

Keith and Betty's Idiosyncratic Recommendations for PCs and Software

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Now with WiFi,
Mozilla, and
Iomega HDD info! 13.0

“What computer should I buy? What printer? What about DSL and cable modems?”

We're often asked to recommend computers, software, and computer dealers. It's hard to keep up with the market, but here are today's recommendations. You may find this somewhat oversimplified, but remember, “we are more likely to reach the truth through error than through confusion.” (Bacon)

Which Computer?

Want a truly personal computer, for Web browsing, email, writing, calculating, simple financial work, games, and maybe a bit of programming? We have some advice. And if you deal with PCs at work and feel a bit under-computer-literate, start here.

If money is tight, get a cheap generic PC clone from one of the better mail-order companies (e.g., PC Connection, Micro Express, Micron). For better service, buy from a well-known manufacturer (e.g., Dell, Gateway). Get a desktop PC based on the AMD Athlon or Intel Celeron chip for just a bit more than \$1000 including monitor and printer. Or, pay about \$400 more for a laptop. But if you're really strapped, consider a used computer (see [below](#)). If you want the best, spend \$3000 for a high-end PC and \$1500 for a color laser printer and high-end scanner. What about a Power Mac or Macintosh IMac? Good computers, but less and less software is being written for the Apple operating system, and “In its current configuration, the Mac runs Windows in emulation and therefore will never perform properly” John Dvorak, *PC Magazine*, 11/4/97, still true today. However, the latest Mac operating system may change things in 2003-4 -- unless the Linux operating system takes over instead. (Check out www.demolinux.org or www.phatlinux.com to see for yourself.)

PC stands for **Personal Computer**, particularly the original IBM PCs. IBM's first PC had a floppy disk drive but no hard disk. Later, the PC-XT (eXtended Technology) had more slots for add-on boards and a hard disk drive. Even later, the PC-AT (Advanced Technology) had a more advanced processor. The term **PC clone** originated with non-IBM computers that could take add-ins for the IBM PC/XT/AT machinery (“hardware”), and run all the same programs (“software”). Later “clones” maintained this compat-

ibility but included more advanced processor chips (80386, 80486SX, 80486, Pentiums). Pentium III computers are now entry-level. Get at least 256 megabytes of memory (512MB is better and memory is cheap). As of the winter 2002, fast Pentium-4 CPUs are everywhere, but you can get by just fine with a 1 GHz Pentium III or AMD Athlon. Used PCs with Pentium II, AMD K6, or Cyrix 6x86MX CPUs will handle anything except the most demanding speech-recognition or graphics programs - but the motherboard may not work with the latest hardware (e.g., USB scanners and printers). See the sidebar on [Bits and Chips](#), page 4, for more on CPUs.

Why buy a clone and not a *real* IBM PC? Well, you *can* get a PC from IBM, and IBM has an OK reputation for service and reliability (but not as good as Dell or Gateway or even Micron). They used to be **much** more expensive than the competition, but no longer. Bigger-name companies (e.g., *IBM, Dell, Gateway, HP*) have higher prices because people will pay for the name and a reputation for service and reliability. Over the past few years, competition has nearly equalized prices, meaning that to a high degree, all PC clones are pretty much reliable, easy to service, and IBM-compatible. Buying a generic PC from a local dealer can work well, though we recommend buying from one of the reliable mail-order dealers, who usually provide better support. Some inexpensive computers may be hard to upgrade (see sidebar [“Putting our money where our mouths are,”](#) page 9) but this is becoming less and less of a problem. For a

We suggest that you read this online at www.pitt.edu/~kconover/ftp/kbrec.pdf

The online version has clickable links – which will allow you to check out the very latest information, and explore topics in much more detail.

cheap but still good-quality PC, get a well-known dealer's generic PC (e.g., [Micro Express, PC Connection](#); see [Some Places to Order](#) at end). Since system components change from month to month, magazine reviews are of limited use. Look at manufacturer reliability (below), quality of components, and what's bundled with the computer.

Lexmark	D+/C/F/-	B	C	B	B	B
NEC	-	C	C	B	B	B
Okidata	D/-/-/-	C	C	C	D	C
Panasonic	B/-/-/-	C	A	B	B	B
Tektronix	-	D	D	D	D	C
Xerox	F/F/C	C	C	B	D	C

*In 2002, PC Magazine rated four ways: Overall/Inkjet/Laser/Multifunction

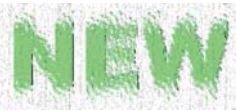
If you worry about a company going dying and leaving your computer an orphan, get a service contract with a reputable company that will continue to provide service. Micron wins the most awards for its PCs, but Dell has the clear edge in service -- at least until it slipped quite a bit starting in the middle of 2001, to roughly Gateway-level.

PC vendors are all famous for saying "You upgraded Windows by installing the security updates and we only support the original configuration. Reformat your hard drive and reinstall the original operating system and then we'll be able to help you." Or, "You sneezed when you opened up your PC. That voids the warranty." (OK, we exaggerate slightly.) And whenever some industry pundit calls the company, they say "Oh, no, that's not our policy, that tech was having a bad day." Right. On a related note, buying an extended warranty (usually 3 years) probably isn't cost-effective for desktop PCs, but can be a life-saver for laptops, which are generally not as reliable or sturdy.

What about used computers? Buying one can be risky; those made before 1997 in particular may be unusable. You can buy from a reputable computer exchange; from a library or a friend's PC, check www.yahoo.com and go to Home > Business and Economy > Shopping and Services > Computers > Retailers > Hardware and you will find a long list of used computer resellers -- find one close to you. Or check [Computer Shopper magazine](#) at your local newsstand. If you're really strapped for cash, get a cheap used PC, and instead of Windows, buy software from New Deal (newdealinc.com) - the software is slick, includes operating system and a complete set of software for \$70, and will run on older PCs that can't handle Windows bloatware. (Bloatware is inefficiently-written software that adds lots of features, and requires lots and lots and lots of RAM and hard disk space.)

What if you want to upgrade later? What if your 120-MHz Pentium is simply not fast enough for your great new CPU-hog program? Well, as long as you have a standard-sized case, get a new motherboard. Doing a solo motherboard transplant might sound, but if you're semi-mechanical, it's a two-evening job at most. [Jameco](#) and [JDR Microdevices](#) (see end of document) are the places to get new motherboards. Keith got a JDR motherboard and case for Betty, total cost for the system unit, including modem, 256 MB RAM, Ethernet, sound card. DVD and CDR/W drives and hard drive about \$800. For more, see "[The Perfect PC](#)" in the 12/11/01 [PC Magazine](#).

Portable Computers are handy. There is a great range in the sizes, prices, and capabilities of portable computers. Some power-user laptops weigh in at about 10 lbs. At the other extreme, some pocket or-



Does Your System Tray Have Dust Bunnies?

The longer you use your PC, the more stuff appears in the System Tray in the lower-right corner. Noticed how your PC gets slower and more likely to crash the longer you use it?

Yes, there is a correlation! Every new piece of software installs stuff on your PC. A few are useful, most is useless, some are bad, and it ALL slows your PC and makes it crash more. The congested system tray in the right lower corner is just the tip of the iceberg.

To keep this under control, download and install the free program STARTUP COP from www.pcmag.com. Look at websites like <http://www2.whidbey.com/djdenham/> and http://www.pacs-portal.co.uk/startup_content.htm to figure out what to disable.

Keep your system tray (and your PC) lean and clean!

school grading, we changed it to an "F." Highlights:

Desktop computers:	August 2002	Aug 2001	July 2000	July 1999	July 1998	July 1997
Acer	D	F	D	F	D	D
Apple	-	C	C	B	C	B
Compaq	F/F/F*	F	D	D	B	B
Dell	A/A/A	A	A	A	A	A
Emachines	F/-/F	F	F	C	-	-
Gateway	B+/D/B+	B	B	C	B	B
HP	D-/F/D-	B	B	B	A	B
IBM	D/C/D	C	B	A	A	A
Locally Built	B+/A/B+	A	B	C	-	-
Micron	B/-/D	A	B	B	B	B
NEC	-	D	C	C	C	C
Sony	B/-/A	C	C	B	B	-
Toshiba	-	C	F	C	C	B

* in 2002, PC Magazine graded three times: overall/office/home.

Laptop computers:	August 2002	Aug 2001	July 2000	July 1999	July 1998	July 1997
Acer	F/-/F	-	-	C	C	D
Apple	A/-/A	C	-	C	C	C
Compaq	F/F/F	F	D	B	D	C
Dell	B+/B+/B+A	B	B	B	A	A
Fujitsu	B/-/B	-	-	C	-	-
Gateway	C/D/C	C	C	B	A	C
HP	A/B/C	C	C	C	C	B
IBM	A/A/A	B	B	A	B	B
Micron	D/-/D	D	C	B	B	B
NEC	F/-/-	-	D	C	C	B
Sony	B-/B/C	B	C	-	-	-
Toshiba	A/C/A	C	C	B	C	B
WinBook	-	-	C	D	D	C
Printers:*	2002	2001	2000	1999	1998	1997
Apple	-	D	C	B	C	B
Brother	B/-/B/-	B	C	D	C	D
Canon	D-/C-/D	C	D	D	B	B
Epson	A/A/-/A	A	B	A	A	A
HP	A+/A/A/A	A	A	A	A	A

Service and Reliability

Lights, Camera, Action . . .

Computer companies may give you a choice of monitors and video cards when you buy a computer; or, you may want to upgrade later. Video monitors and video cards must be compatible, but to some degree you can mix and match cards and monitors. As with computers and CPUs and buses, there are several generations of video standards. The first was the IBM **Monochrome Display Adapter (MDA)**; it displayed text with 25 lines of 80 characters, and connected to a monochrome monitor. IBM also came out with the **Color Graphics Adapter (CGA)** and a corresponding CGA color monitor. This could also display 80x25 text, albeit fuzzier than with a MDA. The CGA showed 16 colors of text, and graphics with 320x200 pixels, 4 colors. (Pixels = Picture Elements: the smallest dot the screen can show.) Later came the **Enhanced Graphics Adapter (EGA)**. All these are now extinct.

The **Video Graphic Array (VGA)** and VGA color monitors, introduced with IBM's PS/2 computer line, were quickly adopted by clone manufacturers. VGA displays 25, 43, or 50 lines of 80-character text, and will display 16-color graphics in 640x480 pixels, or 256 colors with fewer pixels.

IBM's successor to VGA was called **eXtended Graphics Array (XGA)** and the successor to XGA, the **8514/A** (variants are

called **UXGA**). However, clone manufacturers liked VGA so much they extended it into several Super VGA (SVGA) modes with resolutions of 256-color 640x480 pixels; 800x600; 1024x768; 1280x1024; and 1600x1200. Even though they don't exactly correspond, the IBM term XGA and the extension UXGA are sometimes used for these modes. SVGA/XGA/UXGA systems are easy on the eyes and seductively pretty, but the higher the resolution, and the bigger the monitor screen, the more you'll pay. These monitors and cards are downward-compatible. Thus a 1024x768 monitor or card will support 800x600 and regular VGA.

Advanced Graphics Port (AGP) is a technology for making 3D graphics faster - but has to be installed both on the motherboard and the graphics card. All PCs since 1998 have AGP slots at various speeds (2X, 4X). But don't buy an AGP video board for an older PC that doesn't support it.

Refresh Rate is important - a refresh rate of 75 Hz or more is needed to avoid a visibly flickering monitor.

Dot Pitch is also important for monitors - a smaller dot pitch (space between the dots on the screen) means a finer "grain" and a sharper picture. A dot pitch of 0.27 mm or less is good. Some

monitors (Mitsubishi, Sony) use an aperture-grille CRT (cathode-ray tube) instead of a dot-trio shadow-mask CRT; instead of a dot pitch, these have a stripe pitch; for these monitors, 0.25 mm or less is equivalently good. And NEC has a slot-mask CRT, and for these monitors, a pitch of 0.25 mm is equivalent to or slightly better than, a strip pitch of 0.25 or dot pitch of 0.27 mm.

Windows programs are slow compared to text-mode programs. Therefore, almost all video cards have a chip specifically to speed up Windows. Most computers now include such chips. Our recommendation: use whatever card comes with your new PC (it'll be fast), and get a 15" (diagonal) color SVGA monitor (\$300 discount).

LCD Monitors are slick. 17" flatscreen LCD monitors are about \$500, 15" ones cheaper. Note: a 15" LCD flatscreen has a 15" viewable area - whereas a 17" CRT only has a "real" viewable area 15" big. So a 15" flatscreen is as big view-wise as a 17" CRT (and better-looking). We have a Micron 15" and a ViewSonic VG 10" LCD flatscreens and love them.

If you want the latest, best video card for gaming, search the web for reviews, the leader changes monthly.

Graphics RAM Required (on video card)

Resolution (Color Depth)	16-color (4-bit)	256-color (8-bit)	65K-color (high-color or 16-bit)	16.7 million-color (true color, or 24-bit)	Optimal (Acceptable) Monitor Size
640x480	0.5MB	0.5MB VGA	1MB	2MB	15" (14")
800x600	0.5MB	1MB	2MB SVGA	2MB	15"
1,024x768	1MB	1MB	2MB	4MB "XGA"	19"/17" (15")
1,280x1,024	1MB	2MB	4MB	4MB "XGA"	21" (19"/17")
1,600x1,200	2MB	2MB	4MB	8MB "UXGA"	21" (19"/17")

ganizers are so small that they fit in a pocket with room to spare.

In between are "laptops." These notebook PCs generally cost more (about \$400) than an equivalent desktop computer, and are not as expandable. It's reasonable to get a laptop computer as your main computer, knowing that you'll pay more, will have a smaller keyboard and screen, and might not be able to add certain hardware that requires adding "cards" to a desktop PC. However, most hardware (e.g., scanners) works via USB connections, the expandability problem is much less so than even a year ago. You can get an excellent laptop for about \$1000 -- more money gets you a brighter or bigger screen, a DVD drive or CD-R/W instead of a CD-ROM, more RAM, or a lighter laptop.

The category we like best is the ultralight laptop: about 2-3 pounds, and the size of two 8.5"x11" spiral notebooks together. We think Windows CE palmtops are losers, and like Palm-OS based handhelds better, but they don't replace laptops.

Toshiba laptops are solidly built and dependable, and IBM's get good marks, but we don't like the

IBM/Toshiba TrackPoint II pointing device; we prefer late-model touchpads.

Some laptops can connect directly to a large monitor, or you can often get a docking station to put under the computer. The docking station plugs into AC power, and into the back of the laptop. Depending on the model, you can plug one or more standard PC expansion cards into the stand. However, this ends up being more difficult and more costly than buying a desktop, and many newer and only moderately expensive laptops have big, bright screens that are just fine for everyday use.

Many laptop and notebook computers, and now some desktop computers, have a special **PC-Card** (older term: **PCMCIA**) slot. (PCMCIA stands for Personal Computer Memory Card International Association.) These slots take credit-card sized cards with memory, hard disk drives, modems, or other devices. There are standards for Type I (thin), Type

Bits and Chips: What's in a Number?

A History: The **CPU** (Central Processing Unit) is the brain of a PC. The original **IBM PC** was based on a CPU chip made by Intel, the **8088**. The PC became a **PC-XT** when IBM enlarged the motherboard and added a hard disk. It ran the same software, accepted the same boards, and still used an 8088 CPU. Later, a souped-up chip called the **80286** became the brains of the "**PC-AT**." The 80286 chip ran everything an 8088 would, and ATs could still accept add-in boards and monitors for PCs. (IBM PS/2s, however, cannot use monitors or add-in cards from PCs, ATs and kindred clones.) Most manufacturers' computers adhere to the old "IBM standard" for hardware and software. Even computers based on the 80386 and 80486 and Pentium CPU chips are still "IBM-compatible."

The **8088** chip was a "16-bit" chip. It performed all its calculations on 16 bits at a

time. However, the 8088 chip only sent and received data 8 bits at a time. Why use such a chip? Because all of your other chips, such as memory and clock chips, can work on just 8 bits at a time. So you can use cheaper chips on the motherboard (the computer's main circuit board) and the computer costs less.

The **80286** chip took in and gives out 16 bits at a time, which is why the AT had a bus that accepted special 16-bit cards. PC 8-bit cards would also fit in any AT or compatible computer. 16-bit "AT" cards were faster than 8-bit PC cards, but were too big to fit in an 8-bit bus, 8088-based computer like the PC or PC-XT. The 80286 chip was designed to get around the 640 kilobyte memory limitation of the 8088. The 8088 could only support program and active data memory totaling 640 kilobytes. The special mode, to allow the 80286 chip to address more memory, never worked very well. Thus the 80286 is basically just a faster 8088.

The **80386** chip, though, allowed programs to use more than 640K of memory, and did it right. Programs such as Windows worked much better on a 386 than on a 286. The **80386SX** ("386SX") would run any program that ran on an 80386. However, its "bus" was only 16 bits wide, compared to 32 bits for the "true 386." Adding a **math coprocessor chip** to these chips made number-crunching spreadsheets and statistics programs run faster, but it didn't help word processing programs. The 8088 took an 8087, the 80286 an 80287, the 80386 an 80387, and the 80386SX an 80387SX.

For the **80486**, there was no need for a math coprocessor, because the main 486 chip did math. The **80486SX** was a 486 with a broken or disabled coprocessor; the 80487 coprocessor was a fully working 80486. The 486 also has some other additions, including an on-chip memory cache.

The 80386DX or 80486DX are just the "regular" 80386 or 80486 instead of the 80386SX or 80486SX. But the 80486**DX2** operates internally at twice the speed of a "regular" chip. The 80486**DX4** operates at 3 (3, not 4; that's advertising) times external speed.

"Pentium" is Intel's name for what everyone wanted to call the "80586": it runs 486 and 386 software, only faster.

The **Pentium Pro** was designed for operating systems such as Win-

dows NT (not Windows 95/98/Me) and is **worse** than a Pentium of the same speed for running "plain" Windows, so don't get one.

Pentium MMX: an upgrade of the Pentium with MMX(Intel **M**ulti**M**edia **eX**tensions): somewhat faster than a "plain" Pentium.

Pentium II - like a Pentium MMX only faster.

Cyrix M II - like a Pentium II

AMD K-6 - like a Pentium II.

Pentium III - the current standard; the Pentium III Xeon version is faster but only for big corporate computers

Celeron - a souped-up Pentium II - almost as fast as a Pentium III of the same speed; for the budget-conscious.

Pentium IV - basically a P3 with some improvements for streaming video over the Internet. A 1.5 GHz P4 is no better than a 1 GHz P3 for most software - so the 1.1 GHz Athlon is still the speed champ.

AMD Athlon - Much to Intel's dismay, in March 2000 the Athlon became the fastest PC CPU on the market.

The World vs. Intel: CPU chips are made by several companies: Intel, Advanced Micro Devices, and Cyrix. All are excellent, so don't listen to salesmen who tell you to buy only a specific brand CPU.

Intel is the market leader, and aggressively markets to keep it this way. A couple of years ago, AMD, Cyrix, IBM, and SGS-Thomson all developed the "P" system: they say it stands for "Power" but it's OK for you to say "Pentium." For example, the Cyrix 6x86 P166+ runs at 133 MHz, but outperforms a 166 MHz Pentium chip, so they call it a "P166+" (in the table, PR=Pentium Rating); more recently AMD is using a new "equivalent": rating that appears in parentheses in the table; believe what AMD says, their chips outperform Intel chips at the same clock speed.

Mobile chips are specifically designed for low power consumption, and are worth looking for when shopping for a laptop - and the Mobile Pentium III is more efficient than the Mobile Pentium II, and the Pentium III-M is the most efficient yet. Both Intel (SpeedStep) and AMD (PowerNow) offer mobile chips that are fast on AC power and slow down off AC power for longer battery life.

For more, check out [CPU Roadmap](#) in the 2/4/02 [PC Magazine](#).

If you followed the original numbers of chips at the beginning of this box, you might have expected that the Pentium II (or III, or IV) was a 64-bit chip. Nope. They're all 32-bit. But a true 64-bit chip (Itanium) finally appeared in 2001. Too bad no software can use it yet.

	Chip Name	Speed (MHz)
5th Generation 586	Intel Pentium (classic)	75-200
	Intel Pentium mobile	75-166
	Cyrix MediaGX	133-200
	Intel Pentium MMX	150-233
	Intel Pentium MMX mobile	150-200
	Cyrix 6x86	100 (PR120)-150 (PR200)
	Intel Pentium Pro	150-200
6th Generation 586	Intel Pentium II	233-450
	Intel Pentium II mobile	233-266
	Intel Celeron/AMD Duron	266-700
	AMD K6	166-475
	Cyrix 6x86MX	150 (PR166)-208 (PR266)
	Cyrix M II	233 (PR300)
7th Generation 586	Intel Pentium III	450-600
	Intel Pentium III Xeon	500-550
	Intel Pentium III mobile Coppermine	450-500
	Intel Pentium III Coppermine	450-1130 (1.13 GHz)
	Intel Pentium III-M	1.13 GHz (mobile)
	AMD Athlon 4 mobile	1.3 GHz
	AMD Mobile Duron	750 MHz
	AMD Athlon (K7)	500-1100 (1.1 GHz)
8th Gen. 586	Intel Pentium IV (Willamette, Northood)	1.4-3.0 GHz
	Intel Pentium IV-M	? (low-power version)
	AMD Athlon XP	-2.0 GHz (similar performance to faster P IV chips)
64-bit 686	Intel Itanium/Itanium-2/McKinley	800 MHz-1GHz
	AMD K8 Clawhammer/Sledgehammer/Opteron	?

When computer nerds talk about a bus, they mean the electrical lines available on the computer's motherboard (the main circuit board). These lines connect to slots into which you can insert expansion boards. For instance, you might want to install a SCSI card, a USB 2.0 or FireWire card, an internal modem, or some other device into your new computer. You have to get an expansion board that matches the bus your computer uses. Most laptop computers don't have slots for add-in cards, but do have slots for PC cards; see main text.

8088-based PC/XT PCs had an 8-bit bus, 80286-based AT PCs a 16-bit bus. Both are referred to as Industry Standard Architecture = **ISA bus** because clone makers didn't want to use the other three-letter word (IBM). 80386, 80486 and Pentium PCs had a 16-bit AT bus, or one of four "extended" 32-bit buses: **Micro-Channel Architecture (MCA) bus; Extended ISA (EISA) bus; VL-bus; or PCI bus**. All PCs made after 1997 use the PCI bus.

The PCI bus won't take the older 8- and 16-bit boards, but most PCs also have some ISA slots for the older cards. If buying a used PC, make sure you get one with at least one PCI-bus slot open. ISA slots are optional.

IRQs are also known as **Interrupt ReQuest** lines or just interrupts. If you want to sound like you really know a lot about personal computers, start talking about IRQs. But if someone asks you to help them with an IRQ problem on their computer, run away. Fast.

Most chunks of hardware on the motherboard, and most add-in-cards, need an IRQ to communicate with the CPU. With rare exceptions, add-in cards can't share IRQs with each other nor with the motherboard hardware. With the PC and PC-XT, there were 8 interrupts (most used by the motherboard), and with the PC-AT, this jumped to 16 – and we've been stuck at 16 ever since. And with today's computers, it's common to add multiple scanners, ZIP drives, CD-ROM drives and the like. So, be-

ware – you may find that you buy an add-in board but can't use it because your PC doesn't have any free IRQs. Windows, since windows 95, has had a utility for viewing your IRQs (Control Panel | System | Device Manager; select "Computer" and click "Properties"). One way to maximize your usable IRQs is to use a SCSI controller, or a USB hub, to attach as many devices as possible without requiring a new IRQ for each. (See the sidebar on [Hard Disks, Easy Choices](#), page 10 for more about SCSI). A SCSI controller uses only one IRQ but can control 6 or more devices such as scanners, CD-ROMs, hard drives and ZIP drives. And PCs now all come with one or two USB ports already. Note: sometimes you can go into your CMOS BIOS Setup and disable serial or parallel ports you don't use, saving an IRQ or two.

One of the great advantages of Windows is "Plug and Play": insert or attach new hardware and reboot, and Windows will reassign IRQs on the fly, allowing some devices to share IRQs when possible. While not foolproof, this works pretty well.

“Don't miss the Bus” and “Don't let it IRQ you” and “ISA is dead, long live PCI”

Bits and Bytes

II (thicker), and Type III (even thicker) PC-Card slots and cards. There is also a PC-Card 3.0 standard that supports faster cards and slots; a 3.0 slot will generally take a 2.0 card, but you can't put a 3.0 card in a 2.0 slot. There used to be problems with compatibility, but a new PC Card modem should work in any new laptop. If you need a PC Card modem, get a 3com one with the XJACK connector that slides back into the card -- no cable “dongles” to lose. They even make one that is both a modem and an Ethernet connector (i.e., by attaching to a DSL/cable modem) which automatically senses if its plugged into a phone or Ethernet.

Keith has run through a lot of laptops over the years, including Toshiba, Compaq, and HP. He had problems with all of them, particularly the Compaq and HP ones. Now he has a Dell Latitude X200 (about 2.5 lbs, 2-hour battery life, 800 MHz CPU, 384 MB RAM, 30 GB hard drive). But better and lighter laptops come out all the time.

What to Look For When comparison-shopping (which we highly recommend), you need to compare prices of clones with similar features. Here's what you want for a basic PC clone; variations if you want a more expensive computer are in {curly brackets}:

- ✳ AMD Athlon or Intel Pentium III CPU; note that motherboard design and hard drive speed are more important than CPU speed; see [The PC Guide](#) for more.
- ✳ 15" Super VGA color monitor and 1024x768 card {SuperVGA cards supporting 1280x1024 or more pixels and larger monitors or LCD displays are all better, but more expensive}
- ✳ 3.5 inch 1.4 megabyte floppy drive. See sidebar on [Hard-Driving Floppy Disks](#), page 7

- ✳ at least a 20 GB hard disk drive; whatever size you have, you'll fill it sooner than you expect {larger and faster hard drives are better; the IBM DeskStar 7200 RPM drives are particularly nice}
- ✳ 128 MB of RAM (Random Access Memory; 1024K = 1 MB) 256 or 512 MB on the motherboard is even better; ask for memory that you don't have to throw away if you decide to upgrade to more RAM later
- ✳ CD-ROM drive {consider DVD and/or CD-R/W drive}
- ✳ WinXP Professional
- ✳ serial port/ECP parallel port/USB port (*make sure it supports the latest USB 2.0 standard: 40x as fast as USB 1.1*)

If shopping for a laptop computer, look for:

- ✳ keyboard; laptop keyboards should be full-size, including arrow and separate Home, End, PgUp, and PgDn keys
- ✳ removable batteries that charge rapidly, and long battery life (lithium ion are best but expensive); possibly, an external battery charger and spare batteries
- ✳ *lightweight* battery charger/AC adapter
- ✳ easy-to-access connectors
- ✳ If using the laptop for presentations, you might want to get a remote pointing device. Though many LCD projectors have such a device, many of us who do Powerpoint presentation with a laptop prefer one connected to a laptop. The best we've seen are the PocketPoint RF from [www.proxima.com](#) and the RemotePoint RF from [www.interlinkelec.com](#).

A bit is a single digit of binary information: one or zero. Eight bits is a byte: enough information to represent a letter or base-10 numeral. The standard code for converting bytes to what you see on the screen is called ASCII (American Standard Code for Information Interchange).

If you know anything about scientific notation, you know what a megabyte is: 1000 kilobytes (1000K). And, of course, a K (a kilobyte) is 1000 bytes. A single 400-word typewritten page, if converted into binary using ASCII, is about 2K or 2000 bytes. So, a 360K floppy stores 180 pages of ASCII text. A 20 MB hard disk stores 10,000 pages of text. Programs also take room. Graphics take a lot of room; roughly, a picture is worth 1000 words. (Really!)

"I've Been Hacked!"

Computer Aphorisms

If you wait for six months, of course you will get a lot more for your money.

On the other hand, you will not have a new computer for those same six months!

Moore's Law: CPU processing power doubles every 18 months.

Computers are complicated. Expect that nothing new will ever work right the first time.

That includes software, hardware, whatever.

Computers don't let you do things faster; just better.

Hard disk crashes always occur just before you back up your hard disk.

One of Keith's partners installed a cable modem. Someone working over the Internet, through his cable modem, cracked his PC and stole his credit card numbers and started using them. Another friend had a hard disk completely trashed by a virus. **THIS COULD HAPPEN TO YOU.** (Notice I didn't say hacker - to insiders, hackers are the good guys and "crackers" are the bad guys.)

What can you do to practice safe computer and not get a virus, a Trojan, or have someone crack your system? Several things. First, see the main text of this document, under [Personal Firewalls](#), page 8.

Second, close other security holes in Windows and Internet Explorer. Use Windows Update (select it from within Internet Explorer when connected to the Internet) to download all the latest security patches for Windows and Internet Explorer.

Third, do not use an email program that is full of security holes, so many that there is no hope of being able to fix them all. That is, don't use Outlook or Outlook

Express for email - even if you don't open an attachment, a HTML email virus can get you.

"Discussing [anti-virus] solutions in the context of Microsoft's inherently insecure e-mail software is like deciding what kind of paint you're going to put on the barn once the fire's out."

-P. J. Connolly (noted computer security maven)

Even Netscape mail has security holes. We recommend Pegasus, which is free - but the author does ask that you buy a manual. Pegasus is the power user's email program. Download free from www.pmail.com. Never open an attachment unless you know the sender. For a real scare, see www.pc-help.org/security/scrap.htm

Of course, you don't have to be infected by a virus or Trojan to lose your shirt over the Internet. As with any new frontier, con artists abound. Check out the "dot con" site of the FTC for more advice on Web scams: www.ftc.gov/bcp/online/educams/dotcon

✧ *The true techno-weenies should look for: A BIOS which can change the drive boot order (including CD-ROM and non-primary hard drives), select AGP vs. PCI video cards, enable and disable USB, serial, parallel, and PS/2 mouse port to save IRQs, reduce the number of Power-On-Self-Test (POST) self-test to boot quicker, and to password protect the system. You also want lots of fast core RAM and lots of Level 2 cache RAM. See the sidebar [Are You Losing Your Memory?](#), page 17, for more.*

Palms, PDAs, Cellphones, and PIMs: If you don't live on a remote South Pacific island (or even if you do), you may have heard of PDAs: Personal Digital Assistants, such as the Palm Pilot. These are keyboardless small computers that rely on a pen touchscreen and handwriting recognition for input. With the advent of the Palm Pilot and its Palm Operating System (Palm OS), the pocket PDA has arrived. Palm has licensed its operating system to a number of hardware vendors The Palm Pilot caught on because it has a simple, crashproof operating system that's not Windows. "Pocket PC" competitors to the Palm Pilot do run with a version of Windows (Windows CE) -- but different enough from "regular" Windows that standard Windows programs don't run on it. What's the point? To take business away from Palm of course. These Pocket PCs are gradually catching on, but Palm PDAs are still in the lead. Keith has a laptop that only weighs 2.5 lbs. and he tends to carry it all the time (with a spare battery or two when needed). Keith has a Visor Edge and fi-

nally learned how to write with the handwriting recognition engine Graffiti. (OK, he's being a little silly here, it isn't perfect but it's at least usable.)

He can enter addresses and notes and appointments on his laptop or desktop in Microsoft Outlook, and use Laplink to keep the desktop and laptop synchronized, and then "sync" from laptop or desktop to his Visor Edge -- or enter information on his PDA and it will transfer to laptop or desktop. This ability to "sync" data between devices is great. It means you can have your data -- every address and phone number, and piles of reference notes -- with you all the time. (See Keith's web page at www.pitt.edu/~kconover for more on syncing.)

In the August 2002 issue of PC Magazine, the reader survey assigned these grades: **Handspring Visor: A+; Sony Clie: A; Palm Pilot and HP Jornada: B-; Compaq iPAQ C+; Sharp Mobilon D; Psion and Casio Cassiopeia F.** The Handspring, Palm, and Sony all use the Palm operating system, the others (except Psion, which has its own operating system) use Windows CE. Palm got such a poor grade at least in part because of problems getting Palms to sync via a USB cable under Windows XP - a problem not shared by Handspring. There are rumors that Palm and Handspring may merge, with Handspring continuing to develop their Treo line of cellphone/PDA combinations but not non-cellphone PDAs.

This is not the place to go into details about cellular phones. But, certain **CDMA digital phones** (e.g., [Motorola StarTAC and TimePort](#) phones used by Sprint PCS - get digital CDMA with analog backup on the phone) can also use a serial cable and [TrueSync](#) so you can use your PC to update the 100 people whose phone numbers you want on your cellphone. Slick! And there are now cellphone/Palm combinations. They're still all a bit klunky, but we predict that a year from now Palm-OS cellphones will be all the rage.

You will notice that elsewhere we tell you that Outlook is a poor choice for an email program, because of all its security holes. True, but as a **PIM (Personal Information Manager)** it's not bad at all. There are many PIMs, with different features and different main jobs. But [Outlook](#) has some advantages as far as we are concerned:

- ✧ Outlook's dominant market position means it is compatible with much other hardware, including most PDAs and cellphones as described above.
- ✧ Dominant market position means it's compatible with much software, including Symantec WinFax Pro (allows you to use your Outlook contacts as your list of FAX numbers).
- ✧ Has essential PIM functions: calendar, scheduled reminders, ToDo list (Tasks), contacts list, memos (notes).

Floppy drives come in two sizes, each in two densities. That's two sizes but four kinds. Older computers take floppy diskettes that are 5-1/4" in diameter (but enclosed in a square protective package). Though the disk is "floppy" magnetic tape type material, the square protector is only somewhat flexible. The original 5-1/4" diskette holds 360K (about 180 pages of typewritten material). Introduced with the IBM PC-AT, the 1.2 megabyte 5-1/4" drive and the 1.2 megabyte diskettes look exactly the same as their 360K equivalents. A 1.2 megabyte drive can use (format and read) 360K diskettes, but often these cannot be read by 360K drives.

Three-and-a-half inch drives also come in two flavors: **720K** and **1.4 MB**. Both come in relatively thick, hard cases with a small metal sliding sleeve. Like 5-1/4" diskettes, 3.5" diskettes come in two densities. Unlike 1.2 MB 5-1/4" drives, the 1.4 MB 3.5" drives reliably read and write 720K diskettes. So, if you're getting a 3.5" drive, get a 1.4 MB one. The 1.4 megabyte diskettes have an extra hole in one corner, compared with the 720K version; they also have the letters "HD" inscribed on them. Some say 1.0 MB and 2.0 MB rather than 720K or 1.4 MB. This refers to the unformatted capacity; formatting

uses up part of the diskette. So, 1.0 = 720K formatted; 2.0 = 1.4MB formatted. Toshiba and IBM offered 2.88 MB 3.5" disk drives, but they never caught on.

Attempts at a new floppy replacement include IOMEGA's **ZIP drive**, the O.R. Technology/Imation **LS-120 a:drive**, and now the **Sony HiFD** disk drive.

The ZIP drive, which has sold many thousands of units, is an improved version of the previous Bernoulli-brand 5-1/4" floppy disk drives that held up to 230 MB on a single disk (we had one of the 150 MB Bernoulli Drives). The Bernoulli disks were notable for their reliability and virtual indestructibility – as opposed to removable hard disk cartridge drives such as those made by SyQuest. However, the Bernoulli disks were expensive – about \$100 apiece. ZIP disks, though only storing 100 MB, are much cheaper, and so many ZIP drives have been sold that they are becoming a defacto standard. For example, Kinko's offers computers with graphics programs, color printers and other computer services, and uses ZIP drives so you can bring in graphics files and print them; NEC and Micron are shipping ZIP drives as standard in many of their computers. IOMEGA also now has 250 MB Zip drives, which will also read

and write (but not format) the 100MB disks. A competitor, the LS-120 120-MB a:drive, is more expensive – but has the great advantage over the ZIP drive that the a:drive can read and write standard 3.5" floppies.

The 3.5" Sony HiFD drive stores 200 MB and, like the LS-120 a:drive, can read and write standard 1.4 MB 3.5" floppies; but Imation is sure to upgrade the LS-120 a:drive to 200 MB, and IOMEGA is sure to push hard to continue making the ZIP drive a standard . . . The ZIP drive is ahead, but it's still too early to tell which will win and become standard on next years' computers. Stay tuned.

Another new drive is the tiny Compact-Flash format IBM hard drives, designed for digital cameras - but it's still too early to tell how these will fare in the marketplace.

As of August 2002, Iomega (and others) are introducing 20-30 GB and larger portable hard drives which attach via a USB 2.0 or FireWire cable. (They do work via USB 1.1 ports, but Keith found it took 24 hours to back up his 20 GB hard drive onto one of these via USB 1.1.) Over the next six months or so, it seems likely these will take over from tape backup as a preferred backup method.

Hard-driving floppy disks: ZIP, LS-120, HiFD, Clik and Peerless drives

✂ Outlook was the first PIM that properly printed a month-on-two-pages calendar on Filofax paper.

Keith used to keep all his PIM-type information in a Filofax (contacts and notes were just in a word processor file that he printed on Filofax paper). However, as the list grew, the thick wad of contacts made the Filofax exceedingly thick. So instead, he now prints off the Outlook calendar and keeps in the Filofax - it's quicker and easier to jot down information than any PDA - but relies on the Visor Edge for contacts and memos.

The current crop of Palm-OS devices have gotten good enough that we recommend getting one - the OS is solid and easy to use, and they are small enough to keep in a pocket all the time. The Visor Edge and the Palm 505 are the clear winners now. Yes, you can get a color screen - but with much less battery life, and a bigger case that may rip a few pockets. But a Palm OS device isn't quite "there" yet - you can't really use it for graphics or maps as the display just isn't good enough, the backlighting isn't very good, and the CPU isn't fast enough to redraw vector maps. But given another year or two, Palm-OS devices will be great, especially if they're cellphones with integrated GPS (Global Positioning System).

There are a few things we don't like about Outlook: though you can search for and find that specific words appear in individual notes, you can't "find" a particular occurrence of the word within the note, nor can you use the wheel on a wheelmouse to scroll the text of the note. Also, due to limitations of the Palm OS, syncing with a Palm-OS device will trim the ends off any of your long notes. They're just not designed for longer notes, but Keith has scads and scads of information that he likes to keep with him (for instance, lists of the music recordings he has by specific composers, so when browsing CDs at a

store he won't mistakenly buy something he already has). And Outlook doesn't have many of the freeform entry and indexing features found in the now-extinct but long-lamented PIM Agenda (dropped by Lotus because they were clueless about what a great piece of software they had) or Micro Logic's award-winning [Info Select](#).

Printers etc.

Ink-jet printers cost \$150-\$400 discount, and laser printers start at \$250. There is no reason to get anything except an HP -- see page 2 for ratings of manufacturers. If you think you're getting a better deal buying some other brand (except maybe Epson) you're wrong. You'll need a standard printer cable and some extra ink cartridges. If you want a portable printer that will also work at home, expect to pay half again as much.

We printed this with a HP Color LaserJet 4500 printer. Laser printers start at \$250 for a 600 Dots Per Inch (DPI) Hewlett-Packard LaserJet 1000. Although in 2002, laser printers seem to have disappeared from the consumer market, we hate how inkjet ink runs when it gets wet, and how you should use special inkjet paper, even if you can get great color inkjet output cheaply.

The color laserjet is great,, but it's not photo quality. As of fall 2002, the new top-of-the-line photo printer is the Epson Stylus Photo 2200 (\$700 discount). These "photos" are water-resistant, essentially indistinguishable from photos, and on acid-free paper will last at least 80 years.

Safe at any speed?

Digital computers can only work on a few bits at a time. The faster they can do this, the faster the computer works. So, a 1 GHz 8088 CPU, as found in most PC clones, operates more than twice as fast as the original IBM PC's 4.77 MHz. A gigahertz (GHZ) is 1000 megahertz (MHZ); a MHZ is 1,000,000 Hertz; a Hertz is once a second.

There is more to how fast your computer works than just CPU speed. An 8-bit CPU processes 8 bits at a time, a 16-bit processor such as the 80286 acts on 16 bits at a time, and the 80386 eats data 32 bits at a bite. However, for many applications, such as word processing, the speed of your hard disk makes a bigger difference in the speed of your program.

Hard disks are rated by their average access speed; 65 milliseconds is slow, and 10 msec is fast (but read about EIDE adapters in the box on the next page, and [Hard Disks, Easy Choices](#), page 10).

A multifunction device combines inkjet printer, copier, fax, and scanner. If you get one, make sure you get one which has a flatbed scanner; remember you can't get books and most pictures through a sheetfed one! HP has finally done these right, and for \$500 you can get a HP OfficeJet d135 - an excellent deal. But for \$400 vs. \$2000 for the HP Color LaserJet 4600 (plus the cost for a separate scanner) the cost breakpoint is pretty obvious. If you do get a separate scanner, the HP ScanJets 5400 (\$200) and 7400 (\$500) win by a large margin.

Get a case of laser printer/photocopy paper from a local paper or office supply store, and 50 generic floppy diskettes. Other things you might want are:

- ✧ A modem (MOdulator-DEModulator) for connecting to other computers and the Internet via phone lines. An external fax/modem will save a slot in your system for other cards; get a 56K V.90 modem. You can also get modems that include a jack for a telephone handset, making it easy to use utilities like [Net2Phone](#) to place inexpensive long-distance calls via the Internet.
- ✧ A power strip to plug all your computer hardware into, possibly with a surge suppressor.
- ✧ Some diskette and CD boxes.
- ✧ A better mouse - we love the Logitech cordless optical wheel mouse; it's worth the extra \$70 to replace your factory-issue rodent.

You probably don't need an anti-static mat, unless you live in a very dry climate. An Uninterruptible Power Supply (UPS) provides security from low-power computer lockups, but is expensive. But, take care; don't let a salesman sell you a 30 gigabyte hard disk, or anything else fancy, unless you're sure you'll need it, because you may never find much use for it. Use the configuration above as your guide.

Saving your Data

So how do you make prepare for when your hard drive gets trashed by a virus or a mechanical or software crash? A multipronged approach.

Antivirus Protection: get and use Norton Antivirus 2002. It updates virus definitions automatically whenever you're connected to the Internet. And **DO NOT** use Microsoft Outlook for email. Safest is [Pegasus](#), next-safest is Eudora.

GoBack: get and install the full version of [Roxio Goback](#). This allows you to retrieve even more deleted files than the Norton Protected Recycle Bin, and allows you to "roll back" a crashed system to a "safe point" when everything was working. Highly recommended. See page 12 for more.

File Backup: it is still a good idea to back up your data on some sort of backup media. See [Backup Devices](#), page 13, for more.

Starting Up

There are public-domain, freeware, shareware and commercial programs that make using your com-

puter easier. Public domain means absolutely free; freeware means free but there are some restrictions on use; shareware means the honor system: pay only after you've used the program and you like it. Many of these programs can be downloaded from web sites. To download programs, you need a computer with a modem and an Internet connection.

Essential Software/Hardware

There are many, many good utilities out there, and some great ones. Resist the temptation to install everything you hear about -- the more you load your PC, the slower it performs, and the more likely it'll crash. (And even though you uninstall software, it never uninstalls completely, so your system gets "dirtier" with time, and more likely to crash.) Windows crashes on a regular basis, anyway, but with more stuff installed it will occur hourly instead of daily. If you insist on installing scads of stuff, buy more RAM (256 or 512 MB) and your system will be more stable. Despite this, there are several important utility programs you *should* get and install, and they're described below.

Don't believe any software or hardware product that offers a "rebate." Many rebates will never come, for a variety of reasons, only some of which are valid. Don't consider the rebate when pricing things.

Personal Firewalls: IMPORTANT! with the ludicrous security holes of all Windows operating systems, your PC is wide open to attack by evil people. Back when Internet connections were slow dial-up modems, crackers (people who break into others' computers for fun and profit) weren't much of a problem. But now with DSL and cable modems, more and more people are connecting to the Internet via broadband (fast), always-on connections. And Windows, in its default state, advertises itself over the Internet "Please, come steal or destroy all my data."

What can you do? Well, check the *Shields Up* page at [grc.com](#). Following the advice there, you can close the most gaping holes. Good enough for a fast modem connection. But if you want a DSL or cable modem? You need a real **personal firewall**. A firewall is a chunk of hardware, or a software program, that protects your computer from cracker attacks. There are several out there, some better than others. Check the above web site and believe everything Steve Gibson has to say: he's good people. Betty and I have been following his advice for about 15 years and he's never led us wrong. As of the time we're writing this, the best combination is a hardware router along with the free version of [ZoneAlarm](#).

When you are connecting to the Internet with a dial-up modem connection, you get a new URL every time you connect, and the connection is slow by broadband standards -- not very inviting to crackers. But when you install an "always-on" DSL or cable modem, you've got a constant URL with a fast connection. And unless you do something to protect yourself, you're just holding out your system like a piece of cotton candy to any passing cracker.

We created this document using Corel Ventura Publisher, and Adobe Acrobat for the version on Keith's Web Page. It was printed on a HP Color LaserJet 4500 and copied. Type is Bitstream Iowan Old Style (main text), Bitstream Garrison Sans (boxed text). Large headings are in **Garrison ExtraBold** and **Garrison Kayo**. (Garrison is also known as Gill or Hammersmith)

Keith learned to program on a Z-80 (8088 variant) S-100 CP/M (pre-DOS) G.W. Medical School PC that initially had to be programmed by setting switches to program individual bits. When it got a text editor and floppy disk drive, he used it for some medical school papers. Subsequently came the big investment of the \$2000 Osborne-1 portable computer, with two 92K disk drives, and a 4.5" screen, weighing about 20 lbs. - with a **Special \$795 Value** dBase II included. Keith started using it for papers - the included WordStar 2.2 word processor once won an award as "the year's most difficult computer game." And within a month it paid for itself. Betty's job was as circulation manager for an industry newsletter publisher. They had just computerized their mailing list with a MP/M (multicomputer CP/M) network, and the vendor, Entre Computer Systems, couldn't get it to print 3-up labels. And eventually Entree wouldn't come to the office or return their calls. Keith and Betty spent one evening learning the dBase II programming language, wrote a program to print 3-up labels, and saved the day. Betty immediately got a \$2000 raise, paying for the computer.

We later upgraded to a PC clone, followed by several successors, and now we're on our seventh and eighth PCs. Along the way, we found out a number of things:

- Only buy a new PC when there is a program or peripheral that won't work with your old one.
- Trying to upgrade an existing system from Windows 3.1 to Windows 98 may cause serious risk of suicide.
- Motherboard transplants aren't that hard, we've done it several times.
- Cheap generic PCs sometimes can't be upgraded with new hard drives and new operating systems and such, no matter how hard you try. And you can

spend hours, days, weeks and months trying before giving up. (We once made the terrible mistake of buying a PC clone from CompUSA.)

In July 1999, we upgraded to a Micron Millennia PIII-550 with Win98 (note that Micron's Millennia computers generally win lots of awards) with a 22GB 7200-rpm IBM DeskStar UDMA hard drive; a generic Micron 15" LCD monitor, a Logitech cordless mouse; a Hauppauge WinTV TV and FM tuner card, a 4XDVD and a CD-R drive; both 100MB and 250 MB ZIP drives. In August of 2002, we still have the main PC, although now with a new 19" ViewSonicLCD monitor.

We could never get the 3M/US Robotics 56K internal modem bundled with the computer to respond to volume controls (except on and off), even though they were supposed to work. Got a Xircom Portstation USB Modem 56 and 4-port USB hub, into which is hooked a SanDisk CompactFlash card reader (for the Kodak DC-210 digital camera), and an APC UPS. We have Verizon DSL with a Westell DSL modem, attached to a Linksys BEFSR-41 router/Ethernet hub, which attaches to Ethernet PCMCIA cards for both our laptops and a generic ISA 10 Mbps Ethernet card in the Millennia Max. We used to use an HP Colorado 20 GB parallel port tape backup unit, but more recently got an Iomega HDD 30 GB portable hard drive for backup.

We kept our existing UMAX SuperVista S-12 color scanner and a Polaroid SprintScan 35LE slide scanner attached to an Adaptec 2940 U2W SCSI card. Later we replaced the UMAX scanner with an HP ScanJet 7450 scanner. Along the way we got a HP Color LaserJet 4500 printer.

Keith is in the process of assembling a new PC for Betty from parts from JDR Microdevices, should be up and working soon.

Software on the main PC is Win98SE with Norton Systemworks, Adaptec GoBack, MS Office XP Pro with Endnote and Crystal Graphics' PowerPlugs, MicroGrafx iGrafx Designer, Adobe Photoshop and Illustrators, Pegasus mail, Mozilla, Corel Ventura Publisher, Delorme Street Atlas, Maptch Terrain Navigator, Quicken Basic 2001, TurboTax, Mathcad, Stedman's Medical Dictionary, Britannica DVD, American Academy of Pediatrics Visual Red Book, PDR Electronic Library,

OmniPage, and the utilities described in the main text.

Before you become jealous of all the hardware and software working cleanly together, note:

- We have had massive problems with hardware off and on. Over the years we've learned to keep detailed notes of everything when installing stuff on a new drive or PC. You may need to do it all again, and there are always some tricky parts to remember.
- We had tried to use an Intrega = Xircom Portgear USB-Ethernet adapter and it, we think, made the system irregularly and unpredictably take 20 minutes to boot. Gave up on **that** and, when moving to a USB modem freed an IRQ, installed a generic Ethernet card. (Still occasionally have to unplug the power to the USB hub and plug it back in to get the system to boot, properly, though. Not sure if it's the Xircom USB hub and modem, or the USB 1.1 support on the motherboard, doubt we'll ever figure it out.)
- We had an 8GB internal SCSI tape drive at one time. Despite hours on the phone, it never, ever worked. It's gone now.

The points to take home?

- **Computers are complicated devices**, and will use up your time, no matter how experienced you get. Expect to end up with a large box in the basement with discarded computer stuff, both hardware and software. (No, you won't be able to return it for a refund.)
- It sometimes makes more sense to **get a new computer** than upgrade an old one.
- **Consider more-reliable manufacturers** such as Micron or Dell instead of cheaper suppliers such as CompUSA (but there's still no guarantee that you can upgrade any computer).
- **It's a gamble to upgrade** to Win 2000 or Me or XP; if you want to be safe, just get a new computer with it preinstalled. Or back up your data, reformat your hard drive, and install from scratch.

Good luck.



Putting our money where our mouths are . . .

A hardware router means (1) you are essentially invisible to any cracker, (2) you don't have to use Dial-Up Networking to connect to the Internet, it's just **there**, and (3) without a router you have to install special software on your PC. We found that the Verizon DSL PPPoE software - Point to Point Protocol over Ethernet (required for DSL if you don't have a router) - crashed our PC every second time it ran.

(BTW, in August 2002, PC Magazine's survey rated manufacturers of routers and related hardware; **Linksys, Netgear and SMC got an A, Siemens got a C, 3Com, Cisco and D-link got a D, and Intel/Xircom got an F**. We love the [Linksys](#) BEFSR41 we got from [PC Connection](#) (\$70) - it includes a 4-port Ethernet hub so we can link all our PCs into a home network. Here's how this works: **[Phone or Cable Line] - [DSL or**

Broad-Band!

And Home Networks

Broad-band means an Internet connection *much* faster than a modem, including DSL, cable modem, and wireless. Don't even **CONSIDER** broadband until you read *Personal Firewalls* in the main text – and have a firewall up and working!

DSL (Digital Subscriber Line) uses existing phone wires to hook you to a fast Internet connection. Whether you can get a DSL connection, and at which speed, depends on how far you are from a Central Office ("switch") with the right hardware, also on phone line quality. DSL is a bit better than cable modems: not as inviting a target to crackers, doesn't slow down when lots of people nearby are online. In the Verizon (Bell Atlantic) area check out

www.bellatlantic.com/infospeed/ to see if you can get DSL to work; in other areas, or for the Northpoint alternative, check out www.2wire.com. For more, read the *PC Magazine Broadband Special Report*.

It's not easy to set up a DSL, cable modem, or wireless broadband system. And when Keith told Verizon "I've heard that DSL tech support really sucks but yours isn't as bad as all the rest.": "Yeah, that's about right." Phone companies don't understand tech support, and they're having a hard time learning. Cable companies and wireless providers are even worse. If you get a router/hardware firewall as described in the main text (see below) it'll probably make your life a lot easier.

Not only do you have to choose a phone company (in SW PA, Verizon or Northpoint), but also an ISP (Internet Service Provider). AT&T's "@home" service is reputed to secretly limit upload speeds, cut off those who complain, be down a lot, and refuse to allow users to use VPNs (virtual private networks) to connect to work.

If you have multiple computers at home, and want to network them together, bottom line as far as we are concerned: get cheap generic Ethernet cards and a [Linksys](#) router/Ethernet hub for both networking. This will get you a painless connection to a DSL or cable modem, a hardware firewall, and good 24-hour tech support. See the section on [Personal Firewalls](#), p 8.

Hard disks come in two flavors. The **SCSI** (Small Computer System Interface, pronounced "scuzzy") started with Macintosh computers, and you can get PC adapte cards. SCSI disks are large, fast and pricey. PCs now have IDE (Integrated Drive Electronics) connectors, so you can connect hard drives without an adapter card, which is the clear winner over SCSI.

Older drives used to come as plain IDE (also known as ATA-1) but all today are **Enhanced IDE (EIDE)**, also known as Fast ATA, Fast ATA-2 and Ultra DMA. Every year or so, a new generation of EIDE drives comes out with newer and faster interface; however, almost all of these drives are compatible with older motherboards' EIDE adapters, though will run slower with an older motherboard. If you have an "old" IDE or EIDE adapter on your PC's motherboard, you can get a new, cheap EIDE adapter, which will usually make your hard drive work a lot faster.

Data goes onto hard disks in formats called **file systems**. Windows inherited the old PC BIOS (chips on the motherboard) and the MS-DOS **FAT** (file allocation table) file system that only allowed hard disks up to 32 MB (who could ever imagine a drive that big?). **Disk partitioning** became necessary when hard drives got bigger than 32 MB. Originally, you could partition a large physical hard drive into several 32 MB "partitions" or "logical drives," each with its own drive letter (C, D, E, etc.). Is this just ancient history? **No**. Keep on reading. The various BIOS and Windows upgrades (FAT-16, FAT-32, etc.) stalled at 2 GB, 8.4 GB, and 32 GB, with the current limit at 137 GB – but 120GB drives are standard on PCs now, so if you decide to add a larger hard drive to your PC later, you may hit a brick BIOS or FAT wall. The technology to get around the 137 GB limit is called "Big Drives" (though some insist on calling it FAT-48). Sometimes you can get a BIOS or Windows update to deal with larger drives, and sometimes you can get a new hgard drive controller – but sometimes you can't. But you can almost always use **partitioning** to

make that extra hard drive space usable: for instance, making a large but only partly usable hard drive into two "logical" hard drive partitions, C: and D:. All versions of Windows will allow you to partition a hard drive, see your Windows documentation for details. Hard disk manufacturers are improving their installation instructions; the 11/5/02 *PC Magazine* gave 4/5 stars to Seagate for their *80 GB Barracuda ATA IV hard drive* for its installation software.

Drive letters A and B are reserved for floppy drives, and the main hard drive partition is C. Any additional drive, like CD-ROM drives, take up subsequent drive letters (D, E, etc.). But if you add another hard drive, it becomes D, and your CD-ROM drive changes to E and programs can't find their CD-ROMs and refuse to run. *So, when you first get your PC, and before you install your software, reserve a "higher" drive letter (e.g., G) for your CD-ROM.* To install a second hard drive: check the 4/13/00 Norton Utilities bulletin: www.symantec.com/techsupp/vURL.cgi/nuarc

CD-ROMs look like music CDs, but hold computer data. A CD-ROM is just like a read-only floppy diskette (you can't write data to it) but holds data like thousands of floppies. Some CD drives use a SCSI controller, some connect to an IDE adapter.

CD-R/CD-RW drives ("CD-burners") are similar but not identical. CD-R drives can create music CDs and data CD-ROMs, but once the CD is written, it's not erasable. CD-RW drives can write and rewrite (erase and reuse) certain kinds of CDs – but **the CDs these drives make can't be read in all music CD players, or all CD-ROM drives**. Almost all current CD-burners will handle CD-R and CD-RW disks – but most people burn CD-R disks, as they're cheap enough to be disposable. The best software for CD-burners is Adaptec/Roxio [Easy CD Creator](#). As of fall 2002, the premier CD burner is the Yamaha CRW-F1: it will burn a 621 MB CD in two and a half minutes.

CD burners and disks get faster and faster. The original cobalt-blue or emerald-green

CD-Rs (from Taito Yuden) will write up to 32x, and the newer ones have a 70-year life (20 years for earlier ones). The light-green-yellow ones (Mitsui Toatsu) are cheap but not as fast, and last 100 years. But the new top-dog Mitsubishi sky-blue CD-Rs write at 48x and last 100 years.

DVD disks are like CD-ROMs on steroids. A DVD can hold 4.7 to 8.5GB of data: all nine Beethoven symphonies, or two hours of full-motion video with soundtracks in 8 languages and 32-language subtitles. A DVD drive can play existing music CDs and existing CD-ROMs. The best programs for playing DVDs are [PowerDVD](#) and [WinDVD](#).

DVD-burners write to special DVD disks, but with different standards: DVD-RAM, DVD-RW, and DVD+RW. HP now only ships DVD+RW drives, that also burn regular CDs. **DVD+RW** won (though Pioneer put out full-page ads for DVD-R/RW to try to stave off the inevitable).

If you plan to connect your CD-ROM drive and a **SCSI** hard drive to the same adapter, be sure CD-ROM drive and hard drive both are guaranteed to work with the SCSI card. Here is advice from the Insight Direct Web pages (www.insight.com):

"1) Ultra SCSI is twice as fast as SCSI-2 on the same cable. Ultra and SCSI-2 drives and controllers can work together. 2) Wide (68 pin) is twice as fast as narrow (50 pin) at a given clock speed (SCSI-2 or Ultra speed etc.). 3) SCSI-2 and SCSI-3 are command sets. Almost all new drives are SCSI-3. SCSI-3 and SCSI-2 drives and controllers can work together. 4) Wide and narrow drives can work together, but only with special conditions: wide drives don't work on narrow controllers, wide drives cannot connect to narrow cable. Given the above, you can see that an ultra wide drive is four times as fast as a narrow SCSI-2 drive. Also, a narrow SCSI-2 drive could run on an ultra wide SCSI-3 controller (on a 50 pin connector or at the end of a 68 pin cable with an adapter), and a wide ultra SCSI-3 drive could run on a wide SCSI-2 controller." Also check out the pictures: <http://www.adaptec.com/tools/selectors/cables.cgi.html>.

Hard Disks, Easy Choices (and CD/DVD-ROM, CD-R and CD-R/W)

Cable Modem] - [Router] - [Ethernet Hub] - [PC] The BEFSR41 is BOTH a router and an Ethernet hub. One great thing about Linksys, in addition to an "A" grade: they offer lifetime 24/7 toll-free tech support.

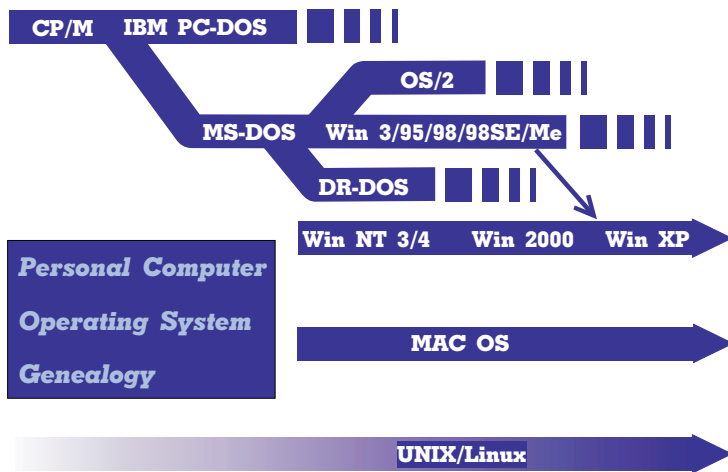
And, as Steve Gibson says at grc.com, although a router provides the best protection, it's not quite complete. If a piece of "spyware" gets on your system, for instance via Netscape download software, or from viewing a malicious ad on a Web page, or a tiny hidden program in some HTML mail you've received, it may stay on your PC and send information to someone else about what you do with your PC - for instance, all the Web sites you view. To detect such spyware activity, a good software firewall program will note outgoing Internet activity and allow you to monitor and control it. The freeware version of ZoneAlarm (free download from zonelabs.com) does this, and pairs neatly with the BEFSR41 router.

Yes, it is possible to use a software firewall instead of a router, though not as safe. Norton Personal Firewall gets OK marks Also, we switched from the software firewall BlackIce Defender, which is still a reasonable choice, to free ZoneAlarm and like it better in some ways. Go to zdnet.com and read Protect your Desktop, and then check grc.com for more up to date software firewall ratings.

Anti-Virus Software Computer "viruses," small destructive programs that can sneak into your computer, are a part of modern computer life. Although you may never encounter one, don't take the threat lightly: a virus can reformat your hard disk and destroy all your data. Almost all shareware, freeware and commercial software firms take great care to make sure their programs are free of viruses, but computer viruses get smarter every day. The most likely way to get one is in an infected email,

but viruses have also been found on commercially purchased software and many come on friend's floppy diskettes. Good programs include several-time *PC Magazine* Editor's Choice Norton

Interface		Burst Throughput	Uses
IDE	IDE ("Integrated Drive Electronics")	2.1-8.3 Mbps	Original IDE, now obsolete
	EIDE (Enhanced IDE, ATA-2, Fast ATA, ATAPI)	11-16.6 Mbps	Standard hard disk interface now, also used for some CD-ROM and tape drives. Good, and cheaper than SCSI.
	Ultra-ATA, DMA-33, UDMA/ Ultra-ATA-66, DMA-66, ATA-100, ATA-133/DMA-133	33.3 Mbps/ 66.6 Mbps/ 100 Mbps/ 133 Mbps	Compatible with EIDE controllers, needs Intel 440LX chips on motherboard or Ultra-ATA controller board for 33.3+ Mbps. Use shielded cables e.g., www.ultracable.com . If Control Panel\System Device Manager shows something like "Intel 82371 AB/EB PCI Bus-Master IDE Controller" then right-click drive in My Computer and check DMA box.
SATA	Serial ATA	150 Mbps-600 Mbps	Backward compatible with EIDE, smaller cables; may replace SCSI or even EIDE
SCSI-1	SCSI-1	1.5-5 Mbps	(obsolete)
SCSI-2	SCSI-2 ("narrow") (Fast SCSI)	3-10 Mbps	For fast hard disks, CD-ROM drives, scanners. Most current format. 50-pin cables, several types of connectors.
	Wide SCSI-2 (Fast/Wide SCSI)	20 Mbps	This and those below are for really fast hard disks; require expensive adapter cards.
SCSI-3	Ultra SCSI	20 Mbps	50-pin cables
	Wide Ultra SCSI	40 Mbps	Most use 68-pin cables, some plug directly into motherboards with 80-pin cables.
	Ultra-2 SCSI	40 Mbps	Under development; most use 68-pin cables, some plug directly into motherboards with 80-pin cables.
	Wide Ultra-2 SCSI	80 Mbps	
	Ultra-3 SCSI	> 80 Mbps	
	Wide Ultra-3 SCSI	up to 160 Mbps	
Ultra 160	160 Mbps	replacement name for Wide Ultra-3 SCSI	
FireWire	IEEE 1394	100-400 Mbps	For CD-ROMs, scanners, printers, cameras.
	IEEE 1394b	up to 1.6 Gbps	May replace EIDE for hard disks.
USB	Universal Serial Bus 1.1/2.0 full-speed/hi-speed	12 Mbps/ 260 Mbps	For mice, keyboards, scanners, cameras. (See " I/O, I/O, it's off to the peripherals we go ," page 18, for more.)
FC	Fibre Channel	100 Mbps-1 Gb-10 Gb	Used for very fast, very expensive disks.
Ethernet	Ethernet/10Base-T	10 Mbps	Used for PC networking by LANs (Local Area Networks). By far the most popular LAN protocol.
	Fast Ethernet/100Base-T	100 Mbps	
	Gigabit Ethernet	1,000 Mbps	
	10 Gb Ethernet	10,000 Mbps	



Antivirus (\$50 discount), and McAfee *VirusScan*, part of *McAfee Utilities* (\$38 discount) and *McAfee Office* (\$56). We used to use *VirusScan* but after some bad support experiences, switched to *Norton Antivirus* (\$40 discount), also part of *Norton Systemworks*.

Major Utility Packages: *Norton Systemworks* (\$60 discount) includes the top-rated Norton Antivirus, at a low cost -- everyone should at least buy *Norton Antivirus*, though Systemworks has lost ground over the past few years. *OnTrack SystemSuite* wins awards and is superior overall (\$60 discount).

Another category is the **PC Service Center**. The hardware and software on your PC can benefit from periodic upgrades, mostly available for free, but it's hard to know when these "slipstream" upgrades are available. Several companies offer for-pay one-stop shopping for such updates via the Internet. Norton Systemworks' *Web Services*, and several other company's offerings, can help you keep your PC up to date, faster, and less likely to crash.

File Managers are utility programs, making it easy to copy, move, delete, and view files; some offer extra options, such as ZIPPING and unZIPPING files (a

single ZIP file contains several files packed together and compressed, to save space), backing up selected files from the hard disk to floppy or ZIP diskettes, finding a file anywhere on a hard disk, showing a graphic tree of your hard disk structure, editing and printing files by just pointing at them in the directory listing, and so forth. Some are public domain, some are shareware (see Starting Up, above), and some are commercial. Windows 3.1's *File Manager* is terrible. The Windows 95/98 *Explorer* is reasonable, but is much more useful when you add on to it a bit. Inso's [Quick View Plus](#) program (\$49 download, \$59 shipped to you from manufacturer, \$49 discount) lets you view many file formats with a mouse click. The *Direct Cable Connection* function of Windows 95 lets you copy files back and forth between a desktop computer and laptop computer, though it doesn't work properly if you also use a TCP/IP Internet connection, and Microsoft has no fix. [LapLink.com's](#) *LapLink Gold* (\$130 download, \$170 shipped from manufacturer, \$133 discount) does the same and is capable of doing a customized and automated laptop/desktop update very quickly. Hint: use *Xchange Agents* and *Restore Connections*; see [Keith's web page](#) for how to use to synchronize Pegasus email between a laptop/desktop.

A requisite add-on is a program to pack many files together in a compressed format, for example, to fit them on a floppy disk to give to a friend, or to email without taking forever. The original DOS program for this made files called ARCHives, but then the company that made the program to create .ARC archives made some bad marketing decisions (i.e., not allowing its programs to be distributed as shareware) and they were eclipsed by Phil Katz's PKware, which made shareware PKzip for DOS's .ZIP format into the unquestioned standard. PKware came out with PKzip for Windows, which was a loser and was eclipsed by Nico Mak's best-selling WinZip ([www.winzip.com](#), downloaded shareware, \$29 registration, \$28 + shipping "discount") -- get it.

Another type of worthwhile utility is the "system rollback" program. These programs use about 10% of your hard drive, and sometimes 10% of your per-

Windows XP ahead: approach with caution

As you can see from the above diagram, the last in the series of Windows "consumer" versions is Windows Me (Millennium Edition). (If you do a limited install, it's Mini-Me.) Although Microsoft had once said that there would be no updates of this type of Windows after Windows 95, and then after Windows 98, and then after Windows 98 Second Edition, they **really mean it this time** that there won't be any updates after Windows Me. Instead, the update of what was once Windows NT, and then was Windows 2000 and now is Windows XP, has replaced both strains of Windows. Basically they've abandoned the corrupted core of Windows 95/98/Me and came out with several versions of Windows XP, but all based on the WinNT/2000 core that has always been less prone to crashing (get XP Pro, forget XP Home). And Windows XP has drivers for hardware that Windows 2000 choked on, and will run all the old Windows games. (Well, almost all.)

There are problems with Windows XP though: on the technical side, it is slower than Win2000 under heavy processing load. But the real problem is sleaze. To use many WinXP features, including emailing Microsoft technical support, Microsoft demands you use their Passport login system, which is a security nightmare to match Outlook. And to use Passport you have to *irrevocably* agree that Microsoft can sell your email address to any spammer it wants to, and that Microsoft can change the contract terms at any time (including adding monthly charges if it wishes) with no notification other than posting on a Web page. On this basis alone, WinXP sucks. WinXP is, however, a solid operating system - so if you get WinXP or upgrade to it, either (1) never use the Passport system, or (2) get a free Microsoft Hotmail account and use it to register your Passport. (having Microsoft spam Microsoft seems just, somehow.)

One study (*Infoworld* September 13, 1998, p. 10) estimated \$2015-\$3100 to upgrade a PC from Win 98 to Win 2000 -- including time and effort and expense to upgrade software to work with the new operating system. Many recommend that you reformat your hard drive and install WinXP from scratch, rather than upgrading.

"Don't buy any software that is numbered .0. Wait for the .1 release and you'll avoid a lot of frustration." This applies in spades to operating systems like Windows. We had a terrible time trying to upgrade Win 3.1 to Win95 - having to reformat the hard disk several times, for example -- and finally just installed Win95 and all our software from scratch on a newly-reformatted hard disk, having backed up our data files and then put

formance, to monitor all the changes you make to your system and record them. If you do bad things to your PC, like killing an important file you just spent 5 hours making, or delete an important system file (and have no idea what), this software can save you. It allows you to recover deleted files, and allows you to "revert" the system to a previous "safe point" - while still keeping the newer files you worked on since that safe point. Windows Me does this for system files, but not the rest of your files. Adaptec roxio.com [GoBack](#) is clearly the leader as of winter 2000-2001 -- Gateway is even putting it on many of the systems they sell. We've been pleased with it so far, and it got a [PC Magazine](#) Editor's Choice this year. A rival, [PowerQuest SecondChance](#), is available.

Backup Devices allow you to save a copy of all the files on your hard disk -- essential in case your hard disk crashes, or if your computer dies for some other reason. With today's hard drives getting larger and larger, this means you need a big device for backup. In the early PC days, we used to back up on floppy disks, but now nobody has a truck big enough to carry all the floppies that would be needed. Then came Bernoulli and ZIP drives, and these were OK until hard drives got even bigger (who wants to spend six hours sitting at a PC stuffing ZIP disks into a slot every 20 minutes?) And about that same time, tape drives became fairly standard for backing up, and we used to recommend tape drives to everyone. But hard drives are still getting bigger and cheaper all the time, and now to back up all of an 80 gigabyte (GB) hard drive, which is now standard on \$3000 PCs, you need a tape drive that costs as much as the PC itself. Sigh. Although it's nice to backup your entire hard drive, you at least must back up your data files, and ideally enough of your hard drive's programs that you can restore from backup without having to spend two weeks reinstalling all your software after a crash (that's about how long it took us last time). Using the backup software with Windows or your backup device, exclude from backup all those multimedia files that take up so much space on your hard drive, and you should be able to fit it all on one of those 10 or 20 GB tapes or removable hard drives.

Options include

- ✖ 100- or 250-MB ZIP disks
- ✖ CD-RW drives
- ✖ removable hard drives
- ✖ tape backup units

It is possible to backup on a ZIP or similar drive (see sidebar on [Hard-Driving Floppy Disks](#), page 7) but this works best on smaller hard drives - even with the big 250 MB Zip disks, it'll take 20-25 to back up a 10 GB hard drive. And you have to be there to switch ZIP disks each time one fills.

CD-RW drives can be used to backup your data, but each disk only stores 700 MB -- so the problem isn't as bad as with ZIP disks, but you still have to be at the computer to insert new CDs on a regular basis. DVD burners will backup a 20 GB hard drive on 2-3 disks, so this is doable.

Removable or detachable hard drives are becoming more attractive as backup devices, but there is no standardization and they are more fragile than ZIP disks or CDs. Nonetheless, the fact that you can do an entire backup unattended, and the dropping price of hard drives, means that this may be the preferred method of backup by the end of 2002. The [Iomega HDD portable drives](#) seem to be market leaders, but things may change rapidly.

Some like to use online storage backup for a monthly fee, backing up their data over the Internet - but some of these companies have gone bankrupt and the users lost all their data. We advise against these services.

A tape backup drive *could* be a reasonable alternative -- *if* you can get a tape drive that will backup your entire hard disk on one tape. But hard drives are getting cheaper and bigger faster than tape drives. Big tape drives are available from suppliers such as [HP](#) and [Onstream](#) for several hundred dollars. You can get a HP SureStore DDS-3 DAT24 tape drive that will, with compression, back up about 24 GB for about \$700. However, at around half this price, an Iomega HDD portable 30 GB hard drive seems a

No matter what size hard disk you get, you'll fill it. Oh, it may take a year or so, but more likely it'll be a matter of months. What to do?

First, do some housekeeping. Back up your hard disk. Then, buy [DiskMapper](#) from [Micro Logic](#) to go through all your subdirectories and see what you can delete. Perhaps you don't really need that game any more. You can offload some of those old documents and pictures onto ZIP disks or onto CD-ROMS with a CD-R drive. OK, that gets you another month or so. But what about that really neat program that takes up 32 gigabytes of hard disk space? Time for serious measures.

Replace the old hard disk with a bigger one? Possible. However, you could get a new hard disk and keep the old, if you

have room and your controller accepts a second hard disk.

Before such extremes, check if you have hidden room on your hard disk. A friend running out of space said "You know, it's supposed to be a 40 MB hard disk but I've only got 30 MB." His hard disk was partitioned into two "logical" hard drives, C: and D:. He was using only the C: drive. However, you can use the DOS command FDISK to set up multiple "logical" hard drives on any large hard drive. Once he formatted drive D:, he had another 10 MB of disk space. (We can't believe the store didn't do this before selling it.)

Assume the worst-case: no hidden partitions, you've deleted all your junk plus a few things you wish you hadn't (you **did** back up the hard disk?), and there's still

not enough room. There is one last software solution: on-the-fly compression programs. These automatically "compress" files so they take less room on the hard disk, and automatically decompress them as used. Once you get them set up, your hard disk runs a tiny bit slower, but you can double the space on your hard disk. Such a program comes with Windows 98. Using such a program increases your risk of a hard disk "crash" slightly (back up your hard disk regularly!), but makes lots of room.

And if this too finds you short of room? A new fast multi-gigabyte IDE drive now goes for about \$170; an "adapter" card (IDE drives don't need "controllers") is about \$50. However, check your computer first; most have IDE adapters on the motherboard.

**Files
Expand
to Fill
Available
Hard Disk
Space**

"What if Operating Systems Ran Airlines?"

PCs run the MS-DOS or PC-DOS operating system, commonly called DOS. Despite what Microsoft says, Windows runs "on top of" DOS. Windows was designed to make the computers easier to use, so the user could "point and click" instead of having to type in a string of commands. Since most new computers now come with Windows, and most new programs are written to run under it, that is what we recommend for most users.

Apple Macintoshes run their own (good) operating system. The new "Power PC" Macintoshes contain a CPU chip that reputedly can run DOS as well as PC software, and can take an add-in Intel CPU board. What you may not know is that much Windows software expects to see other IBM PC type hardware (e.g., video card, keyboard) and won't run properly on Power Mac computers.

There is also an "advanced" version of Windows known as Windows NT which competes with the latest version of IBM's

advanced operating system, OS/2 "Warp." Neither of these should be of interest to those just starting with PCs, or using them for personal use.

Most really big ("mainframe") computers run the large and complicated (but very good) UNIX operating system. Those who understand the arcana of the Unix operating system are referred to as "UNIX Wizards." This does not, as a friend of mine once misunderstood when hearing this in casual conversation, refer to the state of said persons' gonads.

The following explanation making the rounds of the Internet gives the flavor and foibles of the major operating systems before Windows 95:

DOS Airlines - Everybody pushes the airplane until it glides, then they jump on & let the plane coast until it hits the ground again, then push again, jump on again, and so on.

Mac Airways - All the stewards, captains, baggage handlers, & ticket agents

look the same, act the same, & talk the same. Every time you ask a question about details, you are told you don't need to know, don't want to know & everything will be done for you without you having to know, so just sit down & shut up.

Windows Airlines - The airport terminal is nice & colorful with friendly stewards, easy access to the plane, an uneventful takeoff ... then the plane blows up without notice.

Fly NT - Everyone marches out onto the runway, says the password in unison, & forms the outline of an airplane. Then they all sit down & make whooshing sounds like they're flying.

Unix Air - Everyone brings one piece of the plane with them when they come to the airport. They all go out onto the runway & put the plane together piece by piece, arguing constantly about what kind of plane they're building.

better solution. Whichever you get, tape or portable hard drive, you may need to install a FireWire or USB 2.0 card if your PC doesn't have a USB 2.0 port.

Hard drives are much more reliable than they used to be, but backing up your data still makes sense. Especially if you use Microsoft Outlook for email, you are vulnerable to all sorts of viruses that can trash your hard drive.

Help! When things on your PC go bad, there are several places to turn for help. Knowledgeable friends are key, but sometimes not available. You can call the hardware or software vendors, but the hardware vendor says it's a software problem and vice versa. By the way, we recommend a good spread-spectrum phone such as the Panasonic, with a Plantronics lightweight headset. That way you can stay on hold for an hour and still do your daily activities. Keith has been seen working out with his weights with a headset. There are several Web sites that offer expert advice. Microsoft's site can be useful (www.microsoft.com), as can the Web sites of various hardware/ software suppliers. The site MyHelpDesk.com is highly rated, and Windows Annoyances (www.annoyances.org) is an outstanding resource. There are several services that offer technical support, not limited to any particular hardware or software, for a fee; pcsupport.com and expertcity.com get the highest ratings.

The best treatment is prevention, of course -- get Norton Systemworks (see above) and keep it up to date, including its Rescue Disk component, install GoBack (see above) and backup your hard drive regularly (see above). If you still lose data, consider getting a copy of OnTrack's EasyRecovery, which can find and retrieve lost data. Also, if your hard disk seems entirely dead, and you don't have backups, consider calling OnTrack (1-800-872-2599 or 00 800 10 12 13 14 in Europe)-- for a fee, they offer hard disk data recovery services and are acknowledged experts.

There are a number of other utilities we use: [TweakAll](#), [XSetup](#), [EZdesk](#), [WinFax Pro](#), [PowerDVD](#), [Graphic Workshop for Windows](#), [Adobe Acrobat](#), [LifeSaver](#), Key Remap from the [Win95 Kernel Toys](#) (allows the control key to be moved), and QuikRes from the [Win95 Power Toys](#) (both of which work with Win98), [TrayDay](#), [WetSock and SocketWatch](#), [Bitstream Font Navigator](#) (which can reduce your installed fonts below 300, and markedly improve Windows performance, without actually deleting any files -- and you can see and install any of your uninstalled fonts at a moment's notice) and [Omnipage](#). Check for the online version of this document at www.pitt.edu/~kconover to use the links to look at these utilities.

Application Software

Office Suites combine several of the programs below. Microsoft Office is clearly dominant, but there are reasonable alternatives. [WordPerfect Office](#) is the main competition (way back at #2) but if you need something that can read and write MS Word/Excel files, and have no money at all, check out www.software602.com where you can download a free office suite. (They hope you'll get hooked and eventually cough up the money to upgrade to a more advanced version.) If you can't afford a new computer and have an old clunker, or want something that will work on a used computer that can't even really run Windows well, check out www.newdealinc.com for an inexpensive non-Windows operating system and sophisticated office suite that works well. On the other hand, www.openoffice.org offers a free, open-source alternative to Microsoft Office, and is a reasonable alternative. It looks as though openoffice is taking off, and may be adopted instead of Microsoft Office by many companies and government agencies. Check it out.

Everyone has heard about the Internet: the main thoroughfare of the national Information Highway. Well, maybe a few people on the island of Borneo haven't. But I'm sure there are some on Borneo who have, and are right now cruising the "Net."

What is the Internet?

Well, it's the connections between lots of computers. Not the computers, just the connections. Actually, a better question is what the Internet isn't. It isn't a company, it isn't a government agency. It isn't an organization of any kind, and indeed there isn't much organization to the Internet- it just grew. A few things are agreed upon such as how to send things from one computer to another. The main rule is that there are no rules.

So why do you care about this? Because by getting onto the Internet highway, you can electronically drive around the world! So let's see what the Internet can do.

Email

Email stands for Electronic Mail. Those who use email call regular mail snailmail because compared to email it's so slow.

The simplest email is on a Local Area Network. Connecting PCs with a LAN makes sharing a printer easy, and lets you send files easily from one computer to another, or keep files on a single "server" computer so you can reach them from any PC. Large universities and companies connected their LANs, and then email started becoming very useful. Some 15-20 years ago, companies such as MCI started offering wide-area email services between companies. Information utilities like CompuServe, to which people all over the world subscribe, also offer email. A few years ago, which is ancient history in the computer world, Internet email was separate from all these other email systems, and used mostly by computer nerds, university professors, and the military. But now all sorts of email services connect via the Internet.

With many and rapidly-growing connections, Internet email is good for chatting with faraway friends, for managing projects with members scattered across the globe, and for just about anything you might send by snailmail. For email, you and your e-correspondents need modems and connections to the Internet. Your connection may be through your company, agency, or university, or through a commercial service such as CompuServe.

Email addresses look like:

username@somewhere.domain. (say "username at somewhere dot domain.") Most use the naming conventions of the educational institution (e.g., jdoe@bigcomputer.anytown.edu), government branch (jdoe@bigbureau.gov), or commercial service

(e.g., jdoe@compuserve.com).

"Username" is how the computer knows the person, usually some combination of first and last name or initials. I.e., Keith Conover is "kconover" and Betty Thomas is "thomas." Both usernames were set up by administrators at the same university. Remember, consistency is not a characteristic of the Internet. "somewhere.domain" is a computer's name. "somewhere" is one or more descriptive words separated by periods. "domain" tells what kind of institution runs the computer, such as: .edu = educational institution, .com = commercial service or company, .mil = military, .gov = government agency, .org = some kind of organization. Examples: pitt.edu = University of Pittsburgh; nasa.gov=NASA; af.mil=U.S. Air Force; compuserve.com=CompuServe Information Services.

The easiest way to get Internet email is to sign up for a commercial service like CompuServe or America Online. (There are many other Internet service providers out there as well that can be much cheaper; it pays to comparison shop.) Free dial-up modem connections are sometimes available to university faculty and students, and to employees of some companies. Our favorite email program is Pegasus Mail for Windows (it's also free) from: www.pmail.com. It doesn't have the massive security holes of Outlook; see [Always More Threats](#) (PC Mag 7/00).

If using email, you **must** read *Emily Postnews Answers Your Questions on Netiquette*: <http://psg.com/emily.html>

Mailing Lists

People with similar interests can keep a master mailing list of email addresses on one computer. Those with something interesting mail it to this "listserver" computer; it then sends the email message to everyone on the mailing list. There are lots of special interest mailing lists.

Usenet Newsgroups.

There isn't room to go into details here, but Usenet newsgroups have their own codes of behavior. The most obvious is about "flames" (nasty/critical messages, often with ad hominem attacks). People who repeatedly post flames may arouse the ire of the majority. You can't stop a person from sending flames. But participants, or administrators of computers that pass on the newsgroup, can set up a "killfile." This file keeps you from seeing messages from a known flame source. Most browsers (i.e., Netscape and Internet Explorer) include a good newsreader.

World Wide Web (WWW)

The latest fad on the Internet is for the World-Wide Web, which supports hypertext links and color graphics. You can use

Windows and your mouse to browse the Internet Web, with colorful graphics and even real-time video appearing on your screen as you cruise the net. One of the best examples is the WebMuseum (<http://sunsite.unc.edu/wm/>) which has much of the world's great art, with critical commentary, on-line. More and more mail-order businesses are putting their catalogues on the web, which makes shopping from home a breeze, and without piles of junk mail from the postman (although spam from online retailers is just as bad). One of our favorite web shopping sites is English bookstore, so we can get the latest Terry Pratchett books years before they're published in the US. Another is the Amazon.com bookstore that carries just about everything. Even if you're not comfortable ordering merchandise over the Internet, it's still a useful way to get information, and many sites will let you order what you want over the web then call their store with your credit card number. (Whether you should send your credit card number out over the Internet is debated; we have no problem doing it with a site that uses encryption.) Check out the bookmarks page of www.pitt.edu/~kconover for a list of good web stores.

However, to access the web, you need a commercial Internet Service Provider with software for multimedia WWW browsing. Or, you need a connection to a university, corporate computer or commercial provider such as Pipeline or Netcom.

Windows, in a move that is still being debated in the courts, "bundled" its own browser, Internet Explorer, with Windows. Nonetheless, there is a bit of competition from Netscape, owned by AOL now, though free to individual users. But the most interesting is Mozilla, which is the open-source version of Netscape, without all the frills. Though not yet officially shipping, you can download a stable "prerelease" version for free - we like it better than Internet Explorer or Netscape; despite being "prerelease" it is more stable than either, and better features without fancy frills.

For Internet Service Providers, the August 2002 edition of PC Magazine rated ISPs. AOL, though it is by far the largest, got an F. AT&T got a B+ for dialup and a C- for broadband. Local ISPs got an A- for dialup, and B+ for broadband. The only real problem is that, for broadband, your options are generally limited to a maximum of two: a cable modem or a DSL modem, and your choice of an ISP is limited.

There is a massive amount of shareware and free software on the Web available with a click of your mouse. So what are you waiting for? The world is out there! See you in the Iway.

"I Wuz Roadkill on the Infurmentation Hiway!"

PIMs (Personal Information Managers) are important software packages - but discussed [above](#), in conjunction with PDAs, page 6.

Word Processing There are several shareware word processors, easily found on the World-Wide Web. However, some find these inadequate, so the extra money to get a good commercial program may be worthwhile.

Pirate copies are common. If you're using a pirate copy of a program, it's dishonorable not to shell out the cash to buy one. These programs are as hard to design as PCs; the company (even Microsoft!) deserves your support.

New PCs come with Microsoft Windows XP (home or professional; get the professional if you can), and are fast enough, and have enough RAM, to run any common Windows programs well. *WordPerfect* and *Microsoft Word* are the leading word processors. Both are big, sophisticated, and complex, but relatively easy to use. *WinWord* (*Microsoft Word*) is clearly the market leader, and is an excellent program (believe us, we've used some word processing programs in the past, including early versions of *WinWord*, that were real dogs, even though the best then available) but *WordPerfect* is an excellent choice, too.

Word for Windows (yet another common name for *Microsoft Word*) does contain many of the features of desktop publishing programs, such as *Ventura Publisher*, which we used to format and print this document (and post on the WWW in *Adobe Acrobat* .PDF format). *Microsoft Word* also takes many add-ons such as the excellent bibliography manager *Endnote*, from www.endnote.com. Keith uses it to manage his bibliographic references. He can search his saved references, *Endnote*, or search *Medline* from within the program to find the references he needs. He can save references from *Medline* into his *Endnote* library with a few clicks of the mouse. He can enter citations to any of these references into a Word document with a few keystrokes. And when he's done, he just selects a style (e.g., *New Engl J Med*) and presses a button -- and all the citations are formatted correctly, and the references reformatted in the proper style and placed at the end of the document. Slick!

All the above word processors have integrated **spell-checkers**. In addition to checking a paragraph or a whole file, these spellcheckers will check spelling as you type, *Microsoft Word* underlining in red when you type a word it doesn't recognize. *Word* and *WordPerfect* have an autocorrect feature. For instance, if you type h, t, and then e, instead of t, h, and then e, it still comes out **the**. This feature can also be used to expand abbreviations to speed your typing. For example, I type *asrc* and it magically becomes *Appalachian Search and Rescue Conference*. (Spend some time to learn and use this feature -- the trick of doubling the last letter of an acronym is a powerful way to allow you to have your computer automatically expand acronyms and other abbreviations you routinely use -- this means that, for example, you can still type the acronym ASRC and have it not expanded.)

You will probably invest in one of these programs, but you'll need something until you decide which

program to buy. *Notepad*, a very simple word processor, and *WordPad*, a very basic word processor, come with Windows, and are adequate to write an occasional letter.

Spreadsheets are aids to calculation, primarily for financial uses. Microsoft Excel, part of MS Office, is clearly king of the hill. But the spreadsheets in other office suites are excellent, too. But for personal use, all these are massive overkill. Several excellent shareware spreadsheets are available. The best is *As-Easy-As*, www.triusinc.com (registration, including shipping, \$59.00).

Database Programs are for filing and retrieving things like addresses, recipes, and the like. They generally require you to fix the number of characters in each **field** (e.g., *last_name*) of each **record** (e.g., John Doe's record includes fields for name, address, and phone number).

All good word processors (but not straight text editors like the DOS editor or *Notepad*, or simple word processors like *WordPad*) contain a mailmerge feature: a simple database for addresses, but without sophisticated sorting and reporting features like a dedicated database program.

High-end database programs include their own programming language, and are **relational**, meaning that you can connect several databases (e.g., connecting inventory and accounting databases in complex business systems). Such programs, for example the fading but still industry standard *dBase V*, and the highly-rated *Paradox for Windows* and *Microsoft Access*, are necessary for some big business applications but overkill for almost all personal users. (They are very capable but hard to learn.) Home users need an easy-to-use **flat-file** database program. A very easy to use and highly-recommended shareware Windows database is [BusinessCards for Windows](#). There are many special-purpose shareware databases available, too; go to www.winfiles.com to see some examples.

Financial Programs range from simple shareware checkbook-balancers to giant programs to run a multinational corporation. For personal and small business use, trade publications and reviews (and both Betty and Keith) agree that *Quicken* is the best. It is a very popular program that helps you keep track of your personal finances. You enter transactions on the screen just as you would in a manual check register. *Quicken* lets you write checks with your printer, or make payments electronically using your modem. You can print out reports showing exactly how you spent your money by category. You can transfer your data to tax preparation programs such as *TurboTax* and *TaxCut* to fill out and print the tax forms themselves. Both are available for about \$45 ([Egghead Software](#), for example: 1-800-EGGHEAD).

TurboTax is the most popular personal tax preparation program. It is straightforward, but sophisticated enough to be useful for more than basic returns. It offers IRS instructions translated into plain English. It also offers telephone support seven days a week during tax season. You may either print your return on your printer, or file electronically. It is available in versions for DOS and Windows. It retails

Computer "memory" means many different things: for one thing, hard disk space vs. system RAM. RAM = Random Access Memory = memory of which every bit can be accessed at need (each bit has a specific "address"), as opposed to hard disks, floppy disks and CD-ROMs that are sequential access (have to read data in long chunks, rather than knowing whether a single bit is on or off). RAM and disk space are both measured in **bytes, kilobytes (kb), megabytes (Mb), and gigabytes (Gb)**, which makes it downright confusing. Following standard metric notation, 1000 bytes = 1kb, sometimes abbreviated as 1K. 1000kb = 1 Mb or "1 meg" as people often call it. 1000 Mb = 1 Gb. If you want to really confuse someone, explain that 1kb is really 1024 bytes – it's a nice round number for binary computers; then have them figure out how much a gigabyte really is.

Hard disk storage is a kind of memory. If you run out of hard disk space, see the sidebar on "[Files Expand to Fill Available Space](#)," page 13.

System RAM is the memory that your computer uses to actually "think." The more your computer has, the better it can think, and the more things it can hold in memory at once. In the days before Windows, we often got computer programs to run in 64K or 128K of RAM - now, Windows 98 and above really need 64 MB to run at all well, and if you want to run multiple programs at the same time, we strongly recommend a minimum of 128 MB (we currently have 512 MB in our main PC).

There are various types of chips used for RAM. Some are better (faster) than others. Each computer generally has to use the type of RAM for which it was designed, so you can't "upgrade" to a better type of RAM (though you can usually add more of the same type of RAM, a cost-effective speed-up for your computer).

In 1995, plain dynamic fast-page-mode (**FPM**) RAM started to be displaced by Extended Data Out (**EDO**) RAM. In 1997, EDO RAM started to be replaced by **Synchronous Dynamic RAM (SDRAM)**. SDRAM comes in many flavors – and until the industry standardizes, you can only get SDRAM upgrades in the right flavor from your computer manufacturer, rather than getting it from cheap generic suppliers as for most other kinds of RAM. So, if getting a computer with SDRAM, get a lot of RAM when you buy it. SDRAM is still expensive, so manufacturers came up with **Burst EDO (BEDO) RAM**, which is better than EDO RAM but not as good as SDRAM.

Most computers these days use SDRAM, which needs to be at the same speed as the motherboard's main bus: 100 or 133 MHz. So most present computers will need **PCI100** or **PCI133** SDRAM chips for memory expansion.

At some point (we'd originally thought 1999) you may see computers with **RAMbus RAM**, which can be shared between the main core of RAM, the video card, and other RAM-hungry hardware. However, it is turning out to be difficult

and expensive to put into PCs, and now seems to have been beaten by **Double-Data-Rate SDRAM (DDR RAM)**. DDR RAM runs at TWICE the speed of the system bus – thus 200 or 266 MHz. High-performance systems in early 2001 seem to mostly have DDR RAM, which seems to be as fast or faster than RAMbus RAM, but less expensive.

If all this talk of system bus speed and such is bit much, please check out [The Evolving PC Platform](#), *PC Magazine* 10/3/00.

Do not confuse SDRAM with the very fast but very expensive **Static RAM (SRAM)** that is used in small amounts in "Level 2 cache" on many computer motherboards. SRAM Level 2 caches supplement the Level 1 cache that occurs on the CPU chip itself. With some motherboards you can increase the SRAM L2 cache from 128K to 256K or even 512K. It is said that for the L2 cache, **synchronous burst (sync) SRAM** is the best, followed by **pipeline burst SRAM (PBSRAM)**, then **asynchronous (Async) SRAM**.

RAM chips often come several at a time on a small board; these are variously called SIMMs (Single Inline Memory Modules) and DIMMs, and RAMbus chips on RIMMs.

Video cards started off with dynamic RAM (DRAM). Later this was replaced with "dual-ported" video RAM (VRAM), then later with Windows RAM (WRAM) and EDO VRAM and now sometimes Synchronous Graphics RAM (SGRAM). Each claims incremental improvements on previous types.

Are You Losing Your Memory?

for \$79.95 (from TurboTax: 1-800-477-1445), but is available discount for \$35 (deductible on your taxes!). State versions are also available for \$25 discount, but some state versions don't work right; we found the Pennsylvania State version useless several years ago and haven't bothered checking it out again. Both *Quicken* and *TurboTax* are available in CD-ROM versions with lots of financial extras.

Books

If you're looking for a general introduction to computers, we recommend *The Secret Guide to Computers*, a constantly-changing, idiosyncratic and irreverent book; the 2002 edition is \$17.50. Check <http://www.angelfire.com/nh/secret/> for details.

To understand the PC revolution, read the bestseller by pseudonymous Robert X. Cringely, [Accidental Empires: How the Boys of Silicon Valley Make Their Millions, Battle Foreign Competition, and Still Can't Get a Date](#).

Extra Goodies

Map Software includes a great variety of different types of software. Our favorites are:

✂ [Delorme Street Atlas Deluxe](#) - For street navigation, this is unsurpassed. We have a [Jotto desk](#) installed in our beat-up Range Rover - so a laptop can be at the driver's right hand, just in front of the dash, and close to the line of sight out the front of the vehicle. There's a 12V power supply for the laptop, and we connect it to a [Garmin GPS3+](#) GPS and a [MightyMouse 2](#) external GPS antenna. This allows you to, when stopped for a second, to see the "you are here" marker. And, you can plot a route before you set out, and you can quickly refer to the map to see if the "you are here" marker is still on the highlighted route. Works very well. See http://www.pitt.edu/~kconover/street_atlas.htm for more details.

✂ If you want to use your PC to browse and print topo maps, though, ignore Delorme's topo map software. Instead, check out [Maptech Terrain Navigator](#) - clearly a superior product. For \$150 you can have all the topos for a multistate region on CD with an excellent browser program - which will also use a GPS to track your location in real time if you wish.

Graphics Programs are a mixed bunch. The three types: CAD, bit-mapped graphics, and draw programs.

I/O, I/O,
it's
off to the
peripherals
we go . . .



I/O is computerese for Input/Output. Computers have to communicate with peripherals, which means things like printers, external modems, scanners, and the like – things that connect to the computer but are not installed into a slot on the motherboard. (Note that internal modems install into a slot and thus are not peripherals.)

Parallel ports, also sometimes called printer ports, use a particular kind of plug, often called a Centronics plug after the company that made them. Every PC has one parallel port, named LPT1: because it is LinePrinTer port #1. Some computers have a second parallel port called LPT2: (or you can buy an add-in board with a second parallel port on it), which can be used for a second printer, or as a high-speed connection to your laptop using LapLink. Parallel ports are called "parallel" because they send and receive on many wires at the same time.

All PCs have one or two serial ports. The plug is called RS-232, meaning both what the cable and plugs look like and how they work. The first serial port is called COM1:, the second COM2:, and you can also have COM3: and COM4: if you wish. Serial ports are used for external modems, mice, scanners, and all sorts of other peripherals. Serial ports are called serial because they send data in sequence along a single wire. This means they're

not as fast as a parallel port, but they can send information, for instance, out a telephone wire using a modem.

PS/2 mouse ports came in with the introduction of IBM's now-discontinued PS/2 computers, but almost all computers now include a PS/2 mouse port, which frees up one of your serial COM ports for other things. Another way to effectively get more serial ports is to get a four-way switchbox - we have one attached to COM1: and it has cables dangling off it for the REX, the GPS, the ham radio, and the cellphone. We'll never have all of these connected at the same time, so the switchbox works well from keeping you to have to dig around on the back of the case each time you want to use a different serial device.

One of the problems with these old-fashioned I/O ports is that they have a limited number of computer resources to share amongst themselves (interrupts or IRQs, direct memory access or DMA channels, and memory addresses). Trying to add new devices without IRQ or DMA conflicts can make upgrading PCs into a black art. Plug and Play motherboards, and operating systems (e.g., Windows 95 and up) and peripherals are starting to make this somewhat easier.

You can also use **SCSI** (see the sidebar on [Hard Disks, Easy Choices](#), page 10, about SCSI), **USB**, or **Firewire** to con-

nect many peripherals using one IRQ; SCSI is fading, USB is solidly here, and Firewire seems to be coming into its own.

The latest I/O buses aim to make attaching new peripherals foolproof, as well as letting them operate faster. These are the **Universal Serial Bus (USB)** and **IEEE 1394**, better known as **Firewire** or **HPSB** (high-performance serial bus). USB ports are built into many computers built in 1998 and later. Early implementations of USB 1.0 sometimes didn't work well, but most computers built since 1999 have fairly standard and stable USB 1.1 ports. FireWire just hasn't taken off yet, but may become important in computers built in 2002. If buying a new desktop computer, make sure it comes with USB 2.0 ports, which are 40x faster than USB 1.1 ports. USB 2.0 ports should be available on laptops in 2003.

Just to keep you on your toes, the USB people have now (summer 2002) renamed **ALL** USB ports to 2.0; but the ones that run at the slower 1.1 rate are "**USB Full-Speed**" and those that really ARE USB 2.0 ports are to be called "**USB Hi-Speed.**" Classic doubletalk sounds like a sleazy way to make you think you're getting a USB 2.0 port when you're really just getting a slow USB 1.1 port. So make sure you ask for a PC with "**USB 2.0 Hi-Speed**" ports. Sigh.

CAD (Computer-Aided Drafting) programs are great for architectural and engineering drawings, but not for artistic expression. [AutoCAD](#) (\$3300, no discount) is the standard; [AutoCAD LT](#) (\$630 discount) is a reasonable alternative.

Bit-Mapped Graphics Programs can't draw precise shapes as easily as a CAD program, but allow a wide range of expression including spray paint tools; they also are used to modify or touch up photographs. With CAD and draw programs, each line or curve is saved in a mathematical equation; the printout is always sharp no matter how much you enlarge it. With bit-mapped programs, however, you are changing things pixel by pixel on the screen (a pixel is the smallest dot the screen can show). Thus, if you shrink and enlarge the image, it becomes coarse, with chunky blocks instead of smooth lines.

Bit-mapped graphics programs grade from simple toys, such as the paint program included with Microsoft Windows, to sophisticated programs that cost many hundreds of dollars. Two main functions of bitmap programs are **image editing** and painting. Image editing masks (outlines) part of an image and changes it, mostly for photo touchup work. For entry-level programs, [Paint Shop Pro](#) and [Photoshop Elements](#) (both \$100 discount) seem best. [Painter](#) (\$370 discount) works much the way artists do. [Adobe Photoshop](#) (\$600 street, much cheaper with educational discount) is clearly the expert's favorite, although expensive and complex.

Draw Programs combine some of the best elements of CAD and paint programs. [CorelDraw](#) (\$569 discount) is well-known and a good program; we use [Adobe Illustrator](#) (\$400 street, much less with educational discount) All the draw programs include a bitmap editor.

Making Slides Just want to make some slides? Use the top-rated [Microsoft Powerpoint](#) (\$289 discount, much cheaper as part of Microsoft Office or for educational users) and send them to a service bureau, or give them to your company or hospital AV department. Keith prefers to use a computer projector for presentations -- he hasn't made presentation slides for years. Projectors cost \$2000-\$5000 but are widely available at educational institutions and teaching hospitals. Some newer ones weigh only 2 lbs. A good place to learn more, and to buy them, is www.presentingsolutions.com.

Digital Cameras are great for use with one of these graphics packages -- when our child was born prematurely and had to be in the NICU, Keith used the digital camera to take pictures and bring them back for Betty (who was trapped in recovery and couldn't get to the NICU) to see. We recommend those that use a Compact Flash card (Kodak and HP cameras, for example), which holds all your pictures, and can be pulled out of the camera and plugged into your laptop or desktop computer where it acts just like a fast hard drive. The main problems with early digital cameras were the poor resolution, and the long wait

Reality Check . . .

Computers are very useful tools, but are "high-upkeep" items. You may have already gotten this message from what we've had to say above, or from personal experience. Clifford Stoll, the author of *The Cuckoo's Egg*, a bestseller about criminal computer hackers, also has produced a volume entitled *Silicon Snake Oil* that tells it like it is: "Within two years, the value of a computer drops in half. Within five years, it's pretty much superseded. And within a decade, you find them at Goodwill. I know—they're over in aisle B, not far from the bun warmers.

"A word processor may last two years before the next version. These upgrades likely add as many new bugs as are patched, and result in a bigger, more complex program. One that's less and less compatible with old files. And one that requires me to learn new commands, functions, and menu locations.

"Learning a new program takes many hours, often several days. To become fluent may require a month of patiently figuring out commands and reading

manuals. The cost of learning dwarfs the price of the software and hardware.

"We each have a major investment in the systems that we already know. A new program must offer substantial benefits to make up for the time I'll spend figuring it out and memorizing its commands.

"Computer jocks plead with me to get rid of my shopworn programs and replace them with faster, more efficient software. They promise tighter integration, more capabilities, and speedier communications. From experience, I know my real cost: hours of frustration.

"More and more journals are reviewed and published electronically, giving faster turnaround and quicker feedback. I can reach a researcher directly, and perhaps get an answer within an hour. Instead of retyping lists of numbers, I can transfer data straight from the collector into my analysis program.

"Networks [e.g., the Internet -KC] are terrific. On the other hand, I've watched researchers waste morning after morn-

ing, reading irrelevant net news, plowing through email, and fine-tuning their screen savers. I've seen a particle physicist panic when his dissertation evaporated in a disk crash. I grinned to learn of a friend who spent a month building an elaborate puzzle room in a Multi-User Dungeon—I stopped grinning when I heard of his three missed midterms.

"Networks bring a flood of both useful and useless information to our desktops. They help me work more efficiently yet still are counterproductive — they're equally great for working and goofing off. . . . Computer Associates makes business software, including a custom e-mail system. But the chairman, Charles Wang, doesn't use it. Indeed, he shuts down the company's e-mail system for five hours a day, so that his business gets its work done."

The bottom line? Computers and the Internet are powerful tools, but power can corrupt. Don't let your computer or the 'net become ends in themselves. Don't become a mouse potato.

between pictures - but with newer cameras, the resolution is higher (almost as good as a 35 mm camera) and the recovery time is a lot faster. Newer small digital cameras such as the top-rated Nikon Coolpix 2500 (\$300 street) are much better. However, as of August 2002, Nikon has just released (and Keith has just bought) the D100 SLR (single lens reflex) digital back that works with all standard Nikon lenses. For about \$2000, you get a better and more versatile back than any other 35mm camera on the market, digital or film. We expect this to set the standard for 35mm photography for the next year or two, though prices should drop gradually. In the July 2002 *PC Magazine* survey, Canon, Fuji, Minolta, Nikon, Olympus, and Sony all rated A grades.

OCR (Optical Character Recognition) programs are available to use with a scanner, so you don't have to retype text from a book, you can just scan it into your computer! OCR technology has finally reached the point where it works, almost reliably. Full-page flat-bed color scanners now start at about \$110 discount and include OCR software. *OmniPage Pro* (\$480 discount) is the best, and quite good, though *Textbridge* (\$80 discount) also very good; we've had good results with *OmniPage* and our HP ScanJet 7450. These two leaders used to be competitors but now they're both products of www.scansoft.com.

Speech Recognition Speech recognition software has finally gotten to the point where it works. Not great, but it works. Keith has done all of his ED charts with speech recognition for the past couple of years, and we've installed speech recognition on our home computer. *Dragon Naturally Speaking* is the market leader. Speech recognition software works best on a Pentium III and up (which has special support for speech recognition) with **at least** 256MB of RAM.

Learning to Program You don't need to program to use a PC. But many people want to learn at least the basics, and it will help as you delve into the deeper aspects of configuring your PC. There's no question that the best way is to get a good programming language and play with it. No book can teach programming as well as a good programming language itself.

Niklaus Wirth, Swiss originator of the languages *Pascal*, *Modula-2*, and *Oberon*, will not accept computer science students who learned to program in BASIC; he claims they're irretrievably brain-damaged. Dr. Wirth designed Pascal specifically to teach programming, and it is still tops. *Turbo Pascal* is free from <http://community.borland.com/museum/> (though you'll have to register first). Check www.borland.com/pascal/pascalnet.html for many links to tutorials and examples. Borland's *Delphi Personal*, an updated of *Turbo Pascal* (\$50 discount) is all the rage now. But start with *Turbo Pascal* first.

College/University Discounts

Many colleges and universities offer large discounts on a limited selection of hardware and software. To qualify, you must have a faculty, staff, or student ID. For instance, at Pitt, faculty and students can get *Microsoft Office*, *Endnote*, and HP laser printers at much less than even the best mail order prices.

Disclaimer

Free advice is worth what you pay for it; this is no exception. If our advice helps you, fine. If you find it worthless, we disclaim all responsibility. If our advice makes your computer insane and it takes over your Jupiter-bound spaceship, we also disclaim all responsibility. The computer world changes, not over months

NEW



Wi-Fi is in, Wi-Fi is hot, Wi-Fi is phat. Wi-Fi is growing. What is Wi-Fi? Well, it's **wireless Ethernet**. Officially, it's just a wireless networking standard, designed for use in corporate offices so people don't have to plug their laptops into RJ-45 Ethernet ports. Officially, it's **IEEE 802.11b**.

Unofficially, it's become a grass-roots community-based wireless networking world, a way for people to connect to the Internet without wires when you're away from home.

How does Wi-Fi work? Communities, stores, families, anyone who has a high-speed Internet connection can put up an antenna and a Wi-Fi Gateway, and allow anyone nearby to use a small part of their Internet connection's speed to connect wirelessly to the Internet.

Starbucks and McDonald's will be installing Wi-Fi hubs in all their stores. IBM, Intel and AT&T are reportedly planning Project Rainbow to place Wi-Fi points across the country. VoiceStream has similar plans. This is big.

Beware, though: Wi-Fi is "in" which means everyone wants to get on the bandwagon. There is now an official Wi-Fi logo, and it can be used for the more expensive and faster 802.11a standard, which is incompatible with the popular 802.11b "original" Wi-Fi (different frequency, different protocol). There will be devices that will support both frequencies and protocols.

There will be one major competitor to Wi-Fi: cards that use the cellphone network, with its very wide coverage, to provide Internet connections. Stay tuned.

And watch out for *War-Chalking*: chalk marks on buildings that indicate an open node, a closed node, or a WEP-protected node (WEP is *wireless encryption protocol*), shown top to bottom.



and years, but over days and minutes. We can't guarantee the value or reliability of any product, because we can only report what we've seen and heard ourselves. But, we promise that everything that we tell you is in good faith.

Some Places to Order

Computer Discount Warehouse 1020 E. Lake Cook Road Buffalo Grove, IL 60089 Large selection of software, excellent prices.	1-800-314-4239 www.cdw.com
Insight Direct, Inc. 1912 West 4th St. Tempe, AZ 85281 Major supplier of hard drives, has widest selection; knowledgeable sales staff.	1-800-796-1111 www.insight.com
Jameco Electronic 1355 Shoreway Road Belmont, CA 94002 Inexpensive techie parts and kits. Excellent technical support.	1-800-831-4242 www.jameco.com
JDR Microdevices South 10th Street San Jose, CA 95112-4108 Inexpensive techie parts and kits. Excellent technical support.	1-800-538-5000 1850 www.jdr.com
Micro Express Kaiser Avenue Irvine, CA 92714 Small but award-winning mail-order computer manufacturer.	1-800-989-9900 1811 www.microexpress.net
Micron Electronics, Inc. East Karcher Road Nampa, Idaho 83687 Big chip manufacturer, also sells lots of award-winning computers by mail.	1-800-209-9686 900 www.mei.micron.com
PC Connection 6 Mill St. Marlow, NH 03456 Almost universally rated the best PC mail-order house; outstanding service, good prices.	1-800-800-5555 (24 hrs/day) www.pcconnection.com

Upgrade Fever

"I have a ____ computer. Should I upgrade or get a new computer?" That's what people ask often ask us. In general, the answer is to get a new computer. But there are times when upgrading makes sense. Infoworld had a nice article "Desktop upgrade solutions: Salvaging sunken chips" in the July 8, 1996 issue. (They described roadblocks along the upgrade path. See the sidebar on [Putting our Money Where Our Mouths Are](#) for our personal horror story.) They considered a base Gateway 4DX2-66V (80486 DX2-66 CPU) system with 8 MB of RAM, and a 341 MB hard drive and a VL-bus 2 MB VRAM video card. They rated 10 potential upgrades on a 1-10 scale (10 better; the original system got a 5.3), for

most bang for the buck: adding 8 MB of RAM: 7.4; getting a new Gateway P5-133 computer: 7.4; installing an 83 MHz Pentium Overdrive chip: 7.0. Other upgrades, including a Kingston Pentium-133 upgrade chip, a new video board, and a new hard drive, got lower marks. Although these are obsolete systems, the general principles still apply: adding RAM is always good, other upgrades less so.

If you can't stand your PC's slowness any more, get a new computer. Remember, though, that some peripherals, particularly external modems, CD-ROM drives, hard drives, and monitors, can be transferred to a new computer. The only problem is that most dealers will only sell you a computer "loaded" with all these things.

That's one reason we got a Micron rather than a Gateway as an upgrade: we could get the Micron with nothing but a new PCI video card (necessary since our old computer was VL-bus), keyboard and mouse (no option on those) and a single floppy drive. Gateway refused to be so flexible.

The July 2000 PC Magazine offers "[Upgrade Your Hard Drive](#)" with some good advice if you go that route. The July 1998 PC Magazine (dated but still true) advised that if you have \$1500, get a new PC, otherwise upgrade your RAM and hard drive, or maybe get a new motherboard from [JDR Microdevices](#) (see below). Remember, regardless of the CPU speed, a new motherboard will be faster. Good luck.