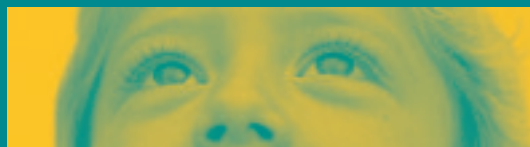


A SPECIAL
SUPPLEMENT TO
CE Vision Magazine

TECHNOLOGIES TO **watch**



- Media **Servers**
- Portable **Entertainment**
- Hybrid **White Goods**
- Innovative **Gaming**
- **Telematics**
- Special: **Future of CE**



TECHNOLOGIES TO **watch**

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FIVE TECHNOLOGIES TO WATCH **Introduction****5****Expand your Horizons**

As a business leader, it is essential to be knowledgeable about the latest developments in the industry. We've all heard, stay ahead of the curve so many times that it sounds trite. But, the very real danger if you don't, is that your competition is going to smash you. In this fast-paced environment, no one has the luxury to rest. We must anticipate what is coming next.

To help keep you informed of some of the prospects in the CE industry, we created *Five Technologies to Watch*, to spotlight up and coming opportunities. For the 2004 issue, after a lively roundtable, we selected media servers, portable entertainment, hybrid white goods, innovative gaming and telematics as areas to look at more closely.

One theme that runs through the publication is that content is beginning to drive these devices. Consumers want to be able to take their information, entertainment and communications with them anywhere – whether that is from room to room at home or on the road. Another theme is that as broadband continues to be rolled out to homes, the rate of innovation in products and technologies will soar.

Five Technologies to Watch also has a section that looks at the more futuristic work being done in labs such as biometrics, conductive surfaces, holograms, nanotechnology, robotics and wearable computers that influence not only the market but society as well.

Did you know that carbon nanotubes are seen as a key to super lightweight, more efficient large flat-panel display screens? Samsung Electronics and Motorola are among the companies developing flat-panel televisions based on electronics being transmitted to the screen via nanotubes. Houston-based Carbon Nanotechnologies Inc. is patenting technologies – most recently a coating for single-wall carbon nanotubes – that will speed the union of nanotubes and consumer electronics devices.

We are part of a dynamic, \$100 billion plus industry that continually reinvents itself. To learn more about the digital devices that are transforming our lives, I invite you to come to the 2005 International CES in Las Vegas, Nev. from January 6-9. Be a part of our exciting industry as we meet and do business at CES. This year, the show features new products and services from more than 2,400 exhibitors. For more information, visit www.CESweb.org.

And the International CES also is the place to learn about technology. Not only do we have a dazzling lineup of keynoters, CEA also hosts more than 100 conference sessions that feature 300 technology experts focusing on areas like wireless technology, electronic gaming, mobile technology, home networking, home entertainment, emerging technologies, technology policy and business solutions. I hope to see you at CES!

Gary Shapiro
CEA President and CEO



Whether for buying music, renting movies or snapping photos, digital alternatives are displacing established technologies. Online services such as Napster and iTunes increasingly are prompting people to purchase music one song at a time, downloaded to a personal computer or to a portable digital audio player, rather than in the form of a pre-recorded compact disc. Similarly, websites such as CinemaNow.com or Movielink.com are selling or renting downloadable movies as a substitute for pre-recorded DVDs or videotapes. Many new camcorders can record video in a digital format that can be readily edited and stored on a PC. Kodak, the company that launched amateur film photography in the late 1800s, has been forced by the advent of digital photography to reinvent itself or lose as customers the many amateur photographers who are abandoning film today.

As a result of this digital shift, people are accumulating an abundance of digital music, video and photo files. But these files are of limited utility if they are stuck in one place – such as the PC's hard disk drive. So, a new kind of device named the “media server” has emerged.

Essentially, a media server is a device that contains a hard disk drive for storing digital media like audio, video and photo files, and a means to distribute those files to other devices that are located elsewhere in the home – either in the same room or in another room. In most instances, the media server has the horizontal box form-factor of a consumer electronics (CE) device such as a DVD player. Alternatively, the media server can be software built into a specialized PC.

Yet while there is a clear definition of what a media server is, right now there are no true media servers available, experts say. Rather, they say, there are a number of different products that offer only some of the capabilities of a true media server. For example, a PC running Microsoft Windows Media Center Edition software can store on its hard drive digital photos, digital audio and digital video – including downloaded music and movies and live TV broadcasts from sources such as cable or satellite-TV services. But these PCs don't readily distribute the media they hold to other devices around the home.

“The interconnectivity is where the limitations are today,” says Sean Wargo, CEA's director of industry analysis.

“There is no one device today that does everything,” says Bernie Sepaniak, president of Escient/ReplayTV/ACT. The company, which is based in Indianapolis, sells digital video recorders (DVRs) under the ReplayTV brand, and digital audio servers and DVD-video servers under the Escient brand.

Because of this division of labor among devices, there is a dearth of data about the market for media servers specifically – although there is data available about the home networking technologies that provide the communications backbone necessary for media servers, and there is data about how consumers use digital media at home.

It is expected that 52 percent of U.S. households will have home networks by 2008.

Currently, according to John Barrett, director of research at Parks Associates, a digital home research firm and consultancy based in Dallas, 10 percent of Internet-connected households in the U.S. have a PC connected to a TV, and 10 percent have a PC connected to a stereo. But just five percent of households take video that was downloaded from the Internet and serve it to a TV from the PC, Barrett says. And the same proportion – five percent – sends music downloaded or streamed from the Internet directly to a stereo from the PC, he says. It is much more common to push music stored on the PC's hard drive to a stereo, or to play a DVD movie using the PC's DVD drive and a TV, Barrett adds.

In a collaborative organization named the Digital Living Network Alliance or DLNA (www.dlna.org), companies in both the CE and PC industries are working together to develop true media servers, as well as “media rendering” devices that take and play or show the media from the servers, with which they seamlessly interconnect. It is expected that the first products resulting from the work of the DLNA will be introduced by the end of 2004, and that consumers will see products with

IT IS EXPECTED THAT 52 PERCENT OF U.S. HOUSEHOLDS WILL HAVE HOME NETWORKS BY 2008.

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DLNA certification on store shelves in 2005. At that point, it is expected that the market for media servers will emerge and grow rapidly – spawning specific market data.

Still, some legal and other technical and business matters must be resolved before media servers will proliferate widely, the experts say.

Origins

The roots of the media server can be traced to the first CD-recordable discs and drives, which debuted in 1990 and allowed people to create custom discs using music pulled from pre-recorded CDs and PC hard drives. The sharing of digital music files online followed in the late 1990s, with the debut of websites like Napster and portable digital audio players like the Rio PMP300 by Diamond Multimedia. Recordable DVDs also debuted in the late 1990s, spurring people to create and share digital video files using the discs. In this decade, streaming and downloading digital video from websites like Movielink has gained traction. And digital photos have followed a similar path to consumer success, from the use of digital photo files on discs and in PCs to the sharing of photos on websites.

Now there is an apparent need to make this plethora of digital media accessible from anywhere in the home, regardless of where the media resides. The solution is the media server.

Strategic Issues/Legislative Implications

To be sure, further work is needed before a media server can become a common household appliance.

The interconnectivity problem that the DLNA is working to solve is only one hurdle, and it is the easiest to overcome, says Joe Olmsted, product manager for digital home products at Alienware Corp. in Miami. The company makes Windows Media Center PCs – named Digital Home Systems – that are designed to be placed in a home's living room and connected to a TV. The biggest challenges to media server designers,

according to Sepaniak, Olmsted and other experts, are the tremendous size and bandwidth requirements of the digital video files that contain reasonably good looking footage, the high cost of hard drive storage space for these files, the relative inadequacy of the wired and wireless networking infrastructures in most homes today, and the technical and legal issues surrounding “content security and rights management.”

Today, says Sepaniak, media server makers must balance the cost of the device with the quality of the video it provides to the user. Because of the high cost of hard drive memory, he says, it is prohibitively expensive to store many DVD-quality movies and audio on the server's hard drive.

With standard-definition video – the quality of a typical cable-TV broadcast – a one-hour TV show could fill a five gigabyte (GB) file and take 10 minutes to transmit over the highest-bandwidth gigabit Ethernet wired home networking infrastructure, Olmsted says. High-definition video will require even more storage space and bandwidth – a 20 megabit-per-second data transfer rate for uncompressed high-definition video, according to Sepaniak. Moreover, most homes aren't equipped with such high-bandwidth wired networking technology. In the U.S., it's rare to find a home network capable of transmitting data at a rate of 2 megabits-per-second, much less a gigabit per second. Even in South Korea, famous for its high-speed Internet access, home networks commonly offer data rates of only 8 megabits-per-second, Sepaniak says. Wireless networking technologies that are prevalent today – various versions of Wi-Fi – are even less adequate for transmitting reasonably high-quality video, Olmsted says.

Bandwidth issues were what killed the Pioneer Digital Library before it ever reached store shelves, says Matt Dever, vice president of planning for the home entertainment division of Pioneer Electronics (USA) Inc. in Long Beach, Calif. The Digital Library, an early attempt at a media server, was shown for the first time at the 2003 International CES, but consumers gave the thumbs-down to the product in beta testing later. One

reason: taking into account bandwidth constraints in the home, the Digital Library was designed to stream only low-resolution, VGA-quality video. “The concept is extraordinarily fascinating,” Dever says, but the technology is not ready for prime time.

At the 2004 International CES last January, Pioneer showed Digital Library 2, capable of streaming high-definition video and recording and archiving video from feeds. But Pioneer still is waiting to bring the product to market, as Digital Library 3. That probably will be in early 2006, when two-way digital cable ready (DCR) is expected to be available, Dever says.

What is Transcoding?

■ Transcoding is process of converting one encoded format to another encoded format

- **Transscale.** Alter resolution (e.g., HD → SD)
- **Transrate.** Alter bit rate (e.g., 3Mbps → 1Mbps)
- **Transcript.** Convert the content protection/DRM of the source to another format

■ Why Transcode?

- Content comes in many different formats. Media transcoding enables media interoperation
- Networked devices may have limited rendering and decoding capabilities
- Home networks (especially wireless) have limited throughput
 - Smart streaming and transrating enables wireless usage

Source: Intel

One solution to the bandwidth issue is a technique called “transrating,” says Danielle Levitas, director of consumer market research at IDC in Mountain View, Calif. Transrating is adjusting the file for changing bit rates and interference to provide “adaptive bandwidth management” and “quality of service.”

Regarding the legal issues surrounding media servers, Sepaniak says that the Digital Millennium Copyright Act clearly makes it illegal to defeat the copy-protection technologies built into DVDs, or to sell software tools that enable this defeat. Thus, the act makes it illegal for a consumer to create a physical copy

of a DVD for personal use, because that could be done only by first defeating the disc’s copy-protection technology, Sepaniak explains.

However, Sepaniak says, it remains unclear whether streaming video over a home network constitutes an illegal personal use copy. It also is unclear what copy-protection technology, if any, may yet be mandated and built into broadcast TV shows, he says. Similar legal issues pertain to media retrieved from the Internet, he adds.

In a related matter, Levitas adds, media servers will need to be designed to “transcode” digital media files – that is, to convert them from one file format to another, to make the files compatible with the media rendering devices that will work then. To that end, broad codec support is necessary for media servers, Levitas says, referring to the technology that creates files in particular formats. “DRM goes hand-in-hand with that,” she adds.

Ultimately, media servers also will have to “transcript,” or convert files from one DRM scheme to another, notes Bill Leszinske, director of digital home marketing and planning at Intel Corp. in Folsom, Calif.

Levitas says she expects that some media servers will be introduced next year without broad codec support, but that the product landscape will improve over time.

In the final analysis, Sepaniak says, “These are obstacles that define the when, not the if, for media servers.

Business Perspectives

Also still to be determined is the media server ecosystem. So far, companies in both the PC and CE industries are approaching the device and its market from different angles, albeit with similar goals. The PC companies are focusing their efforts on media servers based on the Windows Media Center Edition computer operating system, using the form factor of a CE-like set-top box. Meanwhile, the CE companies are concentrating on dedicated devices that use simple remote-control-driven

THE FIRST PRODUCTS RESULTING FROM THE WORK OF THE DLNA WILL BE INTRODUCED BY THE END OF 2004 AND CONSUMERS WILL SEE PRODUCTS WITH DLNA CERTIFICATION ON STORE SHELVES IN 2005.

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user interfaces. So far, which camp will be more successful in the marketplace is unknown.

Cable, satellite TV and telecommunications companies also will play a role in the media server ecosystem, as service and content providers. Among their offerings will be video delivered to the media servers via the Internet, Levitas notes. This is one reason Verizon has begun to install high-speed fiber optic connections to homes around the country – in so-called Fiber-To-The-Home (FTTH) deployments. How to bill for these services remains unresolved, Levitas says. Nevertheless, she says, the big winners in the media server marketplace will be the content and service providers, as well as DRM technology companies and Web-based portals that aggregate content for media servers.

To that end, Levitas says she foresees key partnerships forming, for example, among set-top box and cable companies such as Motorola or Scientific Atlanta, and Comcast or Time Warner Cable, and key partnerships forming among CE companies like HP or Sony and retailers such as Best Buy or Circuit City.

Movie studios, video game developers and music publishers will be important partners to the media server makers, too, Levitas says. The price of a media server will depend upon the amount of storage capacity it has, says Levitas – and the price will help to determine its success among consumers. Some media servers will cost several thousand dollars, others will cost hundreds of dollars, Leszinske says. A popular price will be \$499, she says. Within two years of their debut, media server prices will fall to around \$399, Levitas predicts.

Media servers will be available through a variety of channels, including so-called electronic systems contractors, a channel that already sells the device's capabilities in a different form. These businesses, which comprise the Custom Electronic Design and Installation Association (CEDIA), currently sell and install home networking, home automation and whole-house entertainment systems that enable audio, video and other media to reside in a central location and be accessed from any room in the home or even via the Web from a remote location.

CEDIA already is a proving ground for the concept of media servers, and it will continue to play a role in the device's further development and distribution even as lower-priced versions are introduced in stores, says Ray Lepper, the president of CEDIA (www.cedia.org). "We didn't start out with \$600 PCs," Lepper says by comparison. "We started out with \$3,000 PCs, and the best PCs will still cost \$3,000. Brands are built with different price points," he says, adding that different brands will choose different paths to the consumer.

According to Sepaniak, electronic system contractors will want to sell media servers that sell for thousands of dollars, while high-end CE retailers such as Tweeter or Magnolia will want to sell three-room systems for between \$1,000 and \$1,500, and mass market CE retailers such as Best Buy or Circuit City will want to sell such systems for less than \$1,000.

At the same time, Leszinske notes, retailers also will get into the business of installing media servers and media rendering devices in homes but because of their prices, not in competition with the CEDIA members.

"It's a farther leap from the media server to the automated home, but once we cross the entertainment barrier and the content management barrier, then it becomes more likely that we would consider full home automation," adds Wargo.

Consumer Perspectives

The media server "makes the digital world finally able to meet what the old world could do," declares Olmsted. Twenty years ago, he explains, you could carry your paper photos from one room to the next and show them to anyone, but five years ago your digital photos could be kept only on your PC and anyone who wanted to see them would have to gather around the monitor.

"End users don't wake up one day and say, 'Man, what I really need is a media server,'" says Leszinske. But they know they have 4,000 digital photos and want to show them on their TV, not on their PC, he says. "The vision is there." ■

PORTABLE **Entertainment**

In today's society most of us are constantly on the go, propelled by our daily agendas and tethered to the outside world through our collection of communication devices. But while our pace of life gets faster, we still crave entertainment to provide a distraction from the rat race.

Enter portable entertainment devices. Advances in technology are not only changing the types of portable entertainment devices we use, but also how we use them. The outcome is a digital movement where consumers can access their content – especially entertainment content – wherever they go.

Fortunately, a number of CE products have emerged to meet rising consumer demand for more cutting-edge on-the-go entertainment solutions that go beyond traditional portable audio and video applications. The trends in the portable audio and video entertainment segments uncover some new and exciting directions that businesses are headed.

Portable Audio and the Digital Transition

Over the past decade the most prominent portable audio device apart from boomboxes and portable radios was the portable CD player. Retailers sold millions of these products as consumers embraced the shiny disk and moved away from their old Walkman-style tape players. But today, a new transition is underway to digital music.

There is no escaping the digital wave that will eventually wash over the entire audio realm. Soon analog recordings and playback devices will be as rare as vinyl records and turntables are today. Evidence of the transition to digital music can be found all around us. Consider the number of CD and DVD players that support digital music playback and the successful launch of digital music download services like Sony's Connect or Apple's iTunes. And although there are many flavors and formats of digital music in play today, industry observers agree that digital music is here to stay.

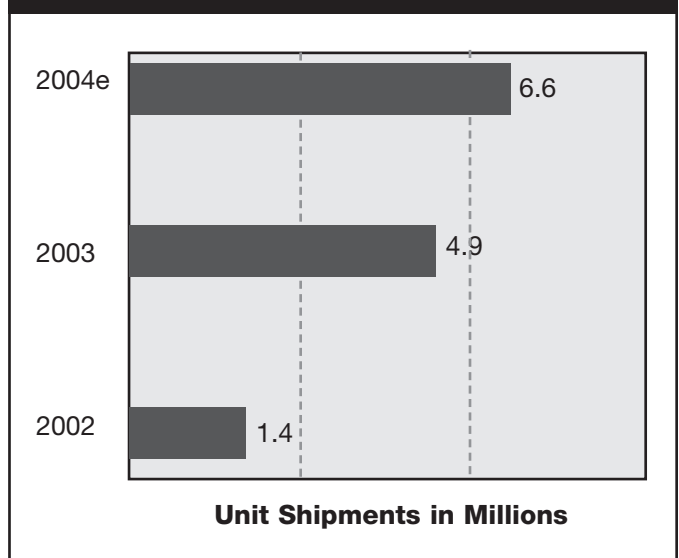
Music Consumption Patterns Changing

Digital music is creating a new music manta in audio and CEA research suggests consumers' consumption of music is beginning to change. This includes how people purchase music, what they play it on and where they listen to it. For example, more consumers want their music with them wherever they go. Meaning they want their music to play on various devices in the home, car or on the move.

CDs have catered to this need, but consumers could hardly tote around their entire CD library with them. This is where digital music offers an alternative. Some of today's palm-sized digital music players offer enough storage capacity to hold several thousand songs, allowing users access to their whole song collection wherever they are.

Consumers also like the ability to purchase music by the song. Where CDs cost between \$10 and \$15 for a collection of tracks, the business model for digital music is built on a la carte music purchases made per song.

CD/MP3 Player Growth



Source: CEA Market Research

CE manufacturers and the music industry are beginning to understand the new demands of consumers and they have responded with innovative products and by adding digital music compatibility to existing audio devices. Digital music has shaken the pillars of the shiny disk and cracks are already visible.

Support for Digital Music Playback

One of the indicators of the growing demand for digital music is how rapidly the number of MP3-compatible devices has increased among traditional portable audio segments. CD/MP3 players provide a good example of how this trend has unfolded.

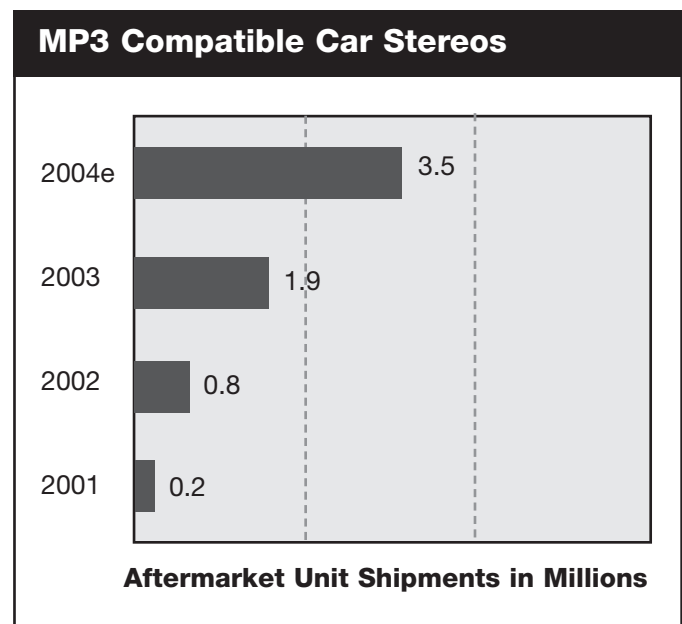
When manufacturers first began shipping MP3-compatible CD players in 2002 the total shipments of these devices (1.4 million units) only totaled nine percent of all portable CD player unit shipments. However, in the following year MP3-compatible portable CD players represented 29 percent of all portable CD player shipments. And during 2004, these devices have continued to gain share. For example, during the first half of 2004, MP3-compatible portable CD players represented 51 percent of all portable CD player shipments.

Paralleling the drive toward digital music compatibility in portable CD players, manufacturers of in-dash CD players also have taken steps to integrate this functionality into their products. When digital music-compatible in-dash CD players first appeared in 2001, they only represented two percent of total shipments of these devices. But their share has steadily grown to nine percent in 2002 and 20 percent in 2003. During the first half of 2004, digital music-compatible in-dash CD players accounted for 31 percent of total in-dash CD player shipments.

Through providing digital music compatibility via CDs, these technologies have served as a bridge to the digital music realm

for those consumers who are not yet ready to shun their shiny disks.

But consumers may be crossing over to digital music and leaving their CDs at home. Competition in the CD/MP3 player market has cut back factory margins to a razor-thin level, which could cause some manufacturers to bow out of the segment. Retail margins are being crimped as well and as a result retailers are beginning to stock more dedicated digital music players – that yield higher margins.



Source: CEA Market Research

Digital Music Gets Off the Ground

In the late 1990s digital music formats were relatively new. And digital music was rooted firmly in the PC universe. Realistically, the PC was the only playback device for MP3s and other digital music formats – but the introduction of digital music players in 1999 allowed these tunes to break free of the PC. The first generation of these devices featured limited solid-state memory (less than 32MB). Shipment volumes of MP3 players steadily ramped up as more consumers began converting their music on shiny disks to digital files. And the emergence of file-sharing

software spurred even more users to join the digital music ranks. In a short time digital music enthusiasts around the globe were exchanging digital music files with each other. But clouds were gathering on the horizon.

Eyeing millions of dollars in lost revenues, the recording industry engaged a successful legal battle with digital music swapping networks claiming the networks (and the people who use them) were illegally distributing licensed content. The networks closed and music file swapping ground to a halt, save for a few rogue individuals. Some questioned if this would be the end of the digital music movement – and the market for MP3 players. Boy, were they wrong.

The Digital Music Renaissance

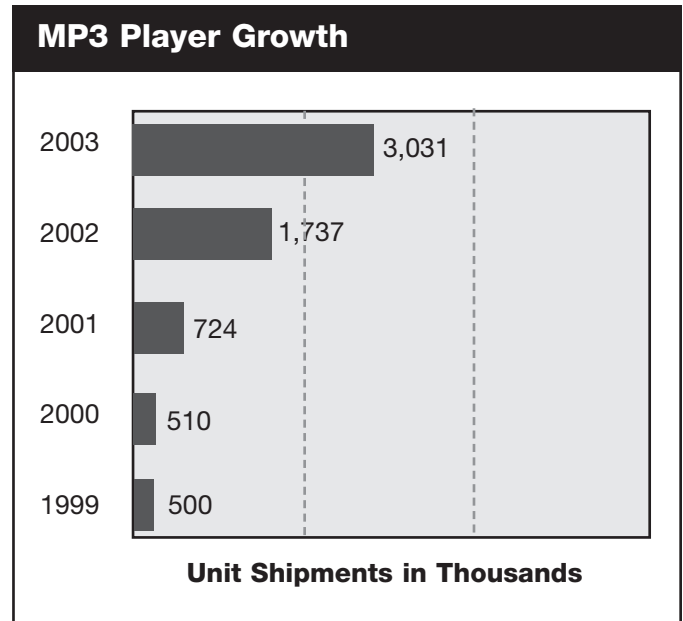
After the dust settled from the music file-swapping crackdown, business models began to organize and emerge that would allow users to purchase licensed copies of digital music. Services like Apple's iTunes brought a legitimate face to digital music. But would this new business model work?

Apple's iTunes recently announced the service had broken the 100 million-song download mark. And the service now offers a catalog of more than one million songs. Other services have come to market to claim their share of the digital music dollars including Sony's Connect, Real's Rhapsody and Roxio that successfully resurrected the Napster name for its subscription-based digital music download service.

So instead of going bust, the digital music market boomed. The emergence of these licensed digital music services actually helped catapult sales of MP3 players and stimulated consumer demand for greater storage capacities on the devices. These developments have led the MP3 player market in an interesting direction but what's happening today?

The Digital Music Player Market Today

During the first half of 2004, shipments of portable MP3 players have topped 2.5 million units, representing a 177 percent

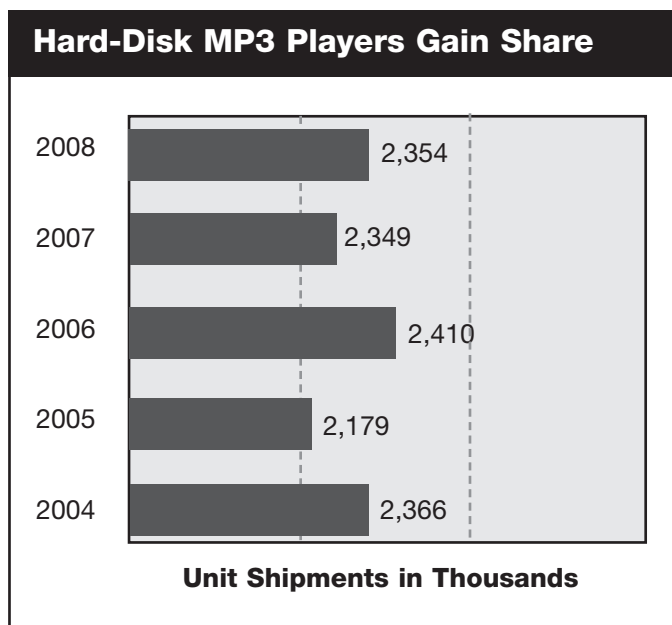


Source: CEA Market Research

increase over last year's same period results. By the end of this year, CEA expects factory-to-dealer shipments of portable MP3 players to tally more than 5.7 million units – nearly doubling last year's volume of about 3 million units.

And CEA forecasts robust growth in this sector in the near future. According to the *2004 CE Ownership and Market Potential Study*, about 9.5 million households plan to purchase a MP3 player within the next year, which is a 33 percent increase over last year. Some 81 percent of these buyers will be purchasing their first MP3 player – a sign that although a few years old, it is still a young market.

CEA's *2004 CE Ownership and Market Potential Study* pegs household penetration of MP3 players at 11 percent. But this figure should climb rapidly as the sales curve for these devices ramps upward. By 2008 CEA expects unit shipments of portable MP3 players to approach the nine million mark, with shipment revenues topping \$1.2 billion.



Source: CEA Market Research

Solid-State or Hard-Drive?

Consumer behaviors toward audio are changing. Not only are more consumers embracing digital music, but they also want to take large volumes of music with them wherever they go. In response to this change, companies have begun to introduce MP3 players that are hard-drive based – that have the capacity to store thousands of songs.

CEA forecasts almost 60 percent of MP3 player's unit shipments will be hard-drive based this year, with the share growing to 74 percent by 2008. But while the current shipment trend illustrates increasing consumer demand for hard disk-based MP3 players, flash-media or solid-state MP3 players could stage a comeback. The storage capacity of flash media-based MP3 players keeps improving and consumers appreciate the longer battery life inherent with solid-state memory.

Clearly this is a space to watch.

Digital Music Players Converge

While portable audio products like CD players and in-dash CD receivers quickly supported MP3 playback via CDs, other product segments have moved to add MP3 player functionality to their feature sets. Some examples of this convergence include PDAs and digital memo recorders. But now thanks to Motorola and Apple Computer we can add cell phones to the list.

In July of this year, Motorola announced it was working with Apple to develop phones that will store and play digital music downloaded from Apple's iTunes service. The music phones are expected to hit the market in 2005. But the Motorola music phone is not the first to market with the MP3 player/cell phone idea.

Many of Nokia's higher-end cell phones already have the capability to playback MP3 files. One current model, the Nokia 3300, has up to two hours of digital music storage capacity. Unlike the Motorola music phones, Nokia phones are not predisposed to one music service. But how many consumers really want an MP3 player/cell phone?

CEA's May 2004 *Wireless Phone Applications and the Future Study* found 11 percent of online adults were interested in using their phone as a MP3 player, but only six percent wanted this feature on their next phone.

This observation is counter to the growth in the MP3 player market where shipment volumes are skyrocketing. And considering how music consumption is shifting away from the shiny disk, it seems plausible a reasonable number of consumers would appreciate an MP3 player/phone. Who knows? Over the next couple of years MP3 phones could be the next big thing in wireless handsets.

Digital Music Moves into the Car

The car is another area of increasing focus for digital music. For some time now consumers have been connecting their digital music players to their car's stereo system to play back music files. Carmakers are catching on to this trend and some are

bringing solutions to market to help drivers easily connect a digital music player to the car stereo. Early this summer, BMW and Apple jointly announced the BMW iPod Adapter that allows users to seamlessly integrate their iPods with their BMW's car audio system through a single cable located in the glovebox. The iPod draws power from the car's battery and the driver can control the iPod through the vehicle's standard or steering wheel mounted audio controls.

While carmakers offer connections to digital music players, aftermarket autosound manufacturers are beginning to cultivate a new crop of head units that feature hard-drives – allowing digital music files to be downloaded and stored on the car stereo through a direct connection or a flash memory slot. In addition to storing digital music files, these hard-drive based head units may eventually be able to digitally record music from radio broadcasts, satellite radio and CDs. Add to this mix a generous helping of flash media and it's easy to see how the days of the shiny disk could be numbered.

Taking another step towards the future, CEA sees wireless technology enabling even more options with digital music. In a short time, consumers will likely be able to wirelessly synchronize their digital music library between their home, car and personal music player.

Opportunities for Digital Music Players

The increased storage capacity of digital music players are opening up alternative uses and greater utility for the products; taking them beyond a just a playback device. In a maverick move, Duke University this year launched a pilot program to see if the Apple iPod could be used as a learning tool. Like other hard-drive-based digital music players, the iPod's drive can hold a wide variety of data in addition to songs. Under the program, Duke has provided 1,650 freshmen with iPods loaded with school-related information and even the school's fight song. In conjunction with the iPod handouts, the school has developed a website modeled on Apple's iTunes site from which iPod equipped students can download class lectures,

course content and other learning materials posted by professors. The Duke University program is an interesting experiment and it highlights one more reason to keep watching the digital music player segment.

Technology Radio Goes Portable

Satellite radio has been available for more than two years and the technology has worked well as a portable entertainment solution through in-car receivers and boombox adapters. Factory-to-dealer shipments of satellite radio products have skyrocketed over the past year, with revenues nearly tripling to \$116 million in the first half of 2004. But while we have been able to bring satellite radio into our homes and cars, a personal satellite radio listening experience has been absent – until now.

HD radio is another new technology radio format that is perking up consumers' ears. Already HD radio has made its way into the aftermarket through car stereos and is trickling into new cars. Home radios and home audio receivers featuring HD radio also are on the way, but we may have to wait a bit longer for a personal HD radio solution. Increasing numbers of radio stations around the country are expected to upgrade their signals to HD radio and this will almost certainly drive consumer demand for a portable HD radio solution. Hopefully we won't have long to wait.

Portable Video Entertainment Grows

The digital music revolution has sparked consumer demand for portable audio entertainment solutions like CD/MP3 players and digital music players and this enthusiasm also is beginning to kindle the flames of demand for portable (or mobile) video entertainment devices.

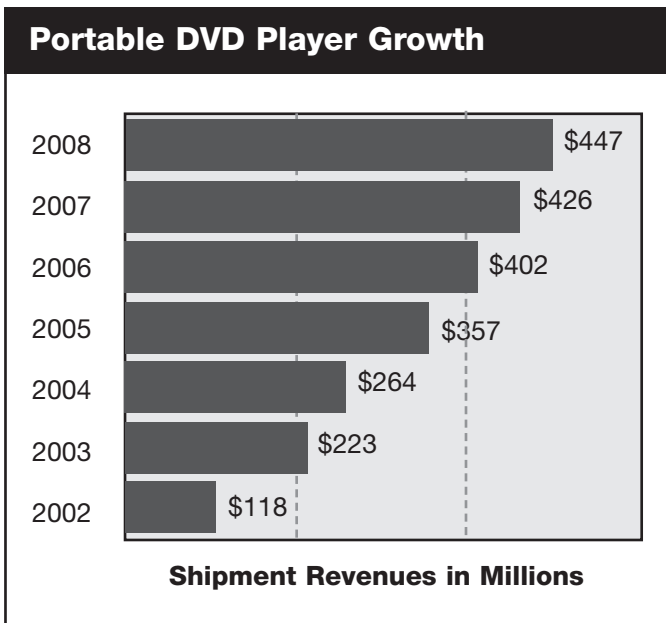
Consumer awareness of mobile video solutions is building thanks to greater competition in the segment among manufacturers, the channel and even carmakers. Mobile video solutions also are more affordable than ever, which has placed mobile video solutions within the reach of most consumer budgets.

CEA estimates 5.3 million U.S. households own a mobile video system – either installed in a vehicle or portable – and CEA research suggests another 4.3 million households intend to purchase a mobile video system this year. It all adds up to a segment that is ripe for growth and certainly one to watch.

brought on by new lower-end devices lowered the average wholesale price 17 percent to \$375. These lower-end solutions garnered the interest of mass merchant super-chains and warehouse club stores, vastly improving consumer exposure and awareness of these devices.

This year CEA expects the wholesale prices for portable DVD players to continue their decline – slipping another 12 percent to a new average of \$330. This means ASPs will likely continue their downward trends as well making these devices more accessible to consumers from a budget standpoint. A quick visit to your local Wal-Mart store provides more than enough validation of this trend. The retail super-store chain carries several portable DVD player SKUs at its stores and features more than 20 products on its website – many of them priced below \$150. To satisfy those who want the best, a couple of higher-end models carrying ASPs above \$500 are sprinkled in among this budget-buy assortment.

In the coming years, CEA foresees continued strong growth in this segment as shipment revenues climb ever higher – approaching the \$450 million level by 2008. And convergence will be a guideword for future generations of portable DVD players. Already higher-end models sport advanced audio playback features like DVD-audio, CD MP3 and WMA files. And a handful of units also include memory card slots for viewing digital images or playing digital music files. These advanced features will trickle down over time, but newer even more advanced features will come to market. What can we expect? Predicting future feature sets can be difficult, but longer battery life, bigger screens and high-definition playback seem likely candidates. In addition, convergence between portable DVD players and portable game consoles is a distinct possibility.



Source: CEA Market Research

Portable DVD Players

Small screens and high prices characterize the first generation of portable DVD players that came on the scene a couple of years ago. According to CEA, the average wholesale price of a portable DVD player in 2002 was \$452, which meant street prices were hovering around the \$1,000 mark. The high price points limited distribution to a few CE superstores and A/V specialty shops. As a result, demand was fairly limited in the beginning. But the seeds of consumer demand had been planted.

Last year several new competitors entered the portable DVD market and the segment began to stratify. Pricing pressure

Mobile Theater – Movies in the Car

Not long ago rear-seat entertainment systems were a rare find in passenger cars, but today it is not uncommon to find mobile theaters installed in a wide array of vehicles from trucks to mini-vans. While not truly portable entertainment, this extension of portable video entertainment offers consumers another way to enjoy video on the go. Consumers have many options when it comes to selecting a mobile theater system from OEM systems installed in new cars to aftermarket solutions designed to meet practically any budget.

Among these aftermarket solutions, system-in-a-bag products offer consumers an inexpensive solution where the only installation required is strapping the bag to the back of a front seat. However, many consumers are opting for installed aftermarket mobile theater solutions where options abound. Consumers may choose an in-dash DVD player connected to monitors mounted on the back of the front seat headrests; or perhaps an overhead console monitor with integrated DVD player better fits the bill. What could be causing the shift in demand?

A throng of low-priced mobile video solutions introduced by a new batch of competitors is a major reason. As manufacturers admit, competition has reached insane levels in the mobile video arena with dozens of companies marketing product to distributors, retailers and custom installers. This activity has put substantial pricing pressure on the traditional autosound brands competing in this space, creating a cutthroat competitive landscape. At the same time, screen sizes have become progressively larger with displays over 12-inches not uncommon.

CEA research has shown consumers are willing to try unknown brands when it comes to purchasing CE products and it seems unlikely the beleaguered 12-volt market would turn aside a sales opportunity.

CEA expects most of the aftermarket shipment volume in the mobile video segment to remain in overhead consoles and sys-

tem-in-a-bag solutions. DVD player shipments also will increase substantially with most of the volume remaining in non-DIN size models.

The future appears bright for the mobile video segment but expect further segmentation in this industry to occur. Segmentation will continue not only from the screen size and features perspective, but also from a value proposition standpoint. Manufacturers and retailers will have to work together to find the right balance between price, feature sets, component quality and service after the sale that will best serve customers. In the end, the business will likely avoid a train wreck, but manufacturers and retailers may be forced to pick competitive segments and stick with them. One thing is certain, consumers will be watching.

Mobile Video Forecast- Unit Sales to Dealers in Thousands				
Year	Stand Alone monitors	Overhead Consoles*	System in a bag	DVD Players**
2003	99	191	210	163
2004	77	172	408	214
2005	89	210	485	317
2006	96	253	560	422
2007	99	297	618	554
2008	103	333	663	600

* may include integrated VCP or DVD player

** includes all in-dash or fixed mobile DVD players

Source: CEA Market Research

Personal Media Players

Another emerging segment consumers will be watching is the personal media player segment that brings together digital music and video playback from electronic files only. These products allow consumers to play back digital music much like a MP3 player, but with integrated color screens, they also enable consumers to view digital photos and playback digitized movies, home videos and even recorded TV shows.

Last year, one of the first products was shown at the 2004 International CES. The hand-held ZVUE personal video player can play digital music, but with its 2.5-inch color screen it also can play videos and display still images – all in a form factor about the size of a deck of playing cards. For its groundbreaking design, the ZVUE was honored in the personal electronics category of the Innovations 2004 Design and Engineering Showcase at the 2004 International CES.

This year, the next-generation of these devices is coming to market. One example, is the iRiver PMP-100 series of personal media players. The PMP-100 supports various video, audio and picture formats including AVI, MPEG4, MP3, WMA, WAV, ASF and JPEG. On the specification side the PMP-100 features a 3.5-inch color display, and includes either a 20GB or 40GB hard-drive. The 40GB version can store up to 150 hours of video and 1,200 hours of digital music.

Emerging technology can be expensive and personal media player devices are no exception. To get the latest and greatest personal media player, expect to pay several hundred dollars. But as competition in this space develops, expect pricing to come down. But what is the market opportunity for this emerging segment?

Market Research firm In-Stat/MDR offers a clue, projecting the personal media player (or personal video player) segment will experience 700 percent growth in 2004, and an overall compound annual growth rate of 179 percent through 2008.

Gaining awareness and mind share among consumers will be a key success factor for the growth of personal media players. And an In-Stat/MDR survey conducted in late 2003 found

nearly 30 percent of respondents indicated they were familiar with these devices.

The Future of Portable Entertainment

Technologies on the horizon promise even more exciting options for consumers to take their video entertainment wherever they go. In the car, telematics – the technology allowing cars to wirelessly connect to outside content sources and services – may eventually deliver video content and games on-demand to passengers. But it is yet unclear when exactly the installed base of properly equipped telematics vehicles will reach critical mass for a profitable business model to emerge.

Video is also an extension of new technology radio in the car and before long providers may begin to add video content to their audio streams. Think music videos to go along with the CD-quality audio – or perhaps proprietary broadcasts from shock jocks.

On the personal video entertainment side, look for the personal media player market to continue to develop, with these devices sporting more features over time and supporting a greater variety of licensed video compression formats like Divx. We also may see portable DVD players form into video ‘iPods’ – complete with on-board storage for digital movie files. Imagine a catalog of hundreds of movies at your fingertips. Music consumption patterns are shifting in a decidedly digital direction and portable digital video is gaining momentum thanks to falling prices. New business opportunities like licensed digital music services are emerging and fostering purchase intent.

In turn, purchase intent for portable entertainment solutions among consumers is at levels conducive to industry growth. And as falling prices intertwine with new features and functions, expect even more consumers to embrace new digital solutions for portable entertainment. Without a doubt, portable entertainment is one category to keep an eye on. ■

HYBRID **White Goods**

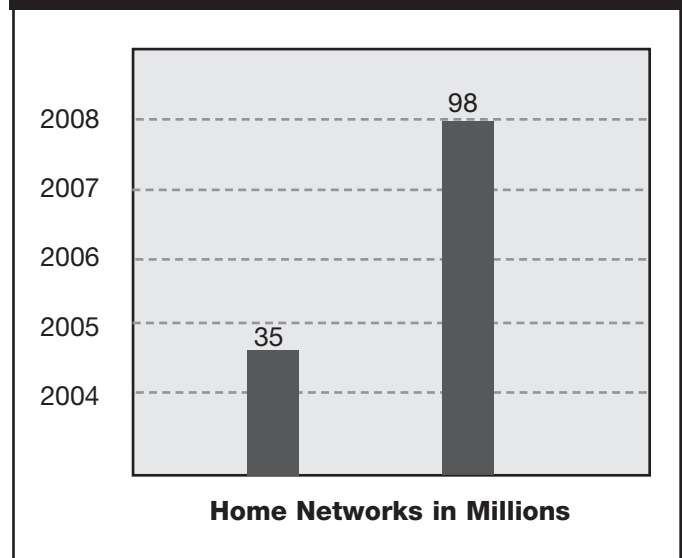
The American kitchen once was a place of hard labor. In the first half of the 20th century, family meals took hours to prepare with awkward devices. Early ovens released so much heat, that the kitchen was like a steam room. In recent years, however, families began to value speed in meal preparation. New inventions such as the microwave made cooking dinner a snap. Meals could be made quickly and easily to accommodate busy schedules.

Now, the American kitchen is about to take another step in its evolution. The need for speed coupled with the desire for old-fashioned 'home cookin' has led to the invention of several new products that could make the kitchen the center of the home. Called hybrid white goods, or simply the smart kitchen, the new category features such novelties as refrigerators that come with cable-ready TV screens, refrigerators that can monitor the shelf life of your in-box items; ovens that can download and execute recipes via the Internet; and even ovens that can be temperature-controlled during the day so they can store and eventually cook food via a cell phone request while you're still at the office.

The new appliances use a mix of old and new technologies, such as barcode readers to recognize food items in the fridge. But the engine of the smart kitchen is a broadband-equipped home network that connects all of the kitchen's products with the family's remote devices, such as a cell phone, pager, office computer or laptop.

The network permits a family member to order a smart kitchen device to begin a task regardless of his/her location. Despite the technological advances of a new product, such as the inventory-tracking fridge, the product's value is dependent on the broadband feature. So the growing demand for broadband in American homes has smart kitchen companies excited about the future. The rapid expansion of high-speed home networks and the rollout of smart kitchen appliances looks like a marriage destined for success.

Worldwide Home Network Growth



Source: InStat/MDR

InStat/MDR projects that 35 million homes worldwide will have home networks by the end of 2004. That number will jump to 98 million by 2008.

And the benefits to the average family are clear. Today's family is time-crunched, the prospect of making kitchen chores more efficient – and possibly even more edible – will likely be appealing.

“Our research shows that busy consumers still blame themselves when they cannot provide their families with home-cooked meals. Solving the food preparation dilemma would dramatically open up the market possibilities for us, especially since the kitchen is the command center of the home,” says Henry Marcy V, Whirlpool Corp.'s vice president for corporate technology and electronics. Whirlpool is a member of the Internet Home Alliance, which is promoting the concept of the smart kitchen.

A RECENT SURVEY BY THE INTERNET HOME ALLIANCE (IHA) SHOWS THAT 42 PERCENT OF U.S. SINGLE-FAMILY HOME- OWNERS (26.1 MILLION HOUSEHOLDS) ARE INTERESTED IN NEW TECHNOLOGY IN A CONNECTED HOME.

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InStat/MDR says that Asia, with its 45.4 million DSL subscribers, could be an attractive target market for smart home networks and products.

Like most new technologies, the smart kitchen industry has an imposing task of bringing the concept home, complicated by the fact that many kitchens are not easily adapted to digital technology. The industry also may need to ride on the coattails of the broadband industry. If high-speed Internet services do not expand at a steady rate, fewer consumers will be interested in the benefits of home networking and full-featured smart kitchens.

What are some of the tactical concerns facing the smart kitchen industry?

Strategic Issues

On the plus side, the smart kitchen industry already has conquered many of the problems that face a new technology. The industry, led by companies such as Whirlpool, IBM, Sears and Hewlett-Packard, has come together to resolve basic design issues. Unlike the music and video industries, the smart kitchen industry does not have to worry about conflicts over standards and proprietary software. This should accelerate the adoption of the technology when people begin to buy. Consumers will not be confused over whether one device works with another.

In addition, the industry has reconciled many development issues as well, thanks in part to a two-year long test program in selected homes. Organized by the Internet Home Alliance, a trade group dedicated to promoting broadband use at home, several companies have joined to offer their devices to consumers who are testing them for reliability and convenience.

A recent survey by the Internet Home Alliance (IHA) shows that 42 percent of U.S. single-family homeowners (26.1 million households) are interested in new technology in a connected home.

The industry still is facing stiff challenges in marketing and

installing smart kitchens nationwide. Despite the clear benefits, many consumers are intimidated by new technologies, particularly if they come attached to yet another new technology like home networking. Although many smart kitchen appliances do not require a broadband connection for basic service (Whirlpool's Polara oven, for instance, will keep raw food at the right temperature during the day so you can cook it instantly when you come home), it's the industry goal to connect all devices to permit remote access. Marketing campaigns for smart kitchen appliances often encourage consumers to consider the broadband option. Whirlpool, for example, now is testing an upgrade to let Polara owners control their ovens via a cell phone or the Net.

However, the industry has to be careful not to push too much on consumers too soon. As many network installers can attest, the average person who installs a home network merely wants to access the Internet on more than one PC in the home. Offers to create a more elaborate network that includes, for example, multi-room game playing are usually rebuffed.

As a result, consumers may hesitate if the smart kitchen appliance seems more complicated than it needs to be. The industry's growth could be slowed if companies put the cart in front of the horse.

A recent survey by the National Kitchen and Bath Association shows that the most popular trend in kitchen design is the inclusion of an entertainment area, including a computer and television.

Another obstacle: Many kitchens are older and can't easily be reconfigured for smart kitchen appliances. In some cases, size is an issue. The refrigerator or oven is simply too large for the consumer's space. In other cases, a home may not have the electrical capacity to handle a more sophisticated device. Or new wiring may be too costly.

This is one reason why the industry is targeting the new home category. Many homebuilders are pre-wiring the kitchen so the smart appliances with a broadband connection are in place before the owner moves in. Real estate and appliance officials

A RECENT SURVEY BY THE NATIONAL KITCHEN AND BATH ASSOCIATION SHOWS THAT THE MOST POPULAR TREND IN KITCHEN DESIGN IS THE INCLUSION OF AN ENTERTAINMENT AREA, INCLUDING A COMPUTER AND TELEVISION.

both hope that the smart kitchen becomes an added value in selling a new home, much like a backyard swimming pool or garage. The home theater industry is following a similar strategy.

In 2002, 57 percent of all new homes were sold with a refrigerator included, equaling one million refrigerators, according to the National Kitchen & Bath Association.

Key Players and Partnerships

The smart kitchen concept has captured the attention of both the electronics industry and companies that traditionally specialize in kitchen products. For instance, Samsung has introduced the "Home PAD Refrigerator," which detects the shelf life of food and automatically displays a list of items stored in the fridge on the door. Via an Internet connection, owners of the Samsung refrigerator can retrieve that information from a remote location. LG Electronics has launched a "TV Refrigerator," which includes a cable-ready, 13.5-inch TV screen, FM radio, two speakers and a TV tuner.

The industry believes that Americans are spending more time in the kitchen than ever before. So, officials contend, consumers are more interested in new devices and techniques to improve meal preparation. "The kitchen is fast becoming the family room for today's consumers and dinner is the one meal the entire family tends to spend together," says Simon Kang, president of LG's Home Appliance Division.

With that in mind, the Internet Home Alliance, a trade group created to promote home networking, has assembled an alliance of companies to participate in a pilot program called "Mealtime." The program, which includes HP, IBM, Sun, Best Buy, Sears, Roebuck & Co., Whirlpool and Icebox, is a real-world test that permits consumers across the country to use the latest devices for meal-preparation and other kitchen chores.

Twenty Boston area homes recently were part of a six-month long test. The Mealtime program provides the industry with invaluable research on what consumers want and why, what the devices should look like and how they should operate. The program is costly, but the research could help the industry accelerate the adoption rate.

The program began in 2003 and includes an Internet-enabled refrigerator and oven, an entertainment center and WAP (wireless application protocol) cell phone. For the past year, consumers have been using the devices to control the kitchen appliances from both home and remote locations. Company officials believe the testing will provide better data to design and market the concept of the smart kitchen.

"What we learn from the Mealtime pilot will drive much of what we do in terms of future product development," says Marcy of Whirlpool Corp. "When it comes to home technology products and services, consumers are going to buy solutions so collaborative testing, like the Mealtime pilot, which includes companies from across the value chain, is becoming one of the most critical parts of today's consumer research equation."

In 2002, new homebuilders installed 1.7 million ranges, cooktops and ovens. In the same year, consumers purchased six million ranges, cooktops and ovens according to the National Kitchen and Bath Association.

Consumer and Business Perspectives

Like the introduction of the microwave, the smart kitchen appears to be a concept that's right for the time. Because in many American families, both parents work fulltime, research indicates that consumers are receptive to products that will improve their meals without adding preparation time.

However, before the smart kitchen becomes a household staple, the industry must hurdle four major obstacles:

1. Prices

Most new devices, such as the Internet-enabled fridge, cost at least \$2,000 each. If you add a home network, the cost for a smart kitchen can run anywhere from \$10,000 to \$20,000. For many consumers, that price exceeds the prospect of greater convenience. The industry is eager to install smart kitchens in new homes to soften the sticker shock. Consumers are more likely to accept the expense if it's included in the cost of the home rather than a separate appropriation in an existing home. Prices will come down, of course, but will remain an obstacle for many consumers for several years.

2. Space

Many consumers, particularly in urban areas, have small, cramped kitchens that do not permit the installation of a smart network. In these residences, the kitchen is only a place to store and cook food quickly and not a family room, as LG's Kang suggests. Therefore, particularly in the early stages, the industry must target the luxury home and new home markets.

3. Fear

If price and space can be eliminated, the industry still must overcome the average consumer's fear of new technology. Many people are intimidated and confused by new products. The idea that your refrigerator could be connected to the Internet may overwhelm some consumers. The industry needs to communicate the benefits in ways that demonstrate how technology makes life simpler and more efficient.

4. Broadband/Home Networks

Although many devices can operate minus an Internet connection the industry's Holy Grail is the wired kitchen. With a home network, consumers will be more likely to buy multiple products and pay to have them connected. However, the growth rate of home networking is steady rather than dramatic. The industry needs to invest in marketing programs designed to persuade more Americans to get high-speed Internet services and home networks.

Distribution

There are three major distribution channels to bring smart kitchen products to the home.

1. Traditional Retail

Stores such as Best Buy (or kitchen appliance dealers) will sell individual products, such as Web-enabled refrigerators and ovens, either at retail or online.

2. Home Network Packaging

Home network installers will purchase the devices and install them as a package for an individual customer.

3. New Home Packaging

Like the network installers, new homebuilders will purchase smart kitchen products and add their expense into the final cost of the home. ■

INNOVATIVE **Gaming**

When it comes to playing electronic games, Americans are quite serious. Indeed, the latest consumer research from the Entertainment Software Association (ESA) shows that about half of all Americans over the age of six now play computer and/or video games. Some 35 percent of U.S. households have at least one video game console, according to the most recent CEA surveys. And about 35 million consumers flock each month to such popular online gaming destinations as the Yahoo, America Online and Pogo websites to play games for free or a fee. In 2003, some 56 percent of Americans under the age of 45 planned to buy at least one computer or video game.

Thanks to such developments, U.S. computer and video game software sales amounted to \$7 billion last year, more than double the total just eight years earlier. Software developers sold more than 239 million computer and video games last year, or nearly two games for every U.S. household. Console software, portable game hardware and portable game software all posted double-digit increases in unit sales. Online-capable console video games alone scaled \$1 billion in U.S. sales for the first time last year.

Overall, the entire gaming industry, including conventional video game consoles, handheld consoles and other equipment and software, generated \$11.2 billion in U.S. sales last year, just 4 percent off the record \$11.7 billion in 2002, according to the NPD Group. That makes gaming bigger than the Hollywood film industry. On a worldwide scale, gaming industry sales topped \$25 billion in 2003. Now a new crop of handheld and wireless games promises to drive gaming sales even higher.

In another sign of Americans' seriousness about gaming, the average U.S. game player turns out not to be some pimply teenage boy. Rather, the average player actually is a far more mature 29-year-old, the ESA found in its latest annual consumer survey. The average game buyer clocks in even older at 36 years of age. Moreover, the ESA discovered, 94 percent of computer game buyers and 84 percent of console game buyers are older than 18 years old.

Annual Growth in U.S. Electronic Game Sales

Year	Dollars (in millions)
1995	\$3,200
1996	\$3,700
1997	\$4,400
1998	\$5,500
1999	\$6,100
2000	\$6,020
2001	\$6,350
2002	\$6,900
2003	\$7,000

Source: The NPD Group, January 2004

Annual Growth in U.S. Electronic Game Sales

Year	Units (in millions)
1996	105
1997	133
1998	181
1999	215
2000	219
2001	225
2002	224
2003	239

Source: The NPD Group, January 2004

A Gaming Technological Primer

Electronic games come in many different sizes and shapes, if not colors. The most popular are still the traditional console video games, which are in an estimated 35 percent of American homes. Game players simply plug the consoles into their family room, living room or bedroom TV sets. Sony, Microsoft and Nintendo split the console market, with Sony the dominant player in the current generation of online-enabled set-top boxes. U.S. consumers bought 186.4 million titles for console play last year, producing \$5.8 billion in sales. A record number of console video games, 49, sold more than 500,000 units apiece.

Computer or PC games make up a small but notable segment of the gaming market. U.S. consumers bought 52.8 million software titles for play on their computers last year, generating \$1.2 billion in sales, down 14 percent from the prior year. Computer games tend to attract an older, more family-oriented crowd than console games, with strategy and children's entertainment titles proving to be the most popular.

Online games constitute another small, but rapidly growing, part of the overall gaming universe. Although largely disdained by serious gamers until recently, the online market has been gathering steam largely because of growing consumer interest in such basic, low-tech "casual" games as bingo, poker, puzzles, trivia and board games, as well as digital slot machines. As a result, the Yahoo and AOL advertiser-supported gaming sites each attract 10 million users per month while Electronic Arts' Pogo site draws 14 million users a month. At the same time, sales of online-capable video games surpassed \$1 billion for the first time last year, up 167 percent from 2002, as both Xbox and PlayStation 2 made inroads in this area.

Portable and wireless games form the fourth and final piece of the growing gaming puzzle. Traditionally dominated by Nintendo with its ubiquitous Game Boy devices, the market segment is now seeing serious new competition emerge from such companies as Nokia and Sony. Nokia already has introduced its basic N-Gage model, a cell phone that doubles as a

portable gaming device, while Sony plans to unveil its PlayStation Portable (PSP) device in Japan in the fall and the U.S. in the winter. Not to be outdone, Nintendo intends to launch its new, advanced Game Boy DS device later this year.

Rise and Fall of U.S. Electronics Game Sales

Year	Dollars (in millions)
1995	\$1,600
1996	\$1,650
1997	\$1,980
1998	\$2,250
1999	\$2,700
2000	\$3,250
2001	\$3,700
2002	\$3,500
2003	\$3,000

Sources: *The NPD Group, January 2004*

Strategic Issues

Gaming is a highly cyclical industry. With new growth heavily dependent on the success of its three main types of video game consoles, the industry's fortunes largely rise and fall on the performance of Sony PlayStation 2, Microsoft Xbox and Nintendo GameCube. So, as all three platforms age and console prices drop from a height of \$299 to \$149 and less, gaming hardware and software sales are bound to dip until the three big players introduce the next generations of their console boxes.

Not surprisingly, then, total U.S. gaming industry sales slipped 4 percent to \$11.2 billion last year after hitting a record \$11.7 billion in 2002, according to the NPD Group. Likewise, console industry sales fell 2.7 percent from \$10.3 billion to \$10 billion.

THE ESTIMATED \$1.7 BILLION PORTABLE GAMING MARKET SHOULD GET A NICE LIFT BY THE WINTER AS SONY INTRODUCES ITS EAGERLY AWAITED PSP DEVICE AND NINTENDO ROLLS OUT ITS GAME BOY DS HANDHELD.

Significantly, console hardware saw the largest percentage drop of any category, posting a 27 percent decline in dollar volume. If console software sales and portable game hardware and software sales hadn't risen at the same time, total industry sales would have fallen off even more sharply.

The downward trend is continuing this year. In May, the NPD Group reported that total U.S. retail sales for the console and portable game industry slid 1 percent to \$1.8 billion in the first quarter of 2004. The drop came despite a 5 percent rise in overall unit sales. Console hardware and portable game software showed the biggest dollar declines, falling to \$336 million and \$157 million, respectively, from \$445 million and \$167 million in the same period a year earlier.

"Shipments are definitely going down for the consoles," says Schelley Olhava, a senior industry analyst at IDC. She expects to see console shipments continue to decline until 2007, after Sony, Microsoft and Nintendo bring out the next versions of their console platforms. "The problem with consoles is that they're in kind of a holding pattern right now," Olhava notes. "We are in the latter half of the console cycle."

As of press time, it was not clear when Sony, Microsoft and Nintendo would unveil their next-generation consoles. Some industry analysts were still betting that the console manufacturers would make that move in time for the 2005 holiday shopping season. But others believe that the new machines won't make their debut until 2006. "Right now, it's still up in the air," says Richard Ow, a senior industry analyst at the NPD Group.

Like any maturing industry, gaming also faces the challenge of spurring fresh growth. With console game hardware sales drooping and console software sales barely climbing, the industry must find other ways of boosting its revenue totals.

That's where such promising areas as online gaming and portable gaming come in. For instance, the estimated \$1.7 billion portable gaming market should get a nice lift by the winter as Sony introduces its eagerly awaited PSP device and Nintendo rolls out its Game Boy DS handheld. In addition, Nokia is coming out with its more advanced N-Gage QD and a fourth player, Tapwave Zodiac, is entering the market.

"What Nokia did is just the first step, bringing the cell phone and portable gaming together," Ow says. He expects to see such new portable gaming devices as the PSP expand the market for handhelds by broadening the demographic reach beyond teenagers and young 20-somethings. Olhava agrees. "The launch of handheld systems should temper the downward decline" of the overall gaming market, she says.

Likewise, the online gaming market should receive a healthy boost from the growing horde of casual gamers flocking to the Internet, especially because many of these users have not been drawn to more conventional video games. In particular, online casual games are hooking women over the age of 35, a far cry from the stereotypical young male that has always been seen as the industry's target audience. "There's this huge number of people playing casual games," Olhava says. "I think it's a really compelling area of the market."

Year-To-Year Changes in Q1 U.S. Gaming Industry Sales	
Category	Dollar Sales
Console Game Hardware	-25%
Console Game Software	+7
Console Game Accessories	+10
Portable Game Hardware	+8
Portable Game Software	-6
Portable Game Accessories	+8

Source: The NPD Group, April 2004

**IN-STAT/MDR PROJECTS THAT THE TOTAL ONLINE GAMING MARKET
WILL NEARLY QUADRUPLE FROM SLIGHTLY MORE THAN \$1 BILLION
IN 2003 TO ALMOST \$4 BILLION BY THE END OF 2008.**

Growth in Online Games	
Year	Portion of Gamers Who Play Online At Least One Hour Per Week
2002	31%
2003	37
2004	43

Source: ESA, May 2004

Forecasts

For gaming analysts, the big question is when the industry’s three hardware heavyweights – Sony, Microsoft and Nintendo – will introduce their next round of video game consoles. With that question still unanswered, the prices of the current consoles still falling and software prices also coming down, analysts generally expect overall industry sales to stagnate or slide for at least another year or two.

At IDC, for example, Olhava sees worldwide gaming industry sales creeping up just 1.8 percent to \$28.3 billion this year while North American sales slip 1.2 percent to \$13.7 billion. She then forecasts double-digit percentage declines in 2005 and 2006 for both worldwide and North American sales before renewed growth in 2007. “This is not atypical of the industry,” she says. “It’s actually fairly standard.”

Beyond the console market, though, the projections are both more bullish and less cyclical. That’s particularly true for such potentially lucrative new areas as online, wireless and portable gaming.

Take online gaming. In its latest forecast in July, the Yankee Group predicts that online gaming sales and subscription revenue will triple from \$353 million to \$900 million today to \$1.1 billion in 2008. The market research and consulting firm argues that online games “will stabilize and supplement revenue from PC and console games.”

Similarly, Olhava sees online PC gaming revenues doubling from \$648 million this year to \$1.4 billion in 2007. Notably, casual games could end up contributing the largest chunk of that total. DFC Intelligence, another market research firm, projects that there will be more than 100 million casual gamers worldwide by the end of this year, as opposed to just 5 million players of such higher-tech online games as Xbox Live.

Even more bullishly, In-Stat/MDR projects that the total online gaming market will nearly quadruple from slightly more than \$1 billion in 2003 to almost \$4 billion by the end of 2008.

While about a sixth of the U.S. population now plays games online, In-Stat estimates, that number will soar to nearly half the population over the next four years.

Consider wireless gaming as well. IDC projects that the number of wireless gamers will more than quadruple from 7.9 percent of all U.S. mobile phone users in 2003 to 34.7 percent by 2008. That translates into 65.2 million wireless gamers just four years from now. And most of those mobile gamers may be women. In its latest mobile entertainment survey in July, the Yankee Group found that women make up 58 percent of U.S. wireless gamers.

Key Players and Partnerships

On the hardware side of the business, the key players are clearly the Big Three console and portable game manufacturers – Sony, Microsoft and Nintendo. Together they’ve controlled nearly the entire \$4 billion-plus hardware market for the past three years, with the departure of Sega’s Dreamcast machine in 2001. But now a fourth player, cell phone king Nokia, is seeking to join their ranks, at least on the portable end. And Sony, like Nokia, is about to enter the handheld market long dominated by Nintendo. Here’s a rundown of these four major rivals.

Sony is the leader by far in the traditional console business. Its wildly popular PlayStation 2 model, which is several years old, is now in at least 24 million North American homes and at least 60 million homes across the globe, according to IDC figures for the end of 2003. Even Microsoft’s acclaimed Xbox

machine doesn't come close to matching these numbers. Now Sony, not content to rest on its laurels, is taking a leaf from Microsoft's book by equipping all its PlayStation 2 machines with built-in network adapters for going online.

Microsoft, which entered the video game business with much fanfare three years ago, remains a strong, if somewhat distant, challenger to Sony. Its Xbox machine now is in at least 8.6 million North American homes and at least 13.4 million households worldwide, according to IDC. Plus, Microsoft's Xbox Live service, a broadband-oriented online gaming platform introduced two years ago, has corralled about 1 million paying subscribers and is expected to approach 2 million by year-end. But, in a sign of serious gamers' continuing resistance to online play, that total is still well below Microsoft's original projections.

Nintendo, which largely caters to younger game players than Sony and Microsoft, competes against those two in the console game market with its GameCube system. But the market that Nintendo rules is portable gaming, where its Game Boy models have been the industry standard for more than a decade. Nintendo aims to build on that base this fall with the release of its Game Boy DS, an advanced handheld device that will allow gamers to communicate with each other by wireless signals.

In the most spirited challenge to Nintendo in years, however, Nokia is taking dead aim at the same market. The large Finnish cell phone maker introduced its own handheld gaming device, N-Gage, as an advanced phone model last year. That first, high-end version has not sold particularly well, ending last year with fewer than 300,000 buyers worldwide, because of its relatively high price (initially \$299), awkward shape and other problems. But Nokia isn't giving up so easily. In July, it planned to launch a new version, N-Gage QD that will supposedly correct a lot of the problems with the original model.

"It's tough to compete in the videogame market and the cell-phone market," Ow notes. "It's really about trying to turn a Game Boy into a cell phone and I'm not sure the market is into

that." But he and other analysts do see Nokia carving out a decent slice of the market over time.

At the same time, Sony plans to enter the handheld market as well with its new PSP model. Analysts generally expect the PSP to be a high-end portable device aimed at an older market than Game Boy's target audience of teenagers. With Sony's brand name and an abundance of games, analysts believe it will make a big dent in Nintendo's market dominance.

Olhava, for instance, predicts that Sony will capture as much as one-third of the worldwide handheld market next year while Nintendo holds onto more than half and Nokia ekes out up to 10 percent. "We expect Sony to drive some presence in the market," she says. "We think they'll end up kind of splitting the market a bit."

Installed Units of Video Game Systems (through end of 2003)

Year	North American Installs	Worldwide Installs
Sony Playstation 2	24.1 million	60 million
Microsoft Xbox	8.6 million	13.4 million
Nintendo Game Cube	6.7 million	13.3 million
Nintendo Game Boy & SP	19.5 million	45.7 million

Source: IDC

On the software side, the major console videogame players are such game designers as Electronic Arts, Nintendo of America, Rockstar Games, Activision and Atari. In the PC videogame arena, Electronic Arts dominates the software field, with seven of the top 10 selling games last year. Other sizable players are Vivendi Universal Publishing, Activision and Microsoft.

Top Selling Games of 2003 (Top 10 Console Video Game Titles)

Platform/Title	Publisher	Release Date
1. PS2/Madden NFL 2004	Electronic Arts	Aug. 2003
2. GBA/Pokemon	Nintendo	March 2003
3. GBA Pokemon Sapphire	Nintendo	March 2003
4. PS2/Need Speed: Underground	Electronic Arts	Nov. 2003
5. GCN/Zelda: TheWind Waker	Nintendo	March 2003
6. PS2/Grand Theft Auto: Vice	Rockstar Games	Oct. 2002
7. GCN /Mario Kart: Double	Nintendo	Nov. 2003
8. PS2/ Tony Hawk UnderGround	Activision	Oct.2003
9. PS2/ Enter The Matrix	Atari	May 2003
10. PS2/Medal HonorRising	Electronic Arts	Nov. 2003

Top Selling Games of 2003 (Top 10 PC Video Game Titles)

Platform/Title	Publisher	Release Date
1. WIN/The Sims: Super Star Expansion Pack	Electronic Arts	May 2003
2. WIN/The Sims Deluxe	Electronic Arts	Sept. 2003
3. WIN/Command & Conquer:Generals	Electronic Arts	Feb. 2003
4. WIN/ Warcraft III:Frozen Throne Expansion Pack	Vivendi	June 2003
5. WIN/The Sims: Makin' Magic Expansion Pack	Electronic Arts	Oct. 2003
6. WIN/The Sims Unleashed Expansion Pack	Electronic Arts	Sept. 2002
7. WIN/Sim City 4	Electronic Arts	Jan. 2003
8. WIN/Call of Duty	Activision	Oct.2003
9. WIN/ MS age of Methology	Microsoft	Oct. 2002
10. WIN/Battlefield 1942	Electronic Arts	Sept. 2003

Source: The NPD Group, January 2004

THE YANKEE GROUP FOUND THAT WOMEN MAKE UP 58 PERCENT OF U.S. WIRELESS GAMERS.

Top Selling Game Genres in 2003	
Console Games	
Action	27.1%
Sports	17.6
Racing	15.7
Roleplaying	8.7
Computer Games	
Strategy	27.1%
Children	14.5
Shooter	13.5
Family Entertainment	9.5

Source: The NPD Group, January 2004

Consumer Perspectives

Clearly, American consumers love their electronic games. Research studies prove this. The question is how, much?

The answer is a lot. As stated at the beginning of this report, the ESA's latest consumer research shows that about half of all Americans over the age of six play computer and/or video games. In fact, electronic games appear to be a staple of many Americans' entertainment diet, with the average player spending about six hours a week indulging in games. About half of all gamers say they are watching less TV and fewer movies because they're spending more time playing games.

In yet another sign of gaming's popularity, some 35 percent of U.S. households have at least one videogame console, according to the most recent CEA survey. A combined 35 million consumers flock each month to three popular online gaming destinations – the Yahoo, America Online and Pogo websites – to play games for free or a fee. Some 56 percent of Americans under the age of 45, and 41 percent of all Americans, planned to buy at least one computer or video game last year. So did 63 percent of all parents.

Although known primarily as the pursuit of the young, gaming

appeals broadly to all age groups. In the ESA's latest survey, some 17 percent of game players now are over the age of 50, up from 13 percent in 2000. Moreover, the ESA found that 94 percent of computer game buyers and 84 percent of console game buyers are older than 18 years old. And 26 percent of those between 55 and 64 planned to buy at least one game last year.

Consumers Planning to Buy Electronic Games in 2003	
All Americans	41%
Parents	63
Under 45	56
45-54	37
55-64	26

Source: ESA, January 2003

Defying conventional wisdom again, gaming also attracts members of both sexes. While men and boys make up 75 percent of console game players in the ESA survey, women and girls now account for 40 percent of online gamers and a surprising 39 percent of all gamers. In fact, women age 18 and older make up a larger chunk of the gaming population – 26 percent – than boys between the ages of 6 and 17, who make up 21 percent of all gamers. Also such casual gaming sites as Pogo.com attract more women than men. Plus, women account for 58 percent of all U.S. wireless players, according to the Yankee Group.

Business Perspectives

If there's one issue that consumes industry executives, it's the shifting demographics of the gaming audience. As America has gotten grayer over the last few years, so has the average game player, driving advances in technology, game design and marketing approach. Content regulation and piracy also have grown as threats to the industry's prosperity, as the federal government has focused on the impact of an entertainment medium with such broad appeal.

UNIVERSAL DOWNLOADS MAY LEAD TO THE RISE OF EPISODIC GAMING, ALLOWING PLAYERS TO UNLOAD EPISODES OF THEIR FAVORITE TITLES JUST AS THEY NOW WATCH EPISODES OF THEIR FAVORITE TV SHOWS.

In a keynote speech at the 10th annual E3 show in Los Angeles in May, ESA President Douglas Lowenstein predicted that tomorrow's gamers will be older, more sophisticated and more discriminating about the games they play. At the same time, he said, there "will be a leveling off of technological advances," with "less and less room to make games look and sound more realistic because photo-realism will be the norm."

As a result, Lowenstein argued, players will be seeking more creativity, depth and interactivity from game developers and publishers. They'll want more original content and fewer

other words, game designers and publishers won't be able to get by just making games that appeal to their friends and fellow developers."

Lowenstein also predicted that game distribution through direct downloads from the Internet will become "ubiquitous" by 2014. He sees game publishers adapting to this reality by digitally distributing smaller game modules, expansion packs and full games. He also believes that universal downloads may lead to the rise of "episodic gaming," allowing players to unload episodes of their favorite titles just as they now watch episodes of their favorite TV shows.

In addition, the ESA chief sees online gaming, long viewed as the future of the industry, finally realizing that ambition. He particularly rhapsodizes about the rise of community-based games like SOCOM and Rainbow Six, local game centers and "social gaming." In his keynote speech, he spoke of the potential of "massive online communities" to draw gamers together in a universe of "shared experiences and relationships."

Finally, Lowenstein believes that mobile and handheld gaming will take off over the next 10 years. Once all the current standards, compatibility, data rate and network speed issues are resolved, he envisions the development of "a new kind of

Demographics of Game Players	
Console Game Players	
Male	75%
Female	25%
Under 18	46%
18-35	35%
36-45	11%
Over 46	8%
Computer Game Players	
Male	61%
Female	39%
Under 18	36%
18-35	26%
36-45	14%
Over 46	25%

Source: ESA, May 2004

licensed titles. They'll crave more complex storylines and greater character development. They'll demand better graphic user interfaces and more advanced use of music, other sound and artificial intelligence.

"Thus, the developers and publishers who prosper in the next decade will be those who dare to break out of their comfort zones to create new kinds of games that meet the full range of diverse tastes populating the market," Lowenstein said. "In

Ratings of Electronic Games Sold	
Ratings	Percentage
(E) Everyone	54%
(T) for Teen	30.5%
(M) for mature	4.9%

Source: ESA, May 2004

smart phone, with built-in GPS, that allows for the creation of mobile games that depend heavily on social contact, communication and community. People may buy or upgrade phones just to play the game that their friends are telling them about."

Whatever the future brings, Americans will still be playing plenty of games. Indeed, in the ESA's latest survey on the subject, 53 percent of all players say they will be engaging in video and computer games 10 years from now as much as or more than they do today. So let the games go on. ■

5

TELEMATICS – A Superconductor for CE

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It's Saturday afternoon and you've just completed a shopping sweep through the local mall. Encumbered with boxes and bags, you arrive at your car only to realize the keys are locked inside. What to do now? Thankfully, your vehicle has a telematics system and with a quick call to your Telematics Service Provider (TSP) your car doors are unlocked remotely by a beam sent from an orbiting satellite. Although this scenario may sound like a passage from a sci-fi novel, it's not. This is telematics technology at work today.

What is Telematics?

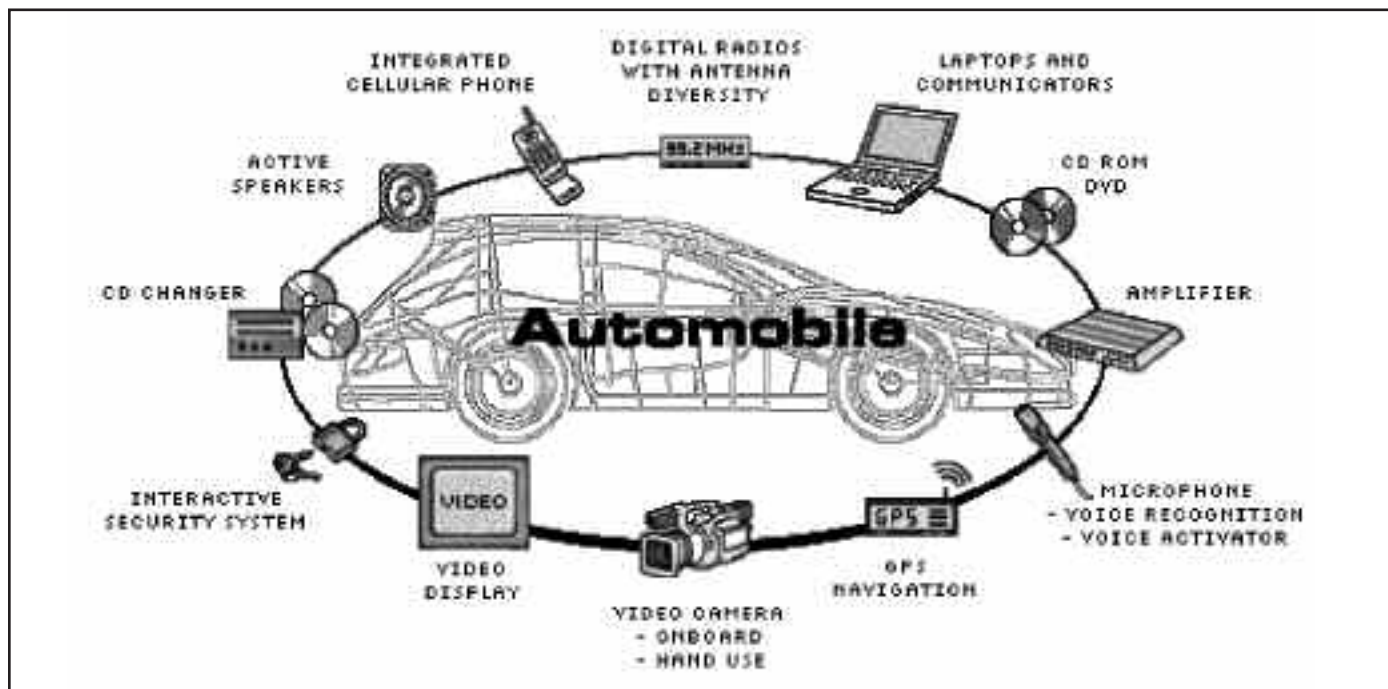
Put simply, telematics enables a vehicle to wirelessly connect to the outside world. But the term has taken on new meanings as in-vehicle networks and consumer electronics have begun to increasingly merge and intersect.

Telematics can refer directly to the electronics 'embedded' in vehicles that enable them to wirelessly exchange information (such as voice, data and other content) with external sources.

Subscription-based services such as emergency response centers (like OnStar) have developed from the implementation of in-vehicle telematics. CEA research shows that most consumers are aware of this form of telematics and telematics-based services like OnStar. But adoption of this form of telematics is still in the early stages.

A New Definition For Telematics

Today's cars are tantamount to computer networks on wheels and the number of mobile CE devices being brought into the car has steadily increased. Wireless phones, PDAs, satellite radio shuttles, MP3 players and mobile navigation units are among the many mobile CE devices used in vehicles today. Telematics systems have evolved to provide a hands-free interface between properly equipped mobile CE devices and the vehicle. This functional evolution has expanded telematics to include facilitating the connection of mobile devices to the in-vehicle network.



Source: MOST Cooperation

Before long, all vehicles will likely feature some form of telematics as standard equipment even if they are not directly accessible to the driver or passenger. For example, telematics could serve exclusively as a diagnostic tool for mechanics or insurance professionals (imagine an automotive black box that can transmit its data).

Industry observers are betting that a vast portfolio of information and entertainment services will quickly begin to form around this technology making the car an even more catalytic environment for consumer electronics; effectively turning the vehicle in to a mobile wireless hub in the ever-expanding CE network. While the deployment of these services is almost certain, it remains unclear who exactly will get the business – automotive OEMs or the aftermarket?

For years, the car has been a crossroads for CE products, but it is important to understand that telematics brings the vehicle itself into the CE fold – allowing it to interface directly with CE devices and become a conduit for wireless communication, entertainment, information, navigation and emergency services. Telematics has the potential to add to the functionality, ease-of-use and enjoyment of CE devices brought into the car.

The Birth of Telematics

Ford Motor Co.'s 'Rescue' service pioneered the telematics market in 1997 with an embedded unit providing emergency response services. In the following year, General Motors debuted its OnStar service; thereafter, the adoption/implementation of telematics by automakers quickly expanded.

According to Telematics Research Group, telematics now are available on more than two-dozen brands of vehicles sold in North America and the number of new cars with this technology continues to rapidly increase.

Help at the Touch of a Button

Telematics services in the U.S. were limited to emergency services initially with a monthly monitoring fee around \$20. As the

telematics market developed, service providers sought to enhance the value proposition of telematics services by adding other benefits such as concierge services and integrated wireless phones – for additional fees. With the push of a button inside the vehicle, or a phone call, drivers could access these services – as long as they were subscribers.

To recoup costs, pioneering carmakers that offered telematics systems, bundled the technology at the trim level or in optional equipment packages. This practice effectively rolled the price of telematics, and the price of a one-year subscription, in with other features like power seats and mirrors, on-board navigation and/or enhanced audio systems. Car manufacturers still employ this strategy, even though declining prices for telematics systems have made it less of a necessity.

This approach has increased the U.S. installed base of vehicles equipped with telematics over the years, but since many consumers purchased telematics as part of a bundle of features, it is a stretch to consider that all these buyers are early-adopters of telematics. A more realistic view portrays those buyers who renewed their telematics service subscriptions after the first year as true early adopters of the technology. According to analysts, the number of telematics early adopters was initially small, but adoption rates have increased as more consumers renew telematics services. Telematics, however, still is in the early adoption phase of development.

Telematics Integrates Mobile Devices

The simpler form of telematics allowing a HFI (hands-free interface) for mobile devices (like wireless phones and PDAs) through a connection with the vehicle began to appear a few years ago in higher-priced autos such as luxury cars and SUVs. Some of these connections were made wirelessly through Bluetooth-enabled devices, while some required docking the device. This functionality was embedded in the vehicle and did not require a subscription fee since services were not attached.

A HOST OF CE PRODUCTS EVENTUALLY WILL BE ABLE TO CONNECT INTO THE VEHICLE AND ACCESS OUTSIDE CONTENT THROUGH THE SYSTEM.

This form of telematics is growing rapidly in today's market. Analysts agree that HFI phone solutions through telematics could eventually become the basic minimal level of functionality for this technology in future vehicles.

A Superconductor for CE

From its infancy as a push-button for wirelessly summoning emergency services, telematics has quickly developed into a more comprehensive in-vehicle system capable of delivering two-way wireless services.

Enabling a control interface for a mobile device is a basic function of telematics systems, but many of these systems also include an embedded control unit that opens up true two-way wireless communications. It is this functionality that industry observers call true telematics.

It is here that telematics' superconductivity for CE products begins to manifest itself and the possibilities are nearly endless. A host of CE products eventually will be able to connect into the vehicle and access outside content through the system.

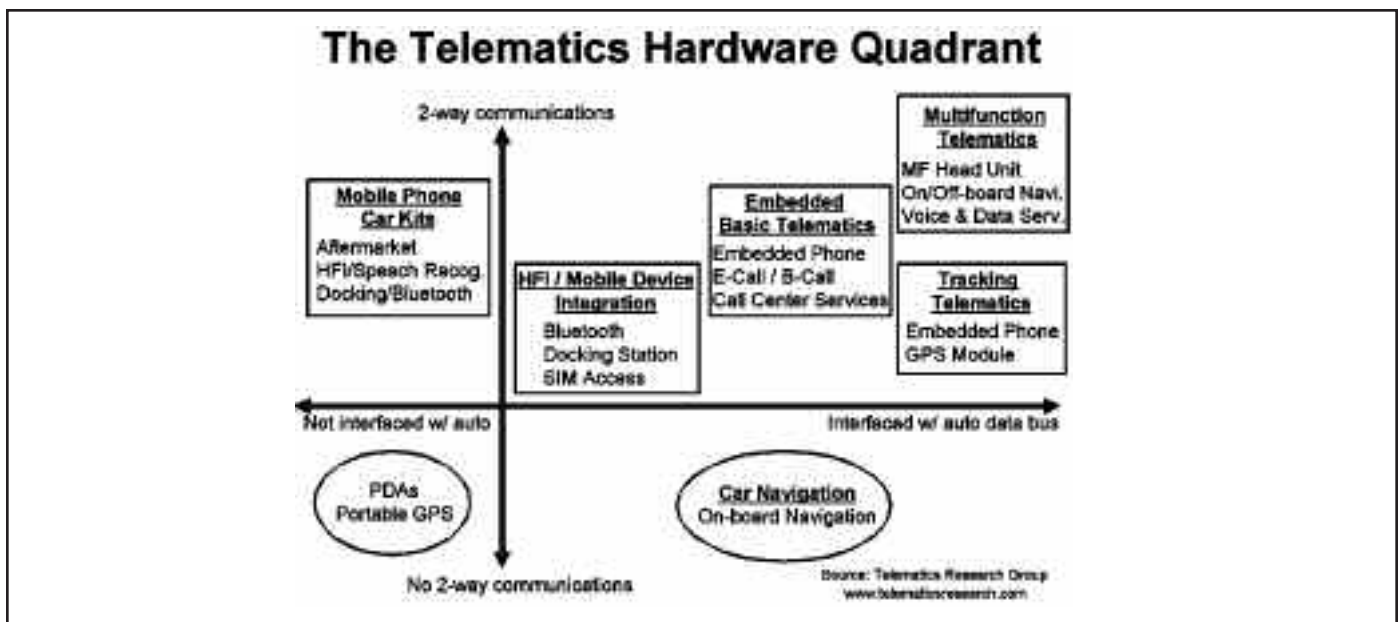
For example, telematics systems can enable off-board navigation systems (where navigation information is beamed to the vehicle instead of scripted from a CD or DVD) through a factory-installed navigation unit or a mobile GPS device. Or telematics could be used to download digital music directly to a car stereo receiver or a mobile digital music player through a wireless broadband connection. Rear-seat entertainment also benefits as telematics enables video and interactive games to be wirelessly piped into the car.

The future for telematics is bright and CE products have a significant role to play. But what challenges lay ahead?

The Rising Tide of Telematics

The telematics business is moving in a number of different directions with the ultimate goal of meeting demand – be it for telematics-based services or wirelessly enabling a host of mobile CE devices brought into the car.

Telematics Research Group envisions the telematics industry stretching across the axis between two-way communications



CONSUMERS ARE MORE WILLING TO OPEN THEIR WALLETS FOR ENTERTAINMENT CONTENT AS OPPOSED TO SAFETY FEATURES.

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and interfacing with the vehicle network. While some mobile CE devices will likely continue to operate independently from the vehicle network, the aftermarket is already at work to enable hands-free interfaces for mobile CE products (like wireless phones) or even gateways into the vehicle network. On the OEM side, CE products like cell phones and navigation devices rapidly are being integrated into the vehicle through technologies embedded in the vehicle network itself. This activity is opening more opportunities for telematics services, but are consumers ready?

Telematics Services Evolving

While the technology for telematics has become increasingly affordable for automotive OEMs to implement into their vehicles, service providers have struggled to find a profitable business model for telematics services.

Allied Business Intelligence Inc. suggests the market for telematics has failed to develop momentum because service providers have not yet delivered meaningful content at a price point palatable to most consumers. Positioned another way, the market for telematics services has a low perceived value among consumers that is exacerbated by high subscription fees that often start at \$20 per month for emergency assistance services only.

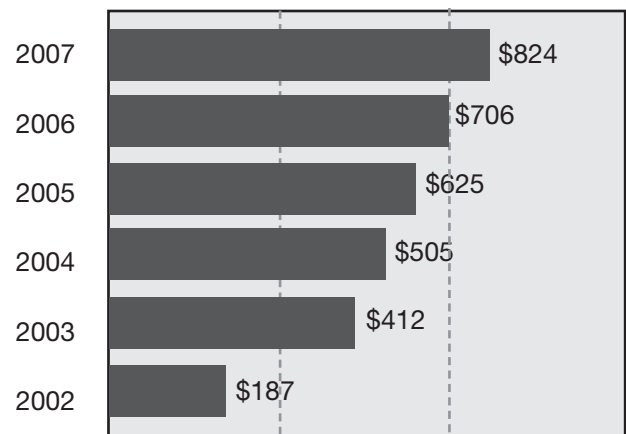
While the attach rate of embedded telematics in new vehicles sold in the U.S. has steadily risen over the past several years – principally from the efforts of General Motors – many consumers do not continue their telematics service after the initial 12 month subscription, analysts say. A study conducted this year by Allied Business Intelligence Inc. found retention rates are highest among owners of luxury vehicles. The study says security applications are the most popular features at present, but they aren't very profitable.

Frequently the cost for the first year of emergency monitoring telematics service is rolled into the price of the vehicle. The challenge for service providers is convincing consumers to continue paying for an emergency monitoring service that hopefully they'll never have to use. To counteract this trend, expect providers to explore ways to lower monitoring costs. For exam-

ple, Frost and Sullivan expects the automation of services through speech-recognition and text-to-speech technologies will reduce subscription fees after 2006.

To boost their value proposition, telematics service providers have ponied-up more services such as concierge assistance and a suite of premium services like integrated, voice-activated wireless phone service and voice portals. Voice portals allow users to access custom sets of information like news, weather, sports scores or stock prices that are set-up through an online user profile created by the driver. These services rate very high on the 'gee-whiz' scale, but once again high prices have curbed broad adoption among consumers, analysts indicate.

Mobile Theater Forecast



Aftermarket Shipment Revenues in Millions

Source: CEA Market Research

However, emergency services and embedded wireless phones may not be enough to fuel the business model for telematics services. What features might help improve customer retention and increase consumer adoption of telematics services?

The Road Ahead

Entertainment may be a key driver for the future of telematics. Strategy Analytics believes consumers are more willing to open

their wallets for entertainment content as opposed to safety features. Entertainment features might include TV, movies and games that could all be wirelessly piped into the vehicle through the telematics system.

Existing telematics services like GM's OnStar or Mercedes-Benz's TeleAid could augment and enhance their current service offerings to include entertainment content, but increasing support for the MOST (Media Oriented Systems Transport) standard among vehicle manufacturers could create a significant opportunity in this arena for the aftermarket as well.

With a gateway into the vehicle network, the aftermarket could likely use the vehicle's telematics system to receive and distribute content services, like entertainment or productivity services, within the vehicle. This could stimulate aftermarket demand for in-car video displays, multi-function head units and plug-and-play command and control devices as consumers seek to upgrade existing vehicles to take advantage of these services. The potential gain from in-vehicle entertainment would affect the entire aftermarket value chain – from manufacturers to service providers to retailers and installers.

Aftermarket Impact – Mobile Theater, Navigation

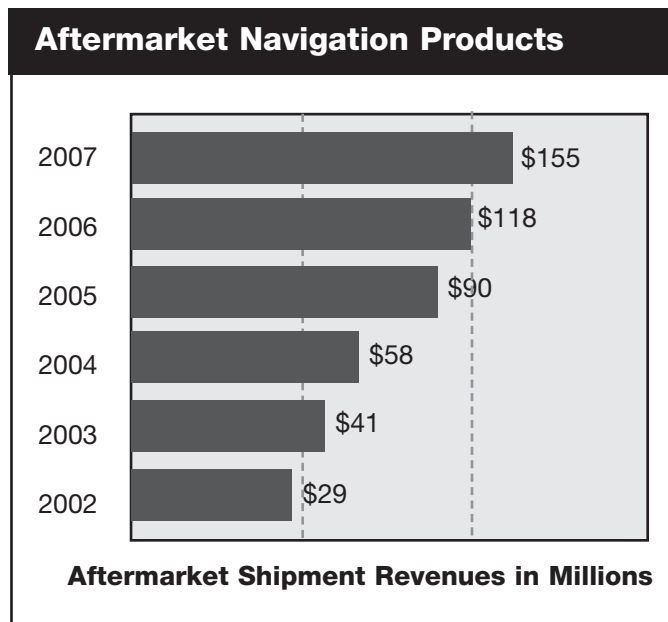
Because of consumers' desire and preference for trim-level solutions, aftermarket mobile theater installations have likely been limited to autosound enthusiasts. But the advent of aftermarket video entertainment services could spur demand for mobile theater products including mobile video displays, in-dash DVD players and DVD changers. CEA forecasts aftermarket shipment revenues from mobile theater products will top \$800 million by 2007.

Already satellite radio has given a much needed lift to the beleaguered 12-volt aftermarket. Aftermarket shipments of satellite radio products continue to reach new highs and OEM installations also are climbing. Service providers Sirius and XM are shrewdly seeking to add new services such as video and traffic data to enhance navigation systems, which could even-

tually be wirelessly piped into the car via telematics and distributed through the vehicle network.

The integration of local traffic data with navigation services is another development that could spur demand for vehicle navigation products in the aftermarket. CEA expects revenues from aftermarket shipments of vehicle navigation equipment to approach \$60 million this year, but will steadily increase to more than \$150 million by 2007. Assuming the vehicle network remains open to the aftermarket, embedded telematics and their installed GPS chips will surely play a role in this growth, enabling aftermarket on-board and off-board navigation services to take root and grow.

But before this vision can become a reality, the aftermarket must have a reliable gateway into the vehicle network. And CEA has been working to assure the aftermarket in the future they will be able to make the MOST of their mobile electronics solutions.



Source: CEA Market Research

Getting the MOST Out of Mobile Electronics

In June 2004, CEA's Mobile Division committee adopted a new standard for mobile electronics, designated CEA-2012 – MOST Network Application. This standard is based on the MOST Cooperation's Media Oriented Systems Transport – a fiber-optic automotive network for real-time data transfer, used in surround sound systems and CD and DVD players. The MOST Cooperation is a group of 19 international auto manufacturers and more than 60 component suppliers working together to develop and refine a common standard for automotive multimedia networking.

The creation of CEA-2012 – MOST Network Application standard – provides a connectivity solution to make it easier to install and use any type of aftermarket digital multimedia product in the vehicle network.

This is good news for custom installers, who each year have faced new barriers when it comes to interfacing aftermarket products with increasingly proprietary networks in new vehicles. This is also good news for aftermarket manufacturers, who can develop new and innovative products and services.

Given a gateway into the vehicle system, the implementation of CEA-2012 among new vehicles could eventually change the aftermarket business from selling hardware (head-units) to supplant the HMI (human machine interface) of the vehicle's OEM touch-screen control center, to selling back-end 'behind the scenes' control units and new software that will change the look and feel of the HMI, while preserving the trim-level aesthetics of the car.

In addition, as automakers implement the CEA-2012 standard, the telematics systems may become addressable by aftermarket components – allowing multiple wireless pipes into the car to deliver a host of services and functions. This opportunity has the potential to change the aftermarket business from box pushers to service providers.

Conclusion

In less than a decade, telematics has evolved from an obscure push-button used to wirelessly summon help in emergency situations, to a robust system capable of delivering a suite of wireless services while simultaneously augmenting the functionality of in-car navigation systems and wireless phones. But telematics is poised to do much more. We are at the threshold of much larger developments.

In-vehicle systems and electronics have evolved into their own network. And we will soon begin to connect our cars to the outside world in the same way we have networked our offices, our homes, and even our personal devices. In the not-too-distant future, telematics will provide the wireless connection that will enable the vehicle network to connect to other networks (like the home) and even the Internet – creating a mobile 'hot-spot.'

Telematics also will provide the conduit for an increasing number of subscription-based mobile in-vehicle services – providing information, productivity and entertainment content to passengers. As the number of telematics equipped vehicles on the road increases, the point at which critical mass for the profitable deployment of these services rapidly approaches.

Through telematics, the connected vehicle network has the potential to appreciably augment our quality of life in a progressively more mobile existence. The rising telematics tide coupled with the opening of the vehicle network will change the culture of the car, bringing new business opportunities to OEMs and the aftermarket alike. ■

FIVE TECHNOLOGIES TO WATCH **Future Watch**



What's Coming Next?

Imagine riding in a car that changes colors depending on the weather. Imagine taking a medication developed in a laboratory the size of your thumbnail. Imagine connecting to the Internet using a fabric patch on your jacket.

Once relegated to science fiction or the active imagination, these and other dazzling technological displays are fast becoming science fact as they begin the journey from research lab toward their inevitable touchdown in the consumer electronics marketplace.

With such rapid progression under way, technology, science and business are poised to intersect in truly unimaginable ways. Companies that want to keep step in the electronics arena must be thinking not only about near-release technologies and products but also those coming further down the line, which ultimately will redefine this century's consumer experience.

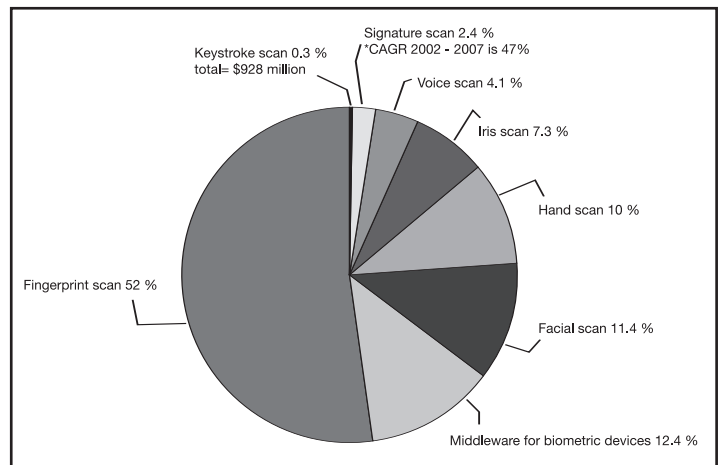
Areas such as biometrics, conductive surfaces, holograms, nanotechnology, robotics and wearable computers demand new skills not only at the R&D level but straight down to business development and marketing. They also are opening a brave new world of social and ethical considerations.

We are creating all of these new enabling technologies, but the businesses that adopt them will have to grapple with how they can be deployed in a safe way," notes Alexandra Kahn, a spokeswoman for the fabled MIT Media Lab. "Because any of the technology we create could be used for good, or not so good purposes."

Getting Personal

Biometrics – the identification of a person using his or her psychological and/or behavioral characteristics – has bubbled up into the mainstream because of its implications for security, be it used to police Internet downloads or stop potential terrorists from crossing international borders.

Biometric systems include fingerprint verification, facial analysis, voice and handwriting recognition, and even body odor detection. The groundswell of recent attention has been focused on the use of biometric fingerprint identification in conjunction with foreign travel.



*Compound annual growth rate. Breakdown of technology market share does not reach 100 percent due to rounding off.

Source: *International Biometric Group*

The European Union (EU) has adopted a proposal for the inclusion of biometric information in the passports of EU citizens by 2015. At home, the Department of Homeland Security (DHS) in January introduced the U.S-Visit program to manage entry and exit of foreigners from select countries using biometric documents and interlinked international databases. Various systems are being tested in 115 U.S. airports and 14 seaports. This summer DHS awarded the Accenture-led Smart Border Alliance a contract worth up to \$10 billion over the next 10 years to develop the system it will roll out.

Not surprisingly, the concept of "genetic screening" has raised eyebrows among civil liberties groups. This spring, for example, human rights organizations from Australia, Asia, Europe and North America co-signed a letter to the International Civil Aviation Organization attacking the idea of including biometrics and tracking tags in passports.

FUNDING FOR NANOTECHNOLOGY RESEARCH HAS INCREASED BY 83 PERCENT SINCE 2001, ACCORDING TO THE WHITE HOUSE.

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"Privacy issues are just beginning to be addressed now," says Anil Jain, distinguished professor in the computer science department at Michigan State University, which is developing biometric algorithms for a variety of applications. "The important thing is to ensure there will be regulations that state if biometric data is being collected with one application in mind it should not be shared for another application."

Beyond the governmental level, a variety of biometric CE applications are on their way to augment user convenience.

Automotive companies including Ford and BMW are exploring keyless ignition in cars that would employ a dashboard voice or a fingerprint sensor not only to start the vehicle but also automatically set the climate, seat position, music and video selections, and other predetermined preferences.

The biometric remote control is another potentially strong electronics application because it could recognize and activate an individual's music and viewing preferences simply upon being picked up. Laptops and PCs already are commercially available from Compaq and others that employ built-in fingerprint sensors rather than a password for login.

In the entertainment industry, the persistent and costly problem of digital rights management – quashing rampant file sharing of music and video downloads – has opened the possibility of biometric verification. The Recording Industry Association of America (RIAA) and Motion Picture Association of America (MPAA) both are reviewing recent demonstrations of a new wireless digital media player called iVue, whose antipiracy lock-down is based on a customer's live fingerprint scan. iVue was developed by biometric vendor Veritouch in conjunction with Swedish design firm, Thinking Materials.

"It all boils down to access control, to a key management problem," Jain says. "If biometrics can be used as a key, it makes it much easier."

Big Bucks for Tiny Solutions

Those seeking proof the U.S. is serious about advancing the science of nanotechnology – measurements at the nanometer, or one-one hundred thousandth the diameter of a human hair – need look no further than the new Advanced Measurement Facility at the National Institute of Standards and Technology (NIST).

The \$235 million lab opened in July and supports some of the world's most delicate experiments at the atomic and molecular levels. Its funding is just a portion of the \$849 million President Bush requested for nanotech R&D across 10 federal agencies in 2004 and the more than \$2 billion authorized in the new 21st Century Nanotechnology Research & Development Act. Funding for nanotechnology research has increased by 83 percent since 2001, according to the White House.

Planned NIST research includes improved measurements of quantities such as mass, length and electrical resistance; the development of quantum computing technology; nanoscale measurement tools and integrated microchip-level technologies; and experiments in nanoscale chemistry. Using a microscopic "biochip" lab embedded in a single chip, scientists will add select proteins and DNA strands to test reactions and develop breakthroughs in drug design and medical diagnostics.

Other NIST research will improve the accuracy of machines that conduct rapid spectroscopic analysis of tiny samples and could detect, for example, explosives residue and therefore improve the accuracy of detection systems. Another project is focused on developing encryption methods that currently are impossible in the transfer of money.

A lot of the technology that comes out of this research will undoubtedly impact you in daily life, whether you are a consumer of a pharmaceutical developed here, when you buy airline tickets and go through a security check based on it," says NIST spokesman Michael Baum.

For the consumer realm, a heavy focus is on the carbon nanotube, a cylinder containing tiny rolled up carbon structures of

two nanometers or less that is more than 100 times stronger than steel at one-sixth the weight. Pioneered by NEC Corp. in 1991, nanotubes can be filled with other substances and made into wires, or semi- and superconductors. When woven into a cable, they could provide electricity transmission lines with vastly improved performance over current power lines.

As such, carbon nanotubes are seen as a key to super lightweight, more efficient large flat-panel display screens. Samsung Electronics and Motorola are among the companies developing flat-panel televisions based on electronics being transmitted to the screen via nanotubes. Houston-based Carbon Nanotechnologies Inc. is patenting technologies – most recently a coating for single-wall carbon nanotubes – that will speed the marriage of the nanotubes and consumer electronics.

The sciences of nanotechnology and holography are converging. Tokyo-based Dai Nippon Printing Co. recently combined hologram and printing technology to record and distribute 3D images viewable at the nano-level. In the U.K., Cambridge University spin-off Smart Holograms is developing holographic sensors that function at the nano level.

I, Robot

Despite Hollywood's penchant for portraying robots as menacing evil-doers, robotic advances hold promise in countless areas of mainstream society.

Non-humanoid robots already have explored the surface of Mars, and now NASA is pushing to handle the upcoming final service mission at the Hubble Space Telescope robotically rather than put astronauts at risk.

Among its many projects, the Robotics Institute at Carnegie Mellon University is developing an autonomous robot capable of detecting land mines, a solar-powered robot for use in off-shore science experiments such as meteorology and marine biology.

Today, humanoid robots are garnering increased attention as research being conducted from university labs to toy, automo-

bile and electronics manufacturers comes to the fore. Honda's ASIMO robot is a four-foot humanoid that can move, hear, speak and assist humans. Sony has developed a robot called QRIO it claims can gather information, walk, dance and even run across uneven surfaces, righting itself if it falls over.

In Japan an initiative called RoboCup is developing robotic athletes with the goal of fielding a team by 2050 that could beat the current World Cup champions.

And Leonardo, the next-generation of the Kismet humanoid robot being developed by the MIT Media Lab in conjunction with Stan Winston Studios, is being eyed for such consumer applications as a companion for elderly or sick persons.

A primary factor in the success of robots is the marriage of artificial intelligence with human behaviors and "emotions." One of the primary reasons MIT sought out Los Angeles-based Stan Winston – the creator of the dinosaurs in "Jurassic Park" – is the studio's expertise in the area of robotic eye contact.

"The ability to make eye contact, for a robot to be able to recognize expression and be able to communicate with expression, is really important in human interaction in terms of conveying emotions," says MIT's Kahn.

MIT's Consumer Push

Leonardo is among myriad MIT works in progress with mainstream implications. In May, Media Lab launched its first-ever research initiative focused specifically on consumer electronics. The program allows a greater pool of companies to participate in research aimed at consumer products and services than those that traditionally fork over the required \$200,000 to become a Media Lab partner.

"Historically the Media Lab has done a lot of work in the area of consumer electronics and we thought it would be a good time to look at ways to bring in dynamic companies that happen to be small- and mid-sized and are doing innovative work in the field into collaboration," Kahn says.

WEARABLE TECHNOLOGY IS JUST WAITING FOR CE MANUFACTURERS TO JUMP ON BOARD WITH ATTRACTIVE USER OUTPUT DEVICES.

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Initially, the Consumer Electronics Lab will focus on five areas: innovative materials and design/ fabrication; new power technologies, including wireless, parasitic and self-generated; new sensors, actuators and displays; self-managing, incrementally and limitlessly scalable ecosystems of smart devices; and cooperative wireless communications that are free of fixed infrastructure.

Cooperative wireless systems decentralize the way information is stored and shared from a single source to multiple individual devices that communicate and spread information to and from one another. Ridding the system of a "central source" allows movement of more information using less energy, and it frees devices of having to be close to a station to get a signal.

Practically speaking, cooperative communications systems could cover a home, a building or even a large geographic area. They are the basis, for example, of the "smart home," which features cooperative appliance systems in which your alarm clock could alert your coffee maker it's time to start brewing.

Another CELab project, tagged Serendipity, is a "match-making cell phone" into which users download a personal or business profile and which can roam to find other cell phones that contain a complementary profile. If a match is made, the phone will automatically make the call.

Of longer-term interest is a project to develop 4-inch fabric patches that are actually ultra-slim computers. When connected with a Velcro-like "network," the fabric can receive, display and send information. Among its possible applications is a hand bag that would sense outside information such as a weather report when lifted up and remind the owner to grab an umbrella if rain was forecasted.

"We've been making inroads in wearable computing technology for more than 10 years and only now companies are coming out with jackets that have MP3 players in them, and by in large the devices are sewn into the fabric," Kahn says.

Wearable Computers

Yet there are those in the wearable computing field who believe the technology is ready for the consumer marketplace, noting amazing progress in the input and processing areas. Wearable technology is just waiting for CE manufacturers to jump on board with attractive user output devices.

"Everyone wants to have a decent margin, and wearable computers are among the highest-margin consumer electronics devices with the exception of plasma and big screen TVs," notes Alex Lightman, CEO of Los Angeles-based MIT spin-off Charmed Technology, which is pioneering ways to incorporate small, wireless Internet devices into fashion, lifestyle and health applications through partnerships with Motorola, among other companies.

Lightman is among a group of believers counting the years before wearables will overtake the mobile phone market because they offer three primary benefits:

A linguistic user interface rather than a graphic one; augmented memory, which fills in information for users on the spot; and augmented reality, which marries virtual information and physical experiences at exactly the right time. A device, for example, would know when a wearer enters the grocery store and would begin itemizing the things he/she needs to buy.

Research shows consumers may be warming to the idea. A recent study from the Wearables Group at Carnegie Mellon determined that functionality is a factor in the perceived comfort of a wearable computing device. Acceptance of wearables will rely on both design comfort and functionality, researchers note, so both must be taken into consideration when developing commercial products.

"Wearables are this weird step child that is born of the computing world but is dying to join its natural home in the consumer world," Lightman says.

Coming To A Neighborhood Near You...

What else is on the horizon for the consumer electronics industry? Printable, three-dimensional models and working products.... Lifelike, 3D images capable of being projected into the home and office... Televisions that can project images in 3D sans plastic glasses.

Sharp Electronics in Japan is selling mobile phones that can transform photos into 3D images, and laptops that can turn almost any onscreen image into 3D using screen fillers.

Matsushita and Toshiba are among companies developing 3D televisions. In April a consortium including Adobe, Intel and Boeing launched the 3-D Industry Forum to set standards to guide three-dimensional forays in entertainment and business.

Conductive surfaces also are gaining momentum: Anything from fabrics to table tops to car exteriors that could be "painted" with electronics technology and react to their environment. So you one day might have a car that changes color to accommodate temperature, or your home might be built from similarly "smart" materials. Both are being developed at MIT.

Xerox Corp. says it has developed semiconductive ink that can be manufactured at low temperatures and in open air and therefore carries a relatively low cost. The technology could foster inexpensive large-area devices such as flat-panel televisions and displays flexible enough to be rolled up.

Progress is being made in software-defined radio (SDR) - a technology that replaces analog radio circuitry with digitally generated radio circuitry and could accommodate calls from virtually anywhere on the globe once widely deployed.

With developments like biometrics, conductive surfaces, holograms, nanotechnology, robotics and wearable computers in sight, the world will be a very different place in the near-future. ■

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- In 2005, the IEEE is featuring its International Conference on Consumer Electronics (ICCE) alongside the International CES.

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