IEEE 100
The Authoritative Dictionary of IEEE Standards Terms

Seventh Edition

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Introduction

IEEE standards establish an authoritative common language that defines quality and sets technical criteria. By guaranteeing consistency and conformity through open consensus, IEEE standards add value to products, facilitate trade, drive markets, and ensure safety. That's why leading companies, organizations, and industries around the globe rely on them.

Critical components of this common language are the terms and definitions that are at the foundation of the vast body of IEEE standards. In the past decade alone, hundreds of terms—describing the latest tools, techniques, and best practices—have been added to the lexicon of IEEE standards.

In this newly updated *Authoritative Dictionary of IEEE Standards Terms,* professional experts and students alike will gain an in-depth understanding and appreciation for the breadth of coverage of IEEE standards terms and definitions not found in any other single source.

The seventh edition of IEEE 100 has been revised to include nearly 35 000 technical terms and definitions from over 800 standards—covering areas such as power and energy, communications, information technology, and transportation systems. In addition to an extensive list of widely used acronyms and abbreviations, this new edition also contains detailed abstracts of each term's associated standard(s). What's more, all definitions are augmented by a combination of indispensable information, including:

- Preferred and popular usage of each term
- Variations in meanings among different technical specialties
- Cross-indexing to related works
- Key explanatory notes for further term clarification

In preparing this latest edition of the Dictionary, we realized that the standards community desired more than just a compilation of IEEE standardized terms and definitions. They needed an authoritative resource created by the organization that develops and produces the standards from which the terms and definitions are derived—the IEEE. In addition, we determined the Dictionary needed to be not only user friendly, but also rich in information. In other words, it needed to be the *Authoritative Dictionary of IEEE Standards Terms*.

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How to Use This Dictionary

The terms defined in the Dictionary are listed in *letter-by-letter* alphabetical order. Spaces are ignored in this style of alphabetization, so *cable value* will come before *cab signal*. Descriptive categories associated with the term in earlier editions of the Dictionary will follow the term in parentheses. New categories appear after the definitions (see Categories, below), followed by the designation of the standard or standards that include the definition. If a standard designation is followed by the letter *s,* it means that edition of the standard was superseded by a newer revision and the term was not included in the revision. If a designation is followed by the letter *w,* it means that edition of the standard was withdrawn and not replaced by a revision. A bracketed number refers to the non-IEEE standard sources given in the back of the book.

Abstracts of the current set of approved IEEE standards are provided in the back of the book. It should be noted that updated information about IEEE standards can be obtained at any time from the IEEE Standards World Wide Web site at http://standards.ieee.org/.

Categories

The category abbreviations that are used in this edition of the Dictionary are defined below. This information is provided to help elucidate the context of the definition. Older terms for which no category could be found have had the category *Std100* assigned to them. Note that terms from sources other than IEEE standards, such as the National Electrical Code® (NEC®) or the National Fire Protection Association, may not be from the most recent editions; the reader is cautioned to check the latest editions of all sources for the most up-to-date terminology.

Categories sorted by abbreviation

AES	aerospace and electronic systems
AHDL	computer—Analog Hardware Descriptive Language
AMR	automatic meter reading and energy management
AP	antennas and propagation
ATL	computer—Abbreviated Test Language for All Systems
BA	computer—bus architecture
BT	broadcast technology
C	computer
CAS	circuits and systems
CE	consumer electronics
CHM	components, hybrids, and manufacturing technology
COM	communications
CS	control systems
DA	computer—design automation
DEI	dielectrics and electrical insulation
DESG	dispersed energy storage and generation
DIS	computer—distributed interactive simulation
ED	electron devices
EDU	education
EEC	electrical equipment and components
ELM	electricity metering
EM	engineering management
EMB	engineering in medicine and biology
EMC	electromagnetic compatibility
GRS	geoscience and remote sensing
GSD	graphic symbols and designations
IA	industry applications
IE	industrial electronics
II	information infrastructure
IM	instrumentation and measurement
IT	information theory

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IVHS	intelligent vehicle highway systems
LEO	lasers and electro-optics
LM	computer—local and metropolitan area networks
MAG	magnetics
MIL	military
MM	computer—microprocessors and microcomputers
MTT	microwave theory and techniques
NEC	National Electrical Code
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NI	nuclear instruments
NIR	non-ionizing radiation
NN	neural networks
NPS	nuclear and plasma sciences
ODM	computer—optical disk and multimedia platforms
OE	oceanic engineering
PA	computer—portable applications
PE	power engineering
PEL	power electronics
PQ	power quality
PSPD	power surge protective devices
PV	photovoltaics
QUL	quantities, units, and letter symbols
R	reliability
RA	robotics and automation
REM	rotating electrical machinery
RL	roadway lighting
S&P	computer—security and privacy
SB	stationary batteries
SE	computer—software engineering
SMC	systems, man, and cybernetics
SP	signal processing
Std100	Standard 100 legacy data
SUB	substations
SWG	power switchgear
T&D	transmission and distribution
TF	time and frequency
TRR	transformers, regulators, and reactors
TT	test technology
UFFC	ultrasonics, ferroelectrics, and frequency control
VT	vehicular technology

Categories sorted by name

aerospace and electronic systems	AES
antennas and propagation	AP
automatic meter reading and energy management	AMR
broadcast technology	BT
circuits and systems	CAS
communication	COM
components, hybrids, and manufacturing technology	CHM
computer	C
computer—Abbreviated Test Language for All Systems	ATL
computer—Analog Hardware Descriptive Language	AHDL
computer—bus architecture	BA
computer—design automation	DA
computer—distributed interactive simulation	DIS
computer—local and metropolitan area networks	LM
computer—microprocessors and microcomputers	MM
computer—optical disk and multimedia platforms	ODM
computer—portable applications	PA
computer—security and privacy	S&P
computer—software engineering	SE
consumer electronics	CE

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control systems	CS
dielectrics and electrical insulation	DEI
dispersed energy storage and generation	DESG
education	EDU
electrical equipment and components	EEC
electricity metering	ELM
electromagnetic compatibility	EMC
electron devices	ED
engineering in medicine and biology	EMB
engineering management	EM
geoscience and remote sensing	GRS
graphic symbols and designations	GSD
industrial electronics	IE
industry applications	IA
information infrastructure	II
information theory	IT
instrumentation and measurement	IM
intelligent vehicle highway systems	IVHS
lasers and electro-optics	LEO
magnetics	MAG
microwave theory and techniques	MTT
military	MIL
National Electrical Code	NEC
National Electrical Safety Code	NESC
National Fire Protection Association	NFPA
neural networks	NN
non-ionizing radiation	NIR
nuclear and plasma sciences	NPS
nuclear instruments	NI
oceanic engineering	OE
photovoltaics	PV
power electronics	PEL
power engineering	PE
power quality	PQ
power switchgear	SWG
quantities, units, and letter symbols	QUL
reliability	R
roadway lighting	RL
robotics and automation	RA
rotating electrical machinery	REM
signal processing	SP
Standard 100 legacy data	Std100
stationary batteries	SB
substations	SUB
surge-protective devices	PSPD
systems, man, and cybernetics	SMC
test technology	TT
time and frequency	TF
transformers, regulators, and reactors	TRR
transmission and distribution	T&D
ultrasonics, ferroelectrics, and frequency control	UFFC
vehicular technology	VT

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A

***aa* auxiliary switch** *See: aa* contact; auxiliary switch.

AAAC Concentric-lay-stranded all aluminum alloy conductor. (T&D/PE) 524-1992r

AAC Concentric-lay-stranded all aluminum conductor. (T&D/PE) 524-1992r

***aa* contact** A contact that is open when the operating mechanism of the main device is in the standard reference position and that is closed when the operating mechanism is in the opposite position. *See also:* standard reference position. (SWG/PE) C37.100-1992

AACSR *See:* aluminum alloy conductor, steel reinforced.

***A* and *R* display (radar)** An *A*-display, any portion of which may be expanded. *See also:* navigation. (AES/RS) 686-1982s

AAU *See:* alternate access unit.

***a* auxiliary switch** *See: a* contact; auxiliary switch.

abampere The unit of current in the centimeter-gram-second (cgs) electromagnetic system. The abampere is 10 A. (Std100) 270-1966w

abandoned call (telephone switching systems) A call during which the calling station goes on-hook prior to its being answered. (COM) 312-1977w

ABASIC A dialect of the BASIC programming language. (C) 610.13-1993w

***A* battery** A battery designed or employed to furnish current to heat the filaments of the tubes in a vacuum-tube circuit. *See also:* battery. (EEC/PE) [119]

ABBET application An end-use program constructed using one or more ABBET components. (ATLAS) 1226-1993s

ABBET component An implementation of the services defined in an IEEE ABBET component standard. (ATLAS) 1226-1993s

ABBET implementation The installation and utilization of one or more ABBET applications. (ATLAS) 1226-1993s

ABBET layer A natural grouping to the ABBET services that is recognized by the ABBET layer model. (ATLAS) 1226-1993s

abbreviated dialing (telephone switching systems) A feature permitting the establishment of a call with an input of fewer digits than required under the numbering plan. (COM) 312-1977w

abbreviated ringing A short, variable burst of power ringing that is required to establish a temporary communications path in certain types of network pair-gain equipment. The switch is instructed, via trunk signals, to output this abbreviated ringing on the end user's line. (SCC31/AMR) 1390.3-1999, 1390.2-1999, 1390-1995

Abbreviated Test Language for All Systems (ATLAS) (1) A standard abbreviated English language used in the preparation and documentation of test procedures or test programs that can be implemented either manually or with automatic or semiautomatic test equipment. (ATLAS/SCC20) 1232-1995, 1226-1998, 771-1984s, 993-1997

(2) A test language used by test engineers in controlling automatic test equipment. (C) 610.13-1993w

A Broad-Based Environment for Test (ABBET) A set of international standards that define language-independent interfaces to industry standards regarding automatic testing and integrated diagnositcs. (SCC20) 993-1997

abbreviation A shortened form of a word or expression. *See also:* reference designation; symbol for a unit; letter combination; graphic symbol; mathematical symbol; symbol for a quantity; functional designation. (GSD) 267-1966

abend *See:* abnormal end.

ability A mode that a device can advertise using Auto-Negotiation. For modes that represent a type of data service, a device shall be able to operate that data service before it may advertise this ability. A device may support multiple abilities. (C/LM) 802.3-1998

abnormal decay The dynamic decay of multiply written, superimposed (integrated) signals whose total output amplitude changes at a rate distinctly different from that of an equivalent singly written signal. *Note:* Abnormal decay is usually very much slower than normal decay and is observed in bombardment-induced conductivity type of tubes. *See also:* charge-storage tube. (ED) 158-1962w

abnormal end Termination of a process prior to completion. *Synonym:* abend. *See also:* exception; abort. (C) 610.12-1990

abnormal glow discharge (gas tube) The glow discharge characterized by the fact that the working voltage increases as the current increases. *See also:* discharge. (Std100) [31]

abnormality Any deviation from the pre-established test conditions, including the tolerance limits, that may affect the outcome of the test. (PE/IC) 1407-1998

abnormal preamble A preamble that does not match the synchronization pattern resulting in a packet error. (C) 610.7-1995

abort (1) (software) To terminate a process prior to completion. *See also:* abend; exception. (C) 610.12-1990

(2) To terminate the transmission of a frame before it has been completely transmitted. (EMB/MIB) 1073.4.1-2000

abort completion point A point at which the execution of an aborted construct must complete. (C) 1003.5-1999

abort deferred operation An operation that always continues to completion without being affected by an abort. Certain operations are required by the Ada language to be abort deferred. (C) 1003.5-1999

abortive release An abrupt termination of a network connection that may result in the loss of data. (C) 1003.5-1999

abort sequence A sequence transmitted by an originating ring station that terminates the transmission of a frame prematurely. It also causes the ring station receiving this frame to terminate the frame's reception. (C/LM) 8802-5-1998

above threshold firing time (microwave switching tubes) (nonlinear, active, and nonreciprocal waveguide components) The time to establish an above-threshold discharge in the gas tube after the application of radio frequency power. This time delay is responsible for the spike in the leading edge of the output leakage waveform. *See also:* duplexer; gas tube. (MTT) 457-1982w

abrupt junction (nonlinear, active, and nonreciprocal waveguide components) (semiconductor) A semiconductor crystal having an *n*-region containing a near-constant net concentration of donor impurities adjoining a *p*-region with a near-constant net concentration of acceptors; used primarily in microwave frequency multipliers, dividers, and parametric circuits. (MTT) 457-1982w

ABS (cable systems in power generating stations) Conduit fabricated from acrylonitrile-butadiene-styrene. (PE/SUB/EDPG) 422-1977, 525-1992r

ABSBH load *See:* average busy season busy-hour load.

absolute accuracy Accuracy as measured from a reference that must be specified. (IA/EEC) [61], [74]

absolute address (software) An address that is permanently assigned to a device or storage location and that identifies the device or location without the need for translation or calculation. *Synonyms:* specific address; explicit address. *Contrast:* symbolic address; relative address; relocatable address. *See also:* absolute assembler; absolute code; absolute loader; absolute instruction. (C) 610.12-1990

(2) (A) (computers) An address that is assigned by the machine designer to a physical storage location. **(B) (computers)** A pattern of characters that identifies a unique storage loca-

commonly used in audible noise investigations is the energy average of the quantities. The units in decibels above 20 μPa are converted to energy units such as microwatts (μW), which are then averaged. (T&D/PE) 539-1990

arithmetic operation (1) An operation for which the VHDL operator is +, -, *, /, **mod**, **rem**, **abs**, or **. (C/DA) 1076.3-1997

(2) An operation that is performed in accordance with the rules of ordinary arithmetic. (C) 1084-1986w

(3) (test, measurement, and diagnostic equipment) Operations in which numerical quantities form the elements of the calculation. (MIL) [2]

arithmetic overflow *See:* overflow.

arithmetic point *See:* radix point.

arithmetic power factor The ratio of the active power to the arithmetic apparent power. The arithmetic power factor is expressed by the equation

$$F_{pa} = \frac{P}{U_a}$$

where

F_{pa} = arithmetic power factor
P = active power
U = arithmetic apparent power.

Normally power factor, rather than arithmetic power factor, will be specified, but in particular cases, especially when the determination of the apparent power for a polyphase circuit is impracticable with the available instruments, arithmetic power factor may be used. When arithmetic power factor and power factor differ, arithmetic power factor is the smaller. (Std100) 270-1966w

arithmetic reactive factor The ratio of the reactive power to the arithmetic apparent power. (Std100) 270-1966w

arithmetic register A register that holds the operands or the results of operations such as arithmetic operations, logic operations, and shift operations. (C) 610.10-1994w

arithmetic shift (1) (mathematics of computing) A shift that affects all digit positions in a register, word, or numeral but does not affect the sign position. For example, +231.702 shifted two places to the left becomes +170.200. *Note:* The result is equivalent to multiplication or division by an integral power of the radix, except for the truncation effects. *Synonym:* numerical shift. *Contrast:* logical shift. (C) 1084-1986w

(2) (general) (A) A shift that does not affect the sign position. **(B)** A shift that is equivalent to the multiplication of a number by a positive or negative integral power of the radix. (MIL/C) [2], [85]

arithmetic underflow *See:* underflow.

arithmetic unit (1) The unit of a computing system that contains the circuits that perform arithmetic operations. (MIL/C) [2], [20], [85]

(2) A functional component of a computer system that performs arithmetic operations. *Note:* The term is also sometimes used for an arithmetic and logic unit. *Synonym:* arithmetic element. *See also:* vector unit; scalar unit. (C) 610.10-1994w

arm *See:* network analysis; branch.

arm a timer To start a timer measuring the passage of time, enabling the notification of a process when the specified time or time interval has passed. (C) 1003.5-1999

armature (of a relay) The moving element of an electromechanical relay that contributes to the designed response of the relay and that usually has associated with it a part of the relay contact assembly. (SWG/PE) C37.100-1992

armature band (rotating machinery) A thin circumferential structural member applied to the winding of a rotating armature to restrain and hold the coils so as to counteract the effect of centrifugal force during rotation. *Note:* Armature bands may serve the further purpose of archbinding the coils. They may be on the end windings only or may be over the coils within the core. (PE) [9]

armature band insulation (rotating machinery) An insulation member placed between a rotating armature winding and an armature band. *See also:* armature. (PE) [9]

armature bar (rotating machinery) (half coil) Either of two similar parts of an armature coil, comprising an embedded coil side and two end sections, that when connected together form a complete coil. *See also:* armature. (PE) [9]

armature coil (rotating machinery) A unit of the armature winding composed of one or more insulated conductors. *See also:* asynchronous machine; armature. (PE/EEC) [119]

armature core (rotating machinery) A core on or around which armature windings are placed. *See also:* armature. (PE) [9]

armature I^2R loss (synchronous machines) The sum of the I^2R losses in all of the armature current paths. *Note:* The I^2R loss in each current path shall be the product of its resistance in ohms, as measured with direct current and corrected to a specified temperature, and the square of its current in amperes. (PE/REM) [9], [115]

armature quill *See:* armature spider.

armature reaction (rotating machinery) The magnetomotive force due to armature-winding current. (PE) [9]

armature-reaction excited machine A machine having a rotatable armature, provided with windings and a commutator, whose load-circuit voltage is generated by flux that is produced primarily by the mag-netomotive force of currents in the armature winding. *Notes:* 1. By providing the stationary member of the machine with various types of windings, different characteristics may be obtained, such as a constant-current characteristic or a constant-voltage characteristic. 2. The machine is normally provided with two sets of brushes, displaced around the commutator from one another, so as to provide primary and secondary circuits through the armature. 3. The primary circuit carrying the excitation armature current may be completed externally by a short-circuit connection, or through some other external circuit, such as a field winding or a source of power supply; and the secondary circuit is adapted for connection to an external load. (EEC/PE) [119]

armature sleeve *See:* armature spider.

armature spider A support upon which the armature laminations are mounted and which in turn is mounted on the shaft. *Synonyms:* armature sleeve; armature quill. (EEC/PE) [119]

armature terminal (rotating machinery) A terminal connected to the armature winding. *See also:* armature. (PE) [9]

armature to field transfer function (G[s]) (synchronous machine parameters by standstill frequency testing) (standstill frequency response testing). The ratio of the Laplace transform of the direct-axis armature flux linkages to the Laplace transform of the field voltage, with the armature open-circuited. (PE/EM) 115A-1987

armature-voltage control A method of controlling the speed of a motor by means of a change in the magnitude of the voltage impressed on its armature winding. *See also:* control. (IA/IAC) [60]

armature winding (rotating machinery) The winding in which alternating voltage is generated by virtue of relative motion with respect to a magnetic flux field. *See also:* asynchronous machine. (PE) [9]

armature winding cross connection *See:* armature winding equalizer.

armature winding equalizer (rotating machinery) An electric connection to normally equal-potential points in an armature circuit having more than two parallel circuits. *Synonym:* armature winding cross connection. *See also:* armature. (PE) [9]

armed sweep *See:* single sweep.

armor clamp (wiring methods) A fitting for gripping the armor of a cable at the point where the armor terminates or where

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ing the allowable temperature rise for the insulation class being used. (PE/NP) 1290-1996

time, real *See:* real time.

timer EEPROM Typically a byte-alterable electrically erasable programmable read-only memory (EEPROM) with on-chip latches for all address, data, and control lines to internally control the duration of a write cycle. (ED) 1005-1998

time referenced point (pulse terminology) A point at the intersection of a time reference line and a waveform. (IM/WM&A) 194-1977w

time reference line (pulse terminology) A line parallel to the time origin line at a specified instant. (IM/WM&A) 194-1977w

time reference lines (A) (pulse terminology) (pulse start [stop]) line. The time reference line at pulse start (stop) time. *See also:* waveform epoch. **(B) (pulse terminology)** (top center line) The time reference line at the average of pulse start time and pulse stop time. *See also:* waveform epoch. (IM/WM&A) 194-1977

time register *See:* timer.

time-related adjectives (A) (pulse terminology) (periodic [aperiodic]) Of or pertaining to a series of specified waveforms or features which repeat or recur regularly (irregularly in time. **(B) (pulse terminology)** (coherent [incoherent]) Of or pertaining to two or more repetitive waveforms whose constituent features have (lack) time correlation. **(C) (pulse terminology)** (synchronous [asynchronous]) Of or pertaining to two or more repetitive waveforms whose sequential constituent features have (lack) time correlation. (IM/WM&A) 194-1977

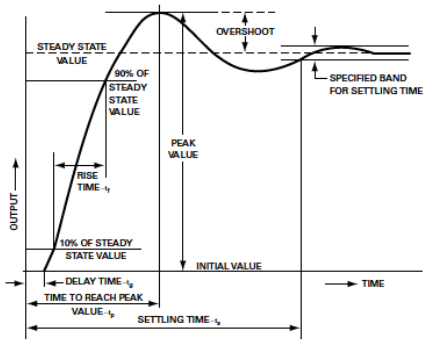
time-related definitions *See:* cycle; frequency; duration; interval; period.

time release A device used to prevent the operation of an operative unit until after the expiration of a predetermined time interval after the device has been actuated. (EEC/PE) [119]

time resolution The minimum time interval that a clock can measure or whose passage a timer can detect. (PA/C/C/PA) 1003.5b-1995, 9945-1-1996

time response (1) (control system feedback) An output, expressed as a function of time, resulting from the application of a specified input under specified operating conditions. *Note:* It consists of a transient component that depends on the initial conditions of the system, and a steady-state component that depends on the time pattern of the input. *Synonym:* dynamic response. (IA/IAC) [60]

(2) (excitation systems) An output expressed as a function of time, resulting from the application of a specified input under specified operating conditions. See the corresponding figure for a typical time response of a system to step increase of input and for identification of the principle characteristics of interest.



[Typical time response of a feedback control system to a step change in input.]

time response (PE/EDPG) 421A-1978s

(3) (synchronous-machine regulator) The output of the synchronous-machine regulator (that is, voltage, current, impedance, or position) expressed as a function of time following the application of prescribed inputs under specfied conditions. (PE/EDPG) 421A-1978s

time, response *See:* response time.

time rise tone (measuring the performance of tone address signaling systems) The time interval between the end of the tone off condition and the beginning of the tone present condition at the beginning of the tone under consideration. (COM/TA) 752-1986w

timer overrun (1) A condition that occurs each time a timer, for which there is already an expiration signal queued to the process, expires. (C/PA) 9945-1-1996

(2) A condition that occurs each time a timer for which there is already an expiration signal queued to the process expires. (C) 1003.5-1999

time scale *See:* time.

time schedule controller (process control) A controller in which the command (or reference input signal) automatically adheres to a pre-determined time schedule. *Note:* The time schedule mechanism may be programmed to switch motors or other devices. (PE/EDPG) [3]

time sharing (software) A mode of operation that permits two or more users to execute computer programs concurrently on the same computer system by interleaving the execution of their program. *Note:* Time sharing may be implemented by time slicing, priority-based interrupts, or other scheduling methods. (C) 610.12-1990, 610.10-1994w

time signal (navigation aids) An accurate signal marking a specified time or time interval. (AES/GCS) 172-1983w

time skew (analog-to-digital converter) In an analog to digital conversion process, the time difference between the conversion of one analog channel and any other analog channel, such that the converted (digital) representations of the analog signals do not correspond to values of the analog variables that existed at the same instant of time. Time skew is eliminated, where necessary, by the use of a multiplexor with a sample/hold feature, allowing all input channels to be simultaneously sampled and stored for later conversion. *See also:* switching time; analog-to-digital converter. (C) 165-1977w, 166-1977w

(2) (A) In a conversion from analog to digital, the time difference between the conversion of one analog channel and any other analog channel, such that the converted (digital) representations of the analog signals do not correspond to values of the analog variables that existed at the same instant of time. **(B)** The time interval between two events which are intended to be simultaneous. (C) 610.10-1994

time-slice simulation (A) A discrete simulation that is terminated after a specific amount of time has elapsed; for example, a model depicting the year-by-year forces affecting a volcanic eruption over a period of 100 000 years. *Synonym:* time-interval simulation. *See also:* critical event simulation. **(B)** A discrete simulation of continuous events in which time advances by intervals chosen independent of the simulated events; for example, a model of a time multiplexed communication system with multiple channels transmitting signals over a single transmission line in very rapid succession. (C) 610.3-1989

time slicing A mode of operation in which two or more processes are each assigned a small, fixed amount of continuous processing time on the same processor, and the processes execute in a round-robin manner, each for its allotted time, until all are completed. (C) 610.12-1990

time slot (1) In time division multiplexing, when time is divided into slots to route data from input to output. (C) 610.7-1995

(2) Any cyclic time interval that can be recognized and defined uniquely. (COM/TA) 1007-1991r

time sorter *See:* time distribution analyzer.

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