2

Good Examples, Bad News

IN THIS CHAPTER

- The E-Books Story: Not Exactly a Page-Turner
- The WAP Flap
- Biting into Bluetooth
- Calling Big LEO
- HDTV—Not a Pretty Picture
- Information Appliances (Or Home on the Digital Range)
- Home Networks and Home Automation
- DSL Takes Its Hits
- Voice Recognition—So Much Talk
- A Cry for Help

Some technologies and products are announced, get a lot of ink, and still don't come close to meeting expectations—not the vendor's and certainly not the consumer's. They were either oversold to a public that wasn't ready for them and didn't understand them, or worse, didn't need or want them in the first place. Or they're simply late to the party. More likely, they're too early. For example:

The E-Books Story: Not Exactly a Page-Turner

The Association of American Publishers, the publishing industry's principal trade organization, thinks the market for electronic book (or e-book) devices and content will grow to several billion dollars by 2004. Accenture (formerly Andersen Consulting), which is helping the AAP develop technical standards for e-books, believes there will be 26 million dedicated e-book devices in consumers' hands by the end of 2005.

If recent experience means anything, that's not likely. A survey taken in the fall of 2001 by Ipsos-NPD found that while two-thirds of online consumers in the United States were familiar with e-books, barely 3% said they were "very likely" to buy one. Scott Adams, famous for his syndicated Dilbert cartoon series, self-published an e-book, *God's Debris*, in 2001. It quickly became the best-selling e-book in the world. But he only sold about 4,500 of them, compared to the more than two million copies of his first book on paper, *The Dilbert Principle*. Adams got the message, predicting in a guest column in the *New York Times* that e-books will never exceed more than 5% of the market for pleasure reading until someone invents a way to read them without using a computer screen. "It's like taking a vacation in your cubicle," said the former engineer.

Market futurist George Forrester Colony, who heads Forrester Research, told the *New York Times*: "The technology industry is driven by thunderstorms. You see poor predictions magnified and enlarged. Asinine ideas like e-books—so much air gets pumped into them."

Book publishers continue to be hopeful, certainly wishful. Simon & Schuster has released Mary Higgins Clark's backlist of books in digital form in hopes of extending her reach. Michael Crichton's best-selling *Timeline*, published in November 1999, is available as a free e-book from BarnesandNoble.com. Walter Mosley's short stories have been published on AOL Time Warner Book's new e-book site, iPublish.com. McGraw-Hill, Houghton Mifflin, and Thomson Learning have developed e-book marketing plans. Simon & Schuster, Random House, Penguin Putnam, and HarperCollins have all signed on with Yahoo to sell their books directly to readers through the

Internet—in the event they ever want to do such a thing. Random House Children's Books has debuted its e-book publishing program, Random View Books, for Microsoft Reader, Adobe eBook Reader, and Palm Reader.

But several publishers have already backtracked. AOL Time Warner, for one, cut back its line of digital books in December 2001, citing a slump in sales. "Perhaps Mr. Gutenberg has the last laugh here," Laurence Kirschbaum, chairman of the books division, told the *New York Times*. "At some point, reality sets in and one has to be realistic about how much of an uphill climb this is going to be." (Reciprocal, the company that provided many of AOL Time Warner's technology for its digital books, went out of business only a few months earlier.)

The AAP has come around to admitting that the market is small; most of the business press and industry analysts describe it as tiny.

True, this is an entirely new market segment. And like most new consumer electronic products, dedicated e-book devices are priced high ($200 to $1,500), availability of content continues to be limited, and not every title from every publisher can be read on every device. In other words, many of these devices are technically incompatible.

Another problem is that several different types of devices are vying for attention from the few who might actually want to read a book electronically. These range from dedicated e-book devices to Palm-type PDAs and handheld and desktop PCs. There are also different file formats, content formats, digital rights management issues (who owns the rights to the e-book titles), and distribution systems.

E-books also don't take full advantage, at least not yet, of the available technology.

Brian Nadel, the editor of *Mobile Computing & Communications* magazine, has addressed this problem, pointing out that while he was impressed with the way the type of *Maestro*, Bob Woodward's look at the Federal Reserve Bank and its chairman, Alan Greenspan, mirrored that of the printed book, it would have been nice to view the printed book's 35 photos of Greenspan and five economic charts. "I would have loved to hear—not just read—Greenspan speak in his cryptic way and

then be able to link to multiple Web sites about him and the Fed." Assuming they can get past all of these tests, how many consumers will want to spend even an hour reading their favorite novelist, or attempt to absorb something like *Keeping Kosher In South Dakota* from an eye-blurring electronic display? How long will consumers put up with recharging or buying replacement batteries for these devices? Especially if the batteries die in the middle of a great sex scene.

The AAP standards aim to create a simulated interoperable environment for e-books for the short term that will allow publishers to convert print books into e-books. The AAP's suggested standards focus on numbering and metadata. The numbering standard is based on an existing technique called a Digital Object Identifier, which is used by the scientific, medical, and technical communities for online content. The metadata standard indicates how data books should be represented and includes information about the author, content, and business rules—like the information provided in a card catalog entry.

Book publishers are trying to avoid having to compete with dot-coms and authors themselves who could sell digital files of their most successful titles, just as they are trying to crank up e-book sales. Horror story writer Stephen King skipped around his traditional publishers to sell a new serial novel directly to his readers in a digital format over the Internet. King offered his book, *The Plant*, a chapter at a time with an easy payment plan, but readers's attention span faded quickly. Worse, less than half of King's subscribers paid for many of the chapters they downloaded (horrors!). Another problem for King was that, because of his huge success as novelist, he was able to garner lots of free publicity nationally about his online miseries. But he was not equipped to generate the publicity and handle the distribution usually provided to authors by traditional book publishers.

John Romanos, president of Simon & Schuster, told the *New York Times* toward the end of 2000, "The logic of electronic books is pretty hard to refute. We see it as an incremental increase in sales as a new form of books for adults and especially for the next generation of readers." A year later,

Simon & Schuster announced that even though the sale of these books was very skimpy, it would open its own online store to sell digital editions of its books directly to consumers. The reason for this change in thinking, the publisher said, was in response to requests from visitors to its Web site to be able to buy books directly. Now, Simon & Schuster said these people can pay for and download electronic files for reading on their computer screens.

Part of book publishers' thinking is that today's high-tech teens will become the early adopters for e-books. At least that's what Scholastic Inc., is hoping. Barbara Marcus, Scholastic's president, told the Jupiter Media Forum in early 2001 that she sees teens as a natural fit for e-books, as long as they're affordable, lightweight, and easy to use.

Whatever happens, the authors (Stephen King notwithstanding) and their agents are making sure they're also covered. In July 2001, in a decision that could put authors and their agents in the position of reselling the digital rights to a previously published work, a federal judge in New York ruled that the term "book" in book contracts with authors does not necessarily include electronic books. Random House, which tried to block Internet startup RosettaBooks from selling digital files with the contents of eight Random House novels, said at the time that it planned to appeal. Random House's view is that an e-book is a book which, it says, means it's theirs. More recently, Random House has backtracked on e-books, essentially killing its AtRandom imprint in recognition of the scant demand. Are there enough e-readers in the world to make this technology a marketing success? The Electronic Book Newsstand Association (EBNA) was formed in January 2001 to boost the awareness of e-reader devices among publishers and consumers. EBNA wants to distribute news, periodicals, and other information via portable reader devices. It says that studies show that American consumers spend far more time reading newspapers and magazines than books. Matthew Benner, director of BarnesandNoble.com's digital book group, told the *New York Times*, "We expect these devices to become the dominant platform for periodical publishing throughout the 21st Century."

In fairness, few people have experienced e-books, but the EBNA's argument seems weak. Checking new headlines, stock market quotes and sports scores from a portable electronic device, yes. News stories and features? Not likely.

If e-books are ever going to have a shot at success, it may be for special applications, such as custom-printed children's books on very cheap (and hopefully rugged) digital devices. Another new wrinkle: publishers are adding author interviews to their e-books and are beginning to offer some bilingual models so readers can switch between, say, English and Spanish. Or technical reference material. Another possibility is local libraries, more of which are making e-books available. Indeed, library associations have been lobbying for the development of inexpensive electronic readers for library use. One drawback, at least, for the moment, is that you have to take what the libraries have loaded into the readers.

The WAP Flap

One of the most widely covered issues in the wireless communications industry in 1997 was how to get wireless handsets to tap into the Internet. Several companies, including the three market-share leaders, Nokia, Ericsson, and Motorola, were pretty sure they had the answer in something called the Wireless Application Protocol, or WAP, which these companies helped develop as a nonproprietary, global technical specification. WAP would enable wireless service subscribers to access Web-based information from mobile or portable cellphones or PDAs.

It sounded pretty good at the time. WAP meant the wireless Internet was here. We could now access the Internet from just about anywhere and at anytime. You couldn't open a business publication or even many daily newspapers without readying something about this wonderful new development that would make our lives so much more productive. Using a WAP-enabled wireless device, you could check the traffic en route to the airport. If traffic is going to hold you up, you could check the train schedule and then purchase a train ticket online instead of driving. On the way to the airport, you could select your seat, check in for the flight, and reserve a special meal.

You could also use WAP for message notification and call management, e-mail, mapping and locator services, weather alerts, news, sports, e-commerce transactions, and banking services.

Cellular phone and other equipment manufacturers were drawn to WAP because it had the potential to generate the critical mass needed for them to open up new product and service opportunities in wireless communications—actually generate new revenue by getting people to spend more time on their cellphones. Network operators supported WAP because it seemed to have minimal risk and investment, and they thought it would help operators decrease churn (keep people from switching wireless carriers, usually for a cheaper plan or more free "airtime" hours), cut costs, and increase revenues by improving existing value-added services and adding new services.

It looked like it couldn't miss, especially with so many of the top telecom companies teaming up to develop and promote the technology. So, why did so many industry analysts and users start referring to WAP as "*W*hat *A P*ain?" And why have there been so many articles like the one in *Wireless Week* that started with sentence, "Is the Wireless Application Protocol dead?" under a headline, "Warning to WAP: Reinvent Or Waste Away."

David Haskins, the managing editor of the online AllNetDevices news service, wrote in July 2000: "Will consumers embrace WAP or is it just another example of over-hyped BWC (Because We Can) technology that the public will ignore?"

Another industry magazine, *America's Network*, was equally uncharitable after conducting a "WAP Test Drive." It wrote, "Using a WAP service is like using the Internet in 1995. You know it's a great idea and you really want to try it out. But when you actually test it, you find that you don't really want to do it again."

Phone.com, a leading proponent and early WAP pioneer, claimed that 100,000 software developers had registered for its WAP developer program and more than 500 companies were actively participating in the WAP Forum, formed in 1998, presumably spending millions collectively to bring WAP-based products to market. But few people were actually using WAP. And those who were, weren't exactly thrilled by it.

In its defense, some analysts and industry supporters suggested that WAP offered a different paradigm for accessing the Web from a PC in the office or at home. That's true, but it got more complicated, with highly publicized complaints that data retrieval was slow, that applications and services were lacking, that WAP was often difficult to navigate, and that cellphone and PDA screens are simply too small for any reasonable text-driven application. The Nielsen Norman Group said after conducting a survey in London, that WAP usability is "failing miserably." Nielson Norman said, "Companies shouldn't waste money fielding WAP services that nobody will use while WAP usability remains so poor. Instead, they should sit out the current generation of WAP while planning their mobile Internet strategy." The WAP Forum, the technologies' support group, quickly pointed out that the study was based on only 20 users and "lacks the basis on which to draw any meaningful conclusions." It didn't help that another market study published by Forrester Research in mid-2000 pointed out that 72% of U.S. households have no interest in receiving data on their wireless phones and 75% are uncomfortable with wireless e-commerce. (As of the end of 2000, the WAP Forum estimated there were more than 40 million WAP-enabled devices in circulation. The organization could not say at the time how many of these handsets subscribers are actually using WAP, but they guessed that it was in the four to five million range.)

WAP took another public flogging in Europe when articles began to appear that anyone using a GSM phone (Global System for Mobile Communications is the digital cellular standard used throughout Europe and part of the United States) didn't actually need WAP. They could get similar results with SMS (Short Messaging Service), which is popular in Europe for delivering text to pagers.

The Meta Group, another market research organization, put WAP's principal developer, Openwave Systems, on the defensive when it reported that as many as 90% of corporate users that purchased WAP-enabled phones have abandonded the data capabilities of these phones. According to Meta, limited content, slow networks, and generally poor user ergonomics

have not met the high user expectations and hype that accompanied WAP-enabled devices when they were first introduced.

WAP also faced competition in Japan from i-mode, a hugely popular wireless Internet-level system, developed by the country's largest mobile carrier, NTT DoCoMo. Introduced in the spring of 1999, i-mode at one point was adding more than 40,000 new subscribers a day in Japan and claimed 17 million users by the end of 2000. To call i-mode a cash cow for NTT DoCoMo is a disservice to the company: Just one of its many unbundled features, sending a cartoon to subscribers every day for a monthly fee of about $1, generates more than $120 million annually for NTT.

Like WAP, i-mode enables users to access e-mail and Internet services with wireless phones and computers. Unlike WAP, i-mode is based on packet data technology, which means that it is always online; you do not have to dial up every time you want access to the Internet or e-mail. Using packet technology also means that i-mode users are charged only for the information they receive, not for how long they stay online. (I-mode also represents a cultural breakthrough. It was bound to be a success, analysts like to point out, because in contrast to the United States, where PC market penetration is huge, the wireless Web is pretty much the only experience the Japanese have with the Internet.) The difficulties with WAP and the success of i-mode have led to growing interest in i-mode outside Japan, mainly in Europe. NTT DoCoMo could also expand the use of i-mode through joint ventures with U.S. wireless operators—AT&T Wireless has licensed i-mode, giving it a potentially strong jump-start in the United States—a particularly interesting prospect if WAP doesn't begin to gain wider acceptance in the United States. Some wireless carriers have talked about supporting both WAP and i-mode. Yet another possibility kicked around the industry is that WAP will be replaced by the Java programming language from Sun Microsystems, which abstracts data on bytecodes so that the same code runs on any operating system. In fact, i-mode will eventually allow users to tap into Java technology, providing even more services to i-mode subscribers.

Another issue lurking in the background, and one that doesn't instill a lot of confidence in wireless manufacturers who are asked to invest in these things, is, who owns the technology? While WAP has been originally promoted as an "open" protocol, Geoworks, a specialist in wireless data communications services and technologies, told the WAP Forum and its members in May 1999 that its patented technology is "employed as essential technology" in the WAP standard and that it planned to license this technology. Phone.com challenged Geoworks' patents as invalid. However, Ericsson, Matsushita Electric (the parent company of Panasonic), Toshiba, and others have lent some credibility to Geoworks' patent claim when they signed a cross-licensing arrangement giving them the right to use Geoworks' WAP technology.

This is also about content. Analysts believe that as the number of practical applications available to WAP users grows, WAP will begin to gain a following. WAP may also find broad acceptance as a sales representatives' automation tool with WAP-enabled phones for checking customer information, checking inventories, and tracking order status while on the road.

Can more than 500 companies be wrong? The jury (in this case, the market) is still out, but the same question is being asked about Bluetooth.

Is WAP an interim technology? Even many of the most objective industry observers don't believe so. WAP will continue to add popular features such as TCP/IP, multimedia, and color graphics, but WAP device owners will still have to contend with tiny keyboards and displays—at least until voice recognition technology and virtual displays, which magnify 2-inch screens into what appear to be 17-inch displays, make huge leaps into portable communications products.

Biting into Bluetooth

The business and technical press coverage of Bluetooth has been constant and often brutal. And for the most part, rightfully so. "Are we getting ahead of ourselves—again?" wrote a technology magazine editor in his monthly column. "It's got

momentum, it's got mass, and it's got great PR." Then there were headlines like, "Bluetooth Riddled With Cavities" and "Bluetooth Still Teething." A more to the point headline would have been, "Bluetooth Vendors Bite Off More Than They Can Chew."

Bluetooth was designed to enable spontaneous connectivity between cellular phones, mobile computers, personal digital assistants (PDAs), and other wireless devices.

Initially conceived as a wireless replacement for cable hookups for portable consumer electronic products, Bluetooth has become a digital transmission standard for short-range links between laptop computers, cellular phones, PDAs, and other electronic devices. But there is an important difference from other wireless networks: It offers what the Bluetooth community calls "unconscious" or "hidden" computing. Bluetooth-enabled products will be designed to automatically seek each other out and configure themselves into piconetworks, which can, among other things, forward e-mail received on a cellular phone in a person's pocket to the notebook computer or laptop in a nearby briefcase. Bluetooth can also exchange business cards with someone passed on the street or in a bar or restaurant if given permission to do so, "opening up whole new blind dating opportunities," according to a Merrill Lynch research report. It can download data from a digital camera to a PC or cellphone. Children sitting in the front of a school bus could play games with children sitting in the back of the same bus. In fixed applications, it can replace hardwired connections with wireless Internet access points in airports, hotel lobbies, and conference centers. A Finnish telecom operator has even demonstrated a Bluetooth-enabled vending machine, allowing consumers to buy products out of the machine by transmitting an account code from a Bluetooth phone or PDA.

Why "Bluetooth?" Because someone at Ericsson suggested naming this new development after King Harald of Denmark, nicknamed Bluetooth, who is credited with uniting the warring factions of Denmark and Norway in the 10th century, when he reigned. Ericsson figured it could do the same with its Bluetooth—unite wireless devices everywhere.

Bluetooth is supposed to be the "next big thing." But it has had some problems getting out of the chute, most of them technical. Ericsson began exploring short-range, low-power, low-cost wireless technologies in 1994. By 1998, Ericsson was convinced it had something important and that it was far enough along in its development to move forward, but it needed help to develop the technology into an open, global standard and to promote the concept. To pull this off, Ericsson teamed with four other heavyweights—IBM, Toshiba, Intel, and Nokia. Together, they formed what became known as the Bluetooth Special Interest Group (SIG), which eventually grew to more than 2,000 company members worldwide.

The hype has been huge, as have been the expectations. Market research organizations projected that more than a billion Bluetooth-enabled devices would be on the market by 2004. One of them, the Gartner Group, said it expected Bluetooth to become a "defining force" in portable electronic products. Merrill Lynch estimated that by 2005, Bluetooth would be in 95% of the world's cellular phones (that's more than a billion phones), 95% of wireless headsets (700 million), 90% of PCs (400 million), 50% of all of the printers sold that year (109 million), and 60% of digital cameras (64 million).

But there were problems. Virtually none of the earliest Bluetooth products tested worked as designed—they simply would not communicate. Testing was difficult because there were no instruments to measure many of Bluetooth's unique functions. It didn't help that the target price for Bluetooth integrated circuits (ICs), set somewhere in the early going at $5—a bit high for a consumer electronics device—didn't seem attainable on any scale until at least 2002, possibly later.

Bluetooth security was another issue, but it stayed in the background until two researchers at Lucent Technologies announced they had found flaws in the technology that could permit anyone to eavesdrop on a digital conversation or even to determine a user's identity. Although the Lucent researchers said the problem could be fixed fairly easily, the disclosure generated more negative press for Bluetooth, focusing mostly on the technology's use in high-traffic areas, such as airports and conference centers.

Another serious issue was interference. Millions of products already in use operate in the same frequency range as Bluetooth—2.4 gigahertz (GHz)—such as microwave ovens, garage door openers, audio remote control devices, toys, the newest cordless phone models, as well as two competing technologies—wireless local area networks, which link offices and factories in buildings or campus-type settings, and HomeRF, which is the standard for wireless home and small office networks capable of linking multiple PCs for other wireless devices. Moving Bluetooth to a higher frequency has been discussed in Bluetooth and regulatory circles, but that could be years off.

Then there's the brand. Bluetooth SIG leaders were deathly afraid that some companies, particularly small startups and no-name Asian toy and accessories makers, would jump the gun with Bluetooth-labeled products before they are technically ready to interoperate with fully "certified" Bluetooth devices and give the brand a bad name. Simon Ellis, communications marketing manager for the mobile and handheld product group at Intel and marketing chairman of the SIG, told *Wireless Systems Design* magazine in December 1998: "It's terribly important that [Bluetooth] not be overhyped, setting up the possibility for disappointment in the marketplace when the actual products start appearing."

Bluetooth also has competition. The most serious is the IEEE 802.11 technical standard for wireless local area networks. Initially developed for use in offices and factories, a number of versions of this technology are emerging that could give Bluetooth a serious run for its money, particularly in fixed wireless applications. Another would-be competitor is infrared (IR) technology, which consumers have been using for years to change their TV channels and adjust the volume on their stereo systems. IR is also a feature that is built into virtually every notebook computer, mainly to wirelessly exchange business cards and to dump text material into an IR-equipped printer at very short range.

The installed base of IR-equipped products easily tops 250 million globally. But unlike Bluetooth, which is a radio and is only range-limited, IR must operate line-of-sight (the IR ports of

different products must be aimed at each other) and operates within a narrow angle (a 30-degree maximum cone) and at very short range. It also transmits data at relatively slow speeds, which helps explain why few people actually use the IR feature in their portable devices. (Toshiba estimated a few years ago that barely 5% of its notebook computer customers used the IR function.) IrDA, the Infrared Data Association, claims this has changed with the growing population of PDA users and says usage is now up to at least 40% among Palm users. IrDA calls them "loyal Palm beamers." IrDA also believes IR use is a cultural issue because it is very popular in Japan and Europe, particularly for exchanging business cards and short text messages. (In fact, Casio's IR-enabled QV2000 digital camera is available virtually everywhere but the United States).

Bottom line, the delivery of Bluetooth products on any kind of a meaningful scale was more than a year behind schedule. Almost everyone anticipated a significant number and variety of Bluetooth products on retailers shelves by the end of 2000. The reality check came when a worldwide survey of design engineers indicated that most of them didn't expect their companies to *begin* delivering Bluetooth-enabled devices in any significant numbers until at least 2003—not a pretty picture for a technology that is only effective and useful when it reaches a critical mass; what good is a Bluetooth-enabled device if it has no one to "talk" to?

None of these problems are as serious, however, as SIG members' concerns about interoperability. As would-be Bluetooth vendors moved into 2001, few of their products had met the SIG's interoperability requirements, which means that almost none of them could actually communicate as they were supposed to.

To help speed Bluetooth products to market, the SIG waived some of the most rigorous test requirements for interoperability and allowed tests of Bluetooth products against what were called Blue Units, which were actually kits made up of key components, software, and documentation to help first-time Bluetooth design engineers accelerate the development of prototype devices. Just to complicate things, some

products were ready for market before test systems had been validated and were available. Meanwhile, SIG members were developing their own test equipment for Bluetooth products and conducting "unplugfests" in which they tested their products against each other to ensure interoperability.

As reported in the November 2000 issue of *IEEE Spectrum*, "With several companies, mostly startups like San Diego's Silicon Wave and Britain's Cambridge Silicon Radio, all but betting the ranch on the success of Bluetooth, it is going to be difficult to soften the hype and face the reality of creating electronic products with an entirely new communications interface. But, then, this is supposed to be a joint effort and, as one market analyst put it, "2,000 companies can't be wrong."

Calling Big LEO

Blame Arthur C. Clarke. In 1945, long before he created the highly successful *Space Odyssey* films (2001 and 2010) with Stanley Kubrick, Clarke came up with the idea of a global network of communications satellites, circling the earth in geostationary orbit. Using this concept and the technology, anyone would be able to talk to and eventually send data, faxes, and video to anyone just about anywhere in the world. Since then, thousands of these satellites have been launched into orbit, and satellite communications has become a multibillion dollar industry.

But most of these satellites serve fixed terminals (the phone on your desk, for example), and handle mainly international traffic and phones in rural or remote areas, such as oil rigs miles out in the ocean. Eventually, commercial aircraft and ships began to use mobile satcom services. More recently, satellite networks have been developed that enable people to use a portable phone, not much bigger than most cellular phones, to call anyone in the world at any time simply by dialing their satellite phone number.

A significant technical achievement, but who needs this? Initially, the developers of this technology thought it would be an immediate and huge success in underdeveloped and developing countries, most of which are saddled with antiquated telecommunications infrastructures. Satellite-based

kiosks would be set up in even the most rural locations so that anyone could call long-lost colleagues and family members anywhere in the world. Also, government agencies, businesses, and even VIPs who must always be in touch could take advantage of this new communications opportunity. In time, as the price of the phones and the rates came down, the service would trickle down to small- and mid-level business travelers and small business owners.

One possible scenario: You're sitting in your office in Bridgewater, New Jersey, and your partner is in Malaysia, on her way to make a sales presentation to a potential new client. You just came up with some new numbers that will vastly enhance your chances of getting the account. You have no idea where she is at the moment but, judging by the time, she's probably somewhere in downtown Kuala Lumpur, en route to her meeting. Fortunately, you can reach her by simply direct-dialing her portable satcom phone, just as you would make any other phone call.

It sounded pretty good during the nearly 15 years that Motorola and others promoted this technology and dumped literally billions of dollars into developing it. But the hype, which included literally hundreds of articles in business and telecom industry magazines (some of them produced by Motorola's own engineers and marketing staff), countless presentations at conferences and seminars, and a very slick in-house-developed quarterly magazine with a "we are the world" flavored text, got way ahead of the reality, which led to some very costly failures.

What can you say about a company that began commercial operations on November 1, 1998, filed for Chapter 11 bankruptcy protection on August 13, 1999, and officially terminated its service on March 17, 2000? The company, known as Iridium and created and supported largely by Motorola, projected in 1997 that it would have 650,000 voice subscribers and 350,000 paging subscribers worldwide by 2000. That should be enough, it said, to meet its market goals. In fact, with a total of fewer than 55,000 subscribers at that point, Motorola was ready to allow its satellites to "deorbit"; that is, literally fall into the ocean rather than continue supporting them.

Iridium wasn't alone. In 1994, Craig McCaw, who had just sold his company, McCaw Cellular, to AT&T for $12 billion, and Microsoft's Bill Gates pooled some of their fortunes and formed Teledesic LLC to develop a high-speed network of 840 communications satellites. With great fanfare, McCaw and Gates said the new space-based network would be in operation beginning in 1998. Those plans were still on hold in 2001 while McCaw tended to his other mobile satcom property, ICO Global Communications Ltd., which filed for bankruptcy only a few weeks after Iridium sought the same protection.

Another mobile satcom hopeful, Globalstar Telecommunications Ltd., a consortium led by Loral Space and Communications and Qualcomm (other partners include China Telecom, DaimlerChrysler Aerospace, and Vodafone Group plc), announced plans to launch a 48-satellite system with operations beginning by 1997. That start date slipped a few years and with only 44,000 subscribers (analysts believe that Globalstar needs 1.6 million customers just to cover its costs and service its debt), Globalstar told the Securities & Exchange Commission in April 2001 that it "may be forced to seek protection under the federal bankruptcy laws" if it couldn't restructure its debt. In February 2002, with only 66,000 subscribers, Globalstar filed for Chapter 11 protection but said a new company will be created whose assets will be held by the company's bondholders and unsecured debt holders.

Part of the problem for Iridium seems to be that its leadership got a little too excited by the rapid growth of cellular and the Internet and thought this would quickly translate into an instant opportunity for totally portable, if somewhat pricey, direct-dial global communications. But how many people who have been using a cellular phone (which may have been free, along with hundreds or thousands of free airtime hours) really need another phone that's nearly twice the size of a cellphone and that costs $3,500 to purchase and $3 to $9 a minute per call—even if it does receive direct-dial calls just about anywhere in the world? Another problem either glossed over by Motorola or discounted as not a big issue was that Iridium's radio signals and those of the other mobile satellite services were not powerful enough to reach inside most buildings

where people work and live and spend a lot of time. They have enough problems reaching the streets between tall city buildings. McCaw figured this out fairly early and has been trying to overcome these problems by getting Federal Communications Commission approval to install enough radio towers in key locations so that ICO would resemble a cellular system in urban areas, with its signals reaching everywhere.

How did all of this get started in the first place?

Iridium was first conceived by Motorola as a network of 77 satellites (hence, Iridium, the element whose atom has 77 orbiting electrons) orbiting 420 miles above the earth, transmitting voice and data satellite-to-satellite until they reached the nearest ground station. At this point, they would be connected to the public telephone network and switched to the caller or callee, just like any other phone call or data connection. However, even before the first satellite was launched, engineers figured out a way to reduce the number of satellites needed for the system to 66. (Motorola had already invested so much in the system and the name that it decided to stick with Iridium.) In generic industry terms, the Iridium satellite system was usually referred to as a Big LEO because it offered both voice and data and operated in *l*ow-*e*arth *o*rbit. Little LEOs, which were to come later, provided data-only services.

Things started to get a little complicated when two long-established communication satellite service providers, the International Maritime Satellite Service, or Inmarsat, which provides global communications to the shipping industry, and the International Telecommunications Satellite Organization, now known simply as Intelsat, a consortium of 139-country signatories providing voice, data, and video communication services, decided they wanted a piece of the global mobile satcom action.

As international treaty organizations, Intelsat and Inmarsat had important advantages over the new mobile satellite services. One of these was easier access to orbital slots in space as well as to the most efficient spectrum assignments. Another was tax privileges and antitrust immunities that the private companies would never have. Any private concern that wanted to compete with Intelsat and Inmarsat was also required, under

the treaty agreements, to coordinate its business plans with the treaty-protected organizations to ensure that they did not significantly harm or cause technical interference to Intelsat and Inmarsat. It didn't take long for the U.S. General Accounting Office (GAO) to publish a study questioning the fairness of Intelsat's entry into the mobile communication satellite arena, which the GAO said, "may be impeding the flourishing of a private market and the benefits it can bring to consumers."

McCaw managed to save ICO in May 2000 with an infusion of $1.2 billion and a new plan to reintroduce the service as a smaller, slightly less ambitious version of Teledesic. Like Iridium, ICO said that it intended to go after niche markets like shipping and long-haul trucking. Rescheduled for launch in 2003, New ICO—an interim name used by McCaw—planned to use a special device that attaches to existing portable handsets rather than developing new, costly, and dedicated phones for its service. The tab for getting this venture off the ground was an estimated $2.5 billion on top of what had already been invested in the venture. More recently, however, with McCaw at the controls, Teledesic said it would reduce the size of its global satcom network to just 30 satellites and signed a contract with Alenia Spazio, an Italian firm, to produce Teledesic's first two satellites. The contract represents the bare minimum required for Teledesic to hang on to its spectrum assigned to it by the FCC. Teledesic now plans to be in operation in 2005, but it must obtain new regulatory approvals for its new orbital satellite scheme, which will focus on delivering high-speed data services. McCaw had considered merging ICO and Teledesic into a single company, probably called ICO-Teledesic, and marketing its services jointly. That's no longer likely, because McCaw says he wants to keep ICO and Teledesic independent as the needs of satellite services evolve globally.

Iridium, meanwhile, has regrouped, also under a new name. The bankruptcy sale has been approved, and a new CEO who, with other investors, has acquired its assets for $25 million, has taken over what is now Iridium Satellite LLC. The new Iridium team has thrown out the old marketing plan in favor of attacking niche markets, such as maritime, petroleum, construction, forestry, and emergency services. It also signed

the U.S. Defense Information Systems Agency to a $72 million service contract.

Will these systems now fly commercially? Going after vertical businesses and the military should work if the Big LEOs can hold down their operating costs. Under the new marketing plan, subscribers get a second-generation Motorola handset, which is much cheaper and closer in size to a cellular phone than the original model, and will pay about 80 cents a minute for phone service. The easy answer is that time will tell, but the niche and high-speed Internet approaches the Big LEOs plan to pursue may be their last chance to succeed.

HDTV—Not a Pretty Picture

Does anyone even remember what HDTV stands for? It's high-definition television. And we have been hearing and reading about it for almost 20 years.

The earliest piece of HDTV hype came from, of all places, a widely reported 1987 Federal Communications Commission advisory committee study that described HDTV as "an economic opportunity of almost unparalleled proportions." Anyone who had actually seen HDTV at the time probably would have agreed. Even then, the picture was startlingly clear, as good as any large-print color photo. Press reports were glowing, referring to "quality that dazzles."

But HDTV has faced one technological and political hurdle after another, mainly from broadcasters (both local stations and the networks) and local and cable TV operators who don't want to spend the money to upgrade their systems. It has also been hard to convince consumers that they really need a TV set with improved picture quality that's going to cost several thousand dollars.

HDTV took one of its first widely publicized hits in 1996 in *The Unpredictable Certainty—Information Infrastructure Through 2000*, published by the Computer Science and Telecommunications Board of the National Science Foundation's National Research Council. In a chapter titled "Making Technologies Work," members of the National Information Infra-

structure 2000 Steering Committee—made up mostly of research executives of leading technology companies and university professors—said they "generally discounted the impact of HDTV as a force shaping communications and information-related behavior and markets for the next 5 to 7 years, given HDTV's high initial prices and very limited sales." The authors also expressed the belief that "it will be even longer before a significant amount of HDTV-compatible programming will be available." The committee considered the availability of new spectrum for other uses to be more important than a higher-fidelity television viewing experience. "TV programming displays on PCs are growing," the committee wrote, "presenting prospects for enhancing and otherwise using those images."

The industry sold 625,000 HDTV-ready receivers to dealers in 2000, a fivefold increase over 1999. But when you add it all up, less than 3% of all TV sales in the United States reported by the Consumer Electronics Association are digital. And those numbers represent sales to dealers, not consumers. The real number is closer to 425,000.

It has been a tough pitch. In 1993, after more than 10 years of well-financed research and development by several organizations in the United States, Japan, and Europe, a "Grand Alliance" was formed by three groups that were competing to develop a technical standard for an American HDTV system. (Japan got a big jump on the rest of the world with its HDTV system, but it's analog based, and it is not selling as hoped.) Taking a "best of the best" approach, Grand Alliance members selected what they thought were the strongest elements of each of their systems and came to an agreement on an advanced TV standard.

In 1995, the FCC's Advanced Television Standard Committee (ATSC) endorsed the alliance's proposal for 18 different standards from which broadcasters could chose. Broadcasters would then have to acquire the equipment needed to transmit in an HDTV format. Special programming would have to be developed and produced. TV manufacturers would then have

to build the sets with circuitry capable of handling all of the different formats.

In 1997, the FCC set aside the spectrum needed for digital broadcasting. It established a nine-year transition period for U.S. consumers to completely switch over from their current analog sets to digital television (DTV) or to add digital-to-analog converters to their old sets. During this time, broadcasters were to begin transmitting digital as well as their usual analog TV signals, using a second channel allocated for DTV. In 2006, according to FCC rules, or until digital broadcasts reach 85% of U.S. households, whichever comes later, analog broadcasts will cease and broadcasters will give up their old analog frequencies to the FCC to be used for other services. (Note: It took more than 20 years for color TV and 16 years for VCRs to reach that level of market penetration. Color TV was introduced in the mid-1950s and didn't start to outsell black-and-white TV sets until the mid-1970s. And color probably wouldn't have grown that fast if David Sarnoff, who ran RCA at the time, had not personally ordered NBC, then owned by RCA, to broadcast all of its prime time programs in color.)

It is unlikely that the FCC deadline will be met because broadcasters are dragging their feet and Congress is unlikely to force the issue. Broadcasters donated millions of dollars to members of Congress between 1987 and 1996 and lobbied the Telecommunications Act of 1996 heavily enough to win free licenses for new spectra valued by industry analysts at $70 billion.

Gary Chapman, president and CEO of LIN Television Corp. and chairman of the board of the National Association of Broadcasters, put his best spin on his industry before the House Telecommunications Subcommittee when he said that broadcasters are developing and implementing various DTV services "in keeping with the flexibility Congress complemented in the '96 Act." In fact, most broadcasters are in no hurry to offer HDTV. At the end of 2000, only 173 out of a total of 1,288 TV stations were broadcasting in a digital format in the United States. When they finally upgrade, many of them will use their new digital channels for an entirely new revenue stream—providing commercial data services in competition with others who currently do the same thing. What some broadcasters called "left-

over bandwidth" until they figured out they could make more money with it (they now call it "enhanced television") will enable them to transmit commercial data over the air, including Web content, stock reports, and printable electronic coupons. In more technical terms, each 6 megahertz DTV channel can transport data at 19.39 megabits per second, which is 346 times faster than a 56K modem. This can be used for television, non-TV data, or a combination of both.

Television set manufacturers have more than held up their end. They have introduced about 200 different digital TV-related products, including DTV and HDTV monitors, integrated sets, and stand-alone set-top boxes. With broadcasts moving slowly and little programming available, TV manufacturers now appear to be in no hurry to produce HDTV, or HDTV-ready, models. Gary Shapiro, president of the Consumer Electronics Association, asked his members in *Vision*, the association's magazine, to "keep the pressure on local broadcasters, and reward those—maybe even with your HDTV ads—that are helping, rather than hurting, our momentum."

They're not having much luck. Most DTV manufacturers' sales have been DTV and HDTV displays that require the addition of a set-top box to receive digital broadcasts. In 1999, 17% of the total DTV products sold (including monitors, integrated sets, and digital set-top receivers) were capable of receiving digital broadcasts. This trend will likely continue if some broadcasters continue to challenge the DTV broadcast standard or insist on using DTV primarily as a subscription service.

With prices ranging from $2,500 to $6,000, most industry analysts believe that it is unlikely that one million HDTV sets will be shipped before 2003. A point of reference: About 130 million color TV sets are manufactured in the world every year. It comes down to the chicken-and-egg thing. Broadcasters say they don't want to build-out their digital system until programmers develop more material in a digital format, and TV manufacturers don't want to crank up their digital set production until more TV stations begin broadcasting digital signals. Consumer confusion about the terminology (DTV, HDTV, standard definition television, and SDTV) doesn't help.

If the programming transition continues at its current pace, the Consumer Electronics Association expects DTV penetration to slow. To meet its moderate projection of 30% market penetration by 2006, broadcasters will have to step-up the pace and provide more substantial HDTV programming. With an accelerated commitment from broadcasters, the CEA believes that it can reach or exceed 50% penetration by 2006.

In February 2002, the National Association of Broadcasters and Consumer Electronics Association began a campaign to promote HDTV, using a series of specially developed commercials and "watch parties" in three cities—Houston, Indianapolis, and Portland, Oregon—with network-affiliated TV stations already broadcasting digital TV signals.

The question for consumers now is, how much better is HDTV reception than their current TV reception? Is it more than $2,000 better? If not, when will broadcasters, programmers, TV manufacturers, and regulators get it together and make HDTV a true mass market reality? How long will it take for the price of these sets to drop to a much more comfortable $500?

Stay tuned.

Information Appliances (Or Home on the Digital Range)

How many times have you read about or seen a feature or a news clip on TV on the "kitchen of the future"? How often have you been told that you can start your morning coffee from your bedroom as soon as you sit up in bed, or turn on your lights and TV simply by dialing a code into your cellular phone from thousands of miles away? Or link your refrigerator to the Internet?

The goal of a growing number of companies is to create an entirely new market segment by developing a standardized platform that would enable your stove to communicate with Internet-enabled information appliances. These IAs, as they're called, are variously described as a stripped-down, low-cost, easy-to-use, sometimes special-purpose alternative to the personal computer that is usually tied into the Internet. "There will come a time, in the not-too-distant future," says the Con-

sumer Electronics Association, "when this will all seem ordinary, even passé."

Maybe.

Hype-generated as it is, this market has stalled before it got into second gear. What some still call the home integrated systems (HIS) market has grown very gradually since a device called X-10 first introduced automated lighting control in the late 1970s. More than 100 million X-10 devices were sold through 1999, but even the Consumer Electronics Association admits that the X-10 is an anomaly in the 20-year history of home control.

According to a 1998 survey by the association called Integrated Home Systems Potential, only 12% of consumers have some type of HIS, which the association defines as a system that allows consumers to manage some or all of their home's lighting, audio and video, security, energy, and communications.

The hype has been rampant for years. Manufacturers of small appliances (electric products that usually sit on top of a counter) and major appliances (such as dishwashers, ovens, and washing machines), along with some consumer electronic manufacturers continue to talk a good game, but they know that a mass market for automating this stuff is a long way off. "The biggest problem," wrote one magazine editor, "is the apathy of the end user to such systems." In other words, very few people actually want it or perceive a need for a refrigerator that tells them or their PC when they're almost out of milk. In fact, of those households that do not have a home system, 46% of those surveyed by the Consumer Electronics Association said they did not have a need for an integrated home network.

The technology is in place, even if the market is still very much in limbo. Current technical "solutions" include Microsoft's Universal Plug-and-Play (UPnP) and Jini, which is being heavily promoted by Sun Microsystems. Both systems can intercommunicate, and both have received strong backing from major appliance manufacturers, but consumers still aren't on board. GE, Maytag, and Whirlpool each plan to develop refrigerators and ovens that can be connected to both the Internet and/or a home network. Why are they doing this?

"It's fairly easy to imagine the benefit, given that many savvy cooks already log on in the kitchen to download recipes," says the Consumer Electronics Association, albeit from their home PC. As the trade association sees it, an Internet-enabled stove would be able to set itself according to cooking instructions downloaded to it from a Frugal Gourmet Web site. At the same time, the Internet fridge could take any inventory of the ingredients needed for the recipe. The fridge could also print out a grocery list and place the order with an online grocer. A bar code reader built onto the face of the microwave could automatically set the power level and timer the instant the cook waved a package of food in front of it. A residential gateway could leverage other Web-based services such as performance upgrades, warranty registration, remote diagnostics, and energy management features.

The next obvious step is to have these "connected" appliances communicate with each other over a universal home network. Whirlpool's concept refrigerator, which could be on the market in a few years, features a built-in touchscreen used to access the Internet, store messages, and control other electronic devices in the home. You can detach the touchscreen to cue the stereo, adjust the intensity of the lights, and post a family schedule. Similar products are in development by other manufacturers.

The Massachusetts Institute of Technology (MIT) has been playing around with kitchen technology for years. To pursue a "vision of the future" in domestic technology, interested graduate students and faculty advisors have formed a group cleverly named Counter Intelligence, which is supported by a tightly knit set of projects called Kitchen Sync. With Kitchen Sync, a microwave oven could, for example, correlate cooking time to weight. Another Kitchen Sync development is Mr. Java, an intelligent coffee machine, which can identify the user of the cup and prepare coffee to the cup owner's liking. Then there is the Kitchen Sync Chocolate Cake Scenario. It's right out of Star Trek. As described by grad student Joseph Kaye, you would announce "Kitchen," bringing Kitchen Sync out of its digital slumber. "I'd like to make a chocolate cake for dessert tonight." Kitchen Sync also reminds you where you put the ingredients and then offers the recipe. It also suggests ingredient substitu-

tions, such as the use of low-fat chocolate. From there, it's only a matter of sliding the cake into the preheated oven and waiting until Kitchen Sync tells you when to take it out.

Another project keeps track of overall consumption of coffee, including dividing the data by day and by hour over time. For example, when MIT researchers first tried this a few years ago, they discovered that coffee use peaked at 11 a.m. and again at 3 p.m. This information was, according to a white paper produced by one of the graduate students at the time, of great interest to many of its sponsors, including Maxwell House and Procter & Gamble (owner of Folgers), who have spent a lot of time and effort tracking usage statistics such as these, historically by hand.

Another MIT application is a refrigerator, known as Cool I/O (for input/output), that keeps track of its contents, with the dates that an item entered the fridge or was used, and its expiration date. Also on MIT's development wish list: Cameras above stoves to ensure that a watched pot never boils over, and trash cans that tell you when they are full. Cool I/O is projected as a 10-year program in terms of actually getting it into the market.

Again, who really needs this stuff? Hardly anyone, according to Andrew M. Odlyzko, the head of the Mathematics & Cryptography Research Department at AT&T Labs, who wrote *The Visible Problems of the Invisible Computers: A Skeptical Look at Information Appliances* in 1999. Published in the online journal *First Monday* (www.firstmonday.org/issues/issue4_9/odlyzko), Odlyzko's take is that no one has really figured out how to make these information appliances work together. "The interaction of the coffee pot, the car, the smart fridge, and the networked camera will create a new layer of complexity. In the rush toward the digital era, we will continue to live right on the edge of intolerable frustration."

This hasn't stopped the market research community from priming the IA pump. In 2000, Parks Associates projected that information appliances will outstrip PCs in the United States by as early as 2001. Parks said its research suggests that 22 million in-home information appliances (excluding Internet-enabled mobile phones and telematics systems in vehicles) will

ship in the United States in 2001, compared with 18 million PCs in the same year. By 2005, Parks forecasted, total revenue from all information appliances (again, excluding Internet-enabled cellphones and telematics systems) will reach $33.7 billion. Another market researcher, International Data Corp., has been saying almost the same thing: that, by 2002, more information appliances will be sold to consumers than PCs. Dataquest also sees 2002 as IAs' watershed year, with measurable growth in TV-enabled Internet access devices, including set-top boxes and dedicated Web tablets.

And while PCs are pretty much compatible with each other, most new and emerging information appliances are not. By one analyst's count, at least 60 different companies were racing to get an information appliance to market before the end of 2000. So far, few have made any formal product introductions, and one of the biggest reasons is that they can't figure out what system architecture will work best in a market where manufacturers are pretty much doing their own thing. For the moment, there are no technical standards for IA. And fixing this problem is not one of the stated goals of the Internet Home Alliance.

Formed in October 2000 this nonprofit association of high-tech manufacturers and retailers has chosen to focus on "catalyzing the home technology industry and fueling mass adoption of connected technology by focusing on solving consumer dilemmas through the Internet Lifestyle." It will have its hands full. 3Com, an early IA player and hardly a lightweight in the consumer marketplace, shut down its Web appliance division early in 2001 and discontinued its retail product, the Audrey Web tablet. At about the same time, Gateway, which barely got its IA product out of the box, said it was "rethinking" its next move in the category.

Why did 3Com drop Audrey? "While we continue to believe in the potential for Audrey," 3Com said in a news release, "there are indications the market will take longer to develop than originally planned and require additional investment." Which 3Com indicated it was not prepared to do at the time.

Netpliances introduced i-opener, powered by AT&T WorldNet Service and scheduled to be available from QVC, the electronic retailer, but that also hasn't gone very far. Vtech,

meanwhile, introduced its e-Mail PostBox and Address Book to Yahoo! customers in the fall of 2000, but the company has since revised its business plan, merging its IA and PDA units into its consumer telephone business division. Merinta, an appliance infrastructure company, has closed up shop. Others are still in the hunt for developing a legitimate IA mass market, including Cidco, Inc., which had sold more than 70,000 of its MailStation "personal Internet communications products" by the end of 2000. Cidco then introduced two cordless e-mail appliances. One of these, the Mivo 350, displays text and graphics on a 16-grayscale LCD screen, supports HP DeskJet 600 and 900 series color inkjet printers, provides a photo album that lets users store up to 10 pictures for printing on the HP printers, and provides storage for up to 400 e-mails, 100 HTML pages, and 5 photos. The Mivo 350 also incorporates personalized Internet options such as local weather, news, stock quotes, horoscope, TV listings, and other features, delivered as HTML Web pages and reformatted to fit the Mivo 350 screen. Users can scroll up and down to view entire HTML pages, just as on a PC.

Heavyweights such as Compaq Computer and Microsoft are selling Compaq's iPaq Pocket PC, a PDA they promote as an IA device for accessing and eventually controlling communications-based Internet appliances. At the same time, Intel Corp. and Compaq are collaborating on the development of wireless handheld communications devices used to access and transmit data over the Internet, including IA applications. And Sony is promoting its eVilla Network Entertainment Center, saying that it offers "the best of the Internet without the hassles of a computer and gives you more entertainment and features than a standard Internet appliance." Samsung Electronics has also begun commercial installations of smart home appliances in a 100-apartment residential complex that is based on Echelon Corp.'s technology—essentially, a system that networks air conditioners, refrigerators, microwave ovens, and washing machines. Using a wireless Web pad, PC, or mobile phone, residents can control and monitor each device over the Internet, perform remote diagnostics, and check user guides.

Little has been heard from Nokia since early 2002 when it announced the formation of Nokia Home Communications, a

new business unit it set up to develop Internet-based technology for the home. Japan's NEC Corp. has also yet to ship the 400 megabyte per second wireless transmission technology for networking home appliances that it announced in January 2000. (NEC's plans called for commercializing the device by the end of 2000.)

Networking giant Cisco Systems is working with Echelon, a control systems specialist, and Microsoft has licensed control technology from Intellon. Companies promoting Sun Microsystems' Java OS formed the Open Service Gateway initiative in 1999 to promote Java-based home networking, and virtually every manufacturer of home automation products has joined the Home API to develop application programming interfaces that would enable third-party software developers to create home-control programs based on the Microsoft Windows operating system.

That said, other issues will soon become apparent to well-informed consumers, particularly those early adopters with an interest in technology. One is the rapidly shrinking availability of Internet addresses. In theory at least, as pointed out earlier in this book, the current system will likely max out when it is hooked into 4.3 billion computers and other devices, or about twice the number currently assigned. With the continued growth of the Internet, and the introduction over the next few years of potentially millions of new, portable, Internet-enabled wireless devices, and the possibility of a totally new category of information appliances under development, with each of these or a tightly knit network of these appliances linked to the Internet, the problem starts to take shape. Most people who track these things anticipate that there will be several billion Internet-enabled devices in use in the world by 2006, but without the numeric address capability to support all of them.

There is something called Internet Protocol version 6 (IPv6), an upgrade of the current IPv4 technical standard, that is designed to handle the more than 4 billion new Internet addresses, but IPv6 may not be fully in place until at least 2006. Meanwhile, Internet use continues to grow, particularly outside North America.

Another thing: Should homeowners who buy information appliances worry about hackers, or anyone else, tapping into their Internet-linked refrigerators to look at its contents? (In this case, "only your doctor knows for sure" no longer applies.)

Want them or not, appliances will eventually be available with new, highly sophisticated features and functions, which—like those available in your VCR—you may never use.

TRUE STORY

About the time *2001: A Space Odyssey* was making its way to movie screens across the country, a computer programmer friend of mine, who also fancied himself a gourmet cook, was trying to use what he thought were artificial intelligence (AI) techniques—at least those that were available to him at the time—to create new recipes under very specific conditions. Convinced that you could not simply double the ingredients of a recipe for, say, four people, when you were expecting eight for dinner, and expect to get the same results, he attempted to write a computer program that would enable him to produce a recipe that would accurately match the original recipe in taste and texture, complete with a new set of ingredient levels and measures. He hoped to do this with virtually any dish he wanted to serve. He worked on this project for a long time, but he never could get it to work.

Home Networks and Home Automation

The amount of money spent by consumers on home networks and home automation in 1999 was probably only exceeded by the amount spent on ink and paper used in reporting on the potential growth in home networking and home automation in 1999.

Walter S. Mossberg, who started writing a personal technology column for the *Wall Street Journal* in 1991 when PCs were just beginning to use 3.5-inch floppy disks, had the industry tagged pretty well when he wrote, in May 1999, "Whenever the computer industry introduces a supposedly simple, purportedly must-have product, smart consumers should grow suspicious. This is an industry with a great hype machine but

almost no clue about what mainstream users consider simple and what they really need. So skepticism is in order when considering the industry's latest 'hot' product: home networking systems." Two and a half years later, in October 2001, Mossberg wrote a much longer feature piece, an update on the "dramatic progress in personal technology," which he ended with the following warning: "While the PC has gotten easier, newer technologies, such as wireless home networking, are as depressingly complicated as computers once were." But this hasn't stopped new-home builders, hoping to differentiate their product, from developing and launching plans to install home networks in all the new homes they build in the next few years. The tough question for home builders and developers is, if they build it, will they come?

Projections for this market are all over the place. Market analysts at Cahners In-Stat say that more than 20 million homes in the United States have more than one PC. Allied Business Intelligence, another market research organization, says that by 2004, nearly 33% of U.S. households will have more than one computer. In January 2000, the research firm Strategic Analytics published a market study suggesting that consumers are lukewarm to home networking. Three months later, Cahners In-Stat, published its own market study in which it said that 2000 would be a big year for home networking. "Without a doubt," Cahners said, "this market will be extremely dynamic throughout 2000 as new products come to market and channel strategies are ironed out." Meanwhile, a survey by the Consumer Electronics Association (CEA), which has invested millions of dollars over the past two decades in home networking industry promotion and standards, indicated that most of these systems will *not* become commonplace in American homes. Most are too expensive for "average" consumers to comfortably afford and are typically best installed while a home is under construction, which immediately limits the market's growth. The trade association does, however, say that it sees a "groundswell of interest" in new home networking systems, with more than half of the consumers it surveyed expressing an interest in spending $5,000 for a network-enabling wiring system for a *new* home.

This is after years of developing and promoting a technical standard called the CEBus. According to the Consumer Electronics Association's CEBus Industry homepage, when traditional home electronic products are outfitted with "Home Plug & Play" network features, they can work together to offer a new generation of functionality. Some examples of the hype:

- Consumers could save on utility costs by having their homes automatically respond to variable time-of-day pricing by utility companies.
- Security systems could display a home's floor plan on a bedroom TV to troubleshoot problems as they happen.
- Household appliances could offer self-diagnostic options that notify when maintenance is due . . . and call to schedule a repairman's visit if so desired.
- Multitasking home PCs could monitor conversations between other household products and let the home's residents tell products what they want done.
- Household clocks could always keep the right time, even after power outages.
- Security system occupancy sensors could let the home's lighting and temperature control equipment know when the home or individual rooms are occupied.

Almost defensively, the CEBus Web asks: Haven't we heard this type of NEWS before?

Their answer is that "Prior announcements concerning standards and specifications for network products in homes differ significantly from the CEBus Industry Council's Home Plug & Play Specification. Prior standardization efforts asked manufacturers to adopt a message transportation method to get an application language (i.e., to get an appliance language, producers had to first select which horse was to carry the message)."

In January 2002, the Consumer Electronics Association announced that the Home Automation & Networking Association (HANA) had merged into the CEA, creating a new Home Automation & Networking (HAN) division for HANA's 500 members, including manufacturers and installers.

Of course, PCs are just a jumping-off point. Anyone can network his home entertainment system (including interactive

TVs and DVDs), home control system, and security system and link them to the Internet. Several homebuilders have developed an assortment of technology packages, from a basic wiring foundation to an "ultimate" networking system. According to the National Association of Home Builders, 34% of builders now offer so-called structured wiring packages as standard or optional amenities.

Every house now built in Las Vegas by Pulte Corp., the nation's largest homebuilder, includes a structured wiring system—one that basically lays a foundation for high-speed networking among a variety of devices within a home—with dual data/telephone cabling and dual RG-6 coaxial cabling run to every room jack. To accommodate home entertainment centers, family rooms feature as an option a special faceplate for four coaxial outlets and two RF-45 jacks. The larger faceplate is for video distribution, including closed-circuit TV. Empty plastic conduit installed from a point outside the home to each bedroom, home office area, and family room ensures the home can support any new technology. New cabling can be fished through the conduit if necessary.

Builders, developers, and new-home buyers in New Jersey can also now purchase in-home broadband networking from Verizon Wireless that will enable consumers to take advantage of the broadband Internet connections that are increasingly available.

But are homeowners really up to the task of installing a home network, particularly one that calls for integrating a PC with home control, security, and entertainment systems? In fact, are retailers able, or even willing, to take on the job of becoming facilities managers for home systems? Given some of the technical issues consumers and retailer/installers face, this is going to be a tough market to pitch.

One of the biggest hurdles in selling home networks has been the lack of a standard network protocol, which would allow a home system made up of components and devices from different manufacturers (sort of like a stereo system) to communicate with each other. Which means that several standards are currently in play and few, if any, of them interoperate.

In January 2001, the Consumer Electronics Association demonstrated its Versatile Home Network (VHN), which, for the technically inclined, operates at 400 megabits per second (400 Mb/s). At the same time, Silicon Image introduced its Digital Visual Interface (DVI), which can transmit at 5 gigabits per second (5 Gb/s). DVI has received high marks from several industry companies, including Universal Studios, Fox, and Warner Bros.

Most PC networks use one of two connectivity standards developed by competing consortia—HomeRF, a wireless system, or the HomePNA Phoneline Networking Alliance, which uses a home's existing telephone wiring. Both groups have developed protocols, or technical standards. More than 150 HomePNA-compliant networking products were on the market at the end of 2001; about 20 products were compliant with the HomeRF Shared Wireless Access Protocol (SWAP). A third home network that is moving into the marketplace uses the power line, but it is much slower than the other systems and only a few of these are available today. (Hoping to create a common power-line protocol, the Consumer Electronics Association formed what it calls the R7 Home Networking Committee, but several companies are not onboard. Shortly after the R7 was created, the HomePlug Powerline Alliance was launched by 3Com, Intel, Panasonic, Radio Shack, and others, to develop their own set of standards.)

HomeRF, with several heavyweight companies behind it, including IBM, Motorola, Compaq, Intel, Siemens, and Proxim, got a huge break in August 2001 when the FCC allowed the HomeRF Working Group to increase the transmission speed of SWAP to 10 Mbp/s, a fivefold increase in HomeRF bandwidth. The rule change, originally proposed by the HomeRF WG and its member companies, looked like it had significant implications for the growth of the home networking market. With this development, HomeRF WG member companies were now free to deliver a variety of new products supporting data speeds comparable to those of corporate wireless networks. With HomeRF running at 10 Mbp/s, consumers could now download Internet audio formats, including MP3, without interrupting other net-

work activity. Dolby Labs said the FCC ruling would open up a new class of audio products that would include wireless surround speakers, high-quality networked digital jukeboxes, and Internet radios. The change also added new support for audio and video streaming and expanded the voice capabilities with support of up to eight cordless handsets.

Forget about it. HomeRF is already being overrun by another wireless network known as IEEE 802.11b, although another system—802.11a—is likely to give the "b" version a run for its money simply because it operates at a higher data rate. Developed primarily for use in offices and factories, 802.11 is gaining market ground on HomeRF fast enough that it could become the predominant in-home wireless system over the next few years.

How did this happen? For one thing, 802.11 network card prices have dropped tremendously—to within a few dollars of HomeRF adapters. The 802.11 technology is also being marketed much more aggressively than HomeRF, and it is increasingly being embedded into a variety of devices, such as laptop computers and wireless devices designed for the home, not simply designed to be plugged into them.

The cable industry also has a stake in home networking through CableLabs, cable operators' research and development consortium. More than a dozen companies, most of them the same companies that joined HomeRF, have signed on to this initiative, called CableHome. Each of them has agreed to work with a royalty-free pool. CableHome starts with the proposition that, if you choose to use home networking equipment approved by your cable operator, the operator will guarantee that it will work seamlessly with your broadband cable services delivered over cable.

Then there's Bluetooth, the short-range wireless system originally developed as a cable replacement between portable devices and fixed, wall-mounted access points. Bluetooth proponents see a huge opportunity in home networking in point-to-point and point-to-multipoint connections with several "piconets" linked together to allow continually flexible connections between portable devices and desktop PCs.

DSL Takes Its Hits

Like WAP, DSL has picked up a few nom de plumes of its own. Disappointing Subscriber Line and Digital Slow Line have shown up in letters to the editor of several industry magazines. But then, DSL—it actually stands for digital subscriber line and provides a high-speed connection to the Internet and corporate intranets—has been a big disappointment to millions who can't get DSL service, as well as to the millions who are getting it.

One consumer watchdog group, the New Networks Institute, estimates that as many as 75% of the DSLs have run into installation or service problems in some areas. But love it or hate it, DSL is the primary way most people get broadband access at home or in small offices. A survey of 150 readers of *Network Magazine* in 2001 indicated that most people hated it, with 55% reporting problems during installation and 35% declaring it a "major headache." Was the service delivered on time? Forty-seven percent said no. Thirty-two percent of the survey's respondents also said the speed of the service was less than advertised. The top rumor coming out of 2001 DSLcon, the industry's own trade show, reported *Telephony* magazine, was that "Technology has fallen victim to the hype machine." DSL even has its own Web sites to register complaints about DSL providers around the country—www.dslreports.com and www.2wire.com.

Despite the horror stories about installation problems, lack of access, and articles in the business press about independent DSL providers struggling to stay alive, market research continues to be generally positive, projecting that by 2003, DSL will exceed installations of all other broadband Internet access technologies combined, including leased lines, frame relay, ATM, cable modem, satellite, and wireless.

Others aren't so sure. DSL is a remote access technology that uses the existing telephone copper wiring infrastructure. It promises high bandwidth (meaning it's fast, at least 10 times faster than dial-up modems while leaving the phone line free for regular calls) and low cost—down to $20–$30 a month in some areas. It has another advantage to the user in that it is

"always on," so there is no waiting for a modem to dial and connect before sending or receiving data. And there are no delays when a network connection is made, enabling DSL providers to use new Internet "push" technologies to send information to the subscriber's computer as soon as the information is available.

So, what's the problem? For one thing, customers must be within 10,000 to 18,000 feet of a central office to get the service. There are also aging copper networks to contend with. Industry estimates of the percentage of phone lines that can handle DSL range from 30% to 60%, which means the service may not be reliable. Installations often fail or simply won't work with some subscribers' wiring.

Another big hangup is that installation often requires working with at least three companies. It usually starts with buying the service from an Internet Service Provider, or ISP, which contracts with a DSP technology company to make the connection. The DSL specialist then must work with the local telephone company to handle some elements of the installation. DSL subscribers complain that when something doesn't work, these companies pass the blame and it can take weeks to fix the problem, if then. It's all about money. Several independent DSL providers have cancelled their expansion plans, revised earnings estimates, cut staff, or simply gone bankrupt.

One of the bankruptcy group, NorthPoint Communications, believes it was blindsided when Verizon Communications decided not to merge with NorthPoint, a deal that would have pumped $800 million into NorthPoint and kept its service intact. Another DSL provider, Rhythms NetConnections, was rumored to be making a bid for NorthPoint's customer base at approximately the same time that Rhythms hired investment banker Lazard Frere & Co. to look into its financial options, including the sale of the company. NorthPoint couldn't wait; it sold its equipment to AT&T. At about the same time, Excite At Home Corp., Microsoft, and Nippon Telegraph & Telephone's Verio business unit, which bought DSL access from NorthPoint, announced they were ending their DSL service, at least for the time being.

The big U.S. carriers, like SBC, the nation's leading DSL provider, Verizon, and some ISPs continue to push DSL as the best way to get homes and businesses connected. SBC hopes to hook up 80% of its customers to DSL by the end of 2002 through so-called neighborhood gateways—sort of subcentral telecom stations—to extend the currently limited reach of their central offices. Even technology hounds such as Stephen H. Wildstrom, *BusinessWeek's* technology columnist, are frustrated. "I'm disappointed," he wrote in December 2000, "but not surprised, to be stuck among the 95% or so of Americans without high-speed Internet service. Despite all the hype and talk of broadcast-type video and CD-quality audio over the Net, we are a dial-up nation, and we are likely to remain that way for a long time to come."

Still, DSL continues to sell well among consumers who need a high-speed alternative to their current dial-up service and are not price conscious. And it's strong internationally. Most analysts believe that DSL will continue to do well, particularly among consumers whose choice is between DSL and cable modems. They're competitively priced, and cable modems use the same type of wire that brings cable TV into the home; cable providers usually require that cable modem subscribers also sign up for the cable TV program service.

The cable guys also want to be your home network. CableLabs, mentioned earlier, has published several documents outlining specifications for quality of service and network architecture to be used when networking a cable connection in the home. The specs are part of the industry's effort to lay a technical groundwork to support home networking for the growing list of applications for the home and small offices, such as multimedia. It's also a clear attempt to better compete with DSL service providers. (Curiously, a study by the Strategis Group found that a greater percentage of cable modem users than DSL users are satisfied with their service based on several measures, including overall quality, access speed, and "always on" connectivity. The group also found that potential churn among DSL users—the rate at which people change or cancel their service—is nearly twice as high as that of cable modem

users, 15% versus 8%. "Therefore," it says, "while DSL providers may acquire more customers due to their superior marketing efforts, they may eventually lose a higher percentage of customers to other DSL providers or to other access technologies than their cable modem counterparts."

When you can get it, and when it works, DSL can offer some interesting applications, like voice-over-DSL, high-speed Internet access, online gaming, video streaming, and conferencing. With more than 400 members, the DSL Forum is busily hyping cooperation among hardware and software vendors and service providers to enhance interoperability between different network's equipment, a move that will improve installation and cost effectiveness.

To help ease the pain of installation, DSL providers are pushing something called self-provisioning. That is, customers will be able to plug the DSL modem into an outlet and a phone line will configure itself by connecting and talking to the central office. The three-mile barrier is another problem, but the DSL camp thinks it may even have a way around that, with potential deployment of service up to five miles from a central office, possible in many areas. Meanwhile, new and emerging higher-speed versions of DSL, with longer range and improved performance, are in the works and may mean writing new technical standards. And at least five industry organizations, the DSL Forum, the Institute of Electrical and Electronics Engineers (IEEE), the Geneva-based International Telecommunications Union, the ATM Forum, and the American National Standards Institute (ANSI), are working the DSL standards issue.

The bigger problem is selling broadband, no matter what the technology, to consumers, particularly in a weakened economy and in an environment where most people use the Internet mainly to check their e-mail. Lower prices will help. So will an improved product and service.

Voice Recognition—So Much Talk

You may have seen the commercial in which a driver is approaching an intersection with a red light and he says,

"Green light" and the light immediately changes to green. Neat stuff, if it actually worked under real-life conditions.

This technology is known as voice recognition or speech recognition. It is the natural interface for wireless devices and one of the more obvious methods of easing concerns about drivers who become distracted while trying to punch in a number in those tiny keypads while using their cellphones. You can simply speak the name or number you want to call, either into a handheld phone or a well-placed microphone dedicated to this purpose.

Most of the time.

Several companies around the world have spent millions trying for at least 25 years to get this technology to work, but it still has some serious bugs. For one thing, it's often not very accurate; that is to say, the technology does not accurately recognize exactly what you're saying and respond accordingly. Another problem is ambient noise. Try using one of these systems at a noisy trade show, at an airport gate during a public address announcement, or in your car with the radio on.

Commercial products and services have been available for some time in some specific, well-controlled applications. Getting airline flight information is one that seems to work most of the time. Voice-activated consumer products are also available, but are technically limited.

Voice portal services such as BeVocal, ShopTalk, and Tellme Networks are gaining in popularity. Sprint PCS now offers its customers a service called Voice Command, which enables users to create a voice-accessible address book. Yahoo! and Lycos have introduced a suite of speech tools and services that give consumers access to their content by telephone. Lernout & Hauspie, a leading speech technology company until it entered bankruptcy proceedings and then closed up shop, had announced plans to enter the wireless communications market with a system that lets mobile phone users access information on the Web, such as traffic reports and movie listings. PDA maker Palm has teamed with SpeechWorks International to add speech recognition to Palm's Web-based calendar service. Motorola has introduced its iRadio Internet system for automobiles with Internet access, a

directory dialer, and address book, and the ability to send and receive e-mail through its voice recognition feature. All of these efforts should lead to improved voice recognition services.

Like so many other technologies, the Internet will be the driving force behind getting voice access into the network. Increasingly, the technology, because it is so easy to use, actually presents carriers and other wireless service providers with an attractive alternative to existing industry technology standards such as the Wireless Application Protocol (WAP). As an alternative to WAP, speech-recognition enables users to access Internet content hands-free.

One of the first things that has to happen to make voice recognition work for everyone is the creation of a technical standard, and that process is well underway. Version 1.0 of the VoiceXML (Voice eXtensible Markup Language) specification has been accepted as a standard by the World Wide Web Consortium (W3C). The W3C's Voice Browser Working Group has agreed to base its efforts to develop a standard on VoiceXML. This is a spec that could provide a high-level programming interface to speech and telephony resources for application developers, service providers, and equipment manufacturers.

Unfortunately, more than two years after Motorola, IBM, Lucent Technologies, and AT&T helped form the VoiceXML Forum to bring technical standards to voice recognition, there is still no way of ensuring that any of these systems can talk to each other.

Interoperability concerns have begun to slip through the standards development cracks and have taken on more of a competitive marketing track, with voice recognition companies introducing their own "open standard" systems and selling their products as modules that can be updated or changed-out as new accessories and technologies are developed. The result is that few of these products may work together, or they won't work together very well.

Wireless service providers can't wait for these developments to kick in. They're convinced that easy access to different services through voice recognition will increase their traffic—and their revenues. Automated speech-recognition-enabled

services could also produce cost savings for the carriers; the cost of processing a phone call using an automated directory assistant is about one-tenth the cost of processing the same call using operator assistance. Bottom line, look for voice portal companies to introduce more sophisticated and useful applications. In fact, voice access to e-mail and Web-based information and services appears to be well on its way to becoming a primary consumer interface for a variety of portable electronic products, including electronic games.

A Cry for Help

With more than 118,000 calls a day made in the United States to 911 and other emergency numbers from wireless phones, the Federal Communications Commission thought it might be a good idea to make it easier to determine the location of people making an emergency call—even if they don't have a clue where they are. From this, Enhanced 911, or E-911, was born.

The media picked up on this early with a story of a New Jersey family that ran off the road in the middle of Nebraska late at night without knowing where they were. They called E-911 and the system tracked them to within a few hundred meters and sent help. Technology to the rescue . . . again.

But what technology? Nearly every major U.S. carrier has filed a request for an extension with the FCC, claiming the technology wasn't up to the task. At least not under the tight location restrictions required by the commission.

The current E-911 rules were adopted in 1996 and reflected the technology available at the time, which anticipated only a network-based approach called automatic location identification (ALI). Now, with the FCC's E-911 plan fully envisioned, emergency response centers can locate the caller by using the nearest cellular towers to triangulate the call and determine which tower is generating the strongest signal from the emergency call. But then the FCC revised its rules to make room for other options.

Under the new rules, wireless carriers who employ a location technology with new, modified, or upgraded cellphones were required to begin activating and selling them no later

than March 1, 2001. At least half of these handsets were to be ALI-capable no later than October 1, 2001. Also, at least 95% of all new digital phones were to be ALI-enabled and activated for this service no later than October 1, 2002.

For network-based E-911 to work, the revised FCC rules call for carriers to achieve 100-meter accuracy for 67% of mobile emergency calls and 300-meter accuracy for 95% of all of these calls. Carriers going the handset route, which means they will use the satellite-based Global Positioning System (GPS), which is more accurate and more reliable, must demonstrate an accuracy of 50 meters for 67% of its emergency calls and 150 meters for 95% of these calls.

Several carriers, including ALLTEL, U.S. Cellular, and Nextel Communications, informed the FCC early on in the process that they were opting for a handset-based E-911 system. Others, including Verizon Wireless and Western Wireless, for example, opted for the network-based system. But they have other technology choices. Most of the carriers selecting the network option favored a combination of something called time difference of arrival (TDOA), which calculates a phone's position based on the speed the signal reaches multiple nearby antennas, and angle of arrival (AOA). With AOA, cellular towers identify the direction from which a signal is coming and then pilots the direction of the incoming call based on a reading from two towers. AT&T Wireless and VoiceStream announced plans early to adopt another hybrid system known as enhanced observed time difference (EOTD). The major supplier of EOTD technology, which works only with cellphones or other wireless devices based on the European-developed digital Global System for Mobile Communications (GSM) system, is U.K.-based Cambridge Positioning Systems. CPS's Cursor software does not require any hardware modification to the handset, only some low-level reprogramming and sufficient memory.

The advantage of using GPS-equipped cellphones is that it gives carriers a running start on providing its customers with a wide array of location-based services. These include navigation data (including directions and information on nearby restaurants and retail outlets), traffic and weather reports, and a wide range of regional entertainment options.

As far as the law enforcement and other emergency services agencies are concerned, the carriers aren't moving fast enough. The Association of Public-Safety Communications Officials (APCO) punched out news releases for months on vehicular deaths across the country that it said might have been avoided if the caller's location could have been determined by E-911 technology.

At this point, it's just a matter of time. Eventually, everyone will have a portable phone with access to some kind of E-911 capability. The fear is that with wireless carriers pushing for new revenue-generating, location-based services, someone responding to an accident might be sent to a drug store on the next block.