Power Mac G5

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The **Power Mac G5** is Apple's marketing name for models of the Power Macintosh which contain the PowerPC 970 CPU.

Power Mac G5

Apple Power Mac G5

Type:	Desktop
Developer:	Apple Computer, Inc.
Released:	June 24, 2003
Discontinued:	August 7, 2006
Processor(s):	Single or dual PowerPC G5, 1.6 - 2.7 GHz
Base Price:	USD$1999 (as of 2006)

The professional-grade computer was the most powerful in Apple's lineup when it was introduced, and was touted by Apple as the fastest personal computer ever built. It was officially launched as part of Steve Jobs' keynote presentation in June 2003 at the Worldwide Developers Conference, and saw three revisions to the line before being retired in August 2006 to make way for its replacement, the Mac Pro. The Power Mac G5 has an anodized aluminum chassis. [Power Mac G5 User's Guide, 2005, page 5]

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Introduction

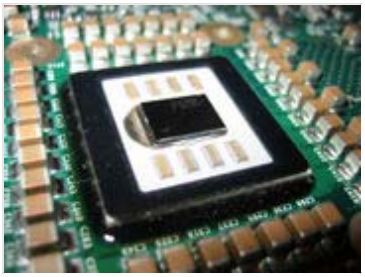
The Power Mac G5 was introduced with three models, sharing the same physical case, but differing in features and performance. The 1.6 GHz model shipped with 256 MBof RAM, an 80 GB hard drive, and could employ a maximum of 4 GB of RAM. The 1.8 and dual-processor 2.0 GHz models shipped with 512 MBof RAM. The dual-processor model also included an ATI Radeon 9600 graphics card.

Steve Jobs stated during his keynote presentation that the Power Mac G5 would reach 3 GHz "within 12 months." This would never come to pass; after three years, the G5 only reached 2.7 GHz (or dual-core at 2.5 GHz) before being replaced by the Intel Xeon-based Mac Pro, which includes processors with speeds of up to 3 GHz.

Also during the presentation, Apple showed Virginia Tech's Mac OS X computer cluster supercomputer (a.k.a. supercluster) known as *System X*, consisting of 1100 Power Mac G5s operating as processing nodes. The supercomputer managed to become one of the top 10 supercomputers that year. The computer was soon dismantled and replaced with a new cluster made of an equal number of Xserve G5 rack-mounted servers, which also use the G5 chip running at 2.3 GHz.

PowerPC G5 and the IBM partnership

The inside of a Power Mac G5 Dual 1.8 GHz


The PowerPC 970FX inside a PowerMac G5.

The PowerPC "G5" (actually called the PowerPC 970 by its manufacturer, IBM) is based upon IBM's dual-core POWER4
microprocessor. At the introduction of the Power Mac G5, Apple announced a partnership with IBM in which IBM would continue to produce PowerPC variants of their POWER processors. According to IBM's Dr. John E. Kelly, "The goal of this partnership is for Apple and IBM to come together so that Apple customers get the best of both worlds, the tremendous creativity from the Apple corporation and the tremendous technology from the IBM corporation. IBM invested over $3 billion US dollars in a new lab to produce these large, 300 mm wafers." (This lab is a completely automated facility located in East Fishkill, New York, and figures heavily in IBM's microelectronics strategy above and beyond the partnership with Apple). The original PowerPC 970 has 58

million transistors and is manufactured using IBM CMOS 9S at 130 nm fabrication process. CMOS 9S is the combination of SOI, Low-k dielectric insulation, and Copper interconnect technology, which were invented at IBM research in the mid-1990s. Subsequent revisions of the "G5" processor have included IBM's PowerPC 970FX (same basic design on a 90 nm process), and the PowerPC 970MP (essentially two 970FX cores on one die). Apple refers to the dual-core PowerPC 970MP processors as either the "G5 Dual" (for single socket, dual-core configurations), or "G5 Quad" (for dual socket, four-core configurations).

The Power Mac G5 line in 2006 consisted of three, dual-core PowerPC G5 configurations, operating at 2.0, 2.3, and a dual-processor 2.5 GHz
configuration (the dual contains four cores in total, two per processor). A 2.7 GHz single-core model was also released. The G5 processor is a common name given by Apple to several different chips manufactured by IBM: the PowerPC 970, 970FX, and 970MP, based upon IBM's POWER4 processor. It contains PCI-X slots, where the newer models use PCI Express. The dual-core G5 configuration can communicate through its FSB at half its internal clock speed. Each processor in the Power Mac G5 has two unidirectional 32-bit pathways: one leading to the processor and the other from the processor. These result in a total bandwidth of up to 20 GB/s. The processor at the heart of the Power Mac G5 has a "superscalar, superpipelined" execution core that can handle up to 216 in-flight instructions, and uses a 128-bit, 162-instruction SIMD unit (AltiVec).

In addition, due to the 64-bit processor (and 42-bit MMU) the Power Mac G5 has a RAM capacity greater than the four gigabyte
addressable memory limit of traditional 32-bit processors. Currently, the Power Mac G5 can hold sixteen gibibytes
of RAM using eight memory slots with 2 GiB per stick, twelve gigabytes greater than the limits on most 32-bit processors sold at the time. (Some more modern 32-bit processors have a 36-bit memory address unit which allows the processor to address more than 4 GiB RAM, but with a performance hit). The Power Mac G5's PowerPC 970 processor itself is capable of addressing 2^{42} bytes (4 tebibytes) of physical RAM and 2^{64} bytes (8 exbibytes) of Virtual RAM. The memory in this final revision of the Power Mac G5 is Dual-Channel DDR2 PC4200, with support for ECC memory.

Product revision history

(**Note:** DP designates a dual-processor machine, and SP designates a single-processor machine)

- **2003 June:** Initial release at speeds of SP 1.6, SP 1.8, DP 2.0 GHz
- **2003 November:** DP 1.8 replaces SP 1.8 GHz; a price reduction on SP 1.6 GHz
- **2004 June:** 90 nm DP 1.8, DP 2.0 and liquid-cooled DP 2.5 GHz replace all previous models
- **2004 October:**
  A new SP 1.8 reintroduced, with a slower, 600 MHz FSB (front-side bus), PCI bus, based upon the iMac G5's architecture (U3lite and Shasta chips). Apple's official name for this machine is "Power Mac G5 (Late 2004)".
- **2005 April:**
  CPU speed increased: DP 2.5 GHz → DP 2.7 GHz (PCI-X), DP 2.0GHz → DP 2.3 GHz (PCI-X), DP 1.8 GHz → DP 2 GHz (PCI). Newly introduced features were the 16x dual-layer SuperDrives across the line and increased storage, up to 800 GB for the higher-end models. The 1.8 GHz SP was not modified.
- **2005 June:** The SP 1.8 model was discontinued in the U.S.
- **2005 July:** And also in Europe
- **2005 October:** Shift to Dual-core
  processors: DP 2.0 GHz → DC 2.0 GHz, DP 2.3 GHz → DC 2.3 GHz, DP 2.7 GHz → DP DC 2.5 GHz (termed a Quad Power Mac G5, with four CPU execution cores), all with DDR2 memory, and PCI Express expansion in place of PCI-X. The older PCI-X, DP 2.7 GHz model remained available for a while, but the

slower speed single-core models were discontinued immediately.
- **2006 August:** The Power Mac is replaced by its Intel successor, the Mac Pro.

A partial list of official firmware updates

- **1 March 2006:** Highly important SMU Update for G5 (Late 2004) (http://www.apple.com/support/downloads/powermacg5late2004firmwareupdatev11.html) (Apple, 2006)
- **27 September 2004:** Version 5.1.5f2 (http://www.apple.com/support/downloads/powermacg5uniprocessor515f2firmwareupdate.html) (Apple, 2004)
- **17 November 2004:** Version 5.1.8f7 (http://www.apple.com/support/downloads/powermacg5june2004firmwareupdate.html) (Apple, 2004)

References

- Apple (2004). "Power Mac G5 (June 2004) Firmware Update 5.1.8f7" (http://www.apple.com/support/downloads/powermacg5june2004firmwareupdate.html) . Retrieved December 26, 2004.
- Apple (2003). *Power Mac G5 Firmware Update V 5.1.4: Information and Download* (http://docs.info.apple.com/article.html?artnum=120287) . Retrieved December 26, 2004.
- IBM, (2004). *IBM PowerPC 970FX RISC Microprocessor User's Manual* (http://www-306.ibm.com/chips/techlib/techlib.nsf/techdocs/AE818B5D1DBB02EC87256DDE00007821) . Retrieved May 6, 2005.

External links

- Ars Technica: Inside the PowerPC 970 Part 1 (http://arstechnica.com/cpu/02q2/ppc970/ppc970-1.html) and Part 2 (http://arstechnica.com/cpu/03q1/ppc970/ppc970-0.html) , very long and detailed
- Ars Technica: A Brief Look at the PowerPC 970 (http://arstechnica.com/wankerdesk/3q02/powerpc.html)
- Ars Technica Review: Power Mac G5 Dual 2.5 GHz (http://arstechnica.com/reviews/004/G5/G5-1.html)
- Power Mac G5 Do-It-Yourself Repair & Upgrades (http://www.apple.com/support/powermac/doityourself/storage.html)
- Apple Discussion Forums for Power Mac G5 (http://discussions.apple.com/category.jspa?categoryID=108)

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Italics denote discontinued products.

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