

Unix Fundamentals

Unix

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Unix (, YOO-niks; trademarked as UNIX) is a family of multitasking, multi-user computer operating systems that derive from the original AT&T Unix, whose development started in 1969 at the Bell Labs research center by Ken Thompson, Dennis Ritchie, and others. Initially intended for use inside the Bell System, AT&T licensed Unix to outside parties in the late 1970s, leading to a variety of both academic and commercial Unix variants from vendors including University of California, Berkeley (BSD), Microsoft (Xenix), Sun Microsystems (SunOS/Solaris), HP/HPE (HP-UX), and IBM (AIX).

The early versions of Unix—which are retrospectively referred to as "Research Unix"—ran on computers such as the PDP-11 and VAX; Unix was commonly used on minicomputers and mainframes from the 1970s onwards. It distinguished itself from its predecessors as the first portable operating system: almost the entire operating system is written in the C programming language (in 1973), which allows Unix to operate on numerous platforms. Unix systems are characterized by a modular design that is sometimes called the "Unix philosophy". According to this philosophy, the operating system should provide a set of simple tools, each of which performs a limited, well-defined function. A unified and inode-based filesystem and an inter-process communication mechanism known as "pipes" serve as the main means of communication, and a shell scripting and command language (the Unix shell) is used to combine the tools to perform complex workflows.

Version 7 in 1979 was the final widely released Research Unix, after which AT&T sold UNIX System III, based on Version 7, commercially in 1982; to avoid confusion between the Unix variants, AT&T combined various versions developed by others and released it as UNIX System V in 1983. However as these were closed-source, the University of California, Berkeley continued developing BSD as an alternative. Other vendors that were beginning to create commercialized versions of Unix would base their version on either System V (like Silicon Graphics's IRIX) or BSD (like SunOS). Amid the "Unix wars" of standardization, AT&T alongside Sun merged System V, BSD, SunOS and Xenix, solidifying their features into one package as UNIX System V Release 4 (SVR4) in 1989, and it was commercialized by Unix System Laboratories, an AT&T spinoff. A rival Unix by other vendors was released as OSF/1, however most commercial Unix vendors eventually changed their distributions to be based on SVR4 with BSD features added on top.

AT&T sold Unix to Novell in 1992, who later sold the UNIX trademark to a new industry consortium called The Open Group which allow the use of the mark for certified operating systems that comply with the Single UNIX Specification (SUS). Since the 1990s, Unix systems have appeared on home-class computers: BSD/OS was the first to be commercialized for i386 computers and since then free Unix-like clones of existing systems have been developed, such as FreeBSD and the combination of Linux and GNU, the latter of which have since eclipsed Unix in popularity. Unix was, until 2005, the most widely used server operating system. However in the present day, Unix distributions like IBM AIX, Oracle Solaris and OpenServer continue to be widely used in certain fields.

Linux

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Linux (LIN-uuks) is a family of open source Unix-like operating systems based on the Linux kernel, an operating system kernel first released on September 17, 1991, by Linus Torvalds. Linux is typically packaged as a Linux distribution (distro), which includes the kernel and supporting system software and libraries—most of which are provided by third parties—to create a complete operating system, designed as a clone of Unix and released under the copyleft GPL license.

Thousands of Linux distributions exist, many based directly or indirectly on other distributions; popular Linux distributions include Debian, Fedora Linux, Linux Mint, Arch Linux, and Ubuntu, while commercial distributions include Red Hat Enterprise Linux, SUSE Linux Enterprise, and ChromeOS. Linux distributions are frequently used in server platforms. Many Linux distributions use the word "Linux" in their name, but the Free Software Foundation uses and recommends the name "GNU/Linux" to emphasize the use and importance of GNU software in many distributions, causing some controversy. Other than the Linux kernel, key components that make up a distribution may include a display server (windowing system), a package manager, a bootloader and a Unix shell.

Linux is one of the most prominent examples of free and open-source software collaboration. While originally developed for x86 based personal computers, it has since been ported to more platforms than any other operating system, and is used on a wide variety of devices including PCs, workstations, mainframes and embedded systems. Linux is the predominant operating system for servers and is also used on all of the world's 500 fastest supercomputers. When combined with Android, which is Linux-based and designed for smartphones, they have the largest installed base of all general-purpose operating systems.

Unix filesystem

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In Unix and operating systems inspired by it, the file system is considered a central component of the operating system. It was also one of the first parts of the system to be designed and implemented by Ken Thompson in the first experimental version of Unix, dated 1969.

As in other operating systems, the filesystem provides information storage and retrieval, and one of several forms of interprocess communication, in that the many small programs that traditionally form a Unix system can store information in files so that other programs can read them, although pipes complemented it in this role starting with the Third Edition. Also, the filesystem provides access to other resources through so-called device files that are entry points to terminals, printers, and mice.

The rest of this article uses Unix as a generic name to refer to both the original Unix operating system and its many workalikes.

Shell script

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A shell script is a computer program designed to be run by a Unix shell, a command-line interpreter. The various dialects of shell scripts are considered to be command languages. Typical operations performed by shell scripts include file manipulation, program execution, and printing text. A script which sets up the environment, runs the program, and does any necessary cleanup or logging, is called a wrapper.

The term is also used more generally to mean the automated mode of running an operating system shell; each operating system uses a particular name for these functions including batch files (MSDos-Win95 stream, OS/2), command procedures (VMS), and shell scripts (Windows NT stream and third-party derivatives like 4NT—article is at cmd.exe), and mainframe operating systems are associated with a number of terms.

Shells commonly present in Unix and Unix-like systems include the Korn shell, the Bourne shell, and GNU Bash. While a Unix operating system may have a different default shell, such as Zsh on macOS, these shells are typically present for backwards compatibility.

GNU Hurd

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

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.

The latest release of Debian/Hurd is in August 2025.

Command-line interface

DEC's DIGITAL Command Language (DCL) in OpenVMS and RSX-11, the various Unix shells (sh, ksh, csh, tcsh, zsh, Bash, etc.), CP/M's CCP, DOS's COMMAND.COM

A command-line interface (CLI), sometimes called a command-line shell, is a means of interacting with software via commands – each formatted as a line of text. Command-line interfaces emerged in the mid-1960s, on computer terminals, as an interactive and more user-friendly alternative to the non-interactive mode available with punched cards.

For nearly three decades, a CLI was the most common interface for software, but today a graphical user interface (GUI) is more common. Nonetheless, many programs such as operating system and software development utilities still provide CLI.

A CLI enables automating programs since commands can be stored in a script file that can be used repeatedly. A script allows its contained commands to be executed as group; as a program; as a command.

A CLI is made possible by command-line interpreters or command-line processors, which are programs that execute input commands.

Alternatives to a CLI include a GUI (including the desktop metaphor such as Windows), text-based menuing (including DOS Shell and IBM AIX SMIT), and keyboard shortcuts.

Vi (text editor)

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vi (pronounced as two letters,) is a screen-oriented text editor originally created for the Unix operating system. The portable subset of the behavior of vi and programs based on it, and the ex editor language supported within these programs, is described by (and thus standardized by) the Single Unix Specification

and POSIX.

The original code for vi was written by Bill Joy in 1976 as the visual mode for the ex line editor that Joy had written with Chuck Haley. Joy's ex 1.1 was released as part of the first Berkeley Software Distribution (BSD) Unix release in March 1978. It was not until version 2.0 of ex, released as part of Second BSD in May 1979 that the editor was installed under the name "vi" (which took users straight into ex's visual mode), and the name by which it is known today. Some current implementations of vi can trace their source code ancestry to Bill Joy; others are completely new, largely compatible reimplementations.

The name "vi" is derived from the shortest unambiguous abbreviation for the ex command visual, which switches the ex line editor to its full-screen mode.

In addition to various non-free software variants of vi distributed with proprietary implementations of Unix, vi was opensourced with OpenSolaris, and several free and open source software vi clones exist. A 2009 survey of Linux Journal readers found that vi was the most widely used text editor among respondents, beating gedit, the second most widely used editor, by nearly a factor of two (36% to 19%).

List of operating systems

v4 UNIX Time-Sharing System v5 UNIX Time-Sharing System v6 MINI-UNIX PWB/UNIX USG CB Unix UNIX Time-Sharing System v7 (It is from Version 7 Unix (and

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.

Brian Kernighan

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Brian Wilson Kernighan (; born January 30, 1942) is a Canadian computer scientist.

He worked at Bell Labs and contributed to the development of Unix alongside Unix creators Ken Thompson and Dennis Ritchie. Kernighan's name became widely known through co-authorship of the first book on the C programming language (The C Programming Language) with Dennis Ritchie. Kernighan affirmed that he had no part in the design of the C language ("it's entirely Dennis Ritchie's work").

Kernighan authored many Unix programs, including ditroff. He is coauthor of the AWK and AMPL programming languages. The "K" of K&R C and of AWK both stand for "Kernighan".

In collaboration with Shen Lin he devised well-known heuristics for two NP-complete optimization problems: graph partitioning and the travelling salesman problem. In a display of authorial equity, the former is usually called the Kernighan–Lin algorithm, while the latter is known as the Lin–Kernighan heuristic.

Kernighan has been a professor of computer science at Princeton University since 2000 and is the director of undergraduate studies in the department of computer science. In 2015, he co-authored the book The Go Programming Language.

SCO–Linux disputes

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In a series of legal disputes between SCO Group and Linux vendors and users, SCO alleged that its license agreements with IBM meant that source code IBM wrote and donated to be incorporated into Linux was added in violation of SCO's contractual rights. Members of the Linux community disagreed with SCO's claims; IBM, Novell, and Red Hat filed claims against SCO.

On August 10, 2007, a federal district court judge in *SCO v. Novell* ruled on summary judgment that Novell, not the SCO Group, was the rightful owner of the copyrights covering the Unix operating system. The court also ruled that "SCO is obligated to recognize Novell's waiver of SCO's claims against IBM and Sequent". After the ruling, Novell announced they had no interest in suing people over Unix and stated "We don't believe there is Unix in Linux". The final district court ruling, on November 20, 2008, affirmed the summary judgment, and added interest payments and a constructive trust.

On August 24, 2009, the U.S. Court of Appeals for the Tenth Circuit partially reversed the district court judgment. The appeals court remanded back to trial on the issues of copyright ownership and Novell's contractual waiver rights. The court upheld the \$2,547,817 award granted to Novell for the 2003 Sun agreement.

On March 30, 2010, following a jury trial, Novell, and not The SCO Group, was unanimously found to be the owner of the UNIX and UnixWare copyrights. The SCO Group, through bankruptcy trustee Edward Cahn, decided to continue the lawsuit against IBM for causing a decline in SCO revenues.

On March 1, 2016, SCO's lawsuit against IBM was dismissed with prejudice; SCO filed an appeal later that month. The case was finally settled in 2021.

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