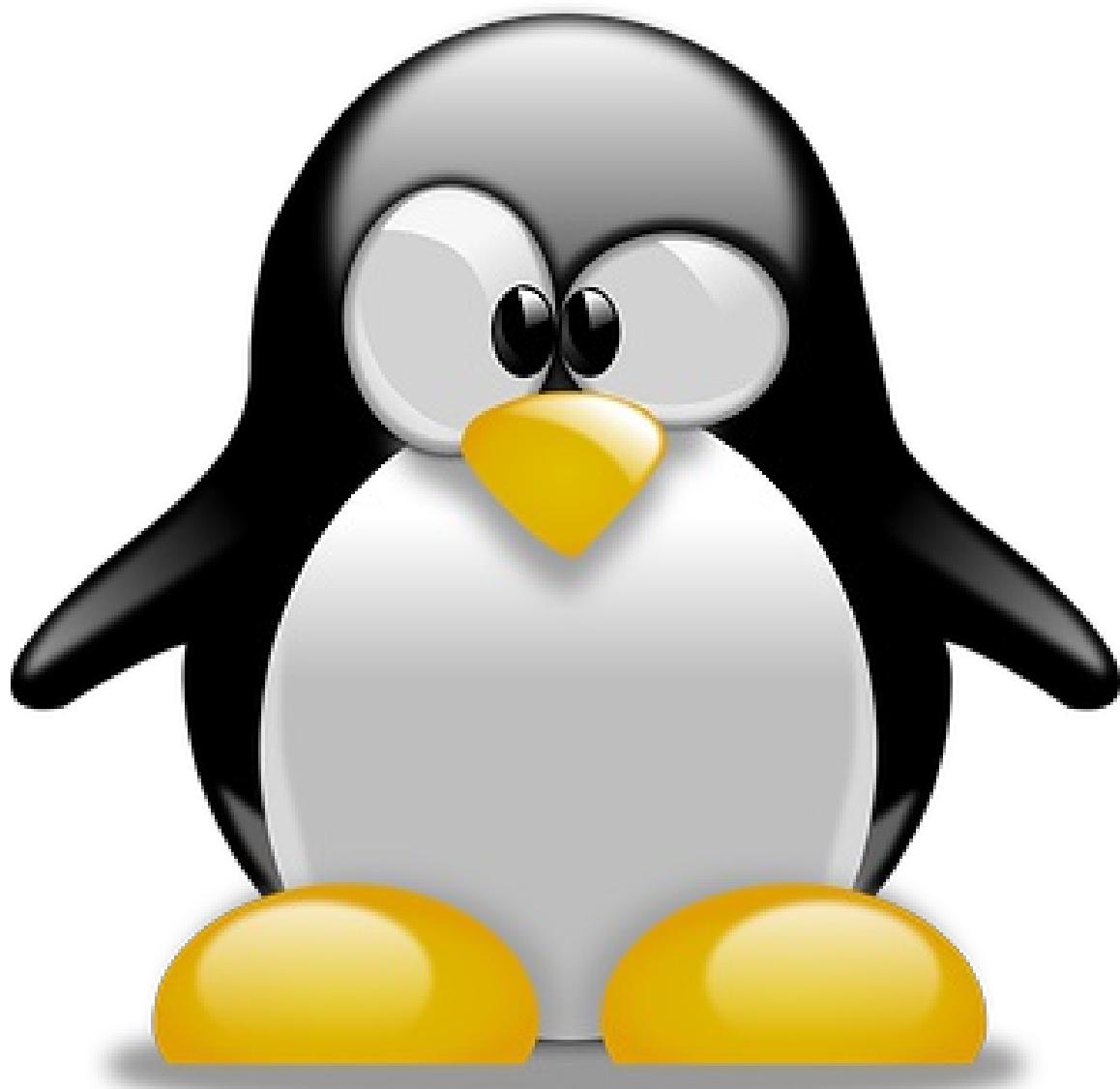


# Intro to OS: Web Scraper

Author: Jake Huber (jah383@case.edu)



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Readers%E2%80%93writers problem

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X Window System  
X86-64

## 2

2 (two) is a number, numeral and digit. It is the natural number following 1 and preceding 3. It is the smallest and only even prime number. Because it forms the basis of a duality, it has religious and spiritual significance in many cultures.



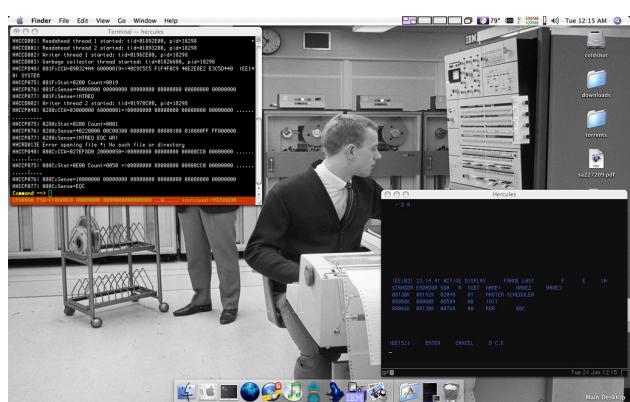
## 360 Model 67

The IBM System/360 Model 67 (S/360-67) was an important IBM mainframe model in the late 1960s. Unlike the rest of the S/360 series, it included features to facilitate time-sharing applications, notably a Dynamic Address Translation unit, the "DAT box", to support virtual memory, 32-bit addressing and the 2846 Channel Controller to allow sharing channels between processors. The S/360-67 was otherwise compatible with the rest of the S/360 series.



## 360 and successors

Disk Operating System/360, also DOS/360, or simply DOS, is the discontinued first member of a sequence of operating systems for IBM System/360, System/370 and later mainframes. It was announced by IBM on the last day of 1964, and it was first delivered in June 1966. In its time, DOS/360 was the most widely used operating system in the world.



## 80286

The 8086 (also called iAPX 86) is a 16-bit microprocessor chip designed by Intel between early 1976 and June 8, 1978, when it was released. The Intel 8088, released July 1, 1979, is a slightly modified chip with an external 8-bit data bus (allowing the use of cheaper and fewer supporting ICs), and is notable as the processor used in the original IBM PC design.



## 94 IBSYS

IBSYS is the discontinued tape-based operating system that IBM supplied with its IBM 709, IBM 7090 and IBM 7094 computers. A similar operating system (but with several significant differences), also called IBSYS, was provided with IBM 7040 and IBM 7044 computers. IBSYS was based on FORTRAN Monitor System (FMS) and (more likely) Bell Labs' "BESYS" rather than the SHARE Operating System.



# American Airlines

American Airlines is a major US-based airline headquartered in Fort Worth, Texas, within the Dallas-Fort Worth metroplex. It is the largest airline in the world when measured by fleet size, scheduled passengers carried, and revenue passenger mile. American, together with its regional partners and affiliates, operates an extensive international and domestic network with almost 6,800 flights per day to nearly 350 destinations in more than 50 countries. American Airlines is a founding member of the Oneworld alliance, the third-largest airline alliance in the world. Regional service is operated by independent and subsidiary carriers under the brand name American Eagle. American Airlines and American Eagle operate out of 10 hubs, with Dallas/Fort Worth (DFW) being its largest. The airline handles more than 200 million passengers annually with an average of more than 500,000 passengers daily. As of 2021, the company employs 123,400 staff members.



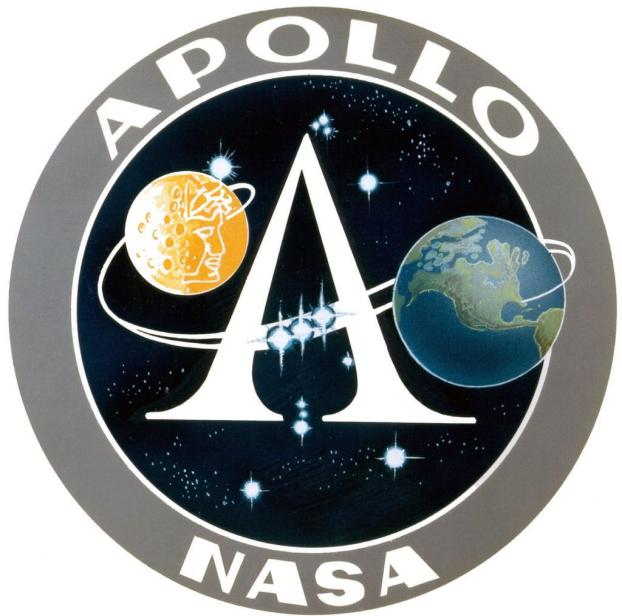
# Android (operating system)

Android is a mobile operating system based on a modified version of the Linux kernel and other open-source software, designed primarily for touchscreen mobile devices such as smartphones and tablets. Android is developed by a consortium of developers known as the Open Handset Alliance, though its most widely used version is primarily developed by Google. It was unveiled in November 2007, with the first commercial Android device, the HTC Dream, being launched in September 2008.



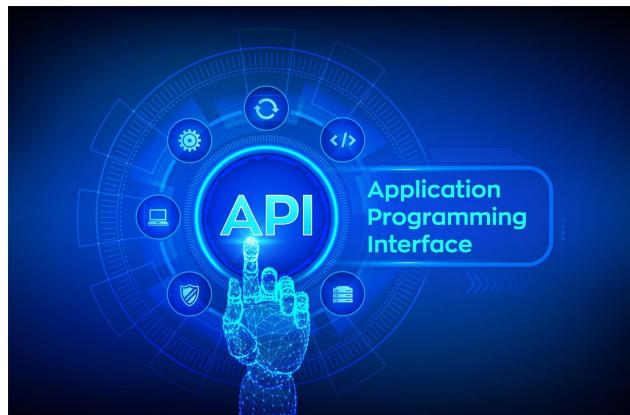
## Apollo program

The Apollo program, also known as Project Apollo, was the third United States human spaceflight program carried out by the National Aeronautics and Space Administration (NASA), which succeeded in preparing and landing the first humans on the Moon from 1968 to 1972. It was first conceived in 1960 during President Dwight D. Eisenhower's administration as a three-person spacecraft to follow the one-person Project Mercury, which put the first Americans in space. Apollo was later dedicated to President John F. Kennedy's national goal for the 1960s of "landing a man on the Moon and returning him safely to the Earth" in an address to Congress on May 25, 1961. It was the third US human spaceflight program to fly, preceded by the two-person Project Gemini conceived in 1961 to extend spaceflight capability in support of Apollo.



## Application programming interface

An application programming interface (API) is a way for two or more computer programs to communicate with each other. It is a type of software interface, offering a service to other pieces of software. A document or standard that describes how to build or use such a connection or interface is called an API specification. A computer system that meets this standard is said to implement or expose an API. The term API may refer either to the specification or to the implementation.



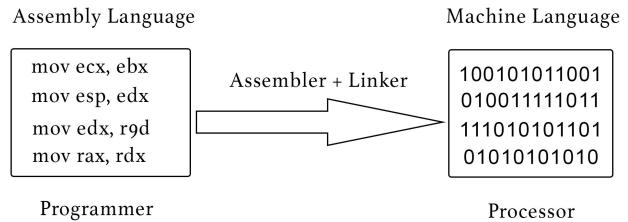
# Architecture

Architecture is the art and technique of designing and building, as distinguished from the skills associated with construction. It is both the process and the product of sketching, conceiving, planning, designing, and constructing buildings or other structures. The term comes from Latin *architectura*; from Ancient Greek ?????????? (arkhitēktōn) 'architect'; from ????- (arkhi-) 'chief', and ?????? (tēktōn) 'creator'. Architectural works, in the material form of buildings, are often perceived as cultural symbols and as works of art. Historical civilizations are often identified with their surviving architectural achievements. The practice, which began in the prehistoric era, has been used as a way of expressing culture for civilizations on all seven continents. For this reason, architecture is considered to be a form of art. Texts on architecture have been written since ancient times. The earliest surviving text on architectural theories is the 1st century AD treatise *De architectura* by the Roman architect Vitruvius, according to whom a good building embodies *firmitas*, *utilitas*, and *venustas* (durability, utility, and beauty). Centuries later, Leon Battista Alberti developed his ideas further, seeing beauty as an objective quality of buildings to be found in their proportions. Giorgio Vasari wrote *Lives of the Most Excellent Painters, Sculptors, and Architects* and put forward the idea of style in the Western arts in the 16th century. In the 19th century, Louis Sullivan declared that "form follows function". "Function" began to replace the classical "utility" and was understood to include not only practical but also aesthetic, psychological and cultural dimensions. The idea of sustainable architecture was introduced in the late 20th century.



# Assembly language

In computer programming, assembly language (or assembler language, or symbolic machine code), often referred to simply as Assembly and commonly abbreviated as ASM or asm, is any low-level programming language with a very strong correspondence between the instructions in the language and the architecture's machine code instructions. Assembly language usually has one statement per machine instruction (1:1), but constants, comments, assembler directives, symbolic labels of, e.g., memory locations, registers, and macros are generally also supported.



# Atlas (computer)

The Atlas Computer was one of the world's first supercomputers, in use from 1962 (when it was claimed to be the most powerful computer in the world) to 1972. Atlas' capacity promoted the saying that when it went offline, half of the United Kingdom's computer capacity was lost. It is notable for being the first machine with virtual memory (at that time referred to as 'one-level store') using paging techniques; this approach quickly spread, and is now ubiquitous.



# Atlas Supervisor

The Atlas Supervisor was the program which managed the allocation of processing resources of Manchester University's Atlas Computer so that the machine was able to act on many tasks and user programs concurrently.



## B (programming language)

B is a programming language developed at Bell Labs circa 1969 by Ken Thompson and Dennis Ritchie.

```
File Edit Selection Find View Goto Tools Project Preferences Help
style.css
1
2
3 .hello_World {
4
5     _In : "different" ;
6     _Programming : "language" ;
7
8 }
```

## B5000

The Burroughs Large Systems Group produced a family of large 48-bit mainframes using stack machine instruction sets with dense syllables. The first machine in the family was the B5000 in 1961. It was optimized for compiling ALGOL 60 programs extremely well, using single-pass compilers. It evolved into the B5500. Subsequent major redesigns include the B6500/B6700 line and its successors, as well as the separate B8500 line.



## Backward compatible

Backward compatibility (sometimes known as backwards compatibility) is a property of an operating system, product, or technology that allows for interoperability with an older legacy system, or with input designed for such a system, especially in telecommunications and computing.



## BareMetal

BareMetal is an exokernel-based single address space operating system (OS) created by Return Infinity.



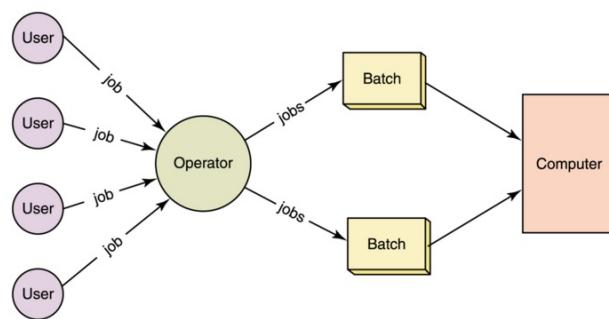
# Bash (Unix shell)

Bash is a Unix shell and command language written by Brian Fox for the GNU Project as a free software replacement for the Bourne shell. First released in 1989, it has been used as the default login shell for most Linux distributions. Bash was one of the first programs Linus Torvalds ported to Linux, alongside GCC. A version is also available for Windows 10 and Windows 11 via the Windows Subsystem for Linux. It is also the default user shell in Solaris 11. Bash was also the default shell in versions of Apple macOS from 10.3 (originally, the default shell was tcsh) to the 2019 release of macOS Catalina, which changed the default shell to zsh, although Bash remains available as an alternative shell. Bash is a command processor that typically runs in a text window where the user types commands that cause actions. Bash can also read and execute commands from a file, called a shell script. Like most Unix shells, it supports filename globbing (wildcard matching), piping, here documents, command substitution, variables, and control structures for condition-testing and iteration. The keywords, syntax, dynamically scoped variables and other basic features of the language are all copied from sh. Other features, e.g., history, are copied from csh and ksh. Bash is a POSIX-compliant shell, but with a number of extensions.

```
Setting up libmpc3:amd64 (1.0.3-1) ...
Setting up binutils (2.26.1-ubuntu1-16.04.4) ...
Setting up libisl15:amd64 (0.16.1-1) ...
Setting up cpp-5 (5.4.0-6ubuntu1-16.04.4) ...
Setting up libcurl4 (4.5.3.1-ubuntu1) ...
Setting up libcurl1-0:amd64 (5.4.0-6ubuntu1-16.04.4) ...
Setting up libbitm1:amd64 (5.4.0-6ubuntu1-16.04.4) ...
Setting up libatomic1:amd64 (5.4.0-6ubuntu1-16.04.4) ...
Setting up libasan0:amd64 (5.4.0-6ubuntu1-16.04.4) ...
Setting up libtsan0:amd64 (5.4.0-6ubuntu1-16.04.4) ...
Setting up libubsan0:amd64 (5.4.0-6ubuntu1-16.04.4) ...
Setting up libgcc1:amd64 (5.4.0-6ubuntu1-16.04.4) ...
Setting up libgcc-5-dev:amd64 (5.4.0-6ubuntu1-16.04.4) ...
Setting up gcc-5 (5.4.0-6ubuntu1-16.04.4) ...
Setting up gcc-5-base:amd64 (5.4.0-6ubuntu1-16.04.4) ...
Setting up linux-headers-4.4.0-91.114:amd64 (4.4.0-91.114) ...
Setting up libcc1-0:dev:amd64 (2.23-0ubuntu9) ...
Setting up manpages-dev (4.04-2) ...
Processing triggers for libc-bin (2.23-0ubuntu7) ...
gcc -o hello hello.c
hello.c:3:1: warning: return type defaults to 'int' [-Wimplicit-int]
main() {
John@johns-pc:~$ ./hello
Hello World
John@johns-pc:~$
```

# Batch processing

Computerized batch processing is a method of running software programs called jobs in batches automatically. While users are required to submit the jobs, no other interaction by the user is required to process the batch. Batches may automatically be run at scheduled times as well as being run contingent on the availability of computer resources.



# Bell Labs

Nokia Bell Labs, originally named Bell Telephone Laboratories (1925?1984),



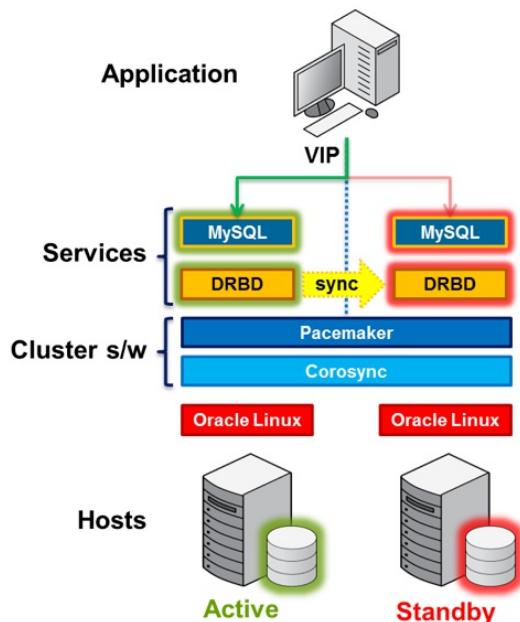
## Berkeley Software Distribution

The Berkeley Software Distribution or Berkeley Standard Distribution (BSD) is a discontinued operating system based on Research Unix, developed and distributed by the Computer Systems Research Group (CSRG) at the University of California, Berkeley. The term "BSD" commonly refers to its open-source descendants, including FreeBSD, OpenBSD, NetBSD, and DragonFly BSD.

# BSD

## Block device

In Unix-like operating systems, a device file or special file is an interface to a device driver that appears in a file system as if it were an ordinary file. There are also special files in DOS, OS/2, and Windows. These special files allow an application program to interact with a device by using its device driver via standard input/output system calls. Using standard system calls simplifies many programming tasks, and leads to consistent user-space I/O mechanisms regardless of device features and functions.



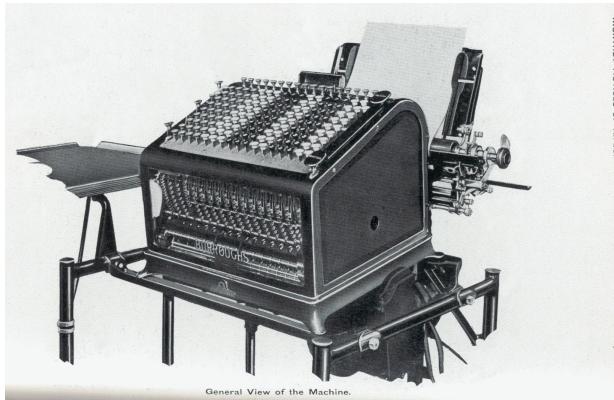
# Burroughs Corporation

The Burroughs Corporation was a major American manufacturer of business equipment. The company was founded in 1886 as the American Arithmometer Company. In 1986, it merged with Sperry UNIVAC to form Unisys. The company's history paralleled many of the major developments in computing. At its start, it produced mechanical adding machines, and later moved into programmable ledgers and then computers. It was one of the largest producers of mainframe computers in the world, also producing related equipment including typewriters and printers.



## Burroughs MCP

The MCP (Master Control Program) is the operating system of the Burroughs small, medium and large systems, including the Unisys Clearpath/MCP systems.



## Burroughs large systems

The Burroughs Large Systems Group produced a family of large 48-bit mainframes using stack machine instruction sets with dense syllables. The first machine in the family was the B5000 in 1961. It was optimized for compiling ALGOL 60 programs extremely well, using single-pass compilers. It evolved into the B5500. Subsequent major redesigns include the B6500/B6700 line and its successors, as well as the separate B8500 line.

Another Burroughs Corporation First  
**A NEW ELECTRONIC COMPUTER THAT IS DIFFERENT**

Combines for the first time

- electronic data processing with magnetic disk character recognition
- high-speed production of hard copy accounting records
- Gives you up-to-the-instant vital management data for improved operational control

The NEW BURROUGHS B251 VISIBLE RECORD COMPUTER adds a new dimension to what already is one of the broadest lines of computer systems. Here is a computer with high-speed data processing, magnetic disk character recognition, and high-speed production of hard copy accounting records. This computer with a difference offers you these advantages: It provides management data for close control of operations and vital management data for improved operational control. It gives you up-to-the-instant vital management data that can be maintained easily by your personnel. Brings broad-area data processing within reach of more and more banks of all sizes. Call a Burroughs Systems Consultant or write Burroughs Corporation, Burroughs Building, 1000 Grand Avenue, Detroit, Michigan.

**B** **Burroughs Corporation**  
NEW DIMENSIONS IN DATA PROCESSING POWER

A black and white photograph showing a woman in a bright orange dress standing next to a large, light-colored computer system. The system consists of a main unit with a control panel, a paper tape reader/punch unit, and a large cabinet. The woman is looking towards the machine.

## Busy waiting

In computer science and software engineering, busy-waiting, busy-looping or spinning is a technique in which a process repeatedly checks to see if a condition is true, such as whether keyboard input or a lock is available. Spinning can also be used to generate an arbitrary time delay, a technique that was necessary on systems that lacked a method of waiting a specific length of time. Processor speeds vary greatly from computer to computer, especially as some processors are designed to dynamically adjust speed based on current workload. Consequently, spinning as a time-delay technique can produce unpredictable or even inconsistent results on different systems unless code is included to determine the time a processor takes to execute a "do nothing" loop, or the looping code explicitly checks a real-time clock.



## C (programming language)

C (pronounced ? like the letter c) is a general-purpose computer programming language. It was created in the 1970s by Dennis Ritchie, and remains very widely used and influential. By design, C's features cleanly reflect the capabilities of the targeted CPUs. It has found lasting use in operating systems, device drivers, protocol stacks, though decreasingly for application software. C is commonly used on computer architectures that range from the largest supercomputers to the smallest microcontrollers and embedded systems.



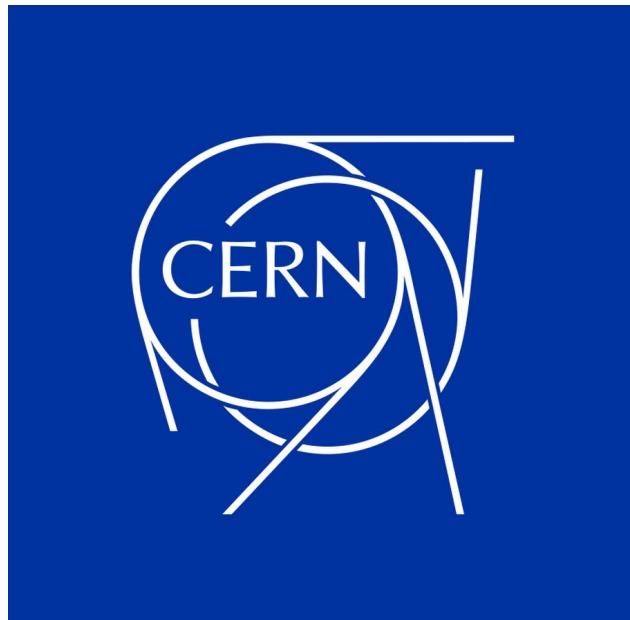
## CDC Kronos

Kronos is an operating system with time-sharing capabilities, written by Control Data Corporation in the 1970s. Kronos ran on the 60-bit CDC 6000 series mainframe computers and their successors. CDC replaced Kronos with the NOS operating system in the late 1970s, which were succeeded by the NOS/VE operating system in the mid-1980s. The MACE operating system and APEX were forerunners to KRONOS. It was written by Control Data systems programmer Greg Mansfield, Dave Cahlander, Bob Tate and three others.



## CERN httpd

CERN httpd (later also known as W3C httpd) is an early, now discontinued, web server (HTTP) daemon originally developed at CERN from 1990 onwards by Tim Berners-Lee, Ari Luotonen and Henrik Frystyk Nielsen. Implemented in C, it was the first web server software.



## CP-67

CP-67 was the control program portion of CP/CMS, a virtual machine operating system developed for the IBM System/360-67 by IBM's Cambridge Scientific Center. It was a reimplementation of their earlier research system CP-40, which ran on a one-off customized S/360-40. CP-67 was later reimplemented (again) as CP-370, which IBM released as VM/370 in 1972, when virtual memory was added to the System/370 series. Details on the development and circumstances of CP-67 can be found in the article History of CP/CMS.

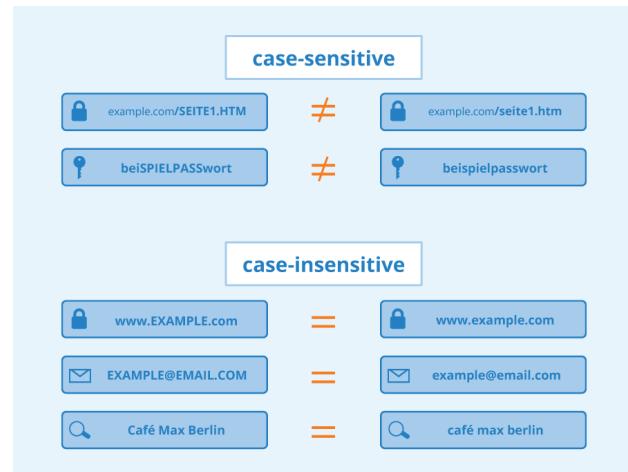


## Call stack

In computer science, a call stack is a stack data structure that stores information about the active subroutines of a computer program. This kind of stack is also known as an execution stack, program stack, control stack, run-time stack, or machine stack, and is often shortened to just "the stack". Although maintenance of the call stack is important for the proper functioning of most software, the details are normally hidden and automatic in high-level programming languages. Many computer instruction sets provide special instructions for manipulating stacks.

# Case sensitivity

In computers, case sensitivity defines whether uppercase and lowercase letters are treated as distinct (case-sensitive) or equivalent (case-insensitive). For instance, when users interested in learning about dogs search an e-book, "dog" and "Dog" are of the same significance to them. Thus, they request a case-insensitive search. But when they search an online encyclopedia for information about the United Nations, for example, or something with no ambiguity regarding capitalization and ambiguity between two or more terms cut down by capitalization, they may prefer a case-sensitive search.



# Central processing unit

A central processing unit (CPU), also called a central processor or main processor, is the most important processor in a given computer. Its electronic circuitry executes instructions of a computer program, such as arithmetic, logic, controlling, and input/output (I/O) operations. This role contrasts with that of external components, such as main memory and I/O circuitry, and specialized coprocessors such as graphics processing units (GPUs).



# ChromiumOS

ChromiumOS (formerly styled as Chromium OS) is a free and open-source operating system designed for running web applications and browsing the World Wide Web. It is the open-source version of ChromeOS, a Linux-based operating system made by Google.



# Classic Mac OS

Mac OS (originally System Software; retronym: Classic Mac OS) is the series of operating systems developed for the Macintosh family of personal computers by Apple Computer from 1984 to 2001, starting with System 1 and ending with Mac OS 9. The Macintosh operating system is credited with having popularized the graphical user interface concept. It was included with every Macintosh that was sold during the era in which it was developed, and many updates to the system software were done in conjunction with the introduction of new Macintosh systems.



## Classified information

Classified information is material that a government body deems to be sensitive information that must be protected. Access is restricted by law or regulation to particular groups of people with the necessary security clearance and need to know, and mishandling of the material can incur criminal penalties.



## Command-line interface

A command-line interpreter or command-line processor uses a command-line interface (CLI) to receive commands from a user in the form of lines of text. This provides a means of setting parameters for the environment, invoking executables and providing information to them as to what actions they are to perform. In some cases the invocation is conditional based on conditions established by the user or previous executables. Such access was first provided by computer terminals starting in the mid-1960s. This provided an interactive environment not available with punched cards or other input methods.

```
Command Prompt
A Last Access
W Last Written
/l Last modified
/n Long display name
/nw Long display name with no separator
/nx Long display name with no separator and no trailing dot
/nxw Long display name with no separator and no trailing dot and no trailing dot
/4 Displays four-digit years

Switches may be preset in the DIRCMD environment variable. Override
preset switches by prefixing any switch with -<hyphen>--for example, -/w.

C:\Users\Anujkumar\Downloads>net
The syntax of this command is:

NET [ ACCOUNTS | COMPUTER | CONFIG | CONTINUE | FILE | GROUP | HELP |
      LISTSPEC | LOCALGROUP | PAUSE | SESSION | SHARE | START | STOP |
      STATISTICS | TIME | USE | USER | VIEW ]

C:\Users\Anujkumar\Downloads>net user
The user name could not be found.
More help is available by typing "NET HELPMSG 2221".

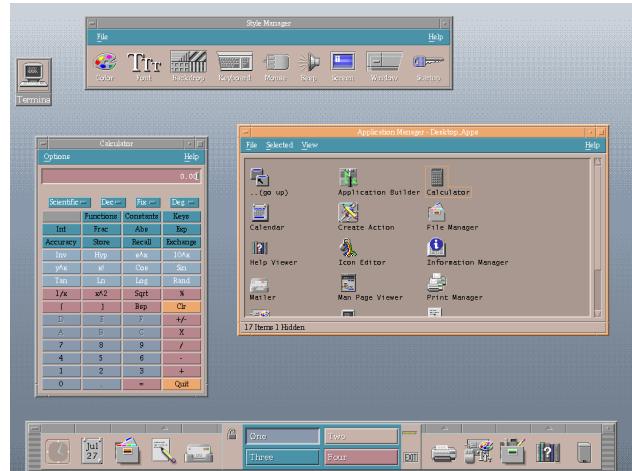
C:\Users\Anujkumar\Downloads>net user
User accounts for >>>ANUJ

Administrator          Anujkumar           Guest
The command completed successfully.

C:\Users\Anujkumar\Downloads>
```

# Common Desktop Environment

The Common Desktop Environment (CDE) is a desktop environment for Unix and OpenVMS, based on the Motif widget toolkit. It was part of the UNIX 98 Workstation Product Standard, and was for a long time the Unix desktop associated with commercial Unix workstations. It helped to influence early implementations of successor projects such as KDE and GNOME desktop environment, which largely replaced CDE following the turn of the century.



# Common Open Software Environment

The Common Open Software Environment (COSE) was an initiative formed in March 1993 by the major Unix vendors of the time to create open, unified operating system (OS) standards.



# Compact disc

The compact disc (CD) is a digital optical disc data storage format that was co-developed by Philips and Sony to store and play digital audio recordings. In August 1982, the first compact disc was manufactured. It was then released in October 1982 in Japan and branded as Digital Audio Compact Disc.



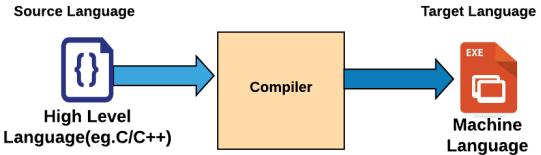
# Comparison of operating systems

These tables provide a comparison of operating systems, of computer devices, as listing general and technical information for a number of widely used and currently available PC or handheld (including smartphone and tablet computer) operating systems. The article "Usage share of operating systems" provides a broader, and more general, comparison of operating systems that includes servers, mainframes and supercomputers.

| Which solution is right for you?   |                  |                  |                          |                            |                             |                                     |
|--|------------------|------------------|--------------------------|----------------------------|-----------------------------|-------------------------------------|
|  | Norton 360       | Norton AntiVirus | Norton Internet Security | Norton Confidential        | Norton Ghost                | Norton Safe & Secure                |
|  | Norton Utilities | Norton Privacy   | Norton Systemworks       | Norton Systemworks Premium | Norton Systemworks Business | Norton Systemworks Business Premium |
| <b>PC Security</b>   |                  |                  |                          |                            |                             |                                     |
| Connects securely to any wireless hotspot                                | ✓                |                  | ✓                        |                            |                             |                                     |
| Blocks hackers from accessing your computer                              | ✓                |                  | ✓                        |                            |                             |                                     |
| Prevents unknown threats from entering your PC                           | ✓                |                  | ✓                        |                            |                             |                                     |
| Confidentially exchange your documents using email and Instant Messaging | ✓                | ✓                | ✓                        |                            | ✓                           | ✓                                   |
| Removes viruses from email   | ✓                | ✓                | ✓                        |                            | ✓                           | ✓                                   |
| Blocks Internet worms at point of entry                                  | ✓                | ✓                | ✓                        |                            | ✓                           | ✓                                   |
| You can surf, read news and play games online without worry              | ✓                | ✓                | ✓                        |                            | ✓                           | ✓                                   |
| Stops spyware from tracking you online                                   | ✓                | ✓                | ✓                        |                            | ✓                           | ✓                                   |
| Blocks spyware from hijacking your computer                              | ✓                | ✓                | ✓                        |                            | ✓                           | ✓                                   |
| <b>Online Transaction Security</b>                                       |                  |                  |                          |                            |                             |                                     |
| Bank, shop and invest online with confidence                             | ✓                |                  | ✓                        | ✓                          |                             |                                     |
| Guards against online identity theft                                     | ✓                |                  | ✓                        | ✓                          |                             |                                     |
| Inspects Web sites to make sure they're not fakes                        | ✓                |                  | ✓                        | ✓                          |                             |                                     |
| Encrypts all online passwords so they can't be stolen                    | ✓                |                  | ✓                        | ✓                          |                             |                                     |
| Enables safe download of photos, music and software                      | ✓                | ✓                | ✓                        |                            | ✓                           | ✓                                   |
| Removes dangerous threats from files being downloaded                    | ✓                | ✓                | ✓                        |                            | ✓                           | ✓                                   |
| Blocks suspicious programs   | ✓                |                  | ✓                        |                            |                             |                                     |
| Allows only authorised programs to connect to Internet                   | ✓                |                  | ✓                        |                            |                             |                                     |
| <b>Backup and Restore</b>  |                  |                  |                          |                            |                             |                                     |
| Backs up data you care about   | ✓                |                  |                          | ✓                          | ✓                           | ✓                                   |
| Protects your valuable files from computer disasters                     | ✓                |                  |                          | ✓                          | ✓                           | ✓                                   |
| Restores damaged or deleted files and folders                            | ✓                |                  |                          | ✓                          | ✓                           | ✓                                   |
| <b>PC Tune-up</b>  |                  |                  |                          |                            |                             |                                     |
| Tunes up your PC and optimises the computer                              | ✓                |                  |                          |                            | ✓                           | ✓                                   |
| Finds and fixes problems that slow your computer                         | ✓                |                  |                          |                            | ✓                           | ✓                                   |
| Removes unwanted Internet clutter and temporary files                    | ✓                |                  |                          |                            | ✓                           | ✓                                   |
| Restores your system after failures                                      |                  |                  |                          |                            | ✓                           | ✓                                   |
| Creates an exact backup copy of everything on the PC                     |                  |                  |                          |                            | ✓                           | ✓                                   |
| Undoes a bad software installation                                       |                  |                  |                          |                            | ✓                           | ✓                                   |

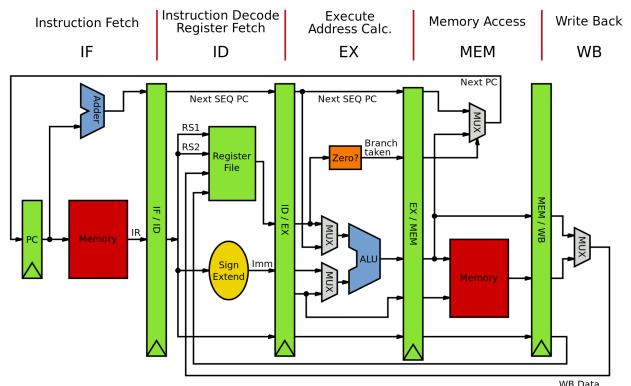
## Compiler

A computer is a machine that can be programmed to carry out sequences of arithmetic or logical operations (computation) automatically. Modern digital electronic computers can perform generic sets of operations known as programs. These programs enable computers to perform a wide range of tasks. A computer system is a nominally complete computer that includes the hardware, operating system (main software), and peripheral equipment needed and used for full operation. This term may also refer to a group of computers that are linked and function together, such as a computer network or computer cluster.



## Computer architecture

In computer engineering, computer architecture is a description of the structure of a computer system made from component parts. It can sometimes be a high-level description that ignores details of the implementation. At a more detailed level, the description may include the instruction set architecture design, microarchitecture design, logic design, and implementation.



## Computer file

A computer file is a computer resource for recording data in a computer storage device, primarily identified by its file name. Just as words can be written to paper, so can data be written to a computer file. Files can be shared with and transferred between computers and mobile devices via removable media, networks, or the Internet.



## Computer hardware

Computer hardware includes the physical parts of a computer, such as the case, central processing unit (CPU), random access memory (RAM), monitor, mouse, keyboard, computer data storage, graphics card, sound card, speakers and motherboard. By contrast, software is the set of instructions that can be stored and run by hardware. Hardware is so-termed because it is "hard" or rigid with respect to changes, whereas software is "soft" because it is easy to change.



## Computer monitor

A computer monitor is an output device that displays information in pictorial or textual form. A discrete monitor comprises a visual display, support electronics, power supply, housing, electrical connectors, and external user controls.



## Computer mouse

Computing is any goal-oriented activity requiring, benefiting from, or creating computing machinery. It includes the study and experimentation of algorithmic processes, and development of both hardware and software. Computing has scientific, engineering, mathematical, technological and social aspects. Major computing disciplines include computer engineering, computer science, cybersecurity, data science, information systems, information technology and software engineering. The term computing is also synonymous with counting and calculating. In earlier times, it was used in reference to the action performed by mechanical computing machines, and before that, to human computers.



## Computer multitasking

In computing, multitasking is the concurrent execution of multiple tasks (also known as processes) over a certain period of time. New tasks can interrupt already started ones before they finish, instead of waiting for them to end. As a result, a computer executes segments of multiple tasks in an interleaved manner, while the tasks share common processing resources such as central processing units (CPUs) and main memory. Multitasking automatically interrupts the running program, saving its state (partial results, memory contents and computer register contents) and loading the saved state of another program and transferring control to it. This "context switch" may be initiated at fixed time intervals (pre-emptive multitasking), or the running program may be coded to signal to the supervisory software when it can be interrupted (cooperative multitasking).



# Computer network

A computer network is a set of computers sharing resources located on or provided by network nodes. The computers use common communication protocols over digital interconnections to communicate with each other. These interconnections are made up of telecommunication network technologies, based on physically wired, optical, and wireless radio-frequency methods that may be arranged in a variety of network topologies.

# Computer program

A computer program is a sequence or set of instructions in a programming language for a computer to execute. Computer programs are one component of software, which also includes documentation and other intangible components. A computer program in its human-readable form is called source code. Source code needs another computer program to execute because computers can only execute their native machine instructions. Therefore, source code may be translated to machine instructions using the language's compiler. (Assembly language programs are translated using an assembler.) The resulting file is called an executable. Alternatively, source code may execute within the language's interpreter. If the executable is requested for execution, then the operating system loads it into memory and starts a process. The central processing unit will soon switch to this process so it can fetch, decode, and then execute each machine instruction. If the source code is requested for execution, then the operating system loads the corresponding interpreter into memory and starts a process. The interpreter then loads the source code into memory to translate and execute each statement. Running the source code is slower than running an executable. Moreover, the interpreter must be installed on the computer.



# Computer security

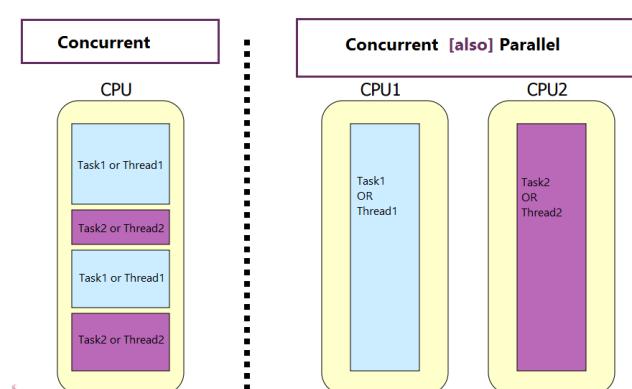
Computer security, cybersecurity (cyber security), or information technology security (IT security) is the protection of computer systems and networks from attack by malicious actors that may result in unauthorized information disclosure, theft of, or damage to hardware, software, or data, as well as from the disruption or misdirection of the services they provide. The field has become of significance due to the expanded reliance on computer systems, the Internet, and wireless network standards such as Bluetooth and Wi-Fi, and due to the growth of smart devices, including smartphones, televisions, and the various devices that constitute the Internet of things (IoT). Cybersecurity is one of the most significant challenges of the contemporary world, due to both the complexity of information systems and the societies they support. Security is of especially high importance for systems that govern large-scale systems with far-reaching physical effects, such as power distribution, elections, and finance.



# Concurrent computing

Concurrent computing is a form of computing in which several computations are executed concurrently?during overlapping time periods?instead of sequentially?with one completing before the next starts.

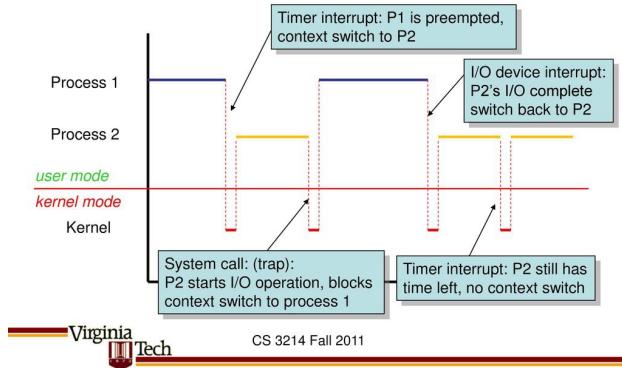
## Concurrency & Parallelism



# Context switch

In computing, a context switch is the process of storing the state of a process or thread, so that it can be restored and resume execution at a later point, and then restoring a different, previously saved, state. This allows multiple processes to share a single central processing unit (CPU), and is an essential feature of a multitasking operating system. In a traditional CPU, each process - a program in execution - utilizes the various CPU registers to store data and hold the current state of the running process. However, in a multitasking operating system, the operating system switches between processes or threads to allow the execution of multiple processes simultaneously. For every switch, the operating system must save the state of the currently running process, followed by loading the next process state, which will run on the CPU. This sequence of operations that stores the state of the running process and the loading of the following running process is called a context switch.

## A Context Switch Scenario



# Control Data Corporation

Control Data Corporation (CDC) was a mainframe and supercomputer firm. CDC was one of the nine major United States computer companies through most of the 1960s; the others were IBM, Burroughs Corporation, DEC, NCR, General Electric, Honeywell, RCA, and UNIVAC. CDC was well-known and highly regarded throughout the industry at the time. For most of the 1960s, Seymour Cray worked at CDC and developed a series of machines that were the fastest computers in the world by far, until Cray left the company to found Cray Research (CRI) in the 1970s. After several years of losses in the early 1980s, in 1988 CDC started to leave the computer manufacturing business and sell the related parts of the company, a process that was completed in 1992 with the creation of Control Data Systems, Inc. The remaining businesses of CDC currently operate as Ceridian.

# Control Data Corporation



<https://de.wikipedia.org/wiki/Datei:CDC-Logo.svg>

## Control flow

In computer science, control flow (or flow of control) is the order in which individual statements, instructions or function calls of an imperative program are executed or evaluated. The emphasis on explicit control flow distinguishes an imperative programming language from a declarative programming language.



## Cooperative multitasking

Cooperative multitasking, also known as non-preemptive multitasking, is a style of computer multitasking in which the operating system never initiates a context switch from a running process to another process. Instead, in order to run multiple applications concurrently, processes voluntarily yield control periodically or when idle or logically blocked. This type of multitasking is called cooperative because all programs must cooperate for the scheduling scheme to work.

## PREEMPTIVE MULTITASKING VERSUS COOPERATIVE MULTITASKING

### PREEMPTIVE MULTITASKING

Task in which a computer operating system uses to decide for how long to execute a task before giving another task to use the operating system

Interrupts applications and gives control to other processes outside the application's control

UNIX, Windows 95, Windows NT are some examples for operating systems with preemptive multitasking

### COOPERATIVE MULTITASKING

Type of computer multitasking in which the operating system never initiates a context switch from a running process to another process

Process scheduler never interrupts a process unexpectedly

Macintosh OS version 8.0-9.2.2 and Windows 3.x operating systems are based on cooperative multitasking

Visit [www.PEDIAA.com](http://www.PEDIAA.com)

## Crash (computing)

In computing, a crash, or system crash, occurs when a computer program such as a software application or an operating system stops functioning properly and exits. On some operating systems or individual applications, a crash reporting service will report the crash and any details relating to it (or give the user the option to do so), usually to the developer(s) of the application. If the program is a critical part of the operating system, the entire system may crash or hang, often resulting in a kernel panic or fatal system error.



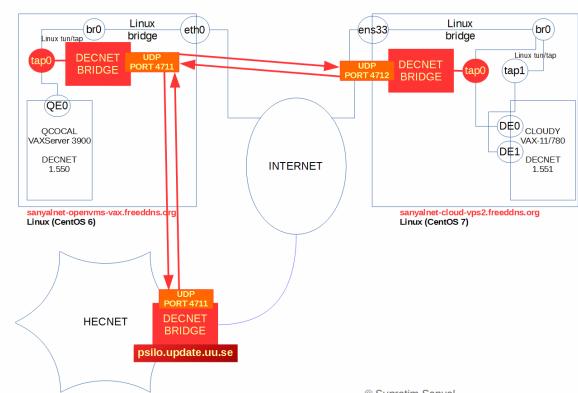
## Credit card

A credit card is a payment card issued to users (cardholders) to enable the cardholder to pay a merchant for goods and services based on the cardholder's accrued debt (i.e., promise to the card issuer to pay them for the amounts plus the other agreed charges). The card issuer (usually a bank or credit union) creates a revolving account and grants a line of credit to the cardholder, from which the cardholder can borrow money for payment to a merchant or as a cash advance. There are two credit card groups: consumer credit cards and business credit cards. Most cards are plastic, but some are metal cards (stainless steel, gold, palladium, titanium), and a few gemstone-encrusted metal cards. A regular credit card is different from a charge card, which requires the balance to be repaid in full each month or at the end of each statement cycle. In contrast, credit cards allow the consumers to build a continuing balance of debt, subject to interest being charged. A credit card differs from a charge card also in that a credit card typically involves a third-party entity that pays the seller and is reimbursed by the buyer, whereas a charge card simply defers payment by the buyer until a later date.



## DECnet

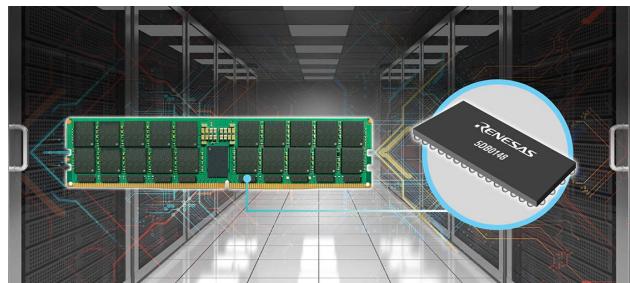
DECnet is a suite of network protocols created by Digital Equipment Corporation. Originally released in 1975 in order to connect two PDP-11 minicomputers, it evolved into one of the first peer-to-peer network architectures, thus transforming DEC into a networking powerhouse in the 1980s. Initially built with three layers, it later (1982) evolved into a seven-layer OSI-compliant networking protocol.



© Supratim Sanyal

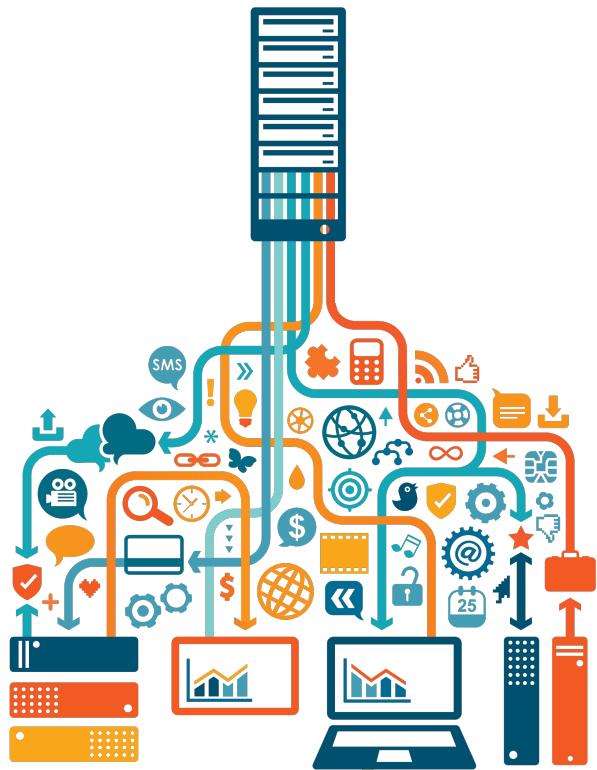
# Data buffer

In computer science, a data buffer (or just buffer) is a region of a memory used to temporarily store data while it is being moved from one place to another. Typically, the data is stored in a buffer as it is retrieved from an input device (such as a microphone) or just before it is sent to an output device (such as speakers). However, a buffer may be used when moving data between processes within a computer. This is comparable to buffers in telecommunication. Buffers can be implemented in a fixed memory location in hardware?or by using a virtual data buffer in software, pointing at a location in the physical memory. In all cases, the data stored in a data buffer are stored on a physical storage medium. A majority of buffers are implemented in software, which typically use the faster RAM to store temporary data, due to the much faster access time compared with hard disk drives. Buffers are typically used when there is a difference between the rate at which data is received and the rate at which it can be processed, or in the case that these rates are variable, for example in a printer spooler or in online video streaming. In the distributed computing environment, data buffer is often implemented in the form of burst buffer that provides distributed buffering service.



# Data storage

Data storage is the recording (storing) of information (data) in a storage medium. Handwriting, phonographic recording, magnetic tape, and optical discs are all examples of storage media. Biological molecules such as RNA and DNA are considered by some as data storage. Recording may be accomplished with virtually any form of energy. Electronic data storage requires electrical power to store and retrieve data.



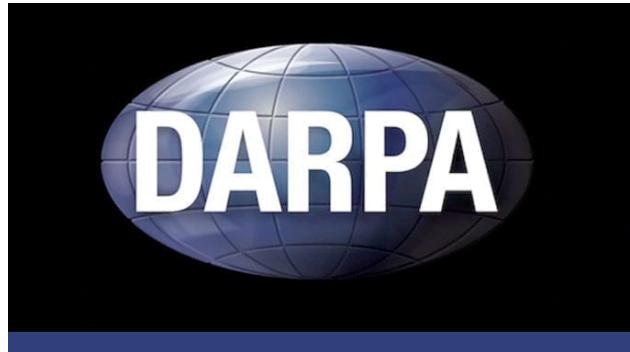
# Dave Cutler

David Neil Cutler Sr. (born March 13, 1942) is an American software engineer. He developed several computer operating systems, namely Microsoft's Windows NT, and Digital Equipment Corporation's RSX-11M, VAXELN, and VMS.



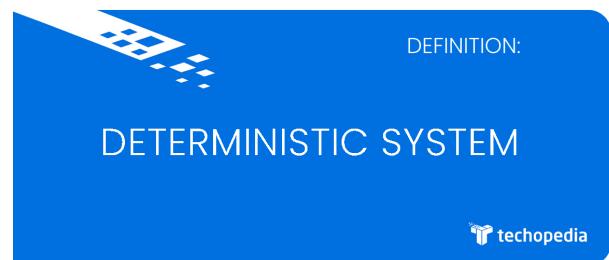
# Defense Advanced Research Projects Agency

The Defense Advanced Research Projects Agency (DARPA) is a research and development agency of the United States Department of Defense responsible for the development of emerging technologies for use by the military. Originally known as the Advanced Research Projects Agency (ARPA), the agency was created on February 7, 1958, by President Dwight D. Eisenhower in response to the Soviet launching of Sputnik 1 in 1957. By collaborating with academia, industry, and government partners, DARPA formulates and executes research and development projects to expand the frontiers of technology and science, often beyond immediate U.S. military requirements. The Economist has called DARPA the agency "that shaped the modern world," and pointed out that "Moderna's COVID-19 vaccine sits alongside weather satellites, GPS, drones, stealth technology, voice interfaces, the personal computer and the internet on the list of innovations for which DARPA can claim at least partial credit." Its track record of success has inspired governments around the world to launch similar research and development agencies. DARPA is independent of other military research and development and reports directly to senior Department of Defense management. DARPA comprises approximately 220 government employees in six technical offices, including nearly 100 program managers, who together oversee about 250 research and development programs. The name of the organization first changed from its founding name, ARPA, to DARPA, in March 1972, changing back to ARPA in February 1993, then reverted to DARPA in March 1996. The agency's current director, appointed in March 2021, is Stefanie Tompkins.



# Deterministic system

In mathematics, computer science and physics, a deterministic system is a system in which no randomness is involved in the development of future states of the system. A deterministic model will thus always produce the same output from a given starting condition or initial state.



# Device register

A Device Register is the view any device presents to a programmer.

A screenshot of a Microsoft Device Support registration page. It features a Microsoft logo and "Device Support" text. The form includes fields for "Country/Region" (with a dropdown placeholder "Select country") and "Product Family Type" (with a dropdown showing "Product Family Type" and options: Surface, XBOX, Band, Phones). Below these is a checkbox for accepting the Privacy Statement, a statement about handling personal data, and a "Register" button.

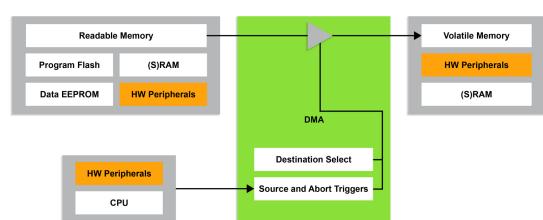
# Digital Equipment Corporation

Digital Equipment Corporation (DEC), using the trademark Digital, was a major American company in the computer industry from the 1960s to the 1990s. The company was co-founded by Ken Olsen and Harlan Anderson in 1957. Olsen was president until forced to resign in 1992, after the company had gone into precipitous decline.



# Direct memory access

Direct memory access (DMA) is a feature of computer systems that allows certain hardware subsystems to access main system memory independently of the central processing unit (CPU).



# Directory (computing)

In computing, a directory is a file system cataloging structure which contains references to other computer files, and possibly other directories. On many computers, directories are known as folders, or drawers, analogous to a workbench or the traditional office filing cabinet. The name derives from books like a telephone directory that lists the phone numbers of all the people living in a certain area.

```
C:\Temp>dir
Volume in drive C is C
Volume Serial Number is 74F5-B93C
Directory of C:\Temp
2009-08-25  11:59    <DIR>          .
2009-08-25  11:59    <DIR>          .
2007-03-01  11:37    2,321,600 AdobeUpdater12345.exe
2009-04-03  10:01      27,988 dd_depcheckdotnetfx30.txt
2009-04-03  10:01      764 dd_dotnetfixerror.txt
2009-04-03  10:01      32,574 dd_dotnetfixinstall.txt
2009-06-09  13:46      35,145 depPatch.log
2009-08-05  17:11      155 k8969856.LOG
2009-04-20  08:37      402 MS179e0b.LOG
2009-04-09  16:34      38,895 offcIn11.log
2009-04-03  16:02    <DIR>          officePatches
2009-07-14  14:30    <DIR>          oHotfix
2009-08-25  11:37      16,384 perfmon_Perfdata_c30.dat
2009-04-03  10:01      1,744 perfmon_Perfdata_111.txt
2009-08-25  11:42      50,245,632 WFV2E.tmp
2009-04-20  10:07      1,397 {AC756A86-7AD7-1033-7B44-A81200000003}.ini
2009-04-20  10:13      617 {AC756A86-7AD7-1033-7B44-A81300000003}.ini
13 File(s)   52,723,295 bytes
4 Dir(s)   83,570,208,768 bytes free
```

# Directory structure

In computing, a directory structure is the way an operating system arranges files that are accessible to the user. Files are typically displayed in a hierarchical tree structure.



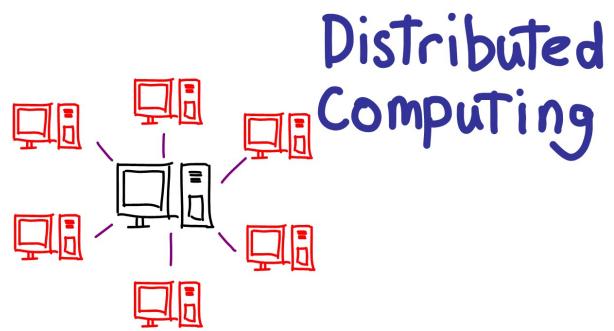
# Disk operating system

A disk operating system (DOS) is a computer operating system that resides on and can use a disk storage device, such as a floppy disk, hard disk drive, or optical disc. A disk operating system provides a file system for organizing, reading, and writing files on the storage disk. Strictly, this definition does not include any other functionality, so it does not apply to more complex OSes, such as Microsoft Windows, and is more appropriately used only for older generations of operating systems.

```
Apple IIe Untitled
ProDOS 2.4.2 is a minor update.
Bug fixes from ProDOS 2.4.1:
1. If a directory with more than
255 files was used, then a
different disk was used, a
Bad Dir Error #51 was reported.
2. Bitsy Bye would not work with an
Appletalk workstation card.
3. Bitsy Bye would crash on a Mac LC
Apple Ile card.
Updates:
1. Thunderclock_years are 2018-2023
2. ADT Pro 2.0.2
3. Copy II Plus 8.4
4. Added Cat Doctor's extra utils
Enjoy.
-JB
John Brooks
#
```

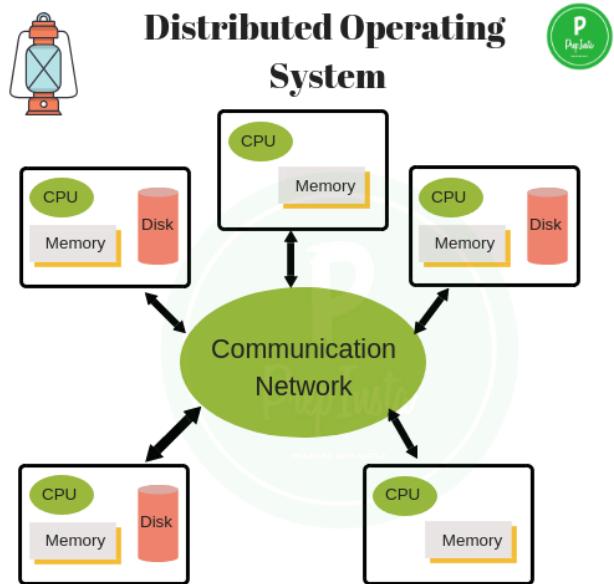
# Distributed computing

A distributed system is a system whose components are located on different networked computers, which communicate and coordinate their actions by passing messages to one another. Distributed computing is a field of computer science that studies distributed systems.



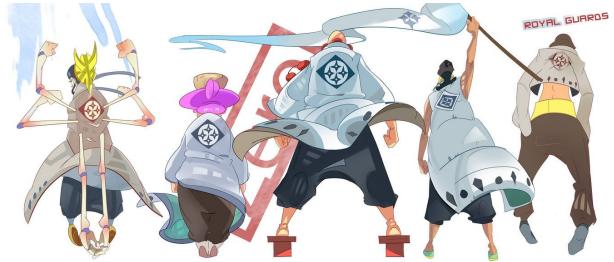
# Distributed operating system

A distributed operating system is system software over a collection of independent software, networked, communicating, and physically separate computational nodes. They handle jobs which are serviced by multiple CPUs. Each individual node holds a specific software subset of the global aggregate operating system. Each subset is a composite of two distinct service provisoners. The first is a ubiquitous minimal kernel, or microkernel, that directly controls that node's hardware. Second is a higher-level collection of system management components that coordinate the node's individual and collaborative activities. These components abstract microkernel functions and support user applications. The microkernel and the management components collection work together. They support the system's goal of integrating multiple resources and processing functionality into an efficient and stable system. This seamless integration of individual nodes into a global system is referred to as transparency, or single system image; describing the illusion provided to users of the global system's appearance as a single computational entity.



## Division by zero

In mathematics, division by zero is division where the divisor (denominator) is zero. Such a division can be formally expressed as



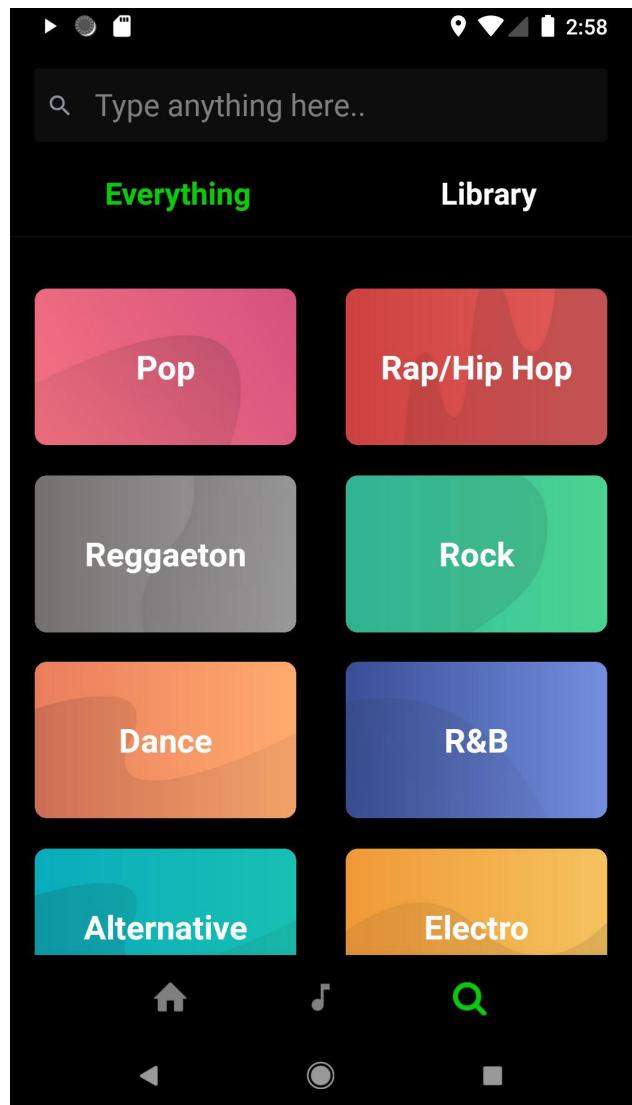
## Domain Name System

The Domain Name System (DNS) is a hierarchical and distributed naming system for computers, services, and other resources in the Internet or other Internet Protocol (IP) networks. It associates various information with domain names assigned to each of the associated entities. Most prominently, it translates readily memorized domain names to the numerical IP addresses needed for locating and identifying computer services and devices with the underlying network protocols. The Domain Name System has been an essential component of the functionality of the Internet since 1985.



# ESound

In computing, the Enlightened Sound Daemon (ESD or EsounD) was the sound server for Enlightenment and GNOME. Esound is a small sound daemon for both Linux and UNIX. ESD was created to provide a consistent and simple interface to the audio device, so applications do not need to have different driver support written per architecture. It was also designed to enhance capabilities of audio devices such as allowing more than one application to share an open device. ESD accomplishes these things while remaining transparent to the application, meaning that the application developer can simply provide ESD support and let it do the rest. On top of this, the API is designed to be very similar to the current audio device API, making it easy to port to ESD.



# EXEC 8

OS 2200 is the operating system for the Unisys ClearPath Dorado family of mainframe systems. The operating system kernel of OS 2200 is a lineal descendant of Exec 8 for the UNIVAC 1108.



# Embedded operating system

An embedded operating system is an operating system for embedded computer systems. Embedded operating systems are computer systems designed to increase functionality and reliability for achieving a specific task. Resource efficiency comes at the cost of losing some functionality or granularity that larger computer operating systems provide, including functions that may not be used by the specialized applications run. Depending on the method used for multitasking, this type of OS is frequently considered a real-time operating system or RTOS. Embedded systems are mostly used as Real-time operating systems.



# Embedded system

An embedded system is a computer system—a combination of a computer processor, computer memory, and input/output peripheral devices—that has a dedicated function within a larger mechanical or electronic system. It is embedded as part of a complete device often including electrical or electronic hardware and mechanical parts.



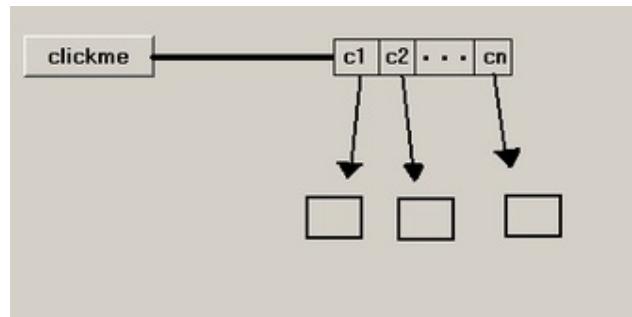
# Emulator

In computing, an emulator is hardware or software that enables one computer system (called the host) to behave like another computer system (called the guest). An emulator typically enables the host system to run software or use peripheral devices designed for the guest system.



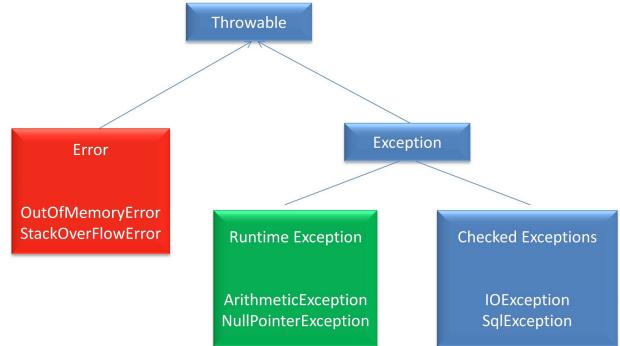
# Event (computing)

In programming and software design, an event is an action or occurrence recognized by software, often originating asynchronously from the external environment, that may be handled by the software. Computer events can be generated or triggered by the system, by the user, or in other ways. Typically, events are handled synchronously with the program flow; that is, the software may have one or more dedicated places where events are handled, frequently an event loop.



# Exception handling

In computing and computer programming, exception handling is the process of responding to the occurrence of exceptions ? anomalous or exceptional conditions requiring special processing ? during the execution of a program. In general, an exception breaks the normal flow of execution and executes a pre-registered exception handler; the details of how this is done depend on whether it is a hardware or software exception and how the software exception is implemented. Exception handling, if provided, is facilitated by specialized programming language constructs, hardware mechanisms like interrupts, or operating system (OS) inter-process communication (IPC) facilities like signals. Some exceptions, especially hardware ones, may be handled so gracefully that execution can resume where it was interrupted.



[www.javatutoronline.com](http://www.javatutoronline.com)

# Executive Systems Problem Oriented Language

The Executive Systems Problem Oriented Language (ESPOL) is a programming language, a superset of ALGOL 60, that provides abilities of what would later be termed a system programming language or machine oriented high order language (mohol), such as interrupting a processor on a multiprocessing system (the Burroughs large systems were multiprocessor systems). ESPOL was used to write the Master Control Program (MCP) on Burroughs computer systems from the B5000 to the B6700. The single-pass compiler for ESPOL could compile over 250 lines per second.

## Problem Oriented Languages & Application

- It is designed to solve specific problems or develop specific application by enabling what you want rather than step by step procedures
- It is fourth generation language
- Application tools

Personal computer application software: word-process, spreadsheet, database, PowerPoint etc.

Query languages and report generators: QBE, SQL, answer/database QMF, RPGIII etc.

Decision support systems and financial planning languages: Express, FCS, IFPD, System W etc.

## Ext4

The ext2 or second extended file system is a file system for the Linux kernel. It was initially designed by French software developer Rémy Card as a replacement for the extended file system (ext). Having been designed according to the same principles as the Berkeley Fast File System from BSD, it was the first commercial-grade filesystem for Linux. The canonical implementation of ext2 is the "ext2fs" filesystem driver in the Linux kernel. Other implementations (of varying quality and completeness) exist in GNU Hurd, MINIX 3, some BSD kernels, in MiNT, Haiku and as third-party Microsoft Windows and macOS drivers. ext2 was the default filesystem in several Linux distributions, including Debian and Red Hat Linux, until supplanted by ext3, which is almost completely compatible with ext2 and is a journaling file system. ext2 is still the filesystem of choice for flash-based storage media (such as SD cards and USB flash drives) because its lack of a journal increases performance and minimizes the number of writes, and flash devices can endure a limited number of write cycles. Since 2009, the Linux kernel supports a journal-less mode of ext4 which provides benefits not found with ext2, such as larger file and volume sizes.



# Federal Information Processing Standards

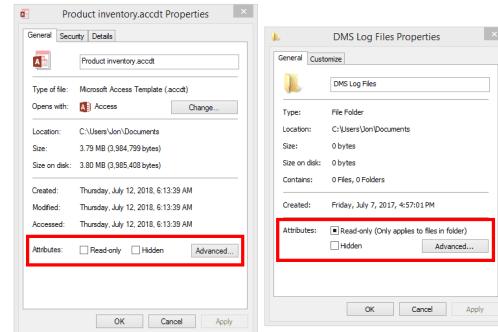
The Federal Information Processing Standards (FIPS) of the United States are a set of publicly announced standards that the National Institute of Standards and Technology (NIST) has developed for use in computer systems of non-military, American government agencies and contractors. FIPS standards establish requirements for ensuring computer security and interoperability, and are intended for cases in which suitable industry standards do not already exist. Many FIPS specifications are modified versions of standards the technical communities use, such as the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), and the International Organization for Standardization (ISO).

LOOK INSIDE!



## File attribute

File attributes are a type of meta-data that describe and may modify how files and/or directories in a filesystem behave. Typical file attributes may, for example, indicate or specify whether a file is visible, modifiable, compressed, or encrypted. The availability of most file attributes depends on support by the underlying filesystem (such as FAT, NTFS, ext4)



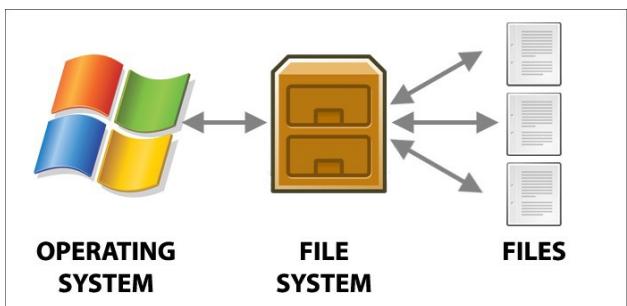
## File locking

File locking is a mechanism that restricts access to a computer file, or to a region of a file, by allowing only one user or process to modify or delete it at a specific time and to prevent reading of the file while it's being modified or deleted.



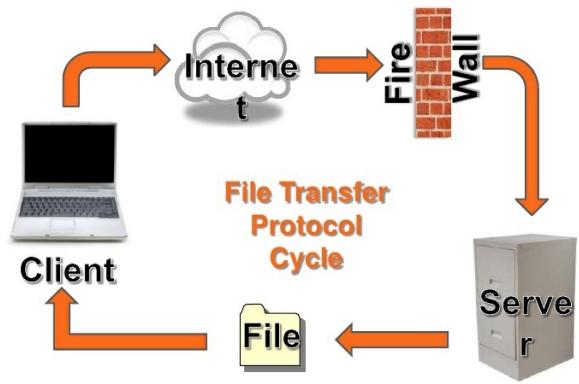
## File system

In computing, a file system or filesystem (often abbreviated to fs) is a method and data structure that the operating system uses to control how data is stored and retrieved. Without a file system, data placed in a storage medium would be one large body of data with no way to tell where one piece of data stopped and the next began, or where any piece of data was located when it was time to retrieve it. By separating the data into pieces and giving each piece a name, the data are easily isolated and identified. Taking its name from the way a paper-based data management system is named, each group of data is called a "file". The structure and logic rules used to manage the groups of data and their names is called a "file system."



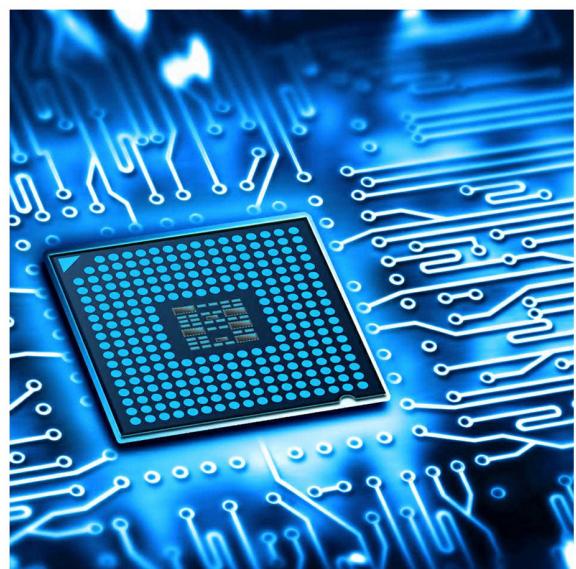
## File transfer protocol

The File Transfer Protocol (FTP) is a standard communication protocol used for the transfer of computer files from a server to a client on a computer network. FTP is built on a client?server model architecture using separate control and data connections between the client and the server. FTP users may authenticate themselves with a clear-text sign-in protocol, normally in the form of a username and password, but can connect anonymously if the server is configured to allow it. For secure transmission that protects the username and password, and encrypts the content, FTP is often secured with SSL/TLS (FTPS) or replaced with SSH File Transfer Protocol (SFTP).



## Firmware

In computing, firmware is a specific class of computer software that provides the low-level control for a device's specific hardware. Firmware, such as the BIOS of a personal computer, may contain basic functions of a device, and may provide hardware abstraction services to higher-level software such as operating systems. For less complex devices, firmware may act as the device's complete operating system, performing all control, monitoring and data manipulation functions. Typical examples of devices containing firmware are embedded systems (running embedded software), home and personal-use appliances, computers, and computer peripherals.



# Free Software Foundation

The Free Software Foundation (FSF) is a 501(c)(3) non-profit organization founded by Richard Stallman on October 4, 1985, to support the free software movement, with the organization's preference for software being distributed under copyleft ("share alike") terms, such as with its own GNU General Public License. The FSF was incorporated in Boston, Massachusetts, US, where it is also based. From its founding until the mid-1990s, FSF's funds were mostly used to employ software developers to write free software for the GNU Project. Since the mid-1990s, the FSF's employees and volunteers have mostly worked on legal and structural issues for the free software movement and the free software community.



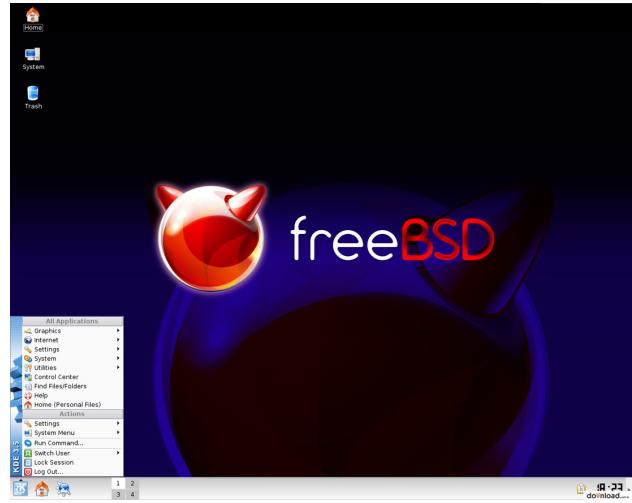
## Free software

Free software or libre software is computer software distributed under terms that allow users to run the software for any purpose as well as to study, change, and distribute it and any adapted versions. Free software is a matter of liberty, not price; all users are legally free to do what they want with their copies of a free software (including profiting from them) regardless of how much is paid to obtain the program. Computer programs are deemed "free" if they give end-users (not just the developer) ultimate control over the software and, subsequently, over their devices. The right to study and modify a computer program entails that source code—the preferred format for making changes—be made available to users of that program. While this is often called "access to source code" or "public availability", the Free Software Foundation (FSF) recommends against thinking in those terms, because it might give the impression that users have an obligation (as opposed to a right) to give non-users a copy of the program.



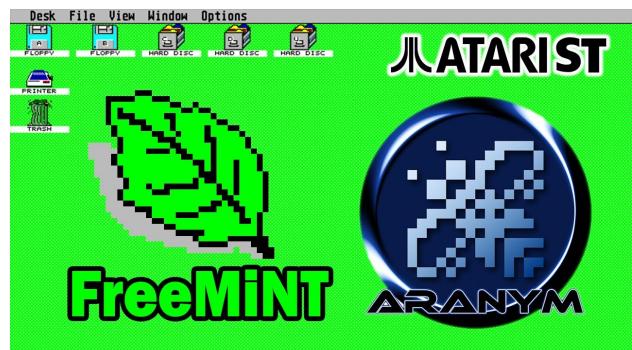
## FreeBSD

FreeBSD is a free and open-source Unix-like operating system descended from the Berkeley Software Distribution (BSD), which was based on Research Unix. The first version of FreeBSD was released in 1993. In 2005, FreeBSD was the most popular open-source BSD operating system, accounting for more than three-quarters of all installed and permissively licensed BSD systems. FreeBSD has similarities with Linux, with two major differences in scope and licensing: FreeBSD maintains a complete system, i.e. the project delivers a kernel, device drivers, userland utilities, and documentation, as opposed to Linux only delivering a kernel and drivers, and relying on third-parties for system software; FreeBSD source code is generally released under a permissive BSD license, as opposed to the copyleft GPL used by Linux.



## FreeMint

MiNT is Now TOS (MiNT) is a free software alternative operating system kernel for the Atari ST system and its successors. It is a multi-tasking alternative to TOS and MagiC. Together with the free system components fVDI device drivers, XaAES graphical user interface widgets, and TeraDesk file manager, MiNT provides a free TOS compatible replacement OS that can multitask.



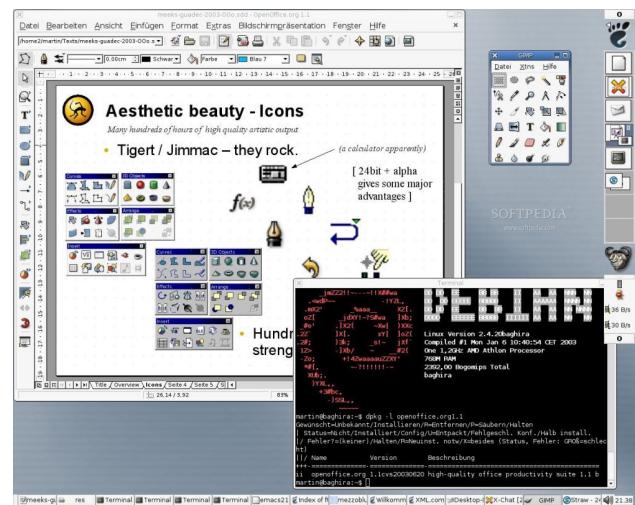
# GNOME

In the fields of molecular biology and genetics, a genome is all the genetic information of an organism. It consists of nucleotide sequences of DNA (or RNA in RNA viruses). The nuclear genome includes protein-coding genes and non-coding genes, other functional regions of the genome such as regulatory sequences (see non-coding DNA), and often a substantial fraction of 'junk' DNA with no evident function. Almost all eukaryotes have mitochondria and a small mitochondrial genome. Algae and plants also contain chloroplasts with a chloroplast genome.



# GNU Hurd

GNU Hurd is a collection of microkernel servers written as part of GNU, for the GNU Mach microkernel. It has been under development since 1990 by the GNU Project of the Free Software Foundation, designed as a replacement for the Unix kernel, and released as free software under the GNU General Public License. When the Linux kernel proved to be a viable solution, development of GNU Hurd slowed, at times alternating between stasis and renewed activity and interest. The Hurd's design consists of a set of protocols and server processes (or daemons, in Unix terminology) that run on the GNU Mach microkernel. The Hurd aims to surpass the Unix kernel in functionality, security, and stability, while remaining largely compatible with it. The GNU Project chose the multiserver microkernel for the operating system, due to perceived advantages over the traditional Unix monolithic kernel architecture, a view that had been advocated by some developers in the 1980s.



# GNU Project

The GNU Project ( (listen)) is a free software, mass collaboration project announced by Richard Stallman on September 27, 1983. Its goal is to give computer users freedom and control in their use of their computers and computing devices by collaboratively developing and publishing software that gives everyone the rights to freely run the software, copy and distribute it, study it, and modify it. GNU software grants these rights in its license.



## General Comprehensive Operating System

General Comprehensive Operating System (GCOS, ; originally GECOS, General Electric Comprehensive Operating Supervisor) is a family of operating systems oriented toward the 36-bit GE/Honeywell mainframe computers. The original version of GCOS was developed by General Electric beginning in 1962. The operating system is still used today in its most recent versions (GCOS 7 and GCOS 8) on servers and mainframes produced by Groupe Bull, primarily through emulation, to provide continuity with legacy mainframe environments. GCOS 7 and GCOS 8 are separate branches of the operating system and continue to be developed alongside each other.

```
ex Command Prompt
C:\burpsuite_v1.01>dir
Volume in drive C has no label.
Volume Serial Number is 8064-DE85

Directory of C:\burpsuite_v1.01

03/30/2006  10:39 AM    <DIR>      .
03/30/2006  10:39 AM    <DIR>      ..
08/11/2005  04:38 PM           517,225 burpsuite_v1.01.jar
08/10/2005  03:46 PM           20,415 IBurpExtender.html
08/09/2005  04:48 PM            6,913 IBurpExtender.java
09/11/2005  04:37 PM           1,674 release.txt
08/11/2005  04:35 PM            38 setup.bat
08/11/2005  04:35 PM           1,174 tc.txt
08/11/2005           6 File(s)      547,439 bytes
08/11/2005          2 Dir(s)   56,260,661,248 bytes free

C:\burpsuite_v1.01>
```

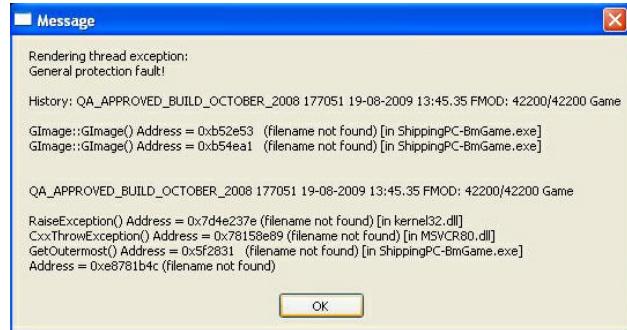
## General Electric

General Electric Company (GE) is an American multinational conglomerate founded in 1892, and incorporated in New York state and headquartered in Boston.



# General protection fault

A general protection fault (GPF) in the x86 instruction set architectures (ISAs) is a fault (a type of interrupt) initiated by ISA-defined protection mechanisms in response to an access violation caused by some running code, either in the kernel or a user program. The mechanism is first described in Intel manuals and datasheets for the Intel 80286 CPU, which was introduced in 1983; it is also described in section 9.8.13 in the Intel 80386 programmer's reference manual from 1986. A general protection fault is implemented as an interrupt (vector number 13 (0Dh)). Some operating systems may also classify some exceptions not related to access violations, such as illegal opcode exceptions, as general protection faults, even though they have nothing to do with memory protection. If a CPU detects a protection violation, it stops executing the code and sends a GPF interrupt. In most cases, the operating system removes the failing process from the execution queue, signals the user, and continues executing other processes. If, however, the operating system fails to catch the general protection fault, i.e. another protection violation occurs before the operating system returns from the previous GPF interrupt, the CPU signals a double fault, stopping the operating system. If yet another failure (triple fault) occurs, the CPU is unable to recover; since 80286, the CPU enters a special halt state called "Shutdown", which can only be exited through a hardware reset. The IBM PC AT, the first PC-compatible system to contain an 80286, has hardware that detects the Shutdown state and automatically resets the CPU when it occurs. All descendants of the PC AT do the same, so in a PC, a triple fault causes an immediate system reset.



# Glossary of operating systems terms

This page is a glossary of Operating systems terminology.

| Heat and Sensor Technology®<br>Glossary |   |
|---|---|
| \$\$\$\$\$\$:                           | Our marking for the total selling price of the order on our design sheet.   |
| 1 ph voltage:                           | One-phase voltage.  |
| 3 ph voltage:                           | Three-phase voltage.  |
| 3 phase delta:                          | A connection type for the ceramic heater. The six wires are connected between the three positive and negative wires.  |
| ASTM:                                   | American Society for Testing and Materials, is an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services.  |
| Accounts payable:                       | A/P or AP. The amount of money that the company owed to suppliers for goods and services. This money is considered a liability on the balance sheet. The Accounts Payable department receives invoices from suppliers and processes outgoing payments.  |
| Accounts Receivable:                    | A/R or AR. The amount of money owed to the company by the customer(s) for goods or services after the invoice has been sent. This money is considered an asset on the balance sheet. The Accounts Receivable department creates and sends invoices and receives and processes incoming payments.                    |
| Alloy:                                  | A metal made up of two or more metal elements to give it greater strength and resistance to corrosion. Because alloys are mixtures of elements, they are also referred to as impure metals. Examples are nickel, bronze, pewter, and zinc.  |
| ambient air:                            | This refers to the state of outdoor air in a surrounding environment. This air is typically measured near ground level, and away from direct sources of pollution.  |
| Amps:                                   | The amount of current passing through the wire. The amp value in a heater is affected by the wire, turns, length, and pitch. Amps are not measured directly on the heaters but can be calculated on the computer and compared to the requirement on the design sheet if the hipot or final ohm reading is too high. |
| Amps Per Core:                          | The calculation of amps for each core in the heater. This value and Total Amps are specified on the design sheet.   |
| annealing:                              | The process of heating solid metal to a high temperature, then cooling it slowly so its particles arrange into a defined lattice.   |
| Bright annealing:                       | The annealing process created in a non-oxidizing atmosphere, resulting in a smooth metallic finish. This process must be requested.   |
| Armor:                                  | A tough, semi-flexible metal covering for the lead wires. It is used for H-leads.   |
| Assembly:                               | The operation in which the core, metal, and other materials are put together. For the mica heaters, assembly follows the prepping operation. After assembly, the mica heaters are shaped.   |
| Barrel nut:                             | A cylindrical nut with threads. The barrel nut is used with a slip (an unthreaded cylinder) to connect the two ends of a heater. The bolt is run through the slip and then screwed into the barrel nut.   |
| Bent strip:                             | A strip heater that contains one or more bends. These bends can be solid or hinged.   |
| Black bushing:                          | The black rubber bushing that is placed between the shaft and the clamp on the thermocouple.  |
| Braid:                                  | A flexible stainless steel covering over the lead wires. Strands of stainless steel are braided into a flexible tube. For C-leads, the braid is welded to the terminal. For E-lead, the braid is separate.  |
| Braid Ring:                             | A small ring that helps to attach the braid to the cartridge heater. The braid is welded to the ring, and the ring is then welded to the heater. For a small ring, the braid is welded on the outside of the ring. For a larger ring, the braid is welded to the inside of the ring.                                |
| Brake:                                  | A machine used to create 90° and 45° bends on the long edge of the channel.   |

## Government of the United States

The federal government of the United States (U.S. federal government or U.S. government) is the national government of the United States, a federal republic located primarily in North America, composed of 50 states, a city within a federal district (the city of Washington in the District of Columbia, where most of the federal government is based), five major self-governing territories and several island possessions. The federal government, sometimes simply referred to as Washington, is composed of three distinct branches: legislative, executive, and judicial, whose powers are vested by the U.S. Constitution in the Congress, the president and the federal courts, respectively. The powers and duties of these branches are further defined by acts of Congress, including the creation of executive departments and courts inferior to the Supreme Court.



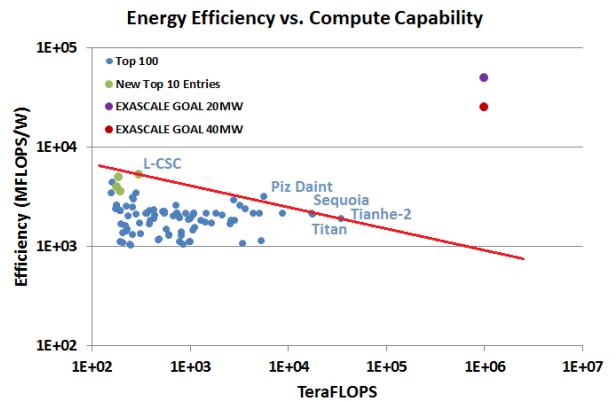
# Graphical user interface

The GUI ( JEE-yoo-EYE or GOO-ee), graphical user interface, is a form of user interface that allows users to interact with electronic devices through graphical icons and audio indicator such as primary notation, instead of text-based UIs, typed command labels or text navigation. GUIs were introduced in reaction to the perceived steep learning curve of CLIs (command-line interfaces), which require commands to be typed on a computer keyboard.



# Green500

The Green500 is a biannual ranking of supercomputers, from the TOP500 list of supercomputers, in terms of energy efficiency. The list measures performance per watt using the TOP500 measure of high performance LINPACK benchmarks at double-precision floating-point format.



# Haiku (operating system)

Haiku is a free and open-source operating system application level compatible with the discontinued BeOS. Its development began in 2001, and the operating system became self-hosting in 2008. The first alpha release was made in September 2009, and the last was November 2012; the first beta was released in September 2018, followed by beta 2 in June 2020, then beta 3 in July 2021. The fourth beta was released on December 23, 2022, still keeping BeOS 5 compatibility in its x86 32-bit images, with much increased number of modern drivers, GTK3 apps and Wine ported, as well as Xlib (X11) and Wayland compatibility layers. Haiku is supported by Haiku, Inc., a non-profit organization based in Rochester, New York, United States, founded in 2003 by former project leader Michael Phipps. In the recent release cycle, Haiku, Inc. employed a developer.



## Hard disk drive

A hard disk drive (HDD), hard disk, hard drive, or fixed disk, is an electro-mechanical data storage device that stores and retrieves digital data using magnetic storage with one or more rigid rapidly rotating platters coated with magnetic material. The platters are paired with magnetic heads, usually arranged on a moving actuator arm, which read and write data to the platter surfaces. Data is accessed in a random-access manner, meaning that individual blocks of data can be stored and retrieved in any order. HDDs are a type of non-volatile storage, retaining stored data when powered off. Modern HDDs are typically in the form of a small rectangular box.



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## Help:Maintenance template removal

Many Wikipedia pages display maintenance templates that identify problems. You may have arrived at this help page after clicking a link on a maintenance template saying "Learn how and when to remove this template message".

02/2016 Help:Maintenance template removal - Wikipedia, the free encyclopedia

### Help:Maintenance template removal

From Wikipedia, the free encyclopedia

Further information: Wikipedia:Responsible tagging and Wikipedia:Tag bombing

This essay is a **how-to guide** detailing process on some aspect or aspects of Wikipedia's norms and practices. It is not one of Wikipedia's policies or guidelines, where something is inconsistent with this page, please defer to those.

**This page in a nutshell:** If you have the ability, please boldly assist Wikipedia by fixing the issues flagged by maintenance templates!

All problems on Wikipedia are resolved through the efforts of volunteers like you. If you understand the problem that the template highlights, such as by reading the explanatory links it contains or found guidance through this page – and have *thoroughly fixed the issues* – you may simply remove the maintenance template, it will not be removed automatically.

Many Wikipedia pages display maintenance templates addressed to problems with the topic or content of the page. You may have arrived at this page after you clicked on a link in just such a maintenance template, that said "[Learn how and when to remove this template message](#)". These maintenance templates are added and removed by volunteers, and this help page explains the process through which this happens.

#### Contents

- 1 Overview
- 2 Addressing the flagged problem
  - 2.1 An example
- 3 When to remove
- 4 When not to remove
- 5 Removal
- 6 Changing template
- 7 Specific template guidance
  - 7.1 Researching the tagged issue
- 8 Still need help?
- 9 See also

#### Overview

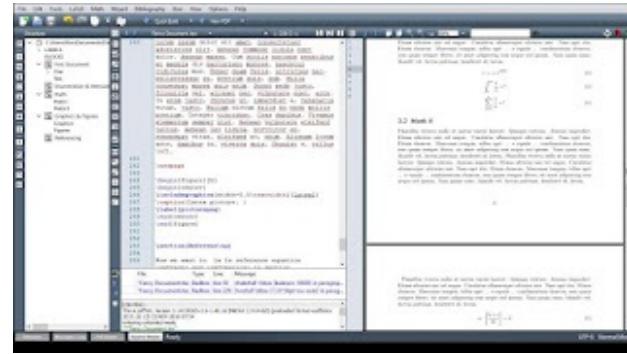
Maintenance templates (or "tags") are never removed automatically. If you fix the issue, the tag will still remain until you or someone else *manually removes it*. The mechanics of removal is usually as simple as clicking edit at the top of a page or in the section involved, removing the code that produces the display of the template, leaving an edit summary, and saving the page. However, it is not okay to remove maintenance templates until the issue flagged by the template is remedied first.

[https://en.wikipedia.org/wikibooks/Help:Maintenance\\_template\\_removal](https://en.wikipedia.org/wikibooks/Help:Maintenance_template_removal)

1/13

# Help:Referencing for beginners

One of the key policies of Wikipedia is that all article content has to be verifiable. This means that reliable sources must be able to support the material. All quotations, any material whose verifiability has been challenged or is likely to be challenged, and contentious material (whether negative, positive, or neutral) about living persons must include an inline citation to a source that directly supports the material. This also means that Wikipedia is not the place for original work, archival findings that have not been published, or evidence from any source that has not been published.



## Hexadecimal

In mathematics and computing, the hexadecimal (also base-16 or simply hex) numeral system is a positional numeral system that represents numbers using a radix (base) of 16. Unlike the decimal system representing numbers using 10 symbols, hexadecimal uses 16 distinct symbols, most often the symbols "0"??"9" to represent values 0 to 9, and "A"??"F" (or alternatively "a"??"f") to represent values from 10 to 15.

| Decimal | Hex | Binary |
|---------|-----|--------|
| 0       | 0   | 0000   |
| 1       | 1   | 0001   |
| 2       | 2   | 0010   |
| 3       | 3   | 0011   |
| 4       | 4   | 0100   |
| 5       | 5   | 0101   |
| 6       | 6   | 0110   |
| 7       | 7   | 0111   |
| 8       | 8   | 1000   |
| 9       | 9   | 1001   |
| 10      | A   | 1010   |
| 11      | B   | 1011   |
| 12      | C   | 1100   |
| 13      | D   | 1101   |
| 14      | E   | 1110   |
| 15      | F   | 1111   |

## History of IBM mainframe operating systems

The history of IBM mainframe operating systems is significant within the history of mainframe operating systems, because of IBM's long-standing position as the world's largest hardware supplier of mainframe computers. IBM mainframes run operating systems supplied by IBM and by third parties.

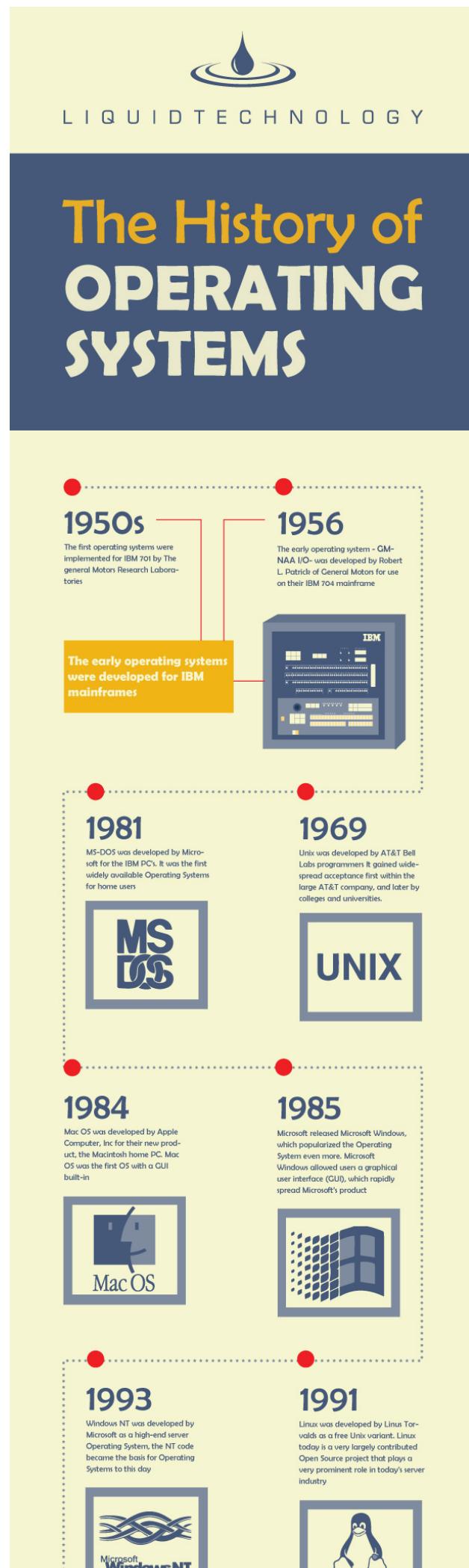


## History of operating systems

## HISTORY OF OPERATING

# systems

Computer operating systems (OSes) provide a set of functions needed and used by most application programs on a computer, and the links needed to control and synchronize computer hardware. On the first computers, with no operating system, every program needed the full hardware specification to run correctly and perform standard tasks, and its own drivers for peripheral devices like printers and punched paper card readers. The growing complexity of hardware and application programs eventually made operating systems a necessity for everyday use.



## WHY DID MICROSOFT BECOME THE OS INDUSTRY LEADER ?



Cost less



Better applications



Embraced by many enterprises early

1

2

3

## Windows 7

is the most popular desktop computer operating system, according to the 2017 StatCounter Global Stats report

### Sources:

<http://www.computerhope.com/issues/ch00777.htm#V>  
<http://www.rutori.com/story/the-history-of-operating-systems-235d>  
<http://www.businessinsider.com/how-apple-really-lost-its-lead-in-the-80-2012-12>  
<http://www.intervalzero.com/software/why-are-windows-pc-so-popular-in-industrial-automation/>

[www.liquidtechnology.net](http://www.liquidtechnology.net)

## History of operating systems#Mainframes

The history of IBM mainframe operating systems is significant within the history of mainframe operating systems, because of IBM's long-standing position as the world's largest hardware supplier of mainframe computers. IBM mainframes run operating systems supplied by IBM and by third parties.



## History of Android OS

# Hobbyist operating system

The development of a hobbyist operating system is one of the more involved and technical options for a computer hobbyist.



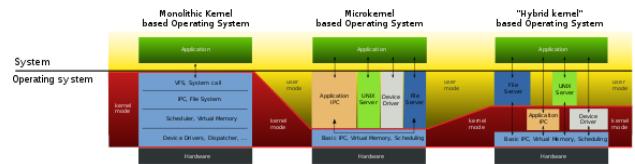
## Homebrew Computer Club

The Homebrew Computer Club was an early computer hobbyist group in Menlo Park, California, which met from March 1975 to December 1986. The club had an influential role in the development of the microcomputer revolution and the rise of that aspect of the Silicon Valley information technology industrial complex.



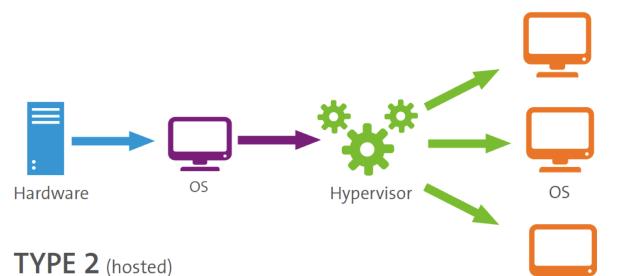
## Hybrid kernel

A hybrid kernel is an operating system kernel architecture that attempts to combine aspects and benefits of microkernel and monolithic kernel architectures used in computer operating systems.



## Hypervisor

A supervisor, or lead, (also known as foreman, boss, overseer, facilitator, monitor, area coordinator, line-manager or sometimes gaffer) is the job title of a lower-level management position that is primarily based on authority over workers or a workplace. A supervisor can also be one of the most senior in the staff at the place of work, such as a professor who oversees a PhD dissertation. Supervision, on the other hand, can be performed by people without this formal title, for example by parents. The term supervisor itself can be used to refer to any personnel who have this task as part of their job description.



## IBM 1410

The IBM 1410, a member of the IBM 1400 series, was a decimal computer with variable word length that was announced by IBM on September 12, 1960 and marketed as a midrange business computer. It was withdrawn on March 30, 1970.



## IBM 7010

The IBM 700/7000 series is a series of large-scale (mainframe) computer systems that were made by IBM through the 1950s and early 1960s. The series includes several different, incompatible processor architectures. The 700s use vacuum-tube logic and were made obsolete by the introduction of the transistorized 7000s. The 7000s, in turn, were eventually replaced with System/360, which was announced in 1964. However the 360/65, the first 360 powerful enough to replace 7000s, did not become available until November 1965. Early problems with OS/360 and the high cost of converting software kept many 7000s in service for years afterward.



## IBM 7040

The IBM 7040 was a historic but short-lived model of transistor computer built in the 1960s.



## IBM 709

The IBM 709 was a computer system, initially announced by IBM in January 1957 and first installed during August 1958. The 709 was an improved version of its predecessor, the IBM 704, and was the third of the IBM 700/7000 series of scientific computers. The improvements included overlapped input/output, indirect addressing, and three "convert" instructions which provided support for decimal arithmetic, leading zero suppression, and several other operations. The 709 had 32,768 words of 36-bit magnetic core memory and could execute 42,000 add or subtract instructions per second. It could multiply two 36-bit integers at a rate of 5000 per second. An optional hardware emulator executed old IBM 704 programs on the IBM 709. This was the first commercially available emulator. Registers and most 704 instructions were emulated in 709 hardware. Complex 704 instructions such as floating point trap and input-output routines were emulated in 709 software.



## IBM 7090

The IBM 7090 is a second-generation transistorized version of the earlier IBM 709 vacuum tube mainframe computer that was designed for "large-scale scientific and technological applications". The 7090 is the fourth member of the IBM 700/7000 series scientific computers. The first 7090 installation was in December 1959. In 1960, a typical system sold for \$2.9 million (equivalent to \$21 million in 2021) or could be rented for \$63,500 a month (equivalent to \$452,000 in 2021).



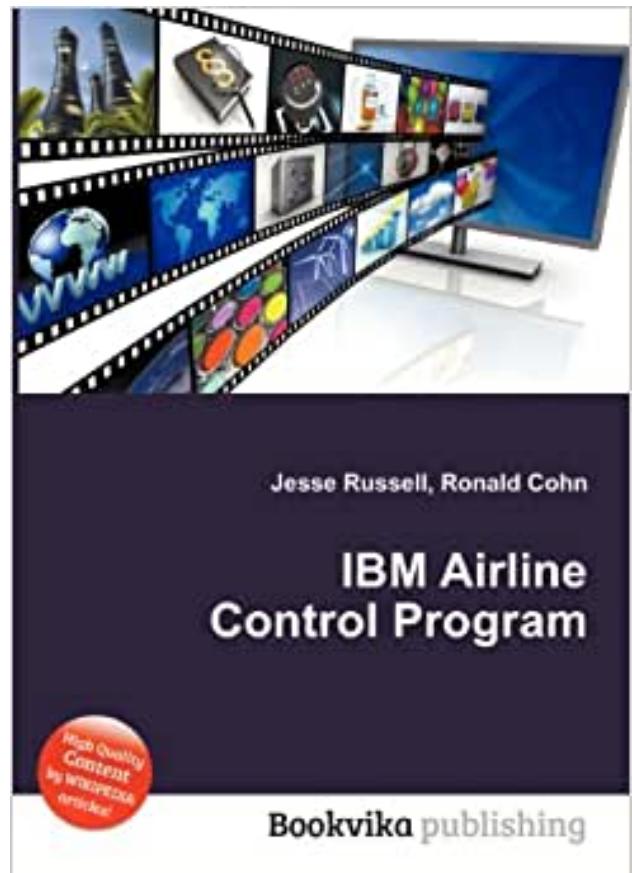
## IBM AIX

AIX (Advanced Interactive eXecutive, pronounced , "ay-eye-ex") is a series of proprietary Unix operating systems developed and sold by IBM for several of its computer platforms.



## IBM Airline Control Program

IBM Airline Control Program, or ACP, is a discontinued operating system developed by IBM beginning about 1965. In contrast to previous airline transaction processing systems, the most notable aspect of ACP is that it was designed to run on most models of the IBM System/360 mainframe computer family. This departed from the earlier model in which each airline had a different, machine-specific transaction system.



## IBM Personal Computer

The IBM Personal Computer (model 5150, commonly known as the IBM PC) is the first microcomputer released in the IBM PC model line and the basis for the IBM PC compatible de facto standard. Released on August 12, 1981, it was created by a team of engineers and designers directed by Don Estridge in Boca Raton, Florida.



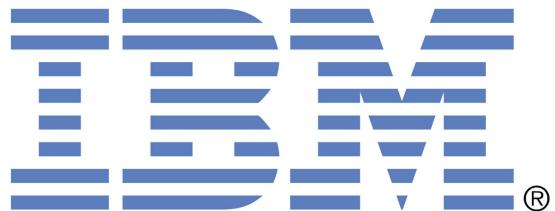
## IBM Power Systems

IBM Power Systems is a family of server computers from IBM that are based on its Power processors. It was created in 2008 as a merger of the System p and System i product lines.



## IBM i

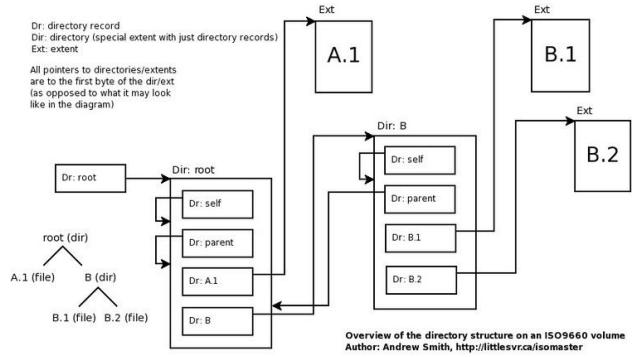
The International Business Machines Corporation (IBM), nicknamed Big Blue, is an American multinational technology corporation headquartered in Armonk, New York and present in over 175 countries. It specializes in computer hardware, middleware, and software, and provides hosting and consulting services in areas ranging from mainframe computers to nanotechnology. IBM is the largest industrial research organization in the world, with 19 research facilities across a dozen countries, and has held the record for most annual U.S. patents generated by a business for 29 consecutive years from 1993 to 2021. IBM was founded in 1911 as the Computing-Tabulating-Recording Company (CTR), a holding company of manufacturers of record-keeping and measuring systems. It was renamed "International Business Machines" in 1924 and soon became the leading manufacturer of punch-card tabulating systems. For the next several decades, IBM would become an industry leader in several emerging technologies.



including electric typewriters, electromechanical calculators, and personal computers. During the 1960s and 1970s, the IBM mainframe, exemplified by the System/360, was the dominant computing platform, and the company produced 80 percent of computers in the U.S. and 70 percent of computers worldwide. After pioneering the multipurpose microcomputer in the 1980s, which set the standard for personal computers, IBM began losing its market dominance to emerging competitors. Beginning in the 1990s, the company began downsizing its operations and divesting from commodity production, most notably selling its personal computer division to the Lenovo Group in 2005. IBM has since concentrated on computer services, software, supercomputers, and scientific research. Since 2000, its supercomputers have consistently ranked among the most powerful in the world, and in 2001 it became the first company to generate more than 3,000 patents in one year, beating this record in 2008 with over 4,000 patents. As of 2022, the company held 150,000 patents.

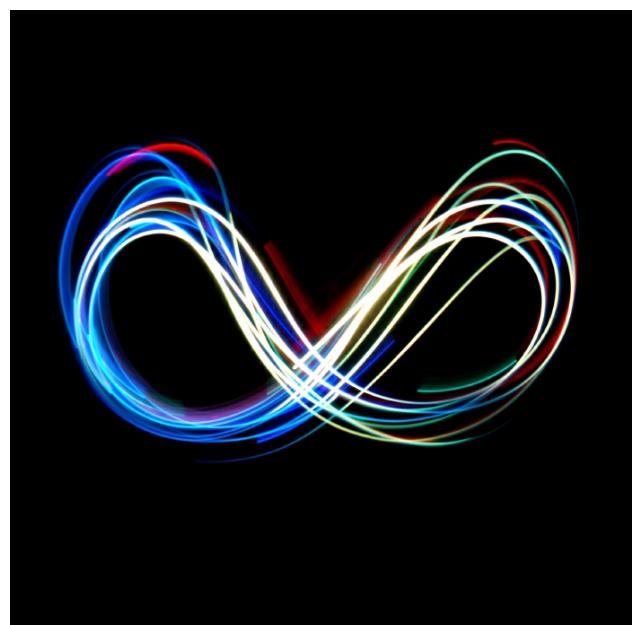
# ISO 9660

The ISO 9000 family is a set of five quality management systems (QMS) standards that help organizations ensure they meet customer and other stakeholder needs within statutory and regulatory requirements related to a product or service. ISO 9000 deals with the fundamentals of QMS, including the seven quality management principles that underlie the family of standards. ISO 9001 deals with the requirements that organizations wishing to meet the standard must fulfill. ISO 9002 is a model for quality assurance in production and installation. ISO 9003 for quality assurance in final inspection and test. ISO 9004 gives guidance on achieving sustained organizational success. Third-party certification bodies confirm that organizations meet the requirements of ISO 9001. Over one million organizations worldwide are independently certified, making ISO 9001 one of the most widely used management tools in the world today. However, the ISO certification process has been criticized as being wasteful and not being useful for all organizations.



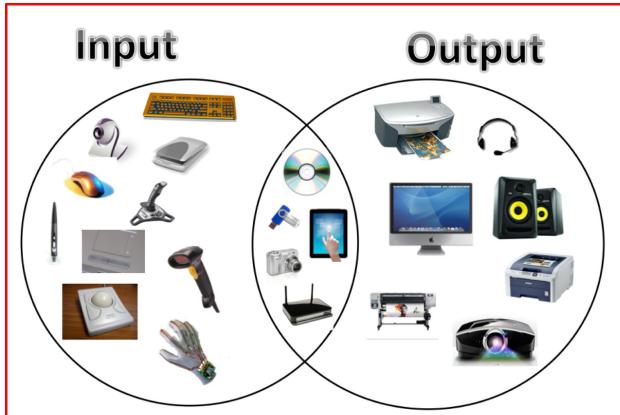
## Infinite loop

In computer programming, an infinite loop (or endless loop) is a sequence of instructions that, as written, will continue endlessly, unless an external intervention occurs ("pull the plug"). It may be intentional.



# Input and output

In computing, input/output (I/O, i/o, or informally io or IO) is the communication between an information processing system, such as a computer, and the outside world, possibly a human or another information processing system. Inputs are the signals or data received by the system and outputs are the signals or data sent from it. The term can also be used as part of an action; to "perform I/O" is to perform an input or output operation.



## Input device

In computing, an input device is a piece of equipment used to provide data and control signals to an information processing system, such as a computer or information appliance. Examples of input devices include keyboards, mouse, scanners, cameras, joysticks, and microphones.



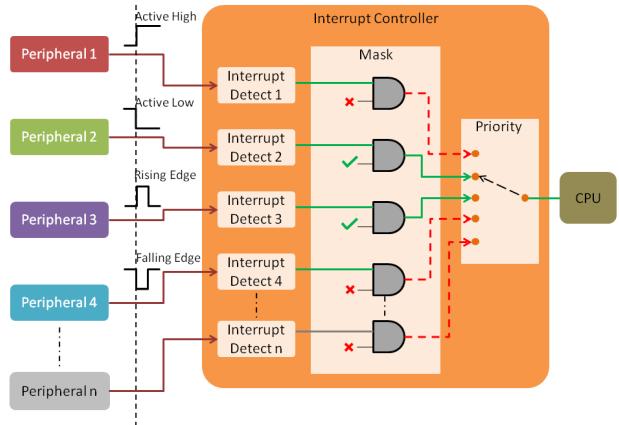
## Intel 80386

The Intel 386, originally released as 80386 and later renamed i386, is a 32-bit microprocessor introduced in 1985. The first versions had 275,000 transistors and were the CPU of many workstations and high-end personal computers of the time. As the original implementation of the 32-bit extension of the 80286 architecture, the i386 instruction set, programming model, and binary encodings are still the common denominator for all 32-bit x86 processors, which is termed the i386 architecture, x86, or IA-32, depending on context.



# Interrupt

In digital computers, an interrupt (sometimes referred to as a trap) is a request for the processor to interrupt currently executing code (when permitted), so that the event can be processed in a timely manner. If the request is accepted, the processor will suspend its current activities, save its state, and execute a function called an interrupt handler (or an interrupt service routine, ISR) to deal with the event. This interruption is often temporary, allowing the software to resume normal activities after the interrupt handler finishes, although the interrupt could instead indicate a fatal error. Interrupts are commonly used by hardware devices to indicate electronic or physical state changes that require time-sensitive attention. Interrupts are also commonly used to implement computer multitasking, especially in real-time computing. Systems that use interrupts in these ways are said to be interrupt-driven.



## Interrupt handler

In computer systems programming, an interrupt handler, also known as an interrupt service routine or ISR, is a special block of code associated with a specific interrupt condition. Interrupt handlers are initiated by hardware interrupts, software interrupt instructions, or software exceptions, and are used for implementing device drivers or transitions between protected modes of operation, such as system calls.

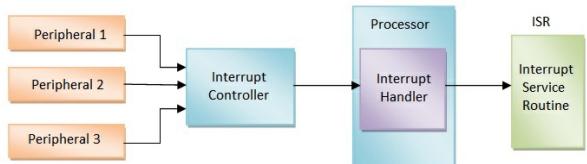


fig: Interrupt Handler

## Interrupt vector table

An interrupt vector table (IVT) is a data structure that associates a list of interrupt handlers with a list of interrupt requests in a table of interrupt vectors. Each entry of the interrupt vector table, called an interrupt vector, is the address of an interrupt handler. While the concept is common across processor architectures, IVTs may be implemented in architecture-specific fashions. For example, a dispatch table is one method of implementing an interrupt vector table.

| Exception number | IRQ number | Offset    | Vector                  |
|------------------|------------|-----------|-------------------------|
| 16+n             | n          | 0x0040+4n | IRQn                    |
| .                | .          | .         | .                       |
| 18               | 2          | 0x004C    | IRQ2                    |
| 17               | 1          | 0x0048    | IRQ1                    |
| 16               | 0          | 0x0044    | IRQ0                    |
| 15               | -1         | 0x0040    | Systick                 |
| 14               | -2         | 0x003C    | PendSV                  |
| 13               |            | 0x0038    | Reserved                |
| 12               |            |           | Reserved for Debug      |
| 11               | -5         | 0x002C    | SVCall                  |
| 10               |            |           | Reserved                |
| 9                |            |           |                         |
| 8                |            |           |                         |
| 7                |            |           |                         |
| 6                | -10        | 0x0018    | Usage fault             |
| 5                | -11        | 0x0014    | Bus fault               |
| 4                | -12        | 0x0010    | Memory management fault |
| 3                | -13        | 0x000C    | Hard fault              |
| 2                | -14        | 0x0008    | NMI                     |
| 1                |            | 0x0004    | Reset                   |
|                  |            | 0x0000    | Initial SP value        |

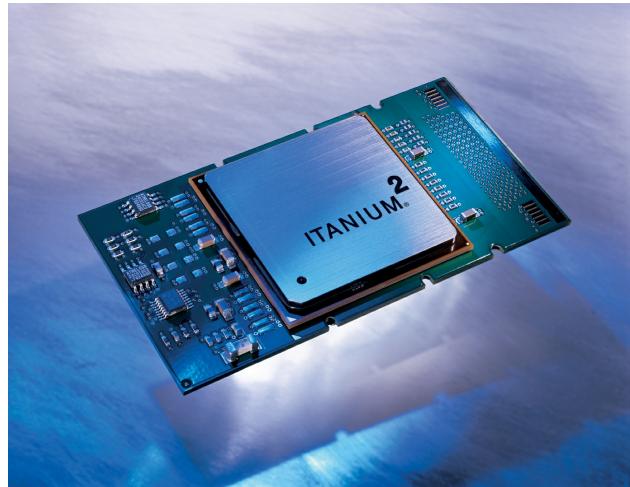
## Interruptible operating system

An interruptible operating system is an operating system with ability to handle multiple interrupts concurrently, or in other words, which allow interrupts to be interrupted.



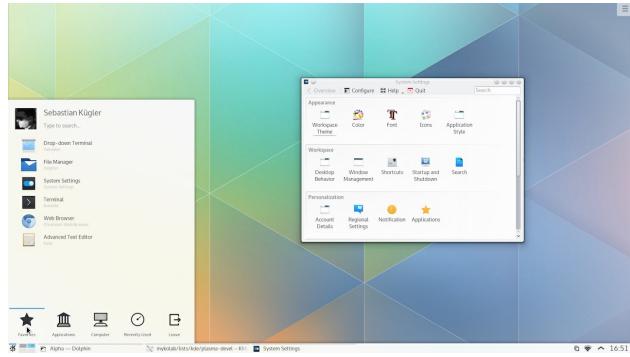
# Itanium

Titanium is a chemical element with the symbol Ti and atomic number 22. Found in nature only as an oxide, it can be reduced to produce a lustrous transition metal with a silver color, low density, and high strength, resistant to corrosion in sea water, aqua regia, and chlorine.



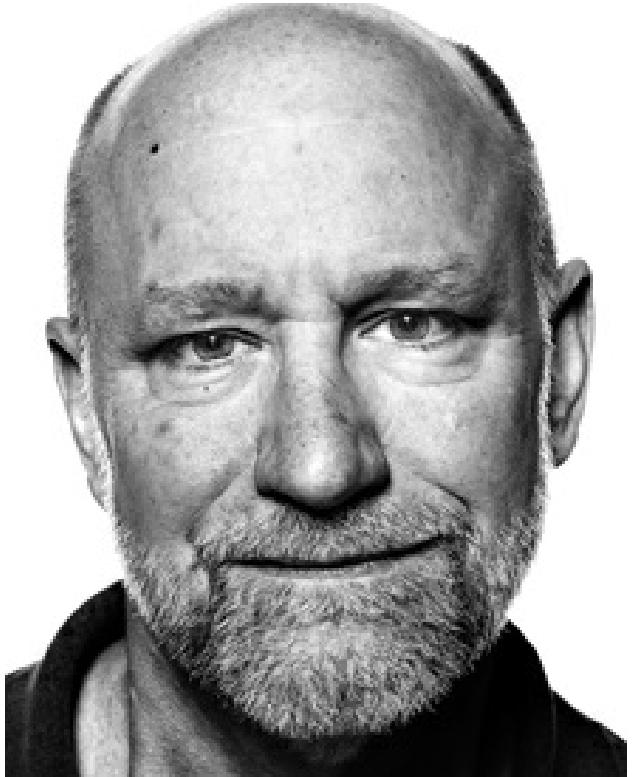
# KDE Plasma 5

KDE Plasma 5 is the fifth and current generation of the graphical workspaces environment created by KDE primarily for Linux systems. KDE Plasma 5 is the successor of KDE Plasma 4 and was first released on 15 July 2014. It includes a new default theme, known as "Breeze", as well as increased convergence across different devices. The graphical interface was fully migrated to QML, which uses OpenGL for hardware acceleration, which resulted in better performance and reduced power consumption. Plasma Mobile is a Plasma 5 variant for Linux-based smartphones.



## Keith Bostic (software engineer)

Keith Bostic is an American software engineer and one of the key people in the history of Berkeley Software Distribution (BSD) Unix and open-source software.



# Library (computing)

In computer science, a library is a collection of non-volatile resources used by computer programs, often for software development. These may include configuration data, documentation, help data, message templates, pre-written code and subroutines, classes, values or type specifications. In IBM's OS/360 and its successors they are referred to as partitioned data sets. A library is also a collection of implementations of behavior, written in terms of a language, that has a well-defined interface by which the behavior is invoked. For instance, people who want to write a higher-level program can use a library to make system calls instead of implementing those system calls over and over again. In addition, the behavior is provided for reuse by multiple independent programs. A program invokes the library-provided behavior via a mechanism of the language. For example, in a simple imperative language such as C, the behavior in a library is invoked by using C's normal function-call. What distinguishes the call as being to a library function, versus being to another function in the same program, is the way that the code is organized in the system. Library code is organized in such a way that it can be used by multiple programs that have no connection to each other, while code that is part of a program is organized to be used only within that one program. This distinction can gain a hierarchical notion when a program grows large, such as a multi-million-line program. In that case, there may be internal libraries that are reused by independent sub-portions of the large program. The distinguishing feature is that a library is organized for the purposes of being reused by independent programs or sub-programs, and the user only needs to know the interface and not the internal details of the library.



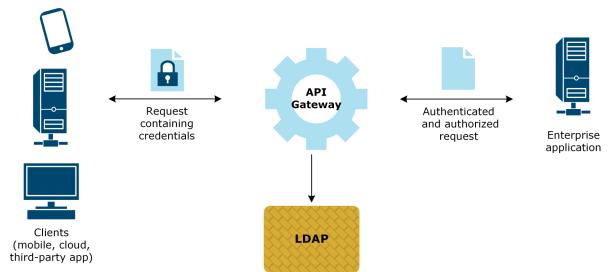
# Light-weight Linux distribution

A light-weight Linux distribution is one that uses lower memory and/or has less processor-speed requirements than a more "feature-rich" Linux distribution. The lower demands on hardware ideally result in a more responsive machine, and/or allow devices with fewer system resources (e.g. older or embedded hardware) to be used productively. The lower memory and/or processor-speed requirements are achieved by avoiding software bloat, i.e. by leaving out features that are perceived to have little or no practical use or advantage, or for which there is no or low demand.



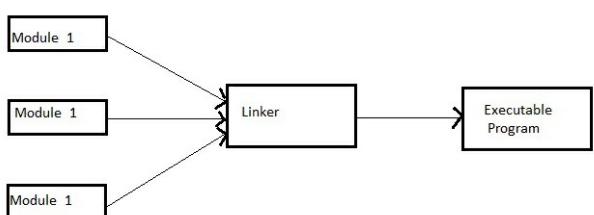
# Lightweight Directory Access Protocol

The Lightweight Directory Access Protocol (LDAP) is an open, vendor-neutral, industry standard application protocol for accessing and maintaining distributed directory information services over an Internet Protocol (IP) network. Directory services play an important role in developing intranet and Internet applications by allowing the sharing of information about users, systems, networks, services, and applications throughout the network. As examples, directory services may provide any organized set of records, often with a hierarchical structure, such as a corporate email directory. Similarly, a telephone directory is a list of subscribers with an address and a phone number.



# Linker (computing)

In computing, a linker or link editor is a computer system program that takes one or more object files (generated by a compiler or an assembler) and combines them into a single executable file, library file, or another "object" file.



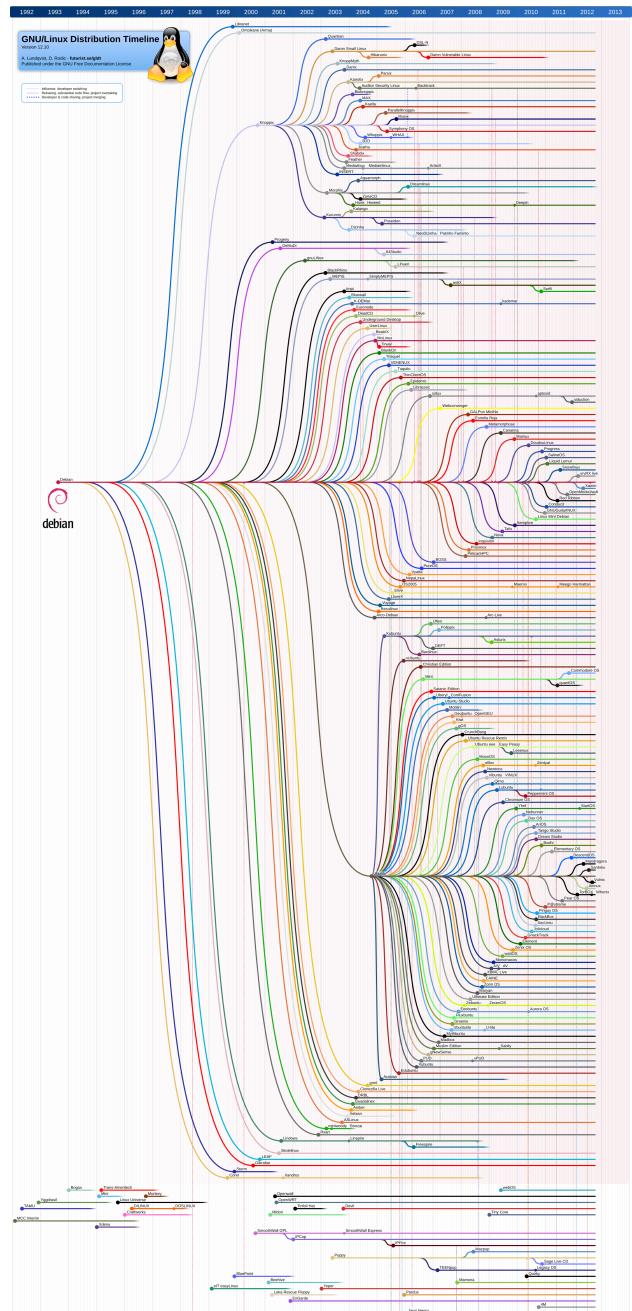
# Linus Torvalds

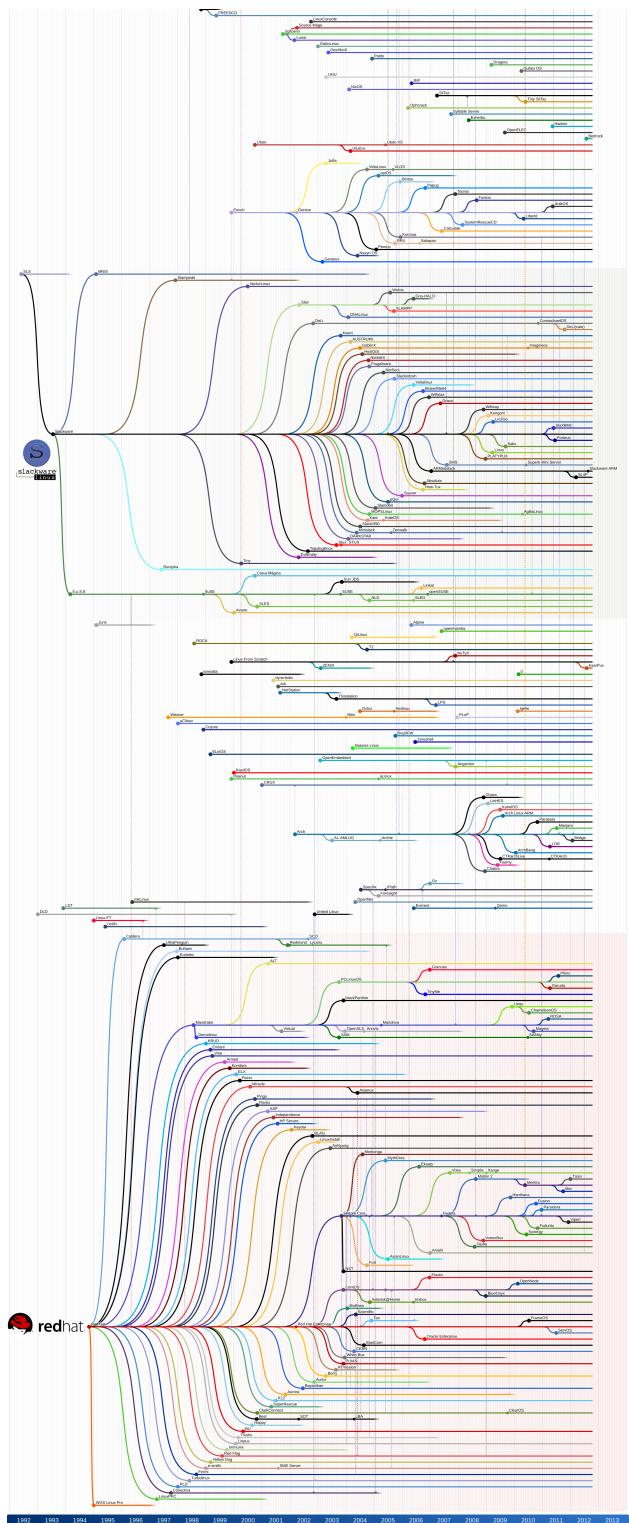
Linus Benedict Torvalds ( LEE-n?z TOR-vawldz, Finland Swedish: [?li?n?s ?tu?rv? lds] (listen); born 28 December 1969) is a Finnish software engineer who is the creator and, historically, the lead developer of the Linux kernel, used by Linux distributions and other operating systems such as Android. He also created the distributed version control system Git.



## Linux distribution

A Linux distribution (often abbreviated as distro) is an operating system made from a software collection that includes the Linux kernel, and often a package management system. Linux users usually obtain their operating system by downloading one of the Linux distributions, which are available for a wide variety of systems ranging from embedded devices (for example, OpenWrt) and personal computers (for example, Linux Mint) to powerful supercomputers (for example, Rocks Cluster Distribution).





## Linux kernel

The Linux kernel is a free and open-source, monolithic, modular, multitasking, Unix-like operating system kernel. It was originally authored in 1991 by Linus Torvalds for his i386-based PC, and it was soon adopted as the kernel for the GNU operating system, which was written to be a free (libre) replacement for Unix.

# List of important publications in computer science#Operating systems

This is a list of important publications in computer science, organized by field. Some reasons why a particular publication might be regarded as important:

ISSN 2319 - 7595  
Volume 7, No.5, September - October 2018

International Journal of Information Systems and Computer Sciences  
Available Online at <http://warse.org/IJISCS/staic/pdf/file/ijiscs03752018.pdf>  
<https://doi.org/10.30534/ijisce/2018/03752018>



## An Enhanced Text Mining Approach using Dynamic Programming

Desmond Bala Bisanda<sup>1</sup>, Nentave Yusuf Garundunma<sup>2</sup>, Mammun Tins Alami<sup>3</sup>, Dachallom Dorcas Datir<sup>1</sup>  
<sup>1,2,3</sup>Department of Computer Science University of Jos, Plateau State, Nigeria  
bisandad@unjos.edu.ng, yusuff@unjos.edu.ng, alamsm@unjos.edu.ng, datird@unjos.edu.ng  
<sup>Corresponding author</sup>

**ABSTRACT—** Test mining is a pervasive area of research in Computer Science. This is the process of finding knowledgeable and useful information and patterns from very huge texts. It is widely applied in several areas of applications such as bioinformatics, medical, financial, business etc. Keyword-based searching has been extensively applied in test dataset considering the keywords as strings. String matching is used in finding all the occurrences of a given pattern P of length m in a given text T of length n, where  $m \leq n$ . An occurrence of a pattern inside the text can

### 1. INTRODUCTION

One of the fundamental problems in information retrieval is searching for key information within huge data sets. Since data on the web is doubling very quickly, this makes knowledge discovery more complex, more challenging and difficult to handle [1]. The act of extracting meaningful knowledge or patterns from a large data set is simply referred to as data mining. Data can be in the form of video, voice, text etc.

Data mining has different areas of applications such as text mining, image processing, and artificial intelligence [4]. Information available in the text data-sets can be structured, semi-structured, or unstructured such as in the form of research papers, and electronic documents [5, 42, 43]. String matching is one of the main information retrieval methods [6].

Searching the text is required to extract knowledge. It is widely applied in numerous areas such as information retrievals, computational biology, text editor, image processing, data science, and search engines [7, 8]. Keywords matching is a type of string matching.

String matching is used in finding the occurrence of a given pattern P in the given text T [10, 11]. Pattern occurrence can simply be considered as "approximate" or "exact" [12]. There are various exact string matching, approximate string matching, regular expression searching, and online string searching (used for causal searching) [13]. In order to speed up the searching, there is a high quest for better algorithms [14]. Recently, the bit-parallelism algorithm has been used to solve pattern matching problem [15]. This kind of algorithm takes advantage of high-speed processor.

This research proposes a framework for text mining using string matching and bit-parallelism with the goal of addressing the problem of polysemy and synonymy in keyword search on textual documents.

simply be characterized as "exact" or "approximate". This paper proposes a framework for text mining using a fast bit-parallel algorithm for searching exact occurrences of a pattern inside a huge body of text. We evaluate the performance of three algorithms in the literature on different text files and discuss their suitability under different situations.

**KEYWORDS—** Algorithms; Bit-Parallelism; Data Mining; String Matching; Text Mining

The rest of the paper is organized as follows: Section II presents a study of related work. Section III and Section IV discusses the methods, procedures, and results discussion respectively. Finally, Section V is the conclusion and directions for future work.

### 2. RELATED WORK

The explosive growth of heterogeneous unstructured data on the Internet [16], prompts for efficient ways of exchanging information such as dissertations, and electronic mails through world wide Web (www) [2, 17]. Generally, frameworks for the exchange and integration of data needed for this purpose data mining mechanism are in high demand [11]. Text mining techniques that are used in converting unstructured data into structured / knowledge discovery have numerous areas of applications such as text searching, string matching, and machine learning [12, 18].

Pattern matching and retrieval of information in text consider the various types of data mining such as classical string matching [19, 20]. The string matching problem is widely applied in numerous applications areas such as image searching, computational biology, and plagiarism detection; generally using the two classes, exact and approximate string matching.

Uppal and Behera in [24] presented a novel algorithm for pattern matching in the area of bioinformatics.

Current release: Kodi v15.2 "Isengard"

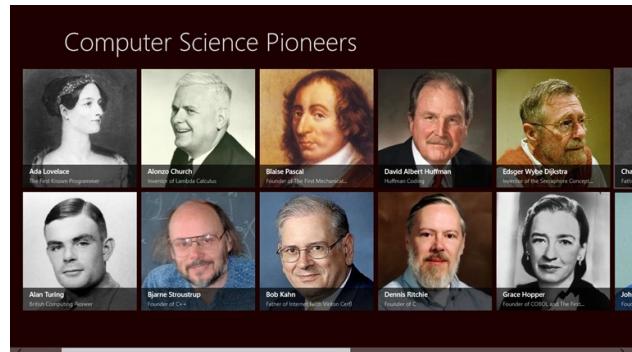


# List of operating systems

This is a list of operating systems. Computer operating systems can be categorized by technology, ownership, licensing, working state, usage, and by many other characteristics. In practice, many of these groupings may overlap. Criteria for inclusion is notability, as shown either through an existing Wikipedia article or citation to a reliable source.

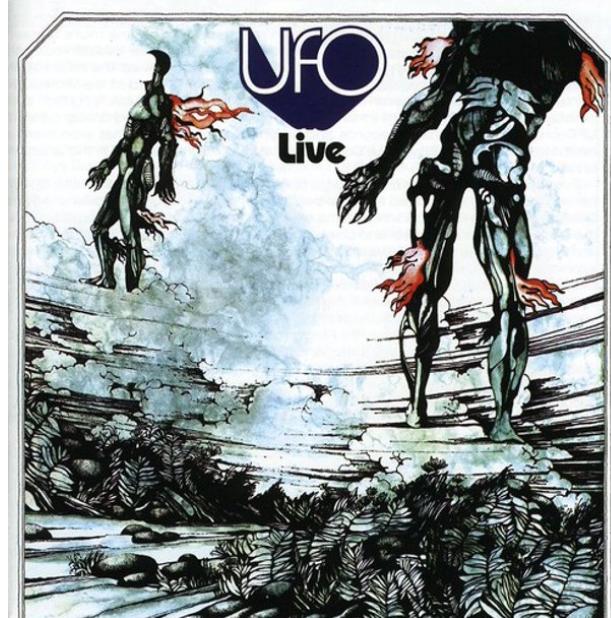
# List of pioneers in computer science

This is a list of people who made transformative breakthroughs in the creation, development and imagining of what computers could do.



## Live CD

Live2D is an animation software that can be used to generate real-time 2D animations? usually anime-style characters?using layered, continuous parts based on an illustration, without the need of frame-by-frame animation or a 3D model. This enables characters to move while maintaining the original illustration at low-cost. It can be considered as the balance of cost and effect of an animation.



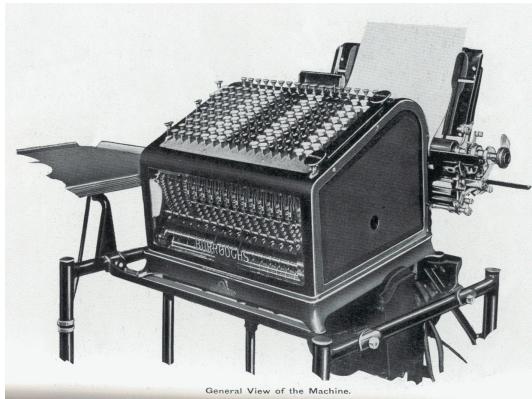
## M

M, or m, is the thirteenth letter in the Latin alphabet, used in the modern English alphabet, the alphabets of other western European languages and others worldwide. Its name in English is em (pronounced ), plural ems.



# MCP (Burroughs Large Systems)

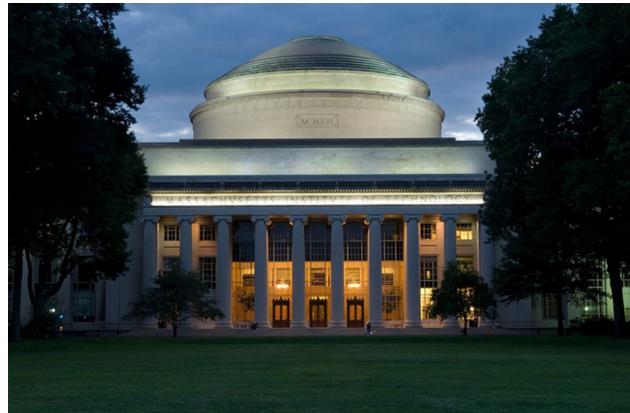
The MCP (Master Control Program) is the operating system of the Burroughs small, medium and large systems, including the Unisys Clearpath/MCP systems.



General View of the Machine.

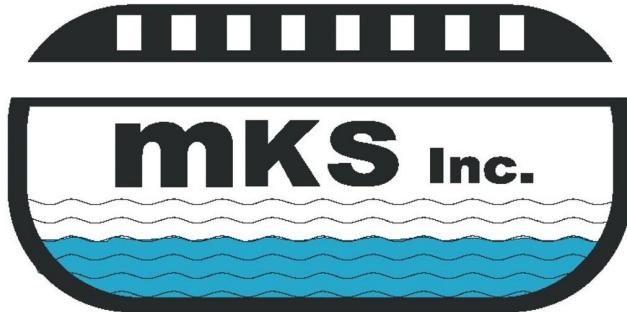
# MIT

The Secret Intelligence Service (SIS), commonly known as MI6 (Military Intelligence, Section 6), is the foreign intelligence service of the United Kingdom, tasked mainly with the covert overseas collection and analysis of human intelligence in support of the UK's national security. SIS is one of the British intelligence agencies and the Chief of the Secret Intelligence Service ("C") is directly accountable to the Foreign Secretary. Formed in 1909 as the foreign section of the Secret Service Bureau, the section grew greatly during the First World War officially adopting its current name around 1920. The name "MI6" (meaning Military Intelligence, Section 6) originated as a convenient label during the Second World War, when SIS was known by many names. It is still commonly used today. The existence of SIS was not officially acknowledged until 1994. That year the Intelligence Services Act 1994 (ISA) was introduced to Parliament, to place the organisation on a statutory footing for the first time. It provides the legal basis for its operations. Today, SIS is subject to public oversight by the Investigatory Powers Tribunal and the Intelligence and Security Committee of Parliament. The stated priority roles of SIS are counter-terrorism, counter-proliferation, providing intelligence in support of cyber security, and supporting stability overseas to disrupt terrorism and other criminal activities. Unlike its main sister agencies, Security Service (MI5) and Government Communications Headquarters (GCHQ), SIS works exclusively in foreign intelligence gathering; the ISA allows it to carry out operations only against persons outside the British Islands. Some of SIS's actions since the 2000s have attracted significant controversy, such as its alleged complicity in acts of enhanced interrogation techniques and extraordinary rendition. Since 1994, SIS headquarters have been in the SIS Building in London, on the South Bank of the River Thames.



## MKS Inc.

MKS, Inc (formerly called Mortice Kern Systems) is a subsidiary of PTC, Inc. It was previously a multinational independent software vendor that was acquired by Parametric Technology Corporation (now PTC) on May 31, 2011. MKS operated in the Application Lifecycle Management (ALM) and Systems Administration market segments. Integrity, a PTC Product manages systems and software development processes and connects engineering artifacts, including requirements, models, code and test, ensuring comprehensive lifecycle traceability.



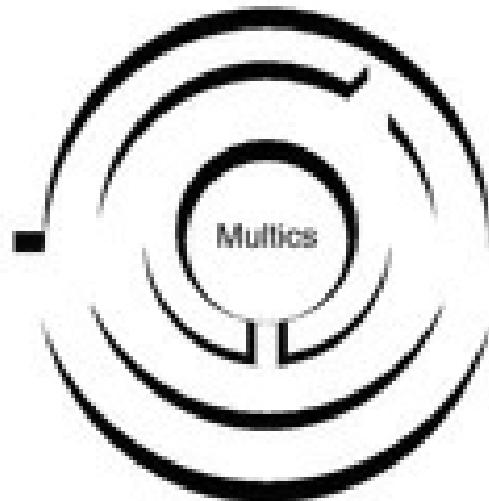
## MOS Technology 6502

The MOS Technology 6502 (typically pronounced "sixty-five-oh-two" or "six-five-oh-two") is an 8-bit microprocessor that was designed by a small team led by Chuck Peddle for MOS Technology. The design team had formerly worked at Motorola on the Motorola 6800 project; the 6502 is essentially a simplified, less expensive and faster version of that design.



# MULTICS

Multics ("Multiplexed Information and Computing Service") is an influential early time-sharing operating system based on the concept of a single-level memory. Nathan Gregory writes that Multics "has influenced all modern operating systems since, from microcomputers to mainframes." Initial planning and development for Multics started in 1964, in Cambridge, Massachusetts. Originally it was a cooperative project led by MIT (Project MAC with Fernando Corbató) along with General Electric and Bell Labs. It was developed on the GE 645 computer, which was specially designed for it; the first one was delivered to MIT in January 1967. GE offered their earlier 635 systems with an early timesharing system known as "Mark I" and intended to offer the 645 with Multics as a larger successor. Bell withdrew from the project in 1969 as it became clear it would not deliver a working system in the short term. Shortly thereafter, GE decided to exit the computer industry entirely and sold the division to Honeywell in 1970. Honeywell offered Multics commercially, but with limited success.



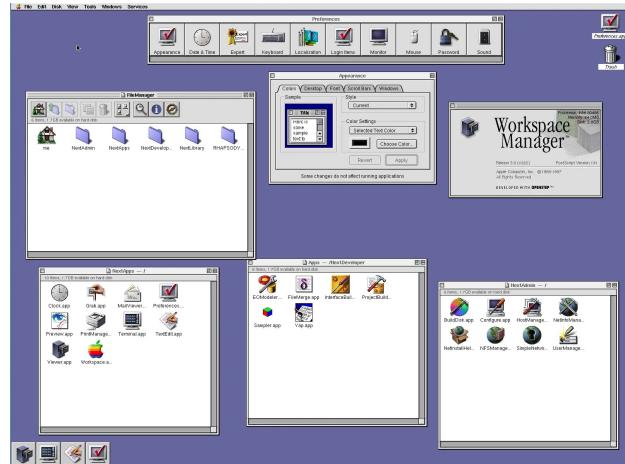
# Mac OS X Lion

OS X Lion, also known as Mac OS X Lion, (version 10.7) is the eighth major release of macOS, Apple's desktop and server operating system for Mac computers.



## Mac OS X Server 1.0

Mac OS X Server 1.0 is an operating system developed by Apple Computer, Inc. Released on March 16, 1999, it was the first version of Mac OS X Server.



## Mac OS X v10.0

Mac OS X 10.0 (code named Cheetah) is the first major release of Mac OS X, Apple's desktop and server operating system. It was released on March 24, 2001, for a price of \$129 after a public beta.



## MacOS Server

Mac OS X Server (later called OS X Server and macOS Server), is a discontinued series of Unix-like server operating systems developed by Apple Inc. based on macOS. It provided server functionality and system administration tools, and provided tools to manage both macOS-based computers and iOS-based devices.

## Machine code

In computer science, and more specifically in computability theory and computational complexity theory, a model of computation is a model which describes how an output of a mathematical function is computed given an input. A model describes how units of computations, memories, and communications are organized. The computational complexity of an algorithm can be measured given a model of computation. Using a model allows studying the performance of algorithms independently of the variations that are specific to particular implementations and specific technology.

### **Machine Code**

```
10011101000110100000  
01100011010001110110  
10000010111101101110  
11110110001011011000  
10000010011100011011  
10010011000111000000
```

## Magnetic tape

Magnetic tape is a medium for magnetic storage made of a thin, magnetizable coating on a long, narrow strip of plastic film. It was developed in Germany in 1928, based on the earlier magnetic wire recording from Denmark. Devices that use magnetic tape could with relative ease record and playback audio, visual, and binary computer data.



## Mainframe computer

A mainframe computer, informally called a mainframe or big iron, is a computer used primarily by large organizations for critical applications like bulk data processing for tasks such as censuses, industry and consumer statistics, enterprise resource planning, and large-scale transaction processing. A mainframe computer is large but not as large as a supercomputer and has more processing power than some other classes of computers, such as minicomputers, servers, workstations, and personal computers. Most large-scale computer-system architectures were established in the 1960s, but they continue to evolve. Mainframe computers are often used as servers.



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# Manchester Mark 1

The Manchester Mark 1 was one of the earliest stored-program computers, developed at the Victoria University of Manchester, England from the Manchester Baby (operational in June 1948). Work began in August 1948, and the first version was operational by April 1949; a program written to search for Mersenne primes ran error-free for nine hours on the night of 16/17 June 1949.



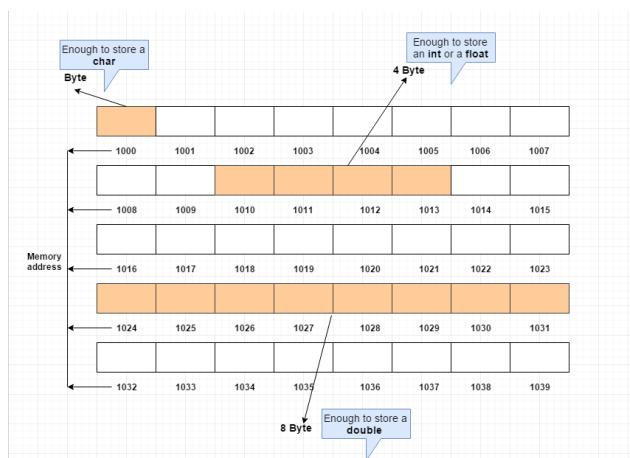
## Mass storage

In computing, mass storage refers to the storage of large amounts of data in a persisting and machine-readable fashion. In general, the term is used as large in relation to contemporaneous hard disk drives, but it has been used large in relation to primary memory as for example with floppy disks on personal computers.



## Memory address

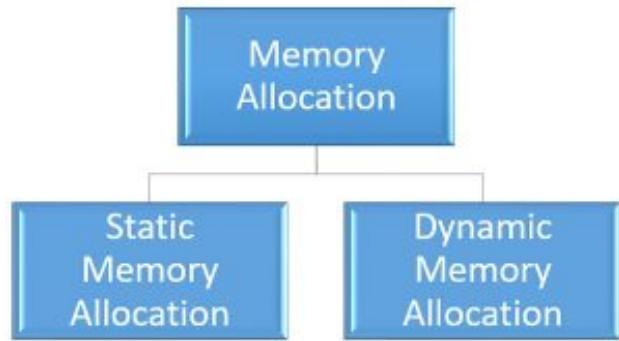
In computing, a memory address is a reference to a specific memory location used at various levels by software and hardware. Memory addresses are fixed-length sequences of digits conventionally displayed and manipulated as unsigned integers. Such numerical semantic bases itself upon features of CPU (such as the instruction pointer and incremental address registers), as well upon use of the memory like an array endorsed by various programming languages.



# Memory allocation

Memory management is a form of resource management applied to computer memory. The essential requirement of memory management is to provide ways to dynamically allocate portions of memory to programs at their request, and free it for reuse when no longer needed. This is critical to any advanced computer system where more than a single process might be underway at any time. Several methods have been devised that increase the effectiveness of memory management.

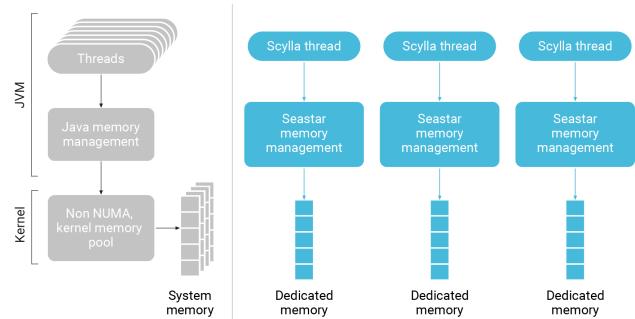
Virtual memory systems separate the memory addresses used by a process from actual physical addresses, allowing separation of processes and increasing the size of the virtual address space beyond the available amount of RAM using paging or swapping to secondary storage. The quality of the virtual memory manager can have an extensive effect on overall system performance.



# Memory management

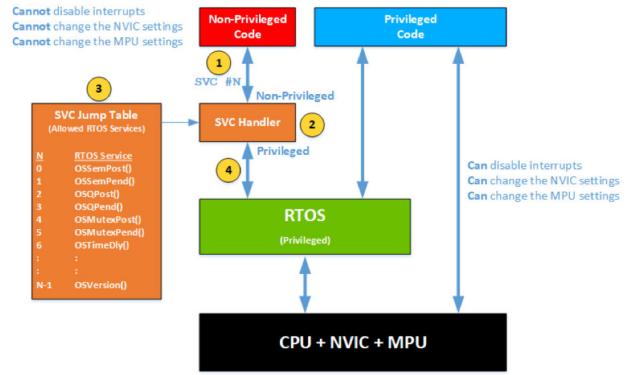
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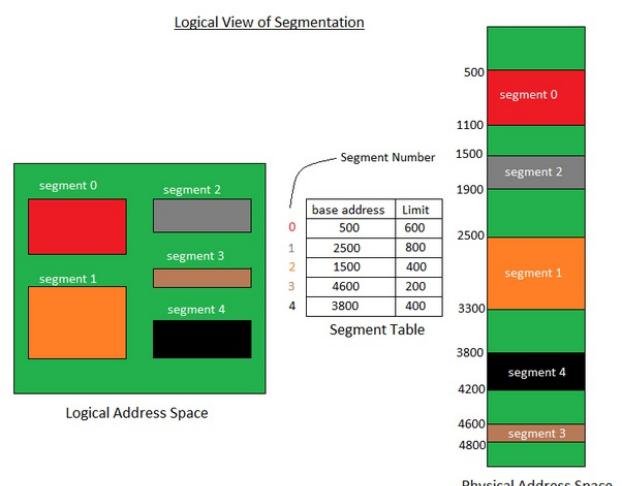
# Memory protection

Memory protection is a way to control memory access rights on a computer, and is a part of most modern instruction set architectures and operating systems. The main purpose of memory protection is to prevent a process from accessing memory that has not been allocated to it. This prevents a bug or malware within a process from affecting other processes, or the operating system itself. Protection may encompass all accesses to a specified area of memory, write accesses, or attempts to execute the contents of the area. An attempt to access unauthorized memory results in a hardware fault, e.g., a segmentation fault, storage violation exception, generally causing abnormal termination of the offending process. Memory protection for computer security includes additional techniques such as address space layout randomization and executable space protection.



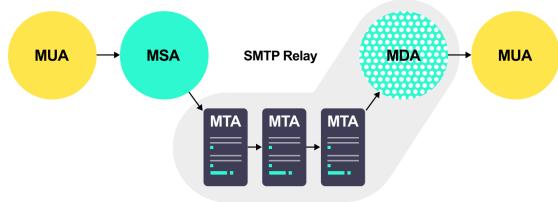
# Memory segmentation

Memory segmentation is an operating system memory management technique of division of a computer's primary memory into segments or sections. In a computer system using segmentation, a reference to a memory location includes a value that identifies a segment and an offset (memory location) within that segment. Segments or sections are also used in object files of compiled programs when they are linked together into a program image and when the image is loaded into memory.



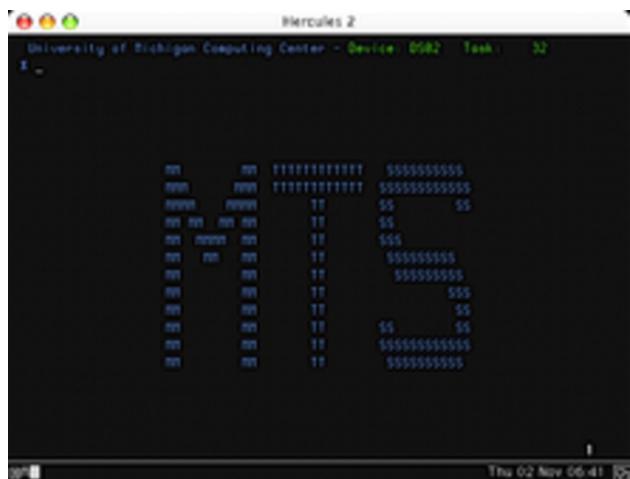
# Message transfer agent

Within the Internet email system, a message transfer agent (MTA), or mail transfer agent, or mail relay is software that transfers electronic mail messages from one computer to another using SMTP. The terms mail server, mail exchanger, and MX host are also used in some contexts.



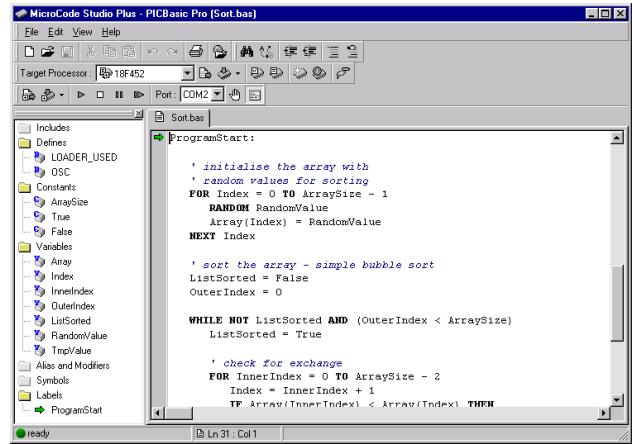
# Michigan Terminal System

The Michigan Terminal System (MTS) is one of the first time-sharing computer operating systems. Developed in 1967 at the University of Michigan for use on IBM S/360-67, S/370 and compatible mainframe computers, it was developed and used by a consortium of eight universities in the United States, Canada, and the United Kingdom over a period of 33 years (1967 to 1999).



# Microcode

In processor design, microcode is a technique that interposes an intermediate layer between the central processing unit (CPU) hardware and the programmer-visible instruction set architecture of a computer. Microcode is a layer of hardware-level instructions that implement higher-level machine code instructions or internal finite-state machine sequencing in many digital processing elements. Microcode is used in general-purpose central processing units, although in current desktop CPUs, it can be a fallback path for cases that the faster hardwired control unit cannot handle. Microcode typically resides in special high-speed memory and translates machine instructions, state machine data, or other input into sequences of detailed circuit-level operations. It separates the machine instructions from the underlying electronics so that instructions can be designed and altered more freely. It also facilitates the building of complex multi-step instructions, while reducing the complexity of computer circuits. Writing microcode is often called microprogramming and the microcode in a particular processor implementation is sometimes called a microprogram.



The screenshot shows the MicroCode Studio Plus interface for PICBasic Pro. The window title is "MicroCode Studio Plus - PICBasic Pro (Sort.bas)". The menu bar includes File, Edit, View, Help. The toolbar has various icons for file operations. The status bar shows "Target Processor: 18F452", "Port: COM2", and "Ln 31 : Col 1". The left pane displays a hierarchical list of symbols: Includes, Defines, Constants, Variables, Alias and Modifiers, Symbols, Labels, and ProgramStart. The right pane shows the assembly code for a sorting program:

```
ProgramStart:
    ; initialise the array with
    ; random values for sorting
    FOR Index = 0 TO ArraySize - 1
        RANDOM RandomValue
        Array(Index) = RandomValue
    NEXT Index

    ; sort the array - simple bubble sort
    ListSorted = False
    OuterIndex = 0

    WHILE NOT ListSorted AND (OuterIndex < ArraySize)
        ListSorted = True

        ; check for exchange
        FOR InnerIndex = 0 TO ArraySize - 2
            Index = InnerIndex + 1
            IF Array(InnerIndex) < Array(Index) THEN
                TmpValue = Array(InnerIndex)
                Array(InnerIndex) = Array(Index)
                Array(Index) = TmpValue
                ListSorted = False
            ENDIF
        NEXT Index
    NEXT OuterIndex
```

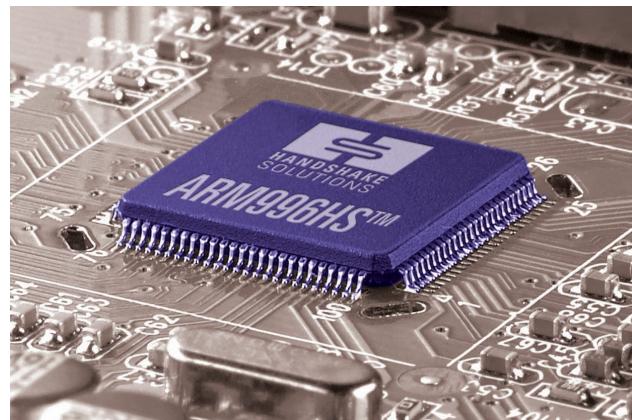
# Microcomputer

A microcomputer is a small, relatively inexpensive computer having a central processing unit (CPU) made out of a microprocessor. The computer also includes memory and input/output (I/O) circuitry together mounted on a printed circuit board (PCB). Microcomputers became popular in the 1970s and 1980s with the advent of increasingly powerful microprocessors. The predecessors to these computers, mainframes and minicomputers, were comparatively much larger and more expensive (though indeed present-day mainframes such as the IBM System z machines use one or more custom microprocessors as their CPUs). Many microcomputers (when equipped with a keyboard and screen for input and output) are also personal computers (in the generic sense). An early use of the term personal computer in 1962 predates microprocessor-based designs. (See "Personal Computer: Computers at Companies" reference below). A microcomputer used as an embedded control system may have no human-readable input and output devices. "Personal computer" may be used generically or may denote an IBM PC compatible machine.



# Microprocessor

A microprocessor is a computer processor where the data processing logic and control is included on a single integrated circuit (IC), or a small number of ICs. The microprocessor contains the arithmetic, logic, and control circuitry required to perform the functions of a computer's central processing unit (CPU). The IC is capable of interpreting and executing program instructions and performing arithmetic operations. The microprocessor is a multipurpose, clock-driven, register-based, digital integrated circuit that accepts binary data as input, processes it according to instructions stored in its memory, and provides results (also in binary form) as output. Microprocessors contain both combinational logic and sequential digital logic, and operate on numbers and symbols represented in the binary number system.



# Microsoft

Microsoft Corporation is an American multinational technology corporation headquartered in Redmond, Washington, United States. Microsoft's best-known software products are the Windows line of operating systems, the Microsoft Office suite, and the Internet Explorer and Edge web browsers. Its flagship hardware products are the Xbox video game consoles and the Microsoft Surface lineup of touchscreen personal computers. Microsoft ranked No. 21 in the 2020 Fortune 500 rankings of the largest United States corporations by total revenue; it was the world's largest software maker by revenue as of 2019. It is one of the Big Five American information technology companies, alongside Alphabet (Google), Amazon, Apple, and Meta (Facebook).



# Microsoft Windows

Windows is a group of several proprietary graphical operating system families developed and marketed by Microsoft. Each family caters to a certain sector of the computing industry. For example, Windows NT for consumers, Windows Server for servers, and Windows IoT for embedded systems. Defunct Windows families include Windows 9x, Windows Mobile, and Windows Phone.



# Midrange computer

Midrange computers, or midrange systems, were a class of computer systems that fell in between mainframe computers and microcomputers. This class of machine emerged in the 1960s, with models from Digital Equipment Corporation (PDP line), Data General (NOVA), Hewlett-Packard (HP3000) widely used in science and research as well as for business - and referred to as minicomputers. IBM favored the term "midrange computer" for their comparable, but more business-oriented systems.



# Minicomputer

A minicomputer, or colloquially mini, is a class of smaller general purpose computers that developed in the mid-1960s and sold at a much lower price than mainframe and mid-size computers from IBM and its direct competitors. In a 1970 survey, The New York Times suggested a consensus definition of a minicomputer as a machine costing less than US\$25,000 (equivalent to \$174,000 in 2021), with an input-output device such as a teleprinter and at least four thousand words of memory, that is capable of running programs in a higher level language, such as Fortran or BASIC. The class formed a distinct group with its own software architectures and operating systems. Minis were designed for control, instrumentation, human interaction, and communication switching as distinct from calculation and record keeping. Many were sold indirectly to original equipment manufacturers (OEMs) for final end-use application. During the two-decade lifetime of the minicomputer class (1965?1985), almost 100 companies formed and only a half dozen remained. When single-chip CPU microprocessors appeared, beginning with the Intel 4004 in 1971, the term "minicomputer" came to mean a machine that lies in the middle range of the computing spectrum, in between the smallest mainframe computers and the microcomputers. The term "minicomputer" is seldom used today; the contemporary term for this class of system is "midrange computer", such as the higher-end SPARC from Oracle, Power ISA from IBM, and Itanium-based systems from Hewlett-Packard.



## Mnemonic

A mnemonic device (nih-MON-ik), or memory device, is any learning technique that aids information retention or retrieval (remembering) in the human memory for better understanding.

| Mnemonic |                    |
|----------|--------------------|
| Please   | P - Parenthesis    |
| Excuse   | E - Exponent       |
| My       | M - Multiplication |
| Dear     | D - Division       |
| Aunt     | A - Addition       |
| Sally    | S - Subtraction    |

## Mobile device

A mobile device (or handheld computer) is a computer small enough to hold and operate in the hand. Mobile devices typically have a flat LCD or OLED screen, a touchscreen interface, and digital or physical buttons. They may also have a physical keyboard. Many such devices can connect to the Internet and connect with other devices such as car entertainment systems or headsets via Wi-Fi, Bluetooth, cellular networks or near field communication. Integrated cameras, the ability to place and receive voice and video telephone calls, video games, and Global Positioning System (GPS) capabilities are common. Power is typically provided by a lithium-ion battery. Mobile devices may run mobile operating systems that allow third-party applications to be installed and run.



## Mobile operating system

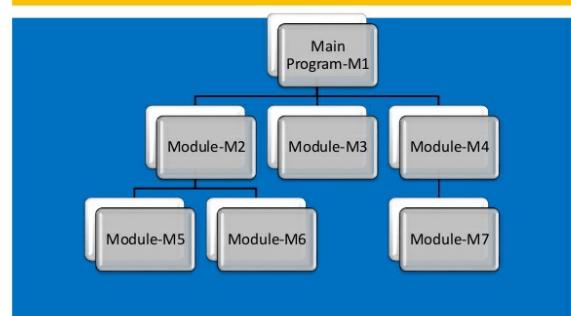
A mobile operating system is an operating system for smartphones, tablets, smartwatches, smartglasses, or other non-laptop personal mobile computing devices. While computers such as typical laptops are "mobile", the operating systems used on them are generally not considered mobile ones, as they were originally designed for desktop computers that historically did not have or need specific mobile features. This line distinguishing mobile and other forms has become blurred in recent years, due to the fact that newer devices have become smaller and more mobile unlike hardware of the past. Key notabilities blurring this line are the introduction of tablet computers and light-weight laptops and the hybridization of the two in 2-in-1 PCs.



## Modular programming

Modular programming is a software design technique that emphasizes separating the functionality of a program into independent, interchangeable modules, such that each contains everything necessary to execute only one aspect of the desired functionality.

Structure of Modular Programming



## MontaVista

MontaVista Software is a company that develops embedded Linux system software, development tools, and related software. Its products are made for other corporations developing embedded systems such as automotive electronics, communications equipment, mobile phones, and other electronic devices and infrastructure.



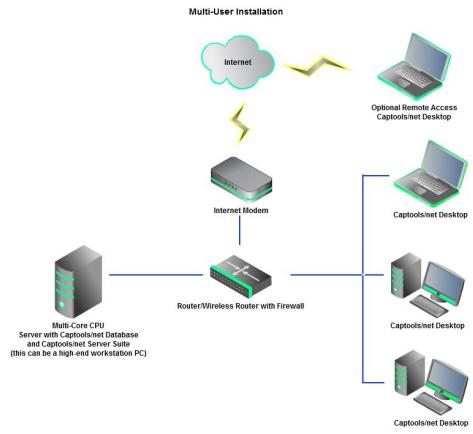
# MorphOS

Morpheus ('Fashioner', derived from the Ancient Greek: ????? meaning 'form, shape') is a god associated with sleep and dreams. In Ovid's Metamorphoses he is the son of Somnus and appears in dreams in human form. From the Middle Ages, the name began to stand more generally for the god of dreams, or of sleep.



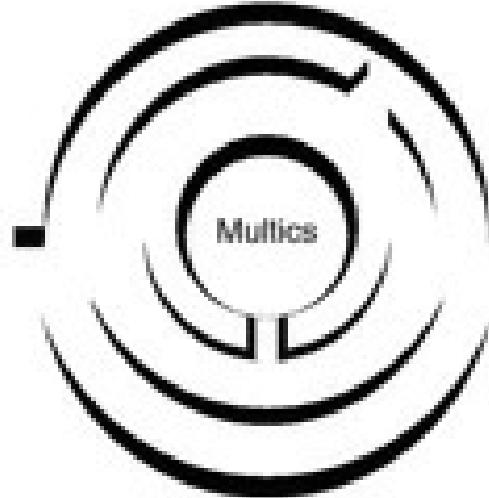
## Multi-user

Multi-user MIMO (MU-MIMO) is a set of multiple-input and multiple-output (MIMO) technologies for multipath wireless communication, in which multiple users or terminals, each radioing over one or more antennas, communicate with one another. In contrast, single-user MIMO (SU-MIMO) involves a single multi-antenna-equipped user or terminal communicating with precisely one other similarly equipped node. Analogous to how OFDMA adds multiple-access capability to OFDM in the cellular-communications realm, MU-MIMO adds multiple-user capability to MIMO in the wireless realm.



# Multics

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## Multilevel feedback queue

In computer science, a multilevel feedback queue is a scheduling algorithm. Scheduling algorithms are designed to have some process running at all times to keep the central processing unit (CPU) busy. The multilevel feedback queue extends standard algorithms with the following design requirements:

### Multilevel Feedback Queue

- A process can move between the various queues. A way to implement aging.
- Multilevel feedback queue scheduler is defined as follows:
  - number of queues.
  - scheduling policy for each queue.
  - method used to upgrade a process.
  - method used to degrade a process.
  - method used to introduce a process (which queue)
  - inter-scheduling between the queues (usually strict priority).

## NTFS

Resilient File System (ReFS), codenamed "Protagon", is a Microsoft proprietary file system introduced with Windows Server 2012 with the intent of becoming the "next generation" file system after NTFS.



## NTFS-3G

NTFS-3G is an open-source cross-platform implementation of the Microsoft Windows NTFS file system with read/write support. NTFS-3G often uses the FUSE file system interface, so it can run unmodified on many different operating systems. It is runnable on Linux, FreeBSD, NetBSD, OpenSolaris, illumos, BeOS, QNX, WinCE, Nucleus, VxWorks, Haiku, MorphOS, Minix, macOS and OpenBSD. It is licensed under the GNU General Public License. It is a partial fork of ntfsprogs and is under active maintenance and development.



## NetBSD

NetBSD is a free and open-source Unix operating system based on the Berkeley Software Distribution (BSD). It was the first open-source BSD descendant officially released after 386BSD was forked. It continues to be actively developed and is available for many platforms, including servers, desktops, handheld devices, and embedded systems. The NetBSD project focuses on code clarity, careful design, and portability across many computer architectures. Its source code is publicly available and permissively licensed.



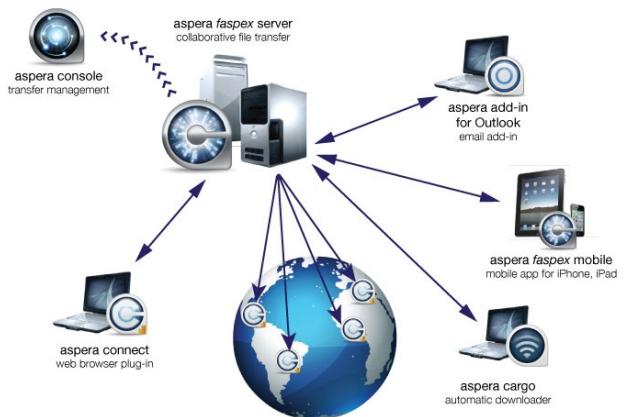
# Network File System

Network File System (NFS) is a distributed file system protocol originally developed by Sun Microsystems (Sun) in 1984, allowing a user on a client computer to access files over a computer network much like local storage is accessed. NFS, like many other protocols, builds on the Open Network Computing Remote Procedure Call (ONC RPC) system. NFS is an open IETF standard defined in a Request for Comments (RFC), allowing anyone to implement the protocol.



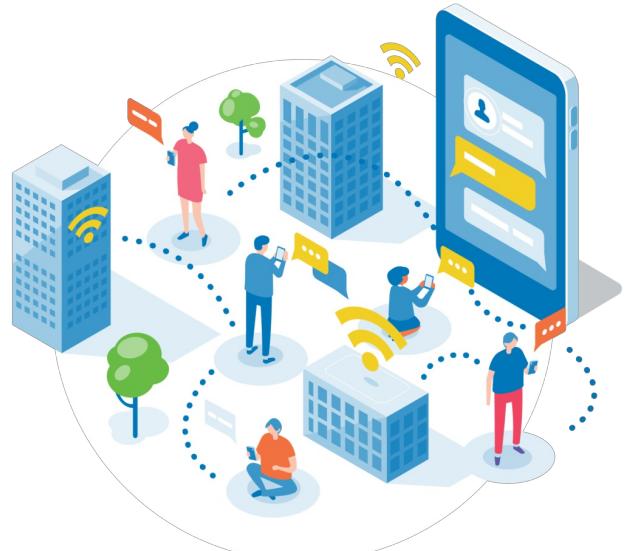
# Network operating system

A network operating system (NOS) is a specialized operating system for a network device such as a router, switch or firewall.



# Network service

In computer networking, a network service is an application running at the network application layer and above, that provides data storage, manipulation, presentation, communication or other capability which is often implemented using a client?server or peer-to-peer architecture based on application layer network protocols. Each service is usually provided by a server component running on one or more computers (often a dedicated server computer offering multiple services) and accessed via a network by client components running on other devices. However, the client and server components can both be run on the same machine.



## Niklaus Wirth

Niklaus Emil Wirth (born 15 February 1934) is a Swiss computer scientist. He has designed several programming languages, including Pascal, and pioneered several classic topics in software engineering. In 1984, he won the Turing Award, generally recognized as the highest distinction in computer science, for developing a sequence of innovative computer languages.



## O

O, or o, is the fifteenth letter and the fourth vowel letter in the Latin alphabet, used in the modern English alphabet, the alphabets of other western European languages and others worldwide. Its name in English is o (pronounced ), plural oes.



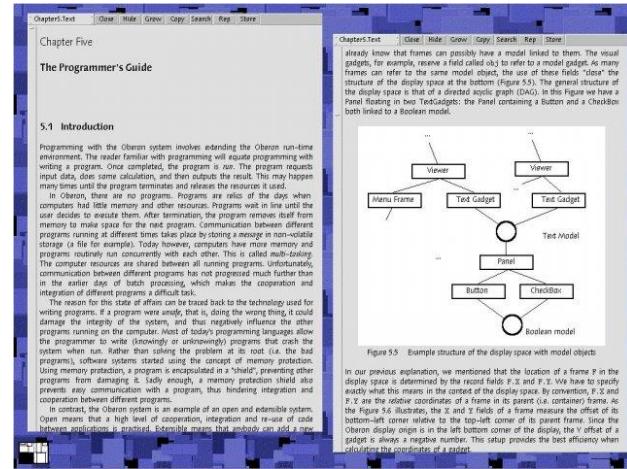
## OEM

Poetry (derived from the Greek poiesis, "making"), also called verse, is a form of literature that uses aesthetic and often rhythmic qualities of language ? such as phonaesthetics, sound symbolism, and metre ? to evoke meanings in addition to, or in place of, a prosaic ostensible meaning. A poem is a literary composition, written by a poet, using this principle.



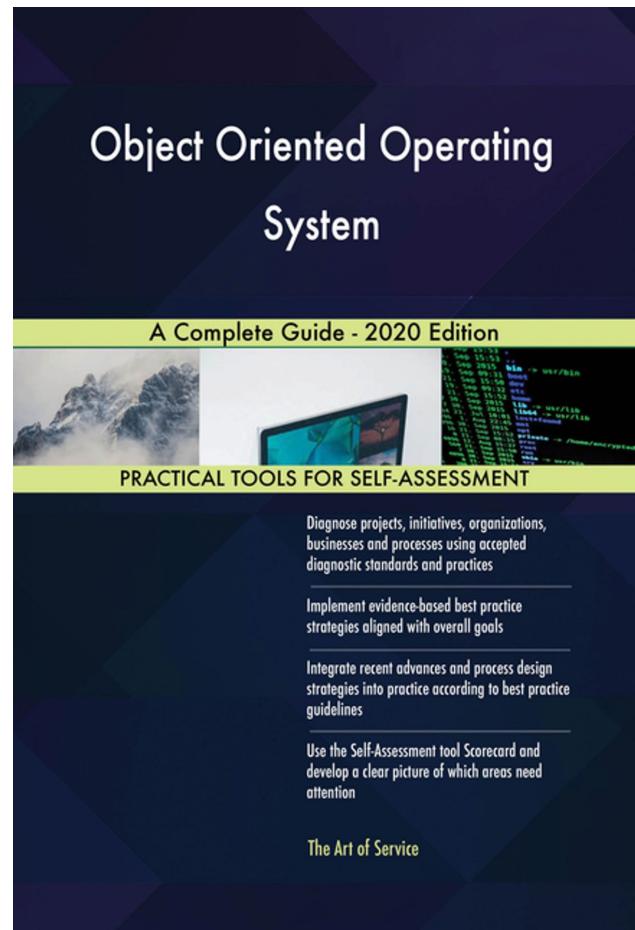
# Oberon (operating system)

The Oberon System is a modular, single-user, single-process, multitasking operating system written in the programming language Oberon. It was originally developed in the late 1980s at ETH Zurich. The Oberon System has an unconventional visual text user interface (TUI) instead of a conventional command-line interface (CLI) or graphical user interface (GUI). This TUI was very innovative in its time and influenced the design of the Acme text editor for the Plan 9 from Bell Labs operating system.



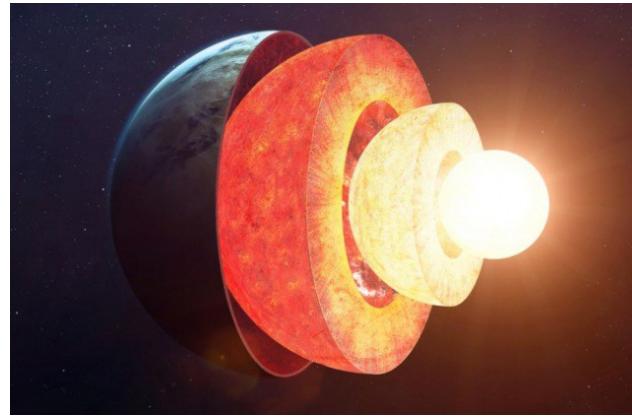
# Object-oriented operating system

An object-oriented operating system is an operating system that is designed, structured, and operated using object-oriented programming principles.



## Open core

The open-core model is a business model for the monetization of commercially produced open-source software. Coined by Andrew Lampitt in 2008, the open-core model primarily involves offering a "core" or feature-limited version of a software product as free and open-source software, while offering "commercial" versions or add-ons as proprietary software. The concept of open-core software has proven to be controversial, as many developers do not consider the business model to be true open-source software. Despite this, open-core models are used by many open-source software companies.



## Operating System Projects

OSP, an Environment for Operating System Projects, is a teaching operating system designed to provide an environment for an introductory course in operating systems. By selectively omitting specific modules of the operating system and having the students re-implement the missing functionality, an instructor can generate projects that require students to understand fundamental operating system concepts.



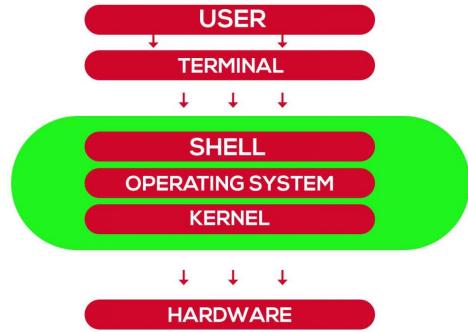
## Operating environment

In computer software, an operating environment or integrated applications environment is the environment in which users run application software. The environment consists of a user interface provided by an applications manager and usually an application programming interface (API) to the applications manager.



# Operating system abstraction layer

An operating system abstraction layer (OSAL) provides an application programming interface (API) to an abstract operating system making it easier and quicker to develop code for multiple software or hardware platforms.



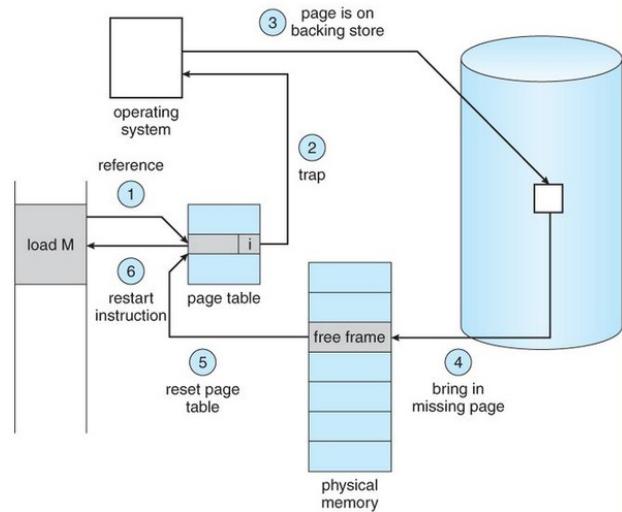
## P-code machine

In computer programming, a p-code machine (portable code machine) is a virtual machine designed to execute p-code (the assembly language or machine code of a hypothetical central processing unit (CPU)). This term is applied both generically to all such machines (such as the Java virtual machine (JVM) and MATLAB precompiled code), and to specific implementations, the most famous being the p-Machine of the Pascal-P system, particularly the UCSD Pascal implementation, among whose developers, the p in p-code was construed to mean pseudo more often than portable, thus pseudo-code meaning instructions for a pseudo-machine.



# Page fault

In computing, a page fault (sometimes called PF or hard fault) is an exception that the memory management unit (MMU) raises when a process accesses a memory page without proper preparations. Accessing the page requires a mapping to be added to the process's virtual address space. Besides, the actual page contents may need to be loaded from a backing store, such as a disk. The MMU detects the page fault, but the operating system's kernel handles the exception by making the required page accessible in the physical memory or denying an illegal memory access.



# Paging

In computer operating systems, memory paging (or swapping on some Unix-like systems) is a memory management scheme by which a computer stores and retrieves data from secondary storage for use in main memory. In this scheme, the operating system retrieves data from secondary storage in same-size blocks called pages. Paging is an important part of virtual memory implementations in modern operating systems, using secondary storage to let programs exceed the size of available physical memory.



## Palm OS

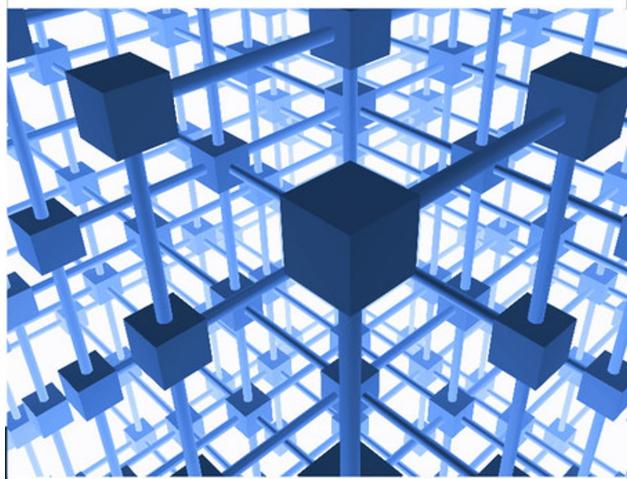
Palm oil is an edible vegetable oil derived from the mesocarp (reddish pulp) of the fruit of the oil palms. The oil is used in food manufacturing, in beauty products, and as biofuel. Palm oil accounted for about 33% of global oils produced from oil crops in 2014. Palm oils are easier to stabilize and maintain quality of flavor and consistency in processed foods, so are frequently favored by food manufacturers. On average globally, humans consumed 7.7 kg (17 lb) of palm oil per person in 2015. Demand has also increased for other uses, such as cosmetics and biofuels, creating more demand on the supply encouraging the growth of palm oil plantations in tropical countries.



# Parallel computing

Parallel computing is a type of computation in which many calculations or processes are carried out simultaneously. Large problems can often be divided into smaller ones, which can then be solved at the same time. There are several different forms of parallel computing: bit-level, instruction-level, data, and task parallelism. Parallelism has long been employed in high-performance computing, but has gained broader interest due to the physical constraints preventing frequency scaling. As power consumption (and consequently heat generation) by computers has become a concern in recent years, parallel computing has become the dominant paradigm in computer architecture, mainly in the form of multi-core processors. Parallel computing is closely related to concurrent computing; they are frequently used together, and often conflated, though the two are distinct: it is possible to have parallelism without concurrency, and concurrency without parallelism (such as multitasking by time-sharing on a single-core CPU). In parallel computing, a computational task is typically broken down into several, often many, very similar sub-tasks that can be processed independently and whose results are combined afterwards, upon completion. In contrast, in concurrent computing, the various processes often do not address related tasks; when they do, as is typical in distributed computing, the separate tasks may have a varied nature and often require some inter-process communication during execution.

## INTRODUCTION TO PARALLEL COMPUTING



ZBIGNIEW J. CZECH

# Penguin

Penguins (order Sphenisciformes , family Spheniscidae ) are a group of aquatic flightless birds. They live almost exclusively in the Southern Hemisphere: only one species, the Galapagos penguin, is found north of the Equator. Highly adapted for life in the water, penguins have countershaded dark and white plumage and flippers for swimming. Most penguins feed on krill, fish, squid and other forms of sea life which they catch with their bills and swallow whole while swimming. A penguin has a spiny tongue and powerful jaws to grip slippery prey. They spend roughly half of their lives on land and the other half in the sea. The largest living species is the emperor penguin (*Aptenodytes forsteri*): on average, adults are about 1.1 m (3 ft 7 in) tall and weigh 35 kg (77 lb). The smallest penguin species is the little blue penguin (*Eudyptula minor*), also known as the fairy penguin, which stands around 30?33 cm (12?13 in) tall and weighs 1.2?1.3 kg (2.6?2.9 lb). Today, larger penguins generally inhabit colder regions, and smaller penguins inhabit regions with temperate or tropical climates. Some prehistoric penguin species were enormous: as tall or heavy as an adult human. There was a great diversity of species in subantarctic regions, and at least one giant species in a region around 2,000 km south of the equator 35 mya, during the Late Eocene, a climate decidedly warmer than today.



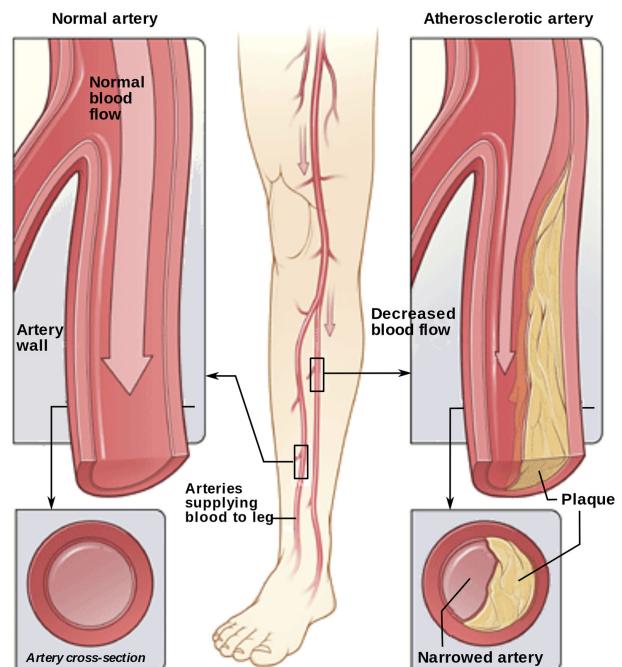
# Per Brinch Hansen

Per Brinch Hansen (13 November 1938 – 31 July 2007) was a Danish-American computer scientist known for his work in operating systems, concurrent programming and parallel and distributed computing.



## Peripheral

A peripheral device or peripheral is an auxiliary hardware device used to transfer information into and out of a computer. The term peripheral device refers to all hardware components that are attached to a computer and are controlled by the computer system, but they are not the core components of the computer.



## Personal computer

A personal computer (PC) is a multi-purpose microcomputer whose size, capabilities, and price make it feasible for individual use. Personal computers are intended to be operated directly by an end user, rather than by a computer expert or technician. Unlike large, costly minicomputers and mainframes, time-sharing by many people at the same time is not used with personal computers. Primarily in the late 1970s and 1980s, the term home computer was also used.



## Personal digital assistant

A personal digital assistant (PDA), also known as a handheld PC, is a variety mobile device which functions as a personal information manager. PDAs have been mostly displaced by the widespread adoption of highly capable smartphones, in particular those based on iOS and Android, seeing a rapid decline in use after 2007. A PDA has an electronic visual display. Most models also have audio capabilities, allowing usage as a portable media player, and also enabling many of them to be used as telephones. By the early 2000's, nearly all PDA models had the ability access the Internet, intranets or extranets via Wi-Fi or Wireless WANs, and generally include a web browser. Sometimes, instead of buttons, PDAs employ touchscreen technology.



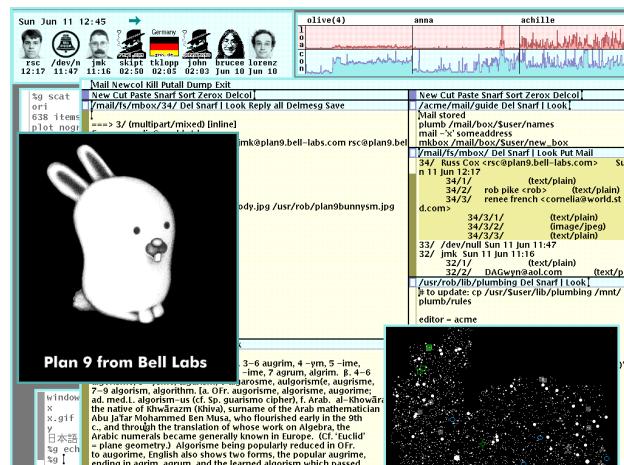
# PikeOS

PikeOS is a commercial, hard real-time operating system (RTOS) that offers a separation kernel based hypervisor with multiple logical partition types for many other operating systems (OS), each called a GuestOS, and applications. It enables users to build certifiable smart devices for the Internet of things (IoT) according to the high quality, safety and security standards of different industries. For safety and security critical real-time applications on controller-based systems without memory management unit (MMU) but with memory protection unit (MPU) PikeOS for MPU is available.



## Plan 9 from Bell Labs

Plan 9 from Bell Labs is a distributed operating system which originated from the Computing Science Research Center (CSRC) at Bell Labs in the mid-1980s and built on UNIX concepts first developed there in the late 1960s. Since 2000, Plan 9 has been free and open-source. The final official release was in early 2015.



## Plugboard

A plugboard or control panel (the term used depends on the application area) is an array of jacks or sockets (often called hubs) into which patch cords can be inserted to complete an electrical circuit. Control panels are sometimes used to direct the operation of unit record equipment, cipher machines, and early computers.



## Polling (computer science)

Polling, or polled operation, in computer science, refers to actively sampling the status of an external device by a client program as a synchronous activity. Polling is most often used in terms of input/output (I/O), and is also referred to as polled I/O or software-driven I/O. A good example of hardware implementation is a watchdog timer.

## Polling (computer science)

## Popek and Goldberg virtualization requirements

The Popek and Goldberg virtualization requirements are a set of conditions sufficient for a computer architecture to support system virtualization efficiently. They were introduced by Gerald J. Popek and Robert P. Goldberg in their 1974 article "Formal Requirements for Virtualizable Third Generation Architectures". Even though the requirements are derived under simplifying assumptions, they still represent a convenient way of determining whether a computer architecture supports efficient virtualization and provide guidelines for the design of virtualized computer architectures.



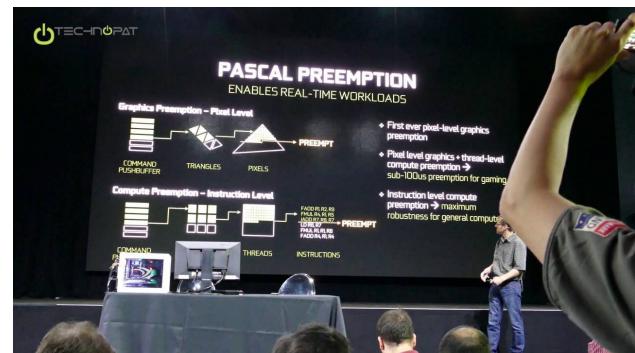
## Ported

In software engineering, porting is the process of adapting software for the purpose of achieving some form of execution in a computing environment that is different from the one that a given program (meant for such execution) was originally designed for (e.g., different CPU, operating system, or third party library). The term is also used when software/hardware is changed to make them usable in different environments. Software is portable when the cost of porting it to a new platform is significantly less than the cost of writing it from scratch. The lower the cost of porting software relative to its implementation cost, the more portable it is said to be.



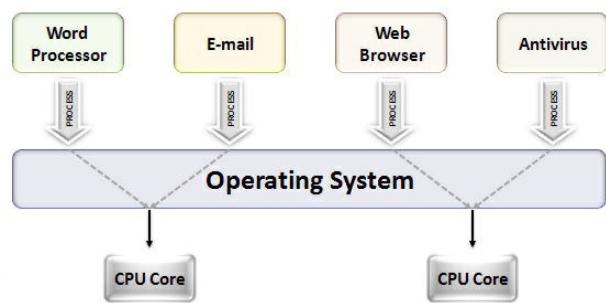
## Preemption (computing)

In computing, preemption is the act of temporarily interrupting an executing task, with the intention of resuming it at a later time. This interrupt is done by an external scheduler with no assistance or cooperation from the task.<sup>153</sup> This preemptive scheduler usually runs in the most privileged protection ring, meaning that interruption and resuming are considered highly secure actions. Such a change in the currently executing task of a processor is known as context switching.



## Preemptive multitasking

In computing, preemption is the act of temporarily interrupting an executing task, with the intention of resuming it at a later time. This interrupt is done by an external scheduler with no assistance or cooperation from the task.<sup>153</sup> This preemptive scheduler usually runs in the most privileged protection ring, meaning that interruption and resuming are considered highly secure actions. Such a change in the currently executing task of a processor is known as context switching.



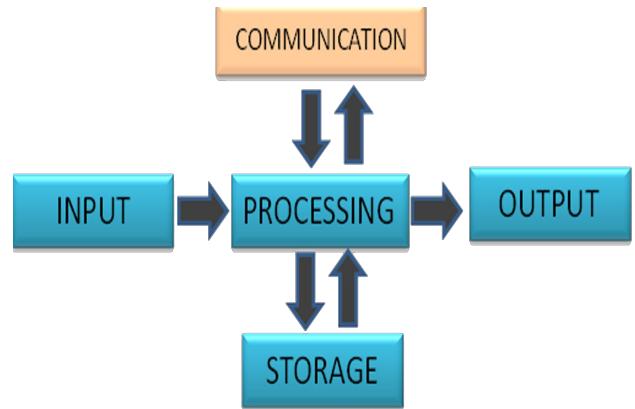
## Printer (computing)

In computing, a printer is a peripheral machine which makes a persistent representation of graphics or text, usually on paper. While most output is human-readable, bar code printers are an example of an expanded use for printers. Different types of printers include 3D printers, inkjet printers, laser printers, and thermal printers.



## Process (computing)

In computing, a process is the instance of a computer program that is being executed by one or many threads. There are many different process models, some of which are light weight, but almost all processes (even entire virtual machines) are rooted in an operating system (OS) process which comprises the program code, assigned system resources, physical and logical access permissions, and data structures to initiate, control and coordinate execution activity. Depending on the OS, a process may be made up of multiple threads of execution that execute instructions concurrently. While a computer program is a passive collection of instructions typically stored in a file on disk, a process is the execution of those instructions after being loaded from the disk into memory. Several processes may be associated with the same program; for example, opening up several instances of the same program often results in more than one process being executed.



# Process control block

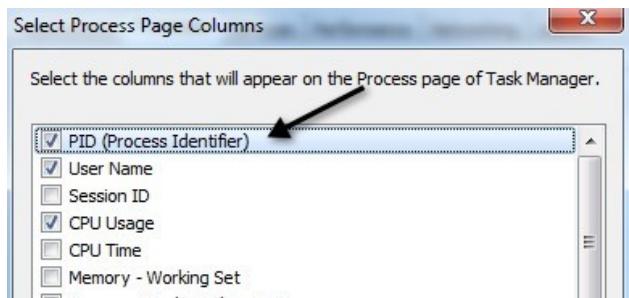
A process control block (PCB) is a data structure used by computer operating systems to store all the information about a process.

|                               |               |
|-------------------------------|---------------|
| Pointer to the process parent | Process State |
| Pointer to the process child  | Process State |
| Process Identification Number |               |
| Process Priority              |               |
| Program Counter               |               |
| Registers                     |               |
| Pointers to Process Memory    |               |
| Memory Limits                 |               |
| List of open Files            |               |
| • • •                         |               |

Created by Notes\_Jam

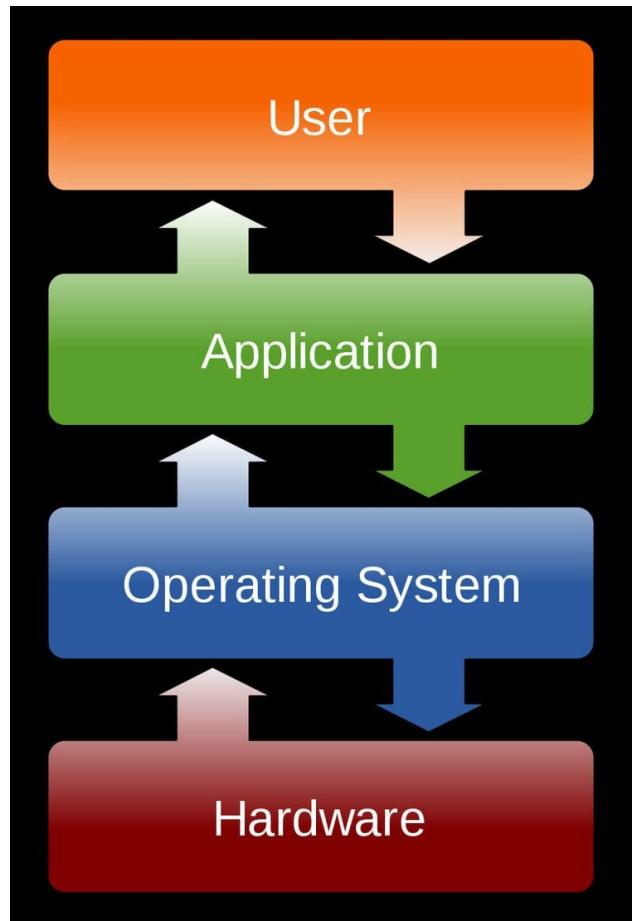
# Process identifier

In computing, the process identifier (a.k.a. process ID or PID) is a number used by most operating system kernels such as those of Unix, macOS and Windows to uniquely identify an active process. This number may be used as a parameter in various function calls, allowing processes to be manipulated, such as adjusting the process's priority or killing it altogether.



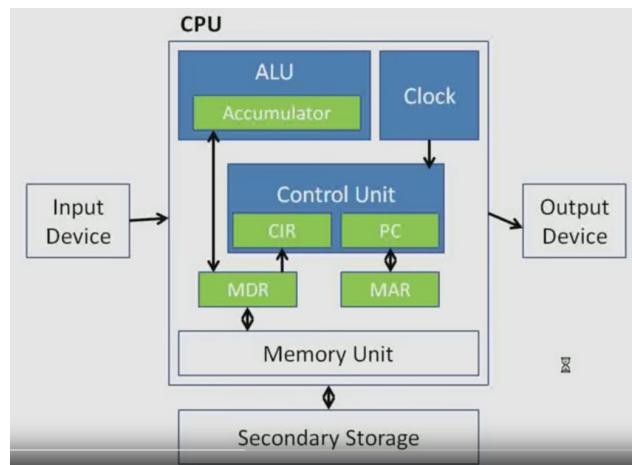
# Process management (computing)

A process is a program in execution, and an integral part of any modern-day operating system (OS). The OS must allocate resources to processes, enable processes to share and exchange information, protect the resources of each process from other processes and enable synchronization among processes. To meet these requirements, the OS must maintain a data structure for each process, which describes the state and resource ownership of that process, and which enables the OS to exert control over each process.



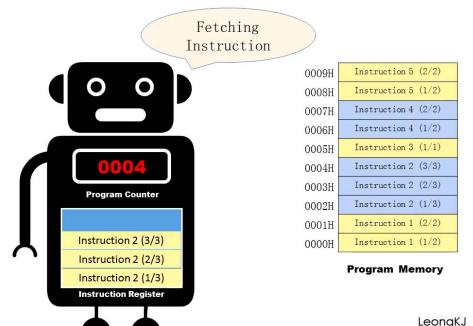
## Processor register

A processor register is a quickly accessible location available to a computer's processor. Registers usually consist of a small amount of fast storage, although some registers have specific hardware functions, and may be read-only or write-only. In computer architecture, registers are typically addressed by mechanisms other than main memory, but may in some cases be assigned a memory address e.g. DEC PDP-10, ICT 1900. Almost all computers, whether load/store architecture or not, load data from a larger memory into registers where it is used for arithmetic operations and is manipulated or tested by machine instructions. Manipulated data is then often stored back to main memory, either by the same instruction or by a subsequent one. Modern processors use either static or dynamic RAM as main memory, with the latter usually accessed via one or more cache levels.



# Program counter

The program counter (PC), commonly called the instruction pointer (IP) in Intel x86 and Itanium microprocessors, and sometimes called the instruction address register (IAR), the instruction counter, or just part of the instruction sequencer, is a processor register that indicates where a computer is in its program sequence. Usually, the PC is incremented after fetching an instruction, and holds the memory address of ("points to") the next instruction that would be executed. Processors usually fetch instructions sequentially from memory, but control transfer instructions change the sequence by placing a new value in the PC. These include branches (sometimes called jumps), subroutine calls, and returns. A transfer that is conditional on the truth of some assertion lets the computer follow a different sequence under different conditions.



LeongKJ

# Programmable Interrupt Controller

In computing, a programmable interrupt controller (PIC) is an integrated circuit that helps a microprocessor (or CPU) handle interrupt requests (IRQ) coming from multiple different sources (like external I/O devices) which may occur simultaneously. It helps prioritize IRQs so that the CPU switches execution to the most appropriate interrupt handler (ISR) after the PIC assesses the IRQ's relative priorities. Common modes of interrupt priority include hard priorities, rotating priorities, and cascading priorities. PICs often allow mapping input to outputs in a configurable way. On the PC architecture PIC are typically embedded into a southbridge chip whose internal architecture is defined by the chipset vendor's standards.



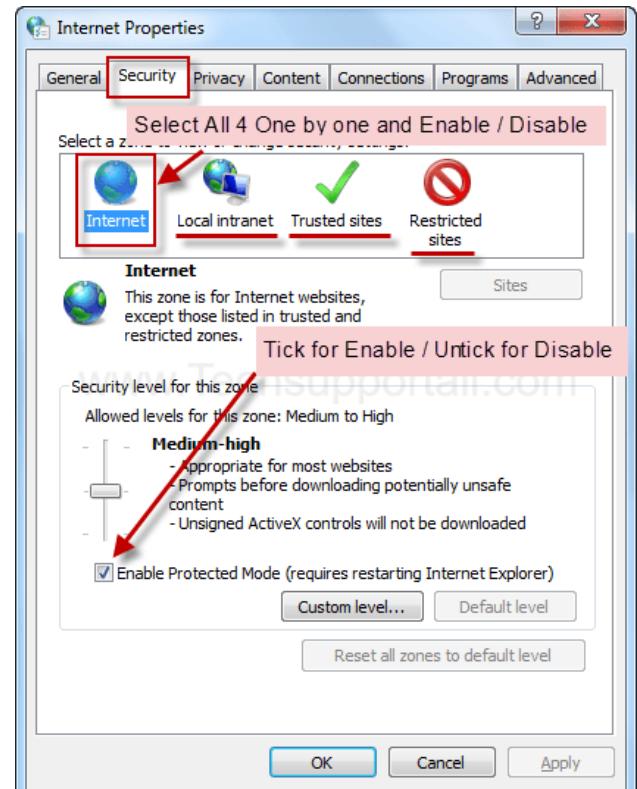
## Proprietary software

Proprietary software is software that is deemed within the free and open-source software community to be non-free because its creator, publisher, or other rightsholder or rightsholder partner exercises a legal monopoly by modern copyright and intellectual property law to exclude the recipient from freely sharing the software or modifying it, and?in some cases, as is the case with some patent-encumbered and EULA-bound software?from making use of the software on their own, thereby restricting their freedoms. It is often contrasted with open-source or free software. For this reason, it is also known as non-free software or closed-source software.



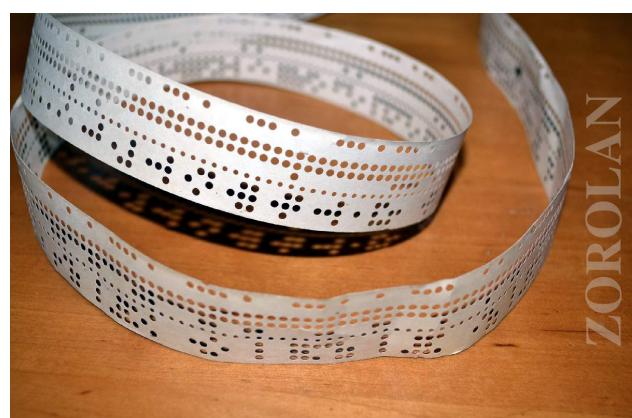
## Protected mode

In computing, protected mode, also called protected virtual address mode, is an operational mode of x86-compatible central processing units (CPUs). It allows system software to use features such as virtual memory, paging and safe multi-tasking designed to increase an operating system's control over application software. When a processor that supports x86 protected mode is powered on, it begins executing instructions in real mode, in order to maintain backward compatibility with earlier x86 processors. Protected mode may only be entered after the system software sets up one descriptor table and enables the Protection Enable (PE) bit in the control register 0 (CR0). Protected mode was first added to the x86 architecture in 1982, with the release of Intel's 80286 (286) processor, and later extended with the release of the 80386 (386) in 1985. Due to the enhancements added by protected mode, it has become widely adopted and has become the foundation for all subsequent enhancements to the x86 architecture, although many of those enhancements, such as added instructions and new registers, also brought benefits to the real mode.



## Punched tape

Punched tape or perforated paper tape is a form of data storage that consists of a long strip of paper in which holes are punched. It developed from and was subsequently used alongside punched cards, differing in that the tape is continuous.



## QNX

QNX ( or ) is a commercial Unix-like real-time operating system, aimed primarily at the embedded systems market. QNX was one of the first commercially successful microkernel operating systems. The product was originally developed in the early 1980s by Canadian company Quantum Software Systems, later renamed QNX Software Systems.



## Qt (software)

Qt (pronounced "cute") is cross-platform software for creating graphical user interfaces as well as cross-platform applications that run on various software and hardware platforms such as Linux, Windows, macOS, Android or embedded systems with little or no change in the underlying codebase while still being a native application with native capabilities and speed.



## RSX-11

RSX-11 is a discontinued family of multi-user real-time operating systems for PDP-11 computers created by Digital Equipment Corporation. In widespread use through the late 1970s and early 1980s, RSX-11 was influential in the development of later operating systems such as VMS and Windows NT.



# RTLinux

RTLinux is a hard realtime real-time operating system (RTOS) microkernel that runs the entire Linux operating system as a fully preemptive process. The hard real-time property makes it possible to control robots, data acquisition systems, manufacturing plants, and other time-sensitive instruments and machines from RTLinux applications. The design was patented. Despite the similar name, it is not related to the Real-Time Linux project of the Linux Foundation. RTLinux was developed by Victor Yodaiken, Michael Barabanov, Cort Dougan and others at the New Mexico Institute of Mining and Technology and then as a commercial product at FSMLabs. Wind River Systems acquired FSMLabs embedded technology in February 2007 and made a version available as Wind River Real-Time Core for Wind River Linux. As of August 2011, Wind River has discontinued the Wind River Real-Time Core product line, effectively ending commercial support for the RTLinux product.

# RTLinux

## Random access memory

Random-access memory (RAM; ) is a form of computer memory that can be read and changed in any order, typically used to store working data and machine code. A random-access memory device allows data items to be read or written in almost the same amount of time irrespective of the physical location of data inside the memory, in contrast with other direct-access data storage media (such as hard disks, CD-RWs, DVD-RWs and the older magnetic tapes and drum memory), where the time required to read and write data items varies significantly depending on their physical locations on the recording medium, due to mechanical limitations such as media rotation speeds and arm movement.



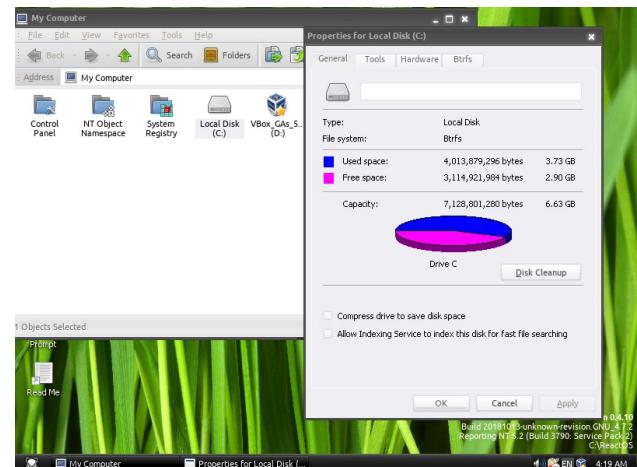
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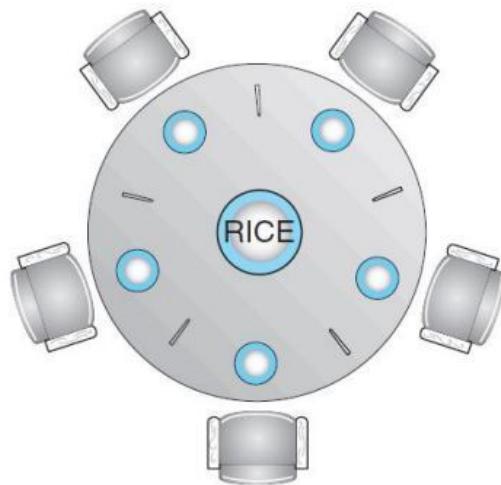
## ReactOS

ReactOS is a free and open-source operating system for amd64/i686 personal computers intended to be binary-compatible with computer programs and device drivers made for Windows Server 2003 and later versions of Windows. ReactOS has been noted as a potential open-source drop-in replacement for Windows and for its information on undocumented Windows APIs. ReactOS has been in development since 1996. As of February 2022, it is still considered feature-incomplete alpha software, and is therefore recommended by the developers only for evaluation and testing purposes. However, many Windows applications are currently working, such as Adobe Reader 9.3, GIMP 2.6, and LibreOffice 5.4. ReactOS is primarily written in C, with some elements, such as ReactOS File Explorer, written in C++. The project partially implements Windows API functionality and has been ported to the AMD64 processor architecture. ReactOS, as part of the FOSS ecosystem, re-uses and collaborates with many other FOSS projects, most notably the Wine project, which presents a Windows compatibility layer for Unix-like operating systems.



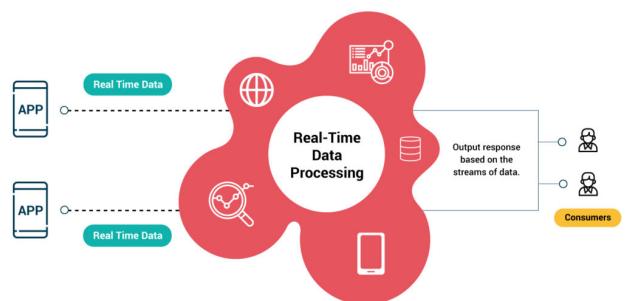
## Readers%E2%80%93writers problem

Readability is the ease with which a reader can understand a written text. In natural language, the readability of text depends on its content (the complexity of its vocabulary and syntax) and its presentation (such as typographic aspects that affect legibility, like font size, line height, character spacing, and line length). Researchers have used various factors to measure readability, such as:



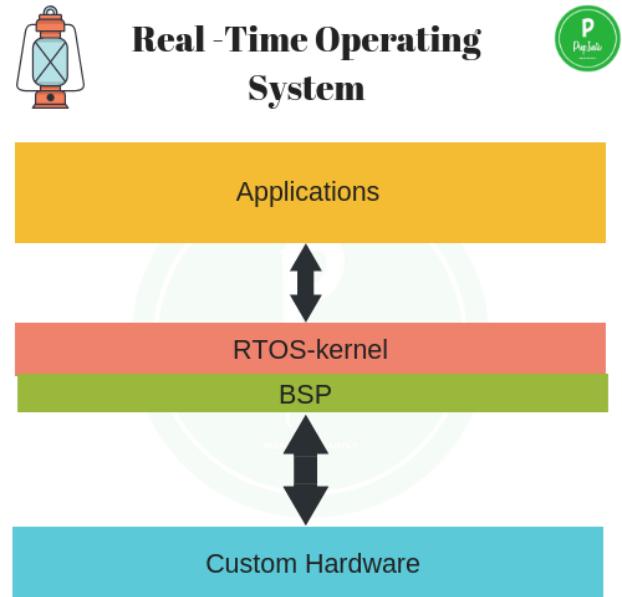
## Real-time computing

Real-time computing (RTC) is the computer science term for hardware and software systems subject to a "real-time constraint", for example from event to system response. Real-time programs must guarantee response within specified time constraints, often referred to as "deadlines". Real-time responses are often understood to be in the order of milliseconds, and sometimes microseconds. A system not specified as operating in real time cannot usually guarantee a response within any timeframe, although typical or expected response times may be given. Real-time processing fails if not completed within a specified deadline relative to an event; deadlines must always be met, regardless of system load.



# Real-time operating system

A real-time operating system (RTOS) is an operating system (OS) for real-time computing applications that processes data and events that have critically defined time constraints. An RTOS is distinct from a time-sharing operating system, such as Unix, which manages the sharing of system resources with a scheduler, data buffers, or fixed task prioritization in a multitasking or multiprogramming environment. Processing time requirements need to be fully understood and bound rather than just kept as a minimum. All processing must occur within the defined constraints. Real-time operating systems are event-driven and preemptive, meaning the OS can monitor the relevant priority of competing tasks, and make changes to the task priority. Event-driven systems switch between tasks based on their priorities, while time-sharing systems switch the task based on clock interrupts.



# Red Hat Enterprise Linux

Red Hat Enterprise Linux (RHEL) is a commercial open-source Linux distribution developed by Red Hat for the commercial market. Red Hat Enterprise Linux is released in server versions for x86-64, Power ISA, ARM64, and IBM Z and a desktop version for x86-64. Fedora Linux serves as its upstream source. All of Red Hat's official support and training, together with the Red Hat Certification Program, focuses on the Red Hat Enterprise Linux platform.



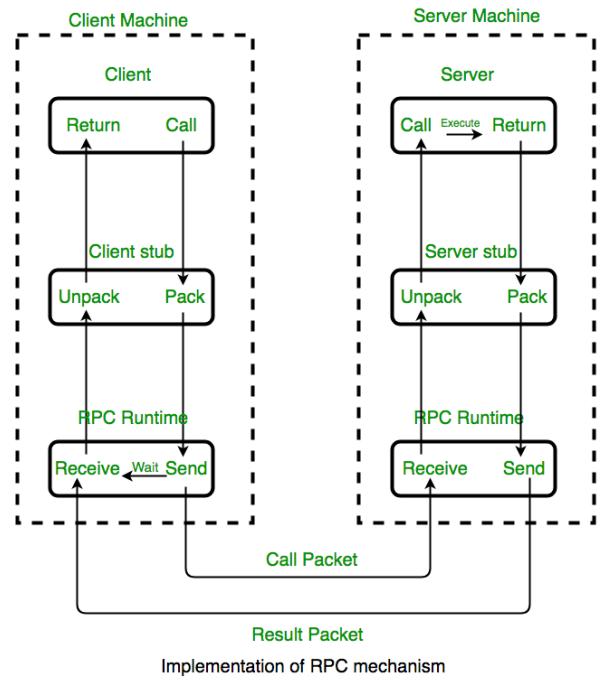
# ReiserFS

Reiser4 is a computer file system, successor to the ReiserFS file system, developed from scratch by Namesys and sponsored by DARPA as well as Linspire. Reiser4 was named after its former lead developer Hans Reiser. As of 2021, the Reiser4 patch set is still being maintained, but according to Phoronix, it is unlikely to be merged into mainline Linux without corporate backing.



## Remote procedure call

In distributed computing, a remote procedure call (RPC) is when a computer program causes a procedure (subroutine) to execute in a different address space (commonly on another computer on a shared network), which is coded as if it were a normal (local) procedure call, without the programmer explicitly coding the details for the remote interaction. That is, the programmer writes essentially the same code whether the subroutine is local to the executing program, or remote. This is a form of client?server interaction (caller is client, executor is server), typically implemented via a request?response message-passing system. In the object-oriented programming paradigm, RPCs are represented by remote method invocation (RMI). The RPC model implies a level of location transparency, namely that calling procedures are largely the same whether they are local or remote, but usually, they are not identical, so local calls can be distinguished from remote calls. Remote calls are usually orders of magnitude slower and less reliable than local calls, so distinguishing them is important.



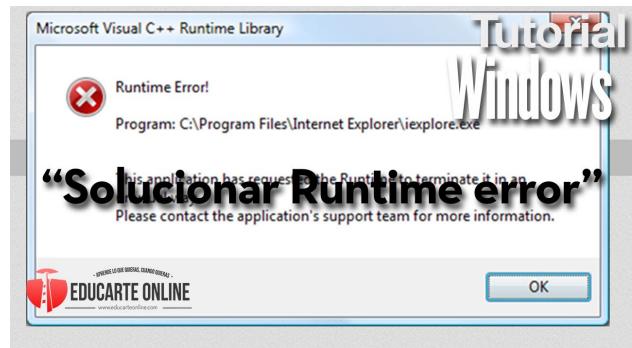
## Resident monitor

In computing, a resident monitor is a type of system software program that was used in many early computers from the 1950s to 1970s. It can be considered a precursor to the operating system. The name is derived from a program which is always present in the computer's memory, thus being "resident". Because memory was very limited on those systems, the resident monitor was often little more than a stub that would gain control at the end of a job and load a non-resident portion to perform required job cleanup and setup tasks.



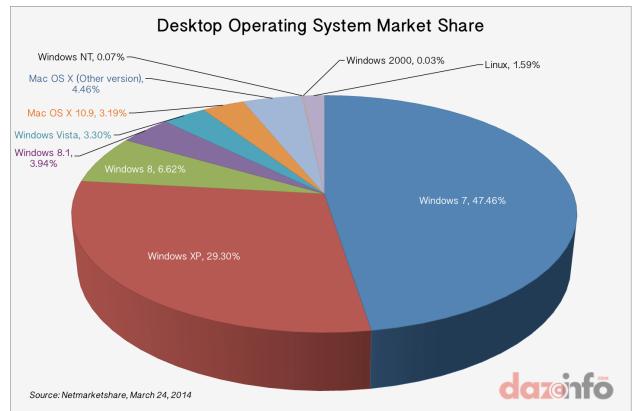
## Runtime library

In computer programming, a runtime library is a set of low-level routines used by a compiler to invoke some of the behaviors of a runtime environment, by inserting calls to the runtime library into compiled executable binary. The runtime environment implements the execution model, built-in functions, and other fundamental behaviors of a programming language. During execution (run time) of that computer program, execution of those calls to the runtime library cause communication between the executable binary and the runtime environment. A runtime library often includes built-in functions for memory management or exception handling. Therefore, a runtime library is always specific to the platform and compiler.



# SHARE Operating System

The usage share of operating systems is the percentage of computing devices that run each operating system (OS) at any particular time. All such figures are necessarily estimates because data about operating system share is difficult to obtain. There are few reliable primary sources and no agreed methodologies for its collection. Operating systems are used in numerous device types, from embedded devices without a screen through to supercomputers.



## SP

S, or s, is the nineteenth letter in the Latin alphabet, used in the modern English alphabet, the alphabets of other western European languages and others worldwide. Its name in English is ess (pronounced ), plural esses.



# SPARC

SPARC (Scalable Processor Architecture) is a reduced instruction set computer (RISC) instruction set architecture originally developed by Sun Microsystems. Its design was strongly influenced by the experimental Berkeley RISC system developed in the early 1980s. First developed in 1986 and released in 1987, SPARC was one of the most successful early commercial RISC systems, and its success led to the introduction of similar RISC designs from many vendors through the 1980s and 1990s.



## Samba (software)

Samba is a free software re-implementation of the SMB networking protocol, and was originally developed by Andrew Tridgell. Samba provides file and print services for various Microsoft Windows clients and can integrate with a Microsoft Windows Server domain, either as a Domain Controller (DC) or as a domain member. As of version 4, it supports Active Directory and Microsoft Windows NT domains.



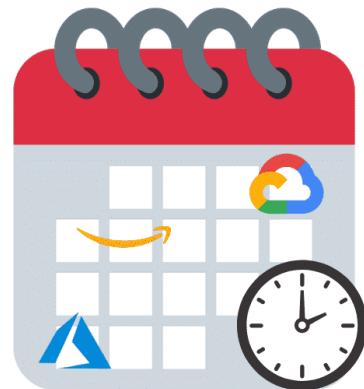
## Sandbox (computer security)

In computer security, a sandbox is a security mechanism for separating running programs, usually in an effort to mitigate system failures and/or software vulnerabilities from spreading. The isolation metaphor is taken from the idea of children who do not play well together, so each is given their own sandbox to play in alone. It is often used to execute untested or untrusted programs or code, possibly from unverified or untrusted third parties, suppliers, users or websites, without risking harm to the host machine or operating system. A sandbox typically provides a tightly controlled set of resources for guest programs to run in, such as storage and memory scratch space. Network access, the ability to inspect the host system, or read from input devices are usually disallowed or heavily restricted.



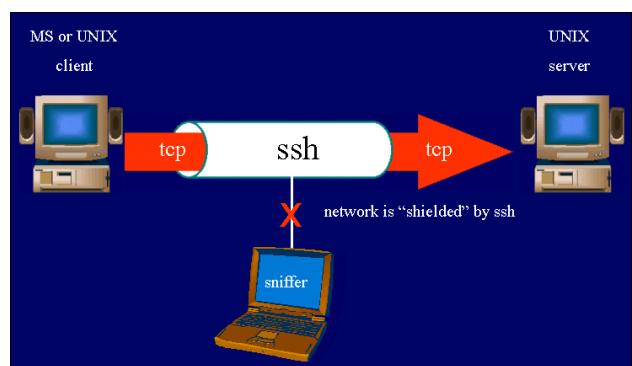
## Scheduler (computing)

In computing, scheduling is the action of assigning resources to perform tasks. The resources may be processors, network links or expansion cards. The tasks may be threads, processes or data flows.



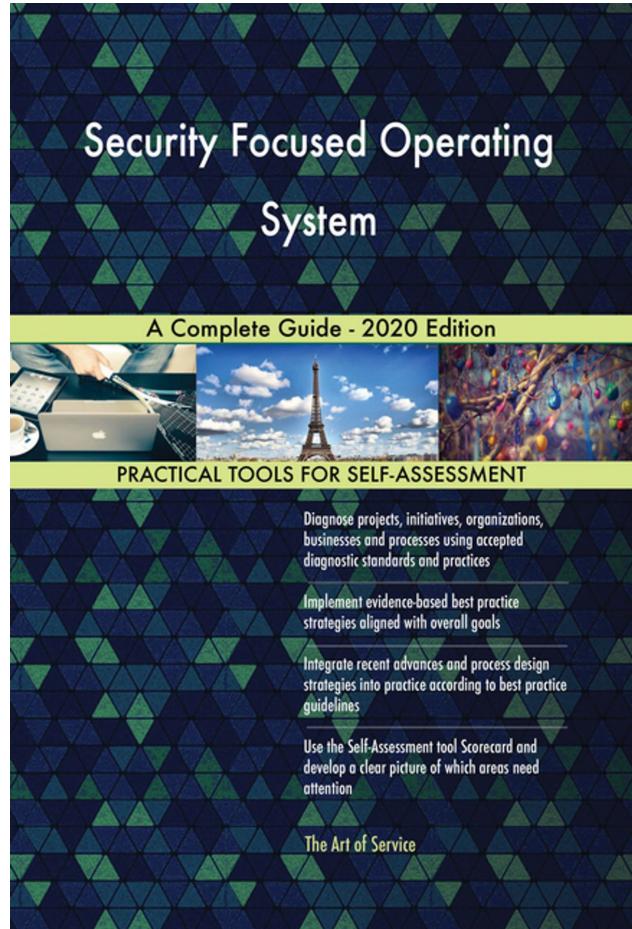
## Secure Shell

The Secure Shell Protocol (SSH) is a cryptographic network protocol for operating network services securely over an unsecured network. Its most notable applications are remote login and command-line execution.



# Security-focused operating system

This is a list of operating systems specifically focused on security. Operating systems for general-purpose usage may be secure without having a specific focus on security. Similar concepts include security-evaluated operating systems that have achieved certification from an auditing organization, and trusted operating systems that provide sufficient support for multilevel security and evidence of correctness to meet a particular set of requirements.



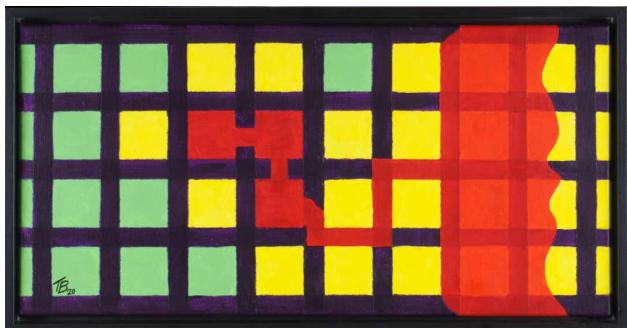
## Segmentation fault

In computing, a segmentation fault (often shortened to segfault) or access violation is a fault, or failure condition, raised by hardware with memory protection, notifying an operating system (OS) the software has attempted to access a restricted area of memory (a memory access violation). On standard x86 computers, this is a form of general protection fault. The operating system kernel will, in response, usually perform some corrective action, generally passing the fault on to the offending process by sending the process a signal. Processes can in some cases install a custom signal handler, allowing them to recover on their own, but otherwise the OS default signal handler is used, generally causing abnormal termination of the process (a program crash), and sometimes a core dump.

A screenshot of a terminal window with a black background and white text. The window has a menu bar at the top with options "Acción", "Herramientas", and "Ctrl+Alt+Supr". The main area of the terminal shows several lines of text starting with "Segmentation fault" repeated multiple times, followed by an error message: "/bin/sh: error while loading shared libraries: [F8]\$[ET][cannot open shared object file: No such file or directory". There is also a single dash character at the bottom.

# Segmentation violation

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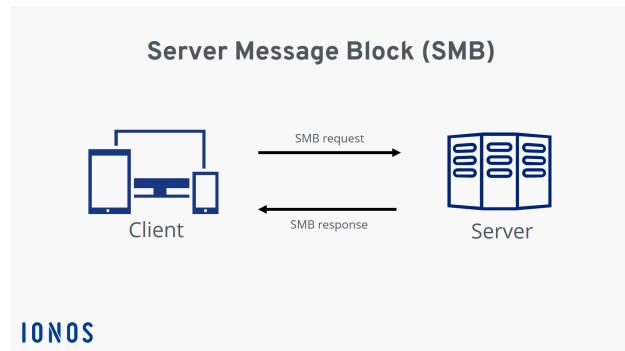
# Server (computing)

In computing, a server is a piece of computer hardware or software (computer program) that provides functionality for other programs or devices, called "clients". This architecture is called the client?server model. Servers can provide various functionalities, often called "services", such as sharing data or resources among multiple clients, or performing computation for a client. A single server can serve multiple clients, and a single client can use multiple servers. A client process may run on the same device or may connect over a network to a server on a different device. Typical servers are database servers, file servers, mail servers, print servers, web servers, game servers, and application servers. Client?server systems are usually most frequently implemented by (and often identified with) the request?response model: a client sends a request to the server, which performs some action and sends a response back to the client, typically with a result or acknowledgment. Designating a computer as "server-class hardware" implies that it is specialized for running servers on it. This often implies that it is more powerful and reliable than standard personal computers, but alternatively, large computing clusters may be composed of many relatively simple, replaceable server components.



# Server message block

Server Message Block (SMB) is a communication protocol originally developed in 1983 by Barry A. Feigenbaum at IBM and intended to provide shared access to files and printers across nodes on a network of systems running IBM's OS/2. It also provides an authenticated inter-process communication (IPC) mechanism. In 1987, Microsoft and 3Com implemented SMB in LAN Manager for OS/2, at which time SMB used the NetBIOS service atop the NetBIOS Frames protocol as its underlying transport. Later, Microsoft implemented SMB in Windows NT 3.1 and has been updating it ever since, adapting it to work with newer underlying transports: TCP/IP and NetBT. SMB implementation consists of two vaguely named Windows services: "Server" (ID: LanmanServer) and "Workstation" (ID: LanmanWorkstation). It uses NTLM or Kerberos protocols for user authentication.

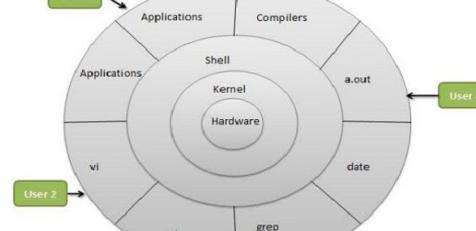


# Shell (computing)

In computing, a shell is a computer program that exposes an operating system's services to a human user or other programs. In general, operating system shells use either a command-line interface (CLI) or graphical user interface (GUI), depending on a computer's role and particular operation. It is named a shell because it is the outermost layer around the operating system. Command-line shells require the user to be familiar with commands and their calling syntax, and to understand concepts about the shell-specific scripting language (for example, bash), while graphical shells place a low burden on beginning computer users and are characterized as being easy to use, yet most GUI-enabled operating systems also provide CLI shells, normally for performing advanced tasks.

## Linux Architecture

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Branch: CSE(7A)



# Single address space operating system

In computer science, a single address space operating system (or SASOS) is an operating system that provides only one globally shared address space for all processes. In a single address space operating system, numerically identical (virtual memory) logical addresses in different processes all refer to exactly the same byte of data. Single address-space operating systems offer certain advantages. In a traditional OS with private per-process address space, memory protection is based on address space boundaries ("address space isolation"). Single address-space operating systems use a different approach for memory protection that is just as strong. One advantage is that the same virtual-to-physical map page table can be used with every process (and in some SASOS, the kernel as well). This makes context switches on a SASOS faster than on operating systems that must change the page table and flush the TLB caches on every context switch.



# Single-board computer

A single-board computer (SBC) is a complete computer built on a single circuit board, with microprocessor(s), memory, input/output (I/O) and other features required of a functional computer. Single-board computers are commonly made as demonstration or development systems, for educational systems, or for use as embedded computer controllers. Many types of home computers or portable computers integrate all their functions onto a single printed circuit board.



# Singularity (operating system)

Singularity is an experimental operating system developed by Microsoft Research between July 9, 2003, and February 7, 2015. It was designed as a high dependability OS in which the kernel, device drivers, and application software were all written in managed code. Internal security uses type safety instead of hardware memory protection.

```
Running C:\ Kernel of Mar 10 2008 23:22:49
Initializing Scheduler
Initializing Service Thread
Registering Diagnostic module...
Singularity Shell (PDB-0)
Type 'help' to get a list of valid commands.
Welcome to Singularity
singularity> help
singularity shell commands:
break      - Break into the kernel debugger
breakpoint - Break into the kernel debugger
breaktest   - Break into the kernel debugger
clear      - Clear screen
decho      - Echo inputs to debugger
echo       - Echo inputs to console
exec      - Execute a command in the space
fg         - Foreground a stopped or background job
help      - Display help message
info      - Display information about a process
reboot    - Reboot computer
shutdown  - Shut down computer
testscript - Test script engine, independent I/O
warmboot  - Warm reboot computer
Singularity>*
```

# Smartwatch

A smartwatch is a wearable computer in the form of a watch; modern smartwatches provide a local touchscreen interface for daily use, while an associated smartphone app provides management and telemetry, such as long-term biomonitoring. While early models could perform basic tasks, such as calculations, digital time telling, translations, and game-playing, smartwatches released since 2015 have more general functionality closer to smartphones, including mobile apps, a mobile operating system and WiFi/Bluetooth connectivity. Some smartwatches function as portable media players, with FM radio and playback of digital audio and video files via a Bluetooth headset. Some models, called watch phones (or phone watches), have mobile cellular functionality such as making telephone calls. While internal hardware varies, most have an electronic visual display, either backlit LCD or OLED. Some use transreflective or electronic paper, to consume less power. They are usually powered by a rechargeable lithium-ion battery. Peripheral devices may include digital cameras, thermometers, accelerometers, pedometers, heart rate monitors, altimeters, barometers, compasses, GPS receivers, tiny speakers, and microSD cards, which are recognized as storage devices by many other kinds of computers.



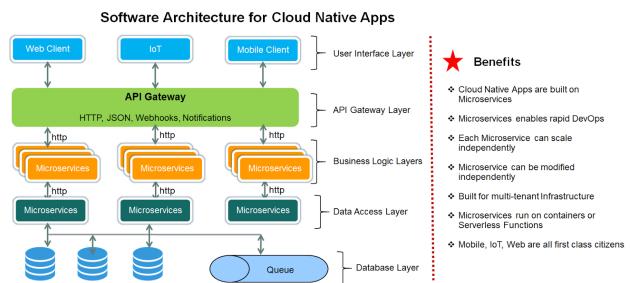
# Software

Software is a set of computer programs and associated documentation and data. This is in contrast to hardware, from which the system is built and which actually performs the work.



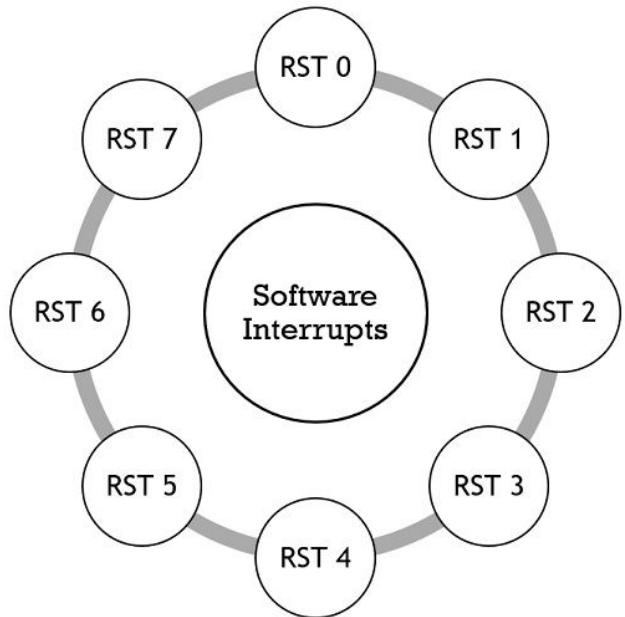
## Software architecture

Software architecture is the set of structures needed to reason about a software system and the discipline of creating such structures and systems. Each structure comprises software elements, relations among them, and properties of both elements and relations. The architecture of a software system is a metaphor, analogous to the architecture of a building. It functions as the blueprints for the system and the development project, which project management can later use to extrapolate the tasks necessary to be executed by the teams and people involved.



# Software interrupt

In digital computers, an interrupt (sometimes referred to as a trap) is a request for the processor to interrupt currently executing code (when permitted), so that the event can be processed in a timely manner. If the request is accepted, the processor will suspend its current activities, save its state, and execute a function called an interrupt handler (or an interrupt service routine, ISR) to deal with the event. This interruption is often temporary, allowing the software to resume normal activities after the interrupt handler finishes, although the interrupt could instead indicate a fatal error. Interrupts are commonly used by hardware devices to indicate electronic or physical state changes that require time-sensitive attention. Interrupts are also commonly used to implement computer multitasking, especially in real-time computing. Systems that use interrupts in these ways are said to be interrupt-driven.



Electronics Desk

# Software maintenance

Software maintenance in software engineering is the modification of a software product after delivery to correct faults, to improve performance or other attributes. A common perception of maintenance is that it merely involves fixing defects. However, one study indicated that over 80% of maintenance effort is used for non-corRECTive actions. This perception is perpetuated by users submitting problem reports that in reality are functionality enhancements to the system. More recent studies put the bug-fixing proportion closer to 21%.



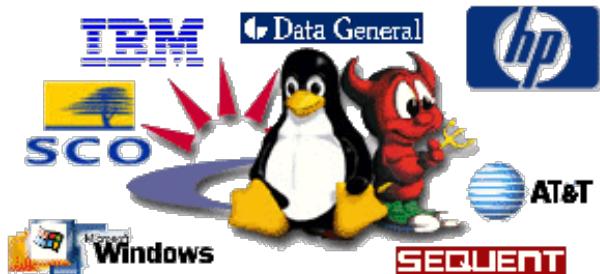
## Software platform

A computing platform or digital platform is an environment in which a piece of software is executed. It may be the hardware or the operating system (OS), even a web browser and associated application programming interfaces, or other underlying software, as long as the program code is executed with it. Computing platforms have different abstraction levels, including a computer architecture, an OS, or runtime libraries. A computing platform is the stage on which computer programs can run.



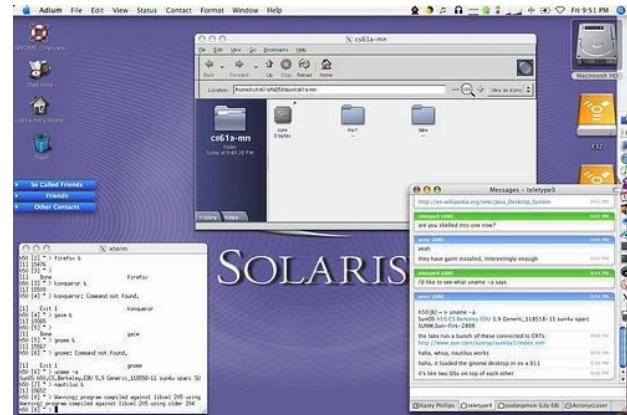
## Software portability

A computer program is said to be portable if there is very low effort required to make it run on different platforms. The pre-requisite for portability is the generalized abstraction between the application logic and system interfaces. When software with the same functionality is produced for several computing platforms, portability is the key issue for development cost reduction.



## Solaris (operating system)

Solaris is a proprietary Unix operating system originally developed by Sun Microsystems. After the Sun acquisition by Oracle in 2010, it was renamed Oracle Solaris. Solaris superseded the company's earlier SunOS in 1993, and became known for its scalability, especially on SPARC systems, and for originating many innovative features such as DTrace, ZFS and Time Slider.



## Solid state drives

A solid-state drive (SSD) is a solid-state storage device that uses integrated circuit assemblies to store data persistently, typically using flash memory, and functioning as secondary storage in the hierarchy of



as secondary storage in the hierarchy of computer storage. It is also sometimes called a semiconductor storage device, a solid-state device or a solid-state disk, even though SSDs lack the physical spinning disks and movable read/write heads used in hard disk drives (HDDs) and floppy disks. SSD also has rich internal parallelism for data processing. In comparison to hard disk drives and similar electromechanical media which use moving parts, SSDs are typically more resistant to physical shock, run silently, and have higher input/output rates and lower latency. SSDs store data in semiconductor cells. As of 2019, cells can contain between 1 and 4 bits of data. SSD storage devices vary in their properties according to the number of bits stored in each cell, with single-bit cells ("Single Level Cells" or "SLC") being generally the most reliable, durable, fast, and expensive type, compared with 2- and 3-bit cells ("Multi-Level Cells/MLC" and "Triple-Level Cells/TLC"), and finally quad-bit cells ("QLC") being used for consumer devices that do not require such extreme properties and are the cheapest per gigabyte (GB) of the four. In addition, 3D XPoint memory (sold by Intel under the Optane brand) stores data by changing the electrical resistance of cells instead of storing electrical charges in cells, and SSDs made from RAM can be used for high speed, when data persistence after power loss is not required, or may use battery power to retain data when its usual power source is unavailable. Hybrid drives or solid-state hybrid drives (SSHDs), such as Intel's Hystor and Apple's Fusion Drive, combine features of SSDs and HDDs in the same unit using both flash memory and spinning magnetic disks in order to improve the performance of frequently-accessed data. Bcache achieves a similar effect purely in software, using combinations of dedicated regular SSDs and HDDs.



# Sorting algorithm

In computer science, a sorting algorithm is an algorithm that puts elements of a list into an order. The most frequently used orders are numerical order and lexicographical order, and either ascending or descending. Efficient sorting is important for optimizing the efficiency of other algorithms (such as search and merge algorithms) that require input data to be in sorted lists. Sorting is also often useful for canonicalizing data and for producing human-readable output.



# Spooling

Spooning or choreic hand is flexion and dorsal arching of the wrists and hyperextension of the fingers when the hands are extended sideways palms down. Spooning is a recognized clinical sign in pediatric neurology during standard evaluation of the posture with extended arms. Spooning is often observed in children up to the age of 5. In older ages it is a clinical sign seen in children with chorea.



# Stack machine

In computer science, computer engineering and programming language implementations, a stack machine is a computer processor or a virtual machine in which the primary interaction is moving short-lived temporary values to and from a push-down stack. In the case of a hardware processor, a hardware stack is used. The use of a stack significantly reduces the required number of processor registers. Stack machines extend push-down automata with additional load/store operations or multiple stacks and hence are Turing-complete.



## Status message

A status message is a function of some instant messaging applications whereby a user may post a message that appears automatically to other users if they attempt to make contact. A status message can tell other contacts the user's current status, such as being busy or what the user is currently doing. It is analogous to the voice message in an answering machine or voice mail system. However, status messages may be displayed even if the person is present. They are often updated much more frequently than messages in answering machines, and thus may serve as a means of instant, limited "publication" or indirect communication.

*"We should all start to live before we get too old. Fear is stupid. So are regrets."*

## Status register

A status register, flag register, or condition code register (CCR) is a collection of status flag bits for a processor. Examples of such registers include FLAGS register in the x86 architecture, flags in the program status word (PSW) register in the IBM System/360 architecture through z/Architecture, and the application program status register (APSR) in the ARM Cortex-A architecture. The status register is a hardware register that contains information about the state of the processor. Individual bits are implicitly or explicitly read and/or written by the machine code instructions executing on the processor. The status register lets an instruction take action contingent on the outcome of a previous instruction.

| PROCESSOR STATUS REGISTER P |   | BYTE | BIT | FLAG |
|-----------------------------|---|------|-----|------|
| 7                           | 6 | 5    | 4   | 3    |
| N                           | V | B    | D   | I    |
|                             |   |      |     | Z    |
|                             |   |      |     | C    |

|                    |                     |                 |
|--------------------|---------------------|-----------------|
| CARRY FLAG         | 0 = FALSE           | 1 = TRUE        |
| ZERO FLAG          | 0 = RESULT NOT ZERO | 1 = RESULT ZERO |
| IRQ DISABLE FLAG   | 0 = ENABLE          | 1 = DISABLE     |
| DECIMAL MODE FLAG  | 0 = FALSE           | 1 = TRUE        |
| BREAK COMMAND FLAG | 0 = NO BREAK        | 1 = BREAK       |
| UNUSED             |                     |                 |
| OVERFLOW FLAG      | 0 = FALSE           | 1 = TRUE        |
| NEGATIVE FLAG      | 0 = POSITIVE        | 1 = NEGATIVE    |

# Sun Microsystems

Sun Microsystems, Inc. (Sun for short) was an American technology company that sold computers, computer components, software, and information technology services and created the Java programming language, the Solaris operating system, ZFS, the Network File System (NFS), and SPARC microprocessors. Sun contributed significantly to the evolution of several key computing technologies, among them Unix, RISC processors, thin client computing, and virtualized computing. Notable Sun acquisitions include Cray Business Systems Division, StorageTek, and Innotek GmbH, creators of VirtualBox. Sun was founded on February 24, 1982. At its height, the Sun headquarters were in Santa Clara, California (part of Silicon Valley), on the former west campus of the Agnews Developmental Center.



# Supercomputer

A supercomputer is a computer with a high level of performance as compared to a general-purpose computer. The performance of a supercomputer is commonly measured in floating-point operations per second (FLOPS) instead of million instructions per second (MIPS). Since 2017, there have existed supercomputers which can perform over 10<sup>17</sup> FLOPS (a hundred quadrillion FLOPS, 100 petaFLOPS or 100 PFLOPS). For comparison, a desktop computer has performance in the range of hundreds of gigaFLOPS (10<sup>11</sup>) to tens of teraFLOPS (10<sup>13</sup>). Since November 2017, all of the world's fastest 500 supercomputers run on Linux-based operating systems. Additional research is being conducted in the United States, the European Union, Taiwan, Japan, and China to build faster, more powerful and technologically superior exascale supercomputers. Supercomputers play an important role in the field of computational science, and are used for a wide range of computationally intensive tasks in various fields, including quantum mechanics,



weather forecasting, climate research, oil and gas exploration, molecular modeling (computing the structures and properties of chemical compounds, biological macromolecules, polymers, and crystals), and physical simulations (such as simulations of the early moments of the universe, airplane and spacecraft aerodynamics, the detonation of nuclear weapons, and nuclear fusion). They have been essential in the field of cryptanalysis. Supercomputers were introduced in the 1960s, and for several decades the fastest were made by Seymour Cray at Control Data Corporation (CDC), Cray Research and subsequent companies bearing his name or monogram. The first such machines were highly tuned conventional designs that ran more quickly than their more general-purpose contemporaries. Through the decade, increasing amounts of parallelism were added, with one to four processors being typical. In the 1970s, vector processors operating on large arrays of data came to dominate. A notable example is the highly successful Cray-1 of 1976. Vector computers remained the dominant design into the 1990s. From then until today, massively parallel supercomputers with tens of thousands of off-the-shelf processors became the norm. The US has long been the leader in the supercomputer field, first through Cray's almost uninterrupted dominance of the field, and later through a variety of technology companies. Japan made major strides in the field in the 1980s and 90s, with China becoming increasingly active in the field. As of May 2022, the fastest supercomputer on the TOP500 supercomputer list is Frontier, in the US, with a LINPACK benchmark score of 1.102 ExaFlop/s, followed by Fugaku. The US has five of the top 10; China has two; Japan, Finland, and France have one each. In June 2018, all combined supercomputers on the TOP500 list broke the 1 exaFLOPS mark.

## Supervisor mode

In computer science, hierarchical protection domains, often called protection rings, are mechanisms to protect data and functionality from faults (by improving fault tolerance) and malicious behavior (by providing computer security).



## Syllable Desktop

Syllable Desktop is a discontinued free and open-source operating system for Pentium and compatible processors. Its purpose is to create an easy-to-use desktop operating system for the home and small office user. It was forked from the stagnant AtheOS in July 2002.



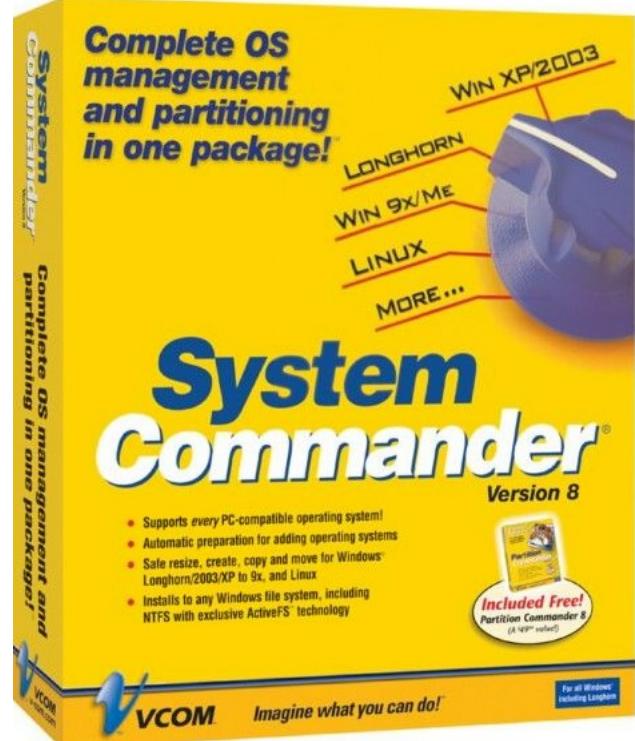
## Symbian

The simians, anthropoids, or higher primates are an infraorder (Simiiformes) of primates containing all animals traditionally called monkeys and apes. More precisely, they consist of the parvorders New World monkeys (Platyrrhini) and Catarrhini, the latter of which consists of the family Cercopithecidae (Old World monkeys in the stricter sense) and the superfamily Hominoidea (apes and ? or including ? humans).



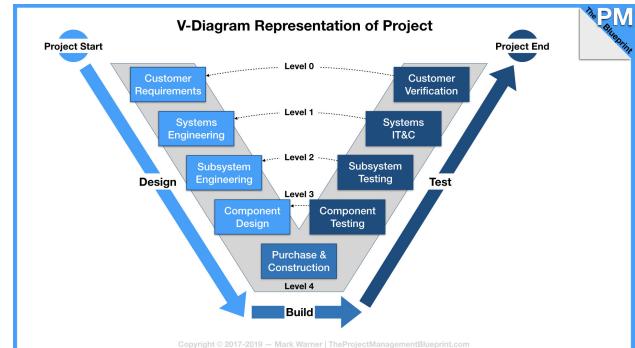
# System Commander

System Commander (SC for short) is a graphical boot manager/loader software application developed by VCOM. The software allowed for multiple operating systems to be installed onto a machine at once, providing a menu from which the user selected the operating system they wished to boot from. Other software with similar functionality includes NTLDR, LILO, GRUB, and Graphical Boot Manager. One of its components was named Partition Commander.



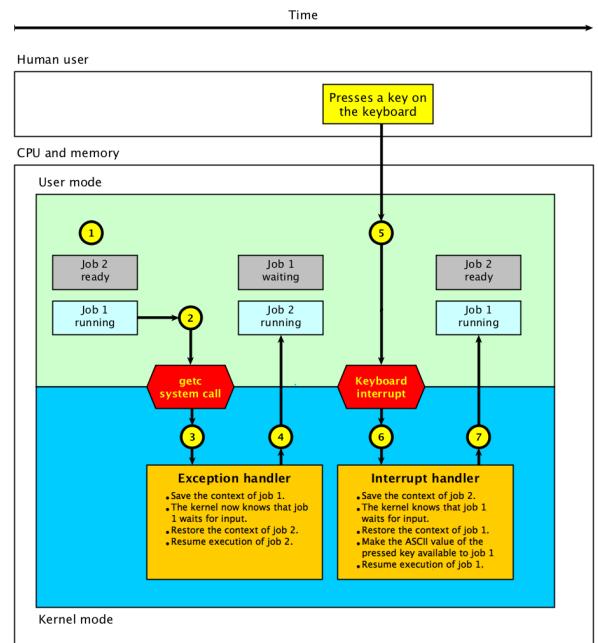
# System V

A system is a group of interacting or interrelated elements that act according to a set of rules to form a unified whole. A system, surrounded and influenced by its environment, is described by its boundaries, structure and purpose and expressed in its functioning. Systems are the subjects of study of systems theory and other systems sciences.



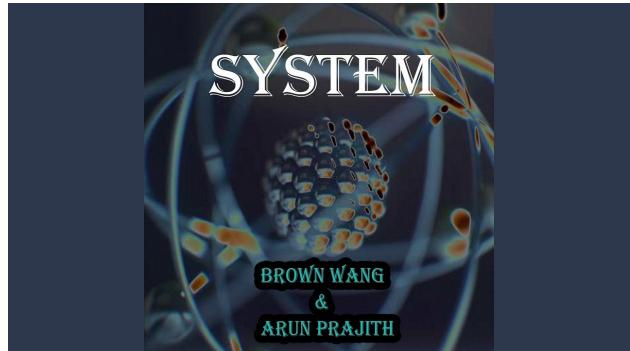
# System call

In computing, a system call (commonly abbreviated to `syscall`) is the programmatic way in which a computer program requests a service from the operating system on which it is executed. This may include hardware-related services (for example, accessing a hard disk drive or accessing the device's camera), creation and execution of new processes, and communication with integral kernel services such as process scheduling. System calls provide an essential interface between a process and the operating system.



# System image

In computing, a system image is a serialized copy of the entire state of a computer system stored in some non-volatile form such as a file. A system is said to be capable of using system images if it can be shut down and later restored to exactly the same state. In such cases, system images can be used for backup.



# System library

In computer science, a library is a collection of non-volatile resources used by computer programs, often for software development. These may include configuration data, documentation, help data, message templates, pre-written code and subroutines, classes, values or type specifications. In IBM's OS/360 and its successors they are referred to as partitioned data sets. A library is also a collection of implementations of behavior, written in terms of a language, that has a well-defined interface by which the behavior is invoked. For instance, people who want to write a higher-level program can use a library to make system calls instead of implementing those system calls over and over again. In addition, the behavior is provided for reuse by multiple independent programs. A program invokes the library-provided behavior via a mechanism of the language. For example, in a simple imperative language such as C, the behavior in a library is invoked by using C's normal function-call. What distinguishes the call as being to a library function, versus being to another function in the same program, is the way that the code is organized in the system. Library code is organized in such a way that it can be used by multiple programs that have no connection to each other, while code that is part of a program is organized to be used only within that one program. This distinction can gain a hierarchical notion when a program grows large, such as a multi-million-line program. In that case, there may be internal libraries that are reused by independent sub-portions of the large program. The distinguishing feature is that a library is organized for the purposes of being reused by independent programs or sub-programs, and the user only needs to know the interface and not the internal details of the library.



# System software

System software is software designed to provide a platform for other software. Examples of system software include operating systems (OS) like macOS, Linux, Android and Microsoft Windows, computational science software, game engines, search engines, industrial automation, and software as a service applications. Application software is software that allows users to do user-oriented tasks such as create text documents, play or develop games, create presentations, listen to music, draw pictures or browse the web. In the late 1940s, the early days of computing, most application software was custom-written by computer users to fit their specific hardware and requirements. System software was usually supplied by the manufacturer of the computer hardware and was intended to be used by most or all users of that system.



# Systems Network Architecture

Systems Network Architecture (SNA) is IBM's proprietary networking architecture, created in 1974. It is a complete protocol stack for interconnecting computers and their resources. SNA describes formats and protocols but, in itself, is not a piece of software. The implementation of SNA takes the form of various communications packages, most notably Virtual Telecommunications Access Method (VTAM), the mainframe software package for SNA communications.

## TOPS-10

TOPS-10 System (Timesharing / Total Operating System-10) is a discontinued operating system from Digital Equipment Corporation (DEC) for the PDP-10 (or DECSYSTEM-10) mainframe computer family. Launched in 1967, TOPS-10 evolved from the earlier "Monitor" software for the PDP-6 and PDP-10 computers; this was renamed to TOPS-10 in 1970.



## TOPS-20

The TOPS-20 operating system by Digital Equipment Corporation (DEC) is a proprietary OS used on some of DEC's 36-bit mainframe computers. The Hardware Reference Manual was described as for "DECSYSTEM-10/DECSYSTEM-20 Processor" (meaning the DEC PDP-10 and the DECSYSTEM-20). TOPS-20 began in 1969 as the TENEX operating system of Bolt, Beranek and Newman (BBN) and shipped as a product by DEC starting in 1976. TOPS-20 is almost entirely unrelated to the similarly named TOPS-10, but it was shipped with the PA1050 TOPS-10 Monitor Calls emulation facility which allowed most, but not all, TOPS-10 executables to run unchanged. As a matter of policy, DEC did not update PA1050 to support later TOPS-10 additions except where required by DEC software.



## Tablet computer

A tablet computer, or a table PC, or a tabletop is a device class of a full-featured large-display portable all-in-one computer with an internal battery. It can either be used on a table's top, hence the name, or carried around the house. Table computers feature an 18-inch or larger multi-touch touchscreen display, a battery capable of at least 2 hours of autonomous work and a full-featured desktop operating system, such as Windows 10. They are typically shipped with pre-installed multi-user touch-enabled casual games and apps, and typically marketed as family entertainment devices. Manufacturers of some table computers provide a specialized graphical user interface to simplify a simultaneous interaction of multiple users, one example is Aura interface, which is installed in Lenovo IdeaCentre Horizon tabletop.



## Tandem

Tandem, or in tandem, is an arrangement in which a team of machines, animals or people are lined up one behind another, all facing in the same direction. The original use of the term in English was in tandem harness, which is used for two or more draft horses, or other draft animals, harnessed in a single line one behind another, as opposed to a pair, harnessed side by side, or a team of several pairs. The tandem harness allows additional animals to provide pulling power for a vehicle designed for a single animal.



# The Open Group

The Open Group is a global consortium that seeks to "enable the achievement of business objectives" by developing "open, vendor-neutral technology standards and certifications." It has over 840 member organizations and provides a number of services, including strategy, management, innovation and research, standards, certification, and test development. It was established in 1996 when X/Open merged with the Open Software Foundation.



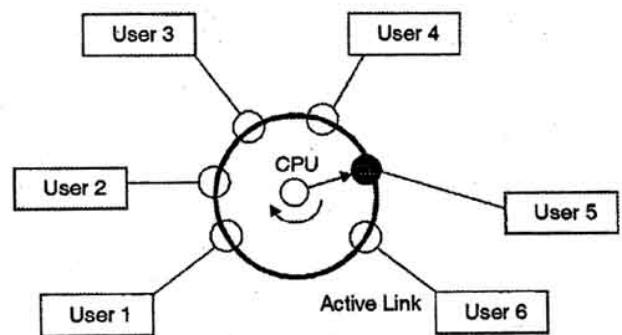
## Time slice

In computing, preemption is the act of temporarily interrupting an executing task, with the intention of resuming it at a later time. This interrupt is done by an external scheduler with no assistance or cooperation from the task.<sup>153</sup> This preemptive scheduler usually runs in the most privileged protection ring, meaning that interruption and resuming are considered highly secure actions. Such a change in the currently executing task of a processor is known as context switching.



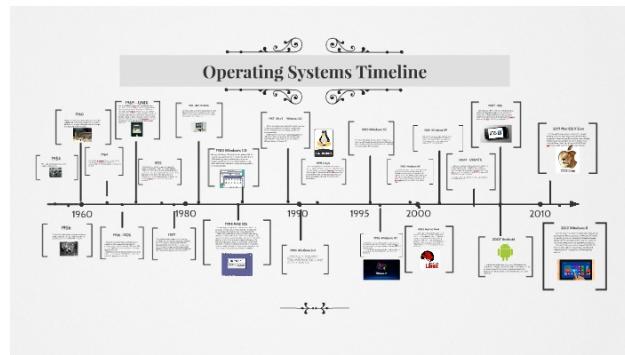
## Time-sharing

In computing, time-sharing is the sharing of a computing resource among many users at the same time by means of multiprogramming and multi-tasking. Its emergence as the prominent model of computing in the 1970s represented a major technological shift in the history of computing. By allowing many users to interact concurrently with a single computer, time-sharing dramatically lowered the cost of providing computing capability, made it possible for individuals and organizations to use a computer without owning one, and promoted the interactive use of computers and the development of new interactive applications.



# Timeline of operating systems

This article presents a timeline of events in the history of computer operating systems from 1951 to the current day. For a narrative explaining the overall developments, see the History of operating systems.



## Transaction Processing Facility

Transaction Processing Facility (TPF) is an IBM real-time operating system for mainframe computers descended from the IBM System/360 family, including zSeries and System z9.



## Trusted Computer System Evaluation Criteria

Trusted Computer System Evaluation Criteria (TCSEC) is a United States Government Department of Defense (DoD) standard that sets basic requirements for assessing the effectiveness of computer security controls built into a computer system. The TCSEC was used to evaluate, classify, and select computer systems being considered for the processing, storage, and retrieval of sensitive or classified information. The TCSEC, frequently referred to as the Orange Book, is the centerpiece of the DoD Rainbow Series publications. Initially issued in 1983 by the National Computer Security Center (NCSC), an arm of the National Security Agency, and then updated in 1985, TCSEC was eventually replaced by the Common Criteria international standard, originally published in 2005.

### Trusted Computer System Evaluation Criteria (TCSEC)

- D – žiadna ochrana
- C – diskrétné riadenie prístupu
  - C1 – nepovinná vzájomná ochrana používateľov
  - C2 – voliteľné riadenie prístupu
- B – povinné riadenie prístupu
  - B1 - povinné riadenie prístupu
  - B2 – štruktúrovaná ochrana
  - B3 – bezpečnostné domény
- A – verifikovaný návrh
  - funkčná zhoda s B3 + formálne preveriteľné vlastnosti

# Trusted operating system

Trusted Operating System (TOS) generally refers to an operating system that provides sufficient support for multilevel security and evidence of correctness to meet a particular set of government requirements.

## Security Models and Designing a Trusted Operating System

MANIKANDAN SUBBU

# UNIVAC

UNIVAC (Universal Automatic Computer) was a line of electronic digital stored-program computers starting with the products of the Eckert?Mauchly Computer Corporation. Later the name was applied to a division of the Remington Rand company and successor organizations.



# UNIVAC 1108

The UNIVAC 1100/2200 series is a series of compatible 36-bit computer systems, beginning with the UNIVAC 1107 in 1962, initially made by Sperry Rand. The series continues to be supported today by Unisys Corporation as the ClearPath Dorado Series. The solid-state 1107 model number was in the same sequence as the earlier vacuum-tube computers, but the early computers were not compatible with the solid-state successors.

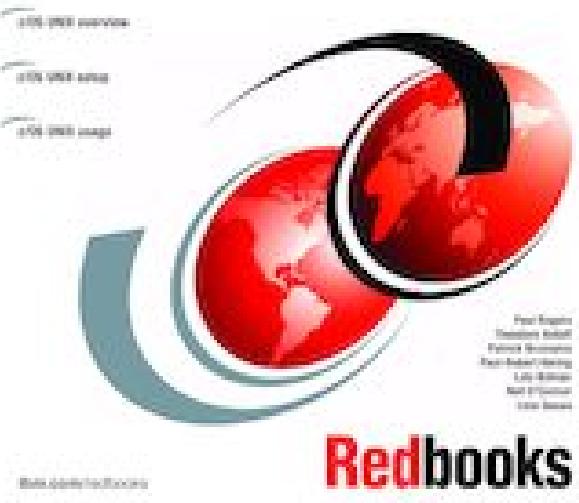


# UNIX System Services

z/OS UNIX System Services (z/OS UNIX, or informally USS) is a base element of z/OS. z/OS UNIX is a certified UNIX operating system implementation (XPG4 UNIX 95) optimized for mainframe architecture. It is the first UNIX 95 to not be derived from the AT&T source code. Through integration with the rest of z/OS, additional Time Sharing Option (TSO) commands are available alongside the usual UNIX services, making it possible to process UNIX files using ISPF. Extensions in JCL make it possible to use these files in batch processing.



## UNIX System Services z/OS Version 1 Release 7 Implementation



# USB flash drive

A USB flash drive (also called a thumb drive in the US, or a memory stick in the UK) is a data storage device that includes flash memory with an integrated USB interface. It is typically removable, rewritable and much smaller than an optical disc. Most weigh less than 30 g (1 oz). Since first appearing on the market in late 2000, as with virtually all other computer memory devices, storage capacities have risen while prices have dropped. As of March 2016, flash drives with anywhere from 8 to 256 gigabytes (GB) were frequently sold, while 512 GB and 1 terabyte (TB) units were less frequent. As of 2018, 2 TB flash drives were the largest available in terms of storage capacity. Some allow up to 100,000 write/erase cycles, depending on the exact type of memory chip used, and are thought to physically last between 10 and 100 years under normal circumstances (shelf storage time).



## Ubuntu (operating system)

Ubuntu (listen) uu-BUUN-too) is a Linux distribution based on Debian and composed mostly of free and open-source software. Ubuntu is officially released in three editions: Desktop, Server, and Core for Internet of things devices and robots. All of the editions can run on a computer alone, or in a virtual machine. Ubuntu is a popular operating system for cloud computing, with support for OpenStack. Ubuntu's default desktop changed back from the in-house Unity to GNOME after nearly 6.5 years in 2017 upon the release of version 17.10. Ubuntu is released every six months, with long-term support (LTS) releases every two years. As of October 2022, the most-recent release is 22.10 ("Kinetic Kudu"), and the current long-term support release is 22.04 ("Jammy Jellyfish").



## Unikernel

A unikernel is a specialised, single address space machine image constructed by using library operating systems. A developer selects, from a modular stack, the minimal set of libraries which correspond to the OS constructs required for the application to run. These libraries are then compiled with the application and configuration code to build sealed, fixed-purpose images (unikernels) which run directly on a hypervisor or hardware without an intervening OS such as Linux or Windows.

# unikernel

## United States Department of Defense

The United States Department of Defense (DoD, USDOD or DOD) is an executive branch department of the federal government charged with coordinating and supervising all agencies and functions of the U.S. government directly related to national security and the United States Armed Forces. The DoD is the largest employer in the world, with over 1.34 million active-duty

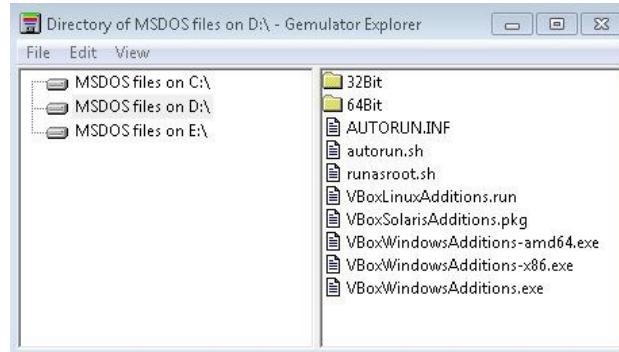


service members (soldiers, marines, sailors, airmen, and guardians) as of June 2022.

The DoD also maintains over 778,000 National Guard and reservists, and over 747,000 civilians bringing the total to over 2.87 million employees. Headquartered at the Pentagon in Arlington, Virginia, just outside Washington, D.C., the DoD's stated mission is to provide "the military forces needed to deter war and ensure our nation's security". The Department of Defense is headed by the secretary of defense, a cabinet-level head who reports directly to the president of the United States. Beneath the Department of Defense are three subordinate military departments: the Department of the Army, the Department of the Navy, and the Department of the Air Force. In addition, four national intelligence services are subordinate to the Department of Defense: the Defense Intelligence Agency (DIA), the National Security Agency (NSA), the National Geospatial-Intelligence Agency (NGA), and the National Reconnaissance Office (NRO). Other Defense agencies include the Defense Advanced Research Projects Agency (DARPA), the Defense Logistics Agency (DLA), the Missile Defense Agency (MDA), the Defense Health Agency (DHA), Defense Threat Reduction Agency (DTRA), the Defense Counterintelligence and Security Agency (DCSA), the Space Development Agency (SDA) and the Pentagon Force Protection Agency (PFPA), all of which are subordinate to the secretary of defense. Additionally, the Defense Contract Management Agency (DCMA) is responsible for administering contracts for the DoD. Military operations are managed by eleven regional or functional Unified combatant commands. The Department of Defense also operates several joint services schools, including the Eisenhower School (ES) and the National War College (NWC).

# Universal Disk Format

Universal Disk Format (UDF) is an open, vendor-neutral file system for computer data storage for a broad range of media. In practice, it has been most widely used for DVDs and newer optical disc formats, supplanting ISO 9660. Due to its design, it is very well suited to incremental updates on both recordable and (re)writable optical media. UDF was developed and maintained by the Optical Storage Technology Association (OSTA).



# University of California, Berkeley

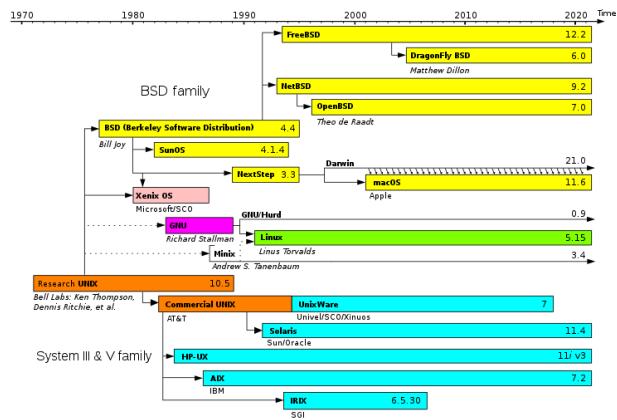
The University of California, Berkeley (UC Berkeley, Berkeley, Cal, or California) is a public land-grant research university in Berkeley, California. Established in 1868 as the University of California, it is the state's first land-grant university and the founding campus of the University of California system. Its fourteen colleges and schools offer over 350 degree programs and enroll some 32,000 undergraduate and 13,000 graduate students. Berkeley ranks among the world's top universities. A founding member of the Association of American Universities, Berkeley hosts many leading research institutes dedicated to science, engineering, and mathematics. The university founded and maintains close relationships with three national laboratories at Berkeley, Livermore and Los Alamos, and has played a prominent role in many scientific advances, from the Manhattan Project and the discovery of 16 chemical elements to breakthroughs in computer science and genomics. Berkeley is also known for political activism and the Free Speech Movement of the 1960s. Berkeley's athletic teams, which compete as the California Golden Bears primarily in the Pac-12 Conference, have won 107 national championships, and its students and alumni have won 223 Olympic medals (including 121 gold medals). Among its alumni, faculty and researchers, Berkeley has more Nobel laureates (107) Turing Award winners (25)



laureates (107), Turing Award winners (20), Fields Medalists (14), and Wolf Prize winners (30) than any other public university in the nation; it is affiliated with 34 Pulitzer Prizes, 19 Academy Awards, and more MacArthur "Genius Grants" (108) and National Medals of Science (68) than any other public institution. The university has produced seven heads of state or government; six chief justices, including Chief Justice of the United States Earl Warren; 22 cabinet-level officials; 11 governors; and 25 living billionaires. It is also a leading producer of Fulbright Scholars, MacArthur Fellows, and Marshall Scholars. Berkeley alumni, widely recognized for their entrepreneurship, have founded numerous notable companies, including Apple, Tesla, Intel, eBay, SoftBank, AIG, and Morgan Stanley.

## Unix-like

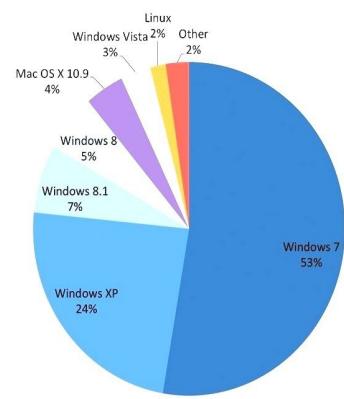
A Unix-like (sometimes referred to as UN\*X or \*nix) operating system is one that behaves in a manner similar to a Unix system, although not necessarily conforming to or being certified to any version of the Single UNIX Specification. A Unix-like application is one that behaves like the corresponding Unix command or shell. Although there are general philosophies for Unix design, there is no technical standard defining the term, and opinions can differ about the degree to which a particular operating system or application is Unix-like.



# Usage share of operating systems

The usage share of operating systems is the percentage of computing devices that run each operating system (OS) at any particular time. All such figures are necessarily estimates because data about operating system share is difficult to obtain. There are few reliable primary sources and no agreed methodologies for its collection. Operating systems are used in numerous device types, from embedded devices without a screen through to supercomputers.

Global Desktop Operating System Market Share



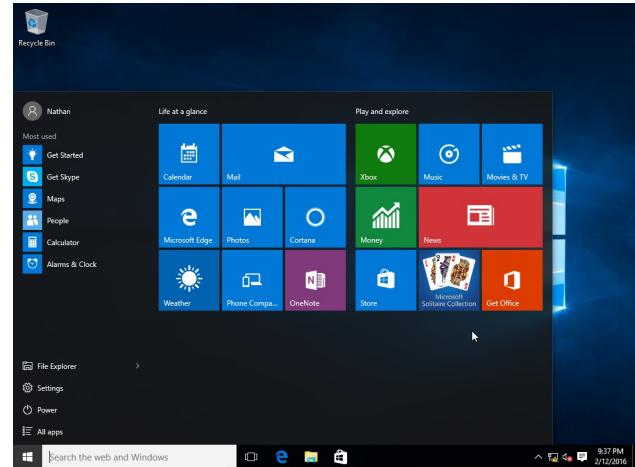
## User (computing)

A user is a person who utilizes a computer or network service.



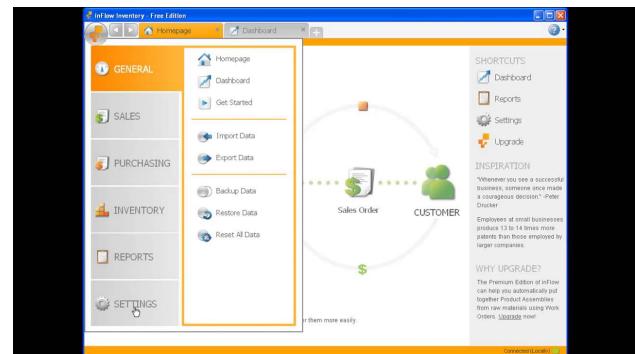
# User interface

In the industrial design field of human-computer interaction, a user interface (UI) is the space where interactions between humans and machines occur. The goal of this interaction is to allow effective operation and control of the machine from the human end, while the machine simultaneously feeds back information that aids the operators' decision-making process. Examples of this broad concept of user interfaces include the interactive aspects of computer operating systems, hand tools, heavy machinery operator controls and process controls. The design considerations applicable when creating user interfaces are related to, or involve such disciplines as, ergonomics and psychology.



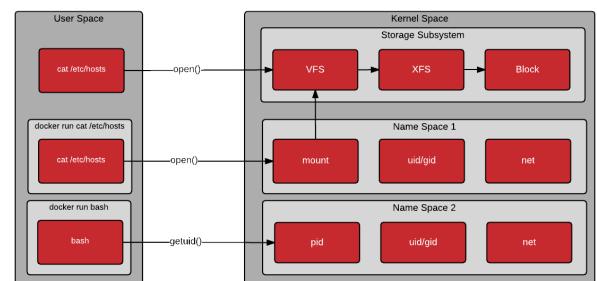
# User mode

A modern computer operating system usually segregates virtual memory into user space and kernel space. Primarily, this separation serves to provide memory protection and hardware protection from malicious or errant software behaviour.



# User space

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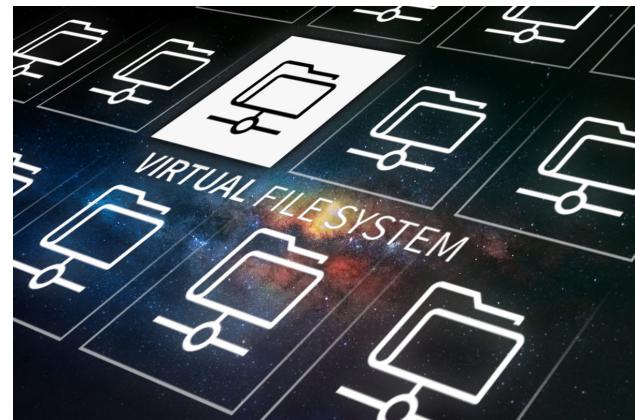
# VMS Software Inc

OpenVMS, often referred to as just VMS, is a multi-user, multiprocessing and virtual memory-based operating system. It is designed to support time-sharing, batch processing, transaction processing and workstation applications. Customers using OpenVMS include banks and financial services, hospitals and healthcare, telecommunications operators, network information services, and industrial manufacturers. During the 1990s and 2000s, there were approximately half a million VMS systems in operation worldwide. It was first announced by Digital Equipment Corporation (DEC) as VAX/VMS (Virtual Address eXtension/Virtual Memory System) alongside the VAX-11/780 minicomputer in 1977. OpenVMS has subsequently been ported to run on DEC Alpha systems, the Itanium-based HPE Integrity Servers, and select x86-64 hardware and hypervisors. Since 2014, OpenVMS is developed and supported by VMS Software Inc. (VSI). OpenVMS offers high availability through clustering ? the ability to distribute the system over multiple physical machines. This allows clustered applications and data to remain continuously available while operating system software and hardware maintenance and upgrades are performed, or if part of the cluster is destroyed. VMS cluster uptimes of 17 years have been reported.



# Virtual file system

A virtual file system (VFS) or virtual filesystem switch is an abstract layer on top of a more concrete file system. The purpose of a VFS is to allow client applications to access different types of concrete file systems in a uniform way. A VFS can, for example, be used to access local and network storage devices transparently without the client application noticing the difference. It can be used to bridge the differences in Windows, classic Mac OS/macOS and Unix filesystems, so that applications can access files on local file systems of those types without having to know what type of file system they are accessing.

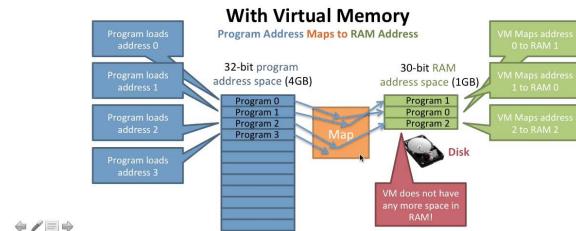


# Virtual memory

Visual memory describes the relationship between perceptual processing and the encoding, storage and retrieval of the resulting neural representations. Visual memory occurs over a broad time range spanning from eye movements to years in order to visually navigate to a previously visited location. Visual memory is a form of memory which preserves some characteristics of our senses pertaining to visual experience. We are able to place in memory visual information which resembles objects, places, animals or people in a mental image. The experience of visual memory is also referred to as the mind's eye through which we can retrieve from our memory a mental image of original objects, places, animals or people. Visual memory is one of several cognitive systems, which are all interconnected parts that combine to form the human memory. Types of palinopsia, the persistence or recurrence of a visual image after the stimulus has been removed, is a dysfunction of visual memory.

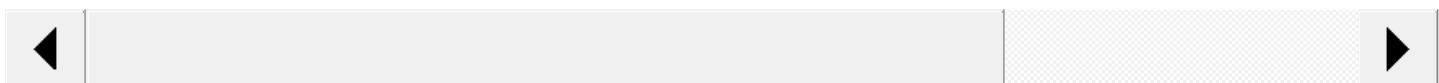
## Solving the problems: #1 not enough memory

- Map some of the program's address space to the disk
- When we need it, we bring it into memory



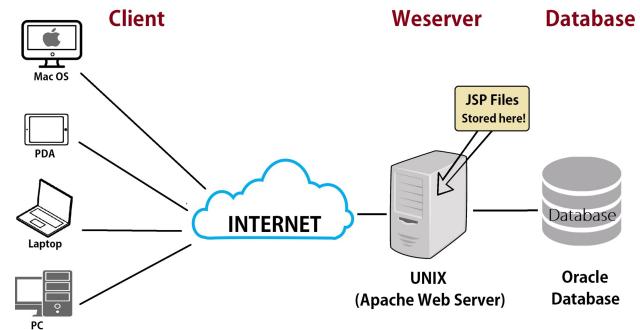
# WIMP (computing)

In human-computer interaction, WIMP stands for "windows, icons, menus, pointer", denoting a style of interaction using these elements of the user interface. Other expansions are sometimes used, such as substituting "mouse" and "mice" for menus, or "pull-down menu" and "pointing" for pointer. Though the acronym has fallen into disuse, it has often been likened to the term graphical user interface (GUI). Any interface that uses graphics can be called a GUI, and WIMP systems derive from such systems. However, while all WIMP systems use graphics as a key element (the icon and pointer elements), and therefore are GUIs, the reverse is not true. Some GUIs are not based in windows, icons, menus, and pointers. For example, most mobile phones represent actions as icons and menus, but often do not rely on a conventional pointer or containerized windows to host program interactions. WIMP interaction was developed at Xerox PARC (see Xerox Alto, developed in 1973) and popularized with Apple's introduction of the Macintosh in 1984, which added the concepts of the "menu bar" and extended window management. The WIMP interface has the following components:



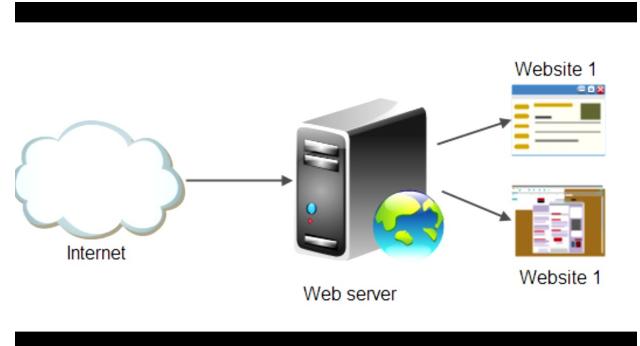
# Web server

A web server is computer software and underlying hardware that accepts requests via HTTP (the network protocol created to distribute web content) or its secure variant HTTPS. A user agent, commonly a web browser or web crawler, initiates communication by making a request for a web page or other resource using HTTP, and the server responds with the content of that resource or an error message. A web server can also accept and store resources sent from the user agent if configured to do so. The hardware used to run a web server can vary according to the volume of requests that it needs to handle. At the low end of the range are embedded systems, such as a router that runs a small web server as its configuration interface. A high-traffic Internet website might handle requests with hundreds of servers that run on racks of high-speed computers.



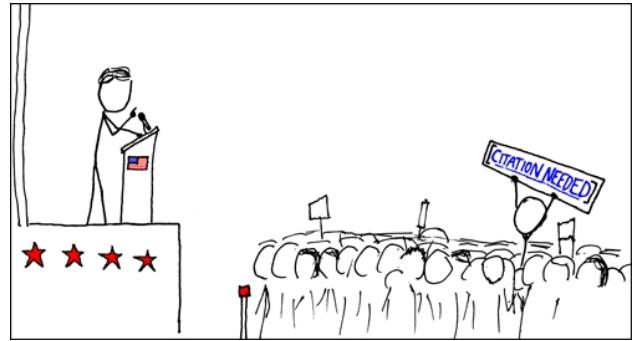
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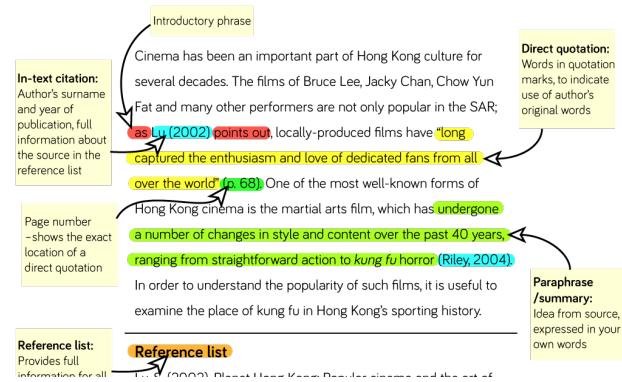
## Wikipedia:Citation needed

To ensure that all Wikipedia content is verifiable, Wikipedia provides a means for anyone to question an uncited claim. If your work has been tagged, please provide a reliable source for the statement, and discuss if needed.



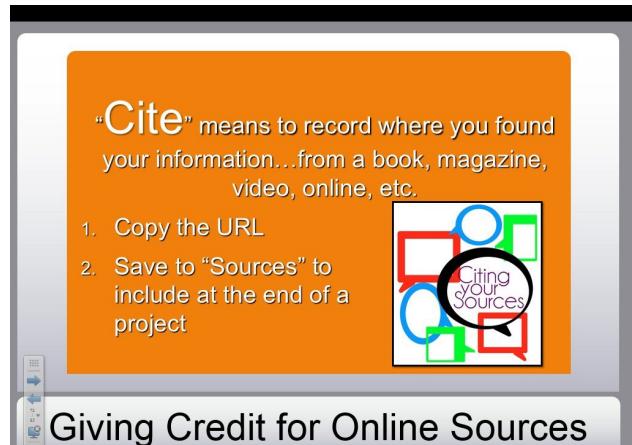
## Wikipedia:Citing sources

A citation, also called a reference, uniquely identifies a source of information, e.g.:



## Wikipedia:Citing sources#What information to include

A citation, also called a reference, uniquely identifies a source of information, e.g.:



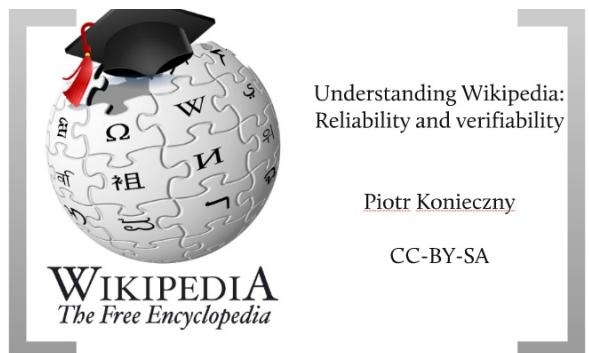
## Wikipedia:Please clarify

The aim of this page is to describe ways to clarify text or request such clarification. There are inline cleanup tags to flag specific wording that is likely to be confusing to the average reader.



## Wikipedia:Verifiability

In the English Wikipedia, verifiability means other people using the encyclopedia can check that the information comes from a reliable source. Wikipedia does not publish original research. Its content is determined by previously published information rather than editors' beliefs, opinions, or experiences. Even if you are sure something is true, it must be verifiable before you can add it. If reliable sources disagree, then maintain a neutral point of view and present what the various sources say, giving each side its due weight.



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In the English Wikipedia, verifiability means other people using the encyclopedia can check that the information comes from a reliable source. Wikipedia does not publish original research. Its content is determined by previously published information rather than editors' beliefs, opinions, or experiences. Even if you are sure something is true, it must be verifiable before you can add it. If reliable sources disagree, then maintain a neutral point of view and present what the various sources say, giving each side its due weight.



## Windows 11

Windows 10 is a major release of Microsoft's Windows NT operating system. It is the direct successor to Windows 8.1, which was released nearly two years earlier. It was released to manufacturing on July 15, 2015, and later to retail on July 29, 2015. Windows 10 was made available for download via MSDN and TechNet, as a free upgrade for retail copies of Windows 8 and Windows 8.1 users via the Windows Store, and to Windows 7 users via Windows Update. Windows 10 receives new builds on an ongoing basis, which are available at no additional cost to users, in addition to additional test builds of Windows 10, which are available to Windows Insiders. Devices in enterprise environments can receive these updates at a slower pace, or use long-term support milestones that only receive critical updates, such as security patches, over their ten-year lifespan of extended support. In June 2021, Microsoft announced that support for Windows 10 editions which are not in the Long-Term Servicing Channel (LTSC) will end on October 14, 2025. Windows 10 received generally positive reviews upon its original release. Critics praised Microsoft's decision to provide the desktop-oriented interface in line with previous versions of Windows, contrasting the tablet-oriented approach of Windows 8, although Windows 10's touch-



Windows 10, although Windows 10's touch-oriented user interface mode was criticized for containing regressions upon the touch-oriented interface of its predecessor. Critics also praised the improvements to Windows 10's bundled software over Windows 8.1, Xbox Live integration, as well as the functionality and capabilities of the Cortana personal assistant and the replacement of Internet Explorer with Microsoft Edge. However, media outlets have been critical of the changes to operating system behaviors, including mandatory update installation, privacy concerns over data collection performed by the OS for Microsoft and its partners, and adware-like tactics used to promote the operating system on its release. Microsoft initially aimed to have Windows 10 installed on over one billion devices within three years of its release; that goal was ultimately reached almost five years after release on March 16, 2020, and is by now most used version in virtually all countries. By January 2018, Windows 10 surpassed Windows 7 as the most popular version of Windows worldwide. As of August 2022, Windows 10 is estimated to have a 72% share of Windows PCs, still 6.2% the share of its successor Windows 11 (and 6.0% of Windows 7). The share has been declining from a January 2022 peak of 82%, since Windows 11, which is now the second most popular Windows version in many countries. Windows 10 has a 58% share of all PCs (the rest being other Windows editions and other operating systems such as macOS and Linux), and a 22% share of all devices (including mobile, tablet and console) are running Windows 10. On June 24, 2021, Microsoft announced Windows 10's successor, Windows 11, which was released on October 5, 2021. Windows 10 is the final version of Windows that supports 32-bit processors (IA-32 and ARMv7-based) and devices with BIOS firmware. Its successor, Windows 11, requires a device that uses UEFI firmware and a 64-bit processor in any supported architecture (x86-64 for x86 and ARMv8 for ARM).

## Windows 95



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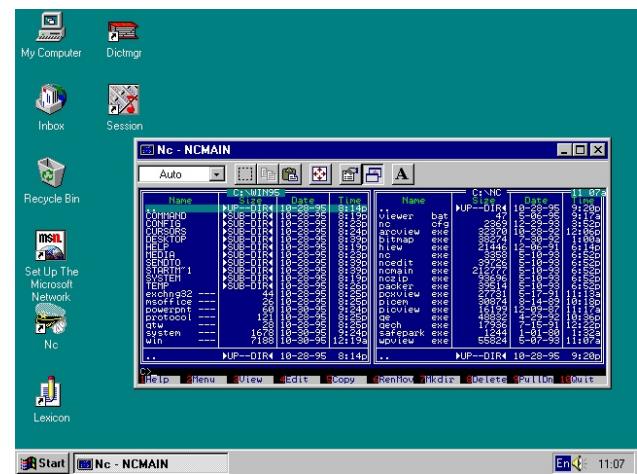
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## Windows 9x

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and a 64-bit processor in any supported architecture (x86-64 for x86 and ARMv8 for ARM).

## Windows ME

Windows 7 is a major release of the Windows NT operating system developed by Microsoft. It was released to manufacturing on July 22, 2009, and became generally available on October 22, 2009. It is the successor to Windows Vista, released nearly three years earlier. It remained an operating system for use on personal computers, including home and business desktops, laptops, tablet PCs and media center PCs, and itself was replaced in November 2012 by Windows 8, the name spanning more than three years of the product.



## Windows NT 4.0

Windows NT 3.1 is the first major release of the Windows NT operating system developed by Microsoft, released on July 27, 1993.



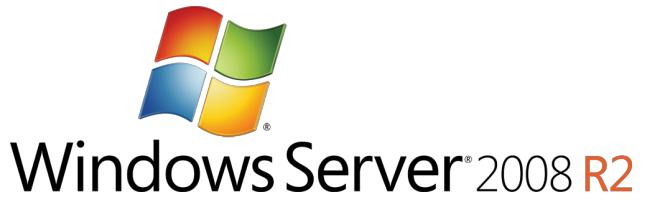
## Windows Server 2003

Windows Server 2008, codenamed "Longhorn Server", is the fourth release of the Windows Server operating system produced by Microsoft as part of the Windows NT family of the operating systems. It was released to manufacturing on February 4, 2008, and generally to retail on February 27, 2008. Derived from Windows Vista, Windows Server 2008 is the successor of Windows Server 2003 and the predecessor to Windows Server 2008 R2.



## Windows Server 2008 R2

Windows Server 2008 R2, codenamed "Windows Server 7", is the fifth version of the Windows Server operating system produced by Microsoft and released as part of the Windows NT family of operating systems. It was released to manufacturing on July 22, 2009, and became generally available on October 22, 2009, shortly after the completion of Windows 7. It is the successor to Windows Server 2008, which is derived from the Windows Vista codebase, released the previous year, and was succeeded by the Windows 8-based Windows Server 2012.



# Windows Vista

Windows Vista is a major release of the Windows NT operating system developed by Microsoft. It was the direct successor to Windows XP, which was released five years earlier, at the time being the longest time span between successive releases of Microsoft's Windows desktop operating systems. Development was completed on November 8, 2006, and over the following three months, it was released in stages to computer hardware and software manufacturers, business customers, and retail channels. On January 30, 2007, it was released internationally and made available for purchase and download from the Windows Marketplace; this is the first release of Windows to be made available through a digital distribution platform. New features of Windows Vista include an updated graphical user interface and visual style dubbed "Aero," a new search component called "Windows Search," redesigned networking, audio, print, and display sub-systems, and new multimedia tools such as Windows DVD Maker. Windows Vista aimed to increase the level of communication between machines on a home network, using peer-to-peer technology to simplify sharing files and media between computers and devices. Windows Vista included version 3.0 of the .NET Framework, allowing software developers to write applications without traditional Windows APIs. Windows Vista removed support for Itanium and devices without ACPI.



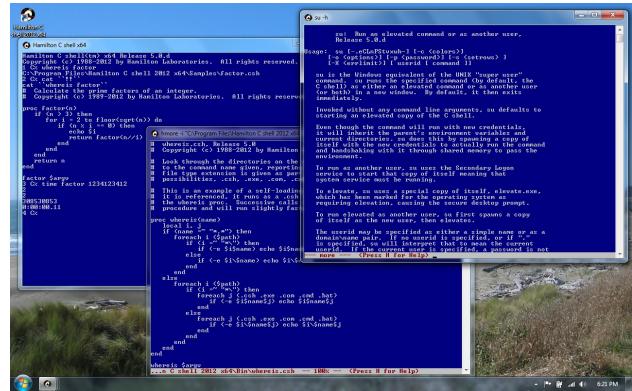
# Windows XP

Windows 7 is a major release of the Windows NT operating system developed by Microsoft. It was released to manufacturing on July 22, 2009, and became generally available on October 22, 2009. It is the successor to Windows Vista, released nearly three years earlier. It remained an operating system for use on personal computers, including home and business desktops, laptops, tablet PCs and media center PCs, and itself was replaced in November 2012 by Windows 8, the name spanning more than three years of the product.



# Windows shell

The Windows shell is the graphical user interface for the Microsoft Windows operating system. Its readily identifiable elements consist of the desktop, the taskbar, the Start menu, the task switcher and the AutoPlay feature. On some versions of Windows, it also includes Flip 3D and the charms. In Windows 10, the Windows Shell Experience Host interface drives visuals like the Start Menu, Action Center, Taskbar, and Task View/Timeline. However, the Windows shell also implements a shell namespace that enables computer programs running on Windows to access the computer's resources via the hierarchy of shell objects. "Desktop" is the top object of the hierarchy; below it there are a number of files and folders stored on the disk, as well as a number of special folders whose contents are either virtual or dynamically created. Recycle Bin, Libraries, Control Panel, This PC and Network are examples of such shell objects.



# Windows shell replacement

This is a list of software that provides an alternative graphical user interface for Microsoft Windows operating systems. The technical term for this interface is a shell. Windows' standard user interface is the Windows shell; Windows 3.0 and Windows 3.1x have a different shell, called Program Manager. The programs in this list do not restyle the Windows shell, but replace it; therefore, they look and function differently, and have different configuration options.



# World Wide Web

The World Wide Web (WWW), commonly known as the Web, is an information system enabling documents and other web resources to be accessed over the Internet. Documents and downloadable media are made available to the network through web servers and can be accessed by programs such as web browsers.

Servers and resources on the World Wide Web are identified and located through character strings called uniform resource locators (URLs). The original and still very common document type is a web page formatted in Hypertext Markup Language (HTML). This markup language supports plain text, images, embedded video and audio contents, and scripts (short programs) that implement complex user interaction. The HTML language also supports hyperlinks (embedded URLs) which provide immediate access to other web resources. Web navigation, or web surfing, is the common practice of following such hyperlinks across multiple websites. Web applications are web pages that function as application software. The information in the Web is transferred across the Internet using the Hypertext Transfer Protocol (HTTP).



# X Window System

The X Window System (X11, or simply X) is a windowing system for bitmap displays, common on Unix-like operating systems.

## X86-64

x86-64 (also known as x64, x86\_64, AMD64, and Intel 64) is a 64-bit version of the x86 instruction set, first released in 1999. It introduced two new modes of operation, 64-bit mode and compatibility mode, along with a new 4-level paging mode.

