

NEWTON's TELECOM DICTIONARY

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so much a mile and/or a minute after that. In some countries, that initial money became known as flag fall. In some countries, when you first make a phone call, they charge you a fixed amount however long the call is and then a certain amount of money based on how long you talk and how far you talk. That initial call setup charge has become known as a flag fall in some countries, including Australia.

Flag Sequence HDLC, SDLC, ADCCP, Frame Relay. The unique sequence of eight bits (01111110) employed to delimit the opening and closing of a frame.

Flagfall See Flag Fall.

Flame An outpouring of verbal abuse that network users write about other users who break the rules. A wonderful term for getting mad via electronic mail. People who frequently write flames are known as "flamers." You can flame by simply sending messages ALL IN CAPS!!!!!!! See Flame Fest, Flame War and Mail.

Flame Bait An intentionally inflammatory posting in a newsgroup or discussion group designed to elicit a strong reaction thereby creating a flame war.

Flame Fest Massive flaming. See Flame.

Flame Mail Slang term for rude electronic mail. Bill Gates, Microsoft chairman, is said to be famous for the flame mail he sends to employees who don't perform according to his likings. Mr. Gates is famous for flame mail sent by him between midnight and 2:00 AM.

Flame Resistant Insulated wire which has been chemically treated so it will not aid the spread of flames.

Flame Retardant Constructed or treated so as not be able to convey flame.

Flame War What happens when people send too much flame mail at each other. The online discussion degenerates into a series of personal attacks against the debaters, rather than discussion of their positions. A heated exchange.

Flaming To send an insulting message, usually in the form of a tirade, sent via online postings but also as personal. Flaming is the verb. Flame is the noun. And too much of flaming can cause a nasty flamewar.

Flamingo, Pink Don Featherstone, of Massachusetts, is the father of the pink flamingo plastic lawn ornament. He graduated from art school and went to work as a designer for Union Products, a Leominster, Mass. company that manufactured flat plastic lawn ornaments. He designed the pink flamingo in 1957 as a follow-up project to his plastic duck. Today, Featherstone is president and part owner of the company, which sells an average of 250,000 to 500,000 plastic pink flamingos a year. www.flamingomania.com/outdoor1.html.

Flammability Measure of a material's ability to support combustion.

Flapping Flapping occurs when a routing table entry changes too often in a relatively short time. It is sometimes caused by a link going up and down or by receipt of conflicting routing updates. See also Bouncing Circuit.

Flash Quickly depressing and releasing the plunger in or the actual handset-cradle to create a signal to a PBX or Centrex that special instructions will follow such as transferring the call to another extension.

Flash Crowds This refers to a published event (i.e. Victoria Secret's Fashion Parade) that receives an overwhelming amount of interest leading to network congestion. The term dates back to a 1973 Larry Niven science fiction story in which the development of teleportation causes thousands of people to suddenly teleport to a location where something interesting is happening.

Flash Button A button on a phone which performs the same thing as quickly pressing the switch hook on a phone. See Flash, Flash Hook, Flasphone.

Flash Cut The conversion from an old to a new phone system occurs instantly as one is removed from the circuit and the other is brought in. There are advantages and disadvantages to Flash Cuts. For one, they're likely to be much more dangerous than the opposite view, known as a Parallel Cut, in which the two phone systems run side by side for a month or so. Also known as Cutover and Hot Cut.

Flash EPROM A type of EPROM that can be electronically erased. It differs from EEPROM in that generally the entire memory must be erased at once.

Flash Hook Another name for Switch Hook. The little button on the telephone that you place your receiver into. It obviously hangs the phone up, releasing that line to receive another call. If you push the flash hook quickly, you can signal the switch at the other end (central office or PBX) to do something, such as place a call on hold and switch to the incoming one (call waiting), or transfer the call to another phone. See Flash and Flash Button above.

Flash Memory Flash memory is nonvolatile storage — i.e. storage that can retain

information without electricity — but which can be electrically erased and reprogrammed. Flash memory occupies little space and doesn't need continuous power to retain its memory. Some laptop companies, like Toshiba, are using flash memory as nonvolatile storage for the BIOS (Basic Input/Output System) and the instructions that start the computer (the bootstrap loader). See also Flash Rom and Memory Cards.

Flash RAM Flash Random Access Memory. A very fast type of RAM that can quickly be erased and rewritten, Flash RAM also retains data when powered off. Typical applications include modems and removable storage media for devices such as PDAs and laptops. See also DDR-SDRAM, DRAM, EDO RAM, FRAM, Microprocessor, RAM, RDRAM, SDRAM, SRAM, and VRAM.

Flash ROM Flash Read Only Memory. Read Only Memory that can be erased and reprogrammed, but stays on when power to your computer is turned off. Flash ROM is used in modems, for example, to hold software known as firmware. When a later software release comes out, you dial a distant computer which downloads new software into your Flash ROM, updating it. See Flash Memory.

FlashPix FlashPix is a new file format designed to optimize the electronic display, manipulation, and distribution of high-resolution images. Developed cooperatively by Eastman Kodak Company, Hewlett-Packard, Live Picture, and Microsoft Corporation, FlashPix has gained recognition as an enabling technology for companies seeking to sell and license images for reuse over the World Wide Web.

FlashROM See Flash ROM.

Flat Base Mount A system for mounting a mast on a flat roof using a ground mount plate. See Ground Mount.

Flat Color A smooth expanse of color in Web design with no blends or interruptions.

Flat File The simplest database structure. Data are arranged in a single table, with all records in identical formats (i.e., identical data field structures), and stacked together in rows and columns to form a large table similar to a spreadsheet. The term "flat file" comes from the fact that the file is two-dimensional, and that all data relevant to a given object are contained in a single file. See Relational Database.

Flat Monitor Monitors are screens for PCs. Some people call flat monitors "flat panels." Others call them "flat screens." These two similar-sounding terms are yet another way to befuddle consumers. If you're looking for a sleek, thin, bright computer monitor, you're looking for a flat-panel screen. And you should be looking for a digital one. These flat panels are liquid-crystal display (LCD) monitors like those found on laptops, and bear no resemblance to television-type monitors. Makers of traditional monitors, which are losing ground to flat panels, have started using the term "flat screen" to describe boxy monitors with flat rather than curved glass on the front. Frankly, I still prefer the glass ones.

Flat Network A term used primarily in the LAN (Local Area Network) domain to describe a network employing bridges, hubs, or OSI Layer 2 switches. As all such devices are protocol-specific, they are relatively inexpensive and are very fast. Such devices read the address of the target device, which address is contained in the packet header, and forward the packet. Some such devices also can filter packets or encapsulate them to resolve protocol differences (e.g., between Ethernet and Token Ring), although this latter function is accomplished at a relatively low level in order not to compromise speed of packet transfer. Flat networks are fairly easy to configure, but tend to be limited in terms of scalability (i.e. size they can grow to); they also can suffer from congestion caused by broadcast traffic. Flat networks are distinguished from hierarchical networks, which employ more complex router technology, operating at OSI Layer 3. See also Hierarchical Network, Bridge, Hub, and Router.

Flat Panel Display A very thin display screen used in portable computers. These screens usually use LCD (liquid crystal display) technologies, which are backlit to make them more readable even in bright light.

Flat Rate Service FR or FRS. A fast-disappearing method of pricing local phone calls in North America. The concept was that for a fixed amount of money — say \$10 a month — you received a plain old desk telephone and an unlimited number of local calls. For years, most residential and most business phones were on a flat rate service. The first thing to go was the phone instrument. You had to pay a dollar or so a month to continue renting it, or you could send it back and buy your own. Second to go was the size of the local calling area you could call. It got smaller. Third to go were the phone calls themselves. This happened first with businesses and now increasingly with residential service. Under this new "pay-per-call" you get charged a "message unit" for each local calls. A message unit is typically eight to ten cents. But psychologically, "message units" sound better than dimes. Fourth to go was the definition of local calls. What was now a "local" call got small-

F

care of by improved microfilm. Only a small part of the interior of the memex is devoted to storage, the rest to mechanism. Yet if the user inserted 5000 pages of material a day it would take him hundreds of years to fill the repository, so he can be profligate and enter material freely. Most of the memex contents are purchased on microfilm ready for insertion. Books of all sorts, pictures, current periodicals, newspapers, are thus obtained and dropped into place. Business correspondence takes the same path. And there is provision for direct entry. On the top of the memex is a transparent platen. On this are placed long-hand notes, photographs, memoranda, all sorts of things. When one is in place, the depression of a lever causes it to be photographed onto the next blank space in a section of the memex film, dry photography being employed. There is, of course, provision for consultation of the record by the usual scheme of indexing. If the user wishes to consult a certain book, he tops its code on the keyboard, and the title page of the book promptly appears before him, projected onto one of his viewing positions. Frequently-used codes are mnemonic, so that he seldom consults his code book; but when he does, a single tap of a key projects it for his use. Moreover, he has supplemental levers. On deflecting one of these levers to the right he runs through the book before him, each page in turn being projected at a speed which just allows a recognizing glance at each. If he deflects it further to the right, he steps through the book 10 pages at a time; still further at 100 pages at a time. Deflection to the left gives him the same control backwards." See also Internet.

Memo 1. A telephone feature that enables the user to store a phone number for calling in the future. For example, while speaking to a Directory Assistance operator, you can put the number she gives you into memory, and then call that number by pushing one or two buttons.

2. A call center term. A free form field used to store descriptive text or comments. The information in a memo field can be of any length and type.

Memorandum of Understanding See MOU.

Memory The part of a computer or sophisticated phone system which stores information or instructions for use. Memory comes in many variations. There is memory which is lost when the power is switched off. There is memory which is retained when power is turned off.

Memory Administration MA. A set of functions that provide network system database updates, network system database integrity, network system database security and network system database backup and restoration. Definition from Bellcore (now Telcordia) in reference to its concept of the Advanced Intelligent Network.

Memory Board An add-on board designed to increase a computer's RAM.

Memory Caching A technology for increasing hardware performance by storing frequently used sequences of instructions in a memory cache separate from the computer's main memory where they can be more quickly accessed by the CPU.

Memory Call Service A family of central office based voice messaging services from BellSouth.

Memory Cards The memory card is a bunch of memory chips crammed into a small plastic cartridge about the size of a credit card and about three times the thickness. It is used in several palmtop computers. As this dictionary was being written, we were awaiting the release of a 16 megabyte memory card. In contrast to flash memory, a memory card requires small batteries, typically the same ones as used in watches. See Smart Card.

Memory Effect The gradual shorting of a battery's useful life, caused by recharging before the battery is completely discharged. This is a real problem with nickel cadmium batteries, less of a problem with Nickel Hydride and even less of a problem with Lithium ion batteries.

Memory Interface A PCMCIA definition. The memory interface is the default interface after power up, PCMCIA Hard Reset and PCMCIA Soft Reset for both PCMCIA cards and sockets. This interface supports memory operations as defined in PCMCIA Release 1.0 and later and is used by both Memory Cards and I/O Cards.

Memory Leak In order to run, a computer program requests chunks of memory from the operating system for itself and for the data it needs. As the program runs, it may make additional requests for memory. If the program is well-written and, therefore, well-behaved, that memory will be explicitly released when the program is closed. A badly written program or a badly written operating system may not release that memory, leaving it in an unusable condition. This may be especially true if the program crashes (i.e., ends unexpectedly), which is common in poorly-written software. This phenomenon is known as a "memory leak," and it's not a good thing. The longer the software runs on your computer, the more and more of your computer memory it uses, and places in an unusable state. Eventually it uses up so much of your RAM memory, it starts using space on your

hard drive. Soon, it runs out of hard disk space. Eventually your whole machine freezes. You are forced to reboot, losing all unsaved data in the process. There are two solutions: The first and most obvious is to reboot your computer, i.e. turn it off, wait ten seconds, then turn it on again. Some operating systems handle memory leak much better than others. Windows 2000 and Windows XP handle it much better than Windows 95 and 98. There is another solution. See Garbage Collection.

Memory Map An indication of what type of data is stored where in a computer's RAM memory.

Memory Moments See Senior Moment.

Memory Protection The structuring of memory resources in Novell's NetWare 4.0 that guards the NetWare server memory from corruption by NLMs. Memory protection allows you to run NLMs in a separate memory domain called the OS PROTECTED domain. Once you determine the NLM to be safe, you can load it into the OS domain, where it can run most efficiently.

Memory Reserve Power The operating voltage, generally provided by a battery, which supplies power to the memory modules when your commercial power fails. You should check your memory reserve power before it's too late. You should test it even when you don't need it.

Memory Technology Driver A PCMCIA card definition. A memory technology driver is a memory device specific software that interfaces to Card Services to mask the details of accessing different memory technologies.

MEMS See MicroElectroMechanical System.

MEN See Metro Ethernet Network.

Menu Options displayed on a computer terminal screen or spoken by a voice processing system. The user can choose what he wants done by simply choosing a menu option — either typing it on the computer keyboard, hitting a touchtone on his phone or speaking a word or two. There are basically two ways of organizing computer or voice processing software — menu-driven and non-menu driven. Menu-driven programs are easier to use but they can only present as many options as can be reasonably crammed on a screen or spoken in a few seconds. Non-menu driven screens allow more alternatives but are much more complex and frightening. It's the difference between receiving a bland "A" or "C" prompt on the screen — as in MS-DOS and receiving a menu of "Press A if you want Word Processing," "Press B if you want Spread Sheet," etc. It's very easy to write menus in MS-DOS using BATch files. See also Audio Menus and Prompts.

Menu Bar call center term. The part of the menu system visible as a single row across the top of the display.

MEO Middle (or Medium) Earth Orbiting satellite. MEOs operate much like LEOs (Low Earth Orbiting satellites systems), although in slightly higher orbits. MEOs generally operate at an altitude of around 10,000 kilometers. Continuous global communications services can be achieved with six to 12 satellites. MEOs are capable of supporting both voice and data services. Contrast with GEO, Geosynchronous and LEO. See also Medium Earth Orbit.

MEP Multiplex Equipment Provisioning.

Merced Merced is a 64-bit multichip module jointly developed by Intel with Hewlett-Packard Co. It extends the Intel architecture in both raw speed (one version will reach 600-MHz) and overall performance. Merced will be followed by the two-chip processor called Flagstaff in the year 2000. Flagstaff chips will be the first built using a process that creates much smaller 0.18-micron-wide circuits, which will enable Intel to build smaller and faster chips in greater volume. There will be two versions of Flagstaff, with a choice of 4 Mbytes or 8 Mbytes of secondary cache, according to writer, Tom Davey.

Merchant Silicon Merchant Silicon is a special microprocessor chip, which is a non-ASIC, commercially available semiconductor chip.

Mercury-Wetted Relay A relay or switch in which the movable contact of the device makes contact with a pool of mercury. Before solid-state devices, this was common technology for switching dry circuits. See also Dry Contact.

Merging Traffic The telecommunications, cable, consumer electronic and media conglomerates all vying for access to the same markets. See Siliwood.

Meridian A Northern Telecom (now called Nortel) name for a family of PBXs.

Meridian Link Meridian Link from Northern Telecom enables Meridian 1 Communication Systems (i.e. PBXs and ACDs) to exchange information with host computers and the application software that resides on those computers. This means that the application software can use information such as Automatic Number Identification (ANI) and Dialed Number Identification System (DNIS) to automatically perform a series of routines, such as record look-up.

RDBMS Relational DataBase Management System. A system that manages databases on a relational basis. The individual databases are in the form of flat files, which are two-dimensional files comprising rows and columns in the logical form of a table, or spreadsheet. Each data record in such a flat file contains all of the information about that entity, or object. For example, your listing in the telephone directory is a row comprising columns for name, address, and telephone number. The same goes for all other entities, including other people and various other legal entities, such as companies, government agencies, and not-for-profit organizations. An RDBMS is able to develop and maintain relationships between entities, such as individuals and organizations with common interests (e.g., lost names, addresses, telephone number prefixes, or even other attributes such as hobbies or work-related interests). Further, a RDBMS is able to automatically update the interrelationships between the entities, as entities are added or deleted, or as attributes change over time.

RDBS Routing Data Base System (an old database from which LERG was once created).

RDC Redirect Confirm packet. Used in Cellular Digital Packet Data (CDPD) mobility packet.

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

RDF 1. Radio Direction Finding.

2. An ATM term. Rate Decrease Factor: An ABR service parameter, RDF controls the decrease in the cell transmission rate. RDF is a power of 2 from $1/32,768$ to 1.

RDI Remote Defect Indication. An indication that a failure has occurred at the far end of an ATM network. Unlike FERF (Far-End Remote Failure), the RDI alarm indication does not identify the specific circuit in a failure condition. See FERF.

RDP See Rate Demarcation Point.

RDQ Redirect Query Packet. Used in Cellular Digital Packet Data (CDPD) mobility management.

RDR Redirect request packet. Used in Cellular Digital Packet Data (CDPD) mobility management.

RDRAM Rambus Dynamic Random Access Memory. Developed jointly by Intel and Rambus Inc., is a high-speed memory chip that runs on a 400 MHz data bus. As RDRAM supports data transfer twice per CPU (Centralized Processing Unit) clock cycle, the effective speed is 800 MHz. The RDRAM architecture also supports a 2-byte wide (i.e., 16 bits) data channel, bringing its effective data transfer rate to 1.6 GBps (GigaBytes per second). While faster than its nearest competitor, DDR-SDRAM (Double Data Rate-Synchronous DRAM), it also is more expensive. See also DDR-SDRAM, DRAM, EDO RAM, Flash RAM, FRAM, Microprocessor, RAM, SDRAM, SRAM, and VRAM.

RDS Radio Data System. A way of sending data along with a standard FM radio broadcast.

RDSI The Spanish term for ISDN.

RDT 1. Recall Dial Tone.

2. Remote Digital Terminal.

RDY Ready.

RE-422 A high-speed electrical interface defined by the ITU-T, supporting data rates of up to 768 Kbps over up to 300 feet of cable.

Re-Engineering A term probably invented by Michael Hammer in the July-August, 1990 issue of Harvard Business Review. In that issue, he wrote "It is time to stop paving the cowpaths. Instead of embedding outdated processes in silicon and software, we should obliterate them and start over. We should 're-engineer' our business: use the power of modern information technology to radically redesign our business processes in order to achieve dramatic improvements in their performance." The term re-engineering now seems to me mean taking tasks presently running on mainframes and making them run on file servers running on LANs — Local Area Networks. The idea is to save money on hardware and make the information more freely available to more people. More intelligent companies also redesign their organization to use the now, more-freely available information. Also called VALUE DRIVEN RE-ENGINEERING.

Re-Initiation Time The time required for a device or system to restart (usually after a power outage).

Re-Installed Customer An MCI term. An MCI customer who is installed again with the same customer account number after having been previously canceled either at their, MCI's, or a third party's request.

REA Rural Electrification Administration. A federal agency within the Department of Agriculture, the REA was established in 1935 to bring electricity and, later, telephone service to rural America. The REA was one of the most successful federal government programs ever. Telephone companies loved the REA, as it offered loans to telcos at a very low rate of interest (2% or less, in many cases). Once the facilities were in place, the telcos nevertheless would have suffered huge losses, as the rates for basic telephone service would not have yielded a satisfactory rate of return on investment. However, the Universal Service Fund provided very substantial additional revenues to further subsidize service in such high-cost areas through the settlements process, which established the cross-subsidy mechanism between the LECs and the IXC's. In fact, a number of independent telephone companies, such as CONTEL, thrived specifically and only because of the combination of REA money and the settlements process. REA money largely dried up some years ago, at least for this purpose, as the definition of "high-cost" changed considerably and as the restrictions on access to and use of such funding become onerous. The REA now is known as the Rural Utilities Service (RUS). See also RUS.

Reach Reach, according to the FCC, refers to the availability of a service in the community. It is the number of homes to which the service is available regardless of whether or not residents choose to subscribe.

Reach Through Reach through is a means of extending the data accessible to the end user beyond that which is stored in the OLAP server. A reach through is performed when the OLAP server recognizes that it needs additional data and automatically queries and retrieves the data from a data warehouse or OLTP system.

Reactance The opposition offered to the flow of an alternating current which is due to the presence of inductance or capacitance or both, in the circuit. Reactance is measured in Ohms. The symbol designation is X.

Read To glean information from a storage device, like a floppy disk. The opposite of READ is WRITE. That's when you put information onto that storage device. Some storage devices can only be READ, but not written to. On a floppy disk that's called being "WRITE PROTECTED." See also WORM, which stands for Write Once, Read Many.

Read After Write Verification A means of assuring that data written to the hard disk matches the original data still in memory. If the data from the disk matches the data in memory, the data in memory is released. If the data doesn't match, the block location is recognized as "bad," and something happens. The data is transferred again. Or in Novell's NetWare, Hot Fix redirects the data to a good block location within the Hot Fix Redirection Area.

Read Before Write A feature of some videotape recorders that plays back the video or audio signal off of tape before it reaches the record heads, sends the signal to an external device for modification, and then applies the modified signal to the record heads so that it can be re-recorded onto the tape in its original position.

Read Only File A PC computer term. A read only file is a file that you can read but cannot make changes to. The read-only attribute specifies whether a file is read-only. To remove the read-only attribute, you would type the following command

ATTRIB -R FILENAME

Read Only Memory ROM.

1. A computer storage medium which allows the user to recall and use information (read) but not record or amend it (write).

2. The smaller part of a computer's memory, in which essential operating information is recorded in a form which can be recalled and used (read) but not amended or recorded (written).

ROM is memory which is programmed at the factory and whose contents thereafter cannot be altered, even by a power breakdown, or being written to, or anything else. ROM memory is also random-access, which means accessing its information is very fast. See also Microprocessor and RAM.

Read Write Cycle Time of reading and writing data onto a memory device. See Read.

Readable Frames The number of video frames received without error.

Readable Octets The number of octets (bytes) received without error.

Readdressing A cellular radio term. The process whereby the serving Mobile Data Intermediate System (MD-IS) receives the encapsulated packets, de-encapsulates them, then locates the Mobile End System (M-ES) to determine the cell and channel stream associated with the M-ES. The function is also performed by the Foreign Agent in Mobile IP. This definition comes from the book "Internetwork Mobility," by Mark Taylor, William Woung and Mohsen Bonon.

Roll About

Roll About A totally self-contained videoconferencing system consisting of the codec, video monitor, audio system, network interfaces and other components. These roll about systems can, in theory, be moved from room-to-room but in fact are not because they are electronic equipment that does not benefit from jostling. It's also heavy.

Roll Call Polling A technique in which every station is interrogated sequentially by a central computer system.

Roll Call A teleconferencing term. In a Dial-Out (operator-initiated) teleconference, the operator will announce each of the participants as he adds them to the conference bridge.

Roll Off Frequency Corner frequency beyond which the attenuation increases rapidly.

Rollover A Web design page term. Imagine you're on a web site and you move your cursor over a piece of art, or even a blank spot. Suddenly, that piece of art changes and reveals an explanation or new menu, or some words or a new piece of art. A rollover is a piece of software which changes the appearance of objects when you roll over them. A rollover is also called a mouseover. See also Busy Out and Rollover Lines.

Rollover Lines You receive many incoming calls. You don't want to miss a call, so you ask your phone company to set your phone lines up to roll over, also called hunt, also called ISG (Incoming Service Group) in telephonese. You order five lines in hunt. The calls come into the first. If the first one is busy, the second rings. If it's busy, the third rings. If they're all busy, then the caller receives a busy. The commonest types of hunting are sequential and circular hunting. Sequential hunting starts at the number dialed, keeps trying one number after another in number order and ends at the last number in the group. It's typically ascending. For example, it starts at 691-8215, goes to 691-8216, then 691-8217, etc. But it can also be ascending — from 691-8217 up. Circular hunting hunts all the lines in the hunting group, regardless of the starting point. Circular hunting, according to our understanding, circles only once (though your phone company may be able to program it circle a couple of times). The differences between sequential and circular are subtle. Circular seems to work better for large groups of numbers. You don't need consecutive phone numbers to do rollovers. Nowadays you can roll lines forwards, backwards and jump around, for example most idle, least idle. Rollovers are now done in software. This also has its downside, since software fails. For example, theoretically if a rollover strikes a dead trunk, it should bounce to the next live trunk. But sometimes it hangs on the dead trunk and many of your incoming calls never get answered. They might ring and ring. They might hit a busy. My recommendation: Test your rollovers at least twice a day. In particular, test that your callers ultimately get a busy if all your lines are busy. Nothing worse your customer should receive a ring-no-answer or a constant busy when calling your company. See also Terminal Number.

ROLM A telephone equipment manufacturer based in Santa Clara, CA, at least once upon a time. ROLM was started in 1969 by four engineers to produce computers for the military. The company introduced one of the first digital PBXs in 1975. It was a great PBX. Later, they developed a line of KTSs (Key Telephone Systems) and hybrid PBX/KTS systems. They were not so good. IBM acquired ROLM in 1984 as part of their plan to integrate the worlds of computers and communications. It didn't work...at all. And IBM lost a lot of money with Rolm. In 1989, IBM sold ROLM to Siemens, at which time it became ROLM Company. In 1994, the name was changed to Siemens Rolm Communication Inc. In 1996, the name was changed to Siemens Business Communication Systems, Inc. Siemens really doesn't use the name ROLM (or Rolm) anymore, but there are a lot of ROLM systems still in service.

Rolodex A Trademarked product which started life as paper card based device to keep names and address on. Now it has become more of a generic name to connote software to let you look up peoples' phone numbers and addresses. Software to do this is also called PIM — for Personal Information Manager.

ROM Read Only Memory. Computer memory which can only be read from. New data cannot be entered and the existing data is non-volatile. This means it stays there even when power is turned off. A ROM is a memory device which is programmed at the factory and whose contents thereafter cannot be altered. In contrast is the device called RAM, whose contents can be altered. See Read Only Memory and Microprocessor.

ROM Font The ROM Font is your PC's type font. It consists of a set of 256 characters which cannot be edited — unless you are running in video mode, in which case you can design your own type font.

Rom Shadowing 386 and higher CPUs provide memory access on 32 & 64 bit paths. Often they will use a 16 bit data path for system ROM BIOS info. Also some adapter cards (ie. older video, network adapters etc.) with on board BIOS may use an 8 bit path

to system memory. For high end computers this is a bottleneck. Like having YIELD signs out on the lanes within a freeway. ROM is very slow, 150ns-200ns. Modern RAM is 60ns or less. Therefore when the system is waiting on this data it generates wait states. For high end computers these wait states slow the entire system down. There is a system developed to transfer the contents of all the slow 8-16 bit ROM chips through out the system into 32 bit faster main memory. "This is ROM SHADOWING". This is accomplished using the MMU, the memory management unit. The MMU takes a copy of the ROM BIOS codes and places it into RAM. To the rest of the system this RAM location looks exactly like the original ROM location. This definition courtesy Charlie Irby, chosirby@foothill.net.

Romanji Romanji is a system of writing Japanese using the Latin alphabet.

Roofing Filter A low-pass filter used to reduce unwanted higher frequencies.

Room Cut-Off Hotel/motel guest telephones restricted from outgoing calls when the guest room is unoccupied.

Room Status And Selection Provides the capability to store and display the occupancy and cleaning status and the type number of each guest room. This helps house-keeping management, maid locating and room selection. Also, communications between the front desk and the housekeeper are speeded up via real-time maid activity and check-out audit printouts to indicate which rooms need cleaning next. The occupancy status is normally changed by the maid or inspector dialing from the room telephone.

Root The base of a tree. The base of a hard disk. See Root Directory.

Root Account Privileged account on UNIX systems used exclusively by network or system administrators.

Root Bridge Exchanges topology information with designated bridges in a spanning-tree implementation to notify all other bridges in the network when topology changes are required. This prevents loops and provides a measure of defense against link failure.

Root CA Ultimate Certificate Authority (CA), which signs the certificates of the subordinate CAs. The root CA has a self-signed certificate that contains its own public key.

Root Certificate Certificate for which the subject is a root. Hierarchical PKI usage: The self-signed public-key certificate at the top of a certification hierarchy.

Root Directory The top-level directory of a PC disk, hard or floppy. The root directory is created when you format the disk. From the root directory, you can create files and other directories.

Root Key Public key for which the matching private key is held by a root.

Root Web The FrontPage web that is provided by the server by default. To access the root web, you supply the URL of the server without specifying a page name. FrontPage is installed with a default root web named <rootweb>. All FrontPage webs are contained by the root FrontPage web.

ROSE Remote Operations Service Element. An application layer protocol that provides the capability to perform remote operations at a remote process. Definition from Bellcore (now Telcordia) in reference to its concept of the Advanced Intelligent Network.

RosettaNet A consortium of information technology, electronic components and semiconductor manufacturing companies working to create and implement open e-business process standards.

Rostered Staff Factor RSF. A call center term. Alternatively called on Overlay, Shrink Factor or Shrinkage. RSF is a numerical factor that leads to the minimum staff needed on schedule over and above base staff required to achieve your service level and response time objectives. It is calculated after base staffing is determined and before schedules are organized, and accounts for things like breaks, absenteeism and ongoing training.

Rostering A call center term. The practice of rotating employees through all existing schedules in a matrix, or roster, of schedules. This "share the grief" method is prevalent in Europe and Australia, where agents work through an entire roster.

ROT13 A way to encode things that the general Internet community can't read. Each letter in a message is replaced by the letter 13 spaces away from it in the alphabet. There are online decoders to read these. For instance, Harry Newton becomes Uneel Arigbo, which sounds a lot more exotic.

ROTA A call center term. 1. An European term for a rotating shift pattern or rotating schedule, 2. Short form for roster.

Rotary Dial The circular telephone dial. As it returns to its normal position (after being turned) it opens and closes the electrical loop sent by the central office. Rotary dial telephones momentarily break the DC circuit (stop current flow) to represent the digits dialed. The circuit is broken three times for the digit 3. The CO counts these evenly-spaced breaks and determines which digit has been dialed. You can hear the "clicks". The number "seven," for example consists of seven "opens and closes," or seven clicks. You can

matically alters system behavior, as capillary action changes the way in which fluids pass through microscale-diameter tubes, as compared with macroscale channels.

Microform Microform means Microfiche and Microfilm.

Micrographics Conversion of information into or from microfilm or microfiche.

Micron One thousandth of a millimeter. Or one millionth of a meter. A unit of measurement corresponding to 1/25,000 of an inch or 40 millionths of an inch.. A micron can be used to specify the core diameter of fiber-optic network cabling. This diameter should match your hardware vendor's requirements; but if you install fiber before you buy the equipment, specify the 62.5-micron size.

Micropayment An on-line payment of a dime or less. Touted as the key catalyst for Internet commerce, micropayments were conceived as a means of generating revenues which would be significant for vendors, in the aggregate, while being so trivial to the individual users that they would not hesitate make micropayments freely. While still rhetorical, micropayments were to apply to such services as custom newsfeeds, processing applets and data queries.

Microphone A transducer that changes the air pressure of sound waves into an electrical signal that can be recorded, amplified and/or transmitted to another location.

Microprocessor An electronic circuit, usually on a single chip, which performs arithmetic, logic and control operations, with the assistance of internal memory. The microprocessor is the fabled "computer on a chip," the "brains" behind all desktop personal computers. Typically, the microprocessor contains read only memory — ROM — (permanently stored instructions), read and write memory — RAM, and a control decoder for breaking down the instructions stored in ROM into detailed steps for action by the arithmetic logic unit — ALU — which actually carries out the numerical calculations. There's also a clock circuitry which connects the chip to an exterior quartz crystal whose vibrations coordinate the chip's operations, keeping everything in step. And finally, the input/output section directs communications with devices on the outside of the chip, such as the keyboard, the screen and the various disk drives.

The Fortune Magazine issue of May 6, 1991 contained a very good explanation of chips and microprocessors (usually used interchangeably). Here is the article, slightly condensed:

Chips today can store and retrieve data, perform a simple mathematical calculation, or compare two numbers or words in a few billionths of a second. And they can carry out tens of thousands of such tasks in the blink of an eye. Today's chips contain millions of transistors, capacitors, diodes, and other electronic components, all connected by metallic threads a fraction of the diameter of a human hair. A single chip the size of a fingernail can store dozens of pages of text or combine circuits that can perform scores of tasks simultaneously.

Most chips fall into one of two categories - memory chips and logic chips. Memory chips have the easier job: They merely store information that will be manipulated by the logic chips, the ones with the smarts. Today's biggest-selling memory chip (mid-1991) is the one-megabit dynamic random access memory, or DRAM. Each DRAM is a slice of silicon embedded with a lattice of 1,000 vertical and 1,000 horizontal aluminum wires that circumscribe one million data cells. The densest DRAM designed so far has 64 million cells.

Think of those wires as streets and those cells as blocks. Each block contains a transistor that can be turned on or off — to signify 1 or 0 — and that can be identified by its unique "address" in the wire grid, much like a house in a suburban subdivision. Each digit, letter, or punctuation mark is represented by 1's or 0's stored in eight-cell strings. (See ASCII.) The word "chip" takes up 32 cells in a memory chip. Most PCs sold today have at least eight one-megabit DRAMs.

It's the job of the logic chips to turn those transistors in the DRAMs on or off, and to retrieve and manipulate that information once it's stored. The most important and complex logic chips are microprocessors like Intel's 80386DX, the brains of the more powerful IBM-compatible PCs sold today. If the structure of a memory chip is a suburban subdivision, the layout of a microprocessor is more like an entire metropolitan area, with distinct neighborhoods devoted to different activities. A typical microprocessor contains among other things:

- A timing system that synchronizes the flow of information to and from memory and throughout the rest of the chip.
- An address directory that keeps track of where data and program instructions are stored in the DRAMs.
- An arithmetic logic unit with all the circuits needed to crunch numbers.
- On-board instructions that control the sequence of microprocessor operations.

Other logic chips in a computer take their cues from the microprocessor millions of times

each second to draw images on the screen, to feed instructions from a spreadsheet program, say, out of the disk drives into DRAMs, or to dispatch data to a modem or a printer. Perhaps most amazing of all, memory and logic chips can accomplish all this with just a trickle of electricity - far less than it takes to light a flashlight bulb.

Ted Hoff at Intel invented the microprocessor in 1971. See also 1971 in the beginning of this dictionary.

Microprocessor Controls A control system that uses computer logic to operate and monitor an air conditioning system. Microprocessor controls are commonly used on modern precision air conditioning systems to maintain precise control of temperature and humidity and to monitor the unit's operation.

Microsatellites Unlike traditional satellites, which can weigh tons, microsatellites are the size of a suitcase and weigh about 220 lbs. Since it costs "a bar of gold to launch a can of Coke," according to the New York Times, lightweight microsatellites will be much cheaper to launch than their obese precursors. The U.S. military's goal is to send microsatellites into space in flocks. In this cluster, they would be reprogrammable, able to switch to new tasks when the Pentagon required it.

Microsecond One millionth of a second. A microsecond is ten to the minus six. One microsecond — a millionth of a second — is the duration of the light from a camera's electronic flash. Light that short freezes motion, making a pitched ball or a bullet appear stationary. See Atto, Nanosecond, Femto and Pico.

Microsegmenting The process of configuring Ethernet and other LANs with a single workstation per segment. The objective is to remove contention from Ethernet segments. With each segment having access to a full 10 Mbps of Ethernet bandwidth, users can do things involving significant bandwidth, such as imaging, video and multimedia.

Microsegmentation Division of a network into smaller segments, usually with the intention of increasing aggregate bandwidth to devices.

Microslot The time between two consecutive busy/idle flags (60 bits, or 3.125 milliseconds at 19.2 kbps). It is used in CDPD only. A cellular radio term.

Microsoft Founded in 1975 by Bill Gates and Paul Allen as Micro-soft (now called Microsoft) it is (or was at the time of writing this edition of this dictionary) one of the largest software companies in the world. See the next few definitions.

Microsoft At Work A new architecture announced by Microsoft on June 9, 1993 and then put into retirement a couple of years later. Many of its features and ideas surfaced in Windows 95. It consisted of a set of software building blocks that will sit in both office machines and PC products, including:

- Desktop and network-connected printers.
- Digital monochrome and color copiers.
- Telephones and voice messaging systems.
- Fax machines and PC fax products.
- Handheld systems.
- Hybrid combinations of the above.

According to Microsoft, the Microsoft At Work architecture focuses on creating digital connections between machines (i.e. the ones above) to allow information to flow freely throughout the workplace. The Microsoft At Work software architecture consists of several technology components that serve as building blocks to enable these connections. Only one of the components, desktop software, will reside on PCs. The rest will be incorporated into other types of office devices (the ones above), making these products easier to use, compatible with one another and compatible with Microsoft Windows-based PCs. The components, according to Microsoft, are:

- Microsoft At Work operating system. A real-time, preemptive, multi tasking operating system that is designed to specifically address the requirements of the office automation and communication industries. The new operating system supports Windows compatible application programming interfaces (APIs) where appropriate for the device.
- Microsoft At Work communications. Will provide the connectivity between Microsoft At Work-based devices and PCs. It will support the secure transmission of original digital documents, and it is compatible with the Windows Messaging API and the Windows Telephony API of the Windows Open Services Architecture (WOSA).
- Microsoft At Work rendering. Will make the transmission of digital documents, with formatting and fonts intact, very fast and, consequently, cost-effective; will ensure that a document sent to any of these devices will produce high-quality output, referred to as "What You Print Is What You Fax Is What You Copy Is What You See."
- Microsoft At Work graphical user interface. Will make all devices very easy to use

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Radio Communication Any telecommunication by means of radio waves.

Radio Frequency That group of electromagnetic energy whose wavelengths are between the audio and the light range. Electromagnetic waves transmitted usually are between 500 KHz and 300 GHz.

Radio Frequency Flooding Radio frequency flooding turns a telephone into a room listening device by transmitting a high power radio signal down a telephone line. The high power radio frequency is able to bypass the open hookswitch in the mouthpiece circuit. Room sounds cause the carbon microphone to modulate the RF signal. Radio frequency flooding is hard to implement but can only be detected by security professionals with the right equipment.

Radio Frequency Identity See RFID.

Radio Frequency Interface shield RFI. A metal shield enclosing the printed circuit boards of the printer or computer to prevent interference with radio and TV reception.

Radio Frequency Interference The disruption of radio signal reception caused by any source which generates radio waves at the same frequency and along the same path as the desired wave.

Radio Frequency Interference Shield RFI Shield. A metal shield enclosing the printed circuit boards of the printer or computer to prevent radio and TV interference.

Radio Paging Access Provides attendant and phone user dial access to customer-owned radio paging equipment to selectively tone-alert, or voice-page individuals carrying pocket radio receivers. The paged party can answer by dialing an answering code from a phone within the PBX.

Radio Paging Access With Answer Back Allows access to customer-provided paging systems and provides the capability in the PBX to connect the paged party when the former answers the radio page by dialing a special code from any PBX.

Radio Resource Management A management entity or subentity concerned with the operation of the radio resources management protocol. A cellular radio term.

Radio Resource Management Entity A management entity or subentity concerned with the operation of the radio resource management protocol. A cellular radio term.

Radio Wave Electromagnetic waves of frequencies between 10 KHz and 3MHz, propagated without guide in free space (air).

Radiocommunications Consultative Council See RCC.

Radiogram A telegram sent by radio. Totally obsolete term, but cute.

Radiometer An instrument, distinct from a photometer, to measure power, in Watts, of electromagnetic radiation.

Radiophone Apparatus for transmitting and/or receiving speech or music by radio. Totally obsolete term, but cute.

Radiosonde An automatic radio transmitter in the meteorological aids service usually carried on an aircraft, free balloon, kite, or parachute, and which transmits meteorological data.

Radiotelegraphy The use of a radio (instead of wire) to communicate telegraphy messages over a distance. An old term, not used much any more. See also Radiotelephony.

Radiotelephony The science, art, and act of transmitting speech by means of radio. Now called telecommunications.

RADIUS Remote Authentication Dial-In User Service is an authentication and accounting system used by many Internet Service Providers (ISPs) and end user organizations to provide secure Internet access, especially in a VPN (Virtual Private Networks) application. When you dial in to the ISP, for example, you must enter your username and password. This information is passed to a RADIUS server, which checks that the information is correct, and then authorizes access to the ISP systems and network. Though not an official standard, the RADIUS specification is maintained by a working group of the IETF. RADIUS is a client/server-based authentication software system that centralizes the administration of user profiles maintained in authentication databases, thereby simplifying the process of supporting multiple VPN switches. The remote access servers act as RADIUS clients which connect to the centralized authentication server. RADIUS is an open specification that can be adapted to work with legacy systems and protocols. RADIUS was developed by Steve Willins of Livingston Enterprises, Inc., which was acquired by Lucent Technologies. See also Authentication, Client/Server, and VPN.

Radome A plastic cover for a microwave antenna. It protects the antenna from awful weather, but has little effect on the radiation pattern of the antenna. Here's a more tech-

nical explanation: A radome is a dielectric cover placed over an antenna to protect it from the environment. For example, the nose of an aircraft which contains the airplane's weather radar antenna. There are hundreds of other radome applications encompassing telecommunications, wireless, radars, satcom, terrestrial communications, ECM equipment and other commercial and military sensors.

RADSL Rate Adaptive Digital Subscriber Line. Transmission technology that supports both asymmetric and symmetric applications on a single twisted pair telephone line and allows adaptive data rates. RADSL employs intelligent ADSL modems which can sense the performance of the copper loop and adjust transmission speed accordingly. These devices adjust dynamically as the performance of the loop varies during a session, much as does a V.34 modem. Depending on various characteristics of the subject cable plant, ADSL accommodates downstream transmission speeds of as much as seven megabits per second, plus bidirectional transmission speeds of as high as 640 Kbps over a single UTP (Unshielded Twisted Pair). Some RADSL equipment can be manually configured. See ADSL.

RAI RAID Redundant Array of Inexpensive Disks. The idea is simple: Put several disk drives into a single housing. Then write your data over the disk drives in such a way that if you lose one or more of the drives, you won't have lost any of your data. Thus the term "redundant." At its simplest, RAID mirrors data to an equal number of disk drives, e.g. two sets of two. At its most complex, RAID writes data across a bunch of drives, so that if one goes the data can be retrieved from the remaining drives. The opposite of RAID is SLED (Single Large Expensive Disk). See also Redundant Array of Inexpensive Disks for a much more detailed explanation.

Railway Revolution The railway revolution took place from about 1825 to 1875 in Britain. It saw a great connecting of commerce and the coming of steam power. See also the Steel and Electricity Revolution.

Rain Attenuation Also known as "rain fade." Signal losses due to absorption are common when radio signals encounter a heavily moisture laden atmosphere. Generally, the higher the radio frequency, the more attenuation (i.e., the greater the signal loss). Since microwave signals for satellite and for landline are essentially line-of-sight, microwave radio is very susceptible to signal attenuation in heavy rain. Modern microwave paths are engineered with weather patterns in mind. In areas where heavy rainfalls occur, microwave links may be closer together or more attention is paid to diverse and duplicated routing.

Rain Barrel Effect Signal distortion of a voice telephone line caused by the under-attenuated echoes on the return path.

Rain Fade See Rain Attenuation.

Rain Outage Loss of signal at Ku or Ka Band frequencies due to absorption and increased sky-noise temperature caused by heavy rainfall.

Rainbow Series According to the National Security Agency (NSA), the Rainbow Series is a six-foot tall stack of books dealing with the evaluation of "Trusted Computer Systems." The term comes from the fact that each book is a different color. Colors include orange, aqua, burgundy, lavender, venice blue, pink, peach, turquoise, and violet.

Raincheck When a sports event is rained out, they give you a "raincheck," voucher for a seat when the event will be played. It's used also in personal relations. "Thanks for your invitation. I can't come to dinner tonight. Can I take a raincheck?" Which means, "Can I come at another time?"

Raised Floor A floor distribution method in which square, steel and wood-laminated plates resting on aluminum locking pedestals are attached to the building floor. The plates are usually covered with cork, carpet, or vinyl tiles, and each plate can be removed for easy access to the cables below. Also referred to as access floor.

Rake Receiver A wireless receiver which can support a number of times, or fingers, which can be combined to form a stronger received signal. Each time is an individual radio channel.

RAM 1. Random Access Memory. The primary memory in a computer, RAM keeps the CPU (Centralized Processing Unit) efficiently fed with data or programs from the hard drive, or other storage medium. RAM can be overwritten with new information. The "random access" part of its name comes from the fact that the next "bit" of information in RAM can be located — no matter where it is — in an equal amount of time. This means that access to and from RAM memory is extraordinarily fast. By contrast, other storage media (e.g., hard drive, magnetic tape, and CD-ROM) store information serially, one bit after another. Therefore, the computer has to search for them, with the search time depending on the distance between the current bit and the target bit. Floppy disks are faster than magnetic tape because their information is readily at hand, though the read/write head will have to search for it. Hard disks are even faster because there are multiple heads and

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because the disks spin faster and everything moves faster. The speed of a CD-ROM search depends on the speed of the CD-ROM drive, but it can be pretty slow. RAM memory is the fastest of all. The problem with RAM memory is that it's volatile. This means when power is turned off (or power glitches occur) RAM memory is erased. RAM memory can be protected with rechargeable batteries — just remember to charge the batteries.

All of that having been said, RAM comes in two types, at least along one dimension: buffered and unbuffered. Buffered RAM contains buffer chips that serve intermediaries between the control chips and the memory chips. The buffers help deal with the relatively large electrical load involved when a computer has a lot of memory. For example, a large server may have 16 DIMM (Dual Inline Memory Module) modules, each with as many as 36 RAM chips, yielding a total of 576 RAM chips. Since the controller cannot directly power so many chips, a buffer associated with each DIMM module assumes that responsibility. Unbuffered RAM typically is used on desktops, laptops, and smaller servers. Now for registered and unregistered RAM. Registered RAM includes a small register, or memory element, that imposes a slight delay, typically one clock cycle on the information transfer, from input to output. Large servers serving large volumes of information to large numbers of users employ registered RAM in order to ensure the integrity of the data being transferred. Now let's tie these two concepts together: buffered RAM may be registered, and unbuffered RAM is always unregistered. See also DDR-SDRAM, DRAM, EDO RAM, Flash RAM, FRAM, RDRAM, SDRAM, SRAM, and VRAM.

2. Remote Access Multiplexer. The various DSL (Digital Subscriber Line) services all involve some form of splitter or modem at the customer premises, and a matching device at the edge of the carrier network. Across the UTP (Unshielded Twisted Pair) local loop, the matching DSL units variously perform such functions as analog-to-digital conversion, data compression and packetization, ATM Adaptation, and Frequency Division Multiplexing (FDM). Generally speaking, the centralized unit at the edge of the carrier network is in the form of a DSLAM (DSL Access Multiplexer) contained within a Central Office (CO) owned by the ILEC (Incumbent Local Exchange Carrier). This approach works well for most subscribers, as they are served by "home run" UTP local loops from the CO to the premises. However, customers served through DLC (Digital Loop Carrier) systems are denied DSL service, as the DLC groups and shapes all local signals into voice-grade channels of 64 Kbps. A ngDLC (next generation DLC) may contain one or more RAMs, which effectively are remote DSLAMs. Unfortunately, the RAMs are about the size of a pizza box, and currently serve no more than eight DSL lines. See also DLC, DSL, DSLAM, and ngDLC.

RAM BIOS BIOS transferred to RAM so things go faster.

RAM Disk A logical device made from semiconductor (i.e. chip) memory which emulates the functioning of a disk drive as closely as possible. Since most semiconductor memory (RAM) is volatile, most RAM disks are also volatile, i.e. they lose their memory when you turn off power.

Ram Hook/Ram Horn Hardware attachment that holds ASW (Aerial Service Wire) drop clamps in aerial span applications.

Rambus DRAM See RDRAM.

Rambutan A symmetric cryptographic algorithm developed by Marconi.

RAMAC RAndoMAccess. Built in 1956 by IBM, RAMAC was the first hard drive computer memory device ever built. Consisting of 50 fixed disk platters, each approximately two feet in diameter, RAMAC could store five million characters at a rate of about 2,000 bits per square inch and at a cost of approximately \$10,000 per MB (MegaByte). Contemporary (1999) hard drives store information less than a dime (\$.10) per megabyte.

Raman Amplifier A means of amplification used in optical fiber transmission systems. Raman amplifiers are of two basic types: Distributed and Discrete. That was easy. The rest of this definition is hard, very hard, but some things in life are just hard. I worked hard to make this easy, but it's still hard. So, read it several times, at least.

Distributed Raman amplification uses the fiber itself as the gain medium, whereas the more traditional approaches use separate network devices such as EDFAs (Erbium Doped Fiber Amplifiers) to amplify the light signal. EDFAs accept a weakened light signal and boost it to a high power level before launching it, i.e., presenting it to the next fiber link. Over a distance, of course, the light signal weakens, and must be boosted again. Distributed Raman amplifiers front-end the EDFAs, serving as "pre-amplifiers." Diode-pumped Raman amplifiers pump on optical signal in the direction opposite the data flow (i.e., in the direction of the incoming optical signal carrying the transmitted data). Raman amplification occurs when higher energy (i.e., higher frequency, and shorter wavelength) pump photons scatter off the vibrational modes (i.e., vibrating atoms in the optical fiber), resulting in coherent (relating to electromagnetic waves that have a definite relationship to

each other) stimulation (i.e., adding energy to) of the lower energy (i.e., lower frequency, and longer wavelength) photons associated with the incoming optical carrier signal (i.e., the one carrying the transmitted data). The pump photons actually can simultaneously amplify multiple carrier wavelengths in a DWDM system. At the same time, the Raman amplification process serves improve the SNR (Signal-to-Noise Ratio, expressed as Signal/Noise), which improves the quality of the incoming carrier signal and, thereby, improves error performance. As Raman amplifiers use the entire fiber as the gain medium, the signal weakens much less over a distance and the overall "launch power" level of the transmission signal need not be as high. That translates into lower power costs. Also as a result of Raman amplification, the spacing of both the EDFAs and the optical regenerators can be increased considerably. That results in lower overall network cost.

For example, a counter-propagating light signal at a wavelength of 1450 nm (nanometers, or billionths of a meter) can be pumped in the direction opposite the transmission wavelength of 1550 nm. At the point that the SNR (Signal-to-Noise Ratio) begins to drop, and the BER (Bit Error Rate) therefore becomes an issue, the Raman effect contributes gain (i.e., amplification) to the transmission signal. Raman amplification reduces the number of amplifiers required by lengthening the distance between them, say from approximately 80 km (8,000 meters) between EDFAs to approximately 100 km between Raman amplifiers. Raman amplification also allows the increasing of the bit rate at a given frequency of light, say from 10 Gbps to 40 Gbps. Raman amplification also works effectively with DWDM (Dense Wavelength Division Multiplexing), as multiple wavelengths can be amplified simultaneously.

Discrete Raman amplification occurs in a box, rather than in the optical transmission fiber. The incoming optical carrier signal enters the standalone Raman amplifier and is channeled into a length of specialty fiber, where the amplification process takes place. The likely application for this approach (it is not used commercially at the time of this writing in April 2001) will be to overcome localized loss such as that which might occur internal to a switch or multiplexer. See also DWDM, EDFA, and Raman Scattering.

Raman Scattering Also known as the Raman Effect. Chandrasekhara Venkata Raman, an Indian physicist, discovered (1928) this phenomenon of the inelastic scattering of light as it encounters physical matter. Raman was awarded the Nobel Prize in Physics in 1930 for this discovery, which confirmed the quantum theory of light, which theory is that light is made up of particles. As incident light (i.e., light falling on or striking something) is scattered as it strikes an atom of solid physical matter, most of the photons retain their incident energy, or frequency, which we would see as a color of light. This "elastic" (i.e., snaps back into its original "form") scattering effect is known as Rayleigh scattering. Raman scattering describes the fact that the incident light also causes the electrical bonds between atoms to vibrate which, in turn, causes a small fraction of the photons to experience a shift in energy, or frequency (which is the inverse of wavelength). In this "inelastic" (i.e., doesn't snap back into its original "form") scattering phenomenon, the difference in the energy of the incident photon and the Raman scattered photon is equal to the energy of the vibration of the scattering molecule.

Raman scattering clearly impacts optical fiber transmission systems. The impact is especially significant in the case of DWDM (Dense Wavelength Division Multiplexing), which involves very precise frequency division multiplexing at the optical level. As the diode lasers introduce high-energy light signals into the clear core of the optical fiber, the phenomenon of Stimulated Raman Scattering (SRS) occurs. SRS occurs when light waves interact with vibrations of atoms in a crystalline lattice (i.e., optical fiber in this context). The atoms absorb the light and re-emit a photon with energy equal to the original photon plus/minus the atomic vibration. This scattering effect travels both forwards and backwards, and can cause frequency shifts in the individual light streams, which negatively affects the integrity of the bit stream. However, a Raman Gain amplifier, also known as a Raman loser, can overcome this effect by shifting the wavelength (frequency) of the incident light to a vastly different value at the output. If the incident light signal is monochromatic and sufficiently intense to reach a certain threshold value, the signal is amplified to the point that it exhibits the characteristics of a stimulated emission. The ultimate impact of this effect is both to clean up the signal, and to amplify it. See also DWDM, Raman Amplifier, and Rayleigh Scattering.

RAMDAC Random Access Memory Digital-to-Analog Converter. The chip on a VGA board that translates the digital representation of a pixel into the analog information needed for display on the monitor. A RAMDAC actually consists of four different components — SRAM to store the color map and three digital-to-analog converters (DACs), one for each of the monitor's red, green, and blue electron guns.