From Wikipedia, the free encyclopedia

*This article is about the operating system. For the kernel, see*[*Linux kernel*](https://en.wikipedia.org/wiki/Linux_kernel)*. For other uses, see*[*Linux (disambiguation)*](https://en.wikipedia.org/wiki/Linux_(disambiguation))*.*

|  |  |
| --- | --- |
| **Linux** | |
| [Tux the penguin](https://en.wikipedia.org/wiki/File:Tux.svg)  [Tux](https://en.wikipedia.org/wiki/Tux) the [penguin](https://en.wikipedia.org/wiki/Penguin), mascot of Linux[[1]](https://en.wikipedia.org/wiki/Linux#cite_note-LinuxOnLine2008-1) | |
| [**Developer**](https://en.wikipedia.org/wiki/Software_developer) | Community |
| [**Written in**](https://en.wikipedia.org/wiki/Programming_language) | Primarily [C](https://en.wikipedia.org/wiki/C_(programming_language)) and [assembly](https://en.wikipedia.org/wiki/Assembly_language) |
| **OS family** | [Unix-like](https://en.wikipedia.org/wiki/Unix-like) |
| **Working state** | Current |
| **Source model** | Mainly [open-source](https://en.wikipedia.org/wiki/Open-source), [proprietary software](https://en.wikipedia.org/wiki/Proprietary_software) is also available. |
| **Initial release** | September 17, 1991; 26 years ago |
| **Marketing target** | [Personal computers](https://en.wikipedia.org/wiki/Personal_computer), [mobile devices](https://en.wikipedia.org/wiki/Mobile_device), [embedded devices](https://en.wikipedia.org/wiki/Embedded_device), [servers](https://en.wikipedia.org/wiki/Server_(computing)), [mainframes](https://en.wikipedia.org/wiki/Mainframe_computer), [supercomputers](https://en.wikipedia.org/wiki/Supercomputer) |
| [**Available in**](https://en.wikipedia.org/wiki/Natural_language) | Multilingual |
| **Platforms** | [Alpha](https://en.wikipedia.org/wiki/DEC_Alpha), [ARC](https://en.wikipedia.org/wiki/ARC_(processor)), [ARM](https://en.wikipedia.org/wiki/ARM_architecture), [Blackfin](https://en.wikipedia.org/wiki/Blackfin" \o "Blackfin), [C6x](https://en.wikipedia.org/wiki/C6x), [ETRAX CRIS](https://en.wikipedia.org/wiki/ETRAX_CRIS), [FR-V](https://en.wikipedia.org/wiki/FR-V), [H8/300](https://en.wikipedia.org/wiki/H8/300), [Hexagon](https://en.wikipedia.org/wiki/Qualcomm_Hexagon), [Itanium](https://en.wikipedia.org/wiki/Itanium), [M32R](https://en.wikipedia.org/wiki/M32R), [m68k](https://en.wikipedia.org/wiki/M68k), [META](https://en.wikipedia.org/wiki/Imagination_META), [Microblaze](https://en.wikipedia.org/wiki/Microblaze), [MIPS](https://en.wikipedia.org/wiki/MIPS_architecture), [MN103](https://en.wikipedia.org/wiki/MN103), [Nios II](https://en.wikipedia.org/wiki/Nios_II), [OpenRISC](https://en.wikipedia.org/wiki/OpenRISC), [PA-RISC](https://en.wikipedia.org/wiki/PA-RISC), [PowerPC](https://en.wikipedia.org/wiki/PowerPC), [RISC-V](https://en.wikipedia.org/wiki/RISC-V), [s390](https://en.wikipedia.org/wiki/S390), [S+core](https://en.wikipedia.org/wiki/S%2Bcore), [SuperH](https://en.wikipedia.org/wiki/SuperH), [SPARC](https://en.wikipedia.org/wiki/SPARC), [TILE64](https://en.wikipedia.org/wiki/TILE64), [Unicore32](https://en.wikipedia.org/wiki/Unicore32), [x86](https://en.wikipedia.org/wiki/X86), [Xtensa](https://en.wikipedia.org/wiki/Xtensa) |
| [**Kernel**](https://en.wikipedia.org/wiki/Kernel_(operating_system))**type** | [Monolithic](https://en.wikipedia.org/wiki/Monolithic_kernel) ([Linux kernel](https://en.wikipedia.org/wiki/Linux_kernel)) |
| [**Userland**](https://en.wikipedia.org/wiki/User_space#USERLAND) | [GNU](https://en.wikipedia.org/wiki/GNU) and various others[[a]](https://en.wikipedia.org/wiki/Linux#cite_note-7) |
| **Default**[**user interface**](https://en.wikipedia.org/wiki/User_interface) | Many |
| [**License**](https://en.wikipedia.org/wiki/Software_license) | [GPLv2](https://en.wikipedia.org/wiki/GPLv2)[[7]](https://en.wikipedia.org/wiki/Linux#cite_note-8) and other free and open-source licenses (the name "Linux" is a trademark[[b]](https://en.wikipedia.org/wiki/Linux#cite_note-10)) |

**Linux** ([/ˈlɪnəks/](https://en.wikipedia.org/wiki/Help:IPA/English) ([About this sound](https://en.wikipedia.org/wiki/File:Linus-linux.ogg) [listen](https://upload.wikimedia.org/wikipedia/commons/0/03/Linus-linux.ogg)) [*LIN-əks*](https://en.wikipedia.org/wiki/Help:Pronunciation_respelling_key))[[9]](https://en.wikipedia.org/wiki/Linux#cite_note-pronunciation-2-11)[[10]](https://en.wikipedia.org/wiki/Linux#cite_note-Foldoc09Jun06-12) is a family of [free and open-source software](https://en.wikipedia.org/wiki/Free_and_open-source_software) [operating systems](https://en.wikipedia.org/wiki/Operating_system) built around the [Linux kernel](https://en.wikipedia.org/wiki/Linux_kernel). Typically, Linux is [packaged](https://en.wikipedia.org/wiki/Package_management_system) in a form known as a [Linux distribution](https://en.wikipedia.org/wiki/Linux_distribution) (or *distro* for short) for both desktop and server use. The defining component of a Linux distribution is the [Linux kernel](https://en.wikipedia.org/wiki/Linux_kernel),[[11]](https://en.wikipedia.org/wiki/Linux#cite_note-13) an [operating system kernel](https://en.wikipedia.org/wiki/Kernel_(computing)) first released on September 17, 1991, by [Linus Torvalds](https://en.wikipedia.org/wiki/Linus_Torvalds).[[12]](https://en.wikipedia.org/wiki/Linux#cite_note-14)[[13]](https://en.wikipedia.org/wiki/Linux#cite_note-15)[[14]](https://en.wikipedia.org/wiki/Linux#cite_note-16)

Linux was originally developed for [personal computers](https://en.wikipedia.org/wiki/Personal_computer) based on the [Intel x86](https://en.wikipedia.org/wiki/Intel_x86) architecture, but has since been [ported](https://en.wikipedia.org/wiki/Porting) to more [platforms](https://en.wikipedia.org/wiki/Computer_hardware_platforms) than any other operating system.[[15]](https://en.wikipedia.org/wiki/Linux#cite_note-17)Because of the dominance of the Linux kernel-based [Android](https://en.wikipedia.org/wiki/Android_(operating_system)) OS on [smartphones](https://en.wikipedia.org/wiki/Smartphone), Linux has the [largest](https://en.wikipedia.org/wiki/Usage_share_of_operating_systems) [installed base](https://en.wikipedia.org/wiki/Installed_base) of all [general-purpose operating systems](https://en.wikipedia.org/wiki/General-purpose_operating_system).[[16]](https://en.wikipedia.org/wiki/Linux#cite_note-marketshare.hitslink.com-18) Linux is also the leading operating system on [servers](https://en.wikipedia.org/wiki/Server_(computing)) and other [big iron](https://en.wikipedia.org/wiki/Big_iron) systems such as [mainframe computers](https://en.wikipedia.org/wiki/Mainframe_computer), and the only OS used on [TOP500](https://en.wikipedia.org/wiki/TOP500) [supercomputers](https://en.wikipedia.org/wiki/Supercomputer) (since November 2017, having before gradually eliminated all competitors).[[17]](https://en.wikipedia.org/wiki/Linux#cite_note-19)[[18]](https://en.wikipedia.org/wiki/Linux#cite_note-rules_supercomputers-20) It is used by around 2.3% of [desktop computers](https://en.wikipedia.org/wiki/Desktop_computer).[[19]](https://en.wikipedia.org/wiki/Linux#cite_note-Netmarketshare.com-21)[[20]](https://en.wikipedia.org/wiki/Linux#cite_note-22) The [Chromebook](https://en.wikipedia.org/wiki/Chromebook), which runs the Linux kernel-based [Chrome OS](https://en.wikipedia.org/wiki/Chrome_OS), dominates the US [K–12](https://en.wikipedia.org/wiki/K%E2%80%9312) education market and represents nearly 20% of the sub-$300 [notebook](https://en.wikipedia.org/wiki/Laptop) sales in the US.[[21]](https://en.wikipedia.org/wiki/Linux#cite_note-23) Linux also runs on [embedded systems](https://en.wikipedia.org/wiki/Embedded_system)—devices whose [operating system](https://en.wikipedia.org/wiki/Operating_system) is typically built into the [firmware](https://en.wikipedia.org/wiki/Firmware) and is highly tailored to the system. This includes [TiVo](https://en.wikipedia.org/wiki/TiVo) and similar [DVR](https://en.wikipedia.org/wiki/Digital_video_recorder) devices, network [routers](https://en.wikipedia.org/wiki/Router_(computing)), facility automation controls, televisions,[[22]](https://en.wikipedia.org/wiki/Linux#cite_note-24)[[23]](https://en.wikipedia.org/wiki/Linux#cite_note-25) [video game consoles](https://en.wikipedia.org/wiki/Video_game_console) and [smartwatches](https://en.wikipedia.org/wiki/Smartwatch).[[24]](https://en.wikipedia.org/wiki/Linux#cite_note-LinuxDevices-26) Many smartphones and [tablet computers](https://en.wikipedia.org/wiki/Tablet_computer) run Android and other Linux derivatives.[[25]](https://en.wikipedia.org/wiki/Linux#cite_note-27)

The development of Linux is one of the most prominent examples of free and open-source [software](https://en.wikipedia.org/wiki/Software) collaboration. The underlying [source code](https://en.wikipedia.org/wiki/Source_code) may be used, modified and distributed—commercially or non-commercially—by anyone under the terms of its respective licenses, such as the [GNU General Public License](https://en.wikipedia.org/wiki/GNU_General_Public_License).

Some of the most popular and mainstream Linux distributions[[26]](https://en.wikipedia.org/wiki/Linux#cite_note-28)[[27]](https://en.wikipedia.org/wiki/Linux#cite_note-29)[[28]](https://en.wikipedia.org/wiki/Linux#cite_note-30) are [Arch Linux](https://en.wikipedia.org/wiki/Arch_Linux), [CentOS](https://en.wikipedia.org/wiki/CentOS), [Debian](https://en.wikipedia.org/wiki/Debian" \o "Debian), [Fedora](https://en.wikipedia.org/wiki/Fedora_(operating_system)), [Gentoo Linux](https://en.wikipedia.org/wiki/Gentoo_Linux), [Linux Mint](https://en.wikipedia.org/wiki/Linux_Mint), [Mageia](https://en.wikipedia.org/wiki/Mageia" \o "Mageia), [openSUSE](https://en.wikipedia.org/wiki/OpenSUSE" \o "OpenSUSE) and [Ubuntu](https://en.wikipedia.org/wiki/Ubuntu_(operating_system)), together with commercial distributions such as [Red Hat Enterprise Linux](https://en.wikipedia.org/wiki/Red_Hat_Enterprise_Linux) and [SUSE Linux Enterprise Server](https://en.wikipedia.org/wiki/SUSE_Linux_Enterprise_Server). Distributions include the Linux kernel, supporting [utilities](https://en.wikipedia.org/wiki/System_software) and [libraries](https://en.wikipedia.org/wiki/Library_(computer_science)), many of which are provided by the [GNU Project](https://en.wikipedia.org/wiki/GNU_Project), and usually a large amount of application software to fulfil the distribution's intended use. Desktop Linux distributions include a windowing system, such as [X11](https://en.wikipedia.org/wiki/X11), [Mir](https://en.wikipedia.org/wiki/Mir_(software)) or a [Wayland](https://en.wikipedia.org/wiki/Wayland_(display_server_protocol)) implementation, and an accompanying [desktop environment](https://en.wikipedia.org/wiki/Desktop_environment) such as [GNOME](https://en.wikipedia.org/wiki/GNOME) or [KDE Plasma](https://en.wikipedia.org/wiki/KDE_Plasma); some distributions may also include a less resource-intensive desktop, such as [LXDE](https://en.wikipedia.org/wiki/LXDE) or [Xfce](https://en.wikipedia.org/wiki/Xfce" \o "Xfce). Distributions intended to run on servers may omit all graphical environments from the standard install, and instead include other software to set up and operate a [solution stack](https://en.wikipedia.org/wiki/Solution_stack) such as [LAMP](https://en.wikipedia.org/wiki/LAMP_(software_bundle)). Because Linux is freely redistributable, anyone may create a distribution for any intended use. Many Linux distributions use the word "Linux" in their name. The [Free Software Foundation](https://en.wikipedia.org/wiki/Free_Software_Foundation) uses the name "[GNU](https://en.wikipedia.org/wiki/GNU)/Linux" to refer to the operating system family, as well as specific distributions, to emphasize that most Linux distributions are not just the Linux kernel, and that they have in common not only the kernel, but also numerous utilities and libraries, a large proportion of which are from the GNU project. This has led to some [controversy](https://en.wikipedia.org/wiki/GNU/Linux_naming_controversy).[[29]](https://en.wikipedia.org/wiki/Linux#cite_note-gnu_linux_faq-31)[[30]](https://en.wikipedia.org/wiki/Linux#cite_note-linux-and-gnu-32)

**Contents**

  [hide]

* [1History](https://en.wikipedia.org/wiki/Linux#History)
  + [1.1Precursors](https://en.wikipedia.org/wiki/Linux#Precursors)
  + [1.2Creation](https://en.wikipedia.org/wiki/Linux#Creation)
  + [1.3Naming](https://en.wikipedia.org/wiki/Linux#Naming)
  + [1.4Commercial and popular uptake](https://en.wikipedia.org/wiki/Linux#Commercial_and_popular_uptake)
  + [1.5Current development](https://en.wikipedia.org/wiki/Linux#Current_development)
* [2Design](https://en.wikipedia.org/wiki/Linux#Design)
  + [2.1User interface](https://en.wikipedia.org/wiki/Linux#User_interface)
  + [2.2Video input infrastructure](https://en.wikipedia.org/wiki/Linux#Video_input_infrastructure)
* [3Development](https://en.wikipedia.org/wiki/Linux#Development)
  + [3.1Community](https://en.wikipedia.org/wiki/Linux#Community)
  + [3.2Programming on Linux](https://en.wikipedia.org/wiki/Linux#Programming_on_Linux)
* [4Hardware support](https://en.wikipedia.org/wiki/Linux#Hardware_support)
* [5Uses](https://en.wikipedia.org/wiki/Linux#Uses)
  + [5.1Desktop](https://en.wikipedia.org/wiki/Linux#Desktop)
  + [5.2Netbooks](https://en.wikipedia.org/wiki/Linux#Netbooks)
  + [5.3Servers, mainframes and supercomputers](https://en.wikipedia.org/wiki/Linux#Servers,_mainframes_and_supercomputers)
  + [5.4Smart devices](https://en.wikipedia.org/wiki/Linux#Smart_devices)
  + [5.5Embedded devices](https://en.wikipedia.org/wiki/Linux#Embedded_devices)
  + [5.6Gaming](https://en.wikipedia.org/wiki/Linux#Gaming)
  + [5.7Specialized uses](https://en.wikipedia.org/wiki/Linux#Specialized_uses)
* [6Market share and uptake](https://en.wikipedia.org/wiki/Linux#Market_share_and_uptake)
* [7Copyright, trademark and naming](https://en.wikipedia.org/wiki/Linux#Copyright,_trademark_and_naming)
* [8See also](https://en.wikipedia.org/wiki/Linux#See_also)
* [9Notes](https://en.wikipedia.org/wiki/Linux#Notes)
* [10References](https://en.wikipedia.org/wiki/Linux#References)
* [11External links](https://en.wikipedia.org/wiki/Linux#External_links)

Design[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=7)]

A Linux-based system is a modular [Unix-like](https://en.wikipedia.org/wiki/Unix-like) operating system, deriving much of its basic design from principles established in Unix during the 1970s and 1980s. Such a system uses a [monolithic kernel](https://en.wikipedia.org/wiki/Monolithic_kernel), the [Linux kernel](https://en.wikipedia.org/wiki/Linux_kernel), which handles process control, networking, access to the [peripherals](https://en.wikipedia.org/wiki/Peripheral), and [file systems](https://en.wikipedia.org/wiki/File_system). [Device drivers](https://en.wikipedia.org/wiki/Device_drivers) are either integrated directly with the kernel, or added as modules that are loaded while the system is running.[[59]](https://en.wikipedia.org/wiki/Linux#cite_note-61)

The GNU [userland](https://en.wikipedia.org/wiki/Userland_(computing)" \o "Userland (computing)) is a key part of most systems based on the Linux kernel, with Android being the notable exception. The Project's [implementation](https://en.wikipedia.org/wiki/GNU_C_Library) of the [C library](https://en.wikipedia.org/wiki/C_standard_library) functions as a wrapper for the system calls of the Linux kernel necessary to the kernel-userspace interface, the [toolchain](https://en.wikipedia.org/wiki/GNU_toolchain) is a broad collection of programming tools vital to Linux development (including the [compilers](https://en.wikipedia.org/wiki/GNU_Compiler_Collection) used to build the Linux kernel itself), and the [coreutils](https://en.wikipedia.org/wiki/GNU_Core_Utilities" \o "GNU Core Utilities) implement many basic [Unix tools](https://en.wikipedia.org/wiki/Unix_commands). The project also develops [a popular](https://en.wikipedia.org/wiki/Bash_(shell)) [CLI](https://en.wikipedia.org/wiki/Command-line_interface) [shell](https://en.wikipedia.org/wiki/Shell_(computing)). The [graphical user interface](https://en.wikipedia.org/wiki/Graphical_user_interface) (or GUI) used by most Linux systems is built on top of an implementation of the [X Window System](https://en.wikipedia.org/wiki/X_Window_System).[[60]](https://en.wikipedia.org/wiki/Linux#cite_note-oreilly-anatomy-62) More recently, the Linux community seeks to advance to [Wayland](https://en.wikipedia.org/wiki/Wayland_(display_server_protocol)" \o "Wayland (display server protocol))as the new display server protocol in place of [X11](https://en.wikipedia.org/wiki/X11). Many other open-source software projects contribute to Linux systems.

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| **Various layers within Linux, also showing separation between the [userland](https://en.wikipedia.org/wiki/User_space" \o "User space) and**[**kernel space**](https://en.wikipedia.org/wiki/Kernel_space) | | | | | | |
| **User mode** | **User applications** | For example, [bash](https://en.wikipedia.org/wiki/Bourne-again_shell), [LibreOffice](https://en.wikipedia.org/wiki/LibreOffice" \o "LibreOffice), [GIMP](https://en.wikipedia.org/wiki/GIMP), [Blender](https://en.wikipedia.org/wiki/Blender_(software)), [0 A.D.](https://en.wikipedia.org/wiki/0_A.D._(video_game)), [Mozilla Firefox](https://en.wikipedia.org/wiki/Mozilla_Firefox), etc. | | | | |
| Low-level system components: | **System**[**daemons**](https://en.wikipedia.org/wiki/Daemon_(computing)): [*systemd*](https://en.wikipedia.org/wiki/Systemd)*, [runit](https://en.wikipedia.org/wiki/Runit" \o "Runit), logind, networkd, [PulseAudio](https://en.wikipedia.org/wiki/PulseAudio" \o "PulseAudio), ...* | [**Windowing system**](https://en.wikipedia.org/wiki/Windowing_system): [*X11*](https://en.wikipedia.org/wiki/X11)*,*[*Wayland*](https://en.wikipedia.org/wiki/Wayland_(display_server_protocol))*, [SurfaceFlinger](https://en.wikipedia.org/wiki/SurfaceFlinger" \o "SurfaceFlinger) (Android)* | **Other libraries:** [*GTK+*](https://en.wikipedia.org/wiki/GTK%2B)*, [Qt](https://en.wikipedia.org/wiki/Qt_(software)" \o "Qt (software)),*[*EFL*](https://en.wikipedia.org/wiki/Enlightenment_Foundation_Libraries)*,*[*SDL*](https://en.wikipedia.org/wiki/Simple_DirectMedia_Layer)*,*[*SFML*](https://en.wikipedia.org/wiki/Simple_and_Fast_Multimedia_Library)*,*[*FLTK*](https://en.wikipedia.org/wiki/FLTK)*, [GNUstep](https://en.wikipedia.org/wiki/GNUstep" \o "GNUstep)*, etc. | | **Graphics**: [*Mesa*](https://en.wikipedia.org/wiki/Mesa_(computer_graphics)), [*AMD Catalyst*](https://en.wikipedia.org/wiki/AMD_Catalyst), ... |
| [**C standard library**](https://en.wikipedia.org/wiki/C_standard_library) | open(), exec(), sbrk(), socket(), fopen(), calloc(), ... (up to 2000 [subroutines](https://en.wikipedia.org/wiki/Subroutine)) [*glibc*](https://en.wikipedia.org/wiki/GNU_C_Library) aims to be [POSIX](https://en.wikipedia.org/wiki/POSIX)/[SUS](https://en.wikipedia.org/wiki/Single_UNIX_Specification)-compatible, *[uClibc](https://en.wikipedia.org/wiki/UClibc" \o "UClibc)* targets embedded systems, [*bionic*](https://en.wikipedia.org/wiki/Bionic_(software)) written for [Android](https://en.wikipedia.org/wiki/Android_(operating_system)), etc. | | | | |
| **Kernel mode** | [**Linux kernel**](https://en.wikipedia.org/wiki/Linux_kernel) | [stat](https://en.wikipedia.org/wiki/Stat_(system_call)), [splice](https://en.wikipedia.org/wiki/Splice_(system_call)), [dup](https://en.wikipedia.org/wiki/Dup_(system_call)), [read](https://en.wikipedia.org/wiki/Read_(system_call)), [open](https://en.wikipedia.org/wiki/Open_(system_call)), [ioctl](https://en.wikipedia.org/wiki/Ioctl" \o "Ioctl), [write](https://en.wikipedia.org/wiki/Write_(system_call)), [mmap](https://en.wikipedia.org/wiki/Mmap" \o "Mmap), [close](https://en.wikipedia.org/wiki/Close_(system_call)), [exit](https://en.wikipedia.org/wiki/Exit_(system_call)), etc. (about 380 system calls) The Linux kernel [System Call Interface](https://en.wikipedia.org/wiki/System_call) (SCI, aims to be [POSIX](https://en.wikipedia.org/wiki/POSIX)/[SUS](https://en.wikipedia.org/wiki/Single_UNIX_Specification)-compatible) | | | | |
| [Process scheduling](https://en.wikipedia.org/wiki/Scheduling_(computing)) subsystem | IPC subsystem | [Memory management](https://en.wikipedia.org/wiki/Memory_management) subsystem | Virtual files subsystem | Network subsystem |
| Other components: [ALSA](https://en.wikipedia.org/wiki/Advanced_Linux_Sound_Architecture), [DRI](https://en.wikipedia.org/wiki/Direct_Rendering_Infrastructure), [evdev](https://en.wikipedia.org/wiki/Evdev" \o "Evdev), [LVM](https://en.wikipedia.org/wiki/Logical_Volume_Manager_(Linux)), [device mapper](https://en.wikipedia.org/wiki/Device_mapper), [Linux Network Scheduler](https://en.wikipedia.org/wiki/Linux_Network_Scheduler), [Netfilter](https://en.wikipedia.org/wiki/Netfilter" \o "Netfilter) [Linux Security Modules](https://en.wikipedia.org/wiki/Linux_Security_Modules): *[SELinux](https://en.wikipedia.org/wiki/Security-Enhanced_Linux" \o "Security-Enhanced Linux)*, [*TOMOYO*](https://en.wikipedia.org/wiki/TOMOYO_Linux), *[AppArmor](https://en.wikipedia.org/wiki/AppArmor" \o "AppArmor)*, [*Smack*](https://en.wikipedia.org/wiki/Smack_(Linux_security_module)) | | | | |
| **Hardware (**[**CPU**](https://en.wikipedia.org/wiki/Central_processing_unit)**,**[**main memory**](https://en.wikipedia.org/wiki/Random-access_memory)**,**[**data storage devices**](https://en.wikipedia.org/wiki/Computer_data_storage)**, etc.)** | | | | | | |

Installed components of a Linux system include the following:[[60]](https://en.wikipedia.org/wiki/Linux#cite_note-oreilly-anatomy-62)[[61]](https://en.wikipedia.org/wiki/Linux#cite_note-63)

* A [bootloader](https://en.wikipedia.org/wiki/Bootloader), for example [GNU GRUB](https://en.wikipedia.org/wiki/GNU_GRUB), [LILO](https://en.wikipedia.org/wiki/LILO_(boot_loader)), [SYSLINUX](https://en.wikipedia.org/wiki/SYSLINUX), or [Gummiboot](https://en.wikipedia.org/wiki/Gummiboot_(software)" \o "Gummiboot (software)). This is a program that loads the Linux kernel into the computer's [main memory](https://en.wikipedia.org/wiki/Main_memory), by being executed by the computer when it is turned on and after the [firmware](https://en.wikipedia.org/wiki/Firmware) initialization is performed.
* An [init](https://en.wikipedia.org/wiki/Init" \o "Init) program, such as the traditional [sysvinit](https://en.wikipedia.org/wiki/Sysvinit" \o "Sysvinit) and the newer [systemd](https://en.wikipedia.org/wiki/Systemd" \o "Systemd), [OpenRC](https://en.wikipedia.org/wiki/OpenRC" \o "OpenRC) and [Upstart](https://en.wikipedia.org/wiki/Upstart_(software)). This is the first [process](https://en.wikipedia.org/wiki/Process_(computing)) launched by the Linux kernel, and is at the root of the process tree: in other terms, all processes are launched through init. It starts processes such as system services and login prompts (whether graphical or in terminal mode).
* [Software libraries](https://en.wikipedia.org/wiki/Library_(computing)), which contain code that can be used by running processes. On Linux systems using [ELF](https://en.wikipedia.org/wiki/Executable_and_Linkable_Format)-format executable files, the [dynamic linker](https://en.wikipedia.org/wiki/Dynamic_linker) that manages use of dynamic libraries is known as ld-linux.so. If the system is set up for the user to compile software themselves, [header files](https://en.wikipedia.org/wiki/Header_file) will also be included to describe the [interface](https://en.wikipedia.org/wiki/Application_binary_interface) of installed libraries. Besides the most commonly used software library on Linux systems, the [GNU C Library](https://en.wikipedia.org/wiki/GNU_C_Library) (glibc), there are numerous other libraries, such as [SDL](https://en.wikipedia.org/wiki/Simple_DirectMedia_Layer) and [Mesa](https://en.wikipedia.org/wiki/Mesa_(computer_graphics)).
  + [C standard library](https://en.wikipedia.org/wiki/C_standard_library) is the library needed to run [C programs](https://en.wikipedia.org/wiki/C_(programming_language)) on a computer system, with the GNU C Library being the standard. For embedded systems, alternatives such as the [EGLIBC](https://en.wikipedia.org/wiki/EGLIBC) (a glibc fork once used by Debian) and [uClibc](https://en.wikipedia.org/wiki/UClibc" \o "UClibc) (which was designed for [uClinux](https://en.wikipedia.org/wiki/UClinux" \o "UClinux)) have been developed, although both are no longer maintained. Android uses its own C library, [Bionic](https://en.wikipedia.org/wiki/Bionic_(software)).
* Basic Unix commands, with GNU coreutils being the standard implementation. Alternatives exist for embedded systems, such as the copyleft [BusyBox](https://en.wikipedia.org/wiki/BusyBox" \o "BusyBox), and the BSD-licensed [Toybox](https://en.wikipedia.org/wiki/Toybox" \o "Toybox).
* [Widget toolkits](https://en.wikipedia.org/wiki/Widget_toolkit) are the libraries used to build [graphical user interfaces](https://en.wikipedia.org/wiki/Graphical_user_interface) (GUIs) for software applications. Numerous widget toolkits are available, including [GTK+](https://en.wikipedia.org/wiki/GTK%2B) and [Clutter](https://en.wikipedia.org/wiki/Clutter_(software)) developed by the [GNOME project](https://en.wikipedia.org/wiki/GNOME_project), [Qt](https://en.wikipedia.org/wiki/Qt_(software)" \o "Qt (software))developed by the [Qt Project](https://en.wikipedia.org/wiki/Qt_Project" \o "Qt Project) and led by [Digia](https://en.wikipedia.org/wiki/Digia" \o "Digia), and [Enlightenment Foundation Libraries](https://en.wikipedia.org/wiki/Enlightenment_Foundation_Libraries) (EFL) developed primarily by the [Enlightenment](https://en.wikipedia.org/wiki/Enlightenment_(software)) team.
* A [package management system](https://en.wikipedia.org/wiki/Package_manager), such as [dpkg](https://en.wikipedia.org/wiki/Dpkg" \o "Dpkg) and [RPM](https://en.wikipedia.org/wiki/RPM_Package_Manager). Alternatively packages can be compiled from binary or source [tarballs](https://en.wikipedia.org/wiki/Tar_(computing)" \o "Tar (computing)).
* User interface programs such as command shells or windowing environments.

**User interface**[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=8)]

The [user interface](https://en.wikipedia.org/wiki/User_interface), also known as the [shell](https://en.wikipedia.org/wiki/Shell_(computing)), is either a [command-line interface](https://en.wikipedia.org/wiki/Command-line_interface) (CLI), a [graphical user interface](https://en.wikipedia.org/wiki/Graphical_user_interface) (GUI), or through controls attached to the associated hardware, which is common for [embedded systems](https://en.wikipedia.org/wiki/Embedded_systems). For desktop systems, the default mode is usually a graphical user interface, although the CLI is commonly available through [terminal emulator](https://en.wikipedia.org/wiki/Terminal_emulator) windows or on a separate [virtual console](https://en.wikipedia.org/wiki/Virtual_console_(PC)).

CLI shells are text-based user interfaces, which use text for both input and output. The dominant shell used in Linux is the [Bourne-Again Shell](https://en.wikipedia.org/wiki/Bourne-Again_Shell) (bash), originally developed for the [GNU project](https://en.wikipedia.org/wiki/GNU_project). Most low-level Linux components, including various parts of the [userland](https://en.wikipedia.org/wiki/Userland_(computing)" \o "Userland (computing)), use the CLI exclusively. The CLI is particularly suited for automation of repetitive or delayed tasks, and provides very simple [inter-process communication](https://en.wikipedia.org/wiki/Inter-process_communication).

On desktop systems, the most popular user interfaces are the [GUI shells](https://en.wikipedia.org/wiki/GUI_shell), packaged together with extensive [desktop environments](https://en.wikipedia.org/wiki/Desktop_environment), such as the [K Desktop Environment (KDE)](https://en.wikipedia.org/wiki/KDE), [GNOME](https://en.wikipedia.org/wiki/GNOME_desktop), [MATE](https://en.wikipedia.org/wiki/MATE_(software)), [Cinnamon](https://en.wikipedia.org/wiki/Cinnamon_(desktop_environment)), [Unity](https://en.wikipedia.org/wiki/Unity_(desktop_environment)), [LXDE](https://en.wikipedia.org/wiki/LXDE), [Pantheon](https://en.wikipedia.org/wiki/Elementary_OS) and [Xfce](https://en.wikipedia.org/wiki/Xfce" \o "Xfce), though a variety of additional user interfaces exist. Most popular user interfaces are based on the [X Window System](https://en.wikipedia.org/wiki/X_Window_System), often simply called "X". It provides [network transparency](https://en.wikipedia.org/wiki/Network_transparency) and permits a graphical application running on one system to be displayed on another where a user may interact with the application; however, certain extensions of the X Window System are not capable of working over the network.[[62]](https://en.wikipedia.org/wiki/Linux#cite_note-64) Several X display servers exist, with the reference implementation, [X.Org Server](https://en.wikipedia.org/wiki/X.Org_Server), being the most popular.

Several types of [window managers](https://en.wikipedia.org/wiki/Window_manager) exist for X11, including [tiling](https://en.wikipedia.org/wiki/Tiling_window_manager), [dynamic](https://en.wikipedia.org/wiki/Dynamic_window_manager), [stacking](https://en.wikipedia.org/wiki/Stacking_window_manager) and [compositing](https://en.wikipedia.org/wiki/Compositing_window_manager). Window managers provide means to control the placement and appearance of individual application windows, and interact with the X Window System. Simpler [X window managers](https://en.wikipedia.org/wiki/X_window_manager) such as [dwm](https://en.wikipedia.org/wiki/Dwm" \o "Dwm) or [ratpoison](https://en.wikipedia.org/wiki/Ratpoison" \o "Ratpoison) provide a [minimalist](https://en.wikipedia.org/wiki/Minimalism_(computing)) functionality, while more elaborate window managers such as [FVWM](https://en.wikipedia.org/wiki/FVWM), [Enlightenment](https://en.wikipedia.org/wiki/Enlightenment_(software)) or [Window Maker](https://en.wikipedia.org/wiki/Window_Maker)provide more features such as a built-in [taskbar](https://en.wikipedia.org/wiki/Taskbar) and [themes](https://en.wikipedia.org/wiki/Theme_(computing)), but are still lightweight when compared to desktop environments. Desktop environments include window managers as part of their standard installations, such as [Mutter](https://en.wikipedia.org/wiki/Mutter_(window_manager)) (GNOME), [KWin](https://en.wikipedia.org/wiki/KWin" \o "KWin) (KDE) or [Xfwm](https://en.wikipedia.org/wiki/Xfwm" \o "Xfwm) (xfce), although users may choose to use a different window manager if preferred.

[Wayland](https://en.wikipedia.org/wiki/Wayland_(display_server_protocol)) is a display server protocol intended as a replacement for the X11 protocol; as of 2014, it has not received wider adoption. Unlike X11, Wayland does not need an external window manager and compositing manager. Therefore, a Wayland compositor takes the role of the display server, window manager and compositing manager. Weston is the reference implementation of Wayland, while GNOME's Mutter and KDE's KWin are being ported to Wayland as standalone display servers. Enlightenment has already been successfully ported since version 19.

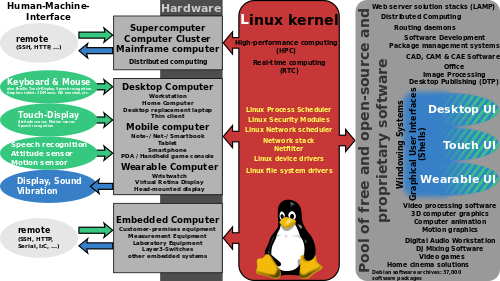
**Video input infrastructure**[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=9)]

*Main article:*[*Video4Linux*](https://en.wikipedia.org/wiki/Video4Linux)

Linux currently has two modern kernel-userspace APIs for handling video input devices: [V4L2](https://en.wikipedia.org/wiki/Video4Linux) API for video streams and radio, and [DVB](https://en.wikipedia.org/wiki/Digital_Video_Broadcasting) API for digital TV reception.[[63]](https://en.wikipedia.org/wiki/Linux#cite_note-65)

Due to the complexity and diversity of different devices, and due to the large amount of formats and standards handled by those APIs, this infrastructure needs to evolve to better fit other devices. Also, a good userspace device library is the key of the success for having userspace applications to be able to work with all formats supported by those devices.[[64]](https://en.wikipedia.org/wiki/Linux#cite_note-66)[[65]](https://en.wikipedia.org/wiki/Linux#cite_note-67)

Hardware support[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=13)]

[](https://en.wikipedia.org/wiki/File:Linux_kernel_ubiquity.svg)

Linux is ubiquitously found on various types of hardware.

*See also:*[*List of Linux-supported computer architectures*](https://en.wikipedia.org/wiki/List_of_Linux-supported_computer_architectures)

The Linux kernel is a widely [ported](https://en.wikipedia.org/wiki/Porting) operating system kernel, available for devices ranging from mobile phones to supercomputers; it runs on a highly diverse range of [computer architectures](https://en.wikipedia.org/wiki/Computer_architecture), including the hand-held [ARM](https://en.wikipedia.org/wiki/ARM_architecture)-based [iPAQ](https://en.wikipedia.org/wiki/IPAQ) and the [IBM](https://en.wikipedia.org/wiki/IBM) [mainframes](https://en.wikipedia.org/wiki/Mainframe_computer) [System z9](https://en.wikipedia.org/wiki/IBM_System_z9) or [System z10](https://en.wikipedia.org/wiki/IBM_System_z9).[[75]](https://en.wikipedia.org/wiki/Linux#cite_note-77) Specialized distributions and kernel forks exist for less mainstream architectures; for example, the [ELKS](https://en.wikipedia.org/wiki/ELKS) kernel [fork](https://en.wikipedia.org/wiki/Fork_(software_development)) can run on [Intel 8086](https://en.wikipedia.org/wiki/Intel_8086) or [Intel 80286](https://en.wikipedia.org/wiki/Intel_80286) [16-bit](https://en.wikipedia.org/wiki/16-bit) microprocessors, while the [µClinux](https://en.wikipedia.org/wiki/%CE%9CClinux) kernel fork may run on systems without a [memory management unit](https://en.wikipedia.org/wiki/Memory_management_unit). The kernel also runs on architectures that were only ever intended to use a manufacturer-created operating system, such as [Macintosh](https://en.wikipedia.org/wiki/Macintosh) computers (with both [PowerPC](https://en.wikipedia.org/wiki/PowerPC) and [Intel](https://en.wikipedia.org/wiki/Intel) processors), [PDAs](https://en.wikipedia.org/wiki/Personal_digital_assistant), [video game consoles](https://en.wikipedia.org/wiki/Video_game_console), [portable music players](https://en.wikipedia.org/wiki/Digital_audio_player), and mobile phones.

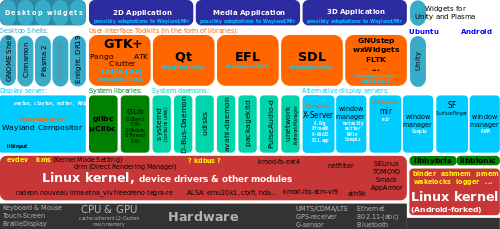
There are several industry associations and hardware [conferences](https://en.wikipedia.org/wiki/Business_conference) devoted to maintaining and improving support for diverse hardware under Linux, such as [FreedomHEC](https://en.wikipedia.org/wiki/FreedomHEC" \o "FreedomHEC). Over time, support for different hardware has improved in Linux, resulting in any off-the-shelf purchase having a "good chance" of being compatible.[[76]](https://en.wikipedia.org/wiki/Linux#cite_note-78)

Uses[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=14)]

*See also:*[*Linux range of use*](https://en.wikipedia.org/wiki/Linux_range_of_use)

Besides the Linux distributions designed for general-purpose use on desktops and servers, distributions may be specialized for different purposes including: [computer architecture](https://en.wikipedia.org/wiki/Computer_architecture) support, [embedded systems](https://en.wikipedia.org/wiki/Embedded_Linux), stability, security, localization to a specific region or language, targeting of specific user groups, support for [real-time](https://en.wikipedia.org/wiki/Real-time_computing) applications, or commitment to a given desktop environment. Furthermore, some distributions deliberately include only [free software](https://en.wikipedia.org/wiki/Free_software). As of 2015, over four hundred Linux distributions are actively developed, with about a dozen distributions being most popular for general-purpose use.[[77]](https://en.wikipedia.org/wiki/Linux#cite_note-79)

**Desktop**[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=15)]

[](https://en.wikipedia.org/wiki/File:Free_and_open-source-software_display_servers_and_UI_toolkits.svg)

Visible software components of the Linux desktop stack include the [display server](https://en.wikipedia.org/wiki/Display_server), [widget engines](https://en.wikipedia.org/wiki/Widget_engine), and some of the more widespread [widget toolkits](https://en.wikipedia.org/wiki/Widget_toolkit). There are also components not directly visible to end users, including [D-Bus](https://en.wikipedia.org/wiki/D-Bus) and [PulseAudio](https://en.wikipedia.org/wiki/PulseAudio" \o "PulseAudio).

*See also:*[*Desktop environment*](https://en.wikipedia.org/wiki/Desktop_environment)*and*[*Linux adoption: Measuring desktop adoption*](https://en.wikipedia.org/wiki/Linux_adoption#DESKTOP)

The popularity of Linux on standard desktop computers and laptops has been increasing over the years.[[78]](https://en.wikipedia.org/wiki/Linux#cite_note-80) Most modern distributions include a graphical user environment, with, as of February 2015, the two most popular environments being the [KDE Plasma Desktop](https://en.wikipedia.org/wiki/KDE_Plasma_Desktop)and [Xfce](https://en.wikipedia.org/wiki/Xfce" \o "Xfce).[[79]](https://en.wikipedia.org/wiki/Linux#cite_note-81)

No single official Linux desktop exists: rather desktop environments and Linux distributions select components from a pool of [free and open-source software](https://en.wikipedia.org/wiki/Free_and_open-source_software) with which they construct a GUI implementing some more or less strict design guide. GNOME, for example, has its [human interface guidelines](https://en.wikipedia.org/wiki/Human_interface_guidelines) as a design guide, which gives the [human–machine interface](https://en.wikipedia.org/wiki/Human%E2%80%93machine_interface) an important role, not just when doing the graphical design, but also when considering people with [disabilities](https://en.wikipedia.org/wiki/Disability), and even when focusing on security.[[80]](https://en.wikipedia.org/wiki/Linux#cite_note-82)

The collaborative nature of free software development allows distributed teams to perform [language localization](https://en.wikipedia.org/wiki/Language_localisation) of some Linux distributions for use in locales where localizing proprietary systems would not be cost-effective. For example, the [Sinhalese language](https://en.wikipedia.org/wiki/Sinhalese_language)version of the [Knoppix](https://en.wikipedia.org/wiki/Knoppix" \o "Knoppix) distribution became available significantly before Microsoft translated [Windows XP](https://en.wikipedia.org/wiki/Windows_XP) into Sinhalese.[[81]](https://en.wikipedia.org/wiki/Linux#cite_note-83) In this case the [Lanka Linux User Group](https://en.wikipedia.org/wiki/Lanka_Linux_User_Group) played a major part in developing the localized system by combining the knowledge of university professors, [linguists](https://en.wikipedia.org/wiki/Linguist), and local developers.

**Performance and applications**[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=16)]

The performance of Linux on the desktop has been a controversial topic;[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] for example in 2007 [Con Kolivas](https://en.wikipedia.org/wiki/Con_Kolivas) accused the Linux community of favoring performance on servers. He quit Linux kernel development out of frustration with this lack of focus on the desktop, and then gave a "tell all" interview on the topic.[[82]](https://en.wikipedia.org/wiki/Linux#cite_note-84) Since then a significant amount of development has focused on improving the desktop experience. Projects such as [Upstart](https://en.wikipedia.org/wiki/Upstart) and [systemd](https://en.wikipedia.org/wiki/Systemd" \o "Systemd) aim for a faster boot time; the Wayland and Mir projects aim at replacing [X11](https://en.wikipedia.org/wiki/X11) while enhancing desktop performance, security and appearance.[[83]](https://en.wikipedia.org/wiki/Linux#cite_note-85)

Many popular applications are available for a wide variety of operating systems. For example, [Mozilla Firefox](https://en.wikipedia.org/wiki/Mozilla_Firefox), [OpenOffice.org](https://en.wikipedia.org/wiki/OpenOffice.org)/[LibreOffice](https://en.wikipedia.org/wiki/LibreOffice" \o "LibreOffice) and [Blender](https://en.wikipedia.org/wiki/Blender_(software)) have downloadable versions for all major operating systems. Furthermore, some applications initially developed for Linux, such as [Pidgin](https://en.wikipedia.org/wiki/Pidgin_(software)), and [GIMP](https://en.wikipedia.org/wiki/GIMP), were ported to other operating systems (including [Windows](https://en.wikipedia.org/wiki/Microsoft_Windows) and [Mac OS X](https://en.wikipedia.org/wiki/Mac_OS_X)) due to their popularity. In addition, a growing number of proprietary desktop applications are also supported on Linux,[[84]](https://en.wikipedia.org/wiki/Linux#cite_note-86) such as [Autodesk Maya](https://en.wikipedia.org/wiki/Maya_(software)), Softimage XSI and [Apple Shake](https://en.wikipedia.org/wiki/Shake_(software)) in the high-end field of animation and visual effects; see the [list of proprietary software for Linux](https://en.wikipedia.org/wiki/List_of_proprietary_software_for_Linux) for more details. There are also [several companies](https://en.wikipedia.org/wiki/Linux_gaming#Commercial_games) that have ported their own or other companies' games to Linux, with Linux also being a supported platform on both the popular [Steam](https://en.wikipedia.org/wiki/Steam_(software)) and [Desura](https://en.wikipedia.org/wiki/Desura" \o "Desura) digital-distribution services.[[85]](https://en.wikipedia.org/wiki/Linux#cite_note-87)

Many other types of applications available for Microsoft Windows and Mac OS X also run on Linux. Commonly, either a [free software](https://en.wikipedia.org/wiki/Free_software) application will exist which does the functions of an application found on another operating system, or that application will have a version that works on Linux, such as with [Skype](https://en.wikipedia.org/wiki/Skype) and some [video games](https://en.wikipedia.org/wiki/Linux_gaming#Commercial_games) like *[Dota 2](https://en.wikipedia.org/wiki/Dota_2" \o "Dota 2)* and [*Team Fortress 2*](https://en.wikipedia.org/wiki/Team_Fortress_2). Furthermore, the [Wine](https://en.wikipedia.org/wiki/Wine_(software)) project provides a Windows compatibility layer to run unmodified Windows applications on Linux. It is sponsored by commercial interests including [CodeWeavers](https://en.wikipedia.org/wiki/CodeWeavers" \o "CodeWeavers), which produces a commercial version of the software. Since 2009, Google has also provided funding to the Wine project.[[86]](https://en.wikipedia.org/wiki/Linux#cite_note-88)[[87]](https://en.wikipedia.org/wiki/Linux#cite_note-89) [CrossOver](https://en.wikipedia.org/wiki/CrossOver" \o "CrossOver), a proprietary solution based on the open-source Wine project, supports running Windows versions of [Microsoft Office](https://en.wikipedia.org/wiki/Microsoft_Office), [Intuit](https://en.wikipedia.org/wiki/Intuit) applications such as [Quicken](https://en.wikipedia.org/wiki/Quicken) and [QuickBooks](https://en.wikipedia.org/wiki/QuickBooks), [Adobe Photoshop](https://en.wikipedia.org/wiki/Adobe_Photoshop) versions through CS2, and many popular games such as [*World of Warcraft*](https://en.wikipedia.org/wiki/World_of_Warcraft). In other cases, where there is no Linux port of some software in areas such as [desktop publishing](https://en.wikipedia.org/wiki/Desktop_publishing)[[88]](https://en.wikipedia.org/wiki/Linux#cite_note-90) and [professional audio](https://en.wikipedia.org/wiki/Professional_audio),[[89]](https://en.wikipedia.org/wiki/Linux#cite_note-91)[[90]](https://en.wikipedia.org/wiki/Linux#cite_note-92)[[91]](https://en.wikipedia.org/wiki/Linux#cite_note-93) there is equivalent software available on Linux. It is also possible to run applications written for [Android](https://en.wikipedia.org/wiki/Android_OS) on other versions of Linux using [Anbox](https://en.wikipedia.org/wiki/Anbox" \o "Anbox).[[92]](https://en.wikipedia.org/wiki/Linux#cite_note-94)

**Components and installation**[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=17)]

Besides externally visible components, such as [X window managers](https://en.wikipedia.org/wiki/X_window_manager), a non-obvious but quite central role is played by the programs hosted by [freedesktop.org](https://en.wikipedia.org/wiki/Freedesktop.org), such as [D-Bus](https://en.wikipedia.org/wiki/D-Bus) or [PulseAudio](https://en.wikipedia.org/wiki/PulseAudio" \o "PulseAudio); both major desktop environments (GNOME and KDE) include them, each offering graphical front-ends written using the corresponding toolkit ([GTK+](https://en.wikipedia.org/wiki/GTK%2B) or [Qt](https://en.wikipedia.org/wiki/Qt_(framework)" \o "Qt (framework))). A [display server](https://en.wikipedia.org/wiki/Display_server) is another component, which for the longest time has been communicating in the X11 display server protocol with its clients; prominent software talking X11 includes the [X.Org Server](https://en.wikipedia.org/wiki/X.Org_Server) and [Xlib](https://en.wikipedia.org/wiki/Xlib" \o "Xlib). Frustration over the cumbersome X11 core protocol, and especially over its numerous extensions, has led to the creation of a new display server protocol, [Wayland](https://en.wikipedia.org/wiki/Wayland_(display_server_protocol)).

Installing, updating and removing software in Linux is typically done through the use of package managers such as the [Synaptic Package Manager](https://en.wikipedia.org/wiki/Synaptic_Package_Manager), [PackageKit](https://en.wikipedia.org/wiki/PackageKit" \o "PackageKit), and [Yum Extender](https://en.wikipedia.org/wiki/Yellow_dog_Updater,_Modified). While most major Linux distributions have extensive repositories, often containing tens of thousands of packages, not all the software that can run on Linux is available from the official repositories. Alternatively, users can install packages from unofficial repositories, download pre-compiled packages directly from websites, or compile the source code by themselves. All these methods come with different degrees of difficulty; compiling the source code is in general considered a challenging process for new Linux users, but it is hardly needed in modern distributions and is not a method specific to Linux.

* **Samples of graphical desktop interfaces**
* [](https://en.wikipedia.org/wiki/File:Ubuntu_15.10_with_Firefox_and_Nautilus_open.png)

[Unity](https://en.wikipedia.org/wiki/Unity_(user_interface))

* [](https://en.wikipedia.org/wiki/File:Linux_Mint_17_(Qiana)_Cinnamon.png)

[Cinnamon](https://en.wikipedia.org/wiki/Cinnamon_(software))

* [](https://en.wikipedia.org/wiki/File:GNOME_Shell.png)

[GNOME](https://en.wikipedia.org/wiki/GNOME)

* [](https://en.wikipedia.org/wiki/File:E17_bw_screenshot.png)

[Enlightenment](https://en.wikipedia.org/wiki/Enlightenment_(window_manager))

* [](https://en.wikipedia.org/wiki/File:Kubuntu_15.04.alpha1_with_plasma5.png)

[KDE Plasma](https://en.wikipedia.org/wiki/KDE_Plasma_Desktop)

* [](https://en.wikipedia.org/wiki/File:Lubuntu_13.04_English.png)

[LXDE](https://en.wikipedia.org/wiki/LXDE)

* [](https://en.wikipedia.org/wiki/File:Screenshot_of_LXQt_0.7.png)

[LXQt](https://en.wikipedia.org/wiki/LXQt)

* [](https://en.wikipedia.org/wiki/File:Ubuntu_MATE_16.04_screenshot.png)

[Mate](https://en.wikipedia.org/wiki/Mate_desktop)

* [](https://en.wikipedia.org/wiki/File:Elementary_OS_0.3.1.png)

[Pantheon](https://en.wikipedia.org/wiki/Pantheon_(desktop_environment))

* [](https://en.wikipedia.org/wiki/File:Fluxbox.png)

[Fluxbox](https://en.wikipedia.org/wiki/Fluxbox)

* [](https://en.wikipedia.org/wiki/File:Sugar-home-view-0.82.jpg)

[Sugar](https://en.wikipedia.org/wiki/Sugar_(desktop_environment))

* [](https://en.wikipedia.org/wiki/File:Screenshot_of_Trinity_3.5.12.png)

[Trinity](https://en.wikipedia.org/wiki/Trinity_(desktop_environment))

* [](https://en.wikipedia.org/wiki/File:XFCE-4.12-Desktop.png)

[Xfce](https://en.wikipedia.org/wiki/Xfce)

* [](https://en.wikipedia.org/wiki/File:I3-gaps-wiki.png)

[i3-gaps](https://en.wikipedia.org/wiki/I3_(window_manager))

* [](https://en.wikipedia.org/wiki/File:Budgie_Desktop.png)

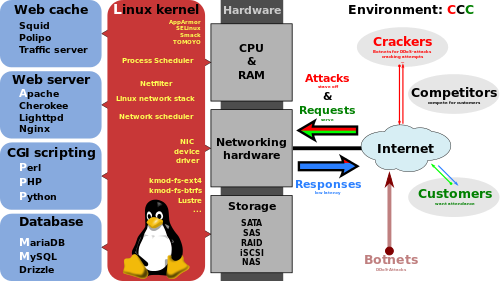
[Budgie](https://en.wikipedia.org/wiki/Budgie_(desktop_environment))

**Netbooks**[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=18)]

Linux distributions have also become popular in the [netbook](https://en.wikipedia.org/wiki/Netbook) market, with many devices such as the [Asus Eee PC](https://en.wikipedia.org/wiki/Asus_Eee_PC) and [Acer Aspire One](https://en.wikipedia.org/wiki/Aspire_One) shipping with customized Linux distributions installed.[[93]](https://en.wikipedia.org/wiki/Linux#cite_note-95)

In 2009, Google announced its [Chrome OS](https://en.wikipedia.org/wiki/Chrome_OS) as a minimal Linux-based operating system, using the [Chrome browser](https://en.wikipedia.org/wiki/Chrome_browser) as the main user interface. Chrome OS does not run any non-web applications, except for the bundled file manager and media player (a certain level of support for [Android](https://en.wikipedia.org/wiki/Android_(operating_system)) applications was added in later versions).[[94]](https://en.wikipedia.org/wiki/Linux#cite_note-96) Netbooks that shipped with the operating system, termed [Chromebooks](https://en.wikipedia.org/wiki/Chromebooks), started appearing on the market in June 2011.[[95]](https://en.wikipedia.org/wiki/Linux#cite_note-97)

**Servers, mainframes and supercomputers**[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=19)]

[](https://en.wikipedia.org/wiki/File:LAMP_software_bundle.svg)

Broad overview of the [LAMP software bundle](https://en.wikipedia.org/wiki/LAMP_(software_bundle)), displayed here together with [Squid](https://en.wikipedia.org/wiki/Squid_(software)). A high-performance and high-availability web server solution providing security in a hostile environment.

[Linux distributions](https://en.wikipedia.org/wiki/Linux_distribution) have long been used as [server](https://en.wikipedia.org/wiki/Server_(computing)) operating systems, and have risen to prominence in that area; [Netcraft](https://en.wikipedia.org/wiki/Netcraft" \o "Netcraft) reported in September 2006, that eight of the ten (other two with "unknown" OS) most reliable internet hosting companies ran Linux distributions on their [web servers](https://en.wikipedia.org/wiki/Web_server),[[96]](https://en.wikipedia.org/wiki/Linux#cite_note-98) with Linux in the top position. In June 2008, Linux distributions represented five of the top ten, [FreeBSD](https://en.wikipedia.org/wiki/FreeBSD) three of ten, and [Microsoft](https://en.wikipedia.org/wiki/Microsoft) two of ten;[[97]](https://en.wikipedia.org/wiki/Linux#cite_note-99) since February 2010, Linux distributions represented six of the top ten, FreeBSD two of ten, and Microsoft one of ten,[[98]](https://en.wikipedia.org/wiki/Linux#cite_note-100) with Linux in the top position.

Linux distributions are the cornerstone of the [LAMP](https://en.wikipedia.org/wiki/LAMP_(software_bundle)) server-software combination (Linux, [Apache](https://en.wikipedia.org/wiki/Apache_HTTP_Server), [MariaDB](https://en.wikipedia.org/wiki/MariaDB" \o "MariaDB)/[MySQL](https://en.wikipedia.org/wiki/MySQL), [Perl](https://en.wikipedia.org/wiki/Perl)/[PHP](https://en.wikipedia.org/wiki/PHP)/[Python](https://en.wikipedia.org/wiki/Python_(programming_language))) which has achieved popularity among developers, and which is one of the more common platforms for website hosting.[[99]](https://en.wikipedia.org/wiki/Linux#cite_note-SecuritySpace-101)

Linux distributions have become increasingly popular on [mainframes](https://en.wikipedia.org/wiki/Mainframe_computer), partly due to pricing and the open-source model.[[100]](https://en.wikipedia.org/wiki/Linux#cite_note-102) In December 2009, computer giant [IBM](https://en.wikipedia.org/wiki/IBM) reported that it would predominantly market and sell mainframe-based Enterprise Linux Server.[[101]](https://en.wikipedia.org/wiki/Linux#cite_note-The_Register-103) At [LinuxCon North America 2015](https://en.wikipedia.org/wiki/LinuxCon" \o "LinuxCon), IBM announced [LinuxONE](https://en.wikipedia.org/wiki/LinuxONE" \o "LinuxONE), a series of mainframes specifically designed to run Linux and open-source software.[[102]](https://en.wikipedia.org/wiki/Linux#cite_note-104)[[103]](https://en.wikipedia.org/wiki/Linux#cite_note-105)

Linux distributions are also dominant as [operating systems](https://en.wikipedia.org/wiki/Operating_system) for [supercomputers](https://en.wikipedia.org/wiki/Supercomputer).[[18]](https://en.wikipedia.org/wiki/Linux#cite_note-rules_supercomputers-20) As of November 2017, all supercomputers on the [500](https://en.wikipedia.org/wiki/TOP500) list run some variant of Linux.[[104]](https://en.wikipedia.org/wiki/Linux#cite_note-top500stats-106)

**Smart devices**[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=20)]

[](https://en.wikipedia.org/wiki/File:Samsung_Galaxy_Note_series_2.jpg)

Android smartphones

Several operating systems for [smart devices](https://en.wikipedia.org/wiki/Smart_devices), such as [smartphones](https://en.wikipedia.org/wiki/Smartphone), [tablet computers](https://en.wikipedia.org/wiki/Tablet_computer), [smart TVs](https://en.wikipedia.org/wiki/Smart_TV), and [in-vehicle infotainment](https://en.wikipedia.org/wiki/In-vehicle_infotainment) (IVI) systems, are based on Linux. Major platforms for such systems include [Android](https://en.wikipedia.org/wiki/Android_(operating_system)), [Firefox OS](https://en.wikipedia.org/wiki/Firefox_OS), [Mer](https://en.wikipedia.org/wiki/Mer_(software_distribution)" \o "Mer (software distribution)) and [Tizen](https://en.wikipedia.org/wiki/Tizen" \o "Tizen).

Android has become the dominant mobile operating system for [smartphones](https://en.wikipedia.org/wiki/Smartphone), running on 79.3% of units sold worldwide during the second quarter of 2013.[[105]](https://en.wikipedia.org/wiki/Linux#cite_note-:0-107) Android is also a popular operating system for tablets, and Android smart TVs and in-vehicle infotainment systems have also appeared in the market.

Cellphones and PDAs running Linux on open-source platforms became more common from 2007; examples include the [Nokia N810](https://en.wikipedia.org/wiki/Nokia_N810), [Openmoko](https://en.wikipedia.org/wiki/Openmoko" \o "Openmoko)'s [Neo1973](https://en.wikipedia.org/wiki/Neo1973), and the [Motorola ROKR E8](https://en.wikipedia.org/wiki/Motorola_ROKR_E8). Continuing the trend, [Palm](https://en.wikipedia.org/wiki/Palm,_Inc.) (later acquired by [HP](https://en.wikipedia.org/wiki/Hewlett-Packard)) produced a new Linux-derived operating system, [webOS](https://en.wikipedia.org/wiki/WebOS" \o "WebOS), which is built into its line of [Palm Pre](https://en.wikipedia.org/wiki/Palm_Pre) smartphones.

[Nokia](https://en.wikipedia.org/wiki/Nokia)'s [Maemo](https://en.wikipedia.org/wiki/Maemo" \o "Maemo), one of the earliest mobile operating systems, was based on [Debian](https://en.wikipedia.org/wiki/Debian).[[106]](https://en.wikipedia.org/wiki/Linux#cite_note-108) It was later merged with [Intel](https://en.wikipedia.org/wiki/Intel)'s [Moblin](https://en.wikipedia.org/wiki/Moblin" \o "Moblin), another Linux-based operating system, to form [MeeGo](https://en.wikipedia.org/wiki/MeeGo" \o "MeeGo).[[107]](https://en.wikipedia.org/wiki/Linux#cite_note-109) The project was later terminated in favor of Tizen, an operating system targeted at mobile devices as well as IVI. Tizen is a project within [The Linux Foundation](https://en.wikipedia.org/wiki/The_Linux_Foundation). Several [Samsung](https://en.wikipedia.org/wiki/Samsung) products are already running Tizen, [Samsung Gear 2](https://en.wikipedia.org/wiki/Samsung_Gear_2) being the most significant example.[[108]](https://en.wikipedia.org/wiki/Linux#cite_note-110) [Samsung Z](https://en.wikipedia.org/wiki/Samsung_Z) smartphones will use Tizen instead of Android.[[109]](https://en.wikipedia.org/wiki/Linux#cite_note-111)

As a result of MeeGo's termination, the Mer project forked the MeeGo codebase to create a basis for mobile-oriented operating systems.[[110]](https://en.wikipedia.org/wiki/Linux#cite_note-112) In July 2012, [Jolla](https://en.wikipedia.org/wiki/Jolla) announced [Sailfish OS](https://en.wikipedia.org/wiki/Sailfish_OS), their own mobile operating system built upon Mer technology.

[Mozilla's](https://en.wikipedia.org/wiki/Mozilla) Firefox OS consists of the Linux kernel, a [hardware abstraction layer](https://en.wikipedia.org/wiki/Hardware_abstraction_layer), a [web-standards](https://en.wikipedia.org/wiki/Web_standards)-based [runtime environment](https://en.wikipedia.org/wiki/Runtime_system) and user interface, and an integrated [web browser](https://en.wikipedia.org/wiki/Web_browser).[[111]](https://en.wikipedia.org/wiki/Linux#cite_note-113)

[Canonical](https://en.wikipedia.org/wiki/Canonical_Ltd.) has released [Ubuntu Touch](https://en.wikipedia.org/wiki/Ubuntu_Touch), aiming to bring convergence to the user experience on this mobile operating system and its desktop counterpart, [Ubuntu](https://en.wikipedia.org/wiki/Ubuntu_(operating_system)). The operating system also provides a full Ubuntu desktop when connected to an external monitor.[[112]](https://en.wikipedia.org/wiki/Linux#cite_note-114)

**Embedded devices**[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=21)]

*See also:*[*Embedded Linux*](https://en.wikipedia.org/wiki/Embedded_Linux)*and*[*Linux devices*](https://en.wikipedia.org/wiki/Linux_devices)

[](https://en.wikipedia.org/wiki/File:Jolla_smartphones.jpg)

The [Jolla Phone](https://en.wikipedia.org/wiki/Jolla_(mobile_phone)) has the Linux-based [Sailfish OS](https://en.wikipedia.org/wiki/Sailfish_OS)

[](https://en.wikipedia.org/wiki/File:Tesla_Model_S_digital_panels.jpg)

[In-car entertainment](https://en.wikipedia.org/wiki/In-car_entertainment)system of the [Tesla Model S](https://en.wikipedia.org/wiki/Tesla_Model_S) is based on [Ubuntu](https://en.wikipedia.org/wiki/Ubuntu_(operating_system))[[113]](https://en.wikipedia.org/wiki/Linux#cite_note-115)

[](https://en.wikipedia.org/wiki/File:My_green_Nokia_X_(13582469484).jpg)

[Nokia X](https://en.wikipedia.org/wiki/Nokia_X), a smartphone that runs Linux kernel

Due to its low cost and ease of customization, [Linux](https://en.wikipedia.org/wiki/Embedded_Linux) is often used in [embedded systems](https://en.wikipedia.org/wiki/Embedded_system). In the non-mobile telecommunications equipment sector, the majority of [customer-premises equipment](https://en.wikipedia.org/wiki/Customer-premises_equipment) (CPE) hardware runs some Linux-based operating system. [OpenWrt](https://en.wikipedia.org/wiki/OpenWrt" \o "OpenWrt) is a community driven example upon which many of the OEM firmware releases are based.

For example, the popular [TiVo](https://en.wikipedia.org/wiki/TiVo) digital video recorder also uses a customized Linux,[[114]](https://en.wikipedia.org/wiki/Linux#cite_note-tivo-116) as do several network [firewalls](https://en.wikipedia.org/wiki/Firewall_(computing)) and [routers](https://en.wikipedia.org/wiki/Router_(computing)) from such makers as [Cisco](https://en.wikipedia.org/wiki/Cisco)/[Linksys](https://en.wikipedia.org/wiki/Linksys). The [Korg OASYS](https://en.wikipedia.org/wiki/Korg_OASYS" \o "Korg OASYS), the [Korg KRONOS](https://en.wikipedia.org/wiki/Korg_KRONOS" \o "Korg KRONOS), the [Yamaha Motif XS](https://en.wikipedia.org/wiki/Yamaha_Motif#Motif_XS)/Motif XF [music workstations](https://en.wikipedia.org/wiki/Music_workstation),[[115]](https://en.wikipedia.org/wiki/Linux#cite_note-117) Yamaha S90XS/S70XS, Yamaha MOX6/MOX8 synthesizers, Yamaha Motif-Rack XS [tone generator module](https://en.wikipedia.org/wiki/Synthesizer), and Roland RD-700GX [digital piano](https://en.wikipedia.org/wiki/Digital_piano) also run Linux. Linux is also used in [stage lighting](https://en.wikipedia.org/wiki/Stage_lighting) control systems, such as the WholeHogIII console.[[116]](https://en.wikipedia.org/wiki/Linux#cite_note-118)

**Gaming**[[edit](https://en.wikipedia.org/w/index.php?title=Linux&action=edit&section=22)]

*Main article:*[*Linux gaming*](https://en.wikipedia.org/wiki/Linux_gaming)

In the past, not many games were available for Linux, but in the recent years, more games have been released with support for Linux. Nowadays, many games support Linux (especially [Indie games](https://en.wikipedia.org/wiki/Indie_game)), except for a few [AAA title](https://en.wikipedia.org/wiki/AAA_(video_game_industry)) games. On the other hand, as a popular mobile platform, [Android](https://en.wikipedia.org/wiki/Android_(operating_system)) (which uses the [Linux kernel](https://en.wikipedia.org/wiki/Linux_kernel)) has gained much developer interest and is one of the main platforms for mobile game development along with [iOS](https://en.wikipedia.org/wiki/IOS) operating system by [Apple](https://en.wikipedia.org/wiki/Apple_Inc.) for [iPhone](https://en.wikipedia.org/wiki/IPhone) and [iPad](https://en.wikipedia.org/wiki/IPad) devices.

On February 14, 2013, [Valve](https://en.wikipedia.org/wiki/Valve_Corporation) released a Linux version of [Steam](https://en.wikipedia.org/wiki/Steam_(software)), a popular game distribution platform on PC.[[117]](https://en.wikipedia.org/wiki/Linux#cite_note-119) Many Steam games were ported to Linux.[[118]](https://en.wikipedia.org/wiki/Linux#cite_note-120) On December 13, 2013, Valve released [SteamOS](https://en.wikipedia.org/wiki/SteamOS" \o "SteamOS), a gaming oriented OS based on Debian, for [beta testing](https://en.wikipedia.org/wiki/Beta_testing), and has plans to ship [Steam Machines](https://en.wikipedia.org/wiki/Steam_Machine_(hardware_platform)) as a gaming and entertainment platform.[[119]](https://en.wikipedia.org/wiki/Linux#cite_note-121) Valve has also developed [VOGL](https://en.wikipedia.org/wiki/VOGL), an [OpenGL](https://en.wikipedia.org/wiki/OpenGL) debugger intended to aid video game development,[[120]](https://en.wikipedia.org/wiki/Linux#cite_note-122) as well as porting its [Source](https://en.wikipedia.org/wiki/Source_(game_engine)) game engine to desktop Linux.[[121]](https://en.wikipedia.org/wiki/Linux#cite_note-123) As a result of Valve's effort, several prominent games such as *[DotA 2](https://en.wikipedia.org/wiki/Dota_2" \o "Dota 2)*, [*Team Fortress 2*](https://en.wikipedia.org/wiki/Team_Fortress_2), [*Portal*](https://en.wikipedia.org/wiki/Portal_(video_game)), [*Portal 2*](https://en.wikipedia.org/wiki/Portal_2) and [*Left 4 Dead 2*](https://en.wikipedia.org/wiki/Left_4_Dead_2) are now natively available on desktop Linux.

On July 31, 2013, [Nvidia](https://en.wikipedia.org/wiki/Nvidia" \o "Nvidia) released [Shield](https://en.wikipedia.org/wiki/Nvidia_Shield) as an attempt to use Android as a specialized gaming platform.[[122]](https://en.wikipedia.org/wiki/Linux#cite_note-124)

Some Linux users play Windows games through [Wine](https://en.wikipedia.org/wiki/Wine_(software)) or [CrossOver Linux](https://en.wikipedia.org/wiki/CrossOver_(software)" \o "CrossOver (software)).