

The PowerPC Macs: Model by Model

IN THIS CHAPTER:

- The PowerPC chip
- The specs for every desktop and portable PowerPC model
- What the model numbers mean
- Mac clones, PPCP, and the future of PowerPC

In March 1994, Apple introduced a completely new breed of Mac — the Power Macintosh. After more than a decade of building Macs around the Motorola 68000, 68020, 68030, and 68040 chips, Apple shifted to a much faster, more powerful microprocessor — the PowerPC chip.

From the start, Apple made it clear it was deadly serious about getting these Power Macs into the world; the prices on the original models were low, and prices on the second-generation Power Macs dropped lower still. A well-equipped Power Mac 8500, running at 180 MHz, with 32MB of RAM, a 2 GB hard drive, and a eight-speed CD-ROM drive costs about \$500 *less* than the original Mac SE/30!

When the Power Macs were first released, Apple promised that *all* future Mac models would be based on the PowerPC chip. Although that didn't immediately prove to be the case — the PowerBook 500 series, the PowerBook 190, and the Quadra 630 series were among the 68040-based machines released *after* the Power Macs — by the fall of 1996, Macs with four-digit model numbers (PowerPC-based Power Macs, LCs, PowerBooks, and Performas) were the only computers still in production. In less than two years,

the Power Mac line has grown to over 45 models. That's why, in this edition, the Power Macs — and PowerPC *PowerBooks* — get their own chapter.

One more note: We've included the most important specs for each model in this chapter. For the real nitty-gritty, however — detailed information about jacks, VRAM, and so on — see the Apple Specs database on the CD-ROM that came with this book.

THE POWERPC CHIP

Remember, the PowerPC isn't a *computer*. It's just a *processor chip* that can form the *basis* of a computer, whether it be a Macintosh, a Windows NT machine, or an automobile transmission. This much-hyped RISC chip, which began shipping in September 1993, is the result of joint development by the two former archenemies — Apple and IBM — and Motorola. (For your cocktail-conversation pleasure: Yes, the PowerPC chip *is* faster, cheaper, and less energy-demanding than the corresponding Pentium chips found in high-end DOS-based PCs. Furthermore, the PowerPC is a new architecture with plenty of room for growth. For example, by mid-1997, an Apple-sponsored startup company called Exponential Technology will be shipping 466 MHz, 500 MHz, and 533 MHz PowerPC processors in the form of a new chip called the X704. The Pentium chip, by contrast, is already reaching its limits.)

RISC, by the way, stands for *reduced instruction set computer*. This reduced instruction set is one of the things that makes the chip so fast; the RISC chip uses a more concise, less-convoluted vocabulary of instructions. Therefore, it can handle more tasks in less time than earlier chips could. Furthermore, the RISC chip not only can process instruction data in larger chunks (32 bits instead of 16 on 68040-based Macs), but also handle more than one set of instructions at the same time. Even the *slowest* Power Mac can theoretically run programs six times faster than, say, a Quadra 800.

The original Power Mac models — the 6100, 7100, and 8100 — used the first-generation 601 PowerPC chip and ran at clock speeds of 60, 66, and 80 MHz, respectively. Since then, four new versions of the PowerPC chip have been released — the 603, 603e, 604, and 604e. The 603-series chips aren't faster than the original 601, just more energy-efficient. They've been used primarily in PowerBooks and Performas. The 604 and 604e chips, on the other hand, are considerably faster and permit dramatically higher clock speeds. See "Get your chips straight," later in this chapter, for details.

All about emulation

To experience the exhilarating speed of a Power Mac in all its glory, you must run software specially written for the PowerPC chip. This special software is called *native-mode PowerPC* software. (That term is often shortened to “native,” even though the term *native* actually means “written specifically for this chip,” whether it’s a PowerPC chip or not.) Every program you owned before March 1994, on the other hand, was written in a foreign language, as far as the Power Mac is concerned.

Obviously, Apple couldn’t release a Mac that didn’t run existing Mac software. So, to ensure compatibility with existing Mac programs, Apple included an *emulator* program in the Power Mac’s ROM. This emulator works behind the scenes, automatically translating the normal Mac code (in which your programs were written) into a format that the PowerPC chip understands. So, despite the fast processor speed, these older programs don’t run any faster in Mac emulation mode on the original Power Macs than they would on, say, a Quadra 700.

Better emulation

Fortunately, the emulation picture is getting brighter. The second-generation Power Macs, such as the 7500 and 8500, use a greatly improved emulator called the DRE (for *Dynamic Recompilation Emulator*) that translates old-style Mac programming into PowerPC code up to 30 percent faster than the original Power Macs did. And, of course, even faster Power Macs mean faster emulation. Even in emulation mode, for example, the latest Power Mac 9500, which runs at 200 MHz and employs the new DRE, is faster than the fastest Quadra. (For first-generation Power Mac owners, the Connectix program called Speed Doubler provides an emulation speed-up that ties or even beats the DRE mechanism.)

On the positive side, emulation means that a Power Mac runs almost all the software you already own. The only programs guaranteed *not* to run on a Power Macintosh are those that require an FPU (math coprocessor chip for high-speed computations); the PowerPC’s FPU is a completely different (and incompatible) design from the relatively inefficient FPU of the Quadra series. As a result, those few 3-D rendering and drafting programs that required an older-style FPU would crash on a Power Macintosh. Fortunately, those were the very programs most likely to take advantage of the RISC chip’s speed and, therefore, the first converted to native PowerPC versions.

The emulated OS

Ironically, Apple's *own* software is largely non-native. In its rush to get the Power Macintosh to market, Apple had time to rework only a small percentage of the Mac's behind-the-scenes *Toolbox* (the set of computer instructions upon which all commercial programs rely and which handles such basic Mac tasks as creating windows and menus) in System 7.1.2.

With each system update, Apple has added a few more nuggets of native PowerPC code to the operating system. By the time System 7.5.3 rolled out in 1996, key components such as QuickDraw, Modern Memory Manager, Desktop Printing, and the Resource Manager were all rewritten in native code. Of course, every Power Mac owner's fantasy would be a *completely* native-PowerPC operating system; Apple is working on it. It's called Mac OS 8 (code-named Copland). Until Apple produces a realistic schedule for completing OS 8, the company will be releasing incremental System-software upgrades, each with a few more chunks of native code. (See Chapter 6.)

In any case, when you run native-PowerPC software on a Power Macintosh, no emulation is required. These programs leave even the fastest Quadra in the dust. Fortunately, all Mac software companies generally release every new program with installers that offer a choice of PowerPC version, 68000, or *fat binary* — a single program version that includes both PowerPC and non-PowerPC code, making it take up lots of disk space, but ensuring its compatibility on any Mac.

Look and feel

On the outside, Power Macs look no different from their predecessors, and most existing Mac appliances — printers, modems, CD-ROM drives, and so on — work fine with Power Macs.

However, as new Power Macs have continued to roll off the assembly line, driven by even faster versions of the PowerPC chip, some fundamental changes have taken place. Although the first PowerPC models used the same 72-pin SIMMs used in other recent Mac models, the newer Power Macs require 168-pin DIMMs, which transfer data at 64 bits at a time instead of 32. Also, the newest Power Macs are equipped with PCI (Peripheral Component Interconnect) expansion slots — instead of the standard NuBus slots found on most earlier Macs — for items such as video digitizer cards, graphics accelerators, and networking hardware. So, although your old laser printer will work just fine with a new Power Mac, the graphics card that came with your monitor will probably have to be replaced. (See Chapter 31 for more about PCI slots.)

Special features

Every Power Macintosh offers audiovisual features previously associated only with the AV Macs (see Chapter 23). These features include speech recognition, the GeoPort, CD-quality stereo recording and playback, and, in the case of the PCI Power Macs, fax/modem/voice mail software (see Chapter 27). All Power Macs come with built-in Ethernet, too (see Chapter 32).

The original Power Macs (6100, 7100, 8100) — which we'll henceforth call the "first-generation" Power Mac models — offered an added-cost AV option. This card provided an input jack for video (so you could make your own QuickTime movies), an additional video-output jack, and more VRAM for richer color displays on your monitor. As you'll read later, most of these features are standard on the second generation of Power Macs — no add-on card is required — and even on some low-cost LC and Performa models.

Upgrading to PowerPC

With the release of the first Power Macs, Apple provided existing Mac owners with several easy and cheap ways to upgrade to Power Macs. Shortly thereafter, Apple stepped aside and left the business of PowerPC upgrades to DayStar, the popular accelerator-card company (and, more recently, a maker of high-powered Mac clones).

Upgrade cards or motherboard swaps were offered for most 1993/1994 Mac models (Quadra 610 through 950; LC 475 through 575 models; Performa 475 through 600; IIfx; and so on). But frankly, given the remarkably low prices of the newest Power Macs, we find it hard to justify most of these upgrades. In almost every case, you're better off selling

TRUE FACT**THE POWER MAC DOES WINDOWS**

So, what's this about the Mac running IBM software?

It's true. You can outfit your Power Macintosh with a program called SoftWindows, which runs software designed for IBM-compatible computers, and Windows, the Mac-clone software from Microsoft. Insignia Solutions, the company that makes SoftWindows, suggests you have from 16MB to 24MB of RAM to use the software.

The first version of SoftWindows (which was actually bundled with some versions of the Power Mac 6100) was on the lame side. It offered the performance of a 25 MHz Intel 486SX-based Windows PC and could run only those Windows programs written in Standard Mode, not the more popular 386 Enhanced Mode. Also, SoftWindows couldn't handle programs requiring the popular PC-clone SoundBlaster audio cards, meaning that you couldn't run SoundBlaster-dependent CD-ROMs and games on your Power Macintosh.

SoftWindows 2.0 was much improved, but still no substitute for an actual PC. It still gave your Mac the speed of a rather low-end 486 PC, but it could run any Windows program, including those on CD-ROM and those requiring Enhanced Mode. And, although SoftWindows 2 supports the Windows Sound System, it still doesn't emulate a SoundBlaster card. SoftWindows 3.0, released in 1996, runs Windows about 30 percent faster than the previous version and does have SoundBlaster support. A Windows 95 version of SoftWindows is also available.

Granted, SoftWindows still runs slower than even an inexpensive PC, but for occasional use with programs that don't require lightning-fast performance, SoftWindows is actually a decent way to emulate Windows on your Mac — without investing in a considerably more expensive PC Compatibility card.

your old Mac and investing in a brand new machine. (See “The Only Upgrade Guide You’ll Ever Need” in Chapter 12.)

What PowerPC really means

Yes, you get some nifty audiovisual features with the Power Macintosh. But mainly, you get *speed*. Think about the time you spend watching the wrist-watch icon. Think about Photoshop operations that currently make you wait for minutes on end. Recall the time you wait for QuickTime movies to be saved — and how jerkily they play back. Imagine how slowly you scroll through the pages of a lengthy PageMaker document. Many of these waiting moments become insignificant when you run PowerPC-ready programs.

The PowerPC chip is also an invitation to software companies to dream up entirely new kinds of software — involving video, 3-D graphics, telephone or answering-machine features, and the like — that previous Macs simply were too slow to handle.

On the other hand, native programs take up much more disk space than non-native software. Worse, PowerPC gobbles up *memory* like you wouldn’t believe. System 7.5 alone, for example, takes up more than 4MB of RAM, and each native program has an enormous appetite — on the order of 3MB *more* than its non-native equivalent’s memory requirement. (Using virtual memory or RAM Doubler on a PowerPC Mac is the only way to reclaim some of that memory. See the Secrets near the end of this chapter for details.) The absolute minimum amount of RAM for a PowerPC Mac is 8MB, just as 4MB was the absolute minimum for an ordinary System 7 machine.

Get your chips straight

Every Power Mac described in this chapter is based on one of five *different* PowerPC chips — the 601, 603, 603e, 604, or the 604e. But what’s the difference between a 601 and a 603? And what makes the 604 different than a 604e? Here’s the rundown:

- The **601** was the first-generation PowerPC chip used in the earliest Power Macs. The first 601s ran at 60 to 80 MHz. Later versions were accelerated to 120 MHz, but that’s about as fast as you can reliably speed up a 601 chip.
- The next-generation chip, the **603**, *isn’t* faster than the 601; in fact, it’s slower, because it has a less efficient cache design. For this reason, a 603 running at 75 MHz offers about the same speed as a 601 running at just 66

MHz. On the positive side, the 603 is less expensive, smaller, and more energy efficient. Apple used the 603 in the 5200-series and the early 6200-series models only.

- Next comes the **603e**, an update of the 603, with a larger chunk of level 1 cache memory (32K instead of 16K). This cache makes the 603e a bit faster. Because the 603e is smaller and runs cooler than any of the other PowerPC chips, it's the one found in all the PowerPC-based PowerBooks. Apple also uses the 603e in its lower-end desktop Macs, including the 5300-, 5400-, 6300-, and 6400- series Performas. With its more power-efficient design, the 603e can be accelerated more dramatically than the 601, with speeds beyond 200 MHz.
- The **604** chip, found in the first 7600, 8500 and 9500 models, is considerably faster than the 601 and 603 chips. To illustrate: A 604 running at 150 MHz is *faster* than a 603e running at 200 MHz. The 604 has the same size internal cache as the 601, but with a more efficient structure — the 32K cache is divided into two sections, one for instructions and another for data. A 604 chip can run at clock speeds of up to 166 MHz.
- Finally, there's the **604e**, a revision of the 604. The 604e is actually a much more sophisticated chip. It has twice as much internal cache memory as the 604 and can initiate four instructions per clock cycle — twice that of the 603e. It's also smaller than the 604 (and, therefore, it uses less power), squeezing 5.6 million circuits into 148 square millimeters. Expect to see Macs in the near future with speeds of 300 MHz or more running on the 604e.

All of this emphasizes a point we've made repeatedly in this book: You can't compare the speed of Power Macs (or any other computers, for that matter) based solely on clock speed. A Power Mac 8500/180 and Performa 6400/180 both run at 180 MHz — but the 8500 is 30 to 50 percent faster, because the 604e chip is inherently faster than the 603e.

(A note about this chapter: Since the dawning of the Power Mac era, you can tell how fast a Mac's processor chip runs just by looking at its name; the number after the slash mark always indicates the Power Mac's clock speed. The official name for the first 9500, therefore, is really 9500/132. But Apple tends to release "speed bump" Macs, identical in every respect to their predecessors, but with a marginally faster PowerPC chip. For example, the Power Macintosh 7200/90 was replaced by the 7200/120. For simplicity's sake, we'll usually leave off the chip-speed designations in our model-by-model discussions.)

POWER MACS, MODEL BY MODEL

Power Macintosh 4400

The Power Mac with the lowest number — the 4400 — is actually one of the most recent additions to Apple's current lineup. The Power Macintosh 4400/200, which debuted in Europe in November 1996 and appeared in the US in February 1997, is aimed at the small business market. Built around the same 200-MHz 603e chip as the Performa 6400, the 4400 comes with the built-in 10Base-T Ethernet hardware usually found on higher-end Power Macs. It's also more upgradable than the 6400; you can boost its RAM to 160 MB instead of 136 MB. Unlike the 6400 minitower, the 4400 is housed in a less expensive, more utilitarian desktop case.

Notice that even though the 4400 is geared for the small business and home computer market, it's *not* called a Performa. Apple decided in 1997 to eliminate the name Performa — a designation nobody ever really understood in the first place — from its product line. (The Performa/Power Mac terminology was evidently baffling to more than just consumers: Apple's own Web site refers to the 4400 as a Performa in a several spots.)

The 4400 is sold in the US, Europe, Latin America and Japan — but the specific configuration you get depends on the country in which you buy it. The European version, for example, comes with 24 MB of RAM, instead of 16, while the Japanese version has a 12X CD-ROM drive instead of an 8X drive.

Price:	\$1,700 – \$1,750
Processor and speed:	PowerPC 603 at 200 MHz.
Memory:	16 MB, expandable to 160 MB
Equipment:	2 GB hard internal 8X CD-ROM drive; 256K L2 cache; 2 MB of VRAM (expandable to 4 MB); keyboard and mouse; 2 PCI expansion slots

Power Macintosh 5200 LC, Power Macintosh 5260, Performa 5200-5270

The 5200, released in April 1995, occupies a unique position in Mac history — it was the first Mac ever to contain a PowerPC 603 processor (a chip similar to the one used in the PowerBook 5300 series).

At first glance, the 5200 looks like simply a large monitor; it's about the same size as a standard 15-inch screen. But when you look closer, you notice the floppy-disk drive, CD-ROM drive slot, and stereo speakers nestled in along the bottom edge of the machine. Apple fused a variant of the 15-inch Multiscan Display with the CPU case itself, creating one sleek-looking unit that can tilt and swivel (see Figure 13-1).

Figure 13-1
The monitor-as-CPU concept. Looks like a monitor, but houses the entire computer! This case design was used for the LC or Performa 5000 lines.



The 5200 models with the LC designation are available only to schools, while the Performa models are sold to the general public. Once again, Apple altered its naming conventions with this model, tacking the LC designation on to the *end* of the model name instead of the beginning.

And speaking of naming conventions: Shouldn't a Mac that's *newer* than a 6100 have a number that's *higher* than 6100? No, because Apple now uses the number 5 at the beginning of a desktop model number to indicate that the machine has a one-piece design (Performa 575, 580, 5200, etc.) instead of a modular design.

The 5200 has been a popular choice with schools because of its low price and compact design. It's also easily expandable. Like the old Color Classic, the 5200 has a pull-out tray for access to its expansion slots, which are very similar to those in the Quadra 630. There's a communications slot for an Ethernet card, a video-in slot for the Apple Video System, a connector for Apple's optional TV tuner, and a single LC-style PDS slot. Into this final slot you can plug the MPEG Media System, a card that allows you to play back full-motion video with CD-quality sound. The 5260 also includes a slot for a 256K cache card. (On the 5200, 256K of level 2 cache memory is soldered on the logic board and can't be upgraded.) There are four versions of the basic 5200: The 5210 and 5220 are sold outside the U.S., while the 5215 is a 5200 with a 1 GB hard drive.

The 5200 is a perfect example of how higher MHz numbers don't necessarily mean better performance. You might think that one of these 75 MHz Macs would be faster than a 60 MHz Mac (such as the Power Mac 6100). Not true; actually, a 5200 runs *slower* than a Power Mac 6100/60. That's because the 603e chip, although it's more compact and consumes less power than a 601 chip, also has a less-efficient cache design; it has only half the Level 1 cache of the 6100 (16K instead of 32K). So, even though the microchip at the heart of the 5200 is running faster in sheer megahertz, the machine as a whole doesn't process data around any faster. (As we pointed out in Chapter 12, MHz ratings are useful only for comparisons between *identical chips* — you can't compare the MHz ratings between a 601 and a 603e PowerPC chip, and you can't compare the MHz ratings between a Power PC and a Pentium.)

After one year, Apple replaced the 5200 with the Power Macintosh 5260 (*without* the LC designation), a revved-up 5200 running on a 100 MHz 603e chip. The 5260, like the original 5200 LC, is sold only to educational institutions. The 5270 is an identical model sold only overseas.

Price:	\$2,000 then, \$1,200 now
On the market for:	1 year (5200 LC version)
Processor and speed:	5200: PowerPC 603 at 75 MHz. 5260: 603e at 100 MHz
Memory:	8MB or 16MB expandable to 64MB
Equipment:	IDE hard drive; built-in video; 15" tilt-and-swivel display; internal quad-speed CD-ROM drive; front-mounted speakers; internal 14.4 Kbps data/fax/voice modem; one PDS slot
Apple Upgrade options:	Power Macintosh 5300/6300 Logic Board Upgrade available for \$700 accelerates CPU to 100 MHz

Power Macintosh 5300 LC, Performa 5300, 5320

On the outside, the 5300 is exactly the same as the 5200 (see Figure 13-1). The sole difference: It's powered by the 603e chip instead of the 603, and it chugs away at 100 MHz instead of 75. This means, of course, that the 5300 is virtually the same as the 5260, but with more RAM (16MB instead of 8MB). (The 5320 is the same model sold outside of the U.S.)

Price:	\$2,400 then, \$1,500 now
Processor and speed:	PowerPC 603e at 100 MHz
Memory:	16MB expandable to 64MB (80-ns, 72-pin DRAM chips required)
Equipment:	Built-in video with 1MB of DRAM; includes Apple Multiple Scan 15"; quad speed CD-ROM drive; 28.8 Kbps fax modem

Power Macintosh 5400–5500

Another one of Apple's for-schools-only computers, the Power Mac 5400 looks identical to all the other one-piece 5200- and 5300-series models (see Figure 13-1). Inside the case, however, it's a whole new Mac. In developing

CASE HISTORY**WORLD'S DUMBEST USER STORIES, PART I**

As consultants and troubleshooters, we've seen it all. We've taken the calls from people whose printer simply wouldn't work (it wasn't plugged in); people who couldn't manage to stick a floppy disk into the drive (a disk was already in the drive); and people whose work disappeared suddenly and without a trace (they had clicked the Desktop, sending their word-processor window to the background).

But that's small potatoes compared to some of the stories we read in the *Wall Street Journal* recently. A technician at Compaq Computers told of a frantic call he received on the help line. It was from a woman whose new computer simply wouldn't work. She said she'd taken the computer out of the box, plugged it in, and sat there for 20 minutes waiting for something to happen. The tech guy asked her what happened when she pressed the power switch. The lady replied, "What power switch?"

In the Mac world, we're used to pressing Return or Enter to dismiss a dialog box. In the PC world, however, it's common for the screen to say, "Press any key to continue." Incredibly, literally *hundreds* of people wind up calling the computer makers to complain that they can't find the "Any" key on the keyboard. Compaq is actually considering changing the instruction to "Press the Return key."

Then there's the immortal tale of the help-line technician who asked the caller to send him a copy of the disk that was giving her trouble. Sure enough, several days later, the technician received a photocopy of the disk. (It was a two-page enclosure, of course, because the disk was double-sided.)

Our credulity is stretched nearly to the breaking point, however, by the following story told by a Dell computer technician. As the *Wall Street Journal* put it: "A customer called to say he couldn't get his computer to fax anything. After 40 minutes of troubleshooting, the technician discovered the man was trying to fax a piece of paper by holding it in front of the monitor screen and hitting the Send key."

the 5400, Apple finally scrapped the logic board architecture that had been used in the Quadra 630 and Performa 5200, 6200, and 6300 models, and replaced it with an entirely new logic board based on the PCI architecture used in higher-end Power Macs. The 5400 logic board includes one PCI slot, 8MB of soldered-on RAM, and 64-bit RAM slots that hold the 168-pin DIMMs used in newer Power Macs. (This same design scheme forms the basis for the tower-style Performa 6400, discussed later in this chapter.)

With this new design comes new speed, with a 603e chip running at 120, 180 or 200 MHz. A later addition to the one-piece series, the 5500, runs at 225 MHz. With a level 2 cache card installed (a \$100 option, worth every penny), the 5400 is faster than a Power Mac 7200/120. At the same time, these Macs have the easy expansion options and slick multimedia features found in the earlier 5200- and 5300-series models: digital video input and output

(included with the 5500); stereo sound; a bay for a TV tuner; a video converter for output to a television; and a super-sharp 15-inch monitor that can switch between three different zoom levels. These are very slick compact classroom Macs. Two spinoffs of the 5400 — the Performa 5410 and 5420 — are sold only outside of the U.S.

Price:	\$2,300
Processor and speed:	PowerPC 603e at 120 MHz
Memory:	16MB expandable to 136MB (70-ns, 168-pin DIMM chips required)
System software notes:	Requires System 7.5.3 Revision 2
Equipment:	Built-in 15-inch multiple scan tilt-and-swivel color display; 1.6 GB IDE hard drive; quad-speed CD-ROM drive; 10BaseT Ethernet connector; NTSC video converter; two GeoPort-capable serial ports; SRS 3-D sound enhancement; communications slot; TV tuner slot; video input and output jacks

Power Macintosh 6100, Performa 6110–6118

Introduced in March 1994, the 6100/60 was the entry-level Power Macintosh (read: least expensive). Its wide, low-slung case looks exactly like that of a Quadra 610 (see Figure 12-8 in the previous chapter). It's equipped with the 601 PowerPC chip running at a 60 MHz or 66 MHz clock speed.

Like the 610, the 6100 offers a PDS slot, which (with a \$99 adapter) can accommodate a NuBus card. (Buyer, beware: The special circuit board on the AV model fills the PDS slot, so the 6100/60 AV *can't* accept any additional cards.) Also like the 610, you turn the machine on by pushing a front-panel button, not by using the keyboard. The original price of the 6100, around \$1,600, was an incredible value at the time. With the optional \$300 cache card, this Mac blazed even faster than the original 7100.

Six months after the 6100 made its debut, it started showing up in department stores under the Performa designation — the very first of the PowerPC-based Performas. As always, the Performa versions of the 6100 (the 6110, 6112, 6115, 6116, 6117, 6118) included monitor, modem, CD-ROM drive, and pre-installed software.

The 6100/60 was replaced in January 1995 by the 6100/66, a nearly identical computer with — as its name indicates — a faster clock speed.

Price:	\$1,700 then, \$650 now (with AV option: \$2,400 then, \$850 now)
Apple code name:	PDM
On the market for:	9 months (non-Performa version)
Processor and speed:	PowerPC 601 at 60 or 66 MHz
Memory:	8MB, expandable to 72MB (80-ns, 72-pin DRAM chips, in pairs, required)
Equipment:	Built-in video (uses System RAM); with adapter, slot can hold a 7" NuBus board or PDS board (except on the AV model, whose slot is already filled); optional AV model includes TV input/output, additional video jack;

optional cache card provides 15 percent speed-up; Ethernet; 2 GeoPort
jacks; records and plays 16-bit CD-quality stereo sound
System software notes: Requires System 7.1.2 (with PowerPC Enabler) or later

Power Macintosh 6200, Performa 6200–6230

The July 1995-born 6200-series models — six Performas and one Power Mac version — were conceived as low-cost computers with a heavy-duty multi-media slant. Each Performa has a 1 GB hard drive, 8MB or 16MB of RAM, a 15-inch screen and an internal quad-speed CD-ROM drive. Come to think of it, a 6200 is nothing more than a 5200 split into two pieces — a monitor and a CPU box — which resembles the Quadra 630 (see Figure 12-12).

As usual, distinguishing between the various Performa models is confusing at best. The *solitary* difference between a Performa 6200 and a 6205 is the speed of the modem (a 6200 has a 14.4 Kbps modem, while the 6205's modem runs at 28.8 Kbps). The next model up *isn't* called the 6210 or 6215 — it's the *6216*. Why? Because it comes with one additional piece of software — Espresso, a personal information manager. After that comes the 6218, with 16MB of RAM instead of 8 (and, oddly enough, a *14.4 Kbps* modem). The 6220 comes with a TV tuner and the Apple Video System, which allows you to digitize video from a VCR or camcorder. And the Performa 6230CD comes with Apple's \$300 MPEG Media System preinstalled, a card that compresses and decompresses full-motion video and 16-bit CD-quality sound.

Like the Quadra 630 series, the Performa 6200 (and the 5200 series, described earlier) comes with an IDE hard drive instead of the usual SCSI hard drive. See Chapters 8 and 30 for IDE details.

Price:	6200: \$2,000 then, \$1,275 now; 6230: \$3,000 then, \$1,700 now
Processor and speed:	PowerPC 603 at 75 MHz
Memory:	8MB or 16MB expandable to 64MB (80-ns, 72-pin DRAM chips required)
Equipment:	IDE hard drive; built-in video with 1MB of DRAM; includes Apple Multiple Scan 15"; quad-speed CD-ROM drive; fax modem

Performa 6260CD, 6290CD

While seemingly identical to other models in the 6200-series family (see Figure 12-12), the Performa 6290, introduced in January 1996, is actually a faster and more powerful computer, built around a 603e chip running at 100 MHz. The 6290 package comes with a 1.2 GB hard drive, 28.8 Kbps internal fax modem and a 14-inch monitor (instead of the 15-inch monitor that came with the earlier 6200-series machines.) The 6260, released six months later, is an identical machine, sold only overseas.

Price:	\$2,200 then, \$1,400 now
Processor and speed:	PowerPC 603e at 100 MHz

MACINTOSH SECRET

THE MODEM PORT SCANDAL OF '95

Every desktop Mac comes with two standard serial ports in the back—a modem port and a printer port, right?

Not quite. Take a look at the back of any Performa with a built-in modem, such as the Performa 6200 or 5200, and you'll see something unprecedented in Mac history — instead of a modem port, there's a little plastic cap with a label that says, "Do not remove." If you pry off the cap and try plugging something into this port anyway, nothing happens. The port is dead.

What's going on here? Believe it or not, the internal Global Village IIv fax modem that comes installed in the communications slot on those 5200 or 6200 models *disables* the external modem port. That's why Apple politely covers the port on those models with a plastic cap.

Apple's thinking on this was evidently, "Who needs a modem port? You've *got* an internal modem." The problem is, of course, modem ports aren't just for modems; they link all kinds of serial devices to your Mac — MIDI keyboards, monitor calibrators, handheld scanners, QuickCam video cameras, Newtons, and so on.

So what if you need to use that dead modem port on your 6200? There *is* a solution: You can remove the internal modem card from the communications slot. As soon as the communications slot is empty, your modem port springs back to life. (Of course, Apple is quick to point out that any damage caused by the removal of the modem is *not* covered under warranty.)

Our advice: Don't buy a 5200 or 6200 with an internal modem. Some of the 6200s and 5200s come bundled with external modems. Buy one of those and you'll get every port you've paid for.

Memory: 8MB expandable to 64MB
 Equipment: Built-in video with 1MB of DRAM; includes Apple Multiple Scan 14"; quad-speed CD-ROM drive; 28.8 Kbps fax modem

Performa 6300 – 6360

The Performa 6300, introduced in November 1995, is a Performa 6290 with more RAM, a 15-inch monitor, and three additional software programs thrown into the Performa bundle (see Figure 12-12). (You can, in fact, turn your 6200 into a 6300 with a \$700 logic-board upgrade from Apple. The upgrade is also available for 5200-series and 630-series Macs.)

The Performa 6320, rolled out six months after the original 6300, is a souped-up version of the 6300, running at 120 MHz. However, Apple canned the 6320 in September 1996, just five months after its release, making it one of the shortest-lived Mac models in history. Then, a month later, the 6360 debuted — a 160 Mhz machine that, with its 16MB RAM, 1.2 GB hard drive, 28.8 modem, and 8X CD-ROM for \$1,500, actually made Windows computers look expensive by comparison.

Price: 6300: \$2,800 then, \$1,650 now; 6360: \$1,500
 Apple code name: Crusader
 Processor and speed: 6300: PowerPC 603e at 100 Mhz; 6360: PowerPC 603e at 160 Mhz
 Memory: 16MB expandable to 64MB (80-ns, 72-pin chips required)
 Equipment: Built-in video with 1MB of DRAM; includes Apple Multiple Scan 15" display; quad-speed CD-ROM drive; 28.8 Kbps fax modem

Performa 6400

Take one glance at a Performa 6400 and your concept of the Performa as a low-end, beginner's-only Macintosh is forever shattered. These hefty, tower-style Macs, introduced in August 1996, are high-powered machines, with 603e chips running at 180 MHz or 200 MHz. The new Performa minitower case resembles a puffed-up 8500, but with softer edges, a rounded, bulging top, and a headphone jack mounted smack in the middle of the front panel (see Figure 13-2).

Figure 13-2
Apple's first minitower Performas: Tall, sleek, powerful. (Courtesy of Apple Computer, Inc. Photograph by John Greenleigh.)



Of course, the 200 MHz Performa 6400 isn't as fast as the 200 MHz Power Mac 9500, which runs on the newer 604e chip. But it *is* as fast as a 150 MHz Power Mac 9500 — and that's still one very fast Performa.

The 6400 doesn't just run faster than other Performas — it sounds better, too. It's the first Performa equipped with a sophisticated sound system that includes SRS surround-sound enhancement and a subwoofer speaker. Plug Apple's TV/FM Radio System into the special expansion bay provided on the 6400 and you can listen to your favorite radio stations (or watch TV) in full, rich stereo.

The 6400 is also one of the first Performas that's easily expandable. It's equipped with two PCI slots as well as a variety of specialized communications and video slots. The Performa 6400 Video Editing Edition, released in October 1996, added an Avid Cinema software suite to Apple's Video System digitizing card, making it easy for camcorder or VCR owners to produce QuickTime movies on the family computer.

ANSWER MAN

The cache story

Q: *I've noticed that some Power Macs come with level 2 cache and some don't. What the heck is Level 2 cache? For that matter, what's level 1 cache?*

A: Both terms refer tiny chunks of super-fast memory that do nothing but feed frequently-used data and instructions to your Mac's PowerPC chip. The larger the cache size, the faster your computer will run.

Level 1 cache is a tiny piece of memory that's built right into the processor chip itself. The size of the level 1 cache depends on the type of PowerPC chip; the 603s has a 16K cache, while the 604e has 64K. At any rate, level 1 cache is etched into the chip; you can't upgrade it.

Level 2 cache is a different story. It's yet another piece of ultra-high-speed memory that retains and feeds data into the PowerPC chip, but this cache isn't a part of the processor chip. It exists in the form of a SIMM or DIMM that plugs directly into the logic board. With most Power Macs, you can upgrade the level 2 cache simply by installing a cache SIMM or DIMM in the appropriate slot. (The SIMM and DIMM chips used in cache slots are *not* the same as the chips you use to upgrade your RAM—they're a special design.) Most Macs can handle up to 256K of level 2 cache, but some can be upgraded to 512K or 1MB.

The bottom line is that adding level 2 cache can speed up your Power Mac by 10 or 15 percent — if you're running native software. As the PowerPC chip speeds through its clock cycles, it looks for instructions to execute. The extra bits of memory in the two caches keep the pipeline full, feeding a continuous flow of data to the CPU for processing. With each clock cycle, the microprocessing chip first checks its internal cache (level 1) for instructions, then checks the external cache (level 2). Finally, it checks your Mac's RAM to grab the next instruction. But cache memory is much faster than standard RAM, so the more cache, the steadier the flow of data to the microprocessor.

Our advice: If your Power Mac supports level 2 cache memory and you don't have any installed, you should definitely add it; a 256K cache chip costs less than \$100. (On the other hand, upgrading from 256K to 512K doesn't produce nearly as much of a performance gain.)

Price:	6400/180: \$2,400 then, \$1,900 now; 6400/200: \$2,800 then, \$2,200 now; 6400/200 Video Edition: \$2,700
Apple code name:	Instatower
Processor and speed:	PowerPC 603e at 180 or 200 MHz
Memory:	16MB (or 32MB in the Video Edition) expandable to 136MB (70-ns, 168-pin DIMM chips required)
Equipment:	Eight-speed CD-ROM drive; 1.6 GB or 2.4 GB IDE hard drive; 256K level 2 cache (with 200 MHz model); two PCI expansion slots, communications slot, input slot for Apple Video System, expansion bay for Apple TV/FM Radio System; 1MB of VRAM; 28.8 Kbps fax modem

Power Macintosh 6500

Think of the Power Mac 6500 as a cross between a Performa 6400 and a Power Mac 5500. It's got the 6400's elegant tower design and hi-fi stereo sound system combined with the 5500's raw speed (powered by a 603e chip running at either 225 or a staggering 250 MHz) and ready-to-use video digitizing features. Plus, the 6500 is one of only two Mac models that comes with an internal Iomega Zip drive (the other is the Power Mac 8600).

Of course, you probably haven't heard much about the 6500; it's sold only to schools, and would have been called a Performa before Apple's name-scheme change of 1997.

Price:	\$2,100–\$2,400
Processor and speed:	PowerPC 603ev at 225 or 250 MHz
Memory:	32 MB RAM, expandable to 128 MB; two DIMM expansion slots, no RAM on logic board
Equipment:	256K level 2 cache; 2 or 3 GB hard drive; 12X CD-ROM drive; internal Iomega Zip Drive; two PCI expansion slots; communications (Comm II) slot for a 28.8-Kbps modem; video input slot for Apple Video System (included with 6500/250); stereo 16-bit sound; SRS surround-sound enhancement; subwoofer speaker

Power Macintosh 7100, 7100AV

This Mac was the middle-priced, midrange model of the original Power Macintosh trio that debuted in March 1994. The 7100 looks like a Quadra 650 (see Figure 12-8) and runs at 66 or 80 MHz. It has three NuBus slots and room for a PDS card. As on the 6100, the optional cache card grants you another 15 percent speed increase — a worthy feature.

This Mac has four RAM slots; as with the other first-generation Power Macs, you must fill those slots with pairs of identical SIMMs. The 7100, like the 6100, was an impressive amount of computer for the money.

The 7100/66 models were replaced in January 1995 by the 7100/80 and 7100/80AV. In addition to providing more speed, the 7100/80 fixed a fairly major problem with the 7100/66 — a glitch that caused slower NuBus performance. Although this slowdown wasn't noticeable with many types of NuBus cards, it was *very* noticeable to those who plugged a video compression card (such as the Radius Spigot Power AV) into one of the slots. The 7100/66's NuBus slot wasn't transferring data fast enough to keep up with the video-capture hardware. The 7100/80's NuBus slots can transfer data three to four times faster than the 7100/66.

Price:	\$2,900 then, \$850 now (AV model: \$3,900 then, \$1,200 now)
Apple code names:	Carl Sagan, BHA
On the market for:	9 months
Processor and speed:	PowerPC at 66 or 80 MHz
Memory:	8MB, expandable to 136MB (80-ns, 72-pin DRAM SIMMs, installed in pairs, required)
Equipment:	Built-in video (uses System RAM) plus PDS video on non-AV model (1MB, expandable to 2MB); three NuBus slots; AV model includes TV input/output and additional video jack (2MB VRAM); optional cache card provides 15 percent speed-up; Ethernet; 2 GeoPort jacks; records and plays 16-bit CD-quality stereo sound
System software notes:	Requires System 7.1.2 (with PowerPC Enabler) or later

Power Macintosh 7200, 7215

In August 1995, the 7200/75 became the new low-end Power Macintosh, replacing both the 6100 — and 7100-series Power Macs. Although it's built around the same PowerPC 601 chip found in the earlier Macs, the 7200 runs at a faster clock speed, making it noticeably faster than its predecessors. The first 7200s ran at 75 MHz or 90 MHz. In 1996, Apple released a “speed-bumped” version of the 7200 which revved its CPU up to 120 MHz. Its bulged-out version of the Power Mac 7100 case design is shown in Figure 13-3.

Figure 13-3

The Power Macintosh 7200 case design also houses such Macs as the 7300, 7500, and 7600.



The 7200 may have been at the bottom of the heap among the second-generation Power Macs, but its features rivaled or outshined those of the high-end Macs of even a year or two earlier. Even the basic 7200 includes a quad-speed CD-ROM drive, a 500MB hard disk, Ethernet support, and three PCI expansion slots (see Chapter 31 for the significance of PCI). The 120 MHz version of the 7200 comes with an eight-speed CD-ROM drive and a 1.2 GB hard drive. There's also a DOS-Compatible version of the 7200, which is simply a 7200/120 with a 100 MHz Pentium processor card pre-installed in one of the PCI slots.

The 7200, along with the other second-generation Power Macs, was one of the first desktop Macs that could be put into sleep mode — just like a PowerBook — to conserve energy. When you put a 7200 to sleep, the computer cuts the video signal going to the monitor, which blacks out the screen. The hard drive keeps spinning, however, and the CPU keeps drawing power.

A special version of the 7200/90 with 16MB of RAM was released in January 1996 and sold overseas as the Power Macintosh 7215/90.

Price:	7200/75: \$1,700 then, \$850 now; 7200/90: \$1,900 then, \$1,150 now; 7200/120: \$1,900 then, \$1,600 now
Apple code name:	Catalyst
Processor and speed:	PowerPC 601 at 75, 90, or 120 MHz
Memory:	8MB, expandable to 256MB via four DIMM slots (16 MB standard on 120 MHz version)
Equipment:	16-bit stereo input and output; Internal AppleCD 600i quadruple-speed CD-ROM drive (eight-speed CD on 120MHz models); 3 PCI slots; 1MB of VRAM, expandable to 2MB; Level-2 cache slot for optional 256K or 512K L2 cache (256K included with 120 MHz model).
System software notes:	Requires System 7.5.2 (with System Enabler 701) or later

Power Macintosh 7300

The Power Mac 7300, released in early 1997, is Apple's replacement for the inexpensive 7200 models, which the 7300 resembles. The two 7300 models, all PowerPC 604e-based, have speeds of 180 and 200 MHz, respectively. The prices are proportional: \$2,300, \$2,700, and \$3,000 or so. Like the 7200 models, they lack video inputs and memory-interleaving advantages; but like all current Macs, the 7300s come ready for business — 32MB of RAM, a 2 GB hard drive, a level 2 cache for added speed, and a built-in 12X CD-ROM. An odd new feature that appears on the 7300 is a security bar that hides the latches you use to pop open the top cover of the computer — presumably to prevent people from tampering with the innards of your Mac. The 7300/200 and 7300/180 both have their processor chips mounted on removable cards that can be replaced with faster processor cards for future upgrades.

Power Macintosh 7500

The Power Mac 7500 looks identical to the 7200; it shares the same case design (see Figure 13-3). But within that case, the 7500's PowerPC 601 chip runs at a faster 100 MHz. The 7500 is also faster because it has been designed with a higher-speed *system bus*, which runs at 50 MHz. Thanks in part to the improved system bus, the 7500/100 fitted with a 256K cache card (optional) is actually *faster* than an 8100/110 at most tasks. The 7500 is more expandable than the 7200, too. With eight DIMM slots instead of four, you can install up to 512MB of RAM.

The 7500's most distinguishing characteristics, however, are its AV features. This second-generation Power Mac, released in August 1995, has sound and video options previously available only in Apple's special AV models. For example, the 7500 has RCA-style plugs for line-level stereo input and output, which provide much better audio quality than the miniplug-style audio jacks found on most other Macs. The 7500 also has RCA phono jacks for video

input from a typical VCR or camcorder, as well as an S-video input connector for the higher-quality video signal from Hi-8 and S-VHS recorders.

The 7500's video digitizing features allow full-screen (640-by-480 pixel) video capture at 15 frames per second. And, like the earlier Power Mac AV models, the 7500 has an internal DAV — a digital audio/video connector — for adding third-party compression/decompression cards that support 24-bit video input.

Despite a winning combination of features, the 7500 was quickly eclipsed by the even faster Power Mac 7600, which replaced it just eight months later.

Price:	\$2,700 then, \$1,750 now
Apple code name:	TNT
Processor and speed:	PowerPC 601 at 100 MHz
Memory:	16MB of RAM, expandable to 512MB via 8 DIMM slots; Requires 64-bit-wide, 168-pin, 70-ns DIMMs
Equipment:	Internal AppleCD 600i quadruple-speed CD-ROM drive; 2MB of VRAM, expandable to 4MB; GeoPort fax and telephony software; 3 PCI slots; 10Base-T and AAUI-15 Ethernet connectors; internal Fast SCSI bus; RCA phono jacks for 16-bit stereo audio input and output; minijacks for 16-bit stereo audio input and output; RCA phono jacks for composite video input; S-video input connector; digital audio/video (DAV) connector for video compression/decompression cards
System software notes:	Requires System 7.5.2 (with System Enabler 701) or later

Power Macintosh 7600

In April 1996, Apple swapped the 7500's PowerPC 601 chip for the faster 604 chip, boosted its speed to 120 MHz, replaced the quad-speed CD-ROM drive with an eight-speed drive, added a slightly larger hard drive and rechristened it the 7600. (A 132 MHz version was released later.) In every other respect, this version of the 7600 was identical to the 7500.

At the end of 1996, the 7600 got another make-over. This time its 604 chip was replaced with an even faster 604e chip running at 200 Mhz and it was fitted with a new 12X CD-ROM drive and the same security bar that was added to the 7300. Despite these changes, Apple decided to leave the 7600's name intact.

Like the 7200, the 7600 is available in a DOS-Compatible configuration, with a 100 MHz Pentium processor card pre-installed in one of the PCI slots.

Price:	7600/132: \$3,000 then; \$2,300 now
Processor and speed:	PowerPC 604 at 120 or 132 MHz or PowerPC 604e at 200 MHz.
Memory:	16MB of RAM, expandable to 512MB via 8 DIMM slots; Requires 64-bit -wide, 168-pin, 70-ns DIMMs
Equipment:	Internal 8X or 12X CD-ROM drive; 2MB of V RAM, expandable to 4 MB; 256K level 2 cache (132 and 200 MHz model only); GeoPort

	fax and telephony software; 3 PCI slots; 10 Base-T and AAUI-15 Ethernet connectors; internal Fast SCSI bus; RCA phono jacks for 16-bit stereo audio input and output; minijacks for 16-bit stereo audio input and output; RCA phono jacks for composite video input; S-video input connector; digital audio/video (DAV) connector for video compression/decompression cards
System software notes:	Requires System 7.5.3 (200 MHz model requires 7.5.5)

Power Macintosh 8100, 8100AV, 8115

At its introduction in March 1994, the 8100 was the fastest personal computer ever made, running native software at an unheard-of 80 MHz and equipped with a 256K cache for even more speed. On the outside, the mini-tower 8100 looks like a Quadra 800 (see Figure 12-13). Its roomy case houses the same three NuBus slots and room for extra internal storage devices, such as additional hard drives, CD-ROM players, or SyQuest drives. The 8100 with the AV option (a PDS card that adds television inputs and outputs) was the first Mac in several years to cost more than \$5,000.

The 8100/100 and the 8100/110 were built on faster-still 601 chips. The only thing more impressive than its speed was its scarcity; virtually no one could find one to buy. (Overseas, the fastest of the 8100-series models was sold as the Power Macintosh 8115/110.)

Apple pulled the plug on the 8100/80 models in January 1995 and discontinued the faster versions nine months later.

Price:	<i>8100/80</i> : \$4,250 then, \$1,100 now; <i>8100/80AV</i> : \$5,660 then, \$1,400 now
Apple code name:	Cold Fusion
On the market for:	9 months
Processor and speed:	PowerPC 601 at 80, 100, or 110 MHz
Memory:	8MB, expandable to 264MB (80-ns, 72-pin DRAM chips required)
Equipment:	Built-in video (uses System RAM) plus PDS video on non-AV model (2MB, expandable to 4MB); three NuBus slots; optional AV model includes TV input/output, additional video jack (2MB VRAM); 256K cache card; Ethernet; 2 GeoPort jacks; records and plays 16-bit CD-quality stereo sound
System software notes:	Requires System 7.1.2 (with PowerPC Enabler) or later

Power Macintosh 8500, 8515

Toward the end of 1995, this was the Power Macintosh everyone wanted — a screaming-fast machine with a stunning range of standard AV features, three PCI slots for expansion, and, at its heart, a PowerPC 604 chip running at 120 MHz. The 8500 thereafter received three speed bumps. In April 1996, two versions running at 132 MHz and 150 MHz were introduced. Then, four months later, Apple replaced the 604 chip with a 604e and again upped the speed, this time to 180 MHz.

TRUE FACT**“CUPERTINO, WE HAVE A PROBLEM . . .”**

Early in the spring of 1996, Apple officials were horrified to discover several serious problems in the ROM and cache components used in the 5200 and 5300 LC Power Macs, as well as the Performa 5200, 5300, 6200, and 6300 models. The faulty components were causing frequent system freezes on some models and sudden, random color shifts on the monitors of others. At the same time, a series of distressing hardware-related problems were emerging on the 5300 PowerBook family: Video screen bezels were separating at the seams, AC power connectors were failing, and PowerBooks were dropping off LocalTalk networks.

These weren't the kind of problems that could be fixed with a software update or yet another system enabler. Apple realized it had only one choice: Notify the tens of thousands of customers who bought the affected models and fix the problems for free.

Thus was born the euphemistically-named *Repair Extension Program for the Apple Power Macintosh and Performa 5200, 5300, 6200, and 6300* and the *Apple PowerBook Repair Extension Program*. Company officials cautiously avoided referring to either of these programs as recalls. In fact, in an official press release, Apple helpfully explained, "This is a repair extension program, not a product recall."

Recall, repair, whatever — the point is that if you have one of these Macs, you're eligible for a free repair if your model suffers from the aforementioned problems. The affected desktop models are: 5200/75 LC, 5300/100 LC, Performa 5200, 5215, 5300, 6200, 6205, 6214, 6216, 6218, 6220, 6230, 6290, or 6300. (The problem was fixed in the 5260 and 6320 models before they were released.) Before calling 800-SOS-APPL to schedule a repair, however, download the free program called 5xxx-6xxx Tester from America Online or Apple's Web page (<http://www.info.apple.com>); it will tell you whether or not your model has the hardware problem, so you don't wind up schlepping your Mac away only to find out that you had a simple extension conflict. (That diagnostic software tests the desktop models, not the PowerBooks.) The repairs are handled by local Apple dealers.

The eligible PowerBooks include the 5300, 5300c, 5300ce, and 5300cs; 190 and 190cs. To get the free repairs, call 800-801-6024. Apple will send you a freight-paid shipping box so you can send in your PowerBook without charge. (If your PowerBook's serial number has the letters AA at the end of its serial number, it was manufactured since the problems in the construction process were corrected. You have nothing to worry about.)

Apple plans to continue the free repair programs for each desktop and portable model until seven years after it is discontinued. If only that free seven-year warranty applied to our Macs for *any* problem that might arise . . .

The 8500 has the same audio features as the 7500 — RCA-style plugs for 16-bit sound — and can also record video signals via composite and S-video jacks. However, the 8500 goes a step further, offering built-in video *output* capabilities, too, so you can show your QuickTime movies on a TV or record them on your VCR in 24-bit color. (Previous AV Macs were limited to 16-bit color for video output; see Chapter 11 for definitions.) If you upgrade the 8500's VRAM to 4MB (the maximum), you can display images on your computer screen *and* a TV at the same time. Thanks to its speed, the 8500 is a QuickTime moviemaking monster. It can capture full-motion video — 30 frames per second — at 320-by-240 pixel size without requiring a compression card or other hardware.

Like its predecessor the 8100, the 8500 is housed in a tower-style case (see Figure 12-13) with three slots (PCI) and a bay for an additional internal drive. As with most of the recent Power Macs, Apple released an overseas-only version of the 8500, too, called the 8515.

Price:	8500/120: \$4,000 then, \$2,600 now; 8500/150: \$3,600 then, \$3,000 now; 8500/180: \$4,500 then, \$3,700 now
Apple code name:	Nitro
Processor and speed:	PowerPC 604 at 120, 132 or 150 MHz; or PowerPC 604e at 180 MHz
Memory:	16MB or 32MB of RAM, expandable to 512MB via 8 DIMM slots; requires 64-bit-wide, 168-pin, 70-ns DIMMs
Equipment:	Internal AppleCD 600i quadruple-speed or eight-speed CD-ROM drive; 2MB of VRAM, expandable to 4MB; GeoPort fax and telephony software; 3 PCI slots; 512K cache card; 10Base-T and AAUI-15 Ethernet connectors; internal Fast SCSI bus; RCA phono jacks for 16-bit stereo audio input and output; minijacks for 16-bit stereo audio input and output; RCA phono jacks for composite video input and 24-bit video output; S-video input/output connector; digital audio/video (DAV) connector for video compression/decompression cards
System software notes:	120 MHz version requires System 7.5.2 (with System Enabler 701) or later; faster versions require System 7.5.3 or later.

Power Macintosh 8600

The Power Mac 8600, which was released in February 1997, is a next-generation version of the 8500. Equipped with a 604e chip that chugs away at 200 MHz, a 12X CD-ROM drive, a super-fast hard drive designed to handle high-speed video applications and — for the first time on an Apple computer — a factory-installed internal Iomega Zip drive, this machine is a multimedia author's dream. (The Power Mac 6500, sold only to schools, is the only other Mac equipped with an internal Zip drive.) The 8600's incredible bundle of hardware is housed in an enormous new tower enclosure. This case has more space for internal storage devices and provides easier access to the computer's

internal components. It also has a larger power supply and more space for DIMMs, so it can be easily upgraded to a maximum of 512 MB of RAM. The price for all this at its release: \$3,200.

Power Macintosh 9500, 9500/180MP, 9515

This June 1995 top-of-the-line Power Mac was, weirdly enough, the *first* of the second-generation Power Macs; it preceded the 7200, 7500, and 8500 by two months. It was, therefore, the first Mac to be built around the PowerPC 604 chip and the first Mac with PCI slots instead of NuBus slots.

Originally, there were two versions of the 9500 — one that ran at 120 MHz and one at 132 MHz. Subsequently, Apple released a 150 MHz version (in April 1996) and two versions based on the 604e chip (August 1996), one running at 180 MHz and one at 200 MHz.

Unlike the other second-generation Power Macs (notably the 7500 and 8500), the 9500 *wasn't* designed to be a multimedia powerhouse. It has neither RCA-style audio jacks for audio cables nor video input/output jacks. In fact, it doesn't have built-in video *at all*. You have to buy the Apple Accelerated Graphics Card or a third-party graphics card just to hook the 9500 up to a monitor.

What the 9500 does offer, pure and simple, is speed and room to expand; it has *six* PCI slots and can hold up to 768MB of RAM (see Figure 12-14). This machine was intended for high-end users who need the 9500's sheer processing muscle for color publishing or multimedia production.

And speaking of sheer processing muscle, the 180 MHz model, officially called the 9500/180MP, was a landmark release — the first computer in Apple's history to offer *multiprocessing*; it's equipped with not one but *two* 604e chips, which work simultaneously to process data. (The MP in the name stands for *multiprocessing*.) One processor handles the Mac OS and controls the stream of information pouring in and out of the computer, while handing off other tasks to the second chip for processing. Obviously, a pair of 604e chips working in tandem in this way can chug through graphics and video data very fast, but software has to be specially rewritten to take advantage of this multiprocessing scheme. Fortunately, a number of companies — Adobe Systems, Deneba, Macromedia, Strata, and others — have promised to release programs to take advantage of multiprocessing. A multi-processor-compatible version of Photoshop, for example, is already available. When used with software that supports multiprocessing, the 9500/180MP can handle tasks twice as fast as a single-processor Mac.

Price:	9500/120: \$4,700 then, \$2,350 now; 9500/132: \$5,300 then, \$2,700 now; 9500/150: \$4,800 then, \$3,700 now; 9500/180MP: \$5,700 then, \$5,200 now
Apple code name:	Tsunami

Processor and speed:	PowerPC 604 at 120, 132 or 150 MHz or PowerPC 604e at 180 or 200 MHz
Memory:	16MB of RAM, expandable to 768MB; requires 168-pin, 64-bit, 70-ns DRAM DIMMs
Equipment:	Internal AppleCD 600i quadruple-speed (or eight-speed) CD-ROM drive; 2MB of VRAM, expandable to 4MB; 512K Level 2 cache; 6 PCI expansion slots; 10Base-T and AAUI-15 Ethernet connectors; one sound-output port for stereo CD audio and one sound input port for 16-bit stereo sound input
System software notes:	Requires System 7.5.2 (with System Enabler 701) or later; 150, 180 and 200 MHz versions require System 7.5.3 or later

Power Macintosh 9600

The Power Mac 9600 became Apple's new high end machine in February 1997, with three models running 604e chips at clock speeds of 200 and 233 MHz (for \$3,700 and \$4,200, respectively). The 9600 also has a faster 4 GB hard drive than the 9500, a new, accelerated graphics card, a 12X CD ROM drive, 32MB of RAM standard, and the same improved tower enclosure introduced on the Power Mac 8600.

As with the 9500, a multiprocessor version of the 9600 is available: the \$4,700 Power Mac 9600/200MP is equipped with two 604e chips mounted on the processor card.

PORTABLE POWER MACS

In the summer of 1995, Apple introduced the first PowerBooks driven by a PowerPC chip — the PowerBook 5300 series. For these models, yet another incarnation of the PowerPC chip was developed — the 603e chip. The 603e is slower than the 601 (the chip in the original desktop Power Macs), but it consumes only a third as much power and has three reduced-power sleep modes. The 603e chip itself also is smaller than the 601, making it perfect for a laptop.

You can upgrade any 1994 PowerBook in the 500 series (the 520, 540, and so on) to be PowerPC equipped, of course; but the new PowerBooks — with the exception of the PowerBook 190 — are designed from the ground up around the PowerPC processor.

PowerBook 1400 family

After the quality-control problems of the 5300 PowerBook series (see “PowerBook 5300,” later in this chapter), Mac fans longed for one rock-solid, reliable, glitch-free PowerBook. And they wanted a CD-ROM built in.

Apple was listening (see Figure 13-4). The PowerBook 1400 debuted in October 1996, filled with crispness and solidity refinements. The trackpad, keyboard, screen-hinge “brake,” and overall construction were all improved, and none of the 5300-style quality problems emerged.

Figure 13-4

The PowerBook 1400's new case is actually the same size as its predecessor, the 5300 — but appears slimmer and slimmer, thanks to a clean, sculpted design and tighter-fitting clamshell halves. (Courtesy of Apple Computer, Inc. Photograph by John Greenleigh.)



Moreover, this PowerBook was the first with a full-size CD-ROM — a 6X CD-ROM unit whose tray slides out of the front edge of the machine (see Figure 13-4). The entire drive pops neatly out of the PowerBook, too, so that you can slide the floppy drive (or a third-party Zip drive, hard drive, or magneto-optical drive) into its place. Other new features: a flip-up keyboard to make upgrading easy, and a clear plastic cover to replace the usual dark gray top panel. Beneath this plastic panel you can insert a BookCover — a colorful paper insert from Apple; your travel itinerary, phone numbers, or business cards; solar-panels; leather, woodgrain, or stainless steel covers; and so on.

Otherwise, the 1400 is much the same as the former top-of-the-line 5300ce — at a fraction of the price. For example, the 1400 inherits the 5300ce's enormous, brilliant, 800-by-600 dpi screen (about the equivalent Desktop area of a 16-inch CRT monitor).

The 1400's speed didn't increase as much as many fans had hoped — the standard model uses the same 117 MHz PowerPC 603e processor chip (with no level 2 cache) as the discontinued 5300ce, although a more expensive 136 MHz model (with a cache) is available. Nor did weight (about seven pounds) or battery life (the same two-hour NiMH battery) improve. Otherwise, the 1400's

sleek new case design, screen, keyboard, CD-ROM, and trackpad are so well designed that you'll quickly forget you're using a laptop. Surprisingly, this handsome machine is meant to be the *low* end model of Apple's PowerBook line; its prices begin at \$2500, including 12MB of RAM, the floppy drive, that enormous color screen, and a 750MB hard drive.

Price:	<i>1400cs without CD-ROM: \$2,500; 1400c with 136 Mhz processor and CD-ROM: \$4,000</i>
Apple code name:	Epic
Processor and speed:	603e at 117 or 133 MHz
Memory:	12 to 16MB of RAM, expandable to 64MB
Equipment:	Removable Apple SuperDrive/6X CD-ROM; 11.3" dual-scan or active-matrix color display (800 by 600 pixels); 750MB or 1 GB hard drive; enhanced, clickable trackpad; 2 PC Card slots (for two Type I or II PC Cards or one Type III card); Nickel-Metal-Hydride battery; internal slot for 8-bit video or Ethernet card; 16-bit stereo sound input/output ports; built-in speaker and microphone

PowerBook Duo 2300c

The 2300 was Apple's first PowerPC Duo. Like other Duos, the 2300 is super-light — only 4.8 pounds — and has a docking connector that fits all Duo docks and mini-docks, as described in Chapter 12 (see "Duo 210/230"). Like the larger 5300-series PowerBooks, the 2300 contains a PowerPC 603e chip running at 100 MHz. Of course, the 2300 is faster than previous Duo models, but it also has a better screen — a 9.5-inch active-matrix color display that's bigger and brighter. Unlike the PowerBook 5300s, the 2300 has a trackpad that lets you double-click simply by tapping on the trackpad, drag-lock with a down-up-down tap, and briefly lift up your finger during a long drag.

Price:	\$3,700 then, \$3,150 now
Apple code name:	AJ
Processor and speed:	603e at 100 MHz
Memory:	8MB of RAM, expandable to 64MB
Equipment:	9.5" active-matrix color display (640 by 480 pixels); 750MB or 1.1 GB hard drive; enhanced trackpad; docking port

MACINTOSH SECRET

THE ASSISTANT EASTER EGG

Not many people use Apple's PowerBook File Assistant, despite its many wonders (described in Chapter 5). Those who do, however, can play this little undocumented game, discovered by free book winner Robin Poirier.

If you press Option while choosing About File Assistant from the  menu, you'll discover a series of names flashing away in the dialog box at warp speed. They continue racing by, too fast to read, until you release the Option key. When you do so, the display will freeze on the one name that happened to be blinking into place when you released the key. It's like an electronic game of musical chairs. Or maybe you'd call it a random name generator?

PowerBook 3400

These laptops were Apple's technological strike back at critics who said it had lost its touch with desirable laptops. The PowerBook 3400 is a Power Mac 8500 in a laptop, with no compromises. At the time of its release in March 1997, this computer was the fastest laptop ever made: 180, 200, or 240 MHz on a new 603ev chip.

The 3400s are based on a PCI-slot architecture, which means they're faster (and you can install actual full-sized PCI cards if you buy a Newer Technology dock). Goodies abound: a 6x CD-ROM; a breathtaking 800 × 600 screen filling 12.1 inches diagonally; four speakers, including "subwoofers" in the bulging upper lid; a built-in 33.6 fax modem/Ethernet jack; and a video output jack backed by enough VRAM to fill an external monitor's 1024 × 768-pixel image.

All of this speed and multimedia talent doesn't come cheap: this PowerBook costs a pretty penny (\$4500 to \$6500 at its release), and it weighs a pretty 7.4 pounds with the CD drive installed. (It's a half inch bigger than previous models in each dimension, too.) But when you recognize that you're getting a PCI Power Mac in a laptop, the money and the weight — and the wait, considering the inevitable shortage — may be worthwhile.

PowerBook 5300 family

Apple introduced PowerPC technology to the PowerBook line in August 1995 with the 5300 series. The four differently named models vary only in their screen technologies (see the specs below); the 5300ce was the first PowerBook to offer a colossal 800-by-600-pixel desktop. (The physical dimensions are no larger, but the pixels are much more tightly packed; see Chapter 14 for details.)

Three of these models contain a 603e chip running at 100 MHz — the same chip used in the 5300- and 6300-series desktop models. The 5300ce has a faster 603e chip — 117 MHz. Unfortunately, the 603e isn't the speediest chip on Earth, and these Macs don't have a level 2 cache for frequently used instructions. As a result, these PowerBooks are nowhere near as fast as their MHz ratings would seem to indicate. Running native PowerPC software, you get about the speed of the slowest Power Mac ever made (the 6100/60). And running *non*-native software — such as, alas, System 7.5 — these laptops can seem *very* slow.

The 5300's are bigger and chunkier looking than earlier PowerBooks, but Apple packed much more into them (see Figure 13-5). For example, these

laptops have removable floppy drives; you can pop the whole drive out of its bay and replace it with another device — or leave it at home if you won't be needing it when you travel.

Figure 13-5
The PowerBook 5300 series and the 190 share the same case design: The first totally black PowerBooks, crammed with more removable pieces and slots and compartments than any Mac before them.



In addition to the expansion bay, there are two PC-card slots. You'll need those slots if you want, for example, a modem or Ethernet hardware, because there isn't room inside the case for built-in versions of those features. PC cards, popular on DOS-based laptops, were formerly known, hopelessly, as PCMCIA cards. You can also buy PC cards that are little hard drives, pagers, and so on.

The 5300's innovative built-in infrared transceiver lets you connect and transfer files to any other Mac that has infrared capabilities. (If you don't have an IR-equipped desktop Mac, you can add an IR pod, such as the \$70 Farallon Air Dock.) With the 5300's IR transceiver, you don't have to mess with cables to connect to a network; you just point the transceivers at each other (within a range of about six feet) and start transferring files.

The 5300's represented Apple's state-of-the-art PowerBook technology in every respect but one: They didn't have the improved double-clickable trackpad found on the PowerBook 190, 1400, and Duo 2300 — which allows you

TRUE FACT**THE MOST EXPENSIVE MACS OF ALL TIME**

What do the Power Mac 8100/110 CD, Mac Portable, Mac IIci, and Mac SE/30 have in common? They are all among the ten most expensive Macs ever released.

True, by today's standards, you would hardly think of the IIci as a powerhouse computer (or consider the leaden Mac Portable much of a laptop). But at the time of their release, these machines represented Apple's cutting edge — and people paid top dollar to get that new technology into their own hands. Amazingly, people paid \$8,800 to get a brand new IIci in September 1989 — about \$3,400 more than it cost in 1995 to buy the most expensive Power Mac 9500/132!

You could argue that the single most expensive Mac model ever released was the almost universally ignored Mac XL, originally called the Lisa, which predated the original Mac 128K by a full year. (Though many people don't consider the XL a real Mac, it *could* run Mac software — up to System 3.2 — and was written up in the earliest issues of *Macworld*.) The Mac XL debuted in January 1983, with a whopping price tag of \$10,000.

Here, for the record, are the nine other top-dollar Macs, listed with their original prices:

Model	Released	Original price
Mac IIcx	March 1990	\$9,870
Mac IIx	October 1988	\$9,300
Quadra 950	May 1992	\$8,800
Mac IIci	September 1989	\$8,800
Quadra 900	October 1991	\$8,500
PowerBook 5300ce	August 1995	\$6,500
Mac SE/30	January 1989	\$6,500
Mac Portable	September 1989	\$6,500
Power Mac 8100/110 CD	January 1995	\$6,300

to double-click by tapping right on the trackpad. (See Chapter 14 for details.)

The PowerBook 5300 also has the dubious distinction of being the first and only Macintosh ever to be *recalled*. Shortly after the PowerBooks were released, Apple discovered that the new lithium ion (LiIon) batteries included with the 5300 models had an unfortunate potential to burst into flames. About 1,000 of the 5300 machines had to be shipped back to Apple, where they were refitted with nonexploding (and shorter-life) NiMH batteries.

Price: 5300: \$2,200 then, \$1,050 now;
 5300c: \$3,700 then, \$2,000 now;
 5300cs: \$2,800 then, \$1,600 now;
 5300ce: \$6,500 then, \$3,350 now.

Apple code name: M2

Processor and speed: PC 603e at 100 or 117 MHz

Memory: 8MB of RAM, expandable to 64MB via one RAM card expansion slot

Display: 5300: 9.5", 16-level grayscale, passive-matrix display, 640 by 480 pixels.
 5300cs: 10.4", passive-matrix color display, 640 by 480 pixels.
 5300c: 10.4", active-matrix color display, 640 by 480 pixels.
 5300ce: 10.4", active-matrix color display, 800 by 600 pixels.

Equipment: Removable Apple SuperDrive; internal 500MB or 1.1 GB hard disk; 2 PC Card slots (for two Type I or II PC Cards or one Type III card); Nickel-Metal-Hydrate battery; 8-bit video output port; 16-bit stereo sound input/output ports; built-in speaker and microphone; trackpad

POWERPC-MAC SECRETS ■

The extension hazard

As we've mentioned, software that isn't specifically written for Power Macs can really slow down your machine. It follows, therefore, that non-native *extensions* are particularly problematic — because these programs run *constantly* in the background. Versions of ATM before 3.8, for example, slow a Power Macintosh by as much as 15 percent. Do a clean install of your System Folder (as described in Chapter 33) after months of adding fun junk to your Power Mac, and you're likely to be shocked at how much faster it is *without* them.

So, how can you tell if your entire system is being dragged down by a few non-native extensions? Use Conflict Catcher (or the demo, included with this book). Open the control panel, click the Reports button, and choose Patched System Traps from the pop-up menu. Read the list of your extensions. Those with multiple asterisks beside their names are those that are probably dragging your entire Mac into the slow lane.

You can also use a freeware utility called PowerPeek (available on the Web at <http://www.zdnet.com/macuser/software/>). Among other things, PowerPeek lists all the native files on your system, so you know exactly which of your programs run under emulation and which aren't. PowerPeek also flashes an indicator light in the upper-right corner of your screen to tell you whether or not your Mac is running native code. The indicator flashes green when you're running native code and flashes red when you're running under emulation.

Not all slots are created equal

A Power Mac 9500 has six PCI slots — but don't fill them arbitrarily. Cards in the top three slots run slower than those plugged into the bottom three. The speed difference has to do with the PCI architecture, which requires one controller for every three slots. Evidently, Apple's design taxes one trio of slots more than the other. So, if you have a choice, fill your slots from the bottom first for the best performance.

Identifying a chip's type and speed

Apple has used five different types of the PowerPC chip in its Power Macs, running at speeds ranging from 60 MHz to 200 MHz. How can you tell which chip is in *your* Power Mac and determine its actual clock speed? Is there any way to tell what chip is running your Mac just by looking at it?





Yes. Open your Mac's case and take a look at the FCC ID label located on the back side of the processor card. The number on the FCC ID label contains nine characters, the last six of which identify the processor and the speed. For example, if the FCC ID ends in 604132, it means you have a 604 processor set to run at 132 MHz.

Zapping PRAM — the PCI way

We mention zapping your Mac's PRAM (parameter RAM) several times in this book; it's a useful troubleshooting technique for stopping crashes and clearing odd glitches from your system. However, PCI Macs store certain information, such as data related to your video-display options, in *nonvolatile RAM* (NVRAM) instead of PRAM.

So here's how you can zap both at the same time to return to default settings. First, shut down your Mac. Then start it again holding down the usual zap-the-PRAM key combo (⌘-Option-P-R). After you hear the second startup chime, press Shift so that your Mac starts up with extensions turned off. Finally, drag the file called Display Preferences out of the Preferences folder in the System Folder and into the Trash — and restart.

Use the right video jack, Jack

As we mentioned earlier, first-generation Power Mac models (6100, 7100, 8100) offer *two* video jacks: The one on the back panel and the one provided by the AV or PDS-video card. This arrangement may leave you with a dilemma: To which jack should you hook your main monitor for the best speed?

If you're running *native* PowerPC programs, use the built-in back-panel jack for a 15 percent screen-redraw speed-up. If you're using *non-native* programs, the back-panel jack gives you a 35 percent *slowdown*. Therefore, if you're doing most of your tasks in emulation, use the card-provided video jack.

The classic Power Mac car-crash sound

When something goes wrong on a Power Macintosh, you hear neither the four tones of a Mac II-class machine nor the *Twilight Zone* theme of the Quadras. Instead, you hear a horrific digitized recording of a car crash.

Want to hear it for yourself without actually damaging anything? The next time you start your Power Mac, press the Interrupt switch *just* after the machine begins to start up (before the screen even lights up). You'll hear it, all right. (See Chapter 7 for the locations of this switch.)



How to tell if it's a native application

Life sure is confusing now that there are two strains of Mac software — native and non-native. Wouldn't it be nice if you could tell at a glance whether some program was native or not?

You can. Just highlight an application's icon and choose Get Info from the File menu. If, at the bottom of the Get Info window, you see a message about turning on virtual memory (and how much real memory you'll save as a result), you've got native software on your hands.

If not, not.

Memory savings recapped

In case you missed it: The most important money saver on a PowerPC Mac is the virtual-memory oddity. Turn *on* virtual memory, even a little bit (or install RAM Doubler), and each native program requires as little as *half as much memory*. (Look at the Get Info box for a native program and see for yourself! See the sidebar "Why a Power Mac needs more RAM" for the reason.) This is one hunk of hard-disk space that's well worth trading away.

An updated Memory Secret

You already know, from having read Chapter 4, that there's a buried surprise in the Memory control panel — you turn on virtual memory, press Option, and click the hard drive pop-up menu.

On PowerPC-based Macs, though, there are new surprises in that secret pop-up menu. Our favorite: "Mr. 601 — the Power to Crush the Other Microprocessors." (You *did* see that *Saturday Night Live* ad spoof, didn't you?)

An updated Monitors Secret

Open the Monitors control panel on a PowerPC Macintosh. Press Option and click the version number. Keep the mouse button down and press the Option key over and over again. This Secret works much like it did pre-PowerPC, with a couple of differences: First of all, some even wackier names and transpositions take place — and now there's color!

(Unfortunately for fans of this trick, modern Power Macs come with the Monitors & Sound control panel instead, which has no juicy little Easter eggs buried in it.)



TRUE FACT**WHY A POWER MAC NEEDS MORE RAM**

When you double-click a program's icon, the hard drive spins and your Mac reads the program's code into memory.

The PowerPC chip doesn't handle this hard-disk-to-RAM process the same way the 68000-series chips did. Older Macs could read *pieces* of program code from the hard disk — and get rid of that code — as necessary. For example, when you print, your program loads the printing code from the hard disk into RAM; when the printing is finished, those printing instructions are dumped out of memory.

Power Mac programs, on the other hand, can't read and dump code fragments as necessary. Their code is stored on the disk as one giant chunk. That's one of the reasons a native PowerPC program requires much more RAM than its non-native counterpart; such a program must load *all* program code into RAM when you launch it. As a result, a native program takes longer to load.

Fortunately, there's a way to let a Power Mac handle a native program in a code-fragments-as-necessary fashion, just as non-native programs do. Turn on Virtual Memory (see Chapter 9). Set that virtual memory amount to 1MB or 2MB more than your actual installed memory. Or, alternatively, install RAM Doubler.

Because virtual memory, at heart, is a method of rapidly swapping information between the hard drive and RAM, it works beautifully on a Power Mac. Microsoft Excel, for example, requires *6,500K less* memory when virtual memory is on or RAM Doubler is installed.

A deeply buried credit

You need MacsBug, Apple's debugging software for programmers, for this one. (It's available on America Online, among other places.) Ask MacsBug to display memory address 40B2E280.

You'll get a testimonial to Gary Davidian, the Apple software genius who single-handedly wrote the 680x0 emulator code that lurks inside every Power Mac — and that just may have saved the company.

The much-too-colorful Mac

Purchasers who laid down multiple thousands to become adopters of Power Mac technology are in for a fascinating surprise. On many Power Macs (the 8500, 7100, and 8100, for example), a couple of important choices are missing from the Monitors' control panel — namely, any color settings below "256." You read that correctly: These Macs *cannot* be switched to black-and-white!

And not just black-and-white — you can't switch these Macs into 4- or 16-color mode, either. The only people who'll care are those several million Mac fans who have games and CD-ROM discs that require 16-color or black-and-white modes to run. Or, people who want fast screen redraws. Or, people who want to take screen-capture PICT files that aren't enormous on the disk. Or, ... oh well.

On first-generation Power Macs, this quirk kicks in if your monitor is connected to the Power Mac's *extra* video jack (the PDS video card's output), not the built-in video jack at the bottom of the case. On later Power Macs, you've only *got* one video jack — you're stuck forever in 256 colors or higher.

We called one of our friends in the engineering department at Apple. We got the classic response: "It's a feature, not a bug."

(What he meant, of course, was "It's less expensive this way.")

What to do with those old NuBus cards

Bought one of those spiffy new PCI-slotted Power Macs? Got a couple NuBus cards left over from your previous Mac? You don't have to dump them. You can buy a NuBus expansion chassis from Second Wave (512-329-9283) that lets you use those cards in your PCI slots.

Ditch the 68000 code

Some of today's programs are labeled "fat binary," meaning that they contain the program code for *both* kinds of chips — both the PowerPC and the previous 68000 series. Of course, if you have only a PowerPC, you might not care to waste all that disk space for storing code you'll never use. And if you have only a Quadra, you could happily do without the bulky PowerPC code. Yet, a fat-binary program is represented by only a single icon! How can you strain out the unneeded code?

Use PowerPCheck, included with this book. It strips out the kind of code you don't need, leaving you with a much smaller, more compact program.

MACINTOSH CLONES

In 1994, Apple announced that it would begin licensing System 7.5 and the PowerPC Macintosh ROM chips to other computer makers so that they could begin building *Macintosh clones*. No single event in Mac history produced more shock waves in the Mac community.

Until 1995, the only computers on Earth running Mac software were the Macs that had rolled off Apple's own assembly line. Now, Apple would let other companies license its trademark operating system. Suddenly, the distinguishing characteristic of a Mac was no longer to be the computer itself but the Mac OS. (This change of philosophy was first visible in System 7.5.1, which starts up not with the traditional "Welcome to Macintosh" message but the updated "Mac OS" logo — see Chapter 6 — and, later, in System 7.6, where the first command under the  menu says "About This Computer" instead of "About This Macintosh.")

In sanctioning such a change, Apple's hope is that its loss of the monopoly on Mac making will be recouped by collecting licensing fees — and the further proliferation of Macintosh. Apple also hopes that by carefully controlling and supervising the clone-maker licensing process, it will spare the world from the kind of compatibility nightmares caused by a clone-making free-for-all (as happened in the DOS world).

In the spring of 1995, the very first Mac clones arrived, manufactured by a small, new, California-based company called Power Computing. Since then, Radius, DayStar Digital, Motorola, Bandai, APS, Akia, Pioneer, and UMAX have announced that they'll be bringing clones to market; other companies have clones on the way. Even IBM is at work on a version of its popular ThinkPad notebook computer capable of running the Mac OS. At this writing, the machines introduced so far have been, reassuringly enough, 100 percent Mac-compatible — although Apple won't allow any of them to be *called* Mac or Macintosh.

Mac clones generally offer the same variety of video options, ports, expansion slots, and drives you find on genuine Power Macs. Some, in fact, offer features *not* available from Apple; Power Computing makes clones fitted with internal Zip or Jaz drives, for example. Daystar's Genesis line of clones feature *four* PowerPC processors in a single machine for lightning-fast multiprocessing of large graphics files in Photoshop. (See "Power Macintosh 9500" earlier in this chapter for more on multiprocessing.) And, of course, clones usually cost 10 to 15 percent less than equivalent Apple machines.

Power Computing is by far the most prominent clone maker in the U.S. The company makes PowerPC-based models in a wide variety of configurations, from a "starter" system running a 132 MHz PowerPC 604 processor to the high-end PowerTower Pro, a 604e-based system that runs at 225 MHz. All the Power Computing models come with a keyboard and mouse, the latest Mac OS software, and a huge software bundle. (If you call Power Computing directly, they'll put together a custom system for you; you just specify which RAM, hard disk, video, and CD-ROM options you prefer.) Power Computing's prices are excellent and the systems have won high ratings from reviewers and customers. And, because the company sells computers in far lower quantities than Apple, its machines are always able to include the very latest, very fastest new PowerPC chips — at a time when these chips are still too scarce for Apple to consider.

Radius, a company known primarily for its accelerator and graphics cards, introduced a handful of clones in 1995, but has since sold its cloning technology to UMAX, which introduced its clones in 1996. The UMAX clones are based on the 603e and 604 chips and, like the Power Computing machines, come with an enormous software bundle that includes programs like Adobe PageMill, Conflict Catcher, ClarisWorks, Quicken, Now Up to Date, and Now Utilities.

Motorola's clones are significant because they're from Motorola. As such, they're built to meet unusually high construction standards, and they come with an unheard-of five-year warranty. As of the turn of 1997, however, none

of the clone companies could be described as innovators; what makes them significant is their lower prices, ability to deliver higher-speed chips before Apple can, and (in Motorola's case) extraordinary warranty.

THE FUTURE: THE POWERPC (CHRP) PLATFORM

The Power Macs are certainly a major leap forward, but the biggest leaps are yet to come. Apple, IBM, and Motorola are already working with prototypes of future incarnations of the PowerPC technology. The G3-series processor, for example, is a next-generation chip now in the works that will be able to run at 400 MHz. And its successor, the G-4 series chip, is eventually expected to reach clock speeds of 500 MHz. And, as we mentioned at the beginning of this chapter, Exponential Technology plans to be producing its 533 MHz in large quantities by mid-1997. In the short term, this can only mean faster, cheaper, and more powerful Macs.

But the PowerPC chip's speed and genius of design won't confer benefits only to Macintosh. Already, Ford and Time-Warner are installing the PowerPC processor in their cars and TV-top boxes.

Perhaps most shocking to old-time Mac purists, Apple and IBM are working *together* on a totally new computer platform. This machine — which, to corporations who buy hundreds of computers at a time, is the Holy Grail of personal computing — will be able to run *your choice* of operating system: the Mac OS, Windows NT, OS/2, or AIX (IBM's version of the Unix environment).

TRUE FACT

CODE NAME: LAST LAUGH

As you may have surmised from reading this chapter and the last one, Apple engineers have a code name for each Mac model while they're designing it (and before Marketing has figured out what it'll actually call the thing).

As Apple bet more and more of its future on the PowerPC Macs, the code names for the three first models began to leak out. The least-expensive one was known internally as PDM, the middle model was Carl Sagan, and the high-powered Mac was nicknamed Cold Fusion.

Meaningless, right? Not a chance; Apple programmers are famous for their stinging wit. In this case, everything becomes clear when you find out what *PDM* stands for: *Pitldown Man*. Remember that case? In 1909, an archaeologist unearthed this fossil skull in Sussex, England. For years, it was believed to be the missing link between apes and men — and then, in 1953, it was proved to be a fake.

OK. So, we've got a hoax, another hoax (cold fusion), and . . . Carl Sagan.

Well, this famous astronomer didn't much care for the implications. He got legal. His lawyers met with Apple's, and he wrote a couple of stern letters stating that his name was being used without permission. Apple's legal staff promised to make its programmers change the code name of the new Mac model.

So, they changed it to BHA. "Random initials," they told the lawyers. Carl Sagan was happy. He went away.

Guess he didn't know what *BHA* stood for: *butt-head astronomer*.

Believe it or not, Sagan sued *again*. After months of haranguing by lawyers, the case was finally settled in 1995 — the judge threw out Sagan's complaint.

MACINTOSH SECRET**THE GRAPHING CALCULATOR NOBODY KNOWS**

Who'd have guessed it? The Graphing Calculator, the oft-neglected PowerPC-native demonstration program included with every Power Mac, is absolutely ripe with secrets. Thanks to its programmer, Greg Robbins, we've been able to reveal a few of them here.

- Turn on Balloon Help and you'll discover some surprises. For example, point to the `csc` and hyperbolic cosine buttons on the large keypad, the program icon itself, and all the credits pages. (Hint: Ernest Rutherford was one of the great pioneers in nuclear physics, having discovered radioactivity.)
- The Graphing Calculator is Macintosh Drag-and-Drop savvy; you can drag graphs right onto the desktop, where they become PICT files. What's really neat is that they carry their equations with them, behind the scenes; dragging a graph back into the calculator restores its equation as well.
- There's a secret benchmark mode that you can use to test your Mac's speed. Enter a graphable equation with an `n` in it, such as $r <<< n$. Control-click the Play button, and the calculator will time a cycle of the slider and report the number of seconds required to graph the cycle. (The time will appear just below the equation.)

The "standard" test for timing a Power Mac using the Calculator is to use the last equation in the Inequalities demo (press the Tab key repeatedly to advance more quickly through various demo graphs, and then click the Stop button when an inequality containing an `n` is shown). For the standard benchmark to test a machine's speed, delete the Calculator preferences file, run the calculator on a Mac with a 640-by-480 screen, display or type in that final inequality, and Control-click the slider Play button.

- The calculator has an "on-screen graphing mode," that allows you to watch it draw the graphs step by step. To activate it, press the Space bar to erase any displayed graph, and then Control-click the Graph button. It's kind of cool to watch the 3-D surfaces draw. Better yet, when this on-screen drawing mode is activated, copying a graph copies it as a drawing — not as a bitmap — so it can be printed at full resolution.
- The Calculator can be used as an equation editor with standard word processors. Just paste an equation picture into one of many word processors (ClarisWorks, WordPerfect, MacWrite Pro, and so on), either double-click or \mathcal{A} -double-click the equation, and the calculator will be launched and the equation entered for editing. When the calculator window is closed, the edited equation is automatically returned to the word processor!

This soon-to-be-released platform — originally called CHRP (Common Hardware Reference Platform — now known as the PowerPC Platform, or PPCP) — will have the same PowerPC and PCI-slot technology used in the Power Macs. On a PPCP machine, you'll be able to run multiple operating systems simultaneously and switch between them as the need arises.

IBM expects to release the first PPCP-based computers in 1997. Their arrival — and further development of the PowerPC — will represent another landmark step in the continual evolution of the Mac.

