**MACINTOSH OPERATING SYSTEM**

**History**

MacOS (pronounced /ˌmækoʊɛs/; previously Mac OS X, then OS X) is the current series of Unix-based graphical operating systems developed and marketed by Apple Inc. designed to run on Apple's Macintosh computers ("Macs"), having been preinstalled on all Macs since 2002. Within the market of desktop, laptop and home computers, and by web usage, it is the second most widely used desktop OS after Microsoft Windows.

Launched in 2001 as Mac OS X, the series is the latest in the family of Macintosh operating systems. Mac OS X succeeded "classic" Mac OS, which was introduced in 1984, and the final release of which was Mac OS 9 in 1999. An initial, early version of the system, Mac OS X Server 1.0, was released in 1999. The first desktop version, Mac OS X 10.0, followed in March 2001. In 2012, Apple rebranded Mac OS X to OS X. Releases were code named after big cats from the original release up until OS X 10.8 Mountain Lion. Beginning in 2013 with OS X 10.9 Mavericks, releases have been named after landmarks in California. In 2016, Apple rebranded OS X to macOS, adopting the nomenclature that it uses for their other operating systems, iOS, watchOS, and tvOS. The latest version of macOS is macOS 10.12 Sierra, which was publicly released in September 2016.

macOS is based on technologies developed at NeXT between 1985 and 1997, when Apple acquired the company. The "X" in Mac OS X and OS X is pronounced "ten", as it is the Roman numeral for the number 10. The X was a prominent part of the operating system's brand identity, and was used to showcase its Unix compatibility; UNIX 03 certification was achieved for the Intel version of Mac OS X 10.5 Leopard and all releases from Mac OS X 10.6 Snow Leopard up to the current version also have UNIX 03 certification. macOS shares its Unix-based core, named Darwin, and many of its frameworks with iOS, tvOS and watchOS. A heavily modified version of Mac OS X 10.4 Tiger was used for the first-generation Apple TV.

Apple also used to have a separate line of releases of Mac OS X designed for servers. Beginning with Mac OS X 10.7 Lion, the server functions were made available as a separate package on the Mac App Store.

Releases of Mac OS X from 1999 to 2005 can run only on the PowerPC-based Macs from the time period. After Apple announced that they were switching to Intel CPUs from 2006 onwards, a separate version of Mac OS X 10.4 Tiger was made and distributed exclusively with early Intel-based Macs; it included an emulator known as Rosetta, which allowed users to run most PowerPC applications on Intel-based Macs. Mac OS X 10.5 Leopard was released as a Universal binary, meaning the installer disc supported both Intel and PowerPC processors. In 2009, Apple released Mac OS X 10.6 Snow Leopard, which ran exclusively on Intel-based Macs. In 2011, Apple released Mac OS X 10.7 Lion, which no longer supported 32-bit Intel processors and also did not include Rosetta. All versions of the system released since then run exclusively on 64-bit Intel CPUs and do not support PowerPC applications.

**Mac OS X**

*Launch of Mac OS X*

Mac OS X was originally presented as the tenth major version of Apple's operating system for Macintosh computers; current versions of macOS retain the major version number "10". Previous Macintosh operating systems (versions of the classic Mac OS) were named using Arabic numerals, e.g. Mac OS 8 and Mac OS 9. The letter "X" in Mac OS X's name refers to the number 10, a Roman numeral. The first version of Mac OS X, Mac OS X Server 1.0, was a transitional product, featuring an interface resembling the classic Mac OS, though it was not compatible with software designed for the older system. Consumer releases of Mac OS X included more backward compatibility. Mac OS applications could be rewritten to run natively via the Carbon API; many could also be run directly through the Classic *Environment with a reduction in performance.*

The consumer version of Mac OS X was launched in 2001 with Mac OS X 10.0. Reviews were variable, with extensive praise for its sophisticated, glossy Aqua interface but criticizing it for sluggish performance.[26] With Apple's popularity at a low, the makers of several classic Mac applications such as FrameMaker and PageMaker declined to develop new versions of their software for Mac OS X.[27] Ars Technica columnist John Siracusa, who reviewed every major OS X release up to 10.10, described the early releases in retrospect as 'dog-slow, feature poor' and Aqua as 'unbearably slow and a huge resource hog'.

*Following releases*

Apple rapidly developed several new releases of Mac OS X. Siracusa's review of version 10.3, Panther, noted "It's strange to have gone from years of uncertainty and vaporware to a steady annual supply of major new operating system releases." Version 10.4, Tiger, reportedly shocked executives at Microsoft by offering a number of features, such as fast file searching and improved graphics processing, that Microsoft had spent several years struggling to add to Windows with acceptable performance.

In 2006, the first Intel Macs released used a specialized version of Mac OS X 10.4 Tiger. In 2007, Mac OS X 10.5 Leopard was the first to run on both PowerPC and Intel Macs with the use of universal binaries. Mac OS X 10.6 Snow Leopard was the first version of OS X to drop support for PowerPC Macs.

As the operating system evolved, it moved away from the classic Mac OS, with applications being added and removed. Targeting the consumer and media markets, Apple emphasized its new "digital lifestyle" applications such as the iLife suite, integrated home entertainment through the Front Row media center and the Safari web browser. With increasing popularity of the internet, Apple offered additional online services, including the .Mac, MobileMe and most recently iCloud products. It also began selling third-party applications through the Mac App Store.

Newer versions of Mac OS X also included modifications to the general interface, moving away from the striped gloss and transparency of the initial versions. Some applications began to use a brushed metal appearance, or non-pinstriped titlebar appearance in version 10.4. In Leopard, Apple announced a unification of the interface, with a standardized gray-gradient window style.

A key development for the system was the announcement and release of the iPhone from 2007 onwards. While Apple's previous iPod media players used a minimal operating system, the iPhone used an operating system based on Mac OS X, which would later be called "iPhone OS" and then iOS. The simultaneous release of two operating systems based on the same frameworks placed tension on Apple, which cited the iPhone as forcing it to delay Mac OS X 10.5 Leopard. However, after Apple opened the iPhone to third-party developers its commercial success drew attention to Mac OS X, with many iPhone software developers showing interest in Mac development.

In two succeeding versions, Lion and Mountain Lion, Apple moved some applications to a highly skeumorphic style of design inspired by contemporary versions of iOS, at the same time simplifying some elements by making controls such as scroll bars fade out when not in use. This direction was, like brushed metal interfaces, unpopular with some users, although it continued a trend of greater animation and variety in the interface previously seen in design aspects such as the Time Machine backup utility, which presented past file versions against a swirling nebula, and the glossy translucent dock of Leopard and Snow Leopard. In addition, with Mac OS X 10.7 Lion, Apple ceased to release separate server versions of Mac OS X, selling server tools as a separate downloadable application through the Mac App Store. A review described the trend in the server products as becoming "cheaper and simpler... shifting its focus from large businesses to small ones."

*OS X*

In 2012, with the release of OS X 10.8 Mountain Lion, the name of the system was shortened from Mac OS X to OS X. That year, Apple removed the head of OS X development, Scott Forstall, and design was changed towards a more minimal direction. Apple's new user interface design, using deep color saturation, text-only buttons and a minimal, 'flat' interface, was debuted with iOS 7 in 2013. With OS X engineers reportedly working on iOS 7, the version released in 2013, OS X 10.9 Mavericks, was something of a transitional release, with some of the skeumorphic design removed, while most of the general interface of Mavericks remained unchanged. The next version, OS X 10.10 Yosemite, adopted a design similar to iOS 7 but with greater complexity suitable for an interface controlled with a mouse.

From 2012 onwards, the system has shifted to an annual release schedule similar to that of iOS. It also steadily cut the cost of updates from Snow Leopard onwards, before removing upgrade fees altogether from 2013 onwards. Some journalists and third-party software developers have suggested that this decision, while allowing more rapid feature release, meant less opportunity to focus on stability, with no version of OS X recommendable for users requiring stability and performance above new features. Apple's 2015 update, OS X 10.11 El Capitan, was announced to focus specifically on stability and performance improvements.

*macOS*

In 2016, with the release of macOS 10.12 Sierra, the name was changed from OS X to macOS. macOS 10.12 Sierra's main features are the introduction of Siri to macOS, Optimized Storage, improvements to included applications, and greater integration with Apple's iPhone and Apple Watch. The Apple File System was announced at the Apple Worldwide Developers Conference in 2016 as a replacement for HFS Plus, a highly-criticized file system. This new file system will be implemented at a later date.

**Hardware compatibility**

List of macOS versions, the supported systems on which they run, and their RAM requirements

|  |  |  |
| --- | --- | --- |
| **Operating system** | **Supported systems** | **RAM requirement** |
| [10.12](https://en.wikipedia.org/wiki/MacOS_Sierra) | Intel Macs (64-bit) released in: 2009 (iMac and main [MacBook](https://en.wikipedia.org/wiki/MacBook) line), 2010 (other) or later | 2 GB |
| [10.8](https://en.wikipedia.org/wiki/OS_X_Mountain_Lion) – [10.11](https://en.wikipedia.org/wiki/OS_X_El_Capitan) | Intel Macs (64-bit) released in: 2007 (prosumer and iMac), 2008 (other consumer), 2009 (Xserve) or later |
| [10.7](https://en.wikipedia.org/wiki/Mac_OS_X_Lion) | Intel Macs (64-bit)[[76]](file:///H:\Operating%20System\Macintosh\macOS%20-%20Wikipedia.htm#cite_note-LionReq-76) [Rosetta](https://en.wikipedia.org/wiki/Rosetta_%28software%29) support dropped from 10.7 and newer. |
| [10.6](https://en.wikipedia.org/wiki/Mac_OS_X_Snow_Leopard) | Intel Macs (32-bit or 64-bit)[[76]](file:///H:\Operating%20System\Macintosh\macOS%20-%20Wikipedia.htm#cite_note-LionReq-76) | 1 GB |
| [10.5](https://en.wikipedia.org/wiki/Mac_OS_X_Leopard) | G4, G5 and Intel Macs (32-bit or 64-bit) at 867 MHz or faster [Classic](https://en.wikipedia.org/wiki/List_of_macOS_components#Classic) support dropped from 10.5 and newer. | 512 MB |
| [10.4](https://en.wikipedia.org/wiki/Mac_OS_X_Tiger) | Macs with built-in [FireWire](https://en.wikipedia.org/wiki/FireWire) and either a [New World ROM](https://en.wikipedia.org/wiki/New_World_ROM) or Intel processor | 256 MB |
| [10.3](https://en.wikipedia.org/wiki/Mac_OS_X_Panther) | Macs with a [New World ROM](https://en.wikipedia.org/wiki/New_World_ROM)[[77]](file:///H:\Operating%20System\Macintosh\macOS%20-%20Wikipedia.htm#cite_note-TigerRequirements-77) | 128 MB |
| [10.0](https://en.wikipedia.org/wiki/Mac_OS_X_10.0) – [10.2](https://en.wikipedia.org/wiki/Mac_OS_X_10.2) | G3, G4 and G5 [iBook](https://en.wikipedia.org/wiki/IBook) and [PowerBook](https://en.wikipedia.org/wiki/PowerBook), [Power Mac](https://en.wikipedia.org/wiki/Power_Macintosh) and [iMac](https://en.wikipedia.org/wiki/IMac) (except [PowerBook G3](https://en.wikipedia.org/wiki/PowerBook_G3) "Kanga") |

**PowerPC–Intel transition**

In April 2002, eWeek announced a rumor that Apple had a version of Mac OS X code-named Marklar, which ran on Intel x86 processors. The idea behind Marklar was to keep Mac OS X running on an alternative platform should Apple become dissatisfied with the progress of the PowerPC platform. These rumors subsided until late in May 2005, when various media outlets, such as The Wall Street Journal and CNET, announced that Apple would unveil Marklar in the coming months.

On June 6, 2005, Steve Jobs announced in his keynote address at the annual Apple Worldwide Developers Conference that Apple would be making the transition from PowerPC to Intel processors over the following two years, and that Mac OS X would support both platforms during the transition. Jobs also confirmed rumors that Apple had versions of Mac OS X running on Intel processors for most of its developmental life. Intel-based Macs would run a new recompiled version of OS X along with Rosetta, a binary translation layer which enables software compiled for PowerPC Mac OS X to run on Intel Mac OS X machines. The system was included with Mac OS X versions up to version 10.6.8. Apple dropped support for Classic mode on the new Intel Macs. Third party emulation software such as Mini vMac, Basilisk II and SheepShaver provided support for some early versions of Mac OS. A new version of Xcode and the underlying command-line compilers supported building universal binaries that would run on either architecture.

PowerPC-only software is supported with Apple's official emulation software, Rosetta, though applications eventually had to be rewritten to run properly on the newer versions released for Intel processors. Apple initially encouraged developers to produce universal binaries with support for both PowerPC and Intel. There is a performance penalty when PowerPC binaries run on Intel Macs through Rosetta. Moreover, some PowerPC software, such as kernel extensions and System Preferences plugins, are not supported on Intel Macs at all. Some PowerPC applications would not run on macOS at all. Plugins for Safari need to be compiled for the same platform as Safari, so when Safari is running on Intel it requires plug-ins that have been compiled as Intel-only or universal binaries, so PowerPC-only plug-ins will not work. While Intel Macs are able to run PowerPC, Intel, and universal binaries; PowerPC Macs support only universal and PowerPC builds.

Support for the PowerPC platform was dropped following the transition. In 2009, Apple announced at its Worldwide Developers Conference that Mac OS X 10.6 Snow Leopard would drop support for PowerPC processors and be Intel-only. Rosetta continued to be offered as an optional download or installation choice in Snow Leopard before it was discontinued with Mac OS X 10.7 Lion.[96][96] In addition, new versions of Mac OS X first- and third-party software increasingly required Intel processors, including new versions of iLife, iWork, Aperture and Logic Pro.

**Features**

*Aqua user interface*

The original Aqua user interface as seen in the Mac OS X Public Beta from 2000

One of the major differences between the classic Mac OS and the current macOS was the addition of Aqua, a graphical user interface with water-like elements, in the first major release of Mac OS X. Every window element, text, graphic, or widget is drawn on-screen using spatial anti-aliasing technology. ColorSync, a technology introduced many years before, was improved and built into the core drawing engine, to provide color matching for printing and multimedia professionals.[98] Also, drop shadows were added around windows and isolated text elements to provide a sense of depth. New interface elements were integrated, including sheets (dialog boxes attached to specific windows) and drawers, which would slide out and provide options.

The use of soft edges, translucent colors, and pinstripes, similar to the hardware design of the first iMacs, brought more texture and color to the user interface when compared to what Mac OS 9 and Mac OS X Server 1.0's "Platinum" appearance had offered. According to John Siracusa, an editor of Ars Technica, the introduction of Aqua and its departure from the then conventional look "hit like a ton of bricks." Bruce Tognazzini (who founded the original Apple Human Interface Group) said that the Aqua interface in Mac OS X 10.0 represented a step backwards in usability compared with the original Mac OS interface. Third-party developers started producing skins for customizable applications and other operating systems which mimicked the Aqua appearance. To some extent, Apple has used the successful transition to this new design as leverage, at various times threatening legal action against people who make or distribute software with an interface the company says is derived from its copyrighted design.

Apple has continued to change aspects of the macOS appearance and design, particularly with tweaks to the appearance of windows and the menu bar. Since 2012, Apple has sold many of its Mac models with high-resolution Retina displays, and macOS and its APIs have extensive support for resolution-independent development on supporting high-resolution displays. Reviewers have described Apple's support for the technology as superior to that on Windows.

The human interface guidelines published by Apple for macOS are followed by many applications, giving them consistent user interface and keyboard shortcuts. In addition, new services for applications are included, which include spelling and grammar checkers, special characters palette, color picker, font chooser and dictionary; these global features are present in every Cocoa application, adding consistency. The graphics system OpenGL composites windows onto the screen to allow hardware-accelerated drawing. This technology, introduced in version 10.2, is called Quartz Extreme, a component of Quartz. Quartz's internal imaging model correlates well with the Portable Document Format (PDF) imaging model, making it easy to output PDF to multiple devices. As a side result, PDF viewing and creating PDF documents from any application are built-in features. Reflecting its popularity with design users, macOS also has system support for a variety of professional video and image formats and includes an extensive pre-installed font library, featuring many prominent brand-name designs.

*Components*

The Finder is a file browser allowing quick access to all areas of the computer, which has been modified throughout subsequent releases of macOS. Quick Look is part of the Finder since version 10.5. It allows for dynamic previews of files, including videos and multi-page documents without opening any other applications. Spotlight, a file searching technology which has been integrated into the Finder since version 10.4, allows rapid real-time searches of data files; mail messages; photos; and other information based on item properties (metadata) and/or content. macOS makes use of a Dock, which holds file and folder shortcuts as well as minimized windows.

Apple added "Exposé" in version 10.3 (called Mission Control since version 10.7), a feature which includes three functions to help accessibility between windows and desktop. Its functions are to instantly display all open windows as thumbnails for easy navigation to different tasks, display all open windows as thumbnails from the current application, and hide all windows to access the desktop. Also, FileVault was introduced, which is an optional encryption of the user's files with the 128-bit Advanced Encryption Standard (AES-128).

Features introduced in version 10.4 include Automator, an application designed to create an automatic workflow for different tasks; Dashboard, a full-screen group of small applications called desktop widgets that can be called up and dismissed in one keystroke; and Front Row, a media viewer interface accessed by the Apple Remote. Moreover, the Sync Services were included, which is a system that allows applications to access a centralized extensible database for various elements of user data, including calendar and contact items. The operating system then managed conflicting edits and data consistency.

All system icons are scalable up to 512×512 pixels as of version 10.5 to accommodate various places where they appear in larger size, including for example the Cover Flow view, a three-dimensional graphical user interface included with iTunes, the Finder, and other Apple products for visually skimming through files and digital media libraries via cover artwork. That version also introduced Spaces, a virtual desktop implementation which enables the user to have more than one desktop and display them in an Exposé-like interface; an automatic backup technology called Time Machine, which provides the ability to view and restore previous versions of files and application data; and Screen Sharing was built in for the first time.

In more recent releases, Apple has developed support for emoji characters by including the proprietary Apple Color Emoji font. Apple has also connected macOS with social networks such as Twitter and Facebook through the addition of share buttons for content such as pictures and text. Apple has brought several applications and features that originally debuted in iOS, its mobile operating system, to macOS in recent releases, notably the intelligent personal assistant Siri, which was introduced in version 10.12 of macOS.

*Multilingual support*

There are 34 system languages available in macOS for the user at the moment of installation; the system language is used throughout the entire operating system environment. Input methods for typing in dozens of scripts can be chosen independently of the system language. Recent updates have added increasing support for Chinese characters and interconnections with popular social networks in China.

*Updating methods*

macOS can be updated using the Mac App Store application or the software update command line utility. Until OS X 10.8 Mountain Lion, a separate Software Update application performed this functionality. In Mountain Lion and later, this was merged into the Mac App Store application, although the underlying update mechanism remains unchanged and is fundamentally different than the download mechanism used when purchasing an App Store application.

**Release history**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Version** | **Codename** | **Darwin version** | **Processor support** | **Application support** | **Kernel** | **Date announced** | **Release date** | **Most recent version** |
| [Rhapsody](https://en.wikipedia.org/wiki/Rhapsody_%28operating_system%29) Developer Release | Grail1Z4 / Titan1U |  | 32-bit PowerPC | 32-bit PowerPC | 32-bit | Unknown | August 31, 1997 | DR2 (May 14, 1998) |
| [Mac OS X Server 1.0](https://en.wikipedia.org/wiki/Mac_OS_X_Server_1.0) | Hera |  | Unknown | March 16, 1999 | 1.2v3 (October 27, 2000) |
| Mac OS X Developer Preview | Unknown |  | May 11, 1998 | March 16, 1999 | DP4 (April 5, 2000) |
| [Mac OS X Public Beta](https://en.wikipedia.org/wiki/Mac_OS_X_Public_Beta) | Kodiak | 1.2.1 | Unknown | September 13, 2000 | N/A |
| [Mac OS X 10.0](https://en.wikipedia.org/wiki/Mac_OS_X_10.0) | Cheetah | 1.3.1 | Unknown | March 24, 2001 | 10.0.4 (June 22, 2001) |
| [Mac OS X 10.1](https://en.wikipedia.org/wiki/Mac_OS_X_10.1) | Puma | 1.4.1 / 5 | July 18, 2001[[](file:///H:\Operating%20System\Macintosh\macOS%20-%20Wikipedia.htm#cite_note-134) | September 25, 2001 | 10.1.5 (June 6, 2002) |
| [Mac OS X 10.2](https://en.wikipedia.org/wiki/Mac_OS_X_10.2) | Jaguar | 6 | 32/64-bit PowerPC | May 6, 2002 | August 24, 2002 | 10.2.8 (October 3, 2003) |
| [Mac OS X 10.3](https://en.wikipedia.org/wiki/Mac_OS_X_Panther) | Panther | 7 | 32/64-bit PowerPC | June 23, 2003 | October 24, 2003 | 10.3.9 (April 15, 2005) |
| [Mac OS X 10.4](https://en.wikipedia.org/wiki/Mac_OS_X_Tiger) | Tiger | 8 | 32/64-bit PowerPC and Intel | 32/64-bitPowerPC and Intel | May 4, 2004 | April 29, 2005 | 10.4.11 (November 14, 2007) |
| [Mac OS X 10.5](https://en.wikipedia.org/wiki/Mac_OS_X_Leopard) | Leopard | 9 | 32/64-bit PowerPC and Intel | June 26, 2006 | October 26, 2007 | 10.5.8 (August 5, 2009) |
| [Mac OS X 10.6](https://en.wikipedia.org/wiki/Mac_OS_X_Snow_Leopard) | Snow Leopard | 10 | 32/64-bit Intel | 32/64-bit Intel 32-bit PowerPC | 32/64-bit[[139]](file:///H:\Operating%20System\Macintosh\macOS%20-%20Wikipedia.htm#cite_note-139) | June 9, 2008 | August 28, 2009 | 10.6.8 v1.1 (July 25, 2011) |
| [Mac OS X 10.7](https://en.wikipedia.org/wiki/Mac_OS_X_Lion) | Lion | 11 | 64-bit Intel | 32/64-bit Intel | October 20, 2010 | July 20, 2011 | 10.7.5 (September 19, 2012) |
| [OS X 10.8](https://en.wikipedia.org/wiki/OS_X_Mountain_Lion) | Mountain Lion | 12 | 64-bit | February 16, 2012 | July 25, 2012[[144]](file:///H:\Operating%20System\Macintosh\macOS%20-%20Wikipedia.htm#cite_note-PR-25-07-144) | 10.8.5 (12F45) (October 3, 2013) |
| [OS X 10.9](https://en.wikipedia.org/wiki/OS_X_Mavericks) | Mavericks | 13 | June 10, 2013[[145]](file:///H:\Operating%20System\Macintosh\macOS%20-%20Wikipedia.htm#cite_note-145) | October 22, 2013 | 10.9.5 (13F1112) (September 18, 2014)[[146]](file:///H:\Operating%20System\Macintosh\macOS%20-%20Wikipedia.htm#cite_note-146) |
| [OS X 10.10](https://en.wikipedia.org/wiki/OS_X_Yosemite) | Yosemite | 14 | June 2, 2014 | October 16, 2014 | 10.10.5 (14F27) (August 13, 2015) |
| [OS X 10.11](https://en.wikipedia.org/wiki/OS_X_El_Capitan) | El Capitan | 15 | June 8, 2015 | September 30, 2015 | 10.11.6 (15G31) (July 18, 2016) |
| [macOS 10.12](https://en.wikipedia.org/wiki/MacOS_Sierra) | Sierra | 16 | June 13, 2016 | September 20, 2016 | 10.12.4 (16E195) (March 27, 2017) |