

# Facing the Future

*Computer hardware is getting a new set of standards.  
Find out how they will affect your future purchases.*



## TECH GLOSSARY

**AGP: Accelerated Graphics Port**  
The current common graphics card standard. Based on the shared PCI bus it replaced, AGP is a dedicated connection to the computer's CPU and memory.

**ATA/IDE: AT Attachment/Integrated Drive Electronics**  
These commonly interchangeable terms represent the standard for mass storage devices, such as hard drives and CD-ROM/DVD drives. Until recently, all ATA devices used a parallel transfer format. New hard drives using the serial version of the standard (SATA) are now common.

**ATX: Advanced Technology Extended**  
A semi-compatible upgrade to the AT form factor first introduced in 1986.

By J.V. Bolkan



The “standard” PC desktop is and always has been a moving target. Although the fear of obsolescence has diminished considerably from the early days of personal computing, it is still true that today’s state-of-the-art system will eventually be too slow, too underpowered, and probably too archaic to warrant repair, or even use. To extend the life of aging computers, most schools, nonprofit organizations, and small businesses have relied on hardware upgrades to gain a few more years of usefulness from their equipment.

Arguably, the availability and relative affordability of upgrade and replacement parts for the PC is one of the primary reasons for its dominant market position. PC parts are available and affordable because virtually all the major components of a PC are based on standards. For example, dozens of manufacturers build motherboards that will work with other companies’ parts. Imagine if cars were based on similar standards—you’d be able to choose the motor you like from one company and it would work fine with a transmission from a different company and both would just plug into the style and body type you chose. After a few years, you could plug in air bags or even a motor that runs on Jell-O, if they become available. If you were so inclined, you could build your own custom car from assorted new parts and save money. Obviously, standards are a huge benefit, yet they do have an equally obvious downside.

### Innovation

What’s hot in the world of PC hardware? Not long ago that question would set your local hardware geek to listing the fastest, greatest, most advanced equipment. Today, you’re likely to get literal answers—the CPU is molten, hard disks are burning, graphics chips are smoking, and the RAM is on fire. Heat and how to deal with it is perhaps the biggest issue confronting PC manufacturers today. In fact, the most contentious new standard proposal, the BTX form factor, is essentially a response to the heat problem alone. (*Editor’s note:* See the Tech Glossary below for a definition of BTX and other technology terms.)

In general, standards tend to be replaced only when they’ve run out of flexibility and expandability. For instance, the AGP standard for graphics cards is more than five years old and is in its fourth generation. Current AGP cards can run at 8X the original AGP speed (they can still work in an older 1X computer, although only at 1X speeds). There will be no 16X AGP, the standard simply can’t accommodate that speed, so the industry is moving to PCI-e, a new standard. Ironically, the original crop of AGP graphics cards were no faster than the previous standard’s best, and the same is currently true for PCI-e. The big difference is that AGP has no room left for growth and PCI-e can conceivably expand to 8X its current speed or beyond.

**BTX: Balanced Technology Extended**  
The new form factor standard defines case, power, and motherboard configurations to ensure more efficient cooling.

**PCI-e: PCI-express**  
The latest version of the personal connection interface bus. Originally a general purpose bus handling all add-on card data flow, a dedicated variation (AGP) has been in use for approximately 10 years. PCI-e has both dedicated and general data capabilities.

**RAM: Random Access Memory**  
This is the volatile (it will “forget” if it loses power) memory in which the computer temporarily stores data. RAM modules have a variety of formats that must be matched to your motherboard configuration. The dominant versions today are DDR (double data rate) and its replacement, DDR2. Incompatible with each other, both versions come in a huge range of speeds and capacities.



The cluttered ATX form factor requires massive cooling fans such as the one on this CPU as well as others exhausting excess heat from the case.

Although current generations perform at essentially identical levels, the PCI-e graphics card standard (bottom) has the potential to perform much faster than the older, maxed out AGP standard (top).



Sleek SATA cabling (the orange cable) can help avoid cable and component cluttering inside computers when it replaces the old style PATA. In addition, SATA drives and the interface can potentially lead to higher performance.



Simply put, standards are great, until they hinder progress. Then they need to be replaced by a new standard that we hope has plenty of potential for future growth. Unfortunately, as consumers, we have extremely limited control over this process.

### Coping with Change

Three key architecture standards are currently in the process of being phased out. Individually, these changes aren't that shocking. Cumulatively, however, the change is more radical than any since the complete redesign of the PC architecture in the early 1980s, only a few years after the original IBM PC was released. As mentioned earlier, AGP graphics cards are being replaced by PCI-e versions, and the BTX form factor (case, motherboard shape, power supply, and connectors) is poised to usurp the ATX standard. The third major standard currently in flux is the hard drive connection standard. The practically ancient parallel ATA (PATA) standard is already being replaced by serial ATA (SATA) motherboards and hard drives.

When you consider how far the PC has advanced in the last 20 years, it's amazing that some key standards from the mid-1980s are still current. For instance, you could build a state-of-the-art Pentium IV or Athlon 64 system in an ATX case you purchased in 1986. If you wanted, you could boot the system off an ancient 80 MB Conner or Seagate IDE (also called ATA) hard drive that might even be older than the case. You'd need a somewhat newer graphics card, but you could go back nearly a decade for an early AGP model. In fact, few PC enthusiasts haven't migrated components from an older system to a new one.

With the arrival of the new standards, upgraders and repair technicians are going to have to be a bit more careful when choosing their new parts. The ATX-BTX switch features the most complex compatibility issues.

The power supply, motherboard, and case are all incompatible with current ATX models. Don't buy a BTX case thinking you can move your other components over. PCI-e graphics cards are also incompatible with AGP versions. You can't fit an AGP card into a PCI-e slot, they aren't backwards compatible, and it is unlikely anyone will create a motherboard with both slots. Currently, you can find plenty of ATX motherboards with either AGP or PCI-e configurations, however, it can be difficult finding a BTX-based system that supports AGP. The good news is that SATA and PATA can coexist, even though they are not compatible.

Most current motherboards, even the forward-looking BTX versions, include both ATA connectors. Relatively slow CD-ROM and DVD optical drives use the same PATA standard as current hard drives and gain very little from a switch. It appears PATA has at least a few more years left as a viable standard. Currently, many systems are available with both PATA and SATA hard drives. SATA is more than capable of handling DVD and whatever comes next, but it will probably be a while before it's your only choice.

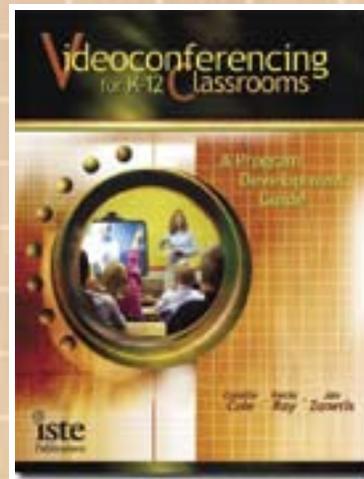
The hard and sometimes bitter truth for end users is that the decisions and debate over standards typically begins well before any input from us is sought. By the time new standards appear on the market, the discussion is mostly over. For instance, PCI-e has been a topic of considerable importance to a huge number of hardware companies for many years and the standard was fully defined long before the first retail PCI-e graphics card hit any shelf. Your choices are to make the move to PCI-e or to try to wait until the next standard arrives in 5-10 years.

### Benefits of Changing

PCs are not the monolithic thing that many people believe. Modern PCs are actually collections of subsystems

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## Nonstandard Hardware Quiz



Test your long-term geekness!  
Remember when a mouse was something your cat chased and real computer users flipped toggle switches? Take our fun little quiz and then break any ties with the bonus software question. Find answers below.

- 1 **The standard test for PC compatibility once was?**
  - a. WordStar runs in at least 40-character wide mode.
  - b. Compatibility!?! A PC is a PC for Pete's sake!
  - c. Will the beige of the case clash with my office carpet?
  - d. It runs MS Flight Simulator.
- 2 **Which wasn't standard equipment on an original IBM PC?**
  - a. A punch card reader
  - b. Graphics
  - c. Automated blogging over high-speed wireless networks
  - d. All of the above
- 3 **The first company to offer a 386-based PC was?**
  - a. Altair
  - b. IBM
  - c. I think my brother-in-law had a 386 Hemi in his 'Cuda.
  - d. Compaq
- 4 **Most original IBM PCs used this display technology?**
  - a. Teletype
  - b. EGA monitor
  - c. Something geeky?
  - d. Green or amber monochrome monitor
- 5 **The first mainstream PC CPU with a built-in math coprocessor was the?**
  - a. Intel 8086
  - b. AMD Athlon
  - c. Math is hard.
  - d. 486DX
- 6 **Intel's 486DX4 ran at what multiple of its internal clock speed?**
  - a. 1
  - b. 4
  - c. Clock ... wow, look at the time, is this quiz almost over?
  - d. 3
- 7 **Bonus Question: Where would you have seen the term "PIP"?**
  - a. Univac
  - b. Windows 386
  - c. Pip, pip, purray???
  - d. CP/M

Answers: d for all.

1. Many early "clones" were not fully compatible with IBM-DOS, and Flight Simulator would only run on 100% compatible hardware.

2. Incredibly, the original PC couldn't even display lines, only alpha-numeric characters. Hercules built an add-on card that provided rudimentary graphics, and virtually every PC quickly adopted "Hercules" graphics capabilities.

3. Compaq beat IBM to the punch with a 386-based system, shifting perceptions from IBM-compatible to the more generic PC-compatible.

4. Amber and green monochrome monitors would burn-in if you left the same characters on the screen for a prolonged time.

Ironically, screen savers didn't become popular until long after color monitors that didn't need "saving" were the standard.

5. The 486 came in two distinct versions, a DX model with math coprocessor and an SX model with the coprocessor disabled. All PC CPUs that followed included both.

6. The DX2 was double, which made sense, then Intel almost released the DX3 which was really 2.5X. To avoid confusion with the "almost" version, Intel named the 3X the DX2 ... way to avoid confusion!

7. CP/M (control program for micro-computers) was a predecessor of DOS that featured the PIP (peripheral interchange program) command for copying files.

that interact with each other. Many of these subsystems are extremely powerful computers themselves. Marketing often confuses the issue. For instance, although it is true that an AMD 64 FX 3800+ CPU is many thousands of times as fast as the old IBM PC's 8086 CPU, hard disk technology hasn't enjoyed nearly the same speed advances. In fact, it isn't uncommon to find that doubling the speed of one component has absolutely no effect on overall system speed. If your CPU spends 90% of its time waiting for information from the hard disk, upgrading the CPU won't provide many benefits at all.

Speed isn't the issue with the new crop of standards, at least not in their initial implementation. Switching to a shiny new BTX form factor system with the newest SATA hard disks and a top end PCI-e graphics card doesn't ensure that someone building a computer today with ATX, PATA drives, and AGP graphics won't be able to match or even exceed your system's performance. However, it does ensure that you'll be able to find replacement and upgrade parts next year and beyond that will almost certainly be significantly faster.

Another advantage to the new technologies is reliability. As mentioned earlier, heat is a major strain on electronics. The BTX design enables more efficient cooling inside the case without extra fans. The switch to the slim serial cables of SATA also makes cooling airflow much more efficient than the bulky wide PATA cables. Even PCI-e, because of its more efficient design, can provide some thermal advantage.

The BTX standard is getting some resistance from some segments of the industry, particularly vendors aligned with Intel competitor AMD. Intel's CPUs currently run considerably hotter than competing AMD processors. Although AMD is balking at the move to Intel's BTX design, the truth is that there is little thermal room left in the

### Vista, Dual Core, 64-bits, and Your Hardware

Microsoft's new version of Windows, Vista, is expected to be available sometime next year. It should run on most systems that currently run Windows XP well, but will probably require more RAM and high-end graphics to perform well. As with XP, it will support dual core and multi-CPU's for applications that can use them. Although Microsoft has not officially stated its upcoming policy, there has been speculation that Vista would come with both 32-bit and 64-bit versions in the box. A 64-bit version of XP recently became available. To take advantage of the 64-bit version, you'll need a 64-bit CPU. Both AMD and Intel offer 64-bit processors. However, the 64-bit version of XP (and presumably Vista) is incompatible with much legacy equipment and many applications.

ATX for either company, and a switch will need to occur soon. Although it may not happen as quickly as the switch to the other standards, choosing a BTX case shouldn't be considered a big risk.

### Protecting Your Investments

It's always difficult to choose the time to make the jump to new standards. Move too early, and you'll probably pay more than necessary as vendors attempt to recoup their startup costs. Wait too long, and you may find that upgrade and repair parts are scarce.

Most institutions will find that it makes the best sense to straddle the upgrade fence. There is no reason to scrap your current systems, but you may want to begin purchasing with an eye to the future.



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