving computer's calculation does not match the result sent by the source computer, the packet is judged corrupt and discarded. An FCS calculation is made for each packet. This calculation is done by plugging the numbers (1's and 0's) from three fields in the packet (destination address, source address, and data) into a polynomial equation. The result is a 32-bit number (again 1's and 0's) that can be checked at the destination computer. This corruption detection method is accurate to one packet in 4 billion. See Frame Check Sequence Errors.

Frame Check Sequence Errors Errors that occur when a packet is involved in a collision or a corrupted by noise.

Frame Dropping The process of dropping video frames to accommodate the transmission speed available.

Frame Duration The sum of all the unit time intervals of a frame. The time from the start of one frame until the start of the next frame.

Frame DS1 The DS1 frame comprises 193 bit positions. The first bit is the frame overhead bit, while the remaining 192 bits are available for data (payload) and are divided into 24 blocks (channels) of 8 bits each.

Frame Error An invalid frame identified by the Frame Check Sum (FCS). See also Frame Errors.

Frame Error Rate FER. The ratio of errored data frames to the total number of frames transmitted. If the FER gets too high, it might be worth while stepping down to slower baud rate. Otherwise, you would spend more time retransmitting bad frames than getting good ones through. In other words, throughput would suffer. The theory is that the faster the speed of data transmission the more likelihood of error. This is not always so. But if you are getting lots of errors, the first — and easiest — step is to drop the transmission speed. Frame Error Rate is thus a measure of transmission quality. It is generally shown as a negative exponent, (e.g., 10 to the minus 2 power (10^{-2}) means one out of 100 frames are in error.) The FER is directly related to the Bit Error Rate (BER). See also Bit Error Rate.

Frame Errors In the 12-bit, D4 frame word, an error is counted when the 12-bit frame word received does not conform to the standard 12-bit frame word pattern.

Frame Flag Sequence The unique bit pattern "01111110" used as the opening and closing delimiter for the link layer frames.

Frame Frequency A video term. The number of times per second a frame is scanned.

Frame Grab To capture a video frame and temporarily store it for later manipulation by a graphics input device.

Frame Grabber A PC board used to capture and digitize a single frame of NTSC video and store it on a hard disk. Also known as Frame Storer. See Video Capture Board.

Frame Ground FGD. Frame Ground is connected to the equipment chassis and thus provides a protective ground. Frame Ground is usually connected to an external ground such as the ground pin of an AC power plug.

Frame Header Address information required for transmission of a packet across a communications link.

Frame Length X.25 packets are fixed in length. ATM cells are fixed in length. Frame Relay frames (packets in the generic sense) are variable in length, which is due to their intended use for LAN internetworking. LAN frames (packets in the generic sense) are variable in length.

Frame Multiplexing The process of handling traffic from multiple simultaneous inputs by sending the frames out one at a time in accordance with a specific set of rules. Instead of multiplexing traffic from a lower-speed connection into a higher speed connection based on a specific time duration for each low-speed channel, frame multiplexing using the length of a given frame as the measurement.

Frame Rate The number of images displayed per second in a video or animation file. The Frame Rate is highly significant in determining the quality of the image, with a high frame rate creating the illusion of full fluidity of motion. 30 frames per second (30 fps) is considered to be full-motion, broadcast quality. On the other end of the scale, 2fps is most annoying. At 30 fps, the brain processes the images, filling in the blanks due to the "Phi Phenomenon." See PHI Phenomenon.

Frame Relay Frame relay, technically speaking, is an access standard defined by the ITU-T in the I.122 recommendation, "Framework for Providing Additional Packet Mode Bearer Services." Frame relay services, as delivered by the telecommunications carriers, employ a form of packet switch-

which means it attempts to deliver every packet, but has no provision for retransmitting lost or damaged packets. IP leaves such error correction, if required, to higher level protocols, such as TCP.

IP addresses are 32 bits in length and have two parts: the Network Identifier (Net ID) and the Host Identifier (Host ID). Assigned by a central authority, the Net ID specifies the address, unique across the Internet, for each network or related group of networks. Assigned by the local network administrator, the Host ID specifies a particular host, station or node within a given network and need only be unique within that network. A Transport Layer, which corresponds to the OSI Transport Layer. The Transmission Control Protocol (TCP) subset runs at this layer. TCP provides end-to-end connectivity between data source and destination with detection of, and recovery from, lost, duplicated, or corrupted packets — thus offering the error control lacking in lower level IP routing. In TCP, message blocks from applications are divided into smaller segments, each with a sequence number that indicates the order of the segment within the block. The destination device examines the message segments and, when a complete sequence of segments is received, sends an acknowledgment (ACK) to the source, containing the number of the next byte expected at the destination.

An Application Layer, which corresponds to the session, presentation and application layers of the OSI model. This layer manages the function required by the user programs and includes protocols for remote log-in (Telnet), file transfer (FTP), and electronic mail (SMTP). See OSI.

TCR 1. Transaction Confirmation Report. A report from a fax machine listing the faxes received and transmitted. It provides details about each fax, including date, time, the remote fax's number, results, total pages.

2. An ATM term. Tagged Cell Rate: An ABR service parameter, TCR limits the rate at which a source may send out-of-rate forward RM-cells. TCR is a constant fixed at 10 cells/second.

TCs 1. Transmission Convergence Sublayer: This is part of the ATM physical layer that defines how cells will be transmitted by the actual physical layer.

2. TCS is a manufacturer of excellent call center manpower scheduling software packages. It is based in Nashville, TN.

TCU 1. Timing Control Unit.

2. Closed User Group Table.

TCV Address Conversion Table.

TDAS See Traffic Data Administration System.

TDC 1. Time Division Controller.

2. Dial Code Table.

TDD 1. Time Division Duplex. A method used in cellular and PCS networks employing TDMA (Time Division Multiple Access) to support full duplex communications. Each radio channel is divided into multiple time slots through TDMA, thereby supporting multiple conversations. TDD supports transmission in the forward direction (from the cell phone to the cell site) through one radio frequency channel and one time slot. Another radio channel and time slot supports transmission in the backward direction (from the cell site to the cell phone). TDD is flexible with regard to allocation of timeslots for forward and reverse, making it best suited for asymmetrical applications, such as web browsing. See also FDD.

2. Telecommunications Device for the Deaf. Under the Communications Act of 1934, a TDD is defined as a machine "that employs graphic communication in the transmission of coded signals through a wire or radio." TDD devices (which typically look like simple computer terminals) use the Baudot

method of communications. Most TDD devices are acoustically coupled and are slow, running at 300 baud.

There is a special TDD/TTY Operator Services number. It's 800-855-1155. Users of TDDs often abbreviate commonly used words or expressions to save time. Here are some of the most frequently used:

AANS	Answer	R	Are
CUD	Could	REC	Receive
GA	Go Ahead	SK	Stop Keying
LTR	Letter	THRU	Through
MSG	Message	THX	Thank You
MIN	Minute	U	You
NITE	Night	UR	Your
PLS	Please	WUD	Would
QQ	Question	XOX	Hugs & Kisses

TDRA Telephone Disclosure and Dispute Resolution Act. A US federal act passed in 1992 which required both the FCC and the FTC to prescribe regulations governing pay-per-call services. Subsequently, the FTC adopted its 900-Number Rule, which became effective November 1, 1993. Under the TDRA, a consumer's telephone service cannot be disconnected for failure to pay charges for a 900-number call, and 900-number blocking must be made available to consumer who do not wish to have access to 900-number services. See also 900-Number Rule.

TDEL Technical Development and Evaluation Laboratory.

TDF 1. Trunk Distributing Frame.

2. Transborder Data Flows are movements of machine-readable data across international boundaries. TDF legislation began in the 1970s and has been put into effect by many countries in an attempt to protect personal privacy of citizens. This term has particular meaning as it relates to electronic commerce or EDI and is becoming more and more relevant with the use of the Internet as a means to conduct global business.

TDHS Time Domain Harmonic Scaling

TDI Transmit Division Intertie.

TDIM See Time Division Multiplex.

TDMA Time Division Multiple Access. One of several technologies used to separate multiple conversation transmissions over a finite frequency allocation of through-the-air bandwidth. As with FDMA (Frequency Division Multiple Access), TDMA is used to allocate a discrete amount of frequency bandwidth to each user, in order to permit many simultaneous conversations. However, each caller is assigned a specific timeslot for transmission. A digital cellular telephone system using TDMA assigns 10 timeslots for each frequency channel, and cellular telephones send bursts, or packets, of information during each timeslot. The packets of information are reassembled by the receiving equipment into the original voice components. TDMA promises to significantly increase the efficiency of cellular telephone systems, allowing a greater number of simultaneous conversations. See CDMA, FDMA.

TDMA-3 An abbreviated way of describing a TDMA system which can support 3 calls in single radio frequency "carrier." IS-54 TDMA divides a carrier frequency into 6 time slots. Initial "full-rate" vocoders will require 2 time slots per user and thus support 3 users on each on each carrier frequency. This is called TDMA-3. Future "half-rate" vocoders will require only 1 time slot per user and support 6 users per carrier frequency, yielding TDMA-6.

TDMA-6 An abbreviated way of describing a TDMA system which is capable of supporting 6 users per carrier frequency. IS-54 TDMA divides a carrier frequency into 6 time slots per

user and thus support 3 users on each carrier frequency. Future "half-rate" vocoders will require only 1 time slot per user and thus will support 6 users per carrier frequency, yielding TDMA-6.

TDMS 1. Technical Document Management Systems.

2. Time Division Multiplex System.

3. Transmission Distortion Measuring Set.

TDOA Time Difference Of Arrival. A precise method of locating a radio receiver, TDOA is being proposed to support wireless 911 services for cellular and PCS networks. Operating much like GPS (Global Positioning Satellite Systems), although in reverse, GPOA uses three cell site antennae to lock in on the signal from the cell phone. The times of signal arrival at each cell site are compared through the use of a precise master clock. Although the differences in time of signal arrival may be only microseconds, the location of the cell phone can be determined through a process of time triangulation, allowing the exact location of the device to be plotted. GPOA offers much improved location-determination than does the old method of triangulation, which relies on signal strength. See also 911 and Triangulation.

TDP Telocator Data Protocol. A new 8-bit protocol for sending messages and binary files (images, spreadsheets, word processing files, executables, etc.) to pagers (also known as beepers). The older (and more common) 7-bit messaging protocol now widely in use is called TAP, which stands for Telocator Alphanumeric Paging Protocol. This protocol can only send simple alphanumeric messages, like "Your shares in XYZ are now \$23, up 98%."

TDR Time Domain Reflectometer.

TDS 1. MCi's name for Terrestrial Data Services, i.e. services that run through on-the-ground fiber, rather than through-the-air satellite services.

2. Terrestrial Digital Service.

3. Transmission Data Service.

TDSAI Transit Delay Selection And Indication.

1. ISDN Terminal Equipment. See the next two definitions.

2. Terminal Equipment: As an ATM term, terminal equipment represents the endpoint of ATM connection(s) and termination of the various protocols within the connection(s).

TDU Tape Drive Unit.

TE Terminating Equipment.

TE1 Terminal equipment type 1 that supports ISDN standards and thus can connect directly to the ISDN network. TE1 could be an ISDN telephone, a personal computer capable of working with ISDN, a videophone, etc. In short, any device that can attach to and work with ISDN.

TE2 Terminal equipment that does not support ISDN standards and thus requires a Terminal Adapter. Non-ISDN terminal equipment (e.g. analog telephone) linked at the RS-232, RS-449, or V.35 interfaces.

Teamware According to Internet Week, May 17, 1999, teamware is a class of web collaboration tools for sharing information over extranets while sparing IT managers much of the administrative work associated with traditional groupware. Teamware applications lack some customization features but are less complex to deploy because they normally let users perform the majority of management functions and also feature a browser interface. Teamware does not provide connectivity to back-end databases and does not scale to handle large volumes of data like Lotus Notes, Microsoft Exchange or Novell GroupWise. However, teamware is intuitive and can be quickly implemented.

Teardrop Attack A teardrop attack occurs when a mali-

cious person sends instructions over a network to a server attempting to crash the server. Some implementations of the TCP/IP IP fragmentation re-assembly code do not properly handle overlapping IP fragments. Teardrop is a widely available attack tool that exploits this vulnerability. There are workarounds that will prevent your server from being attacked.

TEC NIS Telecommunications and Electronics Consortium in the Newly Independent States. An organization based in Moscow and administered by TIA (Telecommunications Industry Association) to assist US telecommunications and telecommunications-related electronics companies with doing business in the region.

TECF Traffic Editor Control File.

Techinfo A common campuswide information system developed at MIT. An Internet term.

Technical Advisory TA. A Bellcore document containing a preliminary view of proposed generic requirements for a technology, equipment, service or interface. The TA document type is being replaced by the Generic Requirements (GR) document type. See Generic Requirements.

Technical Control Center A testing center for telecommunications circuits. The center provides test access and computer-assisted support functions to aid in circuit maintenance.

Technical Control Facility A federal government term. A term plant, or a designated and specially configured part thereof, containing the equipment necessary for ensuring fast, reliable, and secure exchange of information. This facility typically includes distribution frames and associated panels, jacks, and switches; and monitoring, test, conditioning, and order wire equipment.

Technical Load A military term. The portion of the operational load required for communications, tactical operations, and ancillary equipment including necessary lighting, air conditioning, or ventilation required for full continuity of communications.

Technical Means A term in the spy business which means spy satellites and electronic eavesdropping stations, typically costing tens of billions of dollars.

Technical Office Protocol TOP. A seven-layer network architecture designed for office automation that uses International Standards Organization (ISO) or ITU specifications at each level. TOP was defined by Boeing Vertol Corp. and is now controlled by the MAP/TOP (Manufacturing Automation Protocol/Technical Office Protocol) Users Group.

Technical Reference TR. A Bellcore document containing the current view or performance of a technology, equipment, service or interface. The TR document type are being replaced by the Generic Requirements (GR) document type. See Generic Requirements.

Techno-Geek A geek. See Geek.

TEd Trunk Encryption Device.

Teddy Bear A stuffed animal named after President "Teddy" Roosevelt, a keen hunter who once took pity on a baby bear and didn't shoot the baby.

TEDIS Trade Electronic Data Interchange Systems.

Teen Service A feature of some central offices which allows two telephone numbers to be assigned to a single party phone line. Each number has a distinctive ringing pattern so that the called parties can recognize which line is ringing. The inventor of this service named it after the fact that his teenage children were always receiving phone calls. And he wanted a way for them to recognize when the calls were for them and when they were for the parents. Sadly, this phenomenon now begins earlier in life, with children as young as six receiving