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Mac Pro

The **Mac Pro** is a [workstation](#) computer manufactured by [Apple Inc.](#) The machines are based on an [Intel 5400 chipset](#) (formerly Intel 5000X chipset) and [Xeon microprocessors](#), but are similar to the [Power Mac G5](#) they replaced in terms of outward appearance and expansion capabilities. They are currently one of three desktop computers in the [Macintosh](#) lineup.

The Mac Pro was formally announced on [August 7, 2006](#) at WWDC.^[1] Along with the Mac Pro, a new Xeon-based [Xserve](#) was also announced, completing Apple's [transition](#) from the [PowerPC](#) to [x86 architecture](#). On [January 8, 2008](#) Apple unveiled the first 3.2 GHz, 8-core Intel Xeon (Harpertown 45nm) -based Mac Pro.^[2]

Mac Pro



Developer	Apple Inc.
Type	Workstation
Release date	7 August 2006; 861 days ago
Base price	USD\$2,299 (standard configuration US\$2,799)
CPU	Intel Xeon , 1 × quad-core 2.8 GHz 64-bit 2 × quad-core 2.8, 3.0, or 3.2 GHz 64-bit
Web site	www.apple.com/macpro/ 

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Overview

[\[edit\]](#)

An Intel-based replacement for the [Power Mac G5](#) had long been expected prior to the release of the Mac Pro. The [iMac](#), [Mac Mini](#), [MacBook](#) and [MacBook Pro](#) had moved to an Intel-based architecture starting in January 2006, leaving the Power Mac G5 as the only machine in the Mac lineup still based on the [PowerPC](#). Speculation about the G5's eventual replacement was common. Rumors initially expected the machine to differ physically from the existing G5 and considered a number of different

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possible internal configurations based on different [chipsets](#). But the coincidence of Intel releasing a new Core 2-based Xeon workstation platform just prior to the 2006 [Worldwide Developers Conference](#) (WWDC) made it fairly obvious that the resulting machine would be based on it. Even the naming was "obvious"; Apple had dropped the term "Power" from the other machines in their lineup, and started using "Pro" on their higher-end laptop offerings. As such, the name "Mac Pro" was widely used before the machine was announced.^[3]

The Mac Pro is a high-end computer, similar to higher end Optiplexes and [Unix](#) workstations from vendors such as [SGI](#) or [Sun Microsystems](#). Although the high-end technical market has not traditionally been an area of strength for Apple, the company has been positioning itself as a leader in [non-linear digital editing](#) for [high-definition video](#),^[4] which demands storage and memory far in excess of a general desktop machine. Additionally, the [codecs](#) used in these applications are generally [processor intensive](#) and highly [threadable](#), speeding up almost linearly with additional processor cores. Apple's previous machine aimed at this market, the Power Mac G5, had up to two dual-core processors, but lacked the storage expansion capabilities of the newer design. In order to serve this market, Apple sells a variety of standardized bundles combining a Mac Pro with fairly high-end components; for instance, all available setups can support the 30" [Cinema Display](#).

In general, the Mac Pro has been well received in the press.^[5] The combination of high performance, reasonable expandability, very quiet operation and superb mechanical design makes it routinely appear as the comparison system against which other systems are measured. The Xeon platform is, however, Intel's "high end" system and not aimed at more general purpose use. Nevertheless, current-generation Xeons are priced competitively with their high-end desktop platforms, allowing Apple to sell a very powerful system at price points that are considered quite competitive, even by reviewers who do not normally review Apple systems.^[6]

Original marketing materials for the Mac Pro generally referred to the middle-of-the-line model with 2 × dual-core 2.66 GHz processors. Previously, Apple featured the base model with the words "starting at" or "from" when describing the pricing, but the online [Apple Store](#) listed the "Mac Pro at \$2499", the price for the mid-range model. The base model could be configured at US\$2200, much more comparable with the former base-model dual-core G5 at US\$1999, although offering considerably more processing power. Post revision, the default configuration for the Mac Pro includes two quad-core 2.8 GHz Xeon "Harpertown" processors.

There is an extremely large price and performance gap between the Mac Pro and Apple's most powerful consumer machine, the [iMac](#). A particular sore point for many is that the Mac Pro is the only machine in Apple's lineup that allows the end user to change the [graphics card](#) or otherwise install internal upgrades beyond RAM. Other machines in the lineup use [integrated graphics](#) and higher cost laptop parts, while the Mac Pro uses the industry standard PCIe slots. The iMac series use graphics cards and processors that are technically replaceable by a user, though the case design restricts access and the iMac's [MXM graphics](#) have been crippled as an upgrade standard by rampant noncompliance. Buying a workstation platform just to allow for upgradable graphics is something many people and reviewers have complained about. This has led to calls for a smaller, mid range machine with more limited expansion capabilities but retaining additional PCIe slots, similar to many models of [Power Macintosh](#).^[7]

Description

[\[edit\]](#)

The specifications below are from Apple's "tech specs" page^[8] or developer notes^[9], except where noted.

Processors

[\[edit\]](#)

The Mac Pro uses either one or two [Xeon 5400](#) "Harpertown" [64-bit CPUs](#) for a total of four or eight

processor cores. Each CPU chip has 12 MB on-chip **cache** shared among its processor cores.^[10] Each processor slot has its own independent 64-bit 1600 MHz **front side bus**, offering an aggregate throughput between the CPUs and the "northbridge" of 21.3 GB/s.^[11]

Memory

[edit]

The original Mac Pro's **main memory** used 667 MHz **FB-DIMMs**; its successor uses 800 MHz FB-DIMMs. These modules are installed in pairs, one each on two riser cards. The cards have 4 DIMM slots each, allowing a total of 32 GB of memory (8 x 4 GB) to be installed ^[12]. Notably, due to its FB-DIMM architecture, installing more RAM in the Mac Pro will improve its memory bandwidth, but may also increase its memory **latency**.^[13] With a simple install of a single FB-DIMM the peak bandwidth is 8 GB/s, but this can increase to 16 GB/s by installing two FB-DIMMs, one on each of the two buses, which is the default configuration from Apple. While electrically the FB-DIMMs are standard, Apple requests that users use larger-than-normal heatsinks on the memory modules that they install. Problems have been reported by users who have used third party RAM that had normal sized FB-DIMM heatsinks.^[14](see **notes** below).

Hard drives

[edit]

The Mac Pro has room for four internal **hard drives**, in sizes up to either 1TB or 300GB running at 15000rpm, each with its own **SATA-300** port. The hard drives are mounted on individual trays, provided with the machine, by captive thumbscrews similar to the one used for the PCIe slots. There are no cables to be attached, the SATA and power connectors are firmly attached to the case, and the drive is connected to them simply by pushing it in. The case lock on the back of the machine locks the trays into position. The Mac Pro now offers hardware **RAID** circuitry^[15]. Two optical **drive bays** are available, each with a SATA-300 port and an **ATA-100** port. Many **optical drives** still use the older ATA ports, including those currently being shipped with the machines. The Mac Pro also has two internal SATA ports that are not connected to drive bays; these can be put into service through the use of after-market extender cables.^[16]

Expansion cards

[edit]

For internal expansion the Mac Pro has two **PCI Express** (PCIe) 2.0 expansion slots and two PCI Express 1.1 slots, providing them with up to 300 W of power in total. The first slot is intended to hold the main **video card**, and is arranged with an empty area the width of a normal card beside it in order to leave room for the large coolers modern cards often use. In most machines, one slot would be blocked by the cooler. Instead of the tiny screws typically used to fasten the cards to the case, in the Mac Pro a single "bar" holds the cards in place, which is itself held in place by two "captive" thumbscrews that can be loosened by hand without tools and will not fall out of the case.

The PCIe slots can be configured individually to give more **bandwidth** to devices that require it, with a total of 40 "lanes", or 13 GB/s total throughput. When running **Mac OS X**, the Mac Pro currently does not support **SLI** or **ATI CrossFire**, limiting its ability to use the latest "high-end gaming" video card products; however, individuals have reported success with both CrossFire and SLI installations when running **Windows XP**.^[17]

The bandwidth allocation of the PCIe slots can be configured via the Expansion Slot Utility included with Mac OS X only on the August 2006 Mac Pro. The Mac Pro (Early 2008) has its slots hardwired as follows.

	Default
Slot 4	4x
Slot 3	4x

Slot 2	16x
Slot 1 (Double-Wide)	16x

External connectivity

[edit]

For external connectivity the system includes five [USB 2.0](#) and four [FireWire](#) ports, two of the latter being [FireWire 800](#). [Networking](#) is supported with two built-in [Gigabit Ethernet](#) ports, while [802.11 a/b/g/draft-n](#)^[18] [Wi-Fi](#) is supported via an optional [AirPort Extreme](#) card. [Bluetooth](#) is now standard. Unlike other recent Mac products, the Mac Pro does not include the [infrared](#) receiver needed to use the [Apple Remote](#). However, [Front Row](#) is available on all Mac Pros running Mac OS 10.5 ([Leopard](#)) or later, and is accessible using the normal -Esc key combination. The system also provides both digital (optical) and analogue "headphone jacks" for sound in and out, the latter available on both the front and back of the case.

Case

[edit]

The exterior of the [aluminum](#) case is similar to that of the Power Mac G5, with the exception of an additional optical drive bay, and a new arrangement of [I/O ports](#) on both the front and the back. The case is somewhat larger than another PC of the same generation, at 20 × 18½ × 8 inches, compared to another desktop PC (the Dell Dimension 9100) at 17½ × 17½ × 6½ inches. Some of the difference in height is due to the "handles" on the top and bottom of the case. The case can be opened by operating a single lever on the back, which unlocks one of the two sides of the machine, as well as the drive bays. All of the expansion slots for memory, PCIe cards and drives can be accessed with the one panel removed, and require no tools for installation.

The [Xeon](#) processors generate much less heat than the previous dual-core [G5s](#), so the size of the internal cooling devices has been reduced significantly. This allowed the interior to be re-arranged, leaving more room at the top of the case and thereby allowing the drives to double in number. Less heat also means less air to move out of the case for cooling during normal operations; the Mac Pro is very quiet in normal operation, quieter than the already-quiet Power Mac G5^{[19] [20]} , and proved difficult to measure using common decibel meters.^[21]

Specifications

[edit]

- Processors: One (2.8 GHz) or two (2.8, 3.0, or 3.2 GHz) Quad-core [Xeon](#) 5400 ("Harpertown" [Core microarchitecture](#)) processors.
- Memory:^[10] Standard 2 GB 800 MHz [DDR2](#) fully-buffered ECC RAM (upgradeable to 32 GB), in eight [FB-DIMM](#) slots
- Bundled Graphics:^[10] [bytes](#), i.e., 1 GB ATI [Radeon 2600 XT](#) 256 MB, nVidia [8800 GT](#) 512 MB or an nVidia [Quadro FX 5600](#) 1.5 GB
- Storage:^[22] Four drive bays for [Serial ATA](#) (500 GB, 750 GB, 1 TB) or [SAS](#) (300 GB) hard disks: included disks have 16 MB cache (32 MB on the 1 TB hard drive) and run at 7200 RPM (15,000 RPM for the [SAS](#) drives.) Maximum Supported: 4 TB [SATA](#), or 1.2 TB [SAS](#)). Optional hardware [RAID](#) card available with 256 MB of battery-backed cache that allows for [RAID](#) levels 0, 1, and 5. [SAS](#) drives only available when using the hardware [RAID](#) card.
- Optical Drive: 16x [SuperDrive](#) (multiple [DVD](#) write formats) (Pioneer DVR-111D or Sony DW-D150A), optional second drive. Optical bays support [ATA/100](#) and [SATA](#).^[9]
- Networking: two [Gigabit Ethernet](#) ports, Bluetooth 2.0 built-in, optional [AirPort Extreme](#) 802.11 a/b/g/n
- I/O: five USB 2.0 (two on front), two [FireWire 400](#) (one on front), two FireWire 800 (one on front), [optical audio](#) input and output, 3.5 mm stereo audio input and output (one output on front)
-

Software: [Mac OS X v10.5](#) Leopard, [iLife '08](#), [OmniOutliner](#), various trial software.

Operating systems

[\[edit\]](#)

The Mac Pro comes with the [BIOS](#) successor [EFI](#) 1.1 and handles booting differently from the conventional BIOS-based PC.

Apple's [Boot Camp](#) provides BIOS backwards compatibility , allowing dual and triple boot configurations.^{[[23](#)]} These operating systems are easily installable on Intel x86 based Apple computers:

- [Mac OS X](#) 10.5.0 and later
- [Microsoft Windows XP](#) and [Vista](#) 32-bit & 64-bit (hardware drivers are included in Boot Camp)
- Other 80x86 operating systems such as Linux x86 Solaris, DOS, BeOS, and BSD (which is very closely related to Mac OS X)

This is made possible by the presence of an x86 Intel architecture as provided by the CPU and the BIOS emulation Apple has provided on top of EFI. Note that installing any additional operating system other than Windows is not supported by Apple, because the Boot Camp drivers are Windows only. However, it is often possible to achieve full or nearly full compatibility with another OS by using 3rd-party drivers.

There are a number of challenges that one must face when trying to establish a multi-booting configuration on a single hard drive that uses the new GPT partitioning standard that Mac OS takes advantage of at the same time as MBR, which is commonly used by Windows and Linux (though Linux can use GPT). One must synchronize their GPT and MBR partition tables multiple times during the setup of such configurations. The key challenge being that a maximum of 4 partitions can be made on any such hard drive (including the EFI partition). This is because logical & extended MBR partitions are not possible which means that more than 4 partitions can not be referenced for the MBR component of the configuration. Thus having more partitions would force MBR and GPT to have differing partitioning schemes. The diskutil command-line app in Mac OS X (in addition to numerous 3rd-party graphical packages) can non-destructively resize a single partitioned HFS+ formatted volume to a scheme usable for dual/triple boot configurations with BIOS/MBR.

Compatibility

[\[edit\]](#)

Software

[\[edit\]](#)

- Software (PPC Emulation) - PowerPC-Native Applications: As the Mac Pro uses a different hardware platform than earlier [PPC](#) Macintoshes, it is incapable of running PPC applications natively. It instead uses the [Rosetta](#) PPC emulator to seamlessly run PPC applications, though at some performance penalty. Due to the manner in which Apple chose to implement it, Rosetta is incapable of emulating some lower level PPC code, and does not support 64-bit (G5 specific) PPC features.
- Software (Classic Emulation) - [Classic](#) (Mac OS 9.x and earlier): Intel-based Macs do not support Mac OS X's Classic emulation environment, although third-party emulators such as [SheepShaver](#) may allow these applications to run.
- OS Minimums - The lowest version of the operating system that will support the Mac Pro is Mac OS X version 10.4.7. Earlier versions will not boot the computer.
- As of July 2008, the Mac Pro (Early 2008 model, and possibly others) only supports hardware virtualization for users running Mac OS X. This is because Intel Hardware Virtualization is switched off at boot time by the [EFI](#). Virtualization products such as [Parallels Desktop for Mac](#) can still enable the hardware virtualization after the OS has loaded, but only under Mac OS X. A similar bug in the [Mac Mini](#) was later fixed through a firmware update.^{[[24](#)]} It is still possible to enable the hardware

virtualization under Windows using CrystalCPUID's MSR walker. It is also possible to enable it under Linux by loading the MSR module, and using that to write to the appropriate register. Once it is enabled, and locked on, it can only be disabled by physically removing the power supply from the Mac Pro.

Hardware

[edit]

- PCI-Express slots are not normally backwards compatible with prior versions of PCI hardware, such as PCI/33, PCI/66 or PCI-X. Some internal adapters and external chassis do offer PCIe-PCI compatibility. The PCIe 2.0 slots on the January 2008 Mac Pro are backwards compatible with PCIe 1.1 hardware.
- Apple recommends an Apple-specified [heat sink](#) on each memory DIMM for cooling, and the required on-chip thermal manager may shut down memory, or increase fan speed, if it starts to overheat.^[14] Several third-party, self-installable memory upgrades that include Apple-specified heat sinks are available.
- The Mac Pro, as with other platforms, requires Mac OS X compatible firmware. That is to say, a PCIe video card designed exclusively for other operating systems will not work properly under Mac OS X without appropriate drivers and/or firmware, however, they will work under the operating systems they were designed for, installed via Boot Camp or other means. Some video cards and other hardware accessories not marketed for Macintoshes can nonetheless be tricked into compatibility through combination with software extracted from similar Macintosh hardware. Also, [AMD](#) released the [ATI Radeon HD 3870](#) which is compatible with both Mac Pros and PCs from other manufacturers.

References

[edit]

- ↑ Keynote presentation at the [Worldwide Developers Conference, August 7, 2006](#).
- ↑ "[Apple adds 8-core option to Mac Pro](#)", MacNN.
- ↑ [Peering inside the aluminum ball: Woodcrest, Conroe, and the "pro" Macs](#)
- ↑ "[Apple's High Definition Future](#)", Jim Hill Media.
- ↑ "[Mac Pro review, 9 out of 10](#)". Ars Technica.
- ↑ "[Mac Pro vs. Dell Precision: A price comparison](#)". Paul Thurrott's Internet Nexus.
- ↑ "[Night of the Living xMac](#)", Ars Technica.
- ↑ "[Mac Pro tech specs](#)". Apple, Inc..
- ↑ ***a*** ***b*** ***c***"[Mac Pro Developer Note](#)". Apple, Inc..
- ↑ ***a*** ***b*** ***c***Sizes of transistorized memory, such as RAM and cache, are binary values whereby 1 MB = 2²⁰ (1,048,576) bytes and 1 GB = 2³⁰ (1,073,741,824) bytes.
- ↑ A bit rate of 1 GB/s equals one billion bytes per second.
- ↑ [Computer memory upgrades for Apple Mac Pro \(4-core\) Desktop/PC from Crucial.com](#)
- ↑ "[Understanding FB-DIMMs](#)". AnandTech.
- ↑ ***a*** ***b***"[Mac Pro Memory Issues](#)". Ars Technica.
- ↑ [Apple](#)
- ↑ [NewerTech eSATA Extender Cable](#)
- ↑ "[The Mac Pro is SLI capable?](#)". MacUser.
- ↑ [AirPort Extreme performance page](#) see footnote 2
- ↑ "[Mac Pro](#)". Ars Technica.
- ↑ "[PowerMac G5 review](#)". Macworld.
- ↑ "[Bare Feats' rob-ART Morgan says:](#)". Bare Feats'.
- ↑ For hard drives, 1 GB equals 1 billion bytes and 1 TB equals 1 trillion bytes; actual formatted capacities are less.
- ↑ [Triple Boot via BootCamp](#)
- ↑ "[Parallels Forum](#)".

External links

[edit]

- [Apple's Mac Pro website](#)
- [Close-up pictures of the Mac Pro](#)
- [Review of the Mac Pro](#)
- [A Mac Pro with two 3.0GHz quad-core Intel Xeon processors](#)
- [Complete disassembly of a Mac Pro](#)



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Replaced	Current Model
Power Mac G5	Mac Pro
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Accessories	<i>AirPort</i> (<i>Card: B, G, N; Base Station: Graphite, Snow, Extreme G, Express G, Extreme N, Express N</i>) • <i>iPod</i> (<i>Dock Connector, Camera Connector, iPod Hi-Fi, Nike+iPod</i>) • <i>iSight</i> • <i>Keyboard</i> (<i>Pro, Wireless</i>) • <i>Mouse</i> (<i>Pro, Wireless, Mighty Mouse</i>) • <i>Remote</i> • <i>Time Capsule</i> • <i>USB Modem</i> • <i>Xserve RAID</i>
<i>Italics indicate discontinued products. See also: Apple hardware before 1998.</i>	

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