

History of the Macintosh

The Macintosh or Mac is a line of personal computers designed, developed, manufactured, and marketed by Apple Computer. Named after the McIntosh apple, the original Macintosh was released on January 24, 1984. It was the first commercially successful personal computer to use a graphical user interface (GUI) and mouse instead of the then-standard command line interface. The current range of Macintoshes varies from Apple's entry level Mac mini desktop, to a mid-range server, the Xserve. Macintosh systems are mainly targeted towards the home, education, and creative professional markets. Production of the Macintosh is based upon a vertical integration model in that Apple facilitates all aspects of its hardware and creates its own operating system. This is in contrast to PCs, where different brands of hardware run operating systems such as Microsoft Windows.

Original Macintosh computers used the Motorola 68k family of microprocessors, before switching to Motorola and IBM's PowerPC range of CPUs in 1994. Apple transitioned to Intel's processor architecture in 2006, which for the first time allowed Macs to run any x86 operating system natively. Current Macintoshes use the Intel Core and Intel Xeon 5100 series microprocessors. All models of Macintosh are pre-installed with a native version of the latest Mac OS, which is currently at version 10.4 and is called 'Tiger'.



The first Macintosh computer, introduced in 1984, upgraded to a 512K "Fat Mac"

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1979 to 1984: Development

The Macintosh project started in early 1979 with Jef Raskin, an Apple employee, who envisioned an easy-to-use, low-cost computer for the average consumer. In September 1979, Raskin was given permission to start hiring for the project, and he began to look for an engineer who could put together a prototype. Bill Atkinson, a member of the Lisa team (which was developing a similar but higher-end computer), introduced him to Burrell Smith, a service technician who had been hired earlier that year as Apple employee number 282. Over the years, Raskin hired a large development team that designed and built the original Macintosh hardware and software; besides Raskin, Atkinson and Smith, the team included Chris Espinosa, Joanna Hoffman, George Crow, Jerry Manock, Susan Kare, and Andy Hertzfeld.

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**Part of the original Macintosh design team, as seen on the cover of *Revolution in the Valley*.
Left to right: George Crow, Joanna Hoffman, Burrell Smith, Andy Hertzfeld, a Macintosh, Bill
Atkinson, Jerry Mannock.**

Smith's first Macintosh board design was built to Raskin's specifications: it had 64 kilobytes (KB) of RAM, used the Motorola 6809E microprocessor, and was capable of supporting a 256x256 pixel black-and-white bitmap display. (The final product used a 9-inch, 512x342 monochrome display.) Bud Tribble, a Macintosh programmer, was interested in running the Lisa's graphical programs on the Macintosh, and asked Smith whether he could incorporate the Lisa's Motorola 68000 microprocessor into the Mac while still keeping the production cost down. By December 1980, Smith had succeeded in designing a board that not only used the 68000, but made it faster, bumping it from 5 to 8 megahertz (MHz); this board also had the capacity to support a 384x256 bitmap display. Smith's design used fewer RAM chips than the Lisa, and because of this, production of the board was significantly more cost-efficient. The final Mac design was self-contained and had far more programming code in ROM than most other computers; it had 128 KB of RAM, in the form of sixteen, 64 kilobit (Kb) RAM chips soldered to the logicboard. Though there were no memory slots, it was expandable to 512 KB of RAM by means of soldering sixteen 256 Kb RAM chips in place of the factory-installed chips.

The innovative design caught the attention of Steve Jobs, the co-founder of Apple. Realizing that the Macintosh was more marketable than the Lisa, he began to focus his attention on the project. Raskin finally left the Macintosh project in 1981 over a personality conflict with Jobs, and the final Macintosh design is said to be closer to Jobs' ideas than Raskin's. After hearing about the pioneering GUI technology being developed at Xerox PARC, Steve Jobs negotiated a visit to see the Xerox Alto computer and Smalltalk development tools in exchange for Apple stock options. The Lisa and Macintosh user interfaces were clearly influenced by the one designed at Xerox. Jobs also commissioned industrial designer Hartmut Esslinger to work on the Macintosh line, resulting in the "Snow White" design language; although it came too late for the earliest Macs, it was implemented in most other mid- to late-1980s Apple computers. However, Jobs' leadership at the Macintosh project was short lived; after an internal power struggle with Apple's new CEO John Sculley, Jobs resigned from Apple in 1985, went on to found NeXT, another computer company, and did not return until 1997.

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Sculley undermined what the Mac team had been trying to do with the price of the Macintosh, when he artificially inflated the Mac's price from US\$1,995 to US\$2,495.

1984: Introduction

The Macintosh was officially announced on January 22, 1984, with the now-famous 1984 Super Bowl commercial directed by Ridley Scott. This commercial showed a woman, played by Anya Major, who defiantly throws a sledgehammer at a Big Brother-like video screen (which represented IBM). This was symbolic of Apple challenging the text-based computers that dominated the market at the time. The Mac itself went on sale for US\$2,495. It came bundled with two useful programs designed to show off its interface: MacWrite and MacPaint. Although the Mac garnered an immediate, enthusiastic following, it was too radical for some. Because the machine was entirely designed around the GUI, existing text-mode and command-driven programs had to be redesigned and rewritten; this was a challenging undertaking that many software developers shied away from, and resulted in an initial lack of software for the new system. Many users, accustomed to the arcane world of command lines, labeled the Mac a mere 'toy'.

1985 to 1989: The desktop publishing era

In 1985, the combination of the Mac, Apple's LaserWriter printer, and Mac-specific software like Boston Software's MacPublisher and Aldus PageMaker (now Adobe PageMaker) enabled users to design, preview, and print page layouts complete with text and graphics, an activity known as desktop publishing. Desktop publishing was unique to the Macintosh, but eventually became available for PC users as well. Later, programs such as Macromedia FreeHand, QuarkXPress, and Adobe Illustrator strengthened the Mac's position as a graphics computer and helped to expand the emerging desktop publishing market.

The limitations of the first Mac soon became clear: it had very little memory, even compared with other personal computers in 1984, and could not be expanded easily; and it lacked a hard drive and the means to attach one easily. Although by 1985 the Mac's base memory had increased to 512 KB, and it was possible, although inconvenient and difficult, to expand the memory of a 128 KB Mac, Apple realized that the Mac needed improvement in these areas. The result was the Macintosh Plus, released on January 10, 1986 for \$2,600. It offered one megabyte (MB) of RAM, expandable to four, and a then-revolutionary SCSI parallel interface, allowing up to seven peripherals - such as hard drives and scanners - to be attached to the machine. Its floppy drive was increased to an 800 KB capacity. The Plus was an immediate success and remained in production until October 15, 1990; on sale for just over four years and ten months, it was the longest-lived Mac in Apple's history.



The Macintosh II, the first expandable Macintosh.

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Other issues remained, particularly the low processor speed and limited graphics ability, which had hobbled the Mac's ability to make inroads into the business computing market. Updated Motorola CPUs made a faster machine possible, and in 1987 Apple took advantage of the new Motorola technology and introduced the Macintosh II, which used a 16 MHz Motorola 68020 processor. This marked the start of a new direction for the Macintosh, as now, for the first time, it had open architecture with several expansion slots, support for color graphics and a modular break out design similar to that of the IBM PC and inspired by Apple's other line, the expandable Apple II series. Alongside the Macintosh II, the Macintosh SE was released, the first compact Mac with an internal expansion slot (a processor direct slot specific to the machine. The SE shared the Macintosh II's 'Snow White' design language, as well as the new Apple Desktop Bus mouse and keyboard that had first appeared on the Apple IIGS some months earlier.

With the new Motorola 68030 processor came the Macintosh IIx in 1988, which had benefited from internal improvements, including an on-board MMU. It was followed in 1989 by a more compact version with fewer slots (the Macintosh IIcx) and a version of the Mac SE powered by the 16 MHz 68030 (the Macintosh SE/30). Later that year, the Macintosh IIfx, running at 25 MHz, was the first Mac to be '32-bit clean', allowing it to natively support more than 8 MB of RAM, unlike its predecessors, which had '32-bit dirty' ROMs (8 of the 32 bits available for addressing were used for OS level flags). System 7 was the first Macintosh operating system to support 32-bit addressing. Apple also introduced the Macintosh Portable, a 16 MHz 68000 machine with an active matrix flat panel display. The following year the 40 MHz Macintosh IIfx, costing US\$13,000, was unveiled. Apart from its fast processor, it had significant internal architectural improvements, including faster memory and a pair of dedicated ASIC's. Code had to be specifically written to utilize the ASIC's in order to utilize the extra speed that they gave the Macintosh IIfx; however, even normal code executed faster due to the other improvements.



The Macintosh Classic, Apple's early 1990s budget model.

1990 to 1998: Growth and decline

Microsoft Windows 3.0, widely seen as the first version of Windows to challenge the Mac in both performance and feature set, was released in May 1990 and was a usable, less expensive alternative to the Macintosh platform. Apple's response was to introduce a range of relatively inexpensive Macs in October 1990. The Macintosh Classic, essentially a less expensive version of the Macintosh SE,

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sold for US\$999, making it the least expensive Mac until the re-release (and subsequent price cut) of the 400 MHz iMac in February 2001. The 68020-powered Macintosh LC, in its distinctive 'pizza box' case, was available for US\$1800; it offered color graphics and was accompanied by a new, low-cost 512×384-pixel monitor. The Macintosh IIsx, essentially a 20 MHz IIs with only one expansion slot, cost US\$2500. All three machines sold well, although Apple's profit margin was considerably lower than on earlier machines.

1991 saw the much-anticipated release of System 7, a 32-bit rewrite of the Macintosh operating system that improved its handling of color graphics, memory addressing, networking, and cooperative multitasking, and introduced virtual memory. Later that year, Apple introduced the Macintosh Quadra 700 and 900, the first Macs to employ the faster Motorola 68040 processor. They were joined by improved versions of the previous year's hits, the Macintosh Classic II and Macintosh LC II. The latter was upgraded to use a 16 MHz 68030 CPU.

At the same time, the first three models in Apple's enduring PowerBook range were introduced - the PowerBook 100, a miniaturized Macintosh Portable built by Sony; the 16 MHz 68030 PowerBook 140; and the 25 MHz 68030 PowerBook 170. They were the first portable computers with the keyboard behind a palm rest, and with a built-in pointing device (a trackball) in front of the keyboard.

In 1992, Apple started to sell a low-end Mac, the Performa, through non-traditional dealers. At Apple dealers, a mid-range version of the Quadra series called the Macintosh Centris was offered, only to be quickly renamed Quadra when buyers became confused by the range of Classics, LCs, IIs, Quodras, Performas, and Centrises. Apple also unveiled the miniaturized PowerBook Duo range. It was intended to be docked to a base station for desktop-like functionality in the workplace. The PowerBook Duo was dropped from the Apple product line in early 1997.

The next evolutionary step in Macintosh CPUs was a switch to the RISC PowerPC architecture developed by the AIM alliance of Apple Computer, IBM, and Motorola. Since its introduction, the Power Macintosh line proved to be highly successful, with over a million units sold by late 1994, three months ahead of Apple's one-year goal. In the same year, Apple released the second-generation PowerBook models, the PowerBook 500 series, which introduced the novel trackpad.

By 1995, Microsoft and Intel were rapidly eroding Apple's market share with their respective Windows 95 operating system and Pentium processors, both of which significantly enhanced the multimedia capability and performance of the PC. In response, Apple started the Macintosh clone program to regain its foothold in the desktop computer market. This program lasted until August 1997, when Steve Jobs returned to Apple and pulled the plug on the whole operation, reasoning that Apple was losing a lot of money in the clone market. He thought Apple should instead focus on the future.

1999 to the present: New beginnings

In 1998, a year after Steve Jobs had returned to the company, Apple introduced an all-in-one Macintosh that was similar to the original Macintosh 128K: the iMac, a new design that did away with most Apple standard connections, such as SCSI and ADB, in favor of two USB ports. It featured an innovative new design; its translucent plastic case, originally Bondi blue, and later many other colors, is considered an industrial design hallmark of the late 1990s. The iMac proved to be phenomenally successful, with 800,000 units sold in 1998, making the company an annual profit of US\$309 million - Apple's first profitable year since Michael Spindler took over as CEO in 1995. At MacWorld 2000, San Francisco, Steve Jobs bragged that they had sold over 1.35 million iMacs the previous quarter; one every six seconds. The Power Macintosh was redesigned along similar lines.

In 1999, Apple introduced a new operating system, Mac OS X Server 1.0 (codenamed Rhapsody), with a new GUI and powerful Unix underpinnings. Its NeXT-like GUI left many Mac users disappointed, and wondering what the next generation of the Mac OS GUI would look like. Mac OS X was based on

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OPENSTEP, the operating system developed by Steve Jobs' post-Apple company, NeXT. Mac OS X was not released to the public until September 2000, as the Mac OS X Public Beta, with an Aqua interface, much different from Mac OS X Server 1.x. It cost US\$29.99 and allowed adventurous Mac users to sample Apple's new operating system and provide feedback to the company on what they wanted to see in the actual release.

In mid-1999, Apple introduced the iBook, a new consumer-level, portable Macintosh that was designed to be similar in appearance to the iMac that had been introduced a year earlier. Six weeks after the iBook's unveiling, more than 140,000 orders had been placed, and by October the computer was as much a sales hit as the iMac. Apple continued to add new products to their lineup, such as the eMac and Power Mac G4, as well as make two major upgrades of the iMac. On January 11, 2005, Apple announced the release of the Mac mini priced at US\$499, the least expensive Mac to date.



The MacBook Pro is the first Macintosh notebook to use an Intel processor. It was released at Macworld 2006.

In recent years, Apple has seen a significant boost in sales of Macs. Many claim that this is due, in part, to the success of the iPod. The term halo effect has been coined to indicate the effect of satisfied iPod owners, who purchase more Apple merchandise, on the overall sales made by Apple. The iPod digital audio players have recaptured a brand awareness of the Macintosh line that had not been seen since its original release in 1984. From 2001 to 2005, Macintosh sales increased continuously on an annual basis. On October 11, 2005, Apple released its fourth quarter results, reporting shipment of 1,236,000 Macintoshes - a 48% increase from the same quarter the previous year. Starting with the introduction of the iMac Core Duo and the MacBook Pro on January 10, 2006, Apple has gradually switched from PowerPC microprocessors to microprocessors manufactured by Intel. Apple completed that transition on August 7, 2006 at the Apple Worldwide Developers Conference, with the introduction of the Mac Pro.

Hardware

The current (as of September 2006) Macintosh product family uses Intel x86 processors. All Macintosh models ship with at least 512 MB RAM as standard. Current Macintosh computers use an ATI Radeon, nVidia GeForce or Intel GMA graphics processor and include either a Combo Drive, a DVD player and CD burner all-in-one; or the SuperDrive, a dual-function DVD and CD burner. Macintoshes include two standard data transfer ports: USB, standardized in 1998 with the iMac; and FireWire, a technology developed by Apple to support higher-performance devices; while USB is

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ubiquitous today, FireWire is mainly reserved for high-performance devices such as hard drives or video cameras.

In-keeping with the philosophy of making computing as easy as possible, the majority of Macintosh computers shipped with single-button mice. This changed in August 2005, when Apple released the four-button Mighty Mouse (a wireless version was made available on July 25, 2006) and began to ship it with new desktop Macs. Starting with a new iMac G5 released in October 2005, Apple started to include built-in iSight cameras to appropriate models, and a media center interface called Front Row that can be operated by remote control for accessing media stored on the computer.

Processor architecture

The original Macintosh used a Motorola 68000, a 16/32-bit (32-bit internal) CISC processor that ran at 8 MHz. The Macintosh Portable and PowerBook 100 both used a 16 MHz version. The Macintosh II featured a full 32-bit Motorola 68020 processor, but the Mac ROMs at the time contained software that only supported 24-bit memory addressing, therefore using only a fraction of the chip's memory addressing capabilities unless a software patch were applied. Macs with this limitation were referred to as not being '32-bit clean'. The successor Macintosh IIx introduced the Motorola 68030 processor, which added a memory management unit. The 68030 did not have a built-in floating point unit (FPU); thus, '030-based Macintoshes incorporated a separate unit - either the 68881 or 68882. Lower-cost models did without, although they incorporated an FPU socket, should the user decide to add one as an option. The first '32-bit clean' Macintosh that could use 32-bit memory addressing without a software patch was the IIfx. In 1991, Apple released the first computers containing the Motorola 68040 processor, which contained the floating point unit in the main processor. Again, lower-cost models did not have FPUs, being based on the cut-down Motorola 68LC040 instead.

Since 1994 Apple has been using the PowerPC line of processors, starting with the PowerPC 601, which were later upgraded to the 603 and 603e and 604, 604e, and 604ev. In 1997, Apple introduced its first computer based on the significantly upgraded PowerPC G3 processor; this was followed in 1999 with the PowerPC G4. The last generation of PowerPC processor to be introduced was the 64-bit PowerPC 970FX ("G5"), introduced in 2003. During the transition to the PowerPC, Apple's 'Cognac' team wrote a 68030-to-PowerPC emulator that booted very early in OS loading. Initially the emulation speed wasn't stellar, but later versions used a dynamic recompilation emulator which boosted performance by caching frequently used sections of translated code. The first version of the OS to ship with the earliest PowerPC systems was estimated to run 95% emulated. Later versions of the operating system increased the percentage of PowerPC native code until OS X brought it to 100% native.

The PowerPC 604 processor introduced symmetric multiprocessing (SMP) to the Macintosh platform, with dual PowerPC 604e-equipped Power Macintosh 9500 and 9600 models. The G3 processor was not SMP-capable, but the G4 and G5 were, and Apple introduced many dual-CPU G4 and G5 Power Macs. The top of the range Power Macintosh G5 uses up to two dual core processors, for a total of four cores.

On June 6, 2005, Steve Jobs announced that the company would begin transitioning the Macintosh line from PowerPC to Intel microprocessors (transition completed as of August 7, 2006) and demonstrated a version of Mac OS X running on a computer powered by an Intel Pentium 4 CPU. Intel-powered Macs are able to run Macintosh software compiled for PowerPC processors using a dynamic translation system known as 'Rosetta'. The reason for this switch concerns problems with the power consumption of the IBM G5 processors, coupled with IBM's inability to deliver on the promised roadmap. (Mac OS X's predecessor, OPENSTEP, also had a version for Intel processors.) The first Macintoshes with Intel processors were the iMac and the 15-inch MacBook Pro, both announced at the Macworld Conference and Expo in January 2006 and using the Core Duo processor. Throughout the year, the Mac mini was transitioned to the Core Solo or Core Duo, a 17-inch version of the

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MacBook Pro was released, and the MacBooks replaced both the iBooks and 12-inch PowerBooks. On August 7, 2006, the Mac Pro was introduced, replacing the late Power Mac G5, using the Intel Xeon. On the same day, the Xserve also received the same change, also running on a Xeon.

Expandability and connectivity

The earliest form of internal Macintosh expandability was the Processor Direct Slot (PDS), present from the SE onwards. It was basically a shortcut to the CPU socket, not a bus - which also meant that parts for the PDS slot were tied to a specific Macintosh model, with the notable exception of the LC PDS slot, which was standardized across the entire LC line. The PDS slot could be used for processor upgrades, Ethernet cards, the Apple IIe Card, or video cards. The last line of Macintoshes to have PDS slots was the first generation of the Power Macs. The first Macintosh to feature a bus for expansion was the Macintosh II, in the form of six NuBus (parallel 32-bit bus) slots. The NuBus was abandoned in favor of PCI in the second-generation Power Macs, and the G4 introduced 64-bit PCI slots as well as an AGP slot for video cards (which later became powered to support Apple's ADC-based displays). The Power Mac G5 quickly introduced PCI-X slots, which were short-lived, as the latest G5s use PCI Express for graphics and expansion. For memory, Apple has used standard SIMM's (30 and 72-pin), proprietary 168-pin DIMM's, and later industry-standard SDRAM and DDR DIMM's. Currently, the top-of-the-line Power Mac G5's and Xserves use 240-pin DDR2 SDRAM DIMMs in a dual-channel configuration.

The earliest Macintoshes used a special proprietary serial port (a DB-19 connector) for external floppy or hard drives, until SCSI was introduced with the Macintosh Plus. SCSI remained the Macintosh drive medium of choice until the mid 1990s, when less expensive ATA drives were introduced, first on budget models, then across the whole range. Current Power Macs use Serial ATA for internal hard drives, ATA for internal optical drives, and FireWire or USB 2.0 for external drives. For peripherals, the Apple Desktop Bus was introduced with the Macintosh II and Macintosh SE. It was the standard input connector for keyboards and mice until USB was introduced with the iMac. The last Macintosh to have ADB was the Power Macintosh G3 (Blue & White), alongside USB. Other legacy Macintosh peripheral connectors include the serial GeoPort and the AAUI port for networking. For external video signals, Apple used a DB-15 connector on all models prior to the blue-and-white G3, which used a VGA connector. The original AGP-based G4 used VGA, complemented by DVI; almost all later G4s, however, used the Apple Display Connector in addition to a VGA or DVI port. On the most recent Macintoshes, Apple has used single- or dual-link DVI connectors, with the Power Mac G5 having two connectors allowing dual displays (early Power Mac G5's had one DVI and one ADC port).

Software

Operating system

The Macintosh operating system was originally known as the System Software or more simply System. With the release of System 7.6, the official name became Mac OS. From 2001, the 'classic' Mac OS was phased out in favor of the new BSD Unix-based Mac OS X. Apple had offered another UNIX system, A/UX, for its Macintosh servers earlier, but without much success. The Mac OS operating system is widely considered one of the main selling points of the Macintosh platform, and Apple heavily touts its releases with large release-day special events. Apple has generally chosen to stick with some loose user-interface elements in all of its releases, and many similarities can be seen between the legacy Mac OS 9 and the modern Mac OS X.

Mac OS was the first widely used operating system with a graphical interface. No versions of the 'classic' Mac OS featured a command line interface. It was originally a single-tasking OS with limited background execution ability, but optional co-operative multitasking was introduced in System Software 5. The next major upgrade was System 7 in 1991, which featured a new full-color design, built-in multitasking, AppleScript, and more user configuration options. Mac OS continued to evolve up to version 9.2.2, but its dated architecture - such as using cooperative multitasking instead of the more modern preemptive multitasking - made a replacement necessary.

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In March 2001, Apple introduced Mac OS X, a modern and more secure Unix-based successor, using Darwin, XNU, and Mach as foundations. Mac OS X is directly derived from NeXTSTEP, the operating system developed by Steve Jobs' company NeXT before Apple bought it. Older Mac OS programs can still run under Mac OS X in a special virtual machine called Classic, but this is only possible using Apple software on Macintoshes using PowerPC processors; Macintoshes using Intel processors need third party software to run older code. A program similar to Classic called 'Rosetta' will allow PowerPC programs to run on Intel machines. Even though Mac OS X was never certified as a UNIX implementation by The Open Group, it is now the most common Unix-based desktop operating system. Mac OS X is currently at version 10.4 (released on April 29, 2005), code-named Tiger. The next version, Mac OS X v10.5, code-named Leopard, is scheduled to be released in the spring of 2007.

Non-Apple operating systems for today's Macintoshes include Linux, NetBSD, and OpenBSD. With the release of Intel-based Macintosh computers, the potential to natively run Windows-based operating systems on Apple hardware without the need for software such as Virtual PC was introduced. In March of 2006, a group of hackers announced that they were able to run Windows XP on an Intel based Mac. The group has released their software as open source and has posted it for download on their website. On April 5, 2006 Apple announced the public beta availability of their own Boot Camp software which will allow owners of Intel-based Macs to install Windows XP on their machines. Boot Camp will be a standard feature in Leopard.

Software history

Since its introduction, the Mac has been criticized for a lesser range of software titles available for its operating system in comparison to DOS and Windows-based PCs. In 1984 it was apparent that a wider range of software was available for the IBM PC, because it used the most popular operating system of the time, MS-DOS. Apple struggled to encourage software developers to port software titles to the Macintosh; however, Bill Gates at Microsoft realized that the GUI would become an industry standard, and that his software would sell in large quantity if it were available for the Macintosh. In 1984 Microsoft Word and Microsoft MultiPlan were available, and were a large selling point for the Mac. However, it lacked other business software and games. In 1985, Lotus Software introduced Lotus Jazz after the success of Lotus 1-2-3 for the IBM PC, although it was largely a flop.

In 1987, Apple spun off its software business as Claris. It was given the code and rights to several programs that had been written within Apple, notably MacWrite, MacPaint, and MacProject. In the late 1980s, Claris released a number of revamped software titles; the result was the 'Pro' series, including MacPaint Pro, MacDraw Pro, MacWrite Pro, and FileMaker Pro. To provide a complete office suite, Claris purchased the rights to the Informix Wingz spreadsheet on the Mac, renaming it Claris Resolve, and added the new presentation program Claris Impact. By the early 1990s, Claris programs were shipping with the majority of consumer-level Macintoshes and were extremely popular. In 1991, Claris released ClarisWorks, which soon became their second best-selling program. When Claris was later folded back into Apple, ClarisWorks was renamed AppleWorks beginning with version 5.0.

All new Macs now come with a suite of consumer-level applications. In 1999, a digital video editing application, iMovie, was released for use on the iMac DV. Next came iTunes, a digital jukebox designed to work with Apple's iPod digital music player, and on January 7, 2002, Apple released iPhoto, an easy-to-use digital photo organizer. In 2004, Apple began to market these applications, along with iDVD and GarageBand, as a US\$49 suite called 'iLife'. It is intended to make the Mac versatile out of the box by providing several high-value consumer media applications. The most popular tool in the suite, iTunes, now has a Windows version, and has spawned the most popular online music store, the iTunes Music Store. iLife '05 was notable for the addition of support for High Definition video and the RAW image format, and for its price increase to US\$79. In January 2006, iLife '06 was released; iWeb, a new website creation application, was added to the suite.

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To complement the Macintosh, Apple has built up a portfolio of digital media applications, as well as three applications that are geared towards productivity (the iWork suite and FileMaker Pro).

Advertising

Ever since the introduction of the Macintosh in 1984 with the 1984 Super Bowl commercial, Apple has been recognized for its efforts towards effective advertising and marketing for the Macintosh. A 'Macintosh Introduction' 18-page brochure was included with various magazines in December 1983, often remembered because Bill Gates was featured on page 11. For a special post-election edition of Newsweek in November 1984, Apple spent more than US \$2.5 million to buy all of the advertising pages in the issue (a total of 39). Apple also ran a 'Test Drive a Macintosh' promotion that year, in which potential buyers with a credit card could trial a Macintosh for 24 hours and return it to a dealer afterwards. It began to look like a success with 200,000 participants, and Advertising Age magazine named this one of the 10 best promotions of 1984. However, dealers disliked the promotion and supply of computers was insufficient for demand, and many computers were returned in such a bad shape that they could no longer be sold.

In 1985, the 'Lemmings' commercial aired at the Super Bowl; Apple went as far as to create a newspaper advertisement stating 'If you go to the bathroom during the fourth quarter, you'll be sorry'. It was a large failure and did not capture nearly as much attention as the 1984 commercial did. Many more brochures for new models like the Macintosh Plus and the Performa followed. In the 1990s Apple started the 'What's on your PowerBook?' campaign, with print ads and television commercials featuring celebrities describing how the PowerBook helps them in their businesses and everyday lives. In 1995, Apple responded to the introduction of Windows 95 with both several print ads and a television commercial demonstrating its disadvantages and lack of innovation. In 1997 the Think Different campaign introduced Apple's new slogan, and in 2002 the Switch campaign followed. The most recent advertising strategy by Apple is the Get a Mac campaign.

Today, Apple focuses much of its advertising efforts around 'special events', and keynotes at conferences like the MacWorld Expo and the Apple Expo. The events typically draw a large gathering of media representatives and spectators. In the past, special events have been used to unveil the Power Mac G5, the redesigned iMac, and many other Macintosh products.

Effects on the technology industry

Apple has introduced a number of innovations in direct relation to the Macintosh 128K that were later adopted by the rest of industry as a standard for the design of computers. Possibly Apple's number-one effect on the industry was the first large-scale use of a graphical user interface in operating system software. Today, almost every mainstream operating system relies on a graphical user interface, and many operating systems still echo the design of the original Macintosh graphical user interface, such as the use of the 'double click', 'drag and drop', and the mouse used for them. The Macintosh 128K also introduced software which allowed WYSIWYG ('what you see is what you get', pronounced 'whizzy-wig') text and graphics editing alongside significant technical improvements such as: long file names permitting whitespace, not requiring a file extension, 3.5" floppy disk drives, 8-bit mono audio, built-in speakers, and an output jack as standard features.

The Macintosh platform has introduced many innovations and ideas that had significant effects on the computer industry, especially in the area of communications standards. One of the first was the Macintosh Plus, which successfully introduced the SCSI interface in 1986. The Macintosh IIsx and the Macintosh LC introduced standard audio in and out ports in 1990 - today these ports are standard on the large majority of computers. Beginning with the iMac in 1998, Apple made the Universal Serial Bus standard and introduced FireWire, a high-speed data transfer bus now popular in media-editing computers and almost all digital video cameras. Apple also innovated in the area of networking, with heavy marketing and early implementation of the existing wireless networking standard IEEE 802.11b

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(AirPort) in the Macintosh portable lines in 1999. Additionally, the Macintosh platform introduced many of the storage devices that are now standard: The iMac, debuting in 1998, was one of the first computers to have no floppy disk drive; today, almost no new computers come with one.

Apple has also contributed heavily to the field of mobile computing, and many features of their mobile computers have become the norm. The PowerBook 100, 140, and 170 set the ergonomic standard for the placement of the keyboard in 1991 by moving the keyboard behind a palm rest, rather than right at the bottom of the laptop. In 1991, the PowerBook 100 series featured the first built-in pointing device on a laptop: a trackball. The PowerBook Duo also introduced the idea of a dock/port replicator in 1992. One of the most important features ever added to the Macintosh PowerBook lineup was the first true touchpad as a pointing device on the PowerBook 500 in 1994; today, most laptops rely on it as their pointing device. More recently, the PowerBook G4 became the first full-size laptop computer to feature a widescreen display, in 2003 it became the first laptop computer with a 17-inch display, and in 2004 it became the first laptop computer to provide dual-link DVI.

There is much speculation as to why so many Macintosh features have been adopted by competitors. And although they have a history of including some of the best technology available to the consumer market, Macs and their components are often much more expensive than Windows PCs; as such, one could argue that Macintoshes brought what was to become standard earlier at a higher cost, and it is certainly true that it costs far more to develop something than to copy it - both in terms of actual resources, and 'man-hours'. Another view is that competitors were forced to copy the Macintosh for reasons of competition and business, and whether such innovations were superior is irrelevant.

Market share and demographics

Ever since the introduction of the Macintosh, Apple has struggled to gain a significant share of the personal computer market. At first, the Macintosh 128K suffered from a dearth of available software compared to IBM's PC, resulting in disappointing sales in 1985. Only 500,000 Macs had been sold by the end of the year. Jobs had originally predicted that five million units would be sold within two years; sales eventually crossed the two million mark in 1988, and three years later, the installed base finally reached five million. Mac computers are most widely used in the creative professional market, including in journalism and desktop publishing, video editing and audio editing, but have also made inroads into the educative and scientific research sectors.

By 1997, there were more than 20 million Mac users, compared to an installed base of around 340 million Windows PCs. Statistics from late 2003 indicate that Apple had 2.06% of the desktop share in the United States, which had increased to 2.88% by Q4 2004. As of July, 2006, research firms IDC and Gartner reported that Apple's market share had increased to between 4.6% and 4.8%. The actual installed base of Macintosh computers is extremely hard to determine, with numbers ranging from a conservative 3% to an optimistic 16%.

Whether the size of the Mac's market share and installed base is actually relevant, and to whom, is a hotly debated issue. Industry pundits have often called attention to the Mac's relatively small market share to predict Apple's impending doom, particularly in the late 1990s when the company's future seemed bleakest. Others argue that market share is the wrong way to judge the Mac's success, citing the following reasons:

Apple has positioned the Mac as a higher-end personal computer, and so it is misleading to compare a Mac with a low-budget (and perhaps low-quality) PC.

Only within the computer industry does market share seem to be such a major concern. Rarely is the topic raised in the automobile or television industries, for example.

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Too much emphasis is placed on the Mac's worldwide market share at the expense of its United States market share, which as of 2006 stands at almost twice the corresponding worldwide figure.

Because the overall market for personal computers has grown so much and so rapidly, the Mac's increasing sales numbers are effectively swallowed by the industry's numbers as a whole. Apple's small market share, then, gives the false impression that fewer people are using Macs than did (for example) ten years ago.

Market share numbers ignore the total installed base of a particular platform, a statistic which is difficult to accurately determine. For example, if one platform is replaced less often than others, the number in use at any given moment would be higher than indicated by sales alone.

Regardless of the Mac's market share, Apple Computer has remained profitable ever since Steve Jobs' return and the company's subsequent reorganization.

Market research indicates that Apple draws its customer base from an artistic, creative, and well-educated population, which may explain the platform's visibility within certain youthful, avant-garde subcultures. Furthermore, conventional wisdom holds that the platform appeals especially to the politically liberal-minded; even Steve Jobs speculates that 'maybe a little less' than half of Apple's customers are Republicans, 'maybe more Dell than ours'. Accurate or not, this perception can only be reinforced by the company's pattern of political donations, by Al Gore's membership on its board, and surely not least by Jobs' own personal history.

Advantages, disadvantages and criticisms

The Macintosh differs in several ways from other x86 personal computers, especially those that run the Windows operating system. For Macs, both the hardware and bundled software, including the operating system, are manufactured by Apple Computer, whereas Microsoft supplies their software to original equipment manufacturers, including Dell, HP/Compaq, and Lenovo, who make the hardware using a wider range of components. The Unix-based operating system performs multi-user networking as standard. This less-common operating system means that a much smaller range of third-party software is available, although suitable applications, such as Microsoft Office, are available in most areas. The design of the Macintosh operating system and the vigilance of Macintosh users has contributed to the near-absence of the types of malware and spyware that plague Microsoft Windows users. However, recent security issues have made headlines, including a severe hole in the Safari Browser and a 'slew of malicious code' including the 'Leap' & 'Ingtana' worms to infiltrate the system. This has led some industry analysts and anti-virus companies to issue warnings that Apple's OS X is not immune to viruses.

Apple has a history of innovation and making bold changes that is met by a strong uptake of software upgrades. The Classic application allowed users to run 'old' (Mac OS 9) applications on OS X computers, often with a serious performance compromise when compared to natively on Mac OS 9, though without the advantages of a native OS X application. The Apple Intel transition starting in 2006 will not support Classic on new Intel Macs, and purchasers of these computers who are still using Classic applications will have to replace or upgrade this software. The transition will involve the recompilation of most OS X software to maximize performance; in the interim, unmodified OS X applications can run on the Intel chip under the emulation software 'Rosetta'. Applications do not run as fast under Rosetta as a normal application. Many analysts have stated that certain high-profile programs, such as those from Adobe Systems, should not be used under Rosetta until native versions are released. This has not stopped other analysts from fully recommending Apple computers, as can be said about reviews for the recent MacBook.

For much of its history, up until the PCI-based Power Macs, Macintosh hardware was notoriously closed. Connectors were often proprietary, requiring specialized peripherals or adapter cables, and

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the hardware architecture was so closely tied to the Mac OS that it was impossible to boot an alternative operating system; the most common workaround, used even by Apple for its A/UX Unix implementation, was to boot into Mac OS and then to hand over control to a program that took over the system and acted as a boot loader. This technique is not necessary on Open Firmware-based PCI Macs, though it was formerly used for convenience on many Old World ROM systems due to bugs in the firmware implementation. Modern Mac hardware boots directly from Open Firmware or EFI, and is not limited to the Mac OS.

Litigation

The user interface of the GEM 1.1 desktop was an almost direct copy of the Macintosh's; Apple sued on charges of 'look and feel', and eventually won. There have been many lawsuits centered around the Macintosh. These generally involve copyright infringement of the computer's look and feel.

The most notable case involving the Macintosh is Apple Computer, Inc. v. Microsoft Corp.. In 1988, Apple sued Microsoft and Hewlett-Packard on the grounds that they infringed Apple's copyrighted GUI. Cited, among other things, was the use of rectangular, overlapping, and resizable windows. After four years, Apple lost, and the concept of a GUI was no longer Apple's. Some say that Apple was at fault because they were hoarding a superior input system that would put all competitors out of business. Others say Microsoft was stealing Apple's idea, and it would be possible to create a GUI that would not infringe copyright.

Apple's actions were criticized by many people in the software community not directly involved in the lawsuits, including the Free Software Foundation (FSF), makers of the open source GNU tools. The FSF characterized the lawsuits as an attempt by Apple Computer to prevent anyone from making a user interface that worked even vaguely like a Macintosh, and called for a boycott of GNU software for the Macintosh platform. The FSF ended its boycott in 1995. Current versions of the Macintosh ship with some GNU tools installed, and the GNU compiler gcc is an integral part of Apple's XCode development platform.

In 1999, Apple successfully sued eMachines, whose eOne too closely resembled the then-new iMac. Apple also forced Digital Research to alter basic components in its Graphical Environment Manager, the user interface of which was almost a direct copy of the Macintosh's.