.201 **Information technology** (IT) is the application of computers and telecommunications equipment to store, retrieve, transmit and manipulate data,[1] often in the context of a business or other enterprise.[2] The term is commonly used as a synonym for computers and computer networks, but it also encompasses other information distribution technologies such as television and telephones. Several industries are associated with information technology, such as computer hardware, software, electronics, semiconductors, internet, telecom equipment, e-commerce and computer services.[3]

In a business context, the Information Technology Association of America has defined information technology as "the study, design, development, application, implementation, support or management of computer-based information systems".[4] The responsibilities of those working in the field include network administration, software development and installation, and the planning and management of an organisation's technology life cycle, by which hardware and software is maintained, upgraded, and replaced.

Humans have been storing, retrieving, manipulating and communicating information since the Sumerians in Mesopotamia developed writing in about 3000 BC,[5] but the term "information technology" in its modern sense first appeared in a 1958 article published in the *Harvard Business Review*; authors Harold J. Leavitt and Thomas L. Whisler commented that "the new technology does not yet have a single established name. We shall call it information technology (IT)."[6] Based on the storage and processing technologies employed, it is possible to distinguish four distinct phases of IT development: pre-mechanical (3000 BC – 1450 AD), mechanical (1450–1840), electromechanical (1840–1940) and electronic (1940–present).[5] This article focuses on the most recent period (electronic), which began in about 1940.

History of computers

Main article: History of computing hardware

Devices have been used to aid computation for thousands of years, probably initially in the form of a tally stick.[7] The Antikythera mechanism, dating from about the beginning of the first century BC, is generally considered to be the earliest known mechanical analog computer; it is also the earliest known geared mechanism.[8] Comparable geared devices did not emerge in Europe until the 16th century,[9] and it was not until 1645 that the first mechanical calculator capable of performing the four basic arithmetical operations was developed.[10]

Electronic computers, using either relays or valves, began to appear in the early 1940s. The electromechanical Zuse Z3, completed in 1941, was the world's first programmable computer, and by modern standards one of the first machines that could be considered a complete computing machine. Colossus, developed during the Second World War to decrypt German messages was the first electronic digital computer. Although it was programmable, it was not general-purpose, being designed to perform only a single task. It also lacked the ability to store its program in memory. Instead, programming was carried out using plugs and switches to alter the internal wiring.[11] The first recognisably modern electronic digital stored-program computer was the Manchester Small-Scale Experimental Machine (SSEM), which ran its first program on 21 June 1948.[12]

[edit] Data storage

Main article: Data storage device

Early electronic computers such as Colossus made use of punched tape, a long strip of paper on which data was represented by a series of holes, a technology now obsolete.[13] Electronic data storage, which is used in modern computers, dates from the Second World War, when a form of delay line memory was developed to remove the clutter from radar signals, the first practical application of which was the mercury delay line.[14] The first random-access digital storage device was the Williams tube, based on a standard cathode ray tube,[15] but the information stored in it and delay line memory was volatile in that it had to be continuously refreshed, and thus was lost once power was removed. The earliest form of non-volatile computer storage was the magnetic drum, invented in 1932[16] and used in the Ferranti Mark 1, the world's first commercially available general-purpose electronic computer.[17]

Most digital data today is still stored magnetically on devices such as hard disk drives, or optically on media such as CD-ROMs.[18] It has been estimated that the worldwide capacity to store information on electronic devices grew from less than 3 exabytes in 1986 to 295 exabytes in 2007,[19] doubling roughly every 3 years.[20]

[edit] Databases

Main article: Database management system

Database management systems emerged in the 1960s to address the problem of storing and retrieving large amounts of data accurately and quickly. One of the earliest such systems was IBM's Information Management System (IMS),[21] which is still widely deployed more than 40 years later.[22] IMS stores data hierarchically,[21] but in the 1970s Ted Codd proposed an alternative relational storage model based on set theory and predicate logic and the familiar concepts of tables, rows and columns. The first commercially available relational database management system (RDBMS) was available from Oracle in 1980.[23]

All database management systems consist of a number of components that together allow the data they store to be accessed simultaneously by many users while maintaining its integrity. A characteristic of all databases is that the structure of the data they contain is defined and stored separately from the data itself, in a database schema.[21]

The extensible markup language (XML) has become a popular format for data representation in recent years. Although XML data can be stored in normal file systems, it is commonly held in relational databases to take advantage of their "robust implementation verified by years of both theoretical and practical effort".[24] As an evolution of the Standard Generalized Markup Language (SGML), XML's text-based structure offers the advantage of being both machine and human-readable.[25]

[edit] Data retrieval

The relational database model introduced a programming-language independent Structured Query Language (SQL), based on relational algebra.[23]

The terms "data" and "information" are not synonymous. Anything stored is data, but it only becomes information when it is organised and presented meaningfully.[26] Most of the world's digital data is unstructured, and stored in a variety of different physical formats[27][a] even within a single organization. Data warehouses began to be developed in the 1980s to integrate these disparate stores. They typically contain data extracted from various sources, including external sources such as the Internet, organised in such a way as to facilitate decision support systems (DSS).[28]

[edit] Data transmission

Data transmission has three aspects: transmission, propagation, and reception.[29]

XML has been increasingly employed as a means of data interchange since the early 2000s,[30] particularly for machine-oriented interactions such as those involved in web-oriented protocols such as SOAP,[25] describing "data-in-transit rather than ... data-at-rest".[30] One of the challenges of such usage is converting data from relational databases into XML Document Object Model (DOM) structures.[31]

Data manipulation

Hilbert and Lopez[19] identify the exponential pace of technological change (a kind of Moore's law): machines' application-specific capacity to compute information per capita roughly doubled every 14 months between 1986 and 2007; the per capita capacity of the world's general-purpose computers doubled every 18 months during the same two decades; the global telecommunication capacity per capita doubled every 34 months; the world's storage capacity per capita required roughly 40 months to double (every 3 years); and per capita broadcast information has doubled every 12.3 years.[19]

Massive amounts of data are stored worldwide every day, but unless it can be analysed and presented effectively it essentially resides in what have been called data tombs: "data archives that are seldom visited".[32] To address that issue, the field of data mining – "the process of discovering interesting patterns and knowledge from large amounts of data"[33] – emerged in the late 1980s.[34]

Academic perspective

In an academic context, the Association for Computing Machinery defines IT as "undergraduate degree programs that prepare students to meet the computer technology needs of business, government, healthcare, schools, and other kinds of organizations .... IT specialists assume responsibility for selecting hardware and software products appropriate for an organization, integrating those products with organizational needs and infrastructure, and installing, customizing, and maintaining those applications for the organization's computer users."[35]

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