

A Dictionary of
Computing



Many entries in this dictionary have recommended web links. When you see the above symbol at the end of an entry go to the dictionary's web page at <http://www.oup.com/uk/reference/resources/computing>, click on **Web links** in the Resources section and locate the entry in the alphabetical list, then click straight through to the relevant websites.

A Dictionary of
Computing

SIXTH EDITION

OXFORD
UNIVERSITY PRESS

ENGI
016487710

OXFORD

UNIVERSITY PRESS

Great Clarendon Street, Oxford OX2 6DP

Oxford University Press is a department of the University of Oxford.
It furthers the University's objective of excellence in research, scholarship,
and education by publishing worldwide in

Oxford New York

Auckland Cape Town Dar es Salaam Hong Kong Karachi

Kuala Lumpur Madrid Melbourne Mexico City Nairobi

New Delhi Shanghai Taipei Toronto

With offices in

Argentina Austria Brazil Chile Czech Republic France Greece

Guatemala Hungary Italy Japan Poland Portugal Singapore

South Korea Switzerland Thailand Turkey Ukraine Vietnam

Oxford is a registered trade mark of Oxford University Press
in the UK and in certain other countries

Published in the United States

by Oxford University Press Inc., New York

© Market House Books Ltd, 1983, 1986, 1990, 2004, 2008

The moral rights of the author have been asserted

Database right Oxford University Press (maker)

First edition 1983

Second edition 1986

Third edition 1990

Fourth edition 1996

Fifth edition 2004

Sixth edition 2008

All rights reserved. No part of this publication may be reproduced,
stored in a retrieval system, or transmitted in any form or by any means,
without the prior permission in writing of Oxford University Press,
or as expressly permitted by law, or under terms agreed with the appropriate
reprographics rights organization. Enquiries concerning reproduction
outside the scope of the above should be sent to the Rights Department,
Oxford University Press, at the address above

You must not circulate this book in any other binding or cover
and you must impose this same condition on any acquirer

British Library Cataloguing in Publication Data

Data available

Library of Congress Cataloging in Publication Data

Data available

Typeset by Market House Books Ltd.

Printed in Great Britain

on acid-free paper by

Clays Ltd, St Ives plc

ISBN 978-0-19-923401-1

10 9 8 7 6 5 4 3 2 1

encapsulation 1. See OBJECT, INFORMATION HIDING. 2. See INTERNETWORKING.

encoder 1. The means by which an encoding process is effected (see CODE). It may be implemented in hardware or software, the process being algorithmic in nature. 2. A logic circuit, usually an integrated circuit, that generates a unique n -bit binary word, indicating which of its 2^n input lines is active, i.e. at logic 1. A keyboard encoder, for example, may be required to generate a unique binary code indicating which key on the keyboard has been pressed.

If two or more of the device inputs can be active simultaneously then a priority encoder is required, which usually encodes only the highest-order data input.

encoding 1. The transformation of a message into an encoded form. See CODE. 2. The representation of symbols in some alphabet by symbols or strings of symbols in some other alphabet. A common example is binary encoding.

encryption The processing of a message by a sender in order to render it unintelligible to other than authorized recipients. See also CRYPTOGRAPHY.

end-around-carry A type of carry that is required when a radix-minus-one complement representation of integers is used and two integers so represented are summed. If a carry is generated at the most significant end of the two numbers, then this carry must be added to the digit at the least significant end of the result to give the radix-minus-one complement representation of the sum.

end-around shift Another name for circular shift. See SHIFT.

endomorphism A homomorphism from an algebra to itself.

endorder traversal Another name for postorder traversal.

end-to-end control Control acting between two applications that are communicating across one or more networks. Data traversing a network must be protected against a number of possible forms of error. An individual unit of data may be corrupted, lost completely, or delivered more than once; successive units of data may be delivered in the wrong order. The sender may attempt to transmit data more quickly than

the receiver can receive it, or some part of the route can actually carry it. Within the network, the transmitter and receiver at the two ends of an individual link will cooperate to control some of these errors, and this is known as point-to-point control. However, it may also be necessary to require the applications at each end of the overall connection to cooperate in protecting against other forms of error, and this is end-to-end control.

end-to-end encryption The transfer of an encrypted message across a system without intermediate stages of decryption and reencryption. Compare LINK ENCRYPTION.

energizer A hardware or software mechanism that is used as an aid in testing the behavior of a subsystem. The intention is that the energizer should drive the subsystem in a way that simulates its actual application, and should at the same time analyze the responses from the subsystem in order to detect any erroneous behavior.

engine 1. A component of a software system that handles a specific aspect of processing. Engines thus form part, or possibly the whole, of an application's back end. For example, a database engine provides database services other parts of the system; a search engine provides searching services; and so on. Engines can be shared among several applications – for example, through the client/server model – and are often bought from a third-party specialist supplier. 2. Another name for back end.

engineering of computer-based systems (ECBS) A narrower form of systems engineering that addresses only those systems which are computer-based. This is a very important subset of systems engineering, but is still very much wider than software engineering. It encourages a holistic view of a system, its environment, and its components. Often the components of computer-based systems are also (lower-level) computer-based systems. ECBS pays great attention to addressing nonfunctional properties of a proposed design, and the need for give-and-take between different design options prior to committing to an implementation. Give-and-take is seen as a crucial aspect of such developments because it is here that competing requirements and

e

informatics The use of computers to maintain and analyze large amounts of data. The term is applied particularly with respect to databases of chemical compounds or reactions (**chemoinformatics**) or databases in biochemistry or cell biology (**bioinformatics**).

information Generally, information is whatever is capable of causing a human mind to change its opinion about the current state of the real world. Formally, and especially in science and engineering, information is whatever contributes to a reduction in the uncertainty of the state of a system; in this case, uncertainty is usually expressed in an objectively measurable form. Commonly, this is done by means of Shannon's *entropy. Nevertheless, this formula for uncertainty involves probabilities, and these may well have to be subjective. If that is so, the formal measurement must be qualified as depending on subjective probabilities, and "uncertainty" must be replaced by "opinion, or personal estimate, of uncertainty".

Information must be distinguished from any medium that is capable of carrying it. A physical medium (such as a magnetic disk) may carry a logical medium (data, such as binary or text symbols). The information content of any physical objects, or logical data, cannot be measured or discussed until it is known what range of possibilities existed before and after they were received. The information lies in the reduction in uncertainty resulting from the receipt of the objects or the data, and not in the size or complexity of the objects or data themselves. Questions of the form, function, and semantic import of data are only relevant to information inasmuch as they contribute to the reduction of uncertainty. If an identical memorandum is received twice, it does not convey twice the information that its first occurrence conveyed: the second occurrence conveys no information at all, unless, by prior agreement, the number of occurrences is itself to be regarded as significant.

Information has ramifications in security, politics, culture, and the economy, as well as in science and engineering. The extent to which information is used as an economic commodity is one of the defining characteristics of the "post-industrial" society, hence the phrase "the information society".

information destination See SHANNON'S MODEL.

information engineering The engineering approach applied to *information systems. The term shows considerable variation in scope. At its broadest, it refers to the engineering discipline covering a spectrum from *software engineering and *systems engineering to device-level electronics. At its most limited (but perhaps best known), it is the name of a specific proprietary method for the development of organizational information systems, primarily associated with James Martin; this method begins with *enterprise modeling and carries through to the generation of program code, and a number of software toolsets are available for its support.

information hiding A principle, used when developing an overall *program structure, that each component of a program should **encapsulate** or hide a single design decision. The principle was first expounded by David Parnas, who advocated an approach to program development in which a list is prepared of design decisions that are particularly difficult or likely to change; individual components, known as **modules**, are then defined so that each encapsulates one such decision. The interface to each module is defined in such a way as to reveal as little as possible about its inner workings.

This approach leads to modules that are readily understood and can be developed independently. More important, it also leads to programs that are easy to change, with many desired changes requiring modification of only the inner workings of a single module.

information management system A term sometimes used synonymously with *database management system (DBMS) although normally used in a more general sense. The term has no widely accepted definition and thus can be applied to any system of software that facilitates the storage, organization, and retrieval of information within a computer system, without the implication that it need have all the essential characteristics of a DBMS. The information held may include sound fragments, images, and video sequences in addition to the usual textual and numerical information. These newer forms of computer-held information are sometimes argued as being a defining

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.