

Concise Encyclopaedia of Information Technology

Second edition

Adrian V. Stokes



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Gower

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Published by

Gower Publishing Company Limited
Gower House
Croft Road
Aldershot
Hants GU11 3HR
England

and

Gower Publishing Company
Old Post Road
Brookfield
Vermont 05036
USA

British Library Cataloguing in Publication Data

Stokes, Adrian V.

Concise encyclopaedia of information technology.

— 2nd ed.

1. Information storage and retrieval systems

—Dictionaries

I. Title

001.5 Z699

Library of Congress Cataloguing in Publication Data

Stokes, Adrian V.

Concise encyclopaedia of information technology.

1. Electronic data processing

—Dictionaries

I. Title

QA76.15.S86 1984 001.64'03'21 84-21420

ISBN 0 566 02531 0

Introduction to the second edition

This is the second edition of "The Concise Encyclopaedia of Information Technology". It has been updated to reflect changes in usage and new words since the last edition. Some entries have been expanded and a considerable number of new definitions added. I would like to thank the people, especially reviewers, who made suggestions for improvement and hope that this second edition fulfils their expectations.

Adrian V. Stokes
September 1984

Introduction to the first edition

1982 has been designated by the UK Government as "Information Technology Year". It is intended that, within the Year, many of the aspects of information technology will be demonstrated and there are a number of special events during the Year such as the BMA Conference on computers in medicine and the BCS's Silver Jubilee celebrations.

The term "information technology" is perhaps not too clearly understood and there have been various attempts to define what it means, the most definitive being the UNESCO one:

"The scientific, technological and engineering disciplines and the management techniques used in information handling and processing; their applications; computers and their interaction with men and machines; and associated social, economic and cultural matters".

It is difficult to define what "information technology" is accurately. It is even more difficult to understand the plethora of terms used in connection with information technology, especially since so many new ones are being coined. Dictionaries of computer science are often of little use since they may be out of date but, more important, they tend to concentrate on the formal terminology of computer science. While it is important to know what an AVL tree is, it is perhaps more important to understand what is meant by such esoteric terminology as "after the glitch in processing today, we zapped in a patch to cure the bug".

This book is intended to achieve both aims, concisely. It defines a large number of computer terms, both formal and informal, while, at the same time, giving lengthier descriptions of a number of terms of particular importance. It has a number of emphases; first, to define all the important terms used in information technology; secondly, to define all terms used in as concise and meaningful a way as possible; third, in some cases where it is not possible to give a very full description, to give references to other literature where more information can be obtained. Finally, the book has been designed to be as easy to use as possible. For example, each term is defined as briefly as possible and then, if necessary, a more detailed explanation is given. In order to make each

definition self-contained, it is sometimes necessary to duplicate definitions but this has been reduced as far as possible. Where one definition refers to another, if this is not obvious, the term referenced is printed in *italics*. In addition, since there is often confusion over the order in reference books, any terms which include special characters such as "/" are listed as if they were spelt without that character (thus "I/O" is listed as if it were "IO").

This book is intended to be a useful reference book which, it is hoped, will be of great use to students (and lecturers), to DPMs and to anyone with an interest in information technology.

Adrian V. Stokes
December 1981

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A

ABACUS: A mechanical device for performing arithmetic calculations. It operates by sliding beads on parallel wires and the beads are arranged either in groups of ten or five and two. High speeds can be achieved by an expert. The origins of the abacus are in Mesopotamia in about 3000 BC but it is now more often associated with China.

ABEND: An acronym for *ABnormal END*. That is, termination of a job following detection of an error.

ABL: An acronym for *Atlas Basic Language*, an assembler language (with no operation code mnemonics) on the Atlas computer.

ABORT: To terminate prematurely execution of a job (or operation of system) following an error indication. Often in interactive computer systems, the typing of a single character (frequently control-C) allows the user to abort a job.

ABSCISSA: The x-axis (horizontal) of a graph. The y-axis is known as the *ordinate*.

ABSOLUTE ADDRESS: The actual location in (main) storage of a particular item of data. Also known as *machine address*.

ABSOLUTE ADDRESSING: A method of addressing locations in (main) storage using absolute addresses.

ABSOLUTE ASSEMBLER: An assembler which produced object programs in which all addresses are absolute addresses and which hence cannot be relocated.

ABSOLUTE CODE: Programs written using absolute addresses and absolute operation codes so that they may be entered into a computer memory and executed with no further processing required.

ABSOLUTE CODING: Programming using *absolute code*.

ABSOLUTE ERROR: The magnitude of an error taking no account of the sign.

ABSOLUTE OPERATION CODE: The numeric value of an operation code. Used in *absolute code*.

ABSOLUTE VALUE: The value of some number without any regard for its sign.

AC (1): An abbreviation for *accumulator*.

AC (2): An abbreviation for *alternating current*.

ACC: Another abbreviation for *accumulator*.

ACCEPTANCE TEST: A test (or set of tests) used to check that a system conforms according to agreed specifications.

ACCESS (vb): To obtain data from or place data in storage. The storage may be main or peripheral. The data may, in fact, be an instruction (in which case, it is usually stored in main memory). In this case, the word "access" usually implies executing the instruction as well as retrieving it.

ACCESS METHOD: Used to indicate the method of accessing data on backing storage, for example, QSAM – Queued Sequential Access Method.

ACCESS TIME: The time between the issuing of a read command and the obtaining of the data to which the command related. It usually refers to the time taken to read data from a peripheral device into main memory.

ACCUMULATOR: Part of the arithmetic unit of a computer in which (partial) results are formed (or accumulated). It is nearly always a register and is often referred to implicitly in instructions although, in computers with more than one register, one is often designated the accumulator by convention.

ACCURACY: A measure of the exactness of an approximation to the real value. It is often confused with *precision*.

ACE: An acronym for *Automatic Computing Engine*, one of the earliest computers. Its successor was *DEUCE*.

ACK: Acknowledgement. A control character widely used to acknowledge correct receipt of a message. In ASCII, its value is binary 0000110 (control-F).

ACM: An abbreviation for *Association for Computing Machinery*, an American professional association which has a large number of SIGs (Special Interest Groups) active in many areas of computer science.

ACOUSTIC COUPLER: A device for converting digital signals into acoustic signals enabling data to be transmitted over the PSTN with no electrical connection between the terminal and the line. It is usually not possible to use an acoustic coupler for bandwidths greater than 300 bits/second.

ACOUSTIC DELAY LINE: A delay line which stores data using the propagation of sound waves in a suitable medium (often mercury). Now obsolete.

ACOUSTIC MEMORY: A storage medium using *acoustic delay lines*.

ACRONYM: In theory, a group of letters formed from the first (or, sometimes, other than the first) letters of a name. However, in practice, the "acronym" is often first decided then suitable words selected to fit this. An example of this is BASIC which has now acquired the status of an acronym meaning "Beginners' All Purpose Symbolic Instruction Code". A list of acronyms in common usage is given in Appendix A.

ACTIVITY RATIO: The ratio of the number of records being updated to the total number of records within that file.

ACTP: An acronym for *Advanced Computer Technology Project*, a project funded by the UK Government for research and development by industry into advanced techniques.

ACU: An acronym for *automatic call unit*.

ADA: In 1975, the US Department of Defense started a program called the "High Order Language Commonality Program" to establish a single high-level language for DoD applications. A set of requirements were defined, known as "Steelman" and various companies submitted language specifications to fulfil these requirements. The final language, which was called "Ada" after Ada Lady Lovelace who was the daughter of Lord Byron and programmed Charles Babbage's first computers, was designed by CII-Honeywell Bull. A preliminary Ada reference manual was published in 1979.

ADAPTIVE CONTROL SYSTEM: A control system which adapts its own

behaviour to suit the environment in accordance with data from that environment which it obtains by continuous monitoring.

ADAPTIVE ROUTING: A technique of routing in a distributed computer network which adapts to changing conditions by adjusting its parameters in accordance with data obtained by continuous monitoring. ARPANET uses an adaptive routing system.

ADC: An abbreviation for *analogue/digital converter*.

ADCCP: An abbreviation for *Advanced Data Communication Control Procedure*, a *bit-oriented* line-level protocol.

ADDEND: One of the operands in an addition. The addend is added to the *augend* to produce the *sum*. In most computer systems, the addend remains unchanged throughout this operation while the *augend* is replaced by the *sum*.

ADDER: The hardware device in a computer which performs addition. It takes three inputs, the *addend*, *augend* and *carry* and produces two outputs, the *sum* and a *carry*.

ADDITION: The operation of combining an *augend* and an *addend* to form a *sum* according to the usual rules of arithmetic.

ADDITION WITHOUT CARRY: A synonym for *exclusive-or*.

ADDRESS: This word, used either as a verb (meaning to give an address) or a noun, means a reference, usually a number, indicating the location of a specified item, usually in main memory or on backing storage. Thus, "the address of variable A is 8000". An address may be given in any one of a large number of ways and these various methods are given under the name of the method (e.g. *absolute addressing*) and under the heading *addressing*. Instructions are also referred to as "*n*-address instructions" where "*n*" denotes the number of items addressed by the instruction.

ADDRESS BUS: A physical connection between a processor and memory. The processor places an address on the bus and the memory responds by placing the contents of that address back on the bus.

ADDRESS FORMAT: The format of the address part of an instruction.

ADDRESS MODIFICATION: The altering of an address within an

instruction. This can be achieved in two ways, either by the actual changing of the instruction as stored in memory or by the effect of, for example, an *index register* when the *effective address* is formed by modifying the address by the contents of the index register.

ADDRESS REGISTER: A register which contains the address of the current instruction.

ADDRESSING: The technique of referring to an item by means of an *address*. There are a large number of methods by which this can be done and they are described individually under the appropriate heading. The ones described herein are as follows:

- * Immediate
- * Implied
- * Direct (or Absolute)
- * Indirect
- * Register
- * Indexed
- * Base/Displacement
- * Stack
- * Relative

ADP: An acronym for *automatic data processing*.

AFIPS: An acronym for *American Federation of Information Processing Societies*.

AFNOR: An acronym for *Association Francaise de Normalisation*, a French standards body which is a member of ISO.

AGRI: An acronym for *Agricultural Information System*.

AI: An abbreviation for *artificial intelligence*.

ALGOL: An acronym for ALGO~~r~~ithmic Language. The first such language, Algol 58, was developed for use by mathematicians to represent algorithms. In 1960, the "Report on the Algorithmic Language ALGOL 60" was published by IFIP. The report is of considerable interest in that it uses a metalanguage to define the actual language. In 1963, discussions started on a successor language, called ALGOL-X, by Working Group 2.1 of IFIP and the definition of this language, renamed ALGOL 68, was published as the "Report on the Algorithmic Language ALGOL 68". Although it bears considerable similarities to its predecessor, it is very much more powerful.

ALGORITHM: A formal description of the method of solving a specified problem. One method of doing this is by means of an algorithmic language, such as *Algol*.

ALGORITHMIC: Pertaining to the use of *algorithms*.

ALLOCATE: To assign system resources for the processing of a *job*.

ALLOCATION: The process of assigning system resources for the processing of a *job*.

ALOHA: An experimental packet-switched computer network at the University of Hawaii which uses satellite communication links in a broadcast mode. Much work has been done in this network to investigate optimal use of these links and these are described under *broadcast satellite techniques*.

ALPHA: Often used as an abbreviation for *alphabetic* (or sometimes, confusingly, for *alphanumeric*).

ALPHABETIC: An adjective describing characters in the set 'A' . . 'Z' or 'a' . . 'z'.

ALPHAMERIC: A synonym for *alphanumeric*.

ALPHANUMERIC: An adjective describing characters which are either numeric or alphabetic.

ALTERNATE ROUTING: A routing technique used in some computer networks when, in the event of failure of a primary route, an alternate route is provided.

ALT-MODE: A name sometimes given to the character (or key) known more often as *escape*.

ALU: An abbreviation for *arithmetic/logical unit*.

AM: An acronym for *amplitude modulation*.

AMENDMENT FILE: A file which contains the changes required to be made to a *master file*, performed in a batch environment. It consists of a set of *amendment records*.

AMENDMENT RECORD: One record which is a part of an *amendment file*, specifying the change(s) to be made to a record in the *master file*.

AMENDMENT TAPE: A tape (magnetic or paper) containing an *amendment file*.

ANALOG(UE): The representation of values by means of a physical variable, often a voltage level but could be, for example, a length (as in a slide rule). A number of early computers (and some current, special purpose, computers) are based on analog(ue) principles. One based on a combination of analog(ue) and digital principles is known as a "hybrid computer".

ANALOG(UE) CHANNEL: A transmission channel on which the data being transmitted is represented as an analog(ue) signal (for example, a telephone line).

ANALOG(UE)/DIGITAL CONVERTER: A device which converts between analog(ue) and digital signals.

ANALOG(UE) NETWORK: An electrical (electronic) circuit which is set up in order to solve a problem by analog(ue) methods.

ANALYSER: Something which performs analysis, for example, a syntax analyser (part of a compiler) which performs analysis of the *source code* according to pre-defined *syntax rules*.

ANALYSIS: The process of breaking down a problem into its constituent parts.

ANALYST: Usually used as an abbreviation for *systems analyst*.

ANALYTICAL ENGINE: A device invented in 1833 by Charles Babbage which is the forerunner of the modern computer.

AND (1): A Boolean operation which produces a value of TRUE only if both inputs are TRUE.

AND (2): A logical operation which gives the result 1 only if both operands are 1. It conforms to the following table:

&	0	1
0	0	0
1	0	1

ANISOCHRONOUS TRANSMISSION: Transmission of data where the transitions occur at irregular (unclocked) intervals.

ANNOTATION: Explanatory text added to a flowchart or program.

ANSI: The American National Standards Institute (formerly the American Standards Association). This is the USA member body of the International Standards Organization.

ANSWERBACK: The response of a device (usually a terminal) to a specific enquiry (usually the WRU character) in order to verify the identity of the device.

ANSWERBACK DRUM: A component of a terminal (e.g. a Teletype) which automatically sends the terminal identification in response to an enquiry. Since this is a physical component, it provides some degree of security.

ANTIOPE: The French *videotex* system.

APL: An acronym for *A Programming Language*, a very high-level language developed by Iverson of IBM.

APPLE: A home computer made by Apple Computers Inc. A UK version was marketed as the ITT 2020.

APPLICATION: The problem for which computing is required.

APPLICATION PROGRAMS: Programs to solve problems. These should be contrasted with *systems programs* which are programs written to enable operation of computer systems.

APSE: An abbreviation for *Ada Programming Support Environment* which is, as the name implies, an environment in which programs written in the DoD language Ada are run.

ARCHITECTURE: The set of facilities and functional components visible to a programmer using the language of the machine and some of the principles used to realise this language.

ARGUMENT: Most commonly used to indicate values passed to a function or routine. For example, in the call:

$$y = \sin(x)$$

“x” is the argument of the function call.

ARITHMETIC EXPRESSION: An expression consisting of a number of values (or equivalent), joined by various *arithmetic operators*.

ARITHMETIC/LOGICAL UNIT: Part of a *central processor unit* which performs the arithmetic and logical operations on data. It is usually abbreviated to ALU.

ARITHMETIC MEAN: The result of adding together the items in a *set* of values and dividing by the number of items.

ARITHMETIC OPERATION: An operation on data using an *arithmetic operator*.

ARITHMETIC OPERATOR: One of the *set* of operators used to perform arithmetic operations, such as "+", "-", "*", and "/".

ARITHMETIC SHIFT: To shift the bits in a word, treating the value as a signed integer. A left shift of "n" places is equivalent to multiplication by 2^n . Conversely, a right shift of "n" places is equivalent to division by 2^n . It should be contrasted with other shifts such as a *logical shift* or a *circular shift*.

ARITHMETIC STATEMENT: A statement in a programming language to perform arithmetic operations.

ARITHMETIC UNIT: Part of the *central processor unit* which performs arithmetic functions. Usually this is combined with logical functions into the *ALU* (arithmetic and logical unit).

ARPA: The Advanced Research Projects Agency of the United States Department of Defense.

ARPANET: A packet-switched computer network, set up in 1969 by ARPA and now consisting of over 100 "Host" computers, mainly in the continental USA, with links to Hawaii, Norway and England.

Following the publication of a series of papers by Paul Baran of the Rand Corporation in 1964 and early experiments by Marill and Roberts (1966) in the USA, ARPA decided to fund the setting up of a *packet-switched* network, connecting together various sites in the continental USA which were in receipt of ARPA grants. Various criteria were proposed for the network, such as that the end-to-end delay should be less than half a second, that there should be at least two physically separate paths between any two network nodes, that the communications cost should be less than 25% of the total network cost and that software costs should

be minimised at each site. In early 1969, the contract for the network was awarded to a company in Cambridge, Massachusetts called Bolt, Beranek and Newman. The design of the network was that each computer to be connected ("Host") should be connected to a dedicated minicomputer which formed part of the communications sub-network. These node computers were called *IMPs* and were based on Honeywell-516 computers (later 316s). They were later superseded by *TIPs* — Terminal *IMPs* — which had facilities for terminal handling.

The first, four-node, experimental network was operational in early 1970 and expanded rapidly, including the provision of satellite links to Hawaii and London (1973). The network has provided a testbed for much research into computer networks and protocols but now is considered an operational (rather than research) network and is operated by the Defense Communications Agency (DCA).

Although ARPANET mainly provides a communications medium between various computers and terminals, there have been experiments in the concept of distributed operating systems, perhaps the best known of which is *RSEXEC*.

1. Baran, P. et al., "On Distributed Communications", Rand Corporation, 1964.
2. Marill, T. and Roberts, L.G., "Toward a Co-operative Network of Time-shared Computers", *Proc. AFIPS FJCC*, 29, 425-431, 1966.
3. Roberts, L.G. and Wessler, B.D., "Computer Network Development to Achieve Resource Sharing", *Proc. AFIPS SJCC*, 36, 543-549, 1970.

ARQ: An abbreviation for "automatic request for repetition", an error detection and correction technique.

ARRAY: A linearly ordered set of data items, often used synonymously with *matrix*.

ARRAY PROCESSING: A technique of processing on multiple data items (held in an *array*) simultaneously. The term is often used in the context of processing being carried out by a special piece of hardware, known as an *array processor*.

ARRAY PROCESSOR: A device for performing *array processing*.

ARTIFICIAL INTELLIGENCE: A branch of computer science concerned with the design of computer systems so that they have attributes associated with intelligence such as games playing.