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Harry Newton

Steve Schoen, Contributing Editor

Gail Saari, Artistic Director

Newton's Telecom Dictionary
28th Expanded and Updated Edition

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Steve Schoen, Contributing Editor
Gail Saari, Artistic Director
Leigh McLellan, Typesetting

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words, ARP is used to obtain the physical address when only the logical address is known. An ARP request with the IP address is broadcast onto the network. The node on which the IP address resides responds with the hardware address in order that the packets can be transmitted. By way of example, TCP/IP requires ARP for use with Ethernet, in which case the physical address would be defined by the MAC address hard-coded on the NIC (Network Interface Card) of the target workstation. See also RARP.

2. A low-level protocol which serves to map IP addresses, or other non-ATM addresses, to the corresponding address of the target ATM device. Once the ATM address has been identified, the ARP server can stream data to the target device as long as the session is maintained.

ARP poisoning See ARP spoofing.

ARP spoofing The sending of fake Address Resolution Protocol (ARP) packets to an Ethernet LAN in order to change entries in the LAN server's cached lookup table so as to redirect traffic on the LAN from its intended destination to another destination. See ART table. See also pharming.

ARP table A table on routers and network-attached local computers that maps layer 3 (network) addresses to layer 2 (data link) addresses. A layer 3 address is a logical addresses specific to a particular network protocol, such as IP or Appletalk; a layer 2 address is a physical address unique to a specific hardware interface (namely, a network interface card) in a router or network-attached computer. If your computer is running Microsoft Windows, you can display the ARP table on your computer by doing the following. First, run Windows' RUN utility to display the command prompt; then type "ARP-a" (without the quotation marks) and press ENTER. The ARP table will list IP addresses in the first column, the associated MAC addresses in the second column, and each IP address' type (dynamic or static) in the third column. Type EXIT and press ENTER to exit the command prompt and return to what you were doing.

ARPA Advanced Research Projects Agency of the U.S. Department of Defense. (The whole DOD annual telecommunications bill exceeds \$1 billion.) Much of the country's early work on packet switching was done at ARPA. At one stage it was called DARPA, which stands for Defense Advanced Research Projects Agency. ARPA was the U.S. government agency that funded research and experimentation with the ARPANET and later the Internet. The group within DARPA responsible for the ARPANET is ISTO (Information Systems Techniques Office), formerly IPTO (Information Processing Techniques Office). See also DARPA Internet. DARPA has changed its name to ARPA and back again. It's hard to keep up.

ARPANET Advanced Research Projects Agency NETWORK. The U.S. military precursor to the Internet. ARPANET was a Department of Defense data network which tied together many users and computers in universities, government and businesses, most of whom were doing research for the military. ARPANET was the forerunner of many developments in commercial data communications, including packet switching, which was first tested on a large scale on this network. ARPANET was started in 1969 with funds from the Defense Department's Advanced Projects Research Agency (ARPA). ARPANET was split into DARPA (Defense ARPANET) and MILNET (Military Network) in 1983. ARPANET was officially retired in 1990. That was when the Internet officially took off.

ARPM Average Revenue Per Minute.

ARPU Average Revenue Per Unit (or per User). Pronounced R-POOH. The average revenue generated per customer unit per month. How much a customer provides a phone company—wired or wireless. This is one indicator of the financial performance of a telecom company. Is the ARPU rising or falling? How does it compare to the ARPU of competing companies? It's a metric which Wall Street uses to compare companies of different sizes. See the next definition.

ARPU erosion The decline of average revenue per customer due to price competition, substitution of one service for another (for example, use of wireless for some long-distance calls), changing customer demographics, or other factors. See also ARPU.

ARQ Automatic Retransmission reQuest, Automatic Repeat reQuest or Automatic ReQuest for ReTransmission. No one knows which one it really is. But it doesn't matter. They all mean the same thing. ARQ is the standard method of checking transmitted data, used on virtually all high-speed data commu-

nications systems. The sender encodes an error-detection field based on the contents of the message. The receiver recalculates the check field and compares it with that received. If they match, an "ACK" (acknowledgment) is transmitted to the sender. If they don't match, a "NAK" (negative acknowledgment) is returned, and the sender retransmits the message. Note: this method of error correction assumes the sender temporarily or permanently stores the data it has sent. Otherwise, it couldn't possibly retransmit the data. No error detection scheme in data transmission is foolproof. This one is no exception.

array 1. The description of a location of points by coordinates. A 2-D array is described with x,y coordinates. A 3-D array is described with x,y,z coordinates.

2. A named, ordered collection of data elements that have identical attributes; or an ordered collection of identical structures.

3. Two or more hard disks that read and write the same data. In a RAID system, the operating system treats the array as if it were a single hard disk.

4. A form of telecommunications wireless antenna. See Array Antenna and Phased Array Antenna.

array antenna Take a bunch of directional antennas. Aim them at the same transmitting source. Join them together. Presto, you now have a very powerful giant antenna. Array antennas are used for picking up weak signals. They are often used in astronomical and defense communications systems. For a bigger explanation, see Phased Array Antenna.

array connector A connector for use with ribbon fiber cable that joins 12 fibers simultaneously. A fan-out array design can be used to connect ribbon fiber cables to non-ribbon cables.

array processor A processor capable of executing instructions in which the operands may be arrays rather than data elements.

array splice ARS. A splicing device used for ribbon cable. Splices 12 fibers at once.

array waveguide AWG. A passive optical component used for wavelength separation (i.e. to multiplex and de-multiplex wavelengths, particularly those tightly spaced together), which becomes increasingly important in high channel count DWDM systems, which require closer channel spacing. AWGs are fabricated by depositing thin layers of glass onto silicon wafers.

arrestor A device used to protect telephone equipment from lightning, electrical storms, etc. An arrestor is typically gas filled so when lightning strikes, the gas ionizes and, bingo, a low resistance to the ground that drains the damaging high voltage elements of the lightning away.

arrival rate A call center term. The pattern in which calls arrive. Call Arrival Rates can be smooth, like outgoing telemarketing calls, or random, like incoming toll-free number calls, or peaked, where calls escalate in response to advertising.

ARRL See American Radio Relay League.

arrobe Term coined by the French (who else?) to replace the barbaric English "at" (@) in email addresses. The word is derived from arroba, the Spanish equivalent.

ARS 1. Automatic Route Selection, also called Least Cost Routing. A way that your phone system automatically chooses the least expensive way of making the call that it is presented with. That least expensive way may be a tie line or a WATS line, etc. It may even be dial-up, or a VoIP or a cell phone call. See Least Cost Routing and Alternate Routing.

2. See array splice.

ARSG See Australian Radiocommunications Study Group.

ART Autorite de Regulation des Telecommunications (French telecommunications regulator).

artefact Misinterpreted information from a JPEG or other compressed image. Colour faults or line faults that visibly impact the image negatively. The higher the level of compression, the more likely the artefacting.

Arctic Fibre A planned 9,400-mile submarine cable system in the arctic that is expected to be ready for service in Q4 2015. It will provide a shorter route between western Europe (Bude, UK) and east Asia (Maruyama, Japan) than current submarine cable systems that connect western Europe and east Asia via traditional and very much longer eastbound and westbound maritime shipping routes. Arctic Fibre will run from the UK across the North Atlantic, arctic

FERF 1. Far-End Receive Failure. A yellow alarm. A message from a remote network element that is having trouble receiving a signal.

2. Far-End Remote Failure. An alarm indicating a failure at the far end of an ATM network, identifying the specific circuit in a failure condition.

Fermi's Paradox The story goes like this: Sometime in the 1940s, Enrico Fermi was talking about the possibility of extra-terrestrial intelligence with some other physicists. They were impressed that life had evolved quickly and progressively on Earth. They figured our galaxy holds about 100 billion stars, and that an intelligent, exponentially-reproducing species could colonize the galaxy in just a few million years. They reasoned that extra-terrestrial intelligence should be common by now. Fermi listened patiently, then asked, simply, "So, where is everybody?" That is, if extra-terrestrial intelligence is common, why haven't we met any bright aliens yet? This conundrum became known as Fermi's Paradox.

fernsprechvermittlungsstelle A central office in German. In Europe, they call a central office a "public exchange," or just plain "exchange." They look at you kinda strange when you say the North American word, namely "central office."

ferreed assembly A glass enclosed reed relay switch in which the reeds are made of some metal which can be opened or closed by an external magnetic field.

ferret satellite A geosynchronous satellite whose purpose is to gather signals intelligence (sigint) and elint (electronic intelligence). Examples of sigint are radio communications traffic from foreign military units, foreign leaders, and terrorists. Examples of elint are telemetry signals from foreign missiles, satellites and aircraft. See electronic intelligence, signals intelligence.

ferri chrome A coating used on tape comprising a layer of ferric oxide particles and a layer of chromium dioxide particles and combining the attributes of both.

ferric oxide A coating used on tape comprised of red iron oxide, the original material used for magnetic recording tapes.

ferrite A type of ceramic material having magnetic properties and consisting of a crystalline structure of ferric oxide and one or more metallic oxides, such as those of nickel or zinc. See the next definition and barium ferrite, hard ferrite and soft ferrite.

ferrite bar antenna A ferrite bar or rod with copper wire wrapped around one end of it, which is mounted inside the casing of a radio and serves as the radio's internal antenna.

ferroresonant transformer A special transformer which puts out regulated AC voltage even when the input voltage is variable. A ferroresonant transformer may be used by itself to correct brownouts or it may be built into a UPS. A ferroresonant transformer has an undesirable characteristic called "high output impedance" which can prevent protective devices such as circuit breakers on equipment plugged into it from functioning, resulting in a possible safety hazard. Another problem is that computer loads applied to ferro based line conditioners or UPS systems cause the voltage waveform applied to the computer to be very distorted, which may result in undervoltage conditions within the computer. Ferro based UPS systems are becoming obsolete because they can become unstable and oscillate when supplying modern power factor corrected power supplies. This definition courtesy APC.

ferrule A component of a fiber optic connection that holds a fiber in place and aids in its alignment.

Fessenden, Reginald A Canadian-born (1866-1932) inventor who was the first to surmise and demonstrate, in a series of experiments from 1900-1906, that voice, music and other audio content could be transmitted wirelessly. This laid the groundwork for broadcast radio and later, broadcast TV. Guglielmo Marconi, the father of wireless communications, who was Fessenden's contemporary, hadn't believed it possible before Fessenden demonstrated otherwise that sound could be transmitted on radio waves. Marconi's transmissions up to that point had been Morse code. Fessenden is sometimes called the father of radio broadcasting.

festoon cable A cable, generally flat, that is used to deliver power and control aerially on jib and gantry cranes, hoists, plating and cleaning lines, and other industrial and manufacturing automation systems involving mobile/

retractable equipment. Festoon cable is often mounted on C-track, T-track and I-beam trolley systems, and its hanging undulations resemble a garland, hence the name festoon cable. Since 2000, festoon cable that is manufactured for outdoor use must be enclosed in an outer rubber jacket.

festoon network A submarine (i.e. undersea) network built to link coastal cities instead of using a terrestrial network—microwave or optical. Festoon submarine cable systems are used because they're faster and cheaper to install and because disasters like hurricanes, tsunamis, volcano eruptions and don't hurt them. Many nations such as Italy, Thailand, Japan and South Africa already use or are planning to use festoon networks. Corning defines festoon as "a string or garland suspended in a loop or curve between two points." Merriam Webster defines it as "a decorative chain (as of flowers or leaves) hanging typically in a curve between two points." The cable goes out to sea, circles around and comes back to the next port. Hence the name festoon.

FET Field Effect Transistor. Very thin and small transistors are used to control pixels in a TFT (Thin Film Transistor) display.

Fewer A smaller number. The word "fewer" is always confused with the word "less." According to the Oxford American Dictionary, the word "less" is used of things that are measured by amount (for example, eat less butter, use less fuel). Its use with things measured by numbers is regarded as incorrect (for example in "we need less workers"; correct usage is "fewer workers").

FEXT Far-End Crosstalk. A type of crosstalk which occurs when signals on one twisted pair are coupled to another pair as they arrive at the far end of multi-pair cable system. FEXT is an issue on short loops supporting high-bandwidth services such as VDSL (Very-high-bit-rate Digital Subscriber Line), given the relatively high carrier frequencies involved. Services such as ADSL and HDSL, are not affected to the same extent, as the loops are longer and as such interference tends to be attenuated (weakened) on longer loops. See also Crosstalk. Compare with NEXT.

FF Form Feed. A printer function used to skip to the top of the next page or form.

FFA Field Force Automation. Refers to information technology solutions designed to help companies improve communication with employees in the field and yield increased productivity. FFA solutions typically comprise integrated software, hardware and networking components.

FFDI Fast Fiber Data Interface. A proprietary 100 megabit per second local area network that uses fiber optic, coax, shielded twisted pair or unshielded twisted pair. It is manufactured by PlusNet, Phoenix, Arizona.

FFOL Fiber Follow On LAN. Emerging LAN technology.

FFT 1. Fast File Transfer. An ISDN term referring to the fact that file transfers can be accomplished "fast." Reason #1: Two B channels at 64 Kbps each and a D channel at up to 16 Kbps are available to be bonded to provide as much as 144 Kbps. Reason #2: Data transfer is accomplished in an "optimistic" streaming mode, rather than a "pessimistic" packet mode. Therefore, there is no delay associated with acknowledgements. This is possible due to the excellent level of error performance inherent in digital services. The end result is FFT.

2. Fast Fourier Transform. A signal processing term for a common computer implementation of Fourier Transforms. The FFT, as a practical implementation, will always result in a finite series of sine and cosine waves as an extremely close approximation of the possibly infinite series described by the purely mathematical application of the Fourier Transform. See Fourier's Theorem.

FG An ATM term. Functional Group: A collection of functions related in such a way that they will be provided by a single logical component. Examples include the Route Server Functional Group (RSFG), the IASG (Internetwork Address Sub-Group), Coordination Functional Group (CFG), the Edge Device Functional Group (EDFG) and the ATM attached host Behavior Functional Group (AHFG).

FGA Feature Group A. Characterized by a seven-digit local telephone number access code and line side termination to the customer at the first point of switching.

FGB See Feature Group B.

FGC See Feature Group C.

FGC-EA See Feature Group C and Equal Access.

FGD See Feature Group D.

FGD-EA Feature Group D—Equal Access. See Feature Group D, also see Equal Access.

reasons—lying, cheating and stealing are good beginnings. You might spoof a computer system in order to access to a computer system and find out my credit card number. You might spoof my email to convince my wife that I was going to buy her a million dollar necklace for her birthday. (She should be so lucky.) See also Public Key Encryption.

2. Spoofing is also a means of circumventing the difficulty of carrying Internet traffic via satellite. Spoofing involves speeding packet data transmission in systems that may involve delays greater than the time-outs of the protocols involved (e.g. satellite transmission). When data are delayed or may be delayed, either the transmitter or the receiver is "fooled" into "thinking" that data are being successfully transmitted using various spoofing techniques.

spool Simultaneous Peripheral Operation On Line. A program or piece of hardware that controls a buffer of data going to some output device, including a printer or a screen. A spool allows several users to send data to a device such as a printer at the same time, even when the printer is busy. The spool controls the transmission of data to the device by using a buffer or creating a temporary file in which to store the data going to the busy device. See Spooler and Spooling.

spooler A program that controls spooling. Spooling, a term mostly associated with printers, stands for Simultaneous Peripheral Operations On Line. Spooling temporarily stores programs or program outputs on magnetic tape, RAM, or disks for output or processing.

spooling Simultaneous peripheral operations on line. Spooling means temporarily storing programs or program outputs on magnetic tape, RAM or disks for output or processing. The word "spooling" is commonly associated with printers. Here's an example: Pretend that a lot of people on your local area network all want to have their reports printed at the same time. Since only one person can use the printer at a time, users' print requests are spooled to disk on the print server. A network operating system utility called a spooler, running on the print server, handles this. The spooler keeps track of the spooled jobs in queue, releasing them one by one to the printer. When your request reaches the top of the queue, your report is printed out. Spooling is also used in another scenario. On minicomputers, mainframes, and supercomputers, newly submitted batch jobs are first spooled to disk; the operating system's long-term scheduler introduces them into main memory for processing when the time is right, i.e. whenever the system is not congested.

spot beam An antenna beam of a satellite that is aimed at a specific limited-area spot on the surface of the earth, the extent of which is considerably less than the total area of the earth in view.

spot beam antenna A satellite antenna capable of illuminating or focusing on a narrow portion of the earth's surface.

spot coverage Wireless coverage that by design is limited to a specific small area. For example, a femtocell provides spot coverage on a customer's premises for a cellular operator. A spot beam antenna provides spot coverage on the Earth's surface for a satellite operator.

spot frame Single Point Of Termination Frame. See Dedicated Inside Plant.

SPOX An operating system for digital signal processors from Spectron Microsystems, Goleta, CA, now owned by Dialogic in Parsippany, NJ. Spox is a real-time, multitasking operating system that is optimized for use with fixed and floating point digital signal processors in both single- and multiprocessor systems. The SPOX environment is implemented as a library of relocatable, C-callable modules.

SPP 1. Sequenced Packet Protocol. XNS (Xerox Network Systems) protocol governing sequenced data.

2. Signal Processing Platform.

3. Standard Parallel Port.

SPRE Special PREFIX code. Special digits dialed in order to access features of a telephone system, like a PBX or a Centrex. For example, in order to invoke the Call Pickup feature, a PBX user might pick up the handset, dial a three-digit SPRE code specific to the PBX, and answer the call.

spread spectrum Also called frequency hopping, spread spectrum is a modulation technique used in wireless systems. The data to be transmitted are packetized, and spread over a wider range of bandwidth than demanded by the content of the original information stream. Spread spectrum takes an input

signal, mixes it with FM noise and "spreads" the signal over a broad frequency range. Spread spectrum receivers recognize a spread signal, acquire and "despread" it and thus return it to its initial form (the original message). A large number of transmissions can be supported over a given range of frequencies, with each transmission comprising a packet stream and with each packet in a stream being distinguished by an ID contained within the packet header. The receiver is able to distinguish each packet stream from all others by virtue of that ID, even though multiple transmissions share the same frequencies at the same time, with the potential for the overlapping of packets. Spread spectrum is highly secure. Would-be eavesdroppers hear only unintelligible blips. Attempts to jam the signal succeed only at knocking out a few small bits of it. So effective is the concept that it is now the principal anti-jamming device in the U.S. Government's Milstar defense communications satellite system. Spread spectrum technology also is used extensively in wireless LANs and in CDMA (Code Division Multiple Access), the access technique used in many PCS (Personal Communications Systems) cellular systems.

There are two versions of spread spectrum. Direct Sequence Spread Spectrum (DSSS) spreads the signal over a wide range of the 2.4 GHz frequency band. Frequency Hopping Spread Spectrum (FHSS) involves the transmission of short bursts of information over specific frequencies, with the frequency-hopping carefully coordinated between transmitter and receiver. See also CDMA, DSSS and FHSS.

Hedy Lamarr, the actress, created the concept of spread spectrum in 1940 and, two years later, received a U.S. patent for a "secret communication system." The patent was issued to her and George Antheil, a film-score composer, to whom Ms. Lamarr had turned for help in perfecting her idea. Spread spectrum was used extensively by the Allies during the World War II in the Pacific Theater, where it solved the problem of Japanese jamming of radio-controlled torpedoes. World War II electronics were pretty primitive, and Hedy's system used a mechanical switching system, like a piano roll, to shift frequencies faster than the Nazis or the Japanese could follow them. More recently, spread-spectrum has been combined with digital technology, for spy-proof and noise-resistant battlefield communications. In 1962, Sylvania installed it on ships sent to blockade Cuba. Ms. Lamarr never received one penny for her invention. Ms. Lamarr was quite an innovator. She delighted and shocked audiences in the 1930s by dancing in the nude in the movie "Ecstasy," which, sadly, I've never seen.

spreading loss See Free Space Loss.

Sprint A wireless phone company. Sprint began as a venture of Southern Pacific Railroad, which had the clever idea of laying a telecommunications fiber optic cable along its railway line (just like Western Union often ran its telegraph polelines alongside railroad tracks). Later, Southern Pacific sold the network to GTE, at which point it became known as GTE Sprint. The company became known as US Sprint when GTE and United Telecom decided to form a (50/50) joint venture from US Telecom (United's long distance company), GTE Sprint and GTE Telnet. United Telecom bought GTE's interest—the final 19.9%—in 1992. Now it's just called Sprint Corporation. Sprint bought another wireless carrier called Nextel in 2005 and spun off its sleepy landline telecommunications business in 2006. The spun-off company was called Embarq. CenturyTel, now known as CenturyLink, acquired EMBARQ in 2009.

sprite As used in computer graphics refers to a graphic image that can move over a background and other graphic objects in a non-destructive manner.

SPS 1. Signaling Protocols and Switching.

2. Standard Positioning Service. The normal civilian positioning accuracy obtained by using the single frequency C/A code in the GPS (Global Positioning System) system.

3. Solution Provider, also called Microsoft Solution Provider. See Microsoft Solution Provider.

4. Standby Power System. A SPS is a form of uninterruptible power supply. It monitors the power line and switches to battery power as soon as it senses a problem. The switch to battery, however, can require several milliseconds, during which time the computer (or whatever else is connected to it) does not receive any power. Standby Power Systems are sometimes called Line-interactive UPSes. See also UPS.

SPT Spanning Tree
SPTS Single Precision
consists of only one
spud A special
you're going to put
spudger Shovel
to find their way in
single pair.

spur Part of a nation.
A branch. For
system that connects
to this system.

spurious A telephone
when a sound that
input speech utterance

spurious error
outside the necessary
out affecting the communication
include harmonic errors
frequency conversion

spurious rejection
operate normally in
spurious signal
spurring out

is up a telephone line
from the pole. A re-
after he or she spurts
scare. According to
is that spurring out
spurs 1. The shovels
persons (people who
of wooden telephones

2. The cowboy
have done US WEST

Sputnik Sputnik
the Russians on Oct
space race, which the

SPVC Soft Virtual

spy phone A
mobile phone, with

programmed into the
without any audio
answered. The spy
the caller to hear w-

key is touched on the
a phone call, check

with the remote call
phones are sold for

• Keeping track of

• See if you can

• Listen in sales

• Protecting your

• To reveal secret

Spy phones are

Spyglass A pop
code eventually becom-

spyware See at

SPX Sequenced Po-

mented on top of IP
more functions than
implementation of SI

SQE Signal Quality
the MAU to the NIC.

It supports (i.e. it will carry) images, mobile/portable voice, data and video communications at up to 2 Mbps for local area access or 384 Kbps for wide area access. See UMTS.

WCS Wireless Communications Service. Cellular, PCS and the like.

WCY See Weighted Call Value.

WDF Wireless Data Forum. www.wirelessdata.org.

WDM Wavelength Division Multiplexing. A means of increasing the data-carrying capacity of an optical fiber by simultaneously operating at more than one wavelength. WDM is similar to Frequency Division Multiplexing (FDM) in the analog worlds of electrical and radio transmission systems. In optical fiber communications, WDM is any technique by which two or more optical signals having different wavelengths may be simultaneously transmitted in the same direction over one strand of fiber, and then be separated by wavelength at the distant end. Each wavelength is a "virtual channel," which effectively is a separate "light pipe," that can support a given signaling rate, such as OC-48 at 2.4 Gbps or OC-192 at 10 Gbps. Although WDM technology been known since the 1980s, it was restricted to two widely separated "wideband" frequencies. (Note: frequency=speed/wavelength, where the speed of light in glass fiber is essentially constant, so wavelength and frequency are used interchangeably in describing the multiple channels of WDM). The number of distinct wavelengths supported has increased rapidly since WDM became "narrowband" capable in the early 1990s. Initial systems operated at two or four wavelengths, and the term "WDM" is usually used to refer to these low channel-count systems. Beyond WDM is WDWDM (Wide WDM), operating at four channels in applications such as 10GbE (10 Gbps Ethernet). Beyond that is DWDM (Dense WDM), which generally is described as beginning at 10 channels. (Note: The terms do not have absolute differentiating definitions and are used somewhat interchangeably.) DWDM systems in commercial applications use at least eight-channel or sixteen-channel multiplexers, and standards-based systems as dense as 32-channels have been released and implemented in live carrier networks. The capacity is steadily increasing, both by ever-expanding channel counts and faster supported TDM rates within the individual wavelengths. Generally speaking, existing systems trade-off channel count against maximum supported rate: the current maximum channel count of 32 is limited to OC-48 (almost 80 Gbps net throughput), with systems supporting higher signal rates (e.g. OC-192) supporting fewer than half as many channels. At OC-192, a 32-channel system would yield an incredible 320 Gbps, rounded up. Within the next few years it is reasonable to expect to see systems supporting on the order of 100 wavelengths of OC-192 each, yielding bandwidth of almost 1 Tbps per fiber! The advantage of WDM is that of increasing network capacity without deploying additional fiber. To install enough new actual physical fiber to provides the same bandwidth as the equivalent virtual fiber would be enormously more expensive and often a physical impossibility. WDM also compares very favorably to exclusively upgrading SONET equipment to operate at the higher OC-n layers without WDM, especially since the rate multiplier limit of TDM is hit sooner than the channel multiplier limit of WDM. The ITU-T currently has defined 32 standard wavelengths from which WDM equipment manufacturers can choose (expressed as frequencies, the table is centered at 194.10 THz, with 100 GHz spacing, providing as many as 41 center frequencies from 192.10 to 196.10 THz). ITU-T recommendation G.692 implements an additional table which reduces the spacing to 50 GHz, making 40 additional frequencies available. Further, G.692 makes it plain that the table's end-points are not absolute, and future systems are fully anticipated to include further wavelengths. It is not unreasonable to expect that as the technology continues to advance, the channel spacings may also be reduced, although not as soon as the end-points are expanded. Overall, the contemporary wavelength range typically is between 1530nm and 1560nm, with the minimum and maximum wavelengths being restricted by the wavelength-dependent gain profiles of the optical amplifiers. As is common, the standards organizations often are outpaced by technology advances. While most initial fiber optic traffic involved SONET-formatted signals, WDM and SONET are not necessarily linked. Increasingly, carriers are deploying WDM networks in support of packet traffic (e.g. IP and Ethernet) without employing the SONET digital wrapper. SONET is derided

for its overhead intensity, complexity, and cost. Note that WDM and DWDM are physical data transport terms, and not specific to SONET, or any other format standard. Long-haul amplification of WDM signals is achieved with optical ED-FAs (Erbium-Doped Fiber Amplifiers), rather than optical repeaters. The EDFAs are spaced up to 100 kilometers apart, simultaneously boosting the intensity of all the multiple light channels through a "pump laser." The EDFAs operate more effectively than do conventional optical repeaters, and are much less costly to acquire and operate. See also DWDM, EDFA, SONET, and WDWDM.

WDMA Wavelength Division Multiple Access. A technique which is used to provide access to multiple channels carried on different wavelengths on the same fiber-optic cable. Each optical input operates on a different wavelength of light. The multiple inputs are multiplexed over a common long-haul SONET fiber optic link through WDM (Wavelength Division Multiplexing) equipment. See WDM for much more detailed explanation.

WDME Wavelength Division Multiple Emulator. A WDM emulator is used to enhance testing ability and reduce testing time by simultaneously presenting an array of calibrated wavelengths across the spectral range of interest.

WDU Winchester Drive Unit.

WDT See WatchDog Timer.

weaponize A verb meaning to place weapons of destruction in a new environment. I first saw the term in a *New York Times* article relating to the weaponizing of space.

wear leveling The writing of data to the least used blocks on a hard disk, so as to ensure that all parts of the disk are used in a balanced way, thereby preventing premature disk failure due to excessive use of a portion of the disk. The operating system already keeps track of block usage on a disk drive in order to know whether a block has been allocated to a file or is unused and is available for allocation to a file. To support wear-leveling, the operating system needs to keep track of one more piece of data, namely, the number of times a block has been accessed in an I/O operation; thereupon, whenever the operating system needs to allocate one or more unused blocks of disk space to a file, all it needs to do is allocate the least-used blocks first. Wear Leveling is often used in solid state drives (SSDs). Wear leveling is the colloquial term applied to the algorithms implanted by the SSD controller to make sure that no cells are used more than others. Before a write is carried out it literally checks its own internal map of the free cells and sees which free cell(s) have the lowest number of writes and then uses them. Rinse and repeat for EVERY write and you get an idea of what it is doing. The down side to this is it needs FREE cells to work with! The more free cells it has to work with the better. A good safe minimum is to keep at least 10% free of your SSD free.

wearable technology Microcomputers in various forms and for various purposes that you and wear on our body. Such wearable tech may be Google Glass, Nike's FuelBand and even MagicBand, a wristband that stores information about consumers' identity and preferences, so that Disney characters can greet guests by name.

weather frequencies Radio frequencies used by the National Oceanic and Atmospheric Administration's (NOAA) Weather Radio. These radio frequencies are as follows: 162.400 MHz, 162.425 MHz, 162.450 MHz, 162.475 MHz, 162.500 MHz, 162.525 MHz, and 162.550 MHz. For a list of NOAA Weather Radio (NWR) stations in your state, go to www.nws.noaa.gov/nwr/nwrbro.htm.

weather trunk group A trunk group used to provide customers with weather information.

weathermaster method A distribution method where the unused wall space inside heating and cooling units beneath windows is used for satellite location. Cables are fed from a riser or other serving closet to the location through baseboards, conduit, or underfloor system.

web An abbreviation for the Internet's World Wide Web. See Berners-Lee, World Wide Web and Internet.

Web 2.0 Web 2.0 doesn't formally exist. It's the name given to so-called second generation Internet services that emphasize social networking, online collaboration, wikis, podcast, blogging, content tagging and mash-ups—sites that use information from multiple sites to present unified multimedia information.