

The
BeOS

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Peachpit Press

The BeOS Bible

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As if it weren't difficult enough to continue improving and updating an operating system, Be has the added responsibility of keeping up with the ever-changing hardware world. No matter how amazing the OS technology itself is, it doesn't mean jack if it won't work with the hardware you already own or are considering purchasing.

Because the hardware world changes so rapidly, and because this book will be on shelves for a long time to come, we'll try not to date ourselves by speaking too specifically about particular pieces of hardware, and address the issue in more general terms instead.

General Notes

For an OS vendor, hardware support boils down to two basic challenges:

- Understanding and building in code to support computers themselves: motherboards, chipsets, and I/O ports.
- Staying on top of and writing drivers for the vast array of video cards, sound cards, printers, modems, pointing devices, and other peripherals on the market.

As you know, Be is a small company just beginning to find major traction in the computer industry. At a certain point of critical mass, vendors come crawling to operating system vendors, begging to help make sure their hardware is recognized and works properly on that system. Prior to that critical mass point, however, the onus of creating drivers rests on the shoulders of the OS vendors and independent developers. Because hardware companies are often reluctant to release the specifications needed by developers who want to build drivers, and because building drivers is no walk in the woods, Be has their work cut out for them. No one knows better than Be the importance of having as many hardware drivers as possible available to their customers.

At this writing, Be is beginning to gain the support of third-party hardware vendors, who are giving their own time and energy to driver development efforts. It probably won't be long before the floppy disk that ships with a peripheral or I/O card you've just purchased includes BeOS drivers, right there alongside those for other operating systems.



This chapter absolutely does not and cannot represent the final word on hardware support in BeOS. If you want to make sure that hardware you're considering is BeOS-compatible, there's only one place to turn for the official word: Be's Web site. You'll find a complete and up-to-date roster of supported hardware in the "Hardware Ready Lists" at www.be.com/products/beosreadylist.html.

Always, always, always, check the Hardware Ready Lists before committing to hardware purchases.



Be-ing Heard If you want your favorite hardware manufacturer to ship BeOS drivers along with their products, don't just sit there waiting—tell them! Hardware companies make decisions almost exclusively on numbers alone, and until they hear from enough users that there's a potential market for them in BeOS land, we'll sit around twiddling our thumbs. If you have a choice between two products and one supports BeOS while the other doesn't, let the vendor of the one that doesn't know that they lost you as a customer because of their failure to support the world's most technologically advanced operating system. Even if you only get a form letter in response, these numbers are counted. If you intend to write to vendors, keep it short, succinct, and polite. You want to foster respect both for the BeOS community and for the operating system. If a vendor has a form or poll on their site asking which operating system the public wants to see them support, don't be tempted to "stuff" the ballot boxes—this not only leaves the vendor with unusable data, but casts the BeOS community in a poor light.

Machines

When considering a BeOS-capable machine, don't worry about the name on the case. In the PC world, machine vendors are seldom more than assemblers of other vendors' components. Before plunking your money down, you need to know what's inside. If a vendor can't tell you exactly what motherboard and chipset are in the machine and what make and model of video card is installed, talk to another manufacturer.

If you're contemplating buying a new machine and want to make things easy on yourself, there are a number of vendors who build complete machines guaranteed to be BeOS-compatible, or even with BeOS pre-installed! You'll find a complete list of BeOS-savvy hardware vendors at www.be.com/resellers/. The author has had exceptionally good experiences (in all operating systems) with machines purchased from United Micro International. Be has a nickname for these computers: "Ming Specials," so called because Be engineer Ming Low assembled so many of the early x86 machines for Be from UMI parts that the two companies established a

Laptops and BeOS

So who isn't dying to get BeOS running on a laptop? While there are various and sundry scattered reports of people installing and running BeOS on laptops, this capability isn't officially supported in R4. If you are able to get BeOS installed on a laptop, don't expect to get much battery life out of it, as BeOS R4 lacks any kind of power-management functionality. In addition, you won't be able to use any PCMCIA devices (PC Cards) until drivers are written to support them. Expect all of this to change drastically in R5, when laptop support should go into full swing. Until then, if your laptop uses the NeoMagic video chipset, you just may be in luck, as NeoMagic drivers already ship with the system. In addition, make sure your laptop has an ATAPI CD-ROM drive—many laptops use funky CD interfaces that require special drivers. Same goes for the floppy drive—make sure its interface is standard, not proprietary. Note, however, that some detachable laptop floppy drives connect to the parallel port; as long as it's handled by the machine's standard floppy controller (and many are), you should be fine with one of these. You may be able to enjoy network connectivity with a PCMCIA-based NE2000 card via a PCMCIA driver you should find in the `optional/experimental` directory on your R4 installation CD. This driver, ported to BeOS from Linux, should make it into official distribution in the near future. In general, the fewer proprietary components there are on-deck, the better your chances. Expect official laptop support to expand for R5.

friendly relationship. You'll find current pricing on the "Ming Specials" at www.be.com/support/guides/ming-specials.html.

x86 Hardware Considerations

All PCs are not created equal. Subtle differences in the name printed on a chip, for example, can have a huge impact on a machine's performance. If you want maximum performance out of the maximum operating system, do some research before you shop. This book, Be's Web site, and a variety of online resources can help you go into the market armed with the right information. One of the best overall hardware PC information resources is Tom's Hardware Guide, at www.tomshardware.com. Another site worth watching is AnandTech, at www.anandtech.com. Both sites have produced limited BeOS coverage in the past, though pure hardware—not operating systems—is their focus. Finally, don't forget to have a look at BeFunk (www.befunk.com), which maintains a database of hardware that BeOS users have been able to get up and running. BeFunk's list is larger than Be's Hardware Ready List because it chronicles unsupported as well as supported hardware.

Motherboards and CPUs BeOS runs only on relatively modern hardware—you'll probably never see a 486-compatible version of BeOS, so don't bother trying to get it running on those older machines. BeOS is an

operating system unconcerned with the past. Yes, it's efficient, but that efficiency will really only shine when the OS is given room to breathe. When it comes to tossing around huge media files and playing full-screen video, no operating system can compensate for hardware-imposed limitations such as a slow system bus.

As described elsewhere in this book, BeOS uses multiple processors with incredible efficiency. If you'll be running BeOS most of the time, you'll get more bang for your buck by getting two (or more) older processors than by installing one superfast CPU. Last year's 266 MHz CPUs will always be dirt cheap compared to today's 450 MHz CPU. Thus, when running BeOS, you could have 532 MHz for less than the cost of a single 450 MHz processor. The catch is that if you'll be dual-booting into operating systems that won't recognize a second CPU (such as Windows 95/98), you'll end up with half of your processor speed being wasted until you reboot into BeOS. Chance are that once you start using BeOS regularly, you won't want to use anything else, and you won't regret buying a multiprocessor machine.

BeOS works with most—but not all—Pentium-compatible CPUs from alternative vendors such as AMD and Cyrix. Again, check Be's hardware compatibility lists for specifics. However—and this may be a big “however” depending on your needs—it is not possible to run non-Intel CPUs in multiprocessor configurations. The problem is that the SMP spec written by and implemented by Intel is different than the SMP spec written by companies such as AMD and Cyrix. Support for multiple processors has to be present in the motherboard's chipset as well as in the operating system. Since virtually no one is creating chipsets that work with AMD or Cyrix processors in SMP configurations, this one is pretty much out of Be's hands.

Bus Speeds One of the most critical (and most under-rated) aspects of computer hardware is its “bus speed.” This term refers to the width of the path your data follows as it's shunted around between various components in the system: from CPU to RAM to I/O cards and out to your monitor or other output device. Bus speed is expressed in MHz (megahertz), where 1 MHz is equal to 1,000 cycles per second. Unfortunately, the importance of bus speed is too often overlooked by consumers. Don't be fooled—the difference between the older 66 MHz bus and the newer 100 MHz bus is tremendous. Even if a difference of 33MHz in processor speed would barely make a noticeable difference, the performance repercussions for a bus that's ½ wider are, according to one Be engineer, “mind-blowing.”

So how can you tell the difference? At this writing, the easiest way to tell bus speeds apart is by paying attention to the model of the motherboard's chipset. The LX chipset is found on 66 MHz motherboards, while 100 MHz motherboards will use the BX chipset. Of course, the BX version will cost

you more, but you probably won't regret the extra expense.



As this book was going to press, Be had just announced support for Intel's new 400 MHz Xeon processors running in a *quad*-CPU configuration on the NX chipset (the NX chipset is an accelerator for the BX bus, and offers a 64-bit data path between CPU cache and main memory). It was too early to get any performance details, but I'm sure you can visualize BeOS positively *rocking* with 1600 MHz of barn-burning horsepower at its disposal. If cost is no object and your need for speed goes way beyond the desire to simply have a snappy system, your path is clear. Just be sure to invest in a good cooling system while you're at it (liquid nitrogen, anyone?).

To make matters a little more complex, motherboards have separate buses for their I/O card slots: an ISA bus for older components and a PCI bus for newer components. Since ISA cards aren't capable of high throughput anyway, you don't need to worry about that one. The PCI bus can be set to run either synchronously or asynchronously. The vast majority of PCs are set up with a synchronous PCI bus. In this configuration, the PCI bus always runs at half the speed of the memory bus. If the memory bus runs at 66 MHz, the PCI bus will run at half that, or 33 MHz. In an asynchronous setup, the speed of the PCI bus can be controlled by changing jumpers on the motherboard or settings in the BIOS in a process known as "overclocking" (see the sidebar *Notes on Overclocking*). Finally, the PCI bus specification 2.1 calls for expandability of the PCI bus to 66 MHz. In theory, this would quadruple the speed of the PCI bus. In practice, implementations of the 66 MHz PCI bus are very rare.

Notes on Overclocking

Serious hardware jocks know that it's possible to make adjustments to system bus and CPU speeds, either by tinkering with motherboard and BIOS settings or by physically modifying motherboards and/or chips. While these techniques—known as "overclocking"—do make it possible to eke more performance out of some systems in some cases, the practice is discouraged by Be and by this book. There are serious performance and reliability issues associated with overclocking. Unfortunately, it's not always as simple as saying "it either works or it doesn't." Strangely, overclocked systems can *seem* to work fine, but the operating system and/or your applications may yield bizarre results that are indistinguishable from standard crashes and bug-giness. This makes it impossible for Be or application vendors to support you if you should run into problems. If you overclock your system, you void your hardware warranty and forfeit all rights to technical support.

Because systems become cheaper by the month and because BeOS is already so efficient, it's difficult to justify taking these risks for a few extra megahertz that, in actuality, you probably won't even notice most of the time. The official recommendation from *The BeOS Bible* is: Don't do it.



If you're assembling your own machine and purchase a 100 MHz motherboard, it's critical that you also install system RAM that's capable of working at these higher speeds. The Intel-developed specification for this type of memory is called "PC-100." Make sure you specify PC-100 RAM when building a fast-bus machine.

USB and FireWire As described in online chapter, *The Future*, both Universal Serial Bus (USB) and FireWire are scheduled for support in BeOS R5. In fact, limited USB support is already present in R4. Complete support isn't present in R4 for the simple reason that the USB specification is allegedly "a huge, sprawling beast" and will take a good deal of engineering effort to support fully.

R4 contains no support for FireWire, but this ultrafast digital media throughput channel obviously represents a marriage made in heaven for the MediaOS, so you can expect to see most or all of the FireWire spec supported in R5.

In fact, Be's CEO has recently been waxing enthusiastic in broad daylight over the recent appearance of consumer PCs with USB and FireWire ports built right into the front of the case. A/V inputs on the front of the machine mean it will be a snap to jack in your DV camera without fumbling around behind your machine (and without rebooting, remember!).

To Be, this kind of positioning indicates that the industry is as excited about the prospects of consumer media editing as they are.

See online chapter, *The Future*, for more on the difference between USB and FireWire.

CD-ROM and DVD Drives There's only one important acronym to keep in mind when adding a CD-ROM or DVD (Digital Versatile Disc) drive to a BeOS machine: ATAPI. Short for "AT Attachment Packet Interface," this standard was designed as a (mostly successful) attempt to reduce the amount of chaos involved in creating drivers for CD-ROM drives in the PC universe. Fortunately, most CD-ROM and DVD drives made today are ATAPI-compliant, which means that they "just work" with BeOS. It pays to make absolutely sure a given player is ATAPI-compatible before buying; if a CD-ROM or DVD drive requires proprietary drivers of some kind, you may be out of luck getting it to work with BeOS.



As of R4, BeOS is also capable of recognizing, booting from, and installing from SCSI CD-ROM drives on the Intel side. BeOS has always included SCSI support for PowerPC machines. Read more on SCSI later in the *I/O Cards* section of this chapter.

Notes on DVD Recognizing a DVD drive and reading the disks that are made for it are two different things. Since DVD drives are compatible with standard CD-ROM discs, you'll have no problem reading your old CDs with your DVD drive. However, DVD disks are pressed with a unique filesystem

known as UDF, and as of R4.0, a UDF filesystem add-on for BeOS was not yet available. Expect to see UDF support in the near future. Additionally, some DVD players come with special I/O cards that can be used to pass, say, DVD movies on to your home entertainment system. BeOS drivers for these cards is an additional support item on the agenda. Given BeOS's media goals, these items will likely be a priority for Be.



If you're running R3, you may experience some difficulty getting the system to recognize your CD-ROM drive if there are "holes" in the IDE chain. In other words, CD-ROMs need to be situated on the IDE chain right next to other drives. Since the IDE bus supports four drives, you can't, for example, have your only internal hard disk situated at position 0 and your CD-ROM at position 3. Moving the CD-ROM to position 1 on this chain usually clears up this problem. However, the best solution is to upgrade your system to R4, which is exempt from this gotcha.

BeOS R4 should also include support for writeable CD-ROM devices, though we weren't able to test this support in time for publication. Search www.be.com for details.

Ultra DMA IDE As of R4, BeOS includes full support for the Ultra DMA specification, which effectively doubles burst-mode transfer rates for IDE hard drives for a maximum throughput of 33 Mbps (megabits per second). For systems that do not include an Ultra DMA controller, Promise technologies (www.promise.com) makes an Ultra DMA card that you can add to your system to support Ultra DMA disks. BeOS should be supporting at least some of the Promise cards by R4.1.

Macs *PowerPC coverage by Henry Bortman*

Although Be is now focusing its efforts on PCs, the first platform to which the BeOS was ported was PowerPC-based Macs and Mac clones. In fact, the first mass-market machine on which BeOS ran was from Power Computing. The response from Mac users to BeOS was overwhelmingly positive. During the second half of '96, Be worked closely with Apple and with Mac clone vendors to ensure that BeOS could run on then-shipping Mac desktop systems. In fact, most Apple-watchers expected Apple to obtain BeOS as the basis for its next-generation operating system.

But at the end of 1996, Apple shocked its followers by announcing that it had decided to purchase Steve Jobs' company, NeXT, and that it would use NeXT's OpenStep as the basis for the Mac's future OS. Although Apple subsequently abandoned its plan to build its new OS around OpenStep, its purchase of NeXT, and Steve Jobs' installation as Apple's interim CEO, signaled a major change in company strategy, a change that had profound implications for Be.

Shortly after Jobs took the reins, Apple not only shut the door on its licensees, ending the Mac clone era; it also shut the door on Be, refusing to give Be any further information about its hardware designs. As a result, Be has been unable to bring BeOS to any of Apple's G3-based Mac models, including Power Mac G3s, PowerBook G3s, and the iMac. In case the point eluded you, this constitutes Apple's entire line of currently shipping Macs.

Has Apple effectively obsoleted the Mac as a platform for BeOS? Hopefully not. Be intends to continue supporting whatever Mac models it can, at least through R5 and, if customer demand warrants, beyond. Be also hopes to find a way to get the information and technical support it needs to be able to support G3s and future Macs. Unfortunately, at present, it has no reliable way of doing so.

Supported Machines There are three factors that can help you quickly determine whether or not your MacOS system (Apple Mac or clone) is BeOS-compatible:

- **Processor:** BeOS supports only systems originally designed around PowerPC 603 and 604 processors. It does not support 601- or (as mentioned above) G3-based systems.
- **Peripheral Bus:** BeOS will run only on MacOS systems with a PCI bus. It will not run on NuBus-based systems. (Thus, the Power Mac 61/71/8100 series and Power Computing's original models, the Power 100 and 120, for example, are not supported.)
- **Desktop or Portable:** BeOS supports only desktop MacOS systems. No PowerBooks can run BeOS.

Note, however, that even if your system meets these criteria, it is not guaranteed to be BeOS-friendly. For a detailed list of which MacOS systems are (and are not) supported, check the BeOS Web site at www.be.com/support/guides/beosreadylist_ppc.html.

Processor Upgrade Cards Although BeOS cannot support PowerMac G3s, it *can* support systems that have been upgraded with a G3 processor upgrade card, such as Newer Technology's MAXpowr G3 cards. The key factor in determining a system's compatibility is not its processor per se, but rather its logic-board design, particularly its I/O chipsets. When you upgrade a supported system with a G3 processor card, you're not changing chipsets, so it still works.

On the other hand, putting a PowerPC 604 processor upgrade card in an unsupported MacOS system originally designed around a 601 chip leaves you with a faster system for running the MacOS, but still doesn't let you to run the BeOS.

Multiple Processor Cards Apple's clone era was also an era of multi-processor systems. DayStar, UMAX, and Apple itself all shipped MacOS systems containing two processors. DayStar also shipped a four-processor model. BeOS will run—and run exquisitely—on these multiproc systems. In addition, if you upgrade a supported system with a dual-processor card that plugs into a processor-upgrade slot and replaces the original processor, it should work. UMAX S900 systems have an additional proprietary processor slot that allows you to plug in a second processor along with the system's main processor; BeOS supports these configurations as well.

Some multiprocessor upgrade cards, however, plug into a PCI slot rather than into a processor-upgrade slot. Total Impact's TotalPower G3 and TotalPower MP cards are examples. Custom code is required to enable software to run on these cards, and BeOS doesn't fit the bill.

Graphics Adapters BeOS supports the graphics adapters built into all supported MacOS systems. This means that if a system shipped with a built-in graphics chipset, it will work and BeOS will be able to take advantage of any 2D graphics acceleration capability that the chipset offers.

In addition, BeOS will work with most PCI graphics adapter cards. Most users who have these cards, however, are primarily interested in their acceleration capabilities. BeOS supports 2D acceleration on the following cards: ATI Mac 64/Xclaim GA; IXMicro (formerly IMS) TwinTurbo 128M2, 128M4 and 128M8; Matrox Millennium and Millennium II.

3D acceleration is not supported.

Monitors Be strongly recommends that you use a multisync monitor with BeOS. Most monitors produced in the last few years are multisync, though there are still a few older fixed-frequency monitors kicking around (see *Fixed-Frequency Monitors*, later in this chapter. If the only monitor you have available is fixed-frequency, make sure to click the Fixed-Frequency Monitor checkbox in the BeOS Chooser dialog. (If you use the BeOS Launcher instead, hold down the Command key after you start the application, and select Multi-Frequency from the dialog that appears.) This will disable graphics acceleration and you won't be able to change your monitor's bit depth, resolution or refresh rate—but it should work.

BeOS does not currently support the use of multiple monitors. It's OK to have more than one monitor attached to your MacOS system when you're running BeOS, but the OS will only use the primary monitor.

SCSI Adapter Cards BeOS fully supports SCSI devices attached to your MacOS system's built-in SCSI buses. On models that have two SCSI buses, this includes both internal and external buses. Unfortunately, however, there is no support for high-performance SCSI PCI cards on the Mac. There's no

conflict in having these cards installed when you run BeOS, but the OS won't be able to see any devices attached to them.

USB and FireWire Adapter Cards USB and FireWire PCI cards are not supported by BeOS running on MacOS systems.

Hard Disk, CD-ROM, and DVD-ROM Drives Both SCSI and ATAPI (IDE) hard-disk drives are supported by BeOS. The same goes for CD-ROM drives. Some older drive mechanisms may cause problems, but any hard-disk or CD-ROM drive mechanism shipped as standard equipment on a supported MacOS system should work.

DVD-ROM drives, however, are not supported.



Some users have reported a conflict between the Apple CD-ROM Drive extension and the BeOS Chooser extension. You'll know you've encountered this problem if CDs stop showing up on your Mac Desktop just after you install BeOS. If this occurs, try using an extension manager, or renaming the CD-ROM driver so that it loads *before* the BeOS Chooser extension. If that doesn't work, disable the BeOS Chooser extension and use the BeOS Launcher to start BeOS.

Two-Button Mice Be has confirmed that Kensington two- and four-button mice work without problems with BeOS. Multi-button mice from Mouse Systems and Logitech have been less reliable.

Note that by using the keyboard in conjunction with a single-button mouse, you can simulate the action of the right button and middle buttons on a multi-button mouse. Control+ Command+ click simulates the right button; Control+ Option+ click simulates the middle button.

Other Stuff Be has heard from users who have had problems with an assortment of other hardware devices, such as the Visioneer PaperPort SCSI adapter and Apple's 1710 AV monitor. But no list of hardware glitches can ever cover every possible situation.

If you encounter problems, check Be's Web site to see if there is any recent information that covers your particular situation. If you come up empty-handed there, fall back on basic troubleshooting techniques (Chapter 22). Disconnect everything that you think could possibly be causing a problem, then try bringing up BeOS. You might also want to hold down the Shift key while booting MacOS to disable extensions, and then start BeOS from the BeOS Launcher (rather than booting BeOS from the BeOS Chooser extension during the Mac's startup process). This eliminates any possible conflict between the BeOS Chooser extension and other extensions in your System Folder.

Once you get the BeOS to boot with a minimum configuration, reattach devices one at a time until you find the culprit. Sure, it's tedious, but it may

be the only way to isolate the problem. And, incidentally, once you do find the offending device, let Be know about it, so that they can warn other folks and, hopefully, fix the problem. You can access Be's online customer support form at www.be.com/support/assist/custsupport.html.

Input/Output Cards

The realm of I/O (input/output) cards is both tricky and critical for Be. Market forces are just about the only thing that prevents the PC hardware universe from devolving into an absolute chaos of incompatibility. Nearly every single card ever made requires its own driver, and these drivers need to be compiled for each operating system the card is to work with. Fortunately, driver development became much simpler with the release of new APIs in BeOS R4, which means that drivers for new cards should begin to appear more quickly, as developers won't be quite as dependent on Be's limited resources and the task will be less mysterious.

In one sense, video, sound, and network cards fall into the same general bracket: All three are items that users frequently upgrade themselves, all three require very specific drivers in order to operate properly, and all three require careful compatibility checks with Be's hardware ready list. For cards that are supported, all three are in general much easier to get working with BeOS than they are under Windows or Linux. BeOS has very intelligent mechanisms for assigning IRQs and memory addresses, and conflicts are rare.

Getting I/O Cards Up and Running

As described in Chapter 16, *Troubleshooting*, there are a few steps you can take to make sure your cards are properly recognized by BeOS. If you can find an option in your system's BIOS labeled "Plug-and-Play OS," disable it. If that doesn't work, check to see if any of your I/O cards are set to use PnP, and disable it for those cards as necessary.

Once you've disabled Plug-and-Play, you may need to allocate IRQs to your cards manually (IRQs, or interrupt request queues, are discussed in Chapter 16, *Troubleshooting*). While PCI cards are able to share IRQs, you should try whenever possible to reduce the number of IRQs being shared. ISA cards, on the other hand, cannot share IRQs. If you have any ISA cards in your machine, you'll need to take special care to make sure each of them has an IRQ all to itself. In some cases, you may need to use the Device preferences panel to inform BeOS about the actual addresses or resources being used by various cards. See Chapter 10, *Preferences*, for details on the Devices preferences panel. When buying new hardware, try whenever possible to avoid ISA cards—they have much slower throughput capabilities and are more difficult to configure than their PCI cousins.

Notes on Installing Cards

When removing or installing I/O cards, always unplug your machine completely. After removing the cover, touch your hands to any piece of bare chassis to discharge any static electricity. While modern silicon is much less sensitive to static than it used to be, why tempt fate? It wasn't so long ago that you could completely ruin a memory module by handling it wrong. Don't force cards into slots—it's essential that the gold or silver contacts at the card's bottom edge not be damaged. Insert the card at one end of its slot and rock it gently back and forth until it slides comfortably into position. If your chassis is slightly misaligned and a card can't be seated completely without forcing it, it can sometimes be useful to *carefully* re-bend the card's metal backplate (*not* the card body itself!) until it fits over the chassis' mounting bracket properly. If you have cards that demonstrate intermittent problems, or that start working and then stop, suspect a mis-seated card—remove all of your cards one by one and replace them, making sure they're situated all the way into their slots. In rare instances, it can be useful to move a card from one slot to another.

Video Cards

More than any single card in your system, it's critical that your video card be fully supported—because the application server (the `app_server`) depends completely on being able to communicate with a supported video card, BeOS won't boot without it. However, almost every video card in existence includes support for a low-resolution “Super VGA” mode, which requires little technical wizardry to get working. BeOS includes a generic SVGA driver (also called a “stub” driver), which will go into effect automatically any time a genuine driver for your installed card is not found. You'll know this has happened if



Figure 1

If BeOS appears in grayscale and displays this message in NetPositive, you'll know that the system wasn't able to locate a driver for your video card.

BeOS appears in grayscale and you see a message like the one in Figure 1 displayed in NetPositive.

Picking the right video card for BeOS depends a great deal on what you intend to do with the system. If you use BeOS primarily as a general-purpose operating system, spending most of your time working in productivity applications, building Web pages, and experimenting with 2D graphics, chances are you'll be more than happy with an inexpensive but high-quality card from a manufacturer like Matrox. Remember: All video drivers written by Be support 2D hardware acceleration automatically. If, on the other hand, you expect to spend a lot of time in 3D environments,

you have more choices to make. Full-screen gaming, for example, requires extremely fast manipulation of a relatively small number of polygons. 3D rendering and CAD applications, on the other hand, don't need to send your rocketship screaming down textured hallways—they need to render zillions of tiny polygons at once for fine-grained accuracy and detail, but they don't need to move around as quickly as do the graphics in a game like Quake. Study up on graphics cards and make your decision based on the kind of work you do, not on what the first person you talk to tells you is today's hottest card.

In my personal opinion, too many people spend too much time obsessing about the nuances of video cards when they would be perfectly happy with a \$50 Matrox. Really. The so-called “middle ground” cards are capable of performance that *far* exceeds most people's needs.



On Hardware Acceleration and OpenGL All of the video drivers developed by Be offer some level of support for 2D hardware acceleration. As support for 3D acceleration rolls out, it will be in the form of the OpenGL specification, at which point updated drivers for OpenGL cards should be made available as downloads and in future distributions of the operating system. The mere fact that a given video card supports the OpenGL specification does not necessarily mean that you'll get OpenGL acceleration, since this is a separate aspect of writing video drivers. An OpenGL-compatible video card will, however, still function as a normal video card given the appropriate video driver.

If you're way serious about video performance, you'll want to check in with the new (at this writing) AGP, or Accelerated Graphics Port, cards. These require a dedicated AGP slot on the motherboard, as they transcend PCI's throughput capabilities. The AGP slot essentially gives the graphics controller direct access to the system's main memory (which is important because AGP stores 3D textures in the system, rather than in video memory). The 32-bit AGP bus runs at 66 MHz, for a graphics throughput ceiling of 266 megabits/second (and optional, faster modes running at 533 Mbps or 1.07 Gbps).

Video Capture/Tuner Cards

In keeping with the goals of the MediaOS, there are a number of video capture and TV tuner cards available that work well in BeOS. One of the least expensive ways to get yourself set up to watch signal from your television, VCR, or video camera on your monitor is the Hauppauge (pronounced “hop-pog”) WinTV card, which uses the popular bt848 chipset (or variant thereof) and has had BeOS drivers for a long time now. Be's Steve Sakoman maintains an independent site at www.sakoman.com where you can go to find the latest

updates to his suite of BeOS video capture and playback utilities that work with WinTV and other cards. See Chapter 15, *Media Applications*, for more on working with these tools, which use the BDirectWindow API (see Chapter 2, *Meet the System*) to send video data straight to the heart of the video card for awesome performance.

Sound Cards

As with video cards, a sound card should be chosen with an eye, er, ear to the kind of work you'll be doing with it. For most of us, the middle-ground cards from Creative Labs will more than suffice for playing audio CDs and MPEG files, sound-mixing experiments, Internet audio, and the like. If, on the other hand, you intend to use BeOS as a full-on multitrack mixing station, you'll want to spring for one of the high-end, full-duplex models supported by BeOS. Again, do your research online and make your choice accordingly, but don't be snowed by "geek pressure" into buying more card than you need. Remember that BeOS's native efficiency will draw more performance out of your hardware than you'll get under other operating systems!

When looking for a sound card a cut above the average, make sure you find one marked "full duplex." This essentially means that the card will be capable of handling incoming and outgoing audio streams simultaneously. While most half-duplex cards can "fake" full-duplex functionality given the right driver support, there's no substitute for doing it right in the hardware itself. Get a full-duplex card if you're serious about multitrack audio mixing and will need high-quality audio while running devices into your audio card and getting audio signal back out simultaneously.



On Sound Card Latencies As described in online chapter, *The Kits*, BeOS is marvelously efficient at addressing sound cards with minimal latency. In other words, audio applications can talk to audio hardware with less lag time than is possible with the same card running in the same machine under a different operating system. While latencies of 25 milliseconds are not uncommon under MacOS and that number can go as high as 30 ms under Windows, BeOS can talk to identical hardware with around 6 ms latency. Not only that, but Be engineers have indicated that there's still room for improvement in this area, and that future versions of the system may get this latency down to around 1 or 2 ms, if current laboratory tests hold up in the real world.

Clearly, these kinds of numbers make sound card manufacturers very excited, which could mean some very good things for BeOS sound card driver development in the future.

Network Cards

Again, people will argue ad nauseum about the nuanced merits and demerits of various network cards, but for 99% of us the matter is simple: Either it works under BeOS or it doesn't, and it runs either at 10 Mbps or at 100 Mbps (see Chapter 11, *Networking*). We've heard almost universal success stories about generic PCI NE2000 cards. The NE2000 specification is so common that it's supported by every operating system under the sun, and PCI means BeOS will have a much easier time allocating resources to it without your intervention.

Many network cards use common chipsets, so be sure to use the name printed on the chips themselves when checking against Be's Hardware Ready List for compatibility—just because you don't find your particular brand of card, it doesn't necessarily mean your card won't work under BeOS.

SCSI Cards

As of R4, BeOS brings long-awaited support of SCSI (Small Computer System Interface, pronounced "scuzzy") devices to BeOS/x86 (SCSI has always been supported on the PowerPC side), allowing owners of the industry's most common SCSI adapters to use internal and external hard drives, removable cartridges, and peripherals such as scanners. As of R4.0, cards from Adaptec, Symbios, and BusLogic were supported. Others may follow in the future.

Because BeOS is capable of both reading from and writing to the MacOS and Windows filesystems (and Linux with the freely available ext2 filesystem add-on), you should be able to plug your SCSI Zip, Jaz, or external drive enclosures in and enjoy instant access to all of your old system backups, image and movie libraries, or what have you. You can monitor the status and configuration of SCSI devices attached to your system via the SCSI Probe utility in your Applications folder. SCSI support in BeOS isn't limited to "secondary" devices, either—BeOS is fully capable of booting from SCSI devices as well.

While SCSI has a longstanding reputation of being far faster than IDE, the rapid progress of IDE's throughput capabilities, combined with BeOS's radically efficient and multithreaded filesystem, has greatly narrowed the performance gap between the two. In fact, more than one Be engineer has claimed that some IDE setups actually offer *better* performance than some SCSI setups when it comes to the kinds of tasks BeOS does best: tossing around large media files, synchronizing audio and video tracks, and the like. Nevertheless, SCSI still has its advantages, such as the ability to hang up to seven devices from a single adapter. In addition, SCSI drives are often manufactured to higher standards than are IDE drives, which means a longer MTBF (mean time between failure).

The jury may still be out on SCSI versus IDE in BeOS, but one thing is certain: Don't think you can't do high-throughput digital audio/video editing with IDE drives—you absolutely can. Remember: BeOS is designed to bring high-end workstation performance to consumer-level machines.



Using your scanner with BeOS requires additional drivers and/or software. At this writing, none was available for testing, though we understand that at least one party is hard at work in this field and you may see scanner support for a few popular models by the time you read this.

Search BeWare for “SCSI” and you'll find a handful of software that can be used for saving data to SCSI tape devices.

Internal Modems

Fortunately, internal modems do not require additional drivers—as long as your motherboard's COM ports are properly recognized by BeOS (and they should be), there's no reason you should have any difficulty getting an internal modem to work with BeOS. As of R4, BeOS only supports modems on COM3 or COM4.

Some modems ship with additional software that lets you control advanced features of the modem, such as telephone answering, X2 or Flex 56K support, or fax capabilities. While these modems will work fine as basic modems, don't expect to be able to take advantage of the card's advanced features in BeOS until the manufacturer or a third party builds BeOS-specific software to take advantage of them.

No WinModems As described in Chapter 4, *Get Online Fast*, software-based modems do not work with BeOS because they achieve their functionality by emulating true modem hardware in software. WinModems, as their name implies, work only under Windows (and only Windows 95/98 at that), and are a bad idea in general because they suck up CPU cycles and are unfriendly to alternative operating systems. The same applies to GeoPort software modems for the Macintosh.

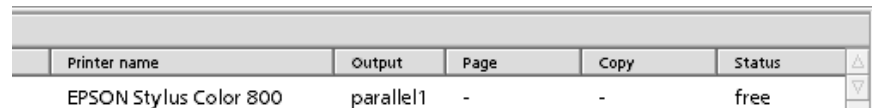
Peripherals

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BeOS doesn't recognize every peripheral device in existence, but it does a handsome job with a wide variety of the most common external devices. Some of the peripherals listed in this section require additional drivers, while others do not.

Printers

BeOS is fully aware of the standard (LPT) printer ports on PC hardware, and includes support for the Hewlett-Packard LaserJet and Apple LaserWriter printer families. Printers are set up and configured via the now-unified Printers preferences panel (previous to R4, this panel was split into AddPrinter and SelectPrinter). In addition to the natively supported printers you'll find in this panel, a variety of additional drivers have been created by third parties and are available on BeWare. Notably, the Epson printer driver offers an exceptional configuration interface and makes great use of attributes in the Be filesystem to help you monitor your printer queue.



Printer name	Output	Page	Copy	Status
EPSON Stylus Color 800	parallel1	-	-	free

Figure 2

The third-party driver for Epson color and grayscale printers uses BFS attributes to log print jobs, so you can use the Tracker itself to monitor your print queue.

If your system includes the faster ECP parallel port, you'll find it natively supported in R4. In addition, R4 also includes a new Print Preview option. If you'd like to see how your documents will appear on the printer without wasting paper, select Print Preview in the Printer preferences panel, then print normally from your application. Once the print job has been rendered, it will appear in a window you can use to evaluate your document's layout, margins, pagination, and other considerations before sending it off to the real printer. You can even use the Print Preview window's magnification options to zoom in or out on your document.

Monitors

Monitor support is not really an issue for BeOS—all Be has to do is support your video card, and the monitor comes along for the ride. Any multisync monitor that you have around should work fine with BeOS, though of course the usual quality caveats apply for monitors in general. When purchasing a new monitor, don't buy on specifications alone. If at all possible, make sure you can see in the store the actual monitor you'll be taking home. It's not enough to see a demo unit on the showroom floor and then take home one "just like it" in a sealed box, because individual units can vary widely from one to the next. Don't settle for a dot pitch of higher than .26, and go for the highest refresh rate you can afford. Don't even consider a monitor smaller than 17 inches.

Your monitor is your primary interface with your computer, and you interact with it all day, every day. In my opinion, the monitor is not a place to skimp just to save a few bucks. As with system memory, extra money spent on a good monitor is paid back to you every single moment your computer is turned on, not just when doing intensive tasks.

Multiple Monitors Support for multiple monitors is an important feature for many BeOS users, and it's important for Be as well. At this writing, multiple-monitor support was scheduled to make its appearance in R5, though this does not constitute a promise or guarantee. Because of the multiple-workspace capabilities built into BeOS, the question of the best way to implement multiple monitors involves some tricky design decisions. Should each monitor get 32 workspaces all to itself? Should the total number of workspaces be divvied up among the available monitors? Should it be possible for a single window to span more than one monitor or workspace? What happens to such a window if two monitors are set to operate at different resolutions? The answers to these questions are difficult to decide on and even more difficult to implement, but as always, Be is committed to "doing it right." When multiple-monitor support is in place, expect it to be implemented with elegance and logic.

Fixed-Frequency Monitors In contrast to the standard multisync monitor, which is capable of running at a wide variety of resolutions and refresh rates and can be set differently depending on the data being sent to it by the video card, there are also monitors out there that work only at resolution settings built into the monitor itself. These monitors (which are usually but not always antiques) do work with BeOS, but you won't get much performance out of them. This is true for a number of reasons. In order to be used, they need to be clearly identified by the operating system. Monitor identification protocols designed to handle this situation exist, but are not supported by BeOS. Another possible solution would be for BeOS to maintain a huge database of all of the fixed-frequency monitors in existence. Again, BeOS does not include such a database. As a result, when you boot a BeOS machine with a fixed-frequency monitor attached, the video card will simply send the monitor the last resolution information it knew about, which will have come from another operating system on the same machine. When used in this mode, the card will not use any of the acceleration features of the video card, and will instead use the CPU to shunt pixels around. The result is inefficient and possibly ugly. The short version: You probably don't want to use a fixed-frequency monitor with BeOS.

Pen Tablets

At this writing, no pen tablets (pointing devices that use a paper-and-pencil metaphor rather than the traditional mouse or trackball) had available BeOS drivers. However, thanks to the new driver API and Input Server in R4, we expect this to change quite soon. We do know that Be has been assisting third parties interested in pen tablet driver development. Keep your eye on BeWare for updates.

External Modems

Because external modems operate through standard serial ports (labeled as printer or modem ports on the Mac), support for them in BeOS has always been a cinch. Just plug in your modem, select an appropriate serial port in the Dial-Up Networking preferences panel, and you're done. In the case of modems that require separate "programming," use the included software under MacOS or Windows to configure the modem, then tell BeOS that the make and model is Other | Preconfigured Modem. There is no technical reason why such a modem should not work with BeOS. This applies to external ISDN terminal adapters and cable modems as well. You'll also find an option labeled "Generic ISDN TA" in the "Generic AT Commands" submenu of the Dial-Up Networking modem picklist. You may want to experiment with this option if you have throughput or connection difficulties.

Scanners

In the past, almost all scanners worked through the SCSI bus and were relatively expensive. Because most x86 computers don't come with built-in SCSI, users needed to either install a general SCSI adapter on their systems or install a "mini" SCSI adapter bundled with the scanner. Recent years, however, have seen a proliferation of inexpensive (often under \$100!) scanners that work through the parallel port and thus require no add-in hardware.

While R4 already includes internal support for parallel scanners, there were no available drivers or scanner software at this writing. The key to scanner support over SCSI is a function called "SCSI disconnect," which was not supported by any of the SCSI drivers shipping with BeOS R4.0. There were, however, early indications that the PowerPC versions of the BusLogic and Symbios SCSI drivers could gain SCSI disconnect support sooner rather than later.

Keep your radar dish trained on Be's Web site for updates on both fronts.

Blinky Lights

Of all the cool features built into the original BeBox, none was more visible than the twin towers of lime-green LEDs running vertically inside the case's front bezel, dancing in concert with the efforts exerted by the twin PowerPC 603s inside. Since Macs and PCs don't have anything similar, you have to rely on the bundled Pulse application (see Chapter 2, *Meet the System*) to keep track of your CPUs' activity ... unless you purchase a hardware add-on kit from Andreas Kaenner called PulseBox. This little device, consisting of two glass tubes filled with similar LEDs, perches on your desktop and jacks into your computer's free serial port so you can enjoy BeBox-like blinky lights. Order PulseBox online at www.archi-line.de/kaenner/Seiten/PulseBox.html.

3Com PalmPilots

As different as they are from one another, BeOS and PalmOS (the operating system that runs the 3Com PalmPilot) have quite a bit in common. Both are maximally efficient, no-nonsense, unburdened operating systems fine-tuned for their specific goals. Not surprisingly, both operating systems have a "just right" feel about them. Does the connection go deeper than surface appearances? Well, the CEO of Be, Inc. also happens to sit on the board of directors at 3Com, so draw your own conclusions.

Since both BeOS users and PalmPilot users are disproportionately geeky, many of us are champing at the bit to start syncing our Pilots with BeOS desktop software, rather than having to boot into MacOS or Windows to do it. Fortunately, Be has ported the GPL (GNU Public License) Pilot-Link libraries to BeOS, making it relatively easy for BeOS applications to talk to connected Pilot cradles. At this writing, the only GUI BeOS application capable of synchronizing with a Pilot was AbiSoft's DayPlan application (see Chapter 12, *Productivity Applications*).

Joysticks

With R4, BeOS steps up its gaming support with a brand new Joystick preferences panel (Chapter 9, *Preferences*), which operates via the also new Input Method. Users who need more fine-grained control than this panel has to offer can also edit joystick configuration files in `/boot/beos/etc/joysticks` (after creating links to them in `~/config/settings/joysticks`). A wide array of the most common joysticks is supported, and additional ones can be added by creating new configuration files in this location, then editing them to the manufacturer's specifications.

Chapter Summary

- Getting your hardware to work with BeOS is usually a walk in the woods. If your hardware is on the Hardware Ready List and you've got a driver installed for it, it will "just work" 99% of the time. For those rare instances when it doesn't, or when you have a need to specify resources for a given piece of internal hardware, the Device preferences panel can be used to force BeOS to reserve resources for use by that component.
- Up until recently, the task of writing hardware drivers has fallen on Be's shoulders, but the computer industry is beginning to take notice of the many ways in which BeOS can add value to their hardware, and companies are stepping up to the plate to contribute drivers of their own.
- When shopping for hardware for use in a BeOS machine, it's critical to both check Be's Hardware Ready Lists and do some research to find out which I/O card or peripheral is best suited to your needs. Not all video cards are created equal, for example, even though "middle-ground" cards will serve the needs of the majority of us just fine.
- Overclocking is a bad idea—don't do it.
- If you're into serious multimedia and want to make sure that your system bus isn't functioning as a bottleneck to processor speed, make sure you get a motherboard with a 100 MHz bus. These are typically known by the model of the motherboard's chipset—BX, rather than LX or HX. If cost is no object, go for a quad-CPU configuration on the NX bus.
- One processor per person isn't enough.