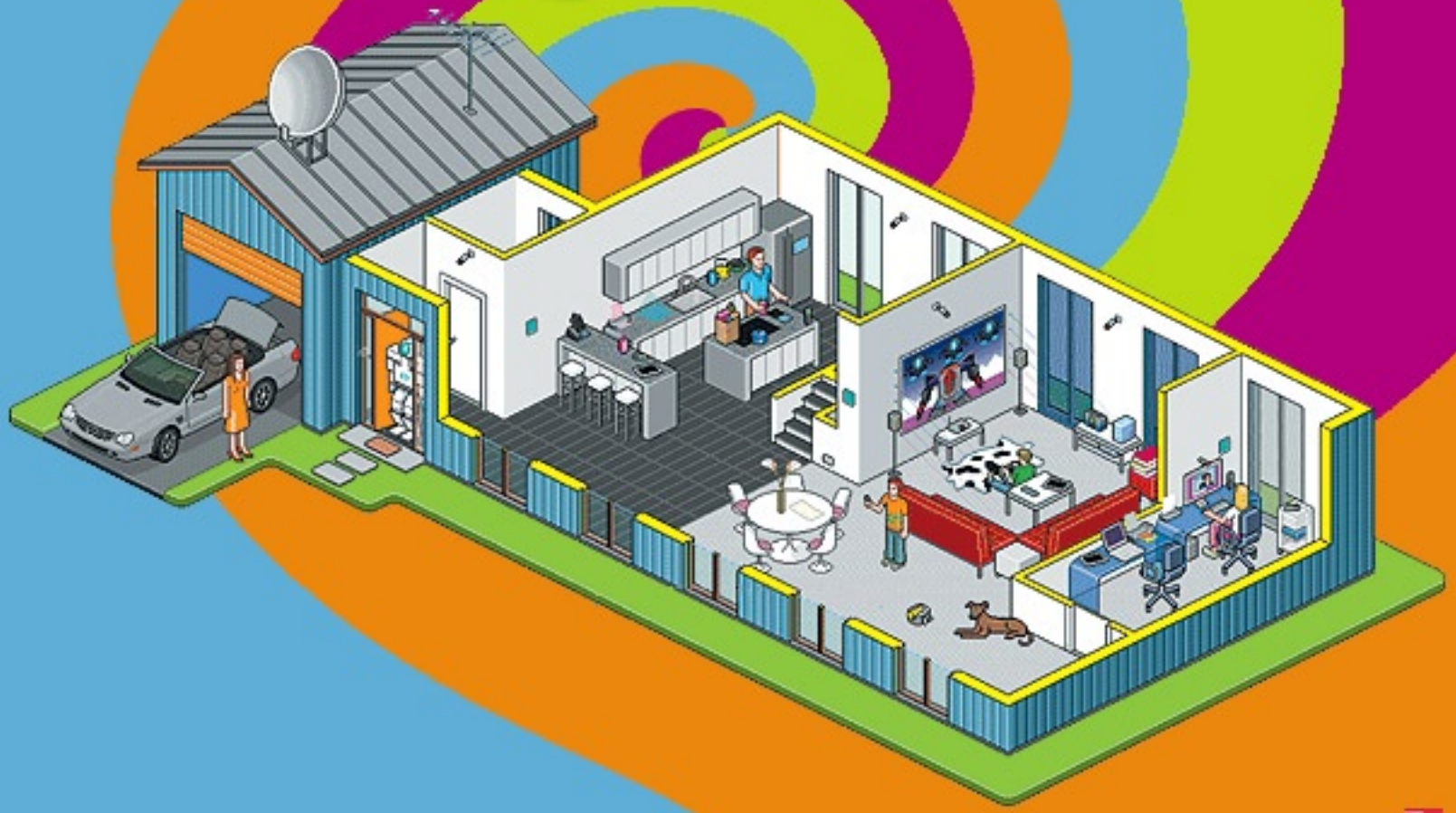
PC MAGAZINE PRESENTS

the digital home



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the digital home

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table of contents

intro-duction. your future home

With the arrival of networking and broadband in the home, one thing has become crystal clear: The future digital home will have even better connections and devices, and will serve its owners in new and fascinating ways—especially in the field of entertainment.

Experts agree that wireless technology is the key enabler you'll find in homes a few years from now. But today's 802.11b and 802.11g wireless networking standards don't have the range or speed to do distributed, wireless video and entertainment in any real sense, especially in bigger, multilevel American homes. A very promising next-generation version of Wi-Fi, though, is 802.11n.

Although a ratified standard for 802.11n isn't expected until late 2006, many companies are talking about delivering access points and other products in 2005 that will be software-upgradable to the standard. That trickle of products is likely to become a flood by 2007. The players involved with 802.11n are talking about quoted data rates of up to 250 Mbps and actual data rates of up to 175 Mbps. (To put these numbers into perspective, current 802.11g technology offers a quoted rate of 54 Mbps, and actual data rates tend to be less than half that.)

Agere Systems, for example, has considered using multiple-input multiple-output (MIMO) antenna technology in 802.11n products and doubling current Wi-Fi channel bandwidth to 40 MHz. The company has also discussed the possibility—thanks to range improvements—of networking an entire home wirelessly with one inexpensive 802.11n access point.

Analysts foresee many new kinds of home applications resulting from these range and performance improvements. "I think as 802.11n becomes hardened as a standard, and if it uses things like MIMO antenna technology, it could transform the digital home," says Mike Wolf, senior analyst at In-Stat/MDR. "The reason most people who are doing things like distributed digital video are using analog instead of wireless digital technology is because the networking technology we have is still far too slow."

"Our partners have asked for four or five times current Wi-Fi speeds from 802.11n, so that people will replace their equipment, and we would like to see one access point cover the whole house," says Mary Cramer, strategic marketing manager at Agere. She foresees multiple HDTV video streams traveling wirelessly in the home of the future, and very fast downloading of entertainment content to multiple devices around the house.

But 802.11n is hardly the only wireless technology that could transform tomorrow's smart homes; ultra wideband (UWB) is another. It works by dispersing many small bursts of high-speed radio signals over a wide radio spectrum, instead of issuing an extended radio signal over a smaller frequency range, as do other wireless technologies. Some ultra-wideband developers, such as Intel, have demonstrated that the technology can produce data rates faster than 200 Mbps.

Then there's a prototype connectivity technology, backed by Intel and others, that is a subset of ultra wideband: wireless USB (WUSB). It's intended to bring data rates comparable to those of USB 2.0 to such tasks as trafficking multiple video and media streams wirelessly between consumer electronics devices, PCs, and peripherals. The expected data rate of wireless USB is 480 Mbps at a range of 2 meters and 110 Mbps at 10 meters, according to Jeff Ravencraft, Intel technology strategist and USB-IF chairman. These very high data rates at close range would enable you to do things like point a camcorder at a PC and stream video wirelessly to the computer.

While the wireless wars rage on, others are approaching the digital home of the future in imaginative, conceptual ways. At the Microsoft campus in Redmond, Washington, Pam Heath is the project leader in charge of the Microsoft Home—an actual house where researchers demonstrate and test technologies of the future.

"One conceptual thing we work with a lot is that any surface in the home is potentially a display surface, such as a kitchen countertop or a wall," says Heath. In the Microsoft Home, you can say the name of a recipe, and the recipe will be displayed on the counter in front of you. If you have a bag of RFID-tagged groceries, you can swipe products past an RFID reader on the counter, and a display on the counter will show what you can cook. In the living room, intelligent LED lights of various colors are embedded in the walls, so that if you sit down for a computer gaming session on the large flat-panel display, the LED lights will respond to events in the game and enhance the experience. All around the house are wall-mounted computers about the size of PDAs that control lighting, temperature, music, and more.

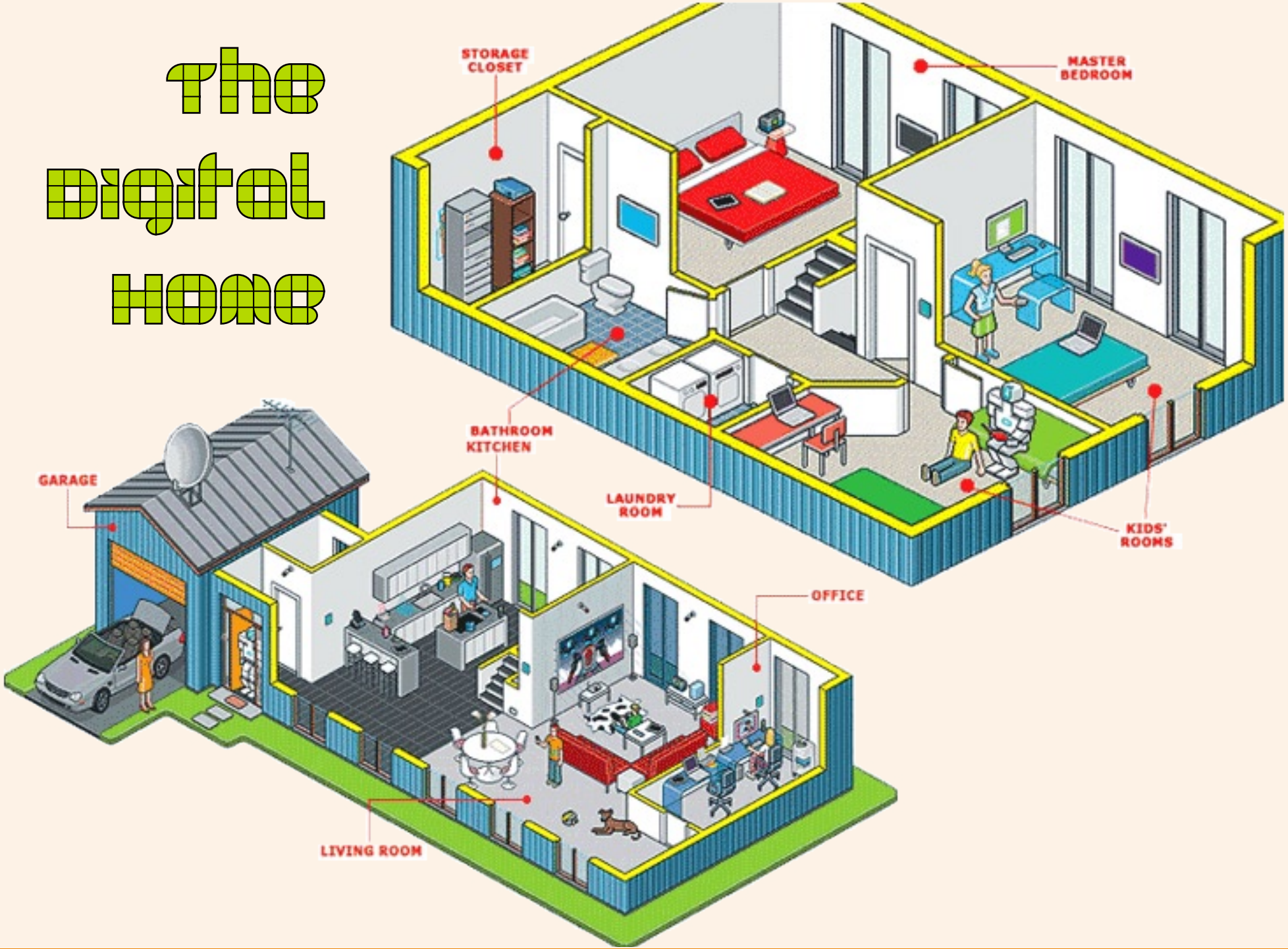
Although Microsoft strategists would like the digital home of the future to have a PC as the central mediating device, others imagine many mediators and see them being consumer electronics devices. "I think you'll see several different kinds of devices controlling content," says Charlie Gonsalves, business development manager in Texas Instruments' streaming media group. "You'll find a sophisticated audio server, a PVR, and a PC or other kind of hub." Gonsalves also notes that the National Association of Home Builders has been considering plans that include a dedicated closet serving as a data center for a home. "You might have redundant hard drives in the closet, and devices for streaming media, controlling wireless bandwidth, and serving the communication needs of a telecommuter who lives in the home."

In home security, futurists see devices such as smart, Web-connected cameras and robots playing a role. White Box Robotics, for example, has produced a prototype robot that looks like R2-D2 and can perform facial recognition on anyone who walks through the front door. JVC, Linksys, Sony, and others are at work developing next-generation IP cameras that can help homeowners keep an eye on their houses from wherever they are. You might find numerous wirelessly connected cameras inside and outside a home, each with its own IP address, motion sensor, remote tilt and swivel controls, and Web server features. From a cell phone or a Web browser, you'll be able to view live streaming video and control the camera remotely, or have the system alert you wirelessly if there is an emergency.

And what's a home of the future without smart appliances? Robotic vacuums, digital washing machines that can control water flow for different kinds of loads, and refrigerators with built-in LCDs already exist, but haven't found their niche quite yet. They will surely get much smarter over time.

Here you'll find our annotated version of what we see as the digital home of the near future. Its central artery is exponentially faster wireless technology that will automate and speed up many tasks. You'll also find it loaded with innovative devices and technologies. It's a smart place to live.

the digital home



first floor

car / garage

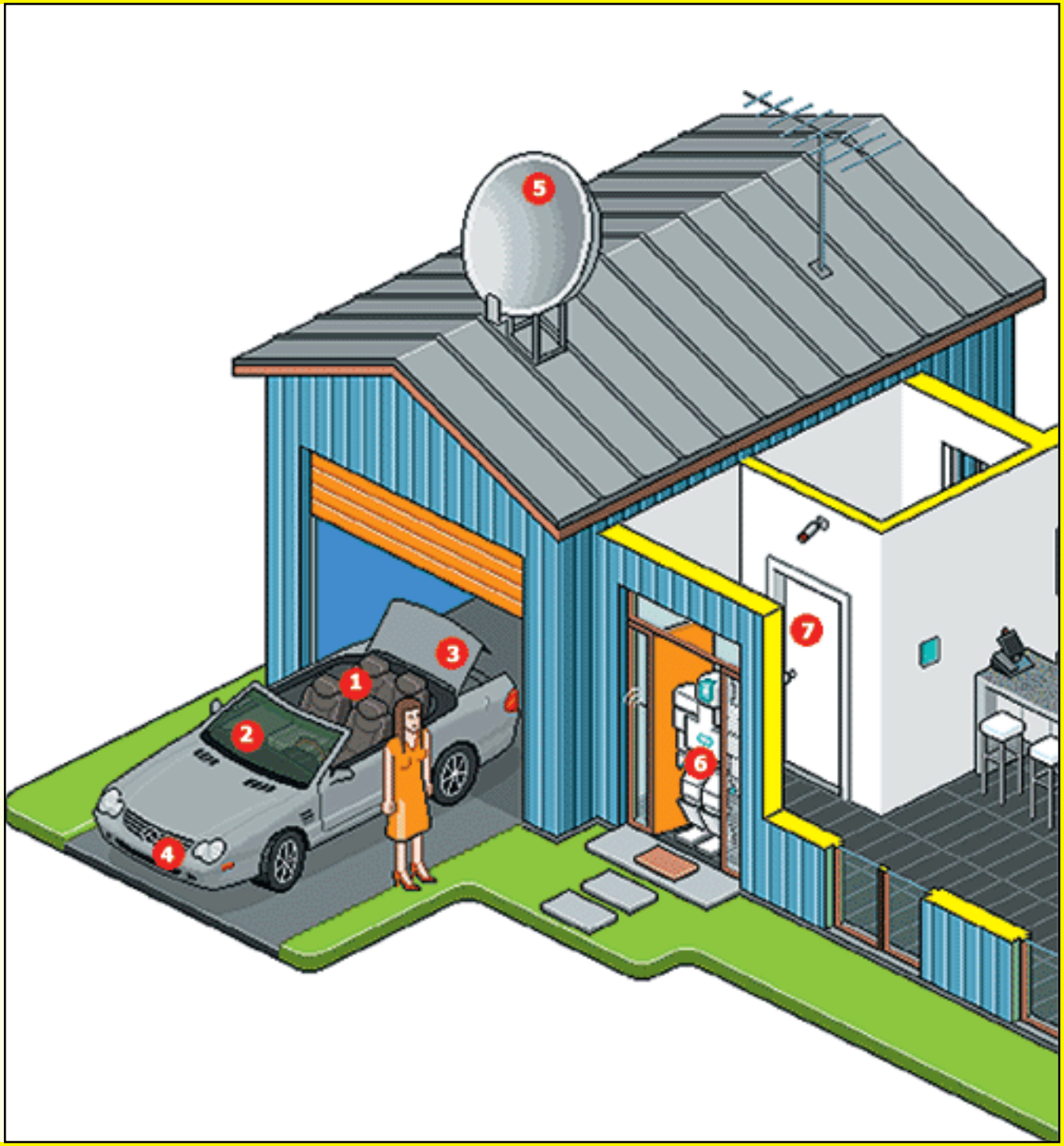
1. Flat-panel LCDs on seat-backs for passenger entertainment.
2. A satellite radio/mapping/ entertainment system that can read e-mails aloud.
3. A Wi-Fi jukebox in the trunk syncs wirelessly with the entertainment center in the living room to download playlists. It can also download movie and educational TV content for passengers.
4. A sensor on the front of the car alerts you if other objects are too close or if you're approaching at too great a speed.

roof

5. An HDTV/satellite/premium services dish.

front hall

6. A software-customizable robot recognizes faces at the door and sends wireless alerts if an intruder enters.
7. A closet houses wirelessly connected storage system arrays for entertainment content, digital photography archives, and backup data.



kitchen

8. A speech-recognizing, cabinet-mounted PC displays recipes, directions, and other information right on the counter.

9. A wireless broadband videophone, portable gamind device, and movie player with an 8-megapixel digital camera, and a speech-recognizing 802.11n Wi-Fi tablet PC.

10. A wireless USB photo printer.

11. An RFID reader on the counter scans RFID-tagged groceries and other retail purchases, tracking your home's inventory and displaying recipe possibilities.

12. An LCD on the refrigerator shows TV, the Web and calendars, and also sends driving directions to the photo printer on the counter via wireless USB.

den / office

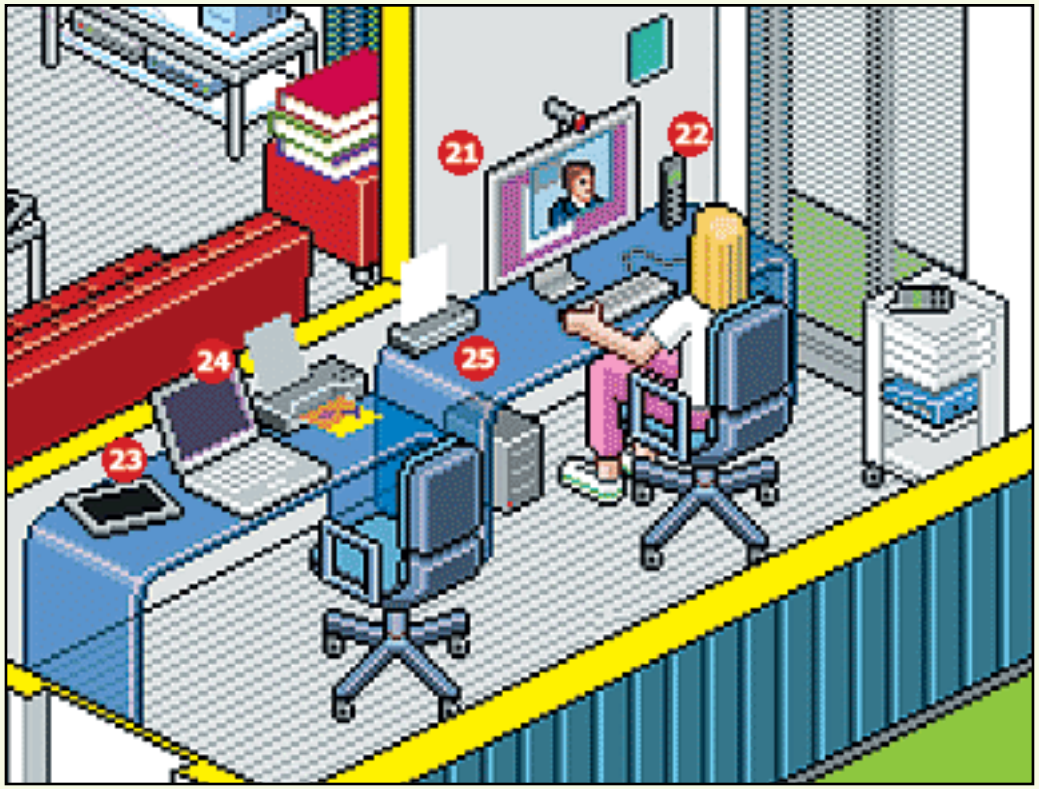
21. A PC-based videoconferencing session with full-duplex Internet audio.

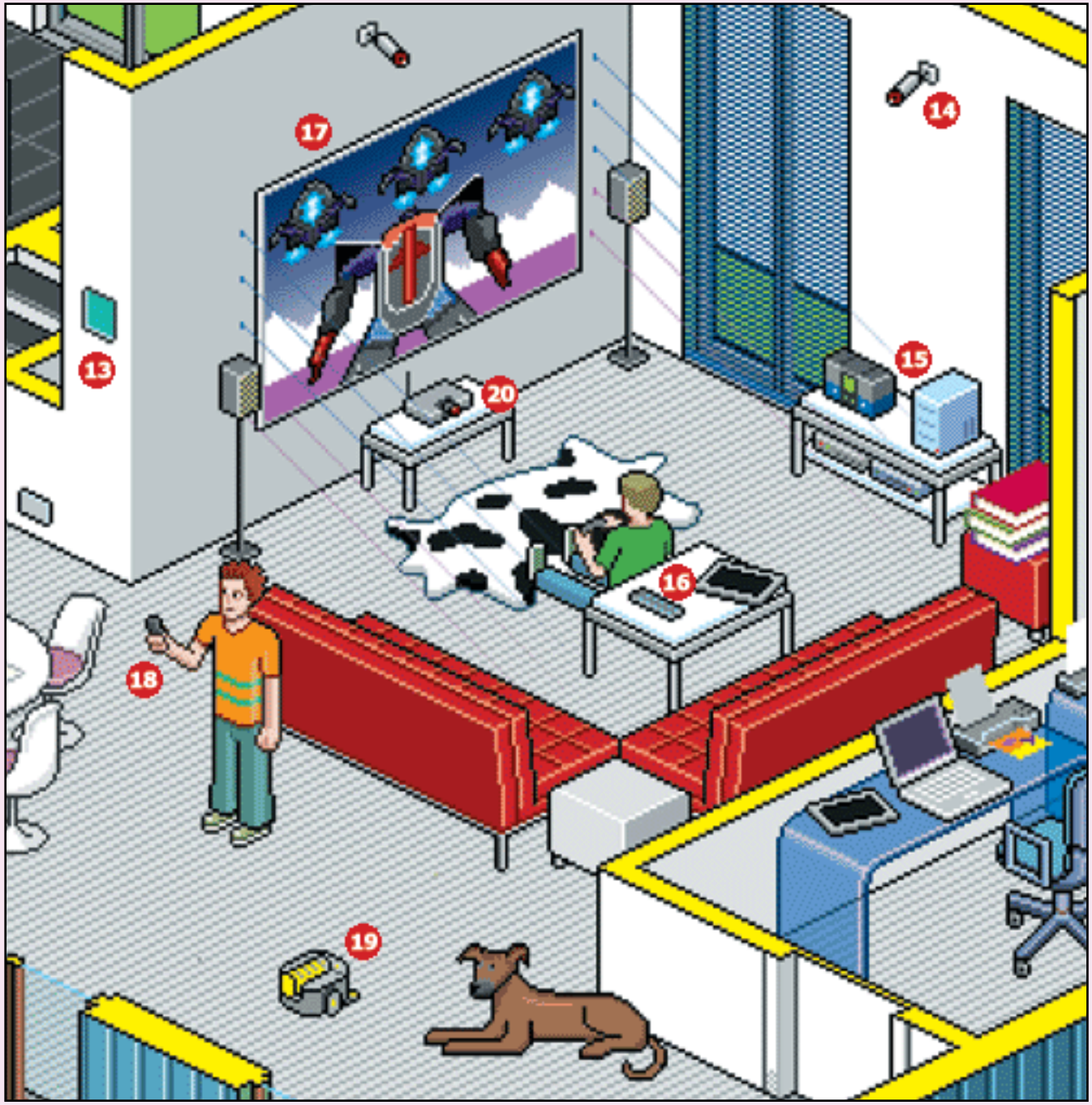
22. An IP phone places calls over the Internet or cellular network—whichever is cheaper.

23. A tablet PC with speech recognition for dictation, automatic text transcription of meetings, and portable videoconferencing.

24. A notebook PC enabled with wireless USB technology; you can stream video to it from a camcorder at 480 Mbps.

25. A wireless USB photo printer and paper-fed text-to-speech translator.





living room

13. A wall mounted touch- and speech-enabled LCD controls music, blinds, temperature, lighting, sprinklers, and entertainment.

14. A wireless, remotely movable IP video camera with a motion sensor and Web server strams video to a browser or cell phone.

15. A central media hub, a DVR (digital video recorder), and other devices stream entertainment throughout the house—all connected wirelessly.

16. An LCD-based universal remote control.

17. A 50-inch, flat-panel TV/display is surrounded by LED lights that enhance gaming. Multiple HDTV streams travel wirelessly throughout the house.

18. A 3G-enabled mobile phone does two-way videoconferencing and has an 8-megapixel digital camera and a 20GB hard drive for storing music and video.

19. A remote-control robotic vacuum that can be activated by cell phone.

20. One Wi-Fi/802.11n access point serves the entire house at over four times the speed of 802.11g rates.

second floor

master bedroom

26. A wireless boom box with Internet radio features.

27. A tablet PC with e-book features.

kids' rooms

28. A plasma display shows content that is streamed wirelessly from the media hub downstairs.

29. A comcorder streams video to a notebook computer via wireless USB.

30. A robot that features customizable software, for hobbyists. It can do a facial-recognition scan on anyone who enters the room, and take pictures or and deliver warnings to uninvited guests.

laundry room

31. A digital washing machine automatically adjusts water flow for different kinds of loads.

bathroom

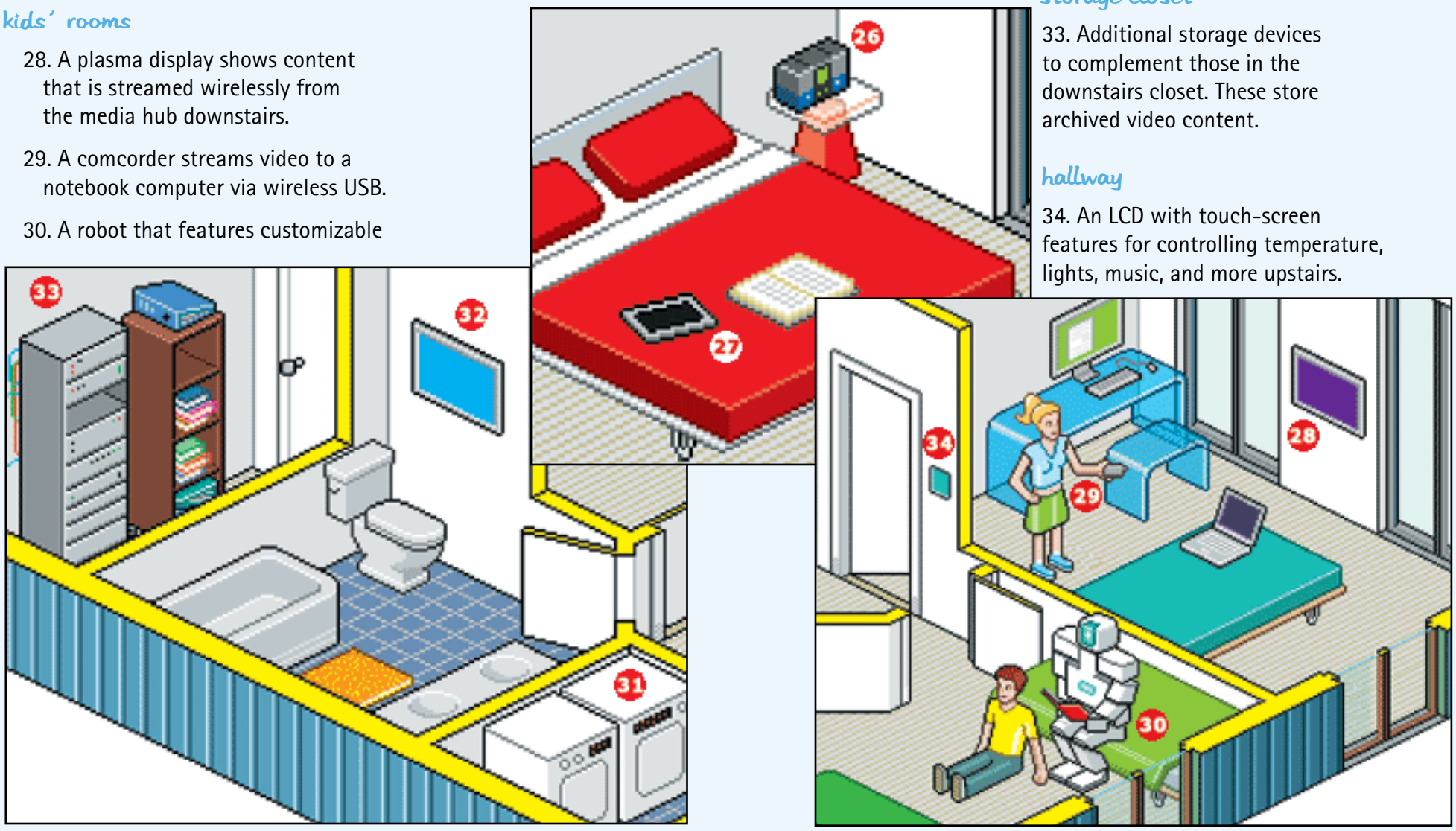
32. A wall-mounted-flat-panel display shows HDTV.

storage closet

33. Additional storage devices to complement those in the downstairs closet. These store archived video content.

hallway

34. An LCD with touch-screen features for controlling temperature, lights, music, and more upstairs.



Building the Digital Home

Laying the Foundation

Technology and the human ingenuity that drives it is amazing. It's only taken us a few thousand years to evolve from "The Flintstones" to "The Jetsons." While we don't yet drive flying cars and live in apartments in the clouds, the insides of our homes are starting to look more and more like the dwelling of George, Jane, Judy and Elroy. Our appliances are getting smarter, our computers can do things we only dreamed of just a decade ago, and our entertainment systems rival the cinema itself.

Imagine a home in which you can hear any of your CDs or MP3s in any room, or where you can watch TV that comes through a cable in the living room on an HDTV in the bedroom. A home where kids can play games with each other on separate computers in separate rooms without any wires connecting them, where the lights are computer-controlled and you can watch the baby from the kitchen through a wireless camera in her room.

That home is the center of this series. In the following chapters, we'll explore different facets of the digital home: distributing TV, video, audio and even FM radio to any room in the house; automating the home; sharing documents, pictures and other files among different computers all over the place without any wires; connecting the bedroom, living room, office, the garage, the bathroom—*the bathroom?*—and living the digital dream.

connectable computer

Of course, it starts with a PC. To lay the foundation for the digitally smart house, you'll need at least one computer, and the more digital home-friendly features it contains, the better. Ideally, your computer should be a modern piece of equipment with a recent Pentium 4 or Athlon 64 processor, lots of fast RAM and scads of hard-drive space. You'll need that kind of power because chances are you're going to be doing a lot of multimedia with it, and stuff like video editing, recording TV signals, storing MP3s, gaming and other such activities can put a lot of demand on those components.

Your computer should be fitted with Wi-Fi (802.11*x*) wireless network capability. Goodies that we'll talk about in upcoming articles will deal with media appliances that communicate wirelessly, so even if you've only got one PC, it should still do wireless Ethernet. Of course, if more than one computer lives in your house, wireless networking is the ideal way to get them all talking to each other.

Wi-Fi access points and interface cards are inexpensive (especially if you choose 802.11b, which, while not as new or speedy as 802.11g, is sufficient for most home networking concerns) and setting up such a network is easy, right down to sharing a broadband Internet connection. Check out ExtremeTech's Go Wireless series.

You might want to integrate your computer with your home entertainment center directly. With the right hardware, a PC can perform DVR/PVR (digital video recorder/personal video

recorder) functions, making it similar to a TiVO. For that, it'll need a TV tuner device, like something in ATI's TV Wonder line, or even a fully integrated system including a graphics card, a TV tuner, VIVO (video in/video out) hardware and a robust software bundle: look to ATI again for its All-In-Wonder series or check out Nvidia's Personal Cinema products. With one of those, your computer can accept TV a signal from cable, satellite or an old fashioned antenna, record, pause, rewind and otherwise manipulate it, and output it to your television. You can control it all with an included remote.

Sound cards come ready to take advantage of your stereo, no matter how robust it is. Creative Labs' SoundBlaster Audigy 2 series, Voyetra's Turtle Beach sound cards, and the recently reviewed Philips Ultimate Edge 5.1 have digital outputs to pipe signals through your surround sound receiver.

Thus, with a home theater PC with all that capability, you can watch DVDs, TV, MPEG files, and streaming video, on your TV; you can listen to CDs, MP3s, WMA files, and other audio through your home audio system; you can play PC games on your big screen television, and more. And with that Wi-Fi adapter, you can share that stuff all over your house.

media center pcs

You don't necessarily have to build a monster PC with all this mojo. You can opt to get a Media Center PC, such as the Sony R series or the iBUYPOWER Media XP System. Such computer systems come with a bevy of options, including those previously mentioned such as TV tuners, remote controls and built-in 802.11 networking.

Media Center PCs usually run Windows XP Media Center Edition 2004, a version of the venerable operating system jazzed up for multimedia computing. It includes a central location, designed to be navigated with a handy remote control from across the living room, to launch various media files, PVR software, DVD movies, and even FM radio signals if the PC has the appropriate tuner.

home theater all over the home

With the right computer, your home will be prepared with a foundation for going digital. Next, we'll discuss beaming audio and video to every room and include exciting gear such as Wi-Fi DVD players and digital media adapters.

audio video foundation

The connected home is expected to live up to a lot of expectations. Look at the entertainment center alone: You'll want the highest-quality television. You'll want to be able to watch it in any room. You'll want to be able to play your digital music files, stored on any computer, through your supercharged home entertainment system. You'll want to record television signals with a PVR (personal video recorder, aka DVR) and view the recordings from any TV you so desire. You'll want to do it all easily, and without having to run wires down the hallway or through the ceiling.

The technology to do all of that is rapidly developing. Some of it's in place, some of it's brand-new, and some is but a dream. My utopian view of the AV portion of a digital home is this:

- To be able to view any feed, be it from cable or satellite TV, a DVD player, a computer file on any computer in the house, a PVR, a VCR (are those things still around?) or anything else, on any display in the house, such as a PC monitor, an HDTV, an NTSC TV or the LED on my microwave.
- Likewise, to be able to listen to any audio source, be it a CD, an MP3 or WMA file, a radio feed or anything else, on any speaker system in the house, including any PC multimedia speaker system or my home entertainment center.
- To do all of that with ease and grace; to have it as simple as clicking a few icons in Windows or banging buttons on my remote control.

Is that so much to ask? In fact, it is. That kind of versatility is oft-dreamed of but as yet is unrealized. For now, you can do some of that. Here's how.

tv and hdtv

If you look at the average living room, it's set up as a sort of Mecca, with each chair or couch radiating from a focal point. The center of the home entertainment center, the glowing king of your audio-visual system, is the television. It's through the powers of this mystical box--or panel, as the case may be--that you view movies, watch shows, check out stuff you taped or PVRed for later, and so on. You can even watch digital content from your computers' hard drives on your TV using gear we'll discuss a little later. In the meantime, for more information visit Buying Guide: HDTVs.

For now, it's time to concentrate on getting the ultimate TV experience. At the very least, that involves getting your hands on a digital source with surround audio, such as those offered by your local cable company and national satellite TV services like DirectTV and the Dish Network. Such systems offer any number of channels, sports packages, TV on-demand and other services.

To get the most of digital television, you'll need:

- A nice television
- A multichannel receiver (One example: Sony STR-DE997/B)
- High-quality speakers to match your receiver
- A high-end DVD player
- A PVR, typically included with your digital TV service
- Additional AV equipment that you might desire, such as a CD changer/jukebox and a VCR.

Of course, for the pinnacle of television quality, you'll want a high-definition television (HDTV) system. You'll need:

- A high-definition-capable television
- A high-definition television tuner, which may be built into the TV
- HDTV content, including broadcast HDTV and that from cable and satellite systems.

Note that not all programs are broadcast in HDTV; high-def tuners will automatically play regular NTSC signals properly.

The best way to get high-quality digital and HDTV content on multiple televisions is to have the cable or satellite provider install a receiver for each TV. In many cases, you can get package deals that include cable or satellite receivers in multiple rooms. Each receiver will come with its own remote control, which will supersede your TV's remote; in many

instances the receiver remote also will be able to control your TV's volume and other features. Most content packages include at least one PVR, be it a TiVo that comes with DirecTV or another brand. With the right system, you can share recorded shows with other units.

sharing digital content

It never fails: You record a show with your PVR and, later, when you want to watch it, the kids are bogarting the TV watching "*Spongebob Squarepants*." Fear not, as some technology lets you retrieve recorded content from other televisions.

For instance, the TiVo Series 2 DVR set-top box can do just that. With a TiVo Series2 DVR atop each television in your home, you can share recorded content throughout your house. It doesn't matter where you recorded it; you can play it with any of your TiVo boxes. They can even be connected wirelessly.

For HDTV PVR sharing, the Scientific Atlanta Multi-Room DVR 8300HD will be an interesting system. The primary television system is fitted with a main unit, and secondary client units are situated at other televisions. The clients anywhere in the house then can display PVR content recorded on the main unit.

Another cool concept in digital content sharing is the wireless, Wi-Fi enabled DVD player such as the PC Gateway Connected DVD Player. Though it comes with some playback limitations, technology like this lets you swap content with PCs. Besides just playing DVDs, such devices let you grab photos, music and videos from your PC and enjoy them in any room in the house.

convergence: pc files on your home entertainment center

With the right hardware, you can enjoy all of the media files on your PC--such as your MP3 and WMA audio files, MPEG-1, -2 and -4 videos, Internet radio, JPEG digital photos and other content--on your home entertainment center. One way to do this is by adding a PC to your home theater, which was discussed in the last installment. There are other ways.

Share digital audio throughout the house with hubs such as the Turtle Beach AudioTron AT-100, a recent **Editors' Choice**. It's a stereo component that fits right in with your CD changer and your multichannel receiver, working with your home network to give your home theater access to Internet radio and the music files stored on your PC's hard drive. The AudioTron has been around since before Wi-Fi took hold, so it'll require a 10BASET network.

But why stop at audio? Media adapters such as the PRISMIQ let you enjoy video, music and photo files, stream Internet radio, and even browse the Web from your home entertainment system. 802.11a/b/g ready, this box sits near your entertainment system and communicates with your home computer network. You can use it to display content from all of the computers on your home network.

Sadly, the super-home-AV-network I envisioned at the beginning of this column isn't possible, but we're getting close. In a matter of years, you'll be able to watch or listen to whatever you want whenever you want to on any display or speaker system in the house. Next, we'll leave AV for a bit and talk about home automation from the comfort of your computer screen.

Home Automation

Your computer is more than a tool for office applications, multimedia and games. It can serve as the center of an automated home, with the ability to dim lights to change the mood or watch movies on your huge-screen TV, to illuminate your driveway when you come home, turn off the coffee maker, alert you of the presence of visitors who pass by motions sensors, and more. Let's take a look at where we are, where we may be heading and what you can do now to begin automating your digital digs.

Home automation standards have come and gone. While there have been many bids for standardization, many have failed--most notably, the once-promising and now-vanished CeBIT. The most prevalent company in home automation is X10; that's right, the company made famous by all of those pop-under ads for wireless cameras. An emerging competitor is Z-Wave, a speedy RF (radio frequency) protocol from Zensys. Technologies expected to hit next year include an X10 enhancement called Insteon and ZigBee, an RF monitoring and control standard built upon 802.15.4 wireless technology.

If you're dying to get started, you should take a look at X10 or Z-Wave starter kits. They make the task of automating home lighting and appliances simple, and they're modular: You can add new modules to expand your control over your home. Let's take a look at these technologies in depth.

x10

For a long time, X10 products relied on an interesting protocol named Powerline Carrier. X10 modules communicated with each other through the home's AC power network. While convenient in the pre-wireless networking age, it had a drawback: Most home electricity systems are split between two 120V "legs." X10 users had to either install a coupler at the circuit box or ensure that all of their devices were installed on the same leg.

A recently introduced upgrade to the X10 family called ActiveHome Pro uses RF technology to communicate with the various modules throughout the house. ActiveHome Pro technology is backward-compatible to support previous X10 modules, and plug-ins soon will let you control your home via the Internet, monitor X10 cameras and more.

The most compelling reason to go with an X10 system is price: You can get a basic starter kit for $49 and a robust one for $99. The latter includes the following:

- A USB (Universal Serial Bus) computer interface and RF transceiver, which sends and receives signals from all ActiveHome Pro modules.
- A lamp module for dimming and otherwise controlling electric lamps.
- A "Socket Rocket" screw-in lamp module, which actually screws into a light-bulb socket.
- A palm-sized remote control and a keychain remote control.
- A three-pin appliance module for controlling appliances such as tools, air conditioners, coffee pots and so on.
- An EagleEye motion sensor, which can trigger macros in the software to, for instance, turn on a light.
- ActiveHome Professional software, which has earned kudos for its user-friendliness.

Other modules you can add to an X10 ActiveHome Pro system include a chime module, which can ring if, say, a motion sensor goes off; wall outlets and switches that can replace your current sockets and switches for X10 control; fluorescent lamp modules; outdoor floodlight/motion sensors; and more.

Not all X10 modules are capable of two-way communication. In other words, they don't all have the ability to acknowledge commands or report their status. If a command fails to reach a module for some reason, the light won't go on, or dim, or do whatever you wanted it to do--and you may not even know about it.

z-wave

You don't need a computer to use a Z-Wave based system. All you need are RF modules that form a mesh network (each of them includes an RF repeater, effectively extending the range of the system indefinitely), and a remote control. With them, you can dim lights, set timers and

control any module from anywhere in the home. But coupled with HomeSeer software, you can do more, including controlling your home modules from anywhere in the world via the Internet. Z-Wave products are available from HomePro, Sylvania and HomeSeer; they'll all work with each other regardless of the brand.

Z-Wave gear is more expensive than X10 merchandise. For $199, a HomeSeer startup kit includes software, a USB PC interface, a remote control and a single lamp module. A Sylvania kit, meanwhile, includes a remote and two lamp modules for about $129, but lacks software and a PC interface.

Z-Wave offers a powerful set of controls. You can create groups of lights that you can then control remotely with a single button. Furthermore, you can create preset lighting scenes to create mood in a few simple steps.

The Z-Wave module selection includes lamp modules, appliance modules and wall-mounted switches. All Z-Wave modules are two-way devices, able not only to receive commands but also to return confirmation. Z-Wave supports as many as 64 devices in its secure network.

future technologies: insteon and zigbee

X10 champion Smarthome got tired of waiting for X10 to abandon its powerline-only topology and developed a new standard called **Inseton** (pronounced in-stee-on). It combines powerline communications with RF technology and, like X10's ActiveHome Pro, it's backward compatible with older X10 technology. The downside? You'll have to wait. The first Insteon devices aren't expected to come to market until 2005.

Insteon is certainly ambitious. While the first set of Insteon products will be light controllers, appliance modules and PC interfaces, Insteon sees in its future all kinds of Insteon-enabled devices that may or may not ever make it to market. Think televisions that can be turned on or off via an Insteon network; microwave ovens controllable from a PC; integrated security systems; and so on.

The Insteon network is secure; all transmissions are encoded on the network. Like Z-Wave devices, Insteon gear will repeat signals in a peer-to-peer style "mesh" network; no routing is required. Products are expected to compare in price to X10 stuff, so Insteon networks will be affordable.

Another emerging technology is called **ZigBee**. A wireless control network based on the IEEE 802.15.4 wireless standard, ZigBee is a mesh network that uses an incredibly small amount of power per device, which will result in far superior battery life compared to other wireless network gear (like Bluetooth gadgets).

With 128-bit encryption and other security features, ZigBee networks should be immune from intrusion. ZigBee will be targeted not only to home automation (including light control, thermostat control, water and gas usage monitoring, and so on), but also to building automation and even industrial automation.

A ZigBee network is virtually unlimited in size. It prides itself as being a standards-based technology, and the ZigBee alliance numbers more than 90 members, including such high profile companies as APC, Cisco Systems, Texas Instruments, Siemens, NEC, and many more. ZigBee products could see the light of day in 2005.

Whether Insteon or ZigBee turns out to be the next big thing remains to be seen; home automation has proven to be a tricky industry with only X10 truly thriving.

Next, we'll get back to the audio/video arena with a tour of the ultimate living room for the digital home.

transforming your living room

In most homes, the living room doubles as the room for home entertainment. Lacking a dedicated screening room, most families do their movie and television watching, hi-fi listening, recording and dubbing in the living room. Indeed, glance in any living room in the United States, and you'll note that the chairs, couches and other seating radiate out from a point of central focus: the television. In this article, we'll take a close look at the optimal setup for a digital living room and what you should look for.

the tv

Choosing a television has evolved into a complicated affair. A range of technologies in flat-panel and projection sets, from ubiquitous CRT to plasma and LCD, makes the decision tumultuous.

First, you have to decide whether you're interested in a standard NTSC television or an HDTV-capable set. For your primary set, let me strongly suggest high-definition TV; if you've never seen the difference between HDTV and NTSC, you should visit a television shop immediately. You won't believe your eyes. HDTV signals are available via broadcast TV and from satellite and cable TV. You need to make sure that your satellite or cable receiver is HDTV-capable to get the signal in all its glory. Besides a signal, to get the benefit of HDTV, you'll need an HDTV-capable set that either has an HDTV receiver built in, or an HDTV-ready set and an HDTV tuner. You'll have a choice of four major TV technologies: CRT, plasma, LCD or projection. You also have the choice of two aspect ratios (the ratio of screen width to height): 4:3 or 16:9. The latter is better for displaying anamorphic widescreen signals, such as those from most widescreen DVDs and HDTV sources. Each of the types of TVs has pros and cons:

* **CRTs** have excellent picture quality, and the image quality lasts for years before degrading, but the sets tend to be heavy and bulky.
* **Plasma TVs** are thin and light, and they can be wall-mounted or hung from the ceiling. The picture quality is above average, but they're susceptible to burn-in and notorious for their blackness level decaying (blacks beginning to appear gray) after only a few years.
* **LCD televisions** are just like flat-panel PC monitors and laptop screens: Their images comprise a grid of liquid crystals. As such, their brightness is excellent and their image quality is stellar, but their blackness level is poor and they're limited in picture size.
* **Rear-projection LCD TVs** have a terrific picture quality, but like their direct-view equivalents, their blackness level is poor.
* **Rear-projection DLP (Digital Light Processor)** screens work by shining color, generated by light hitting a rotating color wheel and reflecting off tons of mirrors on a semiconductor chip. They offer incredible picture quality, but they're expensive, and the viewing angle is limited.
* **Rear-projection LCoS (Liquid Crystal on Silicon)** televisions combine liquid crystal and semiconductor technologies. They offer possibly the best image quality in HDTV in a fairly slim design, but they're prohibitively expensive.
* **Front-projection**: Not always practical, front-projection televisions require two separate units: a projector, often mounted to the ceiling, and a screen. The blackness level is often questionable in front-projection televisions, and some require calibration and special wiring.

the a/v receiver

The nerve center of your home theater system is the A/V receiver, the central unit that powers your speakers, picks up radio signals, decodes surround-sound audio and gives you command over your home entertainment system. So much more than stereo receivers, home theater receivers offer more speaker channels, better surround support, support for and selection among video gear, and more.

When shopping for a receiver, look for a full-bandwidth power rating. This will include a rating in watts per channel (higher is louder) that covers a full frequency spectrum, 20Hz to 20KHz, which is the most accurate power rating available. Also, look at the THD (total harmonic distortion) rating, which, for

best sound, should be less than 0.1 percent (although receivers with digital amplification will have higher THD ratings; they shouldn't be compared with traditional analog receivers).

Make sure your receiver supports the surround-sound formats you're interested in, including Dolby Digital and DTS (for 5.1 surround), Dolby Digital EX (also called THX Surround EX), DTS ES and DTS ES Discreet 6.1 (for 6.1 surround). Note that Dolby Digital EX and DTS ES have their sixth channel, a rear center channel, matrixed from the left and right channels, while the DTS ES Discreet 6.1 standard calls for, as it implies, a discreet center rear channel. While some receivers offer 7.1 channel surround, there isn't such a format; different receivers interpret left and right rear audio information differently and extrapolate extra channels. For the most accurate surround audio, I recommend a receiver that does Dolby Digital EX and both flavors of DTS.

You might also look for a receiver that can handle 96KHz/24-bit audio. This refers to signal accuracy; the higher the sampling and bit ranges, the better. While CD-quality sound is considered to be 44.1KHz/16-bit audio, higher-fidelity sound has become available from sources such as some DVDs and DVD-audio discs.

You'll need a receiver with enough inputs for all of your audio and audio/video sources. Note that most receivers include more audio/video inputs than audio sources alone; audio/video inputs can handle audio without video. Consider the types of inputs available: These can include composite, and optical and coaxial digital for audio; and composite, component and s-video for video. If you have a turntable, you'll probably also want a phono input for lower-voltage signals, so that your turntable won't require a preamp. Be sure to leave room for future expansion.

The receiver probably will have similar outputs for piping signals to various devices. For convenience for temporary connections, you might look for a receiver with front inputs and outputs. For multiroom enjoyment, look for dual-source, dual-room capability. This feature lets the receiver host two sources at the same time, one for multichannel amplification in the "main" room and a second that can be sent pre-amplified to a stereo receiver or amplifier in another room. Thus, you could watch a surround-sound DVD in the living room while your spouse listens to a CD in the den.

For the utmost in control, look for a receiver featuring a multibrand remote that can tackle all of your other gear.

speakers

Your receiver isn't much good without a way to bring the rich sounds of your audio and video systems to your ears. That's what your speakers are for. There's more to it than matching up the number of speakers in your system with the number your receiver supports.

Matching your speakers to your receiver (or, if you're serious about extremely loud music, your amplifier) is an art best suited for the experts at your stereo shop. You have to worry not only about matching the power, but also the quality. Cheap speakers never sound ideal, even with a quality receiver, while high-quality speakers can actually flaunt the inadequacies of poor amplification.

You also have to take into consideration the size of your room and the power you desire. Smaller rooms don't need the wattage that larger rooms demand; and some people are satisfied with loud, while others want to blow their windows out at maximum. I'm limited in how loud I can crank my gear because I live in a townhouse with neighbors on the other side of each wall; when I get a house way out in the country, it'll be possible to hear my hi-fi system from space.

other must-have goodies

The right receiver can control anything you'd care to connect to it. The range of components is barely limited, but might include a DVD player (including an 802.11a/b/g device), a VCR, a turntable, a tape deck, a CD changer, an SACD/DVD-Audio player, a Media Center PC, and anything else you can think of.

Of course, you'll want to be able to play any and all of your digital files (such as MP3 and other music files, movie files, pictures, and other video and audio files) from the PCs on your home network through your living room home entertainment system. If you don't plan on integrating a PC or another wireless computing product into your audio/video system, consider a wireless media adapter like the Viewsonic WMG80 or the Linksys Wireless-B Media Adapter.

With some planning and a generous budget, you can enjoy the utmost in home entertainment, from HDTV video to high-quality audio, in any room. Next chapter, we'll take a walk from the living room into a more computing-oriented room, the home office.

High-Tech Home Office

The nerve center of the digital home tends to be a computer, and often it's the "main" computer in the home office. Dad's computer. The good computer. The one everyone else in the house wishes they could use.

For example, in the home of a friend of mine, there's one tightly monitored "family" computer with various anti-porn programs installed and IRC blocked; that's the one the kids use. One media center computer connects to the home theater. Finally, there's a primary computer in the office. It's that third computer that houses most of the digital content, has the best in multimedia capabilities, has the most processing power, and serves as the host to home control devices such as those discussed elsewhere in this series.

This chapter, it's that central computer and the network resources that we'll concentrate on: what kind of processing power you'll need, the best in networking technology, sharing a broadband connection, and the utmost in PC peripherals.

the computer

If you're in the market for a new system, I strongly suggest you set a budget first and decide how to fill it second. It's easy to get caught up in the wonders of the latest technology and quickly get ahead of what you can actually spend.

When you've decided on a spending cap, go to a site that lets you customize your own computer such as Gateway or Dell and figure out what you can get for the money. You'll have your choice of several components, which include:

* **The processor or CPU**. The top-of-the-line models are the AMD Athlon 64 FX line and the Intel Pentium 4, supporting Hyper-Threading technology chips. These can be pricey, so you might want to settle for a CPU a few notches down in terms of its rating; for example, get an Athlon 64 3400+ instead of a 4000+. If you're absolutely strapped for cash, you can go with a lower-cost, stripped-down AMD Sempron or Intel Celeron processor, but you'll most likely sacrifice some performance for the low price.

* **Memory**.You'll want a minimum of 512MB of RAM. Get a gigabyte if you can afford it.

* **Hard drive**. Don't put too much stock in going with the newer standard, Serial ATA, over Ultra-DMA (also known as IDE); the noticeable, benchmarkable performance increase is negligible. Instead, get as much hard drive space as you possibly can. If you store digital media files, play games, edit movies and partake in other multimedia experiences, you'll need the storage space.

* **Optical drive**. Get a DVD reader with some sort of burning capability, whether it's a DVD-+RW or at least a CD-RW. You'll probably want to make your own CDs, you might want to create DVDs if you're into video

editing and, moreover, ROM burners are the most practical options for backing up data on home computers.

* **Graphics card**. This affects how well your PC will run the latest games. The race is between ATI and Nvidia; ATI's Radeon X800 and Nvidia's GeForce 6800 are the best of the best. For more cost effective options, check out Nvidia's Radeon 9800 line and Nvidia's GeForce 6600 cards.

* **Sound card**. Integrated audio isn't always optimal. Try to get a SoundBlaster Audigy 2 sound card from Creative Labs, or something from Philips's "Edge" line or a Turtle Beach card. Sound cards can support any number of speakers, from 4 satellites and a subwoofer (4.1) to 5.1, 6.1 and 7.1 speaker systems!

peripherals

Besides the core PC, you'll definitely want some gear to attach it to. These include the keyboard, the mouse, the monitor, the printer, the speakers, and anything else that might connect to the box. Here are some recommendations:

* **The keyboard**. While you can settle for a boring, beige, 104-key Windows keyboard, you can get so much more. For a little more money, you can nab a multimedia keyboard with quick buttons for email, Web surfing, CD and media playing, volume control, and more. Check out offerings from Microsoft and Logitech.

* **The mouse**. Microsoft and Logitech also dominate the mouse market. Get a comfortable mouse with lots of buttons, and make sure it's optical so you won't have to clean a mouse ball every few days. You can spend as little as $10 or as much as $80 on a mouse, with features such as sideways scrolling and wireless operation.

* **The monitor**. You'll want something bright and with a flat screen for multimedia viewing as well as Windows desktop and office document display. Consider a flat-panel monitor, but be warned: inch for inch, they're more expensive than traditional, bulky CRT monitors; and an LCD monitor with a low pixel refresh rate (greater than 25 ms) can cause ghosting in games and movies--anything with fast-moving graphics. As a general rule, faster pixel refresh rates (16 ms) mean pricier monitors, but if you do lots of high end graphics work or digital editing, it's worth considering.

* **The speakers**. As much as your sound card affects audio quality, speakers affect it even more. Get as many as your sound card supports and as you wish. I find anything over 5.1 to be a waste of space; I don't get better audio positioning from 6.1 or 7.1 speaker systems. The best names in multimedia speakers are Klipsch's ProMedia series, and Logitech's Z-series. Other nice brands include Philips and Altec-Lansing.

* **The printer**. Any home office needs a printer, and you'll probably want to share it across the network. While you can share printers connected directly to a PC, said PC needs to be on for other computers on the network to use the printer. Consider a wireless, networkable printer such as the HP Deskjet 6840 Color Inkjet Printer, which is armed for 802.11a/b/g networking, can be placed anywhere, and turns out speedy and high-quality print jobs.

* **Other peripherals**. You can add external storage, scanners, game controllers, and more to your computer through the magic of USB or FireWire. The limits of what manufacturers can create are nonexistent; you'll find all manner of gadgetry for your PC.

With a powerful PC and solid peripherals, you're ready for any task—from an online gaming session to crunching your checkbook in Quicken; from checking out a DVD movie to downloading music for your portable MP3 player. Now, you'll need a network to share your computer's resources and, with the framework discussed in the first two installments, enjoy your multimedia files all over the house.

the network infrastructure and broadband connection sharing

For home networking, you should definitely go wireless with Wi-Fi IEEE 802.11b or g wireless networking. With new security measures, wireless networks can be locked up as tight as wired networks; you don't have to run cables all over your house; and you can add computers and network appliances with ease without worrying about where to put them.

Wireless gateways make it easy to share a broadband Internet connection across a Windows network. In most cases, the cable or DSL modem and network gateway will be positioned in the same room as the network's "main" computer, in the home office.

To share a broadband connection across a wireless network, you'll need a wireless gateway with the speed you desire. Without broadband, you'll need at the very least a wireless access point.

Most home networks would be well served with the 11 megabits per second (Mbps) offered by 802.11b standards, but the jump to 802.11g offering 54 Mbps represents a tiny cost increase and will facilitate faster file transfers from one networked PC or device to another.

Each computer will need a wireless network adapter. They're available as PCI expansion cards for desktop and tower PCs, USB devices (in case you're not comfortable working inside the box (but with USB 1.1, you'll be limited to 12 Mbps)), and PCMCIA cards for notebook PCs. For wireless gateways, access points and adapters, look at products from Netgear, Linksys, D-Link, and other brands.

Setting up a wireless network is a cinch with Windows XP's Network Setup Wizard. Set up the wireless gateway as per the manufacturer's instructions. Then, install the wireless adapters in each PC to be networked and install the drivers. Run the Windows XP Network Setup Wizard on each networked PC and answer the questions it asks; it'll walk you step-by-step through sharing files, folders and printers, connecting to the Internet, and more. It'll even offer to make a network setup disk for PCs with pre-XP versions of Windows.

Finally, following the instructions for your wireless gateway and adapters, enable the security features offered by your wireless devices. At the very least, enable WEP, and if possible enable the far more secure WPA. This will prevent people with wireless devices from being able to access your network, leach your Internet connection and access your network shares.

The digital home needs a brain, and most often it's the home office computer. In keeping up the biological metaphor, the digital home's backbone would be the wireless network and its many limbs would be the various network appliances, including PCs, printers, network storage, media adapters, home control devices, and other gear in the ever-expanding field of wireless networking. The home office is armed for awesome computing; next chapter, we get the munchies and wander into the kitchen.

High-Tech Kitchen

Here's how I envision the ultimate kitchen: I get home from work, wander into the kitchen and fire up the computer. I'm not sure what I'm in the mood for; I want something pasta-based that I can throw together quickly. I punch in my desires and the software spits out a list of recipes. I choose a recipe that features whole wheat linguini with garlic oil and chopped tomatoes.

I get the linguini out of the cupboard—a full, 1-pound box—and wave it in front of the computer. The PC scans it and asks how much I plan to use. I'm cooking for two, so I say half a pound (we're hungry). The computer updates its database of my kitchen ingredients. I ask whether we have basil before searching the spice rack; there should be one-fourth of a container. Better add it to the shopping list, which I do with one click. The computer contacts my local grocery store and downloads current prices of the spice in various brands. Then, I load up an MP3 playlist—the songs are stored on my office PC—to entertain me while I chop the garlic and tomatoes and boil the pasta.

Is that a realistic scenario? Some of it is far-fetched from what's available to the home user today, such as the bar-code scanner linked to an ingredient database and connectivity to the supermarket to grab prices. Other things—such as having a computer in the kitchen that communicates with your home network, searching for recipes by ingredient and cooking time and accessing digital entertainment—are possible today with the right PC and software.

the right computer

The kitchen is a great place for a computer, but choosing the best one can be tricky. Few tech companies embrace kitchen computing specifically, which involves making considerations for the limited space and messy environment of the household food center.

One device is the iCEBOX built by Icebox LLC, a division of Salton. Available in both a countertop model and one that mounts under a cupboard with a flip-down screen, the iCEBOX, which is a Windows CE.NET-based appliance, brings television, DVD, the Internet, home video monitoring and more to the kitchen, complete with a keyboard and remote.

The latest model (FS04) has wireless capability to communicate with Wi-Fi networks. The problem is, it's not a PC; you can't install software on it. It can't pick up digital media files from other computers. It's a great entertainment station, but not a computing powerhouse.

Similarly, a few Web-enabled appliances are on the market. LG's Internet Refrigerator features a 15.1" flat-panel display. With it, you can watch TV, surf the Internet, download and enjoy MP3 music and tune in FM radio, cook from a recipe database with pictures, and more. It even functions as a memo pad with voice, pictures and text, so you don't have to leave scraps of paper stuck all over the 'frige with magnets. Similarly, LG has an Internet Microwave, which you can connect directly to a PC and download recipes right into the microwave's onboard computer.

Another way to go is to do it yourself. PC Magazine's Web site has a few suggestions on how to make it happen. The kitchen is the perfect place for a small form factor PC, such as a mini-ATX- or mini-ITX-based system. For information on building your own small form factor PC, check out Build It: A Small Form Factor PC. Your small form factor PC should be equipped with a network interface for your home network; a small, flat-panel monitor, perhaps one that you can mount on the wall. Check out our Buying Guide: LCDs for tips and suggestions. You will also need a basic keyboard and mouse; and multimedia speakers that you can mount on the counter or a wall. Ideally, the PC should reside in a cupboard (this is where the small form factor comes in; it won't bogart that much space from pots and pans), and the wires can be run behind the counter.

Another option would be to use a notebook PC. You can similarly fit it with a network interface, multimedia speakers and a flat-panel monitor; it might even be able to fit in a drawer.

If you have a large enough kitchen, you might even move in a small computer desk to make it your kitchen command center. You'd be able to jockey it like a traditional PC, and you could even get away with a CRT monitor.

protecting the parts

One consideration you have to make in a kitchen PC is the spill and splatter factor. If you protect

the PC case in a cupboard, it should be OK, but the keyboard and monitor are targets for liquids and goo. One thing you don't want to do if your computer case is exposed is to keep a dust cover over it all of the time; it could easily overheat. If you must protect it, cut holes in a dust cover that correspond with the cooling fans in the system to allow for proper airflow.

Since computers are used in messy shops and industrial situations, there's already an industry concerning ways to protect them. Monitor protectors, such as the **Enermax Glory Defender** has an easy-to-clean surface in case of splatter.

Spill proof keyboards, such as the Memorex TS1100, protect against coffee and tomato-sauce damage. Another option would be to get a generic, inexpensive keyboard and fit it with a plastic cover through which you can type, such as the **KeySkin Keyboard Protectors**. Notebook keyboards need protection, too; look for something like the **X-style Universal Notebook PC Keyboard Protector**.

software for the kitchen pc

When you've set up the perfect kitchen PC, you'll need terrific software to go with it. You can use Internet Explorer to surf the Web (if your network shares a connection); Windows Media Player, Winamp, Musicmatch Jukebox or something similar to handle multimedia tasks such as playing digital music files from around the home network; and something like WinDVD for DVD playing—those are no-brainers. But what about your kitchen-specific tasks?

Possibly the king of all recipe organizers is **MasterCook**, which comes with thousands of recipes and lets you add as many more as you please. You can search by ingredient, cook time and more, and print out ingredient lists for shopping or download them to your PDA. It even lets you grab recipes from the Web and keep track of fats, carbs and other nutrition factors.

Another awesome kitchen application is **The Living Cookbook**, whose 2005 version includes an inventory tracker, so you'll always know what you have in your kitchen; a meal-planning calendar, so you can figure out in advance what to have in the coming days or weeks; grocery lists; nutritional analysis and more.

With some clever placement, strategic splatter protection and the right software, you can bring the power of a PC to your kitchen. Next chapter, with full bellies, we continue our tour of the house by ducking into the bedroom for some peace and quiet.

High-Tech Bedroom

Unless you're in school and have the need to do homework and research reports on a regular basis, you might not think of the bedroom as an ideal place for a PC. If you work on a computer all day at your place of employment, come home and catch up on your finances on a PC in the den, watch a movie on your entertainment center PC, play a few rounds of "Doom III" online and get ready for bed, the last thing you might want to do is stare at another monitor when you should be relaxing and letting the stresses of the day melt away.

What do you do in the bedroom? (Besides the obvious—by which I mean sleep, of course.) You might listen to some relaxing music, read a book, watch "Letterman" or a DVD, fire up the baby monitor, dim the lights and snuggle up for a good night's sleep.

A computer can be a part of many of these activities. For instance, it can dim the lights for you; it can act as an e-book reader or an audio book reciting device; it can interface with your bedroom television to play videos or with your stereo to play electronic music files; and it can interface with a wireless camera with microphone to keep an eye on the baby.

As with any room in the house, a PC can enhance your experience in the bedroom without being intrusive.

saving money on a bedroom pc

You don't need a super-muscular computer to accomplish these reasonable tasks. In fact, unless you want to play games, edit video or do other processor- and graphics-intensive tasks, you don't need to pay a lot for a bedroom PC.

If you have an entertainment center in your bedroom, it would be the perfect place for a Media Center PC. Consider the HP m1050y. At a mere $999, it includes a 3.6GHz Pentium 4 processor, a SATA hard drive with a capacity up to 400GB and, if you're able to swing a couple thousand more, a 23-inch HDTV monitor. It comes with a remote control, and you might think about selecting the optional wireless keyboard and mouse for remote data manipulation.

If you have a desk or table upon which to set up a PC, you can go even cheaper. You can get desktop PCs for less than $500 from companies such as Hewlett-Packard and Dell. They won't be uncompromising powerhouses, but they'll do what you need them to. If you plan to connect your PC to an entertainment center, just make sure it has TV-out capability.

Also, you'll want to be able to network it into your home network, so be sure you get wired or wireless Ethernet capability, depending on your needs. If it'll serve as a standalone PC, without a TV or stereo, you should plan to upgrade the speaker system if you have any interest in audio quality (the speakers that come with budget PCs often leave much to be desired).

Finally, if multimedia isn't of interest to you but other functions of a bedroom PC are, you might be interested in a notebook computer. It can do anything a desktop can do, save for offer a rich audio/video experience. And with Wi-Fi connectivity, you can plop it anywhere you wish while maintaining access to your wireless home network.

I find it enjoyable to listen to audio books with the lights out when I'm ready for bed. Whether that's your speed or whether you prefer reading, a bedroom PC is ideal. You can purchase e-books online along with e-book reading software, and you can even get audio books from music download services such as iTunes.

For other entertainment software, you'll want a media player if you plan to use the computer for music or video. Windows Media Player 10 is free and quite robust, able to create and store playlists and access songs and video anywhere on your home network.

control and monitoring

As I discussed in Home Automation, a computer can be used to do things such as dim the lights and monitor motion sensors. If your automation scheme includes these duties, you might consider making it possible to control or monitor it from your bedroom PC.

With the right automation modules, such as plug-in and screw-in lamp modules, you can set the mood in your bedroom with a few clicks of a mouse or remote control. X10, for instance, has modules that you can plug into the wall and

then plug a lamp into the module, and modules that actually screw into light sockets that can be controlled with the software or a remote.

Similarly, the company offers motion sensors and alarm modules that can be used for home security. What better way to keep an eye on things than to run a command program on your bedroom PC that can alert you of movement downstairs when everybody's supposed to be asleep?

If you have infants or small children that require monitoring at night, you can do it from your bedroom computer. Why settle for a simple audio monitor when you can look in on the baby whenever you feel the need? Night-vision, webcam-style cameras, with microphones and video monitoring software, **are available**. Wireless camera kits, from companies such as X10, let you place cameras anywhere in your house and monitor them from any PC.

Next, we head to the head. That's right, we visit another room in which you wouldn't think to place a computer but where you can get a surprising amount of work done: the bathroom!

The Bathroom

A couple of years ago, a rumor tore through the Internet of a Microsoft product called the iLoo, an Internet-connected portable toilet complete with a plasma screen and keyboard for Web surfing during those tender bathroom moments. It was even mentioned that Microsoft might be in cahoots with toilet paper manufacturers who might offer tissue imprinted with URLs to visit. This turned out to be an **urban legend**, but it got us thinking: Why limit bathroom activity to magazines when you can be more productive (er, no pun intended)?

Sure, the bathroom isn't the place where you'd want to install a webcam for NetMeeting sessions, but we've networked the rest of the house, so why not the john? You tend to do your more lengthy bathroom business in the seated position, and let's face it: Sometimes you're there for a while. Why not tap into the digital entertainment available on your home network, or get some work done, while you're there?

The bathroom environment presents unique challenges in turning it into a computer center. Many bathrooms aren't large rooms; they're built for functionality, not legroom. Even if your bathroom is enormous, you have to consider other factors, most importantly humidity. PCs are adverse to moisture, so you'll have to take precautions to keep the bathroom computer running smoothly.

So, what are we waiting for? Let's wire up the water closet!

making the bathroom safe for computing

Some bathroom activity, particularly hot showers, can cause excessive humidity. Water can condense on surfaces of all kinds, including the circuit boards inside your computer. When the mirror fogs up, your PC is probably wet, too. That's very bad; condensation can conduct electricity and summarily short out DC circuitry, causing the computer to fail -- perhaps permanently.

Most bathroom fans are sufficient for clearing out a roomful of excessive humidity over time, but not for keeping up with the moisture generated by a shower. The fan that came with your house is probably noisy and inefficient, made for removing moisture and odor rather than preventing it. If you plan to install a computer in the bathroom, you should consider upgrading your bathroom fan to something that moves a lot of air in a small amount of time. Exhaust fans are rated in how many cubic feet of air they move per second (cfm), but the cfm rating that your bathroom requires depends on a number of factors, including the size of the room. You'd be best served to consult with a building contractor and get a sufficient fan professionally installed with the proper ductwork and controls.

If that's too much to ask for simply installing a computer in your bathroom, then you should make it a point to run your current fan for at least two hours after someone has taken a shower, leave the door open and not operate the computer until it's been given several hours to dry completely.

Whether you employ a notebook or desktop PC, as discussed in the next section, you'll want to protect it from splashing water and other contaminants such as airborne hairspray particles. Consider the waterproof keyboard and keyboard or notebook covers, discussed in the section High-Tech Kitchen.

situating a bathroom computer

If your bathroom's short on space, a notebook PC is ideal for the small environment. You can use it on a portable tray table; the question is, what do you do with it while it's not in use? You want it to be convenient to access and to be out of the way and protected during more water-intensive bathroom endeavors.

Since my bathroom is so small, I actually keep a notebook PC for bathroom use in the linen closet outside the bathroom. Just outside the bathroom door, I keep a folding tray table. That's one idea; if you have a cabinet in the bathroom, that's not inundated with hairspray bottles, extra soap and cough syrup, you can keep it there. If the toilet is next to a wall, consider installing a fold-out tray on hinges.

If you have lots of room in your bathroom, or at least a place near the toilet to mount a flat-screen monitor, you might consider a desktop PC. The case should be protected in a cabinet or enclosure to prevent it from being accidentally splashed. You'll need to have a place to use a keyboard and mouse, a lap-height tray of some sort.

In either case, you can get away with an inexpensive PC as long as you're not planning on doing system-stressing activities such as 3-D rendering or gaming. Check out a few value notebooks. For space considerations, you might consider a small-form-factor desktop PC. For a good look at options, check out Compact PC.

You'll probably want to mount multimedia speakers on the wall behind the toilet. If you're really ambitious, you can mount a 4.1 or 5.1 speaker system for surround sound. If you're using a notebook PC, you might consider an external USB sound device such as the SoundBlaster Audigy 2 NS or the Philips Aurilium for high-fidelity, multichannel sound. You'll need to store it along with the notebook when it's not in use. Similarly, you can install a SoundBlaster Audigy 2 ZS Notebook if your PC has a spare Type II PCMCIA slot. Have the leads for the speaker system inputs near where you'll use the notebook, perhaps dangling on the wall next to or behind the throne.

network and software considerations

You'll want your bathroom PC to be connected to your home network, so you can enjoy Internet access, shared multimedia files and other perks from the rest of the house. Ideally, you'll be employing a wireless Wi-Fi network, so you won't have to run network cabling through or around the bathroom walls.

For a bathroom multimedia experience, you'll need a media player of some sort, such as Microsoft's Windows Media Player or WinAmp. I wouldn't worry about ensuring that the bathroom computer has a DVD player, as it's unlikely you'll be in the bathroom long enough to watch a movie. Of course, you might want to view shorts, extra features or other tidbits -- so it's up to you.

If office work is more to your bathroom liking, share the folders on your home office PC that contain documents, spreadsheets, Quicken data files, and whatever else you'd like to work on while you relieve yourself. Of course, you'll have to install the necessary applications on your bathroom PC.

With a PC in the potty, you can expand your enjoyment of the necessary act with Internet connectivity, digital music, productivity and other activities. We conclude this article by setting up shop in the garage, on the screen porch, and other places outside the house.

the outside

All of the chapters in this article so far have had one thing in common: They've covered automation, entertainment, productivity and other amazing, computer-enhanced feats inside the house. We've explored sharing media, movies, pictures and data all over the home, from the office to the kitchen to the restroom.

There's no need to confine the computer to the walls of the house. In this final installment, we'll explore the wonders of outdoor computing, from installing a networked PC in the garage to monitoring activity, via a wireless network, that happens outside the home. Imagine the benefits of being able to surf the Web for hints or detailed documentation when you're working on your car or lawn mower; of seeing who's at the door before you answer so that if Jehovah's Witnesses or nosy Girl Scouts show up, you can ignore them; of installing a network of motion sensors to detect the presence of unknown and possibly unwanted callers.

the garage pc

The garage is known for grime, pollutants and other hazards that might make computers unhappy. It's for this reason that I suggest employing a desktop computer in the garage. You can take precautions to keep it healthy that aren't possible with a notebook PC.

Let's look at what you'll want in a garage PC:

* Internet connectivity, preferably through a shared broadband connection on the home network
* Multimedia, especially the ability to play tunes while you work
* A keyboard protected from airborne contaminants and grimy fingers
* A powerful set of multimedia speakers, to be heard over the sounds of your labors (but a two-satellite system will probably do, since it's unlikely you'll be in a position to enjoy surround sound)
* An optical mouse, since keeping a mouse ball clean in a dirty environment can be more trouble than it's worth
* Filtered intake fans, to keep particles out
* An easy-to-open case, so that you can clean the system out every month or so with compressed air, a shop vac and electronics cleaner.

What you probably won't need is the ability to play games or edit video, so you don't necessarily need a super-powerful computer. You can probably get away with an inexpensive PC. You can buy fan filters from enthusiast shops such as FrozenCPU.com, which you'll have to install on your own.

For keyboards' protective skins, check out my recommendation in Part VI of this article. Look for an inexpensive optical mouse—a basic Microsoft or Logitech model will do.

Connect the computer to your home network, wired or wirelessly as needed, and employ a decent set of multimedia speakers to enjoy digital music. The speakers can be mounted to the garage wall. You might connect a second set of speakers, using a Y-splitter, to a porch or patio area so you can entertain guests or play some nice, mellow music for warm nights outside. Be sure to take precautions to protect outdoor speakers from the elements.

Speaking of precautions, protect that PC! The workbench probably isn't an ideal place to set the case, especially if you do any woodworking or metalworking on it. Consider building a cabinet for it underneath the bench with a door for accessing the removable media drives.

Every month or so, perform some preventive maintenance on the PC. Clean the fan filters thoroughly. Open the unit and use compressed air to blast any contaminants free from circuit boards that they might have settled upon, and vacuum them up with a shop vac before they resettle. Then, blast the boards with electronic component cleaner. Use special care to wash cooling fans on the CPU and the graphics card.

Have a media player such as iTunes, Windows Media Player, WinAmp or MusicMatch Jukebox installed to play tunes shared across the network. Also, make sure to have Adobe Reader installed to read any PDF versions of reference manuals to which you may refer while working on your vehicles or lawn equipment.

external monitoring

Way back in Part III, **Home Automation**, we discussed home automation. Many of the same manufacturers, especially X10, offer monitors such as wireless cameras and motion detectors that can keep tabs on who's in your yard when you're not expecting company.

For example, X10 offers **outdoor motion sensors** that can activate lights, and which you can keep tabs on with special software. Use them to install a perimeter around your yard and house to alert you to the presence of intruders or stray dogs.

The same company offers **outdoor cameras** that can even pan and tilt to adjust the field of view to your needs. Install one near the front door to scope out who's knocking so you can avoid your mother-in-law--or welcome her, if she brought food. Some even contain Web servers so you can monitor them from any Internet-connected PC.

As technology advances, more specialized equipment will undoubtedly become available, depending on the market's willingness to adopt new innovations. This is an exciting time for home automation, productivity, distributed entertainment and computing on the whole!

your digital home

You could call it a digital paradise. Eric Clarke's three-bedroom home sits just off the bay in Panama City, Florida. Walk out back in the early evening, and you can see the sun setting over the Gulf of Mexico. Step inside, and you can see and hear digital media streaming from room to room. Music, movies, TV feeds, and photos bounce endlessly across a network spanning two PCs, a laptop, six televisions, and a good old-fashioned hi-fi.

One minute, you'll see Clarke sitting on the living room couch with his laptop, downloading new photos from a digital camera. The next, you'll find him stretched out on an upstairs bed, viewing those photos on his widescreen television. A second later, he'll tune the television to a satellite feed of the BBC and, with no more than a flick of the wrist, save an episode of Fawlty Towers to the PC down the hall. Later that night, with another flick, he might even stream a few jazz songs from the desktop downstairs and listen on the hi-fi.

The digital home is here, and it's here to stay. Eric Clarke, a 40-year-old maritime engineer, may be a bit ahead of the curve, but he's not the only one living this sort of audiovisual high life. According to NOP World's Roper Reports, a research organization that's been tracking consumer behavior since the Nixon administration, 34 percent of all Americans with PCs have, at some point, viewed digital photographs or videos on their PCs; 36 percent have played music; 55 percent have played games; and, believe it or not, 6 percent have actually used their PCs to watch TV.

Much like Clarke, a few brave Americans are even linking their PCs to traditional consumer electronics (CE) devices, freeing their digital media from the confines of CRT monitors and desktop speakers. Parks Associates, a firm that tracks the use of digital products, estimates that 15 million households now include some sort of computer network, and that roughly 8 percent of those—1.2 million—involve home stereos, digital audio receivers, televisions, or other CE devices.

Yes, turning your PC into an entertainment hub requires some know-how and, more often than not, a little elbow grease. But equipment is improving little by little, and if you take the plunge, you won't be sorry. You can certainly continue to enjoy music, TV, photos, and movies in all the traditional ways, but the possibilities aren't nearly as broad or exciting.

Clarke's media wonderland revolves around the PC sitting in his upstairs home office. Equipped with a TV tuner card, the system is an entry point for two different television feeds: one from a local cable provider, and one from a Dish Network satellite receiver on the roof. A so-called RF modulator (radio frequency modulator) and some standard TV cable then connect this system to the six televisions spread throughout the house. "You can find an RF modulator at your local Radio Shack," Clarke says. "It just takes a signal from your computer and converts it to a feed you can distribute to so many of the other electronic devices in your house."

Thanks to a handheld remote control and software sold by SnapStream Media, he can

navigate the PC's operating system from any of the six televisions, and not only tune in to his digital TV feeds from anywhere in the house, but also record programs to the PC's hard drive.

And that's just a start. A standard audio cable connects his widescreen television to his stereo system, and a wireless network connects his office PC to a downstairs desktop loaded with digital songs and a laptop loaded with digital photos. He can stream those songs all the way to his stereo and view those photos on any television. Then, of course, the wireless network links to the Internet, providing access to all sorts of other digital content.

Building such a network is no easy task. And though there are 1.2 million households equipped with digital media networks, in the grand scheme of things that's no more than a handful, and the number isn't growing all that quickly. When it comes to connecting PCs to CE devices, most Americans wouldn't even know where to start.

"The complexity and a lack of understanding of PC-to-CE connections have as much to do with the low penetration of these solutions as any other variable," says Kurt Scherf, a Parks Associates vice president and principal analyst. "Up until now, the only way to connect the home computer with other pieces of consumer electronics was to purchase a kludgy and not always reliable wireless system, or simply lay down an ordinary S-Video or audio cable."

That said, things are getting easier. Many consumer electronics devices—including digital video recorders, gaming set-top boxes, and digital media hubs—are now equipped with built-in Ethernet jacks, letting you link to existing wired or wireless home networks in an instant.

Blaine Miller, a 19-year-old sophomore at the University of South Florida, used his Microsoft Xbox to build a simple digital media network in his Tampa apartment. His cable Internet connection plugs into an Ethernet router. The router links a pair of PCs to his Xbox, tying all three to the Internet. And his Xbox plugs into his TV, just like any other Xbox. Thanks to software built into the set-top box, he can, much like Clarke, stream all sorts of digital media from his PCs to his television. "Many times, I'll do slide shows of my digital photo-graphs," he says, "or bring up a video feed from the Weather Channel Web site."

For many, even Blaine Miller's network might be a step too far. But you can always enjoy the digital life without a high-end media network. You can simply plug a digital camera into your PC and view your pictures right there. You can edit them, post them to an online album for viewing (or display them in slide-show format on your PC), and then print them with a home photo printer or through an online printing service. If you plug in a camcorder, you can view and edit your digital videos. You can even share them online in much the same way you share photos, thanks to services like **Mediashare 4.0** and **ShareGear 2004**.

You can download songs from online music stores like Apple iTunes and RealNetworks' Rhapsody. You can plug in an MP3 player, load it with songs, and listen on your afternoon jog. You can listen to Internet radio feeds and watch all sorts of Web video, including news, sports highlights, and the latest movie trailers. According to Singingfish, an AOL-owned site that keeps a running catalog of Internet audio and video, there are now more than 45 million different feeds to choose from.

With movies-on-demand services like CinemaNow, Movielink, and Starz! Ticket on Real Movies, you can download full-length films to your PC or laptop. Thanks to sites like Yahoo! Games on Demand, you can instantly download the latest first-person shoot-'em-ups and play them with people from across the world. And, yes, if you like, you can watch and record television right there on your desktop PC.

The possibilities are nearly endless—whether you're booting up a single Internet PC or tapping into an Eric Clarke–like network of PCs, laptops, televisions, and stereos. Sounds tempting, doesn't it? Wouldn't you love coming home to your own digital paradise?

jetsonize your home

While we aren't quite at the level of the "car in the briefcase" or the Spacely Sprocket, there are a few products on the market right now that would make George Jetson proud.

DUDE, WHERE'S MY DOG?

SPEC DATA

- Product: AOS iSeePet
- Price: around $500.
- Company: AOS Technologies

If you can't go 3 hours without seeing your beloved puppy, we have the product for you. The AOS iSeePet is a combination webcam and pet feeder. Dial in remotely, and the pet feeder emits a sound that calls the pet over for a treat. Currently available only in the U.K., Korea, and Japan, it will be available within the year here in the States for around $500.

ASTRO'S GREAT-GRANDPA

SPEC DATA

- Product: Sony AIBO
- Price: $1,799 list.
- Company: Sony Electronics Inc.

The Sony AIBO dog-like robot is getting new colors this fall (it will come in black), and new software will teach this old dog a few new tricks. In addition to being able to recognize objects, the AIBO will be able to remember objects and their locations.

CABANA-BOT

SPEC DATA

- Product: Aquabot Turbo T2
- Price: $1,400 street.
- Company: Aqua Products Inc.

Lonely housewives around the world are shedding a few tears, as the pool boy has been replaced by a robot. The Aqua Products Aquabot Turbo T2 will scrub, vacuum, and filter algae from most residential pools in a little under an hour. It can even climb stairs, but it can't put suntan lotion on your back.

IT'S A SUPER FRIDGE, SUPER FRIDGE

SPEC DATA

- Product: Samsung HomePAD
- Price: $4,999 list.
- Company: Samsung Electronics America Inc.

It's not just a fridge, people—it's an experience. The Samsung HomePAD displays a list of the items stored inside and tells you when food is about to go bad. But wait, there's more! You can check your e-mail and watch TV on the HomePAD as well. We also hear it keeps your food cold.

OFF-THE-WALL PC

SPEC DATA

- Product: Nobu N12WTB-PC
- Price: $3,129.99 direct.
- Company: Nobu LLC

If you think having the PC in your fridge is a good idea, why not stick one in your wall. The Nobu N12WTB-PC is a handy 733-MHz, 12.1-inch tablet PC with a touch screen.

THIS AIN'T YOUR DADDY'S LA-Z-BOY

SPEC DATA

- Product: iJoy Turbo 2
- Price: $799.95 direct.
- Company: The Sharper Image

The iJoy Turbo 2, available from The Sharper Image, is a robotic massage chair. Don't get too excited: It doesn't talk to you or transform, but it does accurately replicate chiropractic massage techniques. Unlike other chairs that make you feel like you are sitting on top of a washing machine, the iJoy replicates the feeling of having an actual masseuse or masseur working on you.

STUFF THAT GLOWS

SPEC DATA

- Product: Ambient Orb and Ambient Weather Beacon
- Price: Ambient Orb, $149 direct
  Ambient Weather Beacon, $179.
- Company: Ambient Devices

Sure, you can turn on the TV or check the Internet to get news, but the Jetson home should have another news source: a glowing orb. The wireless Ambient Orb changes color with the changes in the stock market, the weather, and the pollen count. The Orb can also detect when IM buddies are online. You can customize the Orb to show the info you want to know. The company also has a rectangular Weather Beacon that changes color with the weather. If it goes purple, Astro will want to come inside, badly.

VACUUMING SUCKS

SPEC DATA

- Product: Roomba
- Price: $249 direct.
- Company: iRobot

So why not get a robot to do that for you as well? The iRobot Roomba is a self-propelled vacuum that scoots itself around your home, cleaning floors and carpets as it goes. The vacuum maneuvers via an infra-red sensor, a bumper, and heuristics. Its creators estimate the Roomba takes about five times longer than you would to vacuum a room yourself, but that's just the point: You don't have to do it yourself.

A DIGITAL PERSONAL TRAINER

SPEC DATA

- Product: Yourself!Fitness
- Price: $35 street.
- Company: Yourself!Fitness

Yourself!Fitness is an interactive fitness application for the Microsoft Xbox, designed with women in mind. Your personal trainer, Maya, tracks your progress, heart rate, and effort, then changes your workouts accordingly. Maya has over 400 unique exercises at her disposal and even offers nutritional advice and 1,000 recipes.

SO I HAVE TO WEAR PANTS WHEN I ANSWER THE PHONE NOW?

SPEC DATA

- Product: Motorola Ojo
- Price: $800 street.
- Company: Motorola Inc.

The Motorola Ojo personal video phone is a wireless (802.11g) phone that lets you see the person on the other end of the line. It has a high-resolution 16:9 LCD, and unlike previous videophones, has a clear and vibrant picture, provided by new compression algorithms.

COMPOST IN THE KITCHEN

SPEC DATA

- Product: Sharp NP-40CX and NP-20CX
- Price: U.S. price undetermined (currently available only in Japan).
- Company: Sharp Corp.

Now that we've moved in to the sleek and shiny future, is there still a place for the gross and stinky past? Actually there is. Sharp has taken the eco-friendly compost heap and moved it into the 21st century. The Sharp NP-40CX and NP-20CX look like typical kitchen appliances, but they break down household kitchen waste and reduce the volume by up to 92 percent in 24 hours. Their secret sauce is a proprietary "composting bio mix," a blend of food-digesting microbes and yeast cells.

HEAVY PETAL

SPEC DATA

- Product: Let's Ka-on
- Price: $46,
- Company: Let's Corp.

Speakers have steadily evolved from huge Marshall stacks to teeny-tiny Bose speakers. The next iteration may be a bit more floral in nature. The Let's Ka-on attaches to the base of a vase and directs sound out through the petals of any flowers placed within. We're not sure if you can pump your gardenias "up to 11," but a loose translation of a statement on the Japanese company's Web site reads, "This personal stereo system has volume control, so you can honorably enjoy the sound you honorably like whether it is noon or night."

your PC

Digital homes have captured the imagination of sci-fi writers since the early twentieth century, appearing as settings or even characters in fiction. Consider "There Will Come Soft Rains" by Ray Bradbury for a house that goes on long after its inhabitants are gone. If you too were to imagine your digital home as a living cyber-being, with neural networks connecting all its parts, there's no doubt what would constitute both its brain and heart: the PC. It's the device responsible for intelligently parsing data and pumping it throughout the home.

Two basic types of PCs can be called into duty for a digital ecosystem: desktops and notebooks. If you want a workhorse that can manipulate, store, and stream data around the home, a desktop is your best bet. Notebooks trail desktops in practically every relevant component, so unless you're tight on space, notebooks should be thought of as complementary devices. That said, a robust PC can do more in the macrocosm of your digital home, but only a notebook can let you take a microcosmic version of it with you.

Our video, music, and gaming sections later in this story recommend systems for those specific tasks, but in this section, we'll cover the basics you need for an all-around multimedia performer.

choosing a desktop

A typical day's work for a digital home PC includes simultaneous downloading, video transcoding, and file streaming. This can bring a typical PC to its virtual knees. You need to buy with performance in mind.

It all begins with getting the most up-to-date processor and chipset you can afford. Everything from transcoding to playing back video and audio requires a lot of behind-the-scenes math, and the processor has to do these operations quickly to ensure a smooth experience. A current chipset gets data from the processor to other parts of the system fast.

If you want an Intel-based system, opt for one built on a 915 or 925 chipset, both of which support DDR2 memory and PCI Express. Pair that platform with the fastest 5-series Pentium 4 processor you can get—that is, look for the highest number in the series, such as 560. Unless money is truly no object or 3D gaming is your primary passion, we don't recommend splurging on a Pentium 4 Extreme Edition chip. You won't feel this chip's benefits as much in multimedia apps as you would in gaming, so it's hard to justify spending several hundred dollars extra on it.

AMD works with multiple chipset vendors, so if you want an Athlon 64–based system, you need to find one with a high-rated Athlon 64 processor, such as a 3700+, and then consider whether the motherboard supports the technologies you are likely to be using. The Athlon 64 gets you the extra future-proofing of 64-bit support. Like Intel with the P4 Extreme Edition, AMD has an extra-pricey chip—the Athlon 64 FX—which makes sense only for hard-core gamers. And finally, Apple offers impressive power in the dual 64-bit CPU setups for all its Power Mac G5 machines.

Get at least 1GB of memory; digital files, particularly video, are large, and your PC will need the virtual workspace. The ability to access memory quickly helps, which is why we recommend DDR2 support. True, it's not any faster than DDR today, but DDR2 is expected to approach 800 MHz by year's end, and it will be useful to have the upgrade path.

You'll want a capacious and fast hard drive: ideally at least 200GB of storage in a Serial ATA (SATA) drive. Most high-end systems have a SATA RAID controller, making it possible to connect two identical drives and stripe data on them with a RAID 0 configuration. This doesn't just give you double the storage; your system will see the two drives as one logical drive, and it can access data on them roughly twice as fast as it would from just one drive.

Despite the proliferation of integrated graphics on both AMD- and Intel-based systems, you'll want a discrete graphics card. Not only will it offload tasks from the CPU and improve performance, but a discrete card may also put out a "hotter" output signal that's less prone to motherboard noise. If you expect to play a lot of compressed video, consider the best ATI Radeon card you can afford. DivX is optimized for Radeon

cards, and they seem to do the best job at smoothing out pixelation in DivX files.

Your graphics card should have digital and analog (VGA) connectors, and you should also shop for a CRT or LCD monitor with digital connectors if possible. This is most important with LCDs: All PC video signals are digital, and LCD panels are digital. If you can avoid having to convert the signal to analog at the graphics card and then back to digital at the LCD, you will get a much better image.

Connectors aside, most CRTs beat most LCDs for watching video, but you can get an LCD with an impressive 16-millisecond pixel response time. On top of that, LCDs add a stylish, futuristic touch to your home. If you'll mostly be burning content for standalone players or streaming to TVs, you can keep the monitor to 17 inches or so to save money.

We mentioned PCI Express earlier. This expansion bus allows you to add cards and peripherals and has moved away from the parallel design of PCI. PCI Express allows multiple serial-data paths to be bundled for better performance. The biggest benefit the new interface currently offers is to graphics, where an interface of 16 data paths, called "by 16" or x16, provides more bandwidth than 8X AGP. In the future, the ability to add high-speed peripherals such as Fibre Channel cards will depend on the presence of PCI Express.

In these pre-Fibre-proliferation days, you'll use either Ethernet or USB 2.0 to access most devices in your digital home. Consider having a Gigabit Ethernet adapter; though your broadband connection will never fully tap it and you don't need it to stream video or audio real time, Gigabit Ethernet will let you set up a high-speed subnet to share files between PCs. To do this you would need to add a Gigabit switch.

As for USB 2.0, all PCs come with that now, making it easy to add numerous peripherals such as printers, scanners, and digital cameras. A media card reader isn't a bad idea for reading memory cards from your digital camera or other device, either, but for connecting most DV camcorders, you'll need FireWire.

One internal peripheral you can't be without is a DVD burner. You can now add or upgrade to a dual-format, dual-layer drive for as little as $100 more than the cost of a standard DVD burner. When dual-layer media get cheaper (discs are still around $15), copying full retail DVDs without recompression will be practical. (Unlike single-layer DVDs, which hold 4.37GB of data, a dual-layer disc can hold 7.95GB.)

A final consideration is audio. If you'll be listening to music or watching movies on your PC, you'll want to buy decent 5.1 surround-sound speakers (one left/right pair sits in front of you, another pair is behind you, a standalone speaker sits on top of or in front of the PC, and a subwoofer rests on the floor). Look for a system that can handle more than 100 watts. As for powering the speakers, the integrated 5.1 audio found in many new systems is sufficient for most music and video playback applications. Musicians will want discrete audio cards with improved I/O for recording.

TOP CHOICES:
DESKTOPS

APPLE POWER MAC G5

SPEC DATA ●●●●○

- Product: Apple Power Mac G5
- Price: $5,448 direct.
- Company: Apple Computer Inc.

Perhaps the most futuristic-looking PC around, the Apple Power Mac G5 is also one of the most forward-thinking. This powerhouse contains dual 2.5-GHz PowerPC G5 CPUs, 1GB of DDR 400 SDRAM, a 160GB SATA hard drive, a 256MB ATI Radeon 9800 XT graphics card, and a DVD-R/CD-RW SuperDrive. The 23-inch widescreen LCD is bright, clear, and of course, very attractive.

DELL DIMENSION 8400

SPEC DATA

- Product: Dell Dimension 8400
- Price: $2,999 direct (using E-Value code 6V411-D84RPW).
- Company: Dell Inc.

The Dell Dimension 8400's list of industry-leading components reads like a futurist's wish list: a dual-layer DVD burner, dual 160GB (7,200-rpm) SATA hard drives in a RAID 0 array, and a 256MB ATI Radeon X800 XT Ultra graphics card. Its 3.6-GHz Intel Pentium 4 560 processor gives it plenty of power, and it boasts 1GB of DDR2 SDRAM and a 925 chipset. A 19-inch LCD monitor comes with the package.

HP PAVILION A550E

SPEC DATA

- Product: HP Pavilion a550e
- Price: $2,599 direct.
- Company: Hewlett-Packard

With Athlon power from one of the big boys, the HP Pavilion a550e offers a nice system at an affordable price. Its Athlon 64 3400+ processor delivers impressive performance, and it comes with 1GB of DDR SDRAM, a 256MB ATI Radeon 9800 graphics card, and a 17-inch LCD monitor. We can't promise you won't need to add another hard drive for deep storage of multimedia data—it comes with dual 80GB (7,200-rpm) SATA hard drives—but the basic feature set, down to a media card reader and DVD burner, is here.

VELOCITY MICRO PROMAGIX

SPEC DATA

- Product: Velocity Micro ProMagix
- Price: $3,748 direct.
- Company: Velocity Micro Inc.

The Velocity Micro ProMagix can handle duty as both the heart of a digital home and as a serious gaming box. Its overclocked 3.6-GHz Pentium 4 560 processor, 1GB of DDR SDRAM, and nVidia GeForce 6800 GT graphics card helped deliver solid performance on our 3D and multimedia benchmark tests, yet it's surprisingly affordable for a machine from a boutique vendor. The dual 200GB (7200-rpm) SATA hard drives offer plenty of storage, and the ProMagix also includes a DVD burner and 19-inch CRT monitor.

choosing notebooks

If your digital home is more of a digital apartment, you might be looking for a heavy-duty (and heavy) notebook that crams in much of the desktop tech you just read about. Otherwise, think of a notebook as a complement to your desktop, and apply what you've read with the following considerations.

Again, go for the fastest processor you can afford, although judging CPU ratings isn't as easy as it is with desktops. Intel, for instance, offers the battery-efficient Pentium M in speeds up to 2 GHz, but that CPU actually performs on a par with Mobile Pentium 4 processors rated at over 3 GHz. AMD has a Mobile Athlon 64 and an Athlon XP-M. When shopping for a notebook, think Pentium M or Athlon XP-M for lighter computers that will often run on battery power. Save the Mobile Pentium 4 and Mobile Athlon 64 for machines that will mostly move from AC outlet to outlet.

As for memory, a notebook pulling media duty should do well with 512MB of DDR SDRAM. Hard drive choices are limited, but 60GB is the magic number. At this size, you can likely get a 7,200-rpm drive, which will perform better than 5,400- or 4,200-rpm models. We even recommend taking slightly lower capacity (say, going from 80GB to 60GB) if it means being able to get a higher-speed drive. Regardless of your drive's capacity, you should carry a smaller subset of applications on your laptop than you'd install on your desktop. For example, you'll likely use a compact video-playback app more often than you'll use a pro-level video-editing bundle.

Notebook vendors don't allow a choice of chipset or motherboard, but more of them are letting consumers pick the graphics processor and even the amount of video memory it contains—though many vendors won't let you choose your screen resolution. You will want to max out all these video specs as much as possible within your budget. Luckily for DivX fans, ATI Radeon Mobility cards are appearing in more laptops.

Speaking of video, you'll want a widescreen LCD for maximum movie enjoyment (or just for working on projects side by side). Whatever the aspect ratio, a 14- or 15-inch screen is very portable; 17-inch screens push the limits of your strength and your ability to be comfortable in tight spots like planes. Try to see the LCD before you buy, and be sure you like its crispness, viewing angles, and look. A growing number of vendors are including screens that have some type of brightness-enhancing technology, so consider this when shopping.

Audio is rarely great on notebooks, and additions such as integrated subwoofers can create hard-to-carry behemoths. Plan on using quality headphones or carrying portable speakers.

If you plan on doing most of your editing of digital content at home, ports won't be much of an issue, although most laptops with the horsepower to handle digital media also have at least USB 2.0. You're likely to find media card readers built in too. Another type of I/O to look for is a built-in TV tuner, which will let you record and watch shows on the go.

Wireless connectivity and battery life determine where you'll be able to stay connected and for how long. Try to buy integrated 802.11g wireless for fast interaction with your home network, and consider a machine with wired Gigabit Ethernet for frequent large data dumps. A laptop intended for true mobile freedom should have one of the aforementioned power-saving CPUs and a battery that's rated or benchmark-tested at over 3 hours.

flash: harmonic media convergence

15 million U.S. households now have a computer network, and roughly 8 percent of those—1.2 million—involve home stereos, digital audio receivers, televisions, or other CE devices.

Source: Parks Associates

TOP CHOICES:
NOTEBOOKS

ACER ASPIRE 2020

SPEC DATA

- Product: Acer Aspire 2020
- Price: $2,300 street.
- Company: Acer America Corp.

At 6.7 pounds, the Acer Aspire 2020 is a solid choice for those looking for a more portable multimedia notebook than the 9- and 10-pounders out there. This system has a 1.8-GHz Pentium M 745 processor, 512MB of DDR SDRAM, and an 80GB hard drive. It also includes a DVD±RW drive and a 15.4-inch display, along with a 128MB ATI Mobility Radeon 9700 graphics card. Below the keyboard, you'll find digital display and multimedia-function keys, which launch and control Acer's multimedia software suite.

HP PAVILION ZD7000

SPEC DATA

- Product: HP Pavilion zd7000
- Price: zd7000: $2,049 direct (with Windows XP Home); dv1000: $1,424 direct.
- Company: Hewlett-Packard

With a BrighTView widescreen 17-inch LCD, the HP Pavilion zd7000 really makes colors pop, enhancing the overall viewing experience. The system, at 9.3 pounds, comes with an 80GB hard drive and DVD+RW drive and is powered by a 3.2-GHz Mobile Pentium 4 processor, 1GB of DDR SDRAM, and 128MB nVidia GeForce 4 Go5700 graphics. We

love the zd7000's large display, but if you're looking for a more portable multimedia laptop, HP has another solid option: the sleek, and cheaper, 5.4-pound HP Pavilion dv1000.

SONY VAIO VGN-A190

SPEC DATA

- Product: Sony VAIO VGN-A190
- Price: $2,700 direct.
- Company: Sony Corp. of America

Thinner and lighter (8.4 pounds) than the competition, the Sony VAIO VGN-A190 lets you take recorded shows on the go—even if you have to leave tuner functionality in the docking station. Its high-resolution widescreen 17-inch display and decent weight make it a system worth considering. The system also includes a 1.7-GHz Pentium M 735 processor, 512MB of DDR SDRAM, an 80GB hard drive, a DVD±RW drive, and an ATI Mobility Radeon 9700 graphics card. We just wish Sony would update its GigaPocket software or include Windows Media Center instead of Windows XP Home.

TOSHIBA QOSMIO E15-AV101

SPEC DATA

- Product: Toshiba Qosmio E15-AV101
- Price: $2,699 direct.
- Company: Toshiba America

The new Toshiba Qosmio E15-AV101 is as close to a mobile multimedia dream machine as we've seen. Thanks to I/O dongles that handle almost every type of connection—even component outputs for HDTV—the Qosmio takes you on the ultimate AV journey. It has a 1.7-GHz Pentium M 735 processor, 512 MB of DDR SDRAM, an 80GB hard drive, and a DVD±RW drive. Add in the new TruBrite 15-inch screen and its nVidia GeForce FX Go5200 graphics card, and this fairly portable laptop (8.2 lbs.) is destined for stardom.

TOP CHOICES:

PRINTERS

It's difficult to imagine having a home PC without a personal printer attached. The following devices can certainly handle basic printing tasks, and some can also handle printing photos or toddler creations for the fridge.

CANON MULTIPASS MP390

SPEC DATA ●●●○○

- Product: Canon MultiPass MP390
- Price: $200 direct.
- Company: Canon USA Inc.

The Canon MultiPass MP390 prints, scans, faxes, copies, and prints photos directly from cameras and memory cards and lets you fax from programs on your computer. Although a bit slow, this printer has good image quality and a low cost per page, making it a reasonable choice for those who do occasional printing and need fax capability.

BROTHER MFC-3420C

SPEC DATA ●●●●○

- Product: Brother MFC-3420c
- Price: $150 street.
- Company: Brother Industries Ltd.

With an automatic document feeder, built-in fax modem, and front-panel numeric keypad, the Brother MFC-3420c offers a full set of printer, copier, scanner, and fax features. This printer is fast and accurate for text and graphics, with admittedly budget-quality photo output. It's a good choice if you are primarily interested in printing from business applications.

HP DESKJET 5150

SPEC DATA ●●●●●

- Product: HP Deskjet 5150
- Price: $90 direct.
- Company: Hewlett-Packard Development Co.

For high-quality output without photocentric bells and whistles, the HP Deskjet 5150 is a solid choice. With the optional duplexer, you can do two-sided printing and print borderless photos on special paper. Test photos we output showed excellent detail and clear colors.

watching video

Without a doubt, digital video is changing what we watch and the way we watch it. It's changing how we create our own visual memories, and how we share and store them. Thanks to media convergence—the blending of computing and consumer technologies—video buffs are reveling in the many new facets of home entertainment.

The traditional TV is no longer the sole provider of movies and shows. It can talk to PCs and other media devices to deliver video on demand anywhere in the house. Such video could be a downloaded movie that sits on a PC's hard drive, a recorded show on a DVR (digital video recorder), or possibly even a show beamed directly from the local cable company. Surveillance cameras hooked into your PC (and TV) can show the UPS guy at the front door or the kids playing in the backyard.

For those who create their own video, improved camcorders and software have raised the bar for home video quality. With high-capacity hard drives and simple editing tools, you can transfer all your videotapes to your PC and edit them with flair. Authoring tools allow you to add titles, music, and transitions to polish what you present at the family reunion, and then burn it all to DVDs. And for those concerned about protecting and preserving all those valuable memories, you can transfer home movies from analog or digital videotape to digital mass storage. Then you can forever halt the aging process that turned Mom's wedding dress a light shade of pink.

Someday, all of our video entertainment will be conveniently located in one handy device in the house. For now, though, we get our video content from various places: We channel-surf the TV, we check out DVDs of our favorite movies, and we watch home videos—that is, if we're ambitious enough to hunt down the transformers and cables needed to connect our camcorders.

Thankfully, new convergence technologies have made these tasks easier and allow us to share our video—no matter what the source—throughout the house.

good-bye, vcr; hello, dvr

There are several devices to help you store and share video content, starting with the PC. The gigantic hard drives found on current PCs can hold dozens of hours of video content, such as home movies in (or converted to) MPEG or WMV format, as well as Hollywood movies downloaded from online sources.

But video-friendly PCs offer far more than just large hard drives. Some, such as those with the Windows XP Media Center Edition OS, include TV tuner cards, letting you watch cable as well as record shows and link to programming guides. These come with TV-out connectors, so you can watch video on your traditional TV that's stored on your PC; you just connect the two devices via audio and video cables. You can easily navigate the Media Center menus on your TV screen from 10 feet away. And those menus aren't designed for enjoying only video; they also make it easy for you to find and play digital music from your hard drive or view photos.

Some Media Center PCs are shaped like stereo receivers and have ultraquiet cooling fans, making them a better fit for living rooms. The new 2005 edition of the OS allows for various levels of Media Center PCs. High-end PCs have multiple TV tuners, so that you can record one show while watching another.

Do-it-yourselfers can create much of the same experience of a new Media Center PC with their existing systems. Many users will want to add PC TV tuner/remote/software bundles from ATI or nVidia. The SnapStream Firefly PC Remote lets you control PC-based media on your computer or with a TV output card on your TV, and its Spotlight feature gives you a single place to find and view premium media content you purchased and downloaded.

TV devotees who don't want the hassle of connecting their PCs to their TVs are turning to dedicated digital video recorders (DVRs), also known as personal video recorders (PVRs). These consoles record TV shows on internal hard drives. Most use the TV's screen to display menus and show program information; a few have on-system displays as well. You can buy a DVR outright from vendors such as TiVo and ReplayTV, rent one from your cable company as part of a set-top box, or buy a combination DVD player/DVR.

stream video with media hubs

A new category of recently emerged products, digital media hubs (also called digital media receivers), lets AV equipment in remote rooms pull content from a PC. Many hubs can stream

audio and photo files, and some also stream video files. (For more on these, see Your Music.) Some media hubs have integrated DVD players; some are equipped with AV receivers, amplifying audio for your speakers and decoding surround sound on your DVD movies, in addition to streaming content to various devices.

Many new media hubs are adapting to work with audio and video content with digital rights management (DRM), which typically means content protected by Microsoft's Janus DRM protocol. Adopted by many online entertainment services, Janus lets you share downloaded content with portable media players and stream it to other devices in your house. But it doesn't allow you to stream commercial DVDs that you own from room to room.

video storage: servers and nas

If you're serious about creating a truly digital home, you'll want to dedicate a PC as a media server. It doesn't have to be a fancy, fast, or even new PC. But it must have plenty of storage capacity, about 120GB to 200GB, so you may need to add a larger hard drive to an old PC, as well as install Windows XP, to give the server the stability it needs.

Another option is to use a network-attached storage (NAS) device, such as the Buffalo LinkStation (250GB drive, $400 street; 120GB, $300). But beware: Only a handful of media hubs can talk to a non-Windows device. The others need a host PC to see the network drive.

room with a view

Finally, one could argue that the most important device you need for watching video is a high-quality display. If you're considering an HDTV, you need to identify how much space you have and what you're willing to spend.

Your choices are plasma display panels (PDPs), LCD panels, and rear-projection TVs (RPTVs), many of which use DLP technology. If you're really space-constrained, you might consider a front projector/screen combination. Each technology has its advantages, but none is perfect. RPTVs represent the best price/performance value, with prices for 42-inch units starting around $2,000. But some good 30-inch LCD panels can be found for as little as $1,700.

TOP CHOICES:
DVRS AND MEDIA CENTER PCS

REPLAYTV 5504

SPEC DATA ●●●●○

- Product: ReplayTV 5504
- Price: $149.99 direct.
- Company: ReplayTV, Digital Networks N.A. Inc.

The ReplayTV 5504 is the perfect device for people who like to jump around within TV shows. It comes equipped with a 40GB hard drive that's good for 40 hours of standard-quality recording. And you can record your favorite shows with the press of a button. Network capabilities let you control the 5504 from a remote Web browser and stream video from one unit to another. Activation costs a lifetime service fee of $299, in addition to the device's price.

SNAPSTREAM BEYOND TV 3

SPEC DATA ●●●●○

- Product: SnapStream Beyond TV 3
- Price: $69.99 direct.
- Company: SnapStream Media Inc.

If your PC already has a TV tuner card, SnapStream Beyond TV 3 is the way to go. The software's slick interface, ViewScape, has easy-to-read menus that fade in and out, and the stellar channel guide lets you record all episodes of a show with one click. You can avoid commercials with the SmartSkip feature and enjoy easy access to Beyond TV 3 from the road.

HP MEDIA CENTER PC M1050Y

SPEC DATA ●●●●◐

- Product: HP Media Center PC m1050y
- Price: $999 direct; with 23-inch HD monitor, $2,899.99.
- Company: Hewlett-Packard Development Co.

The amazing HP Media Center PC m1050y includes a 3.6-GHz Pentium 4 560 processor; the optional 23-inch widescreen HDTV-compatible monitor is dazzling. The neatest feature is the HP Personal Media Drive, which accepts hot-swappable 160GB hard drive cartridges, essentially providing unlimited storage potential.

SONY VAIO VGC-RA810G

SPEC DATA ●●●●●

- Product: Sony VAIO VGC-RA810G
- Price: $2,199.99 direct.
- Company: Sony Electronics Inc.

The Sony VAIO VGC-RA810G is a silent beauty, thanks to an innovative cooling port that reduces the need for noisy fans. The picture quality from the included TV tuner is rock-steady, and the 19-inch SDM-HX93 monitor provides rich, detailed video. With a 3.4-GHz Pentium 4 550 processor and 1GB of RAM, this is a solid Media Center PC.

TOP CHOICES:
DVD PLAYBACK SOFTWARE

Just having a DVD drive on your PC isn't enough; you need the right software before you can watch movies. DVD playback software comes in many flavors (and is often included when you purchase a drive), so you should be able to find the perfect solution for your system and needs.

CYBERLINK POWERDVD 5

SPEC DATA ●●●●●

- Product: CyberLink PowerDVD 5
- Price: Standard, $49.95 direct; Deluxe, $62.95.
- Company: CyberLink Corp.

If you're looking for a higher-quality picture, CyberLink PowerDVD 5 uses CLEV (CyberLink Eagle Vision) technology to adjust color and contrast automatically for the best image.

WINDVD 6

SPEC DATA ●●●●○

- Product: WinDVD 6
- Price: Gold version, $49.95 direct; Platinum, $69.95.
- Company: InterVideo Inc.

Of the available software DVD players, InterVideo's WinDVD 6 has the most features, including new ones such as Quick Clip and Reverse Playback.

TOP CHOICES:
ONLINE MOVIE RENTAL SERVICES

Tired of the poor DVD selection and late fees at your local video store? Online movie rental services let you download movies over your broadband connection and watch them for a limited time.

STARZ! TICKET ON REAL MOVIES

SPEC DATA ●●●○○

- Product: Starz! Ticket on Real Movies
- Price: $12.95 per month.
- Company: Starz Encore Group LLC

Starz! Ticket on Real Movies offers more than 100 downloadable movies on a rotating basis. You can preview and download movies on up to three computers, then watch them as many times as you want within 30 days. You also get a live stream of the Starz! Channel.

CINEMANOW AND MOVIELINK

SPEC DATA ●●●◐○

- Product: CinemaNow
- Price: up to $3.99 per movie; premium subscription, $9.95 per month.
- Company: CinemaNow

SPEC DATA ●●●◐○

- Product: Movielink
- Price: 99¢ to $4.99 per movie.
- Company: Movielink LLC

If you don't watch that many movies a month, both CinemaNow and Movielink offer pay-per-view movie plans. Some movies expire after 24 hours, so you must watch them right away. CinemaNow also offers download-to-own and two subscription plans.

NETFLIX

SPEC DATA ●●●●●

- Product: Netflix
- Price: $14.99 to $21.99 per month.
- Company: Netflix Inc.

For those of you without broadband, there are several ways to rent DVDs online and have them delivered to your door. These services offer free shipping both ways and no due dates or cancellation fees. Netflix, the granddaddy of this type of service, has about 25,000 titles. Subscription prices vary, depending on how many DVDs you want at a time.

WAL-MART DVD RENTALS

SPEC DATA ●●●○○

- Product: Wal-Mart DVD Rentals
- Price: $15.54 and up per month.
- Company: Wal-Mart.com USA LLC

Wal-Mart DVD Rentals is a similarly priced plan.

TOP CHOICES:
TV DISPLAYS

DELL W1700

SPEC DATA ●●●●○

- Product: Dell W1700 LCD monitor/TV
- Price: $699 direct.
- Company: Dell Inc.

The Dell W1700 LCD monitor/TV has a well-designed and easy-to-use remote control. Even at extreme viewing angles, computer images are excellent, and auto-sync eliminates all pixel jitter. Automatic channel identification finds available broadcast television stations without including weak signals.

NEC PLASMASYNC 61XM2+/S

SPEC DATA ●●●●◐

- Product: NEC PlasmaSync 61XM2+/S
- Price: $14,995 list.
- Company: NEC Solutions (America) Inc.

At 61 inches, the NEC PlasmaSync 61XM2+/S is one of the largest displays available—and it's also one of the most expensive. Its built-in scaler and 1,365-by-768 resolution make watching DVD movies into an outstanding experience, and give PC games an immersive feel.

SHARP 37" AQUOS LCD TV (LC-37HV4U)

SPEC DATA ●●●●●

- Product: Sharp 37" Aquos LCD TV (LC-37HV4U)
- Price: $6,499 list.
- Company: Sharp Electronics Corp.

The Sharp 37" Aquos LCD TV (LC-37HV4U) has a resolution of 1,366-by-768. You can see plenty of detail in both shadows and highlights, and it has less smear on moving images than do rival LCDs.

VIEWSONIC N1700W

SPEC DATA ●●●●○

- Product: ViewSonic N1700w
- Price: $600 street.
- Company: ViewSonic Corp.

The ViewSonic N1700w includes a picture-on-picture feature in which viewers can scroll through images to choose between TV programs. Gray-scale response and color tracking are effective. The speakers, with surround sound, produce good sound quality.

creating video

The days of torturing loved ones with grainy, silent Super-8 home movies and carousels full of vacation slides are over. Creating digital videos is now easy and accessible to people of all skill levels and budgets. But before you become the next Spielberg, you're going to need the right tools.

choosing a camcorder

It sounds axiomatic, but video quality starts with the camcorder. For this reason, if you're shooting to edit, stick with MiniDV cameras that store video in the DV format on matchbox-size tape cartridges. Camcorders that store video on DVDs compress the video into MPEG-2 format, which is fine for immediate viewing but inferior to DV for editing. Ditto for the cool new tiny cameras that store video on SD memory in MPEG-2 or MPEG-4 formats.

Prices for MiniDV cameras range from under $300 for some inexpensive consumer models to more than $3,000 for the most expensive prosumer models. Given the near price parity with analog cameras that deliver much lower quality, buying an analog camera makes little sense.

The first thing you should do when comparing digital video cameras is check the size of the charge-coupled device (CCD). This chip converts the signal coming in through the lens into digital information. Generally, larger CCDs (such as 1/3- or 1/4-inch) produce higher-quality video than smaller CCDs (1/6-inch, for example), and cameras with three CCDs outperform those with only one.

Other critical features include a microphone input port, so you can add a separate microphone to augment the notoriously poor microphones embedded in most camcorders. An intelligent accessory shoe, which can power and control both a microphone and video light, is also a handy option.

A standard feature on all MiniDV cameras is a FireWire port, also known as iLink or IEEE 1394, the technology's official designation. You can use this port to connect the camera to the computer and download your video.

editing your video

Mention video editing to most people, and they probably think of Hollywood special effects à la Harry Potter and The Lord of the Rings. But the primary role of consumer video-editing programs is more prosaic; specifically, it's trimming away the visual fat to produce a tight, compelling story: When producing home videos, less is definitely more.

Most video editors offer far more features than home producers will (or should) ever need to use. Zero in on the features you know you'll want, and have an idea of how advanced you want them to be. For example, all video editors let you adjust video color and brightness manually to correct shots taken with inadequate lighting or improper white balancing. Better editors can automatically analyze and correct your footage.

Since most video editors also include DVD-authoring features, you should factor them into your buying decision too.

dvd authoring

DVD authoring is the ability to create menus, add videos and slide shows, and burn your project to a DVD. Usually you edit your video first, and then author your DVD.

Most entry-level authoring tools are completely template-driven, with customizable menus but fixed, sequential page navigation. For the most part, templates make DVDs simple to create, but viewers may have to page blindly through multiple menus to find the desired content.

All programs provide libraries of menu backgrounds, buttons, and other design components; take a good look at them before buying, unless you want to design your own. These components will form your viewer's first impression of your production, and if they look cheesy, so will your content.

If your typical DVD exceeds 60 minutes of content, buy an authoring program that can compress audio into Dolby Digital format. This will save disc space without the potential compatibility issues of MPEG-2 audio compression.

dvd burning

DVD recorders, which can be internally mounted in your PC or connected externally via USB or FireWire, record your production to a disc you

can play in set-top DVD players and computers with DVD drives and the necessary software.

The latest trend in DVD recorders is the dual-layer model, which writes to discs with 7.95GB capacity, compared with the 4.37GB disc capacity of traditional single-layer DVD-R/RW or DVD+R/RW drives. Dual-layer discs are still expensive, and playback compatibility has been spotty in some early tests.

If you're not comfortable tinkering with firmware upgrades and the like, you should probably stick with single-layer recorders. That said, note that all dual-layer drives can also record on single-layer media, so you can still use the less expensive, more compatible media. Whether buying a single- or dual-layer recorder, purchase a unit that can record to both "plus" and "minus" media.

sharing your creations

You can share your personal videos simply by plugging your camcorder into your TV. But how do you share them with friends and family who live on the other coast? Consider services that post your videos to a Web site for viewing by your invited guests. Some video editors let you upload your videos from within the application. Pinnacle Studio uses its **in-house service**, while both Microsoft Windows Movie Maker 2 and Ulead Video Studio use Neptune's **Mediashare**. Pricing and plan details vary by company. There are also unaffiliated third-party options like **sharegear.com**.

All services compress your files before posting them for viewing, which inevitably degrades quality. This is especially true for your viewers who use dial-up modems to connect to the Internet. Video viewed over broadband, however, can look quite good, and you really can't beat the convenience of having it available on the Web.

TOP CHOICES:
CAMCORDERS

CANON OPTURA 20

SPEC DATA ●●●●○

- Product: Canon Optura 20
- Price: $999 list.
- Company: Canon U.S.A. Inc., www.canondv.com

The Canon Optura 20 includes a 16X optical zoom and a manual focus ring on the lens. It's very competent in low-light shooting, which is a common Achilles' heel in Canon's consumer line. Zoom controls offer multiple speeds and are easy to manipulate; the intelligent accessory shoe can house a light or a directional microphone.

PANASONIC PV-GS120

SPEC DATA ●●●◐○

- Product: Panasonic PV-GS120
- Price: $699.95 list.
- Company: Matsushita Electric Co. of America

Boasting a 3-CCD video, 1.2-megapixel still-image capture capability, and a Leica Dicomar 10X optical zoom lens, the Panasonic PV-GS120 produces sharp, well-exposed digital video with accurately reproduced colors. It fits comfortably in your right hand and offers easy access to zoom and basic operating controls. The generous 2.5-inch LCD panel flips out 90 degrees and rotates vertically 270 degrees.

PANASONIC SV-AV30 E-WEAR SD MULTI AV DEVICE

SPEC DATA ●●●●○

- Product: Panasonic SV-AV30 e-wear SD Multi AV Device
- Price: $400 street.
- Company: Matsushita Electric Co. of America

The sleek Panasonic SV-AV30 e-wear SD Multi AV Device functions as a still camera, video recorder, music player, and voice recorder. With a 2-inch (diagonal), 320-by-200 color LCD flip-up screen, 3.55-mm fixed-length lens, flash, and rechargeable lithium ion battery, the SV-AV30 looks like a miniature laptop. An included 64MB SD card gives you 124 photos, 35 minutes of MPEG-4 video, 2 minutes of MPEG-2 video, or 1 hour of 128-Kbps MP3 files. Even with its modest resolution, the SV-AV30 is a stunning device that you'll want to carry everywhere.

PHILIPS KEY019 KEY RING CAMCORDER

SPEC DATA ●●●○○

- Product: Philips KEY019 Key Ring Camcorder
- Price: $279.99 list.
- Company: Koninklijke Philips Electronics N.V.

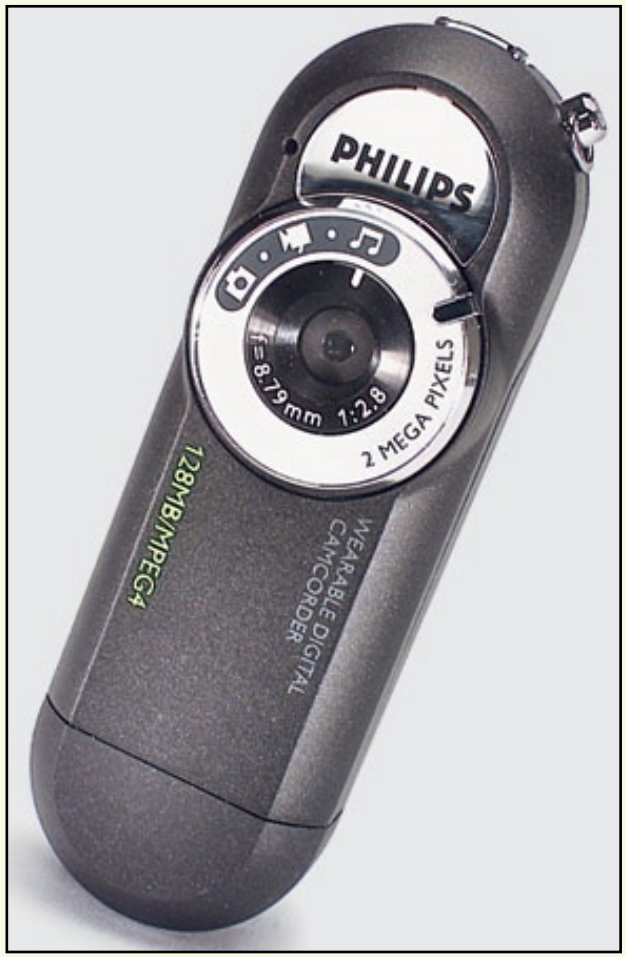
The Philips KEY019 Key Ring Camcorder is also an MP3 player and digital camera. Its 128MB of internal memory stores 2-megapixel still shots, digital video, MP3 files, and documents. The camera doesn't have a zoom or a flash, the MP3 player lacks a playlist function, and the device gets a bit warm after shooting 20 minutes of video. But the wow factor is undeniable.

SONY DCR-HC40 MINIDV HANDYCAM

SPEC DATA ●●●●○

- Product: Sony DCR-HC40 MiniDV Handycam
- Price: $699.99 direct.
- Company: Sony Electronics Inc.

The Sony DCR-HC40 MiniDV Handycam produces superior detail and color accuracy, along with impressive audio. Controls on the LCD panel direct recording and enable and disable LCD backlighting to save battery power while shooting. (With the LCD active, the battery lasted 94 minutes on our tests.) It features an intelligent accessory shoe and a remarkably smudge-resistant and logically organized touch-screen panel.



TOP CHOICES:
DVD EDITING & AUTHORING TOOLS

MYDVD STUDIO 6

SPEC DATA ●●●●○

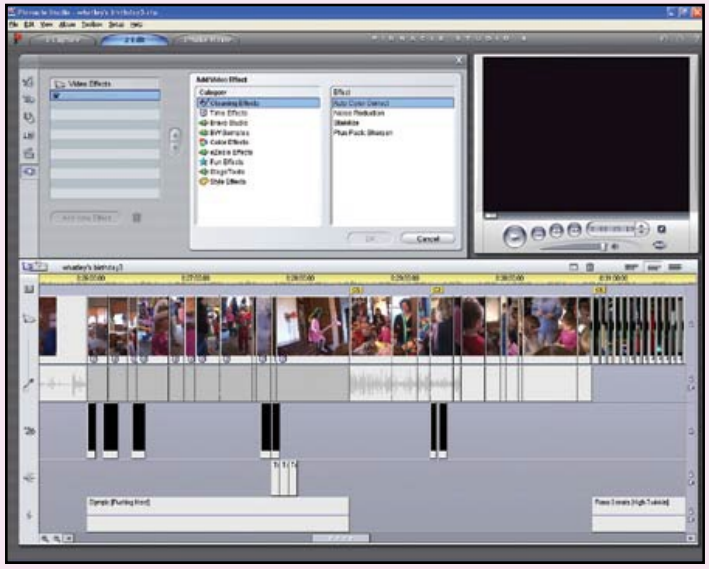
- Product: MyDVD Studio 6
- Price: $69.99 direct.
- Company: Sonic Solutions

MyDVD studio 6 is the most intuitive application we've tested for producing high-qualityDVDs quickly, though it has limited video-editing features. This new version lets you position video thumbnails manually on a menu; you can also import MPEG-4 and DIVX content, as well as video from non-copy-protected DVDs.

PINNACLE STUDIO 9, V. 9.1

SPEC DATA ●●●●○

- Product: Pinnacle Studio 9, v. 9.1
- Price: $99.99 direct.
- Company: Pinnacle Systems Inc.



Pinnacle Studio 9, v. 9.1 features a second video timeline for picture-in-picture and chroma key effects, as well as image pan and zoom for slide shows and outstanding DVD-authoring tools. Pinnacle Studio 9 Plus ($99.99 direct) adds new features, including image stabilization, automatic color correction, and noise reduction.

ULEAD VIDEOSTUDIO 8

SPEC DATA ●●●●○

- Product: Ulead VideoStudio 8
- Price: $99.95 direct.
- Company: Ulead Systems Inc.

As a video editor, Ulead VideoStudio 8 is mature and full-featured. New features include automatic background audio-track creation and pan and zoom capabilities for slide shows. But DVD-authoring options are very limited.

IDVD AND IMOVIE

SPEC DATA ●●●◐○

- Product: iDVD and iMovie
- Price: $49 direct for the iLife '04 suite (includes iDVD, iMovie, iPhoto, iTunes, and GarageBand).
- Company: Apple Computer Inc.

The dazzling templates of Apple's iDVD and graceful usability of iMovie enable novices to produce impressive results. iMovie's interface is a model of simplicity, and its capture function is one-click simple. Direct trimming gives users the ability to trim a clip by dragging the edges to a new location. iMovie also offers a good range of special effects, including lightning, fog, and fairy dust—all with excellent configuration options. iDVD has 45 templates that are light-years ahead of the rest. Navigation options are good, with submenus and chapter menus, and you can create slide shows with transitions and match image duration to background audio.

ADOBE VIDEO COLLECTION 2.5 PROFESSIONAL

SPEC DATA ●●●●◐

- Product: Adobe Video Collection 2.5 Professional
- Price: $1,499 direct.
- Company: Adobe Systems Inc.

All Adobe's video production tools are functional, but they work best as part of the Adobe Video Collection 2.5 Professional suite. For example, Premiere is highly usable but lacks chroma key and motion controls. Enter AfterEffects, which buttresses these capabilities and adds much more. Encore's menu design capabilities, though improved, are competitively weak. But Photoshop offers round-trip menu editing between the two programs.

SONIC DVDIT 5

SPEC DATA ●●●○○

- Product: Sonic DVDit 5
- Price: $299 direct.
- Company: Sonic Solutions

Sonic DVDit 5 has a structured workflow, excellent design templates, a slide show creation function, and disc and jewel case printing. Assigning navigational properties to buttons and menus is easy, but DVDit can't capture video directly, making it less efficient than Ulead DVD Workshop for tape conversions.

TOP CHOICES:

VHS TO DVD CONVERSION SOFTWARE

HP DVD MOVIE WRITER DC 4000

SPEC DATA ●●●●○

- Product: HP DVD Movie Writer dc 4000
- Price: $249.99 direct.
- Company: Hewlett-Packard Development Corp.

Editor's Note: This product is essentially the same as the previous model, the dc 3000, our previous Editors' Choice winner in this category.

For beginners, the HP DVD Movie Writer dc 4000 is a good product to start with. It captures analog home movies, converts them to digital, and provides software so you can edit your videos and add titles, music, and more.

ADS INSTANT DVD 2.0

SPEC DATA ●●●○○

- Product: ADS Instant DVD 2.0
- Price: $199 direct.
- Company: ADS Tech

The ADS Instant DVD 2.0 offers strong performance and good video quality. Three application-specific programs are included: muvee autoProducer DVD SE (converts your home movies to music videos), Ulead DVD MovieFactory 2 (for tape conversion), and, for more advanced video editing, Ulead VideoStudio 7 DVD SE.

ADAPTEC VIDEOH! DVD MEDIA CENTER USB 2.0 EDITION

SPEC DATA ●●●●○

- Product: Adaptec VideOh! DVD Media Center USB 2.0 Ed.
- Price: $179.99 list.
- Company: Adaptec Inc.

Now here's a device that gives you more for your money. The Adaptec VideOh! DVD Media Center USB 2.0 Edition easily captures analog video from camcorders, VHS tapes, and digital media and converts it into MPEG-1 or MPEG-2 files. You can also record, pause, replay instantly, fast forward, and rewind television shows. The package includes Sonic MyDVD video creation software as well.

your music

Just about any desktop computer made in the past decade is capable of playing high-quality audio. Until recently, however, the average music fan had no compelling reason to ditch his or her conventional CD player in favor of a PC. But many factors—from the emergence of legal download services to dedicated network audio receivers to obscenely inexpensive hard drives—have made a computer the next must-have component for your home entertainment system.

music on your pc: the basics

As we mention in "Your PC", the ultimate multimedia PC should have plenty of storage space (ideally, 200GB). This allows you to store thousands of CDs as digital audio files—MP3, WMA, and other formats—encoded with typical compression settings (about 160 Kbps, for example). You'll need a CD burner, which can be used for ripping audio CDs to digital files and, of course, burning CDs. Consider buying a DVD drive as well, so you can take advantage of the new multichannel audio DVDs that offer albums with 5.1 surround sound (provided you have a sound card that supports multichannel standards). You'll also want plenty of USB 2.0 ports for connecting peripherals, such as portable players.

If music is really important to you, don't settle for just a basic audio card. A good interface will have a low signal-to-noise ratio and offer better output options for connecting to other audio devices. For CD-quality audio, a stereo 16-bit interface should work fine, but a 24-bit device will give better sound quality. If you're playing DVDs or surround mixes, you need an audio device that supports surround sound, such as the Creative Sound Blaster Audigy 2 ZS.

managing your music library

The digital-jukebox software you use is more than just a window into your music library. Programs such as iTunes, Musicmatch Jukebox, RealPlayer, and Windows Media Player are more like command centers. All are available in free versions, and some offer enhanced versions with superior audio features and faster CD burning.

Even the free players can rip audio CDs, play back audio files in various formats, and be used for managing playlists and large music libraries. They even let you listen to streaming audio, and they also provide online stores where you can legally buy and download audio files.

tuning your network

One reason more people are tapping into their PCs as audio devices is that the prevalence of home networks has made it easy to get music from your PC to your stereo, either via a wired or wireless connection. The digital media hubs we mention in "Your Video" work with audio and video, streaming digital music stored on your PC to your stereo system. The choices include traditional-looking stereo components that read the music on your network, simple wireless hubs, and even boom boxes—at widely varying prices. Be sure the hub you choose supports the format your music is stored in. Getting Down With Downloads

When the peer-to-peer craze first hit (remember the original Napster?), many record companies wanted to quell the buzz around digital audio. Now, though, the same companies want you to download music (legally, of course), and they expect you to put your music onto portable players. Services like the Apple iTunes Music Store and Microsoft's new MSN Music store make it easy to buy and organize music, transfer it to a portable player, and burn it to CD. And you can almost always purchase individual tracks to download, so you can get the songs you want without having to buy the whole album.

On the downside, purchasing music online is more akin to buying a software license than to buying a CD: Your rights to duplicate and transport the music are limited, and depending on the vendor, the format may not work with your portable player. Online music sales are also currently restricted to compressed audio formats such as MP3, AAC, and WMA, so you aren't really getting CD-quality audio, though the difference is unnoticeable to many people.

taking it with you

One of the main benefits of the MP3 format is the convenience of portable music players. When picking a player, think about how you plan to use it. Flash-based players, which are a good option if you want to take music to the gym, are small and light. They have no moving parts and offer long battery life, but they have only about 256MB of storage on the average. Hard-drive

players, on the other hand, tend to be heavier, and their battery life is shorter. But these devices have anywhere from 20GB to 60GB of storage space, so they can hold hundreds of CDs worth of music. Players with micro hard drives are a new option; they're closer to the size of flash-based players, but can hold up to 2GB of music.

Finally, be sure the player you choose supports the music file format you use. Sony's players, for example, will work only with Sony's proprietary ATRAC3plus format and the Sony Music Store

TOP CHOICES:
MEDIA HUBS

CREATIVE LABS SOUND BLASTER WIRELESS MUSIC

SPEC DATA ●●●●○

- Product: Creative Labs Sound Blaster Wireless Music
- Price: $200 direct.
- Company: Creative Labs Inc.

If you have a wireless home network, the easiest way to stream your digital music library to your stereo is to use the Creative Labs Sound Blaster Wireless Music. This small wireless hub plugs into your stereo's analog line-in or optical S/PDIF inputs (or directly into a set of powered speakers). It then streams music from any computer connected to your home network.

PRISMIQ MEDIAPLAYER

SPEC DATA ●●●●●

- Product: Prismiq MediaPlayer
- Price: $200 direct.
- Company: Prismiq Inc.,

The Prismiq MediaPlayer is an excellent all-in-one solution for the serious digital junkie who wants to pipe music and video throughout the home. The hub includes an Ethernet port, RCA audio/video jacks, S-Video connectors, and coaxial optical audio outputs. You can also add a wireless network card. Controlling the MediaPlayer with its handy remote control, you can easily stream digital audio files to your stereo, MPEG video from your hard drive to your TV, and so on.

TURTLE BEACH AUDIOTRON AT-100

SPEC DATA ●●●●◐

- Product: Turtle Beach AudioTron AT-100
- Price: $200 street.
- Company: Voyetra Turtle Beach Inc.

Those who don't mind dealing with wires might consider the Turtle Beach AudioTron AT-100. This device, which looks like a traditional stereo component, also streams music stored on your network. Unlike many of the other options, it supports network-attached storage (NAS) drives, meaning that if you have such a drive, you don't have to turn on your PC to listen to music.

tip: use radio to beam your music

For a quick-and-dirty way to transmit music wirelessly throughout your home, use a close-range FM transmitter to send a signal from your computer's audio outputs to any FM receiver in your house.

TOP CHOICES:
PORTABLE PLAYERS

APPLE IPOD

SPEC DATA

- Product: Apple iPod
- Price: 20GB, $299 direct; 40GB, $399.
- Company: Apple Computer Inc.

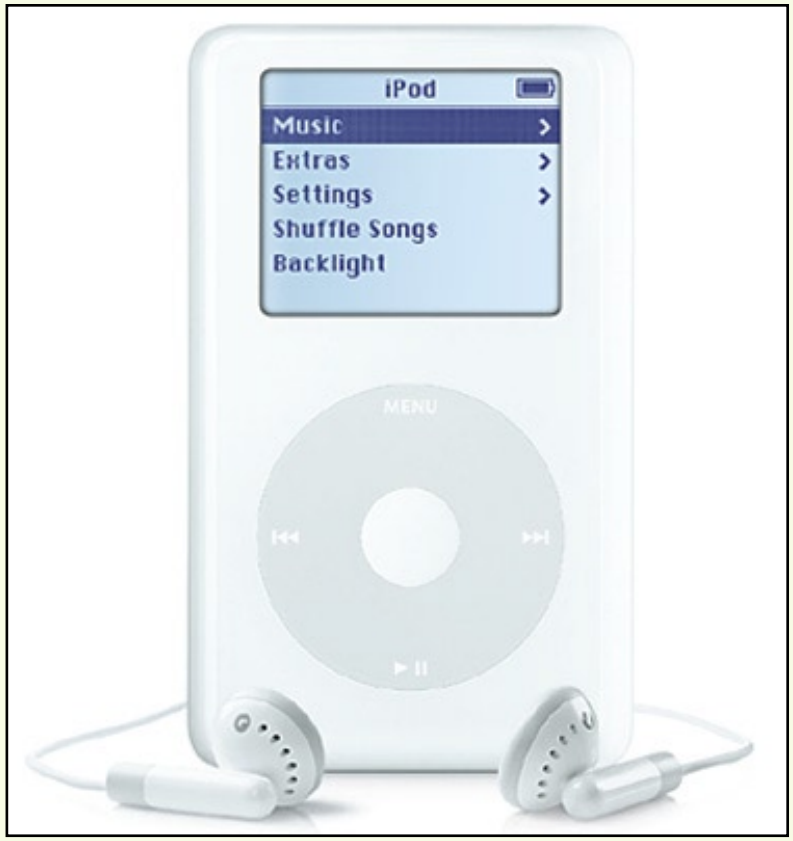
The Apple iPod has been a favorite of ours since its release. The newest iPod supports both USB 2.0 and FireWire 400. This iPod is a millimeter thinner than the previous iPod and offers an updated touch-wheel interface borrowed from the iPod Mini.

APPLE IPOD MINI

SPEC DATA

- Product: Apple iPod Mini
- Price: $249 direct.
- Company: Apple Computer Inc.

If you want a smaller player with a roomy hard drive, check out the 4GB Apple iPod Mini. You really can carry it in your shirt pocket.



RIO CARBON

SPEC DAT5

- Product: Rio Carbon
- Price: $250 street.
- Company: Rio Audio

The new Rio Carbon won't rub off on your hands, but it will rub off on your lifestyle. This tiny 5GB player does everything you wish the iPod Mini did, such as voice recording, bookmarked Audible voice files, and drag-and-drop transfers. Your fingers will love its palm-pleasing shape and the navigation/volume wheel; your ears will love the sound quality.

SAMSUNG YEPP YP-T5

SPEC DATA

- Product: Samsung Yepp YP-T5
- Price: $150 direct.
- Company: Samsung Electronics America Inc.

The excellent Samsung Yepp YP-T5 is a tiny flash player about the size of a lipstick case. It has 256MB of storage, many features, and an FM receiver, yet weighs only 1.3 ounces.

TOP CHOICES:

SOFTWARE MUSIC PLAYERS

APPLE'S ITUNES

SPEC DATA ●●●●○

- Product: Apple's iTunes
- Price: Free download.
- Company: Apple Computer Inc.

Apple's iTunes quickly found its way onto Windows desktops, thanks to its market-leading music store. The newest version, iTunes 4.6, is now available. (For our review of Version 4.5, visit www.pcmag.com .) iTunes is a competent audio player, offering a simple interface and standard features such as playlists and CD burning. But the real appeal is the gigantic online store, which offers more than 1 million tracks to download.

MUSICMATCH JUKEBOX 9.0

SPEC DATA ●●●●○

- Product: Musicmatch Jukebox 9.0
- Price: Jukebox Basic, free download; Jukebox Plus, $19.99.
- Company: Musicmatch Inc.

Musicmatch Jukebox 9.0 is an excellent option for managing and listening to digital audio files. Unlike Windows Media Player, Musicmatch Jukebox is purely a music player; it doesn't support video. Its premium options are unique and appealing. Notably, the On Demand service (an extra $8 per month) is like a customizable radio station; you can pick exactly what songs you want to hear and when. The music is streamed to you, so you don't have to own the CDs. Additionally, Musicmatch offers a decent music- download store integrated with the application.

WINDOWS MEDIA PLAYER 10

SPEC DATA ●●●●◐

- Product: Windows Media Player 10
- Price: Free download.
- Company: Microsoft Corp.

Windows Media Player 10, available as a free update from Microsoft's Web site, has a vastly improved interface, and the player now includes MP3 encoding for the first time. It supports digital audio (including streaming radio stations), video, and photos; it offers plenty of tools for easily managing large libraries of music files. Media Player 10 also provides a spate of useful audio tools, such as EQ. The really big news, however, is that Microsoft has launched the MSN Music service, which lets you buy music downloads right from within the Windows Media Player interface.

your photos

Taking digital photos has become part of our daily lives, and there's no better evidence of that than the massive number of cameras in pockets and purses, even in embedded cell phones. People enjoy the immediacy and accessibility of taking digital shots, as well as what they can do with them afterward on their home computers. Editing, manipulating, organizing, and printing are all easily within reach, giving you total control of the process.

No digital home is complete without a camera and the right suite of photo software. Here's how to equip yourself with the right tools.

capture your photos

Choosing the right digital camera is the first step, and it requires some research. Before you start, figure out what kind of camera you want. Many compact cameras can take impressive pictures but lack the sex appeal of ultracompacts. The latter are small enough to fit in your shirt pocket but might not deliver top-notch performance. Superzooms have 10X or greater optical zoom lenses and are just below the enthusiast category, which comprises full-size models that offer more control than compacts. Digital SLRs are the highest-end cameras available, offering true reflex through-the-lens viewfinders, interchangeable lenses, and total control over your pictures.

Once you figure out what kind of camera you want, you'll be bombarded with numbers. Don't get too hung up on camera resolution; even midrange 3-megapixel (MP) models give you enough for an attractive 8-by-10 print; raise that to 4MP or 5MP if you want some room for cropping your photo before printing. A more pressing issue is a digital camera's lag time—the time lapse from when you press the shutter button to when the camera actually snaps the picture. Many cameras claim to have a lag time of less than a second, but you should test this in the store before buying.

Also of concern is start-up time—how much time a powered-down camera needs before it's ready to shoot. Again, this is something to try in the store, but anything from 1 to 5 seconds is normal. You should also ask how long you have to wait between shots. Many cameras now offer a burst mode, which lets you fire off two or three shots per second and store the pictures in the camera's buffer memory before writing them to your media card.

manage your photos

No matter which camera you use to snap photos, you'll probably transfer the images to your PC to store, manage, and edit. Don't forget that Windows offers a lot of built-in photo-handling options. Microsoft Windows XP's AutoPlay feature, for example, automatically downloads pictures from a connected camera. You can then open that folder of images in Windows Explorer and perform actions such as rotating image thumbnails, watching simple slide shows, creating layouts for printing multiple pictures on a single page, and ordering prints online from services like Ofoto and Shutterfly.

Over time you may acquire thousands of photos, and trying to find a certain image by rooting around in folders on your hard drive can be an exercise in futility; having a solid software solution for managing your collection is vital.

Image-organizing programs let you assign multiple keywords or tags to each image. These let you search your collection by keywords to find, for instance, all the photos that both your brother Rob and your sister Linda took during their trip to Vancouver—no matter where those pictures are scattered on your hard drive. Of course, as your photo collection swells, your hard drive fills; make sure you choose a program that lets you burn backup CDs or DVDs and keeps track of which images have already been backed up.

edit your photos

Almost everywhere you look there are devices with image-editing capability, from cameras with built-in red-eye removal to photo printers featuring on-board image-enhancing functions. These fixes can be effective, but to make photos really look their best, you should turn to image-editing software.

Several midrange programs offer a slew of easy one-click commands for novices, without skimping on complex tools for more advanced users. For instance, all the major midrange programs have one-click sharpening functions for correcting focus by a predefined amount. But they also offer the powerful (if confusingly named) Unsharp Mask command, which gives you total control over the precise amount and scope

of sharpening. Best of all, some programs let you apply image corrections as adjustment layers, giving you flexibility to adjust the amount of correction at a later date or cancel it altogether.

And if you find you frequently shoot sequences of similar photos, look for software offering batch processing. This function can be an invaluable time-saver, applying basic functions like resizing, renaming, and simple color correction to an entire group of images at once.

print your photos

Dedicated photo printers that crank out prints at a maximum size of 4-by-6 inches are easy to recommend. Print quality can equal that of your local developer, and in some cases the cost is the same as well (29 cents per print). Portability is another big plus; many dedicated photo printers are battery operated and quite compact, so you wouldn't even think twice about taking one along on your next vacation.

If you need to make larger prints and also crank out the occasional page of text, a desktop photo printer may be what you're looking for. Most photo printers use at least six colors of ink, usually two shades each of cyan and magenta, plus yellow and black. Ideally, each color is packaged in its own cartridge, meaning that you won't have to throw away a lot of magenta and yellow ink just because you've been printing tons of blue skies. And don't stress about a printer's claims of resolution and speed; practically every photo printer on the market has sufficient resolution. And print speed can be misleading, since vendors almost never test at the slow Best Quality mode you'll want to use for your prints.

Even if excellent photo output is your primary goal, all-in-one devices that also scan, copy, and fax can really let you have your cake and eat it too. Although photo output from one of these multifunction devices may not be quite at the same quality as a photo printer, some models are able to deliver excellent results.

Like dedicated photo printers, all-in-ones that emphasize photo printing may even include connections for printing directly from your digital camera or its removable media.

share your photos

Back in the olden days, folks would return from vacation, drag the slide projector and screen out of the closet, and invite their friends over for a big-screen slide show of their trip. Now you can do this digitally. Just connect the bundled cable from your camera's video-out port to an RCA jack on your TV or VCR, switch to your camera's review mode, and let the slide show begin. And in case your camera isn't cooperating, you can use a media hub to stream photos on your PC to your TV wirelessly. Or, if you have a Media Center PC connected to your TV or a large display, you can present your photos as a slide show with just a few simple clicks.

For family and friends who live too far away to invite over for popcorn and a slide show, numerous online photo-sharing services offer unlimited space for housing your images. You can upload photos by simply dragging and dropping them into a downloadable software interface or into the Web page itself. From there you can have the service send e-mail to your friends inviting them to visit the Web site.

Many photo-organizing software programs offer other ways to share your images, making it easy to build your own Web gallery or create sophisticated slide shows on video CDs or DVDs, featuring music, narration, slick transitions, panning, and zooming.

flash: digital cameras on the rise

Digital camera shipments in the U.S. totaled 14.3 million units in 2003 and will rise to over 27 million by 2008.
Source: Gartner, August 2004.

tip: take control before you shoot

Some cameras let you shoot in RAW file format. This cuts out the automatic brightening and sharpening a camera performs on images before storing them, giving you more control over image

TOP CHOICES:
DIGITAL CAMERAS

CANON EOS DIGITAL REBEL

SPEC DATA ●●●●○

- Product: Canon EOS Digital Rebel
- Price: With lens, $999 list; without, $899. 6.3 megapixels.
- Company: Canon U.S.A. Inc.

The Canon EOS Digital Rebel is a fast and easy-to-use digital SLR, and the lens is surprisingly good considering its light weight and low price. Image quality is generally excellent, but our flash shots were often underexposed. The Rebel lacks a flash exposure compensation control, which we fixed by using an external flash. But this adds considerable cost and weight. Read the full review.

CANON POWERSHOT S60

SPEC DATA ●●●●○

- Product: Canon PowerShot S60
- Price: $500 street. 5 megapixels.
- Company: Canon U.S.A. Inc.

The Canon PowerShot S60 compact camera takes crystal-clear pictures with its 3.6X zoom lens and wide-angle capabilities. ISO selections include nine white balance choices, with one for underwater. Video capabilities are slim: 640 by 480 pixels at just 10 fps for 30 seconds.

But the zoom operates smoothly, and you can shoot from as close as 2 inches, though with wide-angle distortion. Boot-up time was 3.8 seconds, recycling in 2.6 seconds. Our daylight still life was clear with honest colors and great exposure. Read the full review.

CASIO EXILIM PRO EX-P600

SPEC DATA ●●●●○

- Product: Casio Exilim Pro EX-P600
- Price: $599.99 list. 6 megapixels.
- Company: Casio Inc.

Although a bit pricey, the Casio Exilim Pro EX-P600 compact camera is worthwhile. The solid image quality, versatile 4X zoom lens, and impressive design, LCD, and menus outweigh this camera's dark exposures and mediocre recycle times. With 25 scene modes, beginners will appreciate the on-screen help. And pros will like its focus bracketing and advanced modes—all easily accessible. Our daylight image was balanced, though slightly dark. Flash shots were well illuminated, if a bit cool. It boots in 3.03 seconds and recycles in 4 seconds. Read the full review.

KODAK EASYSHARE LS743 COMPACT

SPEC DATA ●●●●○

- Product: Kodak EasyShare LS743 compact
- Price: $299.95 list. 4 megapixels.
- Company: Eastman Kodak Co.

The Kodak EasyShare LS743 compact is a nifty little point-and-shoot. It has a 1.8-inch LCD that is sharp but doesn't automatically adjust when the scene is very dark or light. It can accommodate SD or MMC cards, and it comes with 16MB of built-in memory. The camera boots in 4 seconds and recycles in 1.5. Our daylight and flash test shots were crisp, with excellent detail and color, though slightly underexposed. Read the full review.

LEICA DIGILUX 2

SPEC DATA ●●●●◐

- Product: Leica Digilux 2
- Price: $1,850 list. 5 megapixels.
- Company: Leica Camera AG

You'll love the features of the Leica Digilux 2 enthusiast camera, including an anodized silver body, leather trim, well-placed shutter button, and smooth manual focus. It also offers fast shooting and an excellent 3X optical zoom lens. The bright, 2.5-inch LCD complements the high-resolution electronic viewfinder by displaying a magnified square.

Our flash test shot was excellent, with accurate exposure, even illumination, and outstanding color. The daylight shot exhibited sharp detail and very good exposure. Sure, $1,850 is a little pricey, but those who want the best will understand. Read the full review.

NIKON D70

SPEC DATA ●●●●●

- Product: Nikon D70 digital SLR
- Price: With lens, $1,300 street; without lens, $1,000. 6.1 megapixels.
- Company: Nikon U.S.A. Inc.

Get ready for some serious competition with the Nikon D70 digital SLR. Its body is solid and well designed. The camera offers a host of professional features, including shutter speeds up to 1/8,000 second, sRGB and Adobe RGB color modes, and sharpening and color saturation controls. On our tests, image quality was good yet somewhat underexposed when we shot pictures at the default settings. But when we manually configured white balance and exposure controls or shot in RAW mode, the quality jumped to excellent. The D70 handles and shoots as fast as any film SLR out there and boots in just 0.4 seconds. Read the full review.

OLYMPUS CAMEDIA C-765 ULTRA ZOOM

SPEC DATA ●●●●○

- Product: Olympus Camedia C-765 Ultra Zoom
- Price: $450 street. 4 megapixels.
- Company: Olympus America Inc.,

The Olympus Camedia C-765 Ultra Zoom is a superzoom camera that produces sharp images with its 10X zoom lens. Not to mention that the 1.8-inch LCD is extremely bright and crisp. With seven resolutions, the camera also offers support for TIFF files and four levels of JPEG compression. It captures 640-by-480 QuickTime video with audio, but at only 15 fps. Boot and recycle times were slow at 6.8 and 2.5 seconds, respectively. But when we took daylight still-life shot, the C765 showed realistic colors and even exposure. Read the full review.

SONY CYBER-SHOT DSC-T1

SPEC DATA ●●●●○

- Product: Sony Cyber-shot DSC-T1
- Price: $500 street. 5.1 megapixels.
- Company: Sony Electronics Inc.

The Sony Cyber-shot DSC-T1 ultracompact camera is stunning. Although it does not have an optical viewfinder, its massive 2.5-inch LCD enables easy viewing. The camera offers 30-fps video, manual focus, eight program modes, and a histogram. In our testing, boot time was lightning fast at 1.6 seconds, but recycle time and burst mode were slow at just 3.6 and 4 seconds, respectively. Our test shots had a yellow cast. The daylight image was underexposed, but the flash image was well exposed. Despite its rated 5.1 megapixels (MP), the DSC-T1's resolution is more in line with a 4-MP model. Nevertheless, the DSC-T1 is designed for buyers who want the highest-resolution possible in a subcompact digital camera. Read the full review.

TOP CHOICES:
PHOTO SOFTWARE AND SERVICES

Now that you've taken those priceless photos, it's time to make them look their best and show off your photographer's eye to family and friends. Here are some software packages and services that make editing, managing, printing, and sharing your photos a snap.

ADOBE PHOTOSHOP ELEMENTS 2.0

SPEC DATA ●●●●○

- Product: Adobe Photoshop Elements 2.0
- Price: $99 direct.
- Company: Adobe Systems Inc.

Adobe Photoshop Elements 2.0 is a powerful yet easy-to-use program that offers impressive graphics technology. It lets you fix red-eye, eradicate color casts, sharpen blurry images, and more. We like the Fill Flash and Adjust Backlighting features.

While its simplicity appeals to novices, more experienced users appreciate its versatile-layer technology and full complement of special-effects filters, vector shapes, and editable text. And mistakes are no big deal, thanks to a History palette that lets you roll back edits.

JASC PAINT SHOP PRO 8

SPEC DATA ●●●●○

- Product: Jasc Paint Shop Pro 8
- Price: Download, $99 direct; CD, $109.
- Company: Jasc Software Inc.

Jasc Paint Shop Pro 8 delivers an amazing amount of power at a low price. It does take a while to learn, but automated tools, such as One Step Photo Fix, auto-sharpen, and red-eye removal, give novices a head start. It also offers many correction mechanisms for power users, including a channel mixer, histogram adjustments, and tone cures.

The template-based approach lets you lay out multiple images to be printed on a single page. And a deal with Shutterfly (www.jasc.shutterfly.com) lets you easily order prints, as well as specialty items like calendars and greeting cards. Look for a review of Jasc Paint Shop Pro 9 in an upcoming issue of PC Magazine.

MICROSOFT DIGITAL IMAGE SUITE 10

SPEC DATA

- Product: Microsoft Digital Image Suite 10 ●●●○○
- Price: $129 direct.
- Company: Microsoft Corp.

The Microsoft Digital Image Suite 10 bridges the gap between your digital camera and PC. It scans your hard drive for images and imports photos from your camera. It also catalogs images on CDs without copying them to your hard drive, and the archiving system lets you burn incremental backup CDs of recently added or edited photos.

You can assign keywords, star ratings, and new user-definable flags to individual images. The Photo Story feature lets you create a video slide show of your images, adding background music, narration, and pans and zooms. But you can't zoom in closer on vertically oriented photos.

Microsoft Digital Image Suite 10 is a competent and easy-to-use package, but it pales in comparison to the offerings from Adobe and Jasc.

ACDSEE 6.0

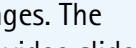
SPEC DATA 

- Product: ACDSee 6.0
- Price: $49.99 direct.
- Company: ACD Systems Ltd.

ACDSee 6.0 sets the bar for image management programs. The power and flexibility is most obvious in its organizing, sorting, searching, and retrieving of files. Its screen is divided into four panes: Folders, Thumbnails, Preview, and Image Basket. You can customize the screen and undock panes. A new Acquire wizard simplifies the process of retrieving images from a camera, scanner, or USB storage device. But it offers no help menu to guide you in choosing the right options.

ACDSee now lets you perform the most common image-editing tasks, such as adding effects, adding or removing noise, and cropping. The new Backup utility archives the database information with or without its associated images and can do full or incremental backups.

ADOBE PHOTOSHOP ALBUM 2.0

SPEC DATA 

- Product: Adobe Photoshop Album 2.0
- Price: $49.99 direct.
- Company: Adobe Systems Inc.

Adobe Photoshop Album 2.0 is even more impressive than Version 1.0. But you probably won't need to upgrade if you already have it.

Version 2.0 retains the timeline across the top, which lets you browse through images according to when they were taken. Tags are organized into categories, and you can create a hierarchical structure for organizing them.

The image-editing tools are first-rate for this caliber of software. You can now run Auto Fix on multiple images at once, avoiding the tedious task of editing one image at a time. A simple wizard resizes and compresses images for you and can generate a PDF-based slide show automatically.

JASC PAINT SHOP PHOTO ALBUM 5

SPEC DATA 

- Product: Jasc Paint Shop Photo Album
- Price: Download, $45 direct; CD, $49.
- Company: Jasc Software Inc.

Previous versions of Jasc Paint Shop Photo Album had a frustrating interface, but Jasc Paint Shop Photo Album 5 has followed its competitors' lead, moving away from a hierarchical structure.

You still get the hierarchical folders, but that schema is now supplemented by Calendar and Keyword views. These make finding pictures easier. Photo Album doesn't provide the full set of image-editing features you get in the company's Paint Shop Pro editing application, but it does offer an impressive set of tools that do a very good job of adjusting images.

EZ PRINTS

SPEC DATA 

- Product: ez prints
- Price: 4 by 6" prints, 29¢ each; 8 by 10" prints, $2.45.
- Company: ez prints inc.

Most of ez prints' business comes from partnered Web services that offer photo-sharing and other similar tools. For sheer print quality, ez prints is the best. It does a better job of adjusting colors when necessary. The intentionally dark pictures were kept dark—but enhanced to look better. Otherwise, the service is somewhat lacking. For instance, ez prints is devoid of photo-editing tools. The service does provide a general enhancement feature that consistently improved the look of our images.

OFOTO

SPEC DATA 

- Product: Ofoto
- Price: 4 by 6" prints, 29¢ each; 8 by 10" prints, $3.99.
- Company: Ofoto Inc.

Ofoto offers equally handy tools and is quite easy to use. The service also produces very good prints that are close to the original images. Still, Shutterfly, with its impressive image enhancement feature and slightly easier-to-use Web site, edges out Ofoto in our eyes.

SHUTTERFLY

SPEC DATA ●●●●○

- Product: Shutterfly
- Price: 4 by 6″ prints, 29¢ each; 8 by 10″ prints, $3.99.
- Company: Shutterfly

Shutterfly is extremely easy to navigate and offers convenient single-click actions for common tasks. It successfully enhanced and brightened the dark pictures without any posterization. The only minor flaw was that the sky in one of our pictures contained some hints of unnatural purple.

SNAPFISH

SPEC DATA ●●●●○

- Product: Snapfish
- Price: 4 by 6″ prints, 19¢ each; 8 by 10″ prints, $3.79.
- Company: Snapfish

Snapfish offers good-looking prints but can't match the quality of Ofoto and Shutterfly. The dark pictures we submitted were automatically brightened, and the result is a posterization effect. Also, the tools aren't as streamlined as with some services; for example, tasks we performed with Shutterfly in just one or two clicks required far more on Snapfish.

OURPICTURES

SPEC DATA ●●●●○

- Product: OurPictures
- Price: $19.95 per year.
- Company: OurPictures Inc.

Built on Microsoft .NET, OurPictures provides a tabbed interface that gives you easy access to two folders: one that holds the pictures you've taken and one that holds the pictures you've received from other people. You can edit, print, and save pictures, view them as a slide show, or share them with friends. When you send images to other OurPictures users, the photos stream straight to their desktops, appearing in the app's Received Pictures folder. As the recipient, you can opt to have OurPictures automatically print incoming images. When you send photos to someone who isn't an OurPictures user, that person receives an e-mail message with a link to a temporary Web page. For the next 30 days, he or she can use this page to view, print, or download the photos. The only real hassle is convincing your friends and family to load and use the application.

SMUGMUG

SPEC DATA ●●●●○

- Product: smugmug
- Price: Standard plan, $29.95 per year.
- Company: Modgods Inc.

smugmug offers a nice selection of built-in styles for displaying photos and some slick photo-editing abilities. It also shows the upload progress of individual files, as well as the time remaining. Smugmug provides a dozen presentation styles, including thumbnails, slide show, and journal. For customizing albums, you can't go beyond setting black or white as a background color. Fortunately, you can brand your pages using HTML, CSS, and JavaScript. The photo-editing tools are solid, with support for cropping and resizing images, adding color effects like sepia tones, and auto-correcting color balance. smugmug doesn't let you individualize your albums significantly without digging into HTML, but it is effective and creates very attractive photo galleries.

TOP CHOICES:
PHOTO PRINTERS

CANON I9900 PHOTO PRINTER

SPEC DATA ●●●●●

- Product: Canon i9900 Photo Printer
- Price: $500 street.
- Company: Canon U.S.A. Inc.

For large, high-quality photos, the Canon i9900 Photo Printer delivers. This standard printer has two front-panel buttons and supports the PictBridge standard but not memory cards. It uses eight ink cartridges, adding red and green to the usual six colors. This pays off in true photo quality. Text quality is also excellent; more than half of the fonts we tested were easily readable at 4 points with default settings. Graphics in default mode showed only minor flaws. If you need a printer that does it all and produces superb photos fast, the i9900 is tough to beat. Read the full review.

EPSON PICTUREMATE

SPEC DATA ●●●●○

Price: $499.99 List

- Product: Epson PictureMate
- Price: $200 street.
- Company: Epson America Inc.

Possibly the easiest way to print photos is with the Epson PictureMate dedicated photo printer. Based on standard ink jet technology, it competes with thermal-dye photo printers.

It tops out at 4- by 6-inch photos but prints at true photo quality. You can print from multiple memory cards, PictBridge, CD, ZIP drives, USB memory keys, and Bluetooth. Unfortunately, it has no color LCD to preview the images; for this you have to print an index sheet, with 20 images per sheet.

Image quality is a match for conventional film-based photos. It's also waterproof and smear-proof. Read the full review.

HP PHOTOSMART 7960

SPEC DATA ●●●●●

Price: $499.99 List

- Product: HP Photosmart 7960
- Price: $229.99 direct.
- Company: Hewlett- Packard Development Co.

The HP Photosmart 7960 lets you print true photo-quality images without using your PC and can serve as your single, all-purpose printer. Front-panel buttons let you set options and choose which pictures to print. It doesn't support PictBridge but has slots for most memory cards. Output quality was excellent with saturated colors, smooth gradients, and crisp lines and edges for graphics; text was easily readable in default mode at 5 points or smaller. You'll love the tilting 2.5-inch LCD on the front rather than the top of the box. If you want a standard photo printer with direct printing from memory cards, the 7960 should be your printer of choice. Read the full review.

your games

Everything was so simple 20 years ago. If you wanted an in-home arcade, you bought an Atari system and played Asteroids on your living-room television. If you were lucky, a friend would show up and the two of you would spend the afternoon passing a joystick back and forth, each playing while the other watched.

Today, it's a little different. You can play on a Microsoft Xbox, a Nintendo GameCube, a Sony PlayStation 2, or a souped-up PC. You can choose from literally thousands of titles, including 3D sports games like Madden NFL 2004, strategy games like Command & Conquer, and first-person shoot-'em-ups like DOOM III and Quake. And thanks to the wonders of modern networking, you can connect your console or PC to the Internet and compete with friends across town or strangers halfway around the world.

take it online

Almost all the leading PC titles, including Battlefield 1942, DOOM III, Medal of Honor, and Quake, now let you compete online. You can easily set up a private game with friends or log on to a public server and play with strangers.

You can do much the same on the newest gaming consoles, including the GameCube, PlayStation 2, and Xbox, but the real action is on the PC side. In addition to playing traditional first-person shooters online, millions are enjoying massively multiplayer online games (MMOGs) with titles such as Dark Age of Camelot and Star Wars Galaxies. An MMOG is played only online, bringing together hundreds of thousands of gamers into one massive virtual world.

your next party

Couple your broadband connection with a home network, and the possibilities multiply. You can throw a LAN party, where all your gamer friends show up with their PCs, plug into your router and compete face-to-face. This has been going on among serious gamers for years, but it's becoming more popular now that more people are gaming and have home networks.

You can tie together multiple gaming consoles in much the same way. You can even tie your gaming console to the rest of your digital home, using it to stream pictures, videos, and MP3s from your PC to your television. (For more on multiplayer gaming and LAN parties, see "The Broadband Lifestyle").

rent, don't buy

A broadband connection also gives you access to games on demand. Atari, Comcast, Yahoo!, and others now rent popular retail titles directly from the Web. You pay a small subscription fee—typically $15 per month—and they give you unlimited access to dozens of titles, many of which are still on sale down at the local mall. Nowadays, you'll find games such as Age of Wonders II, Border Zone, Civilization III, and Dead Man's Hand.

This fall, a company called Infinium Labs will offer even newer games through a set-top box. Priced at about $30 a month, its Phantom Gaming Service promises to include almost every game you find on retail shelves—although you may have to pay an extra fee for the hottest titles.

what you need

What do you need to join the fun? If you prefer the PC platform, you need a system with some serious juice. We recommend an AMD Athlon 64 FX-53 or a Pentium 4 Extreme Edition processor, a 7,200-rpm hard drive with at least 160GB of storage space, and a high-end graphics card along the lines of an ATI Radeon 9800XT or an nVidia GeForce FX 5950 Ultra. And don't forget an extra-wide display, a 19- to 21-inch CRT, and an eight-piece Creative Gigaworks S750 speaker set. All together, a dream gaming system will cost you anywhere from $2,500 to $5,000.

If you don't want to spend that much, consider a system with an AMD Athlon 64 chip or a 2.8-GHz Pentium 4, a midrange 3D graphics card along the lines of an ATI Radeon 9800 Pro, a 17-inch monitor, and some run-of-the-mill speakers. This shouldn't cost you much more than $1,700. But make sure you stick to a 7,200-rpm hard drive and at least 512MB of memory.

Depending on which games you're into, you might want to look into a gaming console as well—especially if you're interested in home networking. Each costs between $100 to $200. And whichever hardware you choose, you can't do without a broadband Internet connection. This isn't like the old days: The real action is on the Web.

TOP CHOICES:
GAMING SYSTEMS

CYBERPOWER GAMER ULTRA 9900 PRO

SPEC DATA

- Product: Cyberpower Gamer Ultra 9900 Pro
- Price: $2,899 direct.
- Company: Cyberpower Inc.

The Cyberpower Gamer Ultra 9900 Pro is a gaming bargain, with a flashy green X-Blade case, Athlon 64 FX-53 CPU, a 20.1-inch ViewSonic LCD, and nVidia GeForce 6800 Ultra graphics. The Athlon chip, helped along by 1GB of DDR SDRAM and two 74GB, 10,000-rpm SATA drives in RAID 0 array, delivers solid performance. The case fans, each with a blue LED, help keep the case cool.

FALCON NORTHWEST MACH V

SPEC DATA

- Product: Falcon Northwest Mach V
- Price: $6,140 direct.
- Company: Falcon Northwest

The Falcon Northwest Mach V is a slick-looking system with blistering performance. It's far from cheap, but this system doesn't cut any corners. It features a 3.6-GHz Pentium 4 560 processor (overclocked to 3.8 GHz), 1GB of 533-MHz DDR2 SDRAM, and an nVidia GeForce 6800 Ultra graphics card. To keep the processor cool, the Mach V uses a hermetically enclosed water system. You also get an 8X DVD±RW dual-layer drive, Klipsch 5.1 Ultra speakers, and a 21-inch NEC CRT monitor.

VELOCITY MICRO GAMER'S EDGE FX

SPEC DATA

- Product: Velocity Micro Gamer
- Price: $4,459 direct.
- Company: Velocity Micro

The Velocity Micro Gamer's Edge FX certainly lives up to its name. It's hard not to love a performance core made up of an AMD Athlon 64 FX-53 slightly overclocked to 2.46 GHz, 1GB of Corsair PC3200 DDR SDRAM, and a 256MB ATI Radeon X800 XT graphics card. For TV buffs, this system includes a Leadtek Winfast TV2000 XP TV/FM tuner, and the 12X DVD±RW drive comes in handy for burning recorded shows. Video and games look great on the included 21-inch NEC FE2111 CRT monitor.

TOP CHOICES:

CONSOLES

For those interested in console gaming, there are three choices—Microsoft, Nintendo, and Sony. Performance differences among these aren't significant, so your buying decision will probably be based on which game titles are available. So do a little research to make sure you buy one that supports the games you want to play.

MICROSOFT XBOX

SPEC DATA

- Product: Microsoft Xbox
- Price: $149.99 list.
- Company: Microsoft Corp.

The Microsoft Xbox boasts a 733-MHz Intel CPU, a custom nVidia graphics chipset, and 64MB of memory. It supports online gaming (with a paid subscription to Xbox Live), while an optional kit adds support for playing DVDs.

NINTENDO GAMECUBE

SPEC DATA

- Product: Nintendo GameCube
- Price: $149.99 list
- Company: Nintendo

The Nintendo GameCube has a 485-MHz PowerPC CPU, a custom ATI graphics chipset, and 40MB of memory. A network adapter can be added for online gaming. But unlike the others, the GameCube doesn't support DVD playback.

SONY PLAYSTATION 2

SPEC DATA

- Product: Sony PlayStation 2
- Price: $149.99 list.
- Company: Sony Computer Entertainment America Inc.

The 4-year-old Sony PlayStation 2 is built on a 128-bit 300-MHz processor, a custom Sony graphics chipset, and 32MB of RDRAM. It can play DVDs and supports online gaming with an optional network adapter. And you'll be happy with its plentiful selection of games.

Tying It All Together

Once you've purchased the various devices and software you'll need for your digital home, you may be flummoxed by the task of hooking everything up, so that all the parts play together nicely on the same network. After all, the keys to these devices are their connections, allowing music to stream from your living room PC to your bedroom speakers, your photos to stream from your home office PC to your living room TV, and so on.

Many of you already have a rudimentary network for sharing your Internet connection. The question is, will it support your additional multimedia needs?

In terms of wired networking, in which you run Ethernet cable through your walls or along the baseboard, the answer is yes. More and more people, though, are forgoing the wires and setting up wireless networks. And these, too, are capable of handling just about any multimedia content short of HDTV.

But these are just home networking basics. Now, on to specifics. Following are answers to the most frequently asked questions we've encountered regarding the setup and use of digital entertainment and home networking devices.

Q: If I choose a wired connection for transferring video in my house, is Gigabit Ethernet necessary?

A: No. As long as you don't plan on streaming HDTV content, a 100-Mbps Fast Ethernet network will work just fine. But if you're planning for the future and expect to stream HDTV or transfer large files between workstations or servers within your home, Gig E (and the cable to support it—preferably Category 6) is the right call.

Q. What's the best wireless standard for streaming various media?

A: If you want to carry a mix of traffic, accommodate multiple streams, and support multiple users wirelessly in your home, the optimal solution is a dual-mode router or access point with 802.11a and 802.11g built in. These devices cost from $100 to $250, and you'll need either dual-mode client cards or a mix of 802.11a and 802.11g cards for your devices. The "a" radio could, for instance, be configured to handle video streams, while the "g" radio could handle everything else.

A second choice, particularly if you'll be streaming more data and audio than video, would be to just go with 802.11g-only products, which are the most popular in the wireless market. These are cheaper—priced from $65 to $100—and, like 802.11a products, they offer a data rate of 54 Mbps. But "g" also has a longer range than "a," particularly when the signal needs to penetrate walls and floors, and is compatible with the older, slower 802.11b standard.

A forthcoming standard, 802.11n, promises to double the throughput available with "g"—ideal for streaming video. Look for precertification "n" products at the end of this year or early next.

Q. If I want to blanket my house with wireless connectivity for all of my devices, how many access points will I need?

A: This depends on the size, design, and construction of your house. Dense materials such as concrete and brick can decrease the range of your wireless router or access point dramatically. A device performing at 15 Mbps out to 120 feet in an open space might get only 5 Mbps at 60 feet under challenging conditions.

If your wireless signal won't reach upstairs, try purchasing a directional antenna or a wireless bridge, repeater, or signal booster to amplify your access point's signal. Or you can use power-line networking to help bridge the gap. With this method, the wireless signal is transmitted through your home's electrical wiring at a maximum data rate of 14 Mbps, though on our tests, actual throughput maxed out at 4.8 Mbps. Once you've extended your Ethernet connection upstairs, you can then plug a wireless access point into your power-line adapter in a wall outlet to distribute the signal wirelessly on the second floor.

Q. I bought a digital media hub so I can stream MP3s, photos, and video from my home office PC to my living-room stereo or TV. How do I go about connecting the two?

A: Install the digital media hub next to your TV and music system. Connect the hub's audio and video cables—either color-coded analog or digital—to your audio-video receiver's Aux-In or CD jacks. Or you can connect the hub's cables to a pair of powered speakers—creating a digital boom box—or directly to the TV's video-in jack. Composite cables are best; if they are not available, then use S-Video. Keep in mind, too, that with the advent of HDTV, two additional types of cable are becoming popular, DVI, which carries just a digital video signal, and HDMI, which carries both digital audio and video signals. With almost all media hubs, you must install the included media client application or applet on each PC where your content is stored and have it search for your music, photo, and video files.

If you purchase a wireless media hub, once you set it up and turn it on, it should find your home access point automatically. If you have a hidden network identifier (SSID) and WEP encryption enabled, you'll have to type your SSID and WEP key into the hub using the remote control. Once you do this, the media hub will request the audio, video, or photo files from your PC; stream them over your wireless network; uncompress them from MP3 or WMA format in the hub; and pass them off to the component you select, whether a dedicated digital audio receiver, stereo system, or TV.

The PC serving up the content has to be on at all times if you want 24/7 access to your music. And a single PC can easily send a half-dozen music, photo, or video streams throughout the house simultaneously.

If your PC is in the same room as your AV system (or just one room away) and you're interested only in streaming audio, the simplest solution is to run an audio cable (from your PC's audio-out jack to your receiver's CD or Aux-In jack) along the baseboard or perhaps through a wall. An example of a high-quality wired solution is the Xitel HiFi-Link (**$49.95 direct**), a USB-to-audio converter with a 30-foot cable. With such a solution, you'll need to control the music from your PC, which will not be a problem if you're running hour-long playlists or albums.

Q. How do I connect my digital video recorder (DVR, also known as a personal video recorder or PVR) to my home network?

A: With TiVo or ReplayTV, you can connect to your network either via a USB-to-Ethernet adapter or via a USB wireless adapter (while 802.11b will be fine for downloading schedule updates, to stream the content you'll need 802.11g or 802.11a).

TiVo Series II receivers with the Home Media Option (**$50 licensing fee**) let you stream audio and photo files to or from your home PCs over Ethernet once you load a small client program on the PCs to be used.

Q. I have a vast collection of photos and music stored on my network. How do I protect it?

A: The best protection is a multitiered defense. Many people don't realize that a virus or worm can potentially wipe out their entire collection of photos or music. First, make sure that you have adequate protection on your Internet connection. You should deploy a firewall with stateful packet inspection at your gateway to the Internet. This means buying a router or dedicated firewall that sits right behind your cable modem or DSL modem.

We also recommend that you run a software-based firewall on all your PCs and that you run a virus scanner with updated virus signatures to catch any harmful viruses or worms that might have slipped through. None of these by itself is sufficient, though companies such as Symantec and Zone Labs offer integrated software solutions that work as firewalls as well as virus scanners.

Just as important as security is backup. Even if you don't use any kind of backup software, try to copy your photo and music files to CDs or DVDs. Ideally, you should keep a set of copies at a different location, such as your office. This will give you access to your files even if a disaster such as a fire strikes.

If you find that you have too much content or not enough time to back up on CDs or DVDs, consider purchasing an external USB hard drive and copying all of your data to it. Just make sure its capacity is larger than that of your internal hard drive.

Q. If I enable file sharing on my network, how do I make sure that others have access only to specific folders, such as music folders, and not the entire hard drive?

A: When setting up file sharing in Windows, you can assign users and permissions to every folder you want to share. To do this in Windows 2000 and XP, find the desired folder in Windows Explorer, right-click on the folder, and select Sharing and Security. Choose Share this folder, and type in the name you'd like the folder to be called on the network. Then select the Security tab, and add users from the local Windows database.

If you don't have any names in the database, you can add them manually by going to *Control Panel > Administrative Tools > Computer Management*. Choose Users from the Local Users and Groups subdirectory. From the Action menu, select New User and follow the wizard to add the users' information. Once you add a valid user, you can deny or allow Full Control, Change, or Read privileges for the chosen folder. All of this is somewhat tedious.

It's easier just to grant Full Control to Everyone, but don't do it; granting everyone full control means that people on your network can browse all your files, as well as delete them. So be specific and stingy when sharing access to folders on your hard drive. If you really don't want to set up security on an individual basis, at least create a group log-on name for all the members of your family.

Q. Is file sharing the best way for three family members to share separate music collections on separate PCs, so that they can be accessed from any PC or media hub?

A: It's the cheapest method. Anybody allowed access can map a drive on their local PC to one of the remote PCs and play music files. This does, however, require that all PCs are turned on at all times.

If you have large amounts of music and photos, a better approach is to create a centralized network server for sharing these files. This could be as simple as a dedicated PC with a large hard drive or an external USB hard drive, or you can get a bit more sophisticated and employ an actual server or home NAS (network-attached storage) device.

This makes backing up your memories and music easier, too. Just keep in mind that if you'll be using a media hub to stream your music to your stereo, not all hubs talk directly to NAS devices. You may need to map the NAS device to a drive on one of your PCs and run the media hub's client software on that PC.

Q. I want to play games with people on the Internet. What settings do I need to adjust on my router and PC to let me do that?

A: Online games require the opening of specific ports on your broadband router. So you have three choices: You can manually open ports in your firewall using port forwarding, rely on Universal Plug and Play (UPnP), or establish a DMZ (demilitarized zone)—a subnetwork that sits between your internal network and the Internet. We recommend that you use port forwarding to open ports selectively, as specified in the game's documentation. This will ensure that your computer is protected against attack, but you'll still be able to use Internet applications.

UPnP is the easiest method for setting up gaming, because port configuration is managed automatically by the game,

OS, and router. But by using it, you're opening up a huge security hole in your network. If you go the UPnP route, make sure that you've applied Microsoft's December 2001 patch (Microsoft Security Bulletin MS01-059), and scan regularly for spyware that could potentially exploit UPnP services. Another easy setup option is to establish a DMZ for your PC when gaming. But this may compromise security, too, because it opens every port on your router (not just the ones needed by the game), leaving you vulnerable to attack.

Q. I went to an online music store, paid, and legally downloaded music. The downloaded songs play on my PC but not on my digital media hub or MP3 player. What gives?

A: Welcome to the morass of Digital Rights Management (DRM). There are no easy answers, and things keep getting more confusing. For example, RealNetworks has come out with a technology called Harmony, which allows songs from Real's service to play on almost any device—including Apple iPods. That has angered Apple, which uses its own DRM technology to control where songs can be played. Meanwhile, Microsoft has come out with its own music service and is moving forward with its own DRM strategy, dubbed Janus.

At this juncture, Real's Harmony lets you get tunes you can play on a very broad array of devices. But all of this is a moving target, and there remain many incompatibilities even between devices that are supposed to support certain formats. No doubt, as the DRM battles continue, some music listeners will remain irritated over proprietary rights strategies.

Q. What's the easiest way for me to share a printer across my network?

A: The simplest and least expensive option is to dedicate a single Windows PC on your network as a print server. The catch here is that the PC must always be running for others on your network to print. A second option is to buy and install a wired or wireless print server, which usually costs from $100 to $150. You simply plug one into any printer via a USB or parallel port. The server then communicates with your router and in turn with any PCs on your network. (For more on print servers, see "Unleash Your Printer").

The final option is to buy a network printer, though these are designed for businesses and are priced that way.

Q: Is it worthwhile to use the Windows Wireless Network Setup Wizard for configuring the PCs to add them to my home network? And if so, does it also configure other networked devices, such as media hubs and PVRs?

A: Microsoft Windows Service Pack 2 (SP2) adds an easy way to configure your home wireless network. Announced at the 2004 WinHEC show, the Wireless Network Setup Wizard is very helpful indeed.

The Wizard adds an icon to your Control Panel that starts you on your way. If you're setting up your network from scratch, start on your main PC, run the wizard and save the settings to a flash drive as instructed, and then bring the key around to other devices such as the wireless access point, desktops, laptops, printers/all-in-ones, PocketPCs, and projectors. Plug the flash drive in to these devices, and most of them should be automatically configured to be on your home network.

Return the flash drive to your main PC. If any devices failed to set themselves up automatically, you'll get a list of settings you can print out (unless, of course, it's your printer that didn't set itself up automatically). Set each device up manually. If you're adding devices to an existing network, you'll need to run the wizard, manually put in the information like SSID (the wireless network name) and WEP key (for security), create the flash drive, and use it to set up your new devices.

This is a first step for the wizard. Other devices, such as media hubs, PVRs, Internet radio, and the like,

will not be able to use the Wireless Network Setup Wizard. These will need to be set up according to the manufacturer's instructions.

Q: I have digital photos that I want to display on my TV when the grandparents come over. What's the easiest way to do this?

A: There are multiple methods. If you have Microsoft Windows XP, connect the PC or laptop with the photos on it to your TV via an S-Video cable. Then select My Pictures from the Start menu. Once it opens highlight a folder with pictures in it and click the View as slide show option in the upper left corner.

There are other methods. First, purchase and install a media hub to connect your PC to the TV (described above). Second, if you have a PC with CD-RW capabilities and a standalone DVD player that will play CDs, create a photo CD and use the player and TV to display them. Finally, and perhaps most cumbersome, if you have a flash-memory card reader on both your PC and DVD player, copy the files you'd like to view from your PC's hard disk to a card and then use the DVD player to run a slide show of your photos.

If you want to build a polished slide show on disc, try ArcSoft DVD SlideShow 1.0 (**$49.99 direct**), which creates DVDs of photos and lets you add musical backgrounds. Microsoft Photo Story (**$19.95 direct** as part of Plus! Digital Media Edition) is cheaper and easier to use, but still functional. Both can burn shows to disc.

Q: How do I stream regular TV across my home network?

A: You can **download Windows Media Encoder** for free; it captures analog or digital video, then converts and streams the video. You'll spend a good bit of time configuring it, but it works for anything from a 160-by-120 webcam to HDTV. If you have an ATI Radeon graphics card, the included EasyShare software utility can rebroadcast video, too. Similarly, nVidia, Radeon's competitor, has the ForceWare Multimedia suite as part of its Personal Cinema software that ships with its cards.

Q: I only want to stream audio throughout my house. What's the cheapest and most effective method—a traditional AV setup, or using my PC and digital media hubs?

A: The latter. If you have a wireless home network you don't even need to run any wires between rooms. You can purchase any one of several wireless media hubs and connect it to the PC where your music content is stored.

With such a setup, you will need powered speakers (from $50 to $300) to go with a media hub like the Sonos amplified hub (**$499 direct**), or an all-in-one hub-and-speaker solution such as the Philips Streamium MC-i250/37, a combination hub/mini boom box (**$329.99 direct**) in each room.

Such devices typically sit on your desk or mount on a wall. With additional media receivers and the right cables and connections, you can also use the stereo system or high-end clock radio you already have in other rooms. Media Center extenders (from $250 to $350) do the same thing, but only with Media Center PCs.

Bottom line: You pay more for traditional AV and get a smoother audio-only experience. You pay less and get more versatility with media hubs, if you're okay with desktop or wall-mounted speakers. Keep in mind that while you can play simultaneous streams of different music in each room, few hubs can synchronize music, so you probably won't be able to listen to the same music as you walk from room to room.

Q: Which should I use, MP3 or WMA?

A: Either format is acceptable. MP3 is more widely used, but WMA offers slightly better sound quality. (A 96-Kbps WMA file sounds the same as a 128-Kbps MP3). If you're getting an iPod, you'll need MP3 files. Apple's AAC format and Ogg Vorbis are both good formats in terms of sound quality, but few player models support them.

Q: What setting, or bit rate, should I use for ripping music?

A: Most users can't tell 128Kbps from the real thing; they certainly can't do so at 192Kbps. At 320Kbps or lossless (essentially half the size of a direct copy of the CD), it's mathematically equal to the real thing. Look at it this way: Using 320Kbps/lossless, you can fit 300 CDs, worth $4,500, on a 100GB hard disk, costing $50 after rebate. Our suggestion: lossless WMA for home playback and archiving, and 128Kbps for portable players. Total hit: 400MB per CD, or 250 CDs on a 100GB hard disk.

Q: I know I need a network to connect my entertainment devices. Should I go with wired or wireless?

A: This depends on both the location and bandwidth needs of your entertainment devices. If most of your devices are in one location, such as a central entertainment center, and are fitted with RJ-45 (Ethernet) jacks, you can use patch cables and a wired switch to connect them all. If you want your network to include devices such as media hubs or PCs in various rooms throughout your house, you can install a wireless access point at the entertainment center and use wireless client cards in the devices or wireless media receivers.

One thing to remember about wireless streaming: The distance between the source of your content and the device it's streaming to is critical; the shorter the distance, the higher the bandwidth. Also, any walls and floors that come between two devices can interfere with the wireless signal.

If any of your devices don't have wireless built-in and don't have a PCI or PC Card slot available to accept a wireless card, you may need to stick with a wired connection. Trying to retrofit any devices with USB wireless adapters often causes more configuration problems than it is worth.

Q: How many simultaneous streams (audio and video) can I have going at the same time on my network?

A: In general, if you have a wired network, you can probably have several audio and one or two video streams running simultaneously. If your network is wireless, you should limit yourself to a single video stream or two simultaneous audio streams. Though Gigabit Ethernet is becoming more popular, most wired home networks use Fast Ethernet, with a data rate of 100 Mbps. In reality, you'll typically see 80 Mbps of usable throughput for your traffic, once you take out the network protocol overhead that eats up some of the bandwidth. By comparison, an 802.11g or 802.11a wireless data rate of 54 Mbps boils down to about 25 Mbps of usable throughput. Worse still is the usable throughput of 802.11b, which is about 5 Mbps.

What your streaming content requires also varies greatly. MP3 files will typically consume between 64 Kbps (for radio-quality audio) to 128 Kbps (for CD-quality audio). There are more demanding audio streams, such as Dolby AC-3, that can use up to 640 Kbps. Streaming video is much more voracious, needing 7 to 15 Mbps for standard or extended-definition TV streams and 18 Mbps for compressed HDTV video streams. These variations in bandwidth are due to different compression technologies and the resolution of the content you wish to display. Obviously, if someone is browsing the Web or downloading files while you're streaming media, this can further congest your network and reduce data transfer rates.

Q. I've seen wireless gaming adapters on retail shelves. What are these devices? And can they be used for more than just gaming?

A: Wireless gaming adapters are essentially wired Ethernet-to-wireless (802.11b or 802.11g) bridges designed for use with the Microsoft Xbox, Nintendo GameCube, and Sony PlayStation 2 game consoles. (Full review of the Microsoft Xbox Wireless Adapter). Manufactured by such companies as Belkin, D-Link, Hawking, Linksys, Microsoft, and Nyko, these products let you do two things. First, you can use one to connect your game console

to your wireless network and then to the Internet, for online game play.

Alternatively, these adapters can be used for head-to-head gaming between two consoles of the same type within 100 feet or so (you'll need an adapter for each console). The advantage of a wireless gaming adapter is that you won't have to run an Ethernet cable from your Internet connection to the console or between the consoles. Although the Microsoft adapter can be used only with the Xbox, the others can be used with all three platforms (though for the PS2 you'll need an additional Ethernet adapter). Many can be configured directly from your gaming console using your TV, but some require a PC for initial configuration.

flash: media server mania

Worldwide unit shipments of media server products will almost double in 2004—to a whopping 6 million units. High-end digital cable or satellite set-top boxes and networked DVD players will provide the majority of media server product unit shipments through 2008.
Source: In-Stat/MDR, 2004

tip: wireless or wired

Which works best? For transferring multimedia files, wireless is cool but can be unreliable. Wired is faster and more reliable but can be expensive. You should run wired Ethernet at least from your router to your main PC, and from your media hub to the PC that stores your media files.

counter-point: the PC is wrong for the digital home

Let me begin by putting my cards, or prejudices, on the table. I don't really adhere to the solar-system view of home media championed by Microsoft, which puts a media-centric PC in the role of the sun, with an array of relatively dumb devices orbiting the PC like planets. The solar model, in fact, looks suspiciously like IBM's old mainframe model—with the various media-adapter devices acting as dumb terminals and the PC masquerading as a mainframe. Instead of a monolithic server and lots of dumb clients, I see a world of single-function peers. Each does a great job at one thing and connects wirelessly in a kind of media mesh, making content available anywhere in the house, whenever and wherever you want it. Intelligence is pushed out to the edge, to the devices, rather than being concentrated at the center—like the sun.

But you can't really debunk the opposing approach if you don't give it a good chance. So, recently, I decided to unwrap a few media adapters to see how well they performed, and to see if—indeed—the solar-system model had any legs. I gathered up four media adapters and put them to the test: a Gateway Connected DVD player, Pinnacle Show Center, Roku SoundBridge Network Music Player and ADS Tech Media-Link. The Gateway and Pinnacle were older units, each upgraded to the latest version of its firmware. The Roku and ADS unit each shipped within the last month or so.

I attempted to connect each device to my home 802.11g wireless network, and then to the beefy 64-bit PC I built recently (which I chronicled in my "When I'm 64" story). That's where I ran into my first bit of trouble. Although the industry espouses this vision of myriad dissimilar devices all connecting up transparently, it just ain't so. Here's what really happened:

connected dvd player:

I never did get the Gateway Connected DVD player to hook up with its software, even after upgrading everything. Even after specifying the access-point SSID and channel, DHCP was totally hopeless. The player kept defaulting to some random IP address. Even when I manually entered an IP address—something no standard consumer should ever have to do—it didn't help. After about 2 hours, I gave up in disgust. As a DVD player, the Gateway is not bad, but it's terrible as a media adapter. Perhaps that's why Gateway has deep-sized the product line.

showcenter:

In the "happy, happy, joy, joy" world espoused by solar-system devotees, all these media satellites should be able to talk to one server application, but that's not the case. The Pinnacle's Show Center uses different server software than the Gateway device, which meant loading up yet another server to stay resident on my home PC. This pattern would repeat itself throughout the test, as each device needed its own separate server program. Happily, by the time I installed the Roku SoundBridge, I saw light at the end of the tunnel, but I don't want to get ahead of myself.

Pinnacle's Show Center was as balky as the Gateway, even after I dug up one of the limited number of supported wireless cards. DHCP and auto configuration also failed, but at least I did get it to work wirelessly, by manually configuring SSID, channel, and static IP address. This was harder than it might sound, because the stupid configuration software inside the unit relied on the numeric keypad on the remote for selecting letters and numbers, rather than popping up a soft keyboard on screen. And since remote sensitivity was poor, I found myself frequently cycling past the letter or number I wanted. Again, this is much too frustrating for the typical user to suffer through.

media-link:

Despite the fact that both the Pinnacle and the ADS boxes use the same OEM software, the ADS experience was even worse. It required its own server software (of course), and the device configuration screens were even more hopeless. Again, I had to key in the access-point name and IP address manually. This was even more painful than with the ShowCenter, if such a thing could be possible. The data entry area for the IP address, for example, wasn't big enough to display the entire address—which made entering it in a leap of faith. The remote control also depicts alpha characters under their associated number key, which meant I repeatedly hit the wrong key during data entry. (Note to remote-control designers: the letters either go on the key, or above. Thank you.) Again, there was no soft keyboard, and amazingly no way to specify the wireless channel either.

Like the Pinnacle, I did get it connected eventually, but with far too much work for the average bear.

soundbridge:

Roku's SoundBridge, comparably, was a breath of fresh air. The unit doesn't ship with software at all. It works with either Apple's iTunes or open-source software downloaded from the Roku site. It also works with new server software from Microsoft—part of Windows Media Player 10—which promises real media-adapter/server independence. The software was easy to download and install, and once it was running, the SoundBridge automatically configured itself and recognized the software. All I had to do was approve its connection, and the two were working together swimmingly.

Alas, none of the other media adapters I tried would connect to Microsoft's software. So that meant if I wanted all four to be live (assuming I'd ever get the Gateway DVD player to connect), I'd need to run four different server applications on my system. I'd have to ask an astronomer, but it seems to me that a four-sun solar system would be highly unstable, just as I'd expect it to be on my PC.

how well did they work?

So how did they perform? The ADS interface was so bad I wrapped it up and stuffed it back into its box after about 10 minutes of fumbling. The ShowCenter was better, probably because it's been out for a year, and the software has been updated a few times. Still, it doesn't display artist and title information when playing music, it doesn't cache your entire library to ease song searching, and the photo interface could use some work. Oddly, the unit won't output video simultaneously to both the component and composite ports. This is a niggling detail for most people, but a real problem for my particular configuration.

Forget playing back video on any of these devices. Even after connecting the Show Center to my server via my home Ethernet network (which actually works like a charm), DivX video playback stuttered and stalled like a 20-year-old Yugo.

Finally, after much work, both the ShowCenter and the SoundBridge connected and worked fine, for the most part. I do like the idea of accessing my music around the house, although video clearly has a long way to go. It's nice to see the photos too, but I don't miss it on the SoundBridge. I'm not happy running two separate servers on my PC, but so far I've only had two or three unexplainable traumatic system crashes. And with one wired and one wireless device, network contention doesn't seem to be a problem.

Still, I'm not happy about leaving my PC on all the time. I wish my HD TiVo was part of the mix, because Windows PCs still do a bad job recording regular TV, not to mention HDTV (for more, see my story on ATI's All In Wonder HD).

In a perfect world, I'd have a killer audio server, like the Escient Fireball (if only I could afford it), a killer video server, like my HD TiVo

(read all about it in my HD TiVo review), and a photo repository as well. A mesh network, or maybe gigabit Ethernet, would connect each one up to thin adapters connected to each of my TVs and my stereo. And I'd be able to watch/listen to different streams in each room, or the same stream everywhere

But whichever way you go—a web of smart single-purpose devices or the solar-centric PC-based approach—one thing's clear: We're not there yet. The software's too difficult to use, the connectivity too fractured, the devices too expensive and limiting, and the network is too slow. One caveat, however. I have yet to test the full-on Microsoft solution, which uses a special Media Center flavor of Windows, and even dumber clients (called extenders) to deliver a solar-centric experience. They're supposed to be easier to integrate, but you still end up with a single central server trying to be all things for all media.

And beyond the devices themselves, the whole industry is in disarray. Consider Windows Media Video? Sure you want it, but what flavor? Seven, Eight, or Nine? Or HD? What about DivX? What version? Every time the standard changes, the chips have to change too. And then there's Hollywood. The MPAA, like the RIAA, considers you guilty of piracy until proven innocent. Thus, they are erecting huge roadblocks to keep you from moving media around your home. My Dad recently downloaded a WMV-based baseball game and wanted to watch it on his portable DVD player. No such luck. The built-in DRM restricts him to watching it on a PC or Portable Media Center. He bought it, but he'll either have to become a criminal, or spend $500 to watch it on the road.

Maybe things will get better this year, but I doubt it. Until then I'll watch my TiVo in the media room, listen to MP3s in the office, living room, and kitchen, and make photo DVDs to share around the house. And you will too. If anyone tells you any different, give them a funny look. They're probably from Mars.