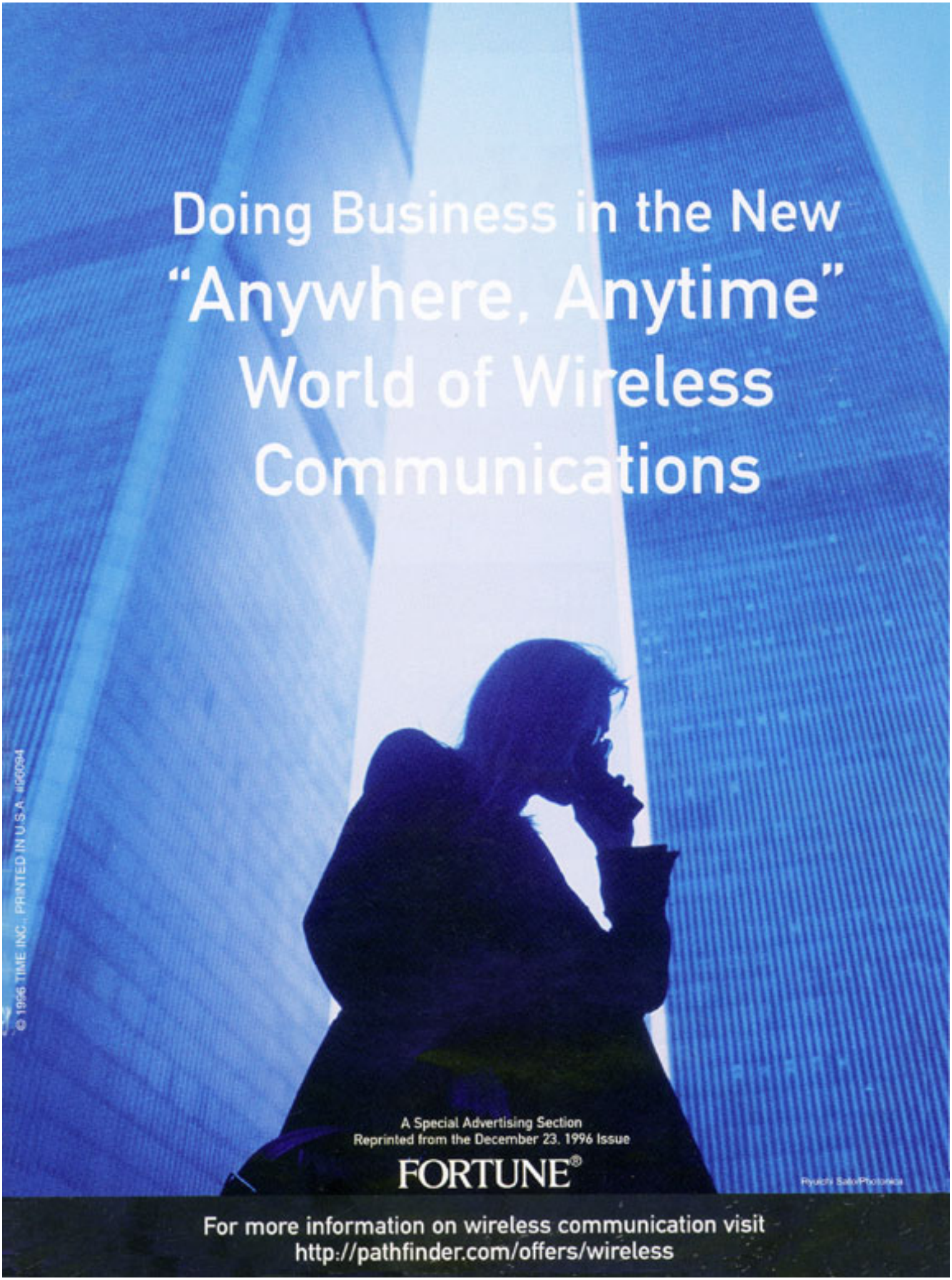

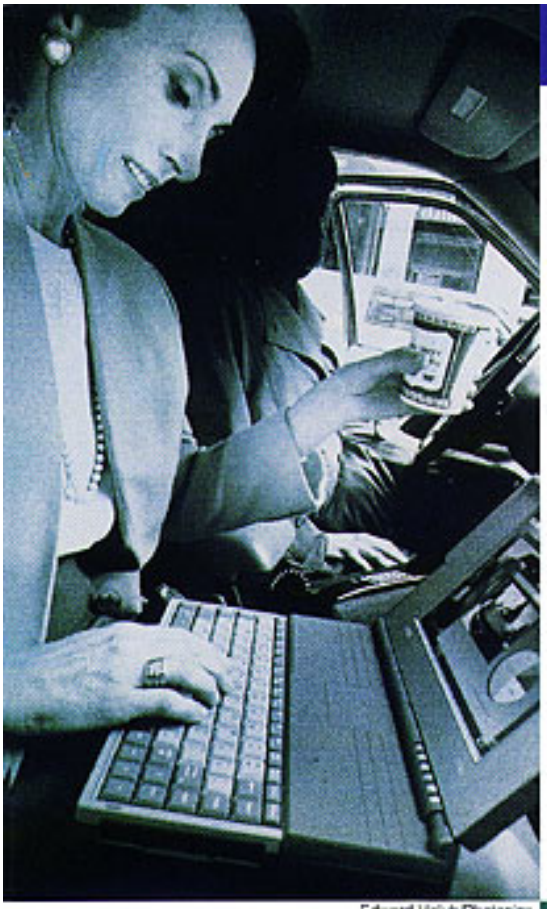

Edward Holub/Photonica

Years ago, carrying a cell phone may have been viewed by some cynics as a status symbol in a culture that admittedly seems to worship "busyness." Countless movies and TV shows used cellular phones to portray characters obsessed with work and unconcerned with the rest of life.

Today, wireless communications is less about impressing people and more about enhancing the user's ability to communicate with anyone they want, at any time, no matter where they are located—an essential component of remaining competitive into the year 2000 and beyond. According to the Cellular Telecommunications Industry Association (CTIA), there are 47 million wireless users in North America, with that number growing 30% a year.

Meeting the Need

The communications requirements of your workforce today are different than they were a decade ago. Wireless technology, once considered a luxury, is now as essential a tool to many businesspeople as their fax machine, beeper, modem, and PC.

According to *InfoWorld*'s 1995 Remote Access Study, almost one in three corporate employees surveyed already uses some type of remote access technology to keep in touch with clients and colleagues when away from their desks. The February 1996 issue of *Business Communications Review* revealed that the number of individuals working at home had grown to 46 million in 1995.

The number of wireless users is growing 30% a year

Downsizing and the resultant workaholism of the 1990s has extended business hours, so that workers never know where or at what time they'll need to call a customer, colleague, supervisor, or prospect. Professionals in global markets especially have to be able to take and make calls at odd hours outside the office.

What Works in Wireless Communication?

Aside from cost and the issue of whether the system has the features your workforce needs, obsolescence, compatibility, and interoperability are major concerns. As technology platforms evolve, will your hardware and software evolve with them? Or will your wireless investment become obsolete and force you to buy a slew of new equipment in just a couple of years?

The other side of compatibility is interoperability, which is defined as the ease with which different systems from different vendors work together. This is particularly important in wireless communications, where users travel or "roam" between areas served by different service providers using different technologies.

Defining "Wireless" Technology

There are two basic types of wireless phone systems: cellular and personal communications service, or PCS.

On one level, the difference is the frequency at which the systems operate. Cellular—from which we get the term "cell phone"—operates at frequencies of 800 to 900 MHz, and is the older, more established technology.

PCS is a newer, lower-powered technology. Competitive to cellular, PCS operates in the 1.5 to 1.8 MHz range. Manufacturers promoting PCS say the phones and air time cost less, while the lower power consumption allows longer phone operation before the need to replace batteries.

Within wireless systems, conversations are actually transmitted over the air using a variety of different technologies known as "access methods." For cellular telephones, advanced mobile phone service (AMPS)—an analog access method—has been around the longest. Analog access transmits wireless voice over the air in a signal format remarkably similar to the actual spoken word.

If you speak into a microphone, your voice—which is analog—appears on an oscilloscope as a series of sine waves. Analog systems maintain the signal in this format, simply stepping up the frequency to enable wireless transmission of the conversation.

In the United States, AMPS is the standard for analog cellular service. Europe's analog system, the global standard for mobile communications, or GSM, lets a traveler use the same cell phone in more than 20 countries, with all calls billed to one account.

Wireless Goes Digital

In wireless communications, as in most other areas of high tech, digital is fast replacing analog as the state of the art, and two digital technologies—CDMA and TDMA—are currently competing for domination of the wireless market.

Call division multiple access (CDMA) gives wireless phone systems up to 10 times the capacity of analog with more efficient use of spectrum. CDMA assigns a code to all speech bits, transmits encoded speech over the air, and puts the scrambled signal back into understandable form on the receiving end. Multipath signal processing techniques maximize signal intensity, enabling the phone company to provide wireless service over a broader geographic region while accommodating a greater number of users.

Edward Holub/Photonica

PCS consumes less power than conventional cellular systems

Advantages of CDMA over analog include increased capacity and improved voice quality. CDMA provides wireless users with consistently clear communications, increased call privacy, fraud prevention, and advanced features and services that can be added easily. CDMA's digital technology and lower power requirements result in smaller terminals for wireless networks. Messaging service is also improved greatly, as is in-building mobility through small phone company base stations called "microcells."

The major competitor of CDMA is time division multiple access (TDMA), a technology that divides the available frequency bandwidth among all users, permitting a large number of simultaneous conversations.

TDMA works in a manner similar to the time-division multiplexing used in landline networks. Conversations are transmitted as a series of frames, with each frame divided into time slots. The phone sends bursts, or packets, of information during each time slot. The packets are reassembled by the receiving equipment into the original voice components.

TDMA significantly increases the efficiency of cellular telephone systems, allowing the phone company to service three digital conversations within the same frequency range previously used for one analog conversation. In addition, TDMA digital eliminates static and "pop" that may be present in calls made with analog technology, ensuring superior voice quality.

"TDMA is a proven, tested technology," says Laurence F. Wood, chief scientist, FutureVision Group, Inc., a Sante Fe-based R&D firm. He notes TDMA is particularly effective for wireless users with a high degree of mobility. "Optimized channel separation between the circuits minimizes cross-talk while increasing capacity."

Digital PCS Saves AT&T Wireless Customers Money

AT&T Wireless, the largest wireless service provider in the world, recently announced availability of a TDMA-based digital PCS service in major markets across the U.S. and Canada.

By combining voice, messaging, and paging in a single mobile terminal, AT&T's digital PCS consolidates three separate devices—a pager, phone, and personal messaging system. This reduces the wireless devices users must carry while cutting down on battery requirements and charging systems.

A key business feature of AT&T's digital PCS offering is wireless office service, which allows local mobile users to pay a lower fee than those who are calling from a distance. When used within a building or campus, AT&T's digital PCS functions like a cordless phone making a local call, even allowing four-digit extension dialing. As users roam outside the home area, the functionality automatically switches to that of a PCS wireless terminal, retaining all advanced features the internal phone system provides.

Satellites can fill in coverage gaps

AT&T Digital PCS offers caller ID and voice mail with message-waiting indicator. Users can receive text and numeric messages on their phones from personal computers and text dispatch services, eliminating the need to wear a beeper. Digital technology also offers the customer greater privacy and increased protection against cellular fraud, often without a personal ID number.

Because of the lower power consumption, digital PCS has dramatically improved handset battery performance, enabling users to talk longer or leave their phones on for extended periods using a feature known as sleep mode. With digital PCS, some phones can be in a ready mode for up to 60 hours before recharging is required—two to three times longer than traditional wireless phones.

QUALCOMM Announces the Next Generation of Wireless Phones: CDMA

According to telecommunications author and publisher Harry Newton, QUALCOMM invented CDMA wireless technology. Or as QUALCOMM describes it in their promotional materials: "A few years ago, a group of our engineers had this idea that they could make the cellular spectrum work more efficiently so you wouldn't sound like you were calling from the autobahn with all your windows down, when you were actually in the car, riding around town, with every window closed." What they came up with is CDMA technology and phones to make wireless communication easier and clearer.

CDMA provides crystal clear calls that sound like home phones, with no static or cross-talk, reduced background noise, and fewer dropped calls. CDMA's digital encoding provides enhanced security and privacy, which means your phone number won't get stolen or "cloned" and your conversations won't be overheard.

QUALCOMM recently shipped a new line of CDMA digital cellular and PCS wireless phones to wireless carriers across the country. The phones offer consumers all the benefits of QUALCOMM's CDMA technology in a compact, lightweight unit with user-friendly features.

For example, the phone has a built-in pager and answering machine. When you sign up for short messaging service (SMS) from a wireless carrier, you can receive alphanumeric messages on the phone's large five-line, easy-to-read LCD display.

One of the biggest improvements in QUALCOMM's CDMA phones is much longer batter life than ordinary phones, because CDMA uses less power. QUALCOMM's QCP-800 CDMA/analog cellular phone offers up to five hours of talk time, and their QCP-1900 PCS phone provides up to four hours of talk time. Also, the phone's advanced lithium ion battery is easy to take care of—it can be recharged as often as required, without being fully drained.

QUALCOMM's CDMA wireless technology and phones are now becoming commercially available at wireless carriers worldwide.

AG Communication Systems Solutions Bring Together Wireless and Cellular

Arizona-based AG Communication Systems has come up with an in-building wireless solution—ROAMEO—that connects seamlessly with the existing office phone system as well as the external cellular network. When subscribers are away from their desks, calls to their desk phones are automatically routed to their cellular phones. If they are within the office complex, the in-building wireless system handles the call—at a significantly lower cost than regular cellular service. If they are outside the office premises, the call comes through as a regular cellular call.

According to AG Communication Systems, one of ROAMEO's main advantages is that it allows key personnel to be reached at one phone

number, wherever they are. "I think of ROAMEO as a workplace stress-buster because it all but eliminates every working professional's pet peeve—phone tag," says Julian Thomson, the system's business leader. "It also saves money by cutting down on return long-distance calls. ROAMEO is fully compatible with current analog standards, yet easily adaptable to digital systems of the future." The company has also introduced technology that provides similar advantages for the residential and small business markets. Its ACRE products allow a single phone to function as a cordless phone within range of a base station and a cellular phone when the subscriber is on the road.

For American Mobile Satellite, Space Is the Final Frontier

Taking wireless technology in a different direction—up—American Mobile Satellite Corporation (AMSC) is the first wireless provider to offer a full range of mobile satellite services—including data, telephone, and nationwide dispatch—to virtually anyplace in the U.S. These include SKYCELL PLUS service for mobile workforces; direct dial SKYCELL Satellite Telephone Service, and Mobile Messaging Service, which provides two-way mobile data and global positioning capabilities.

The first U.S. company to hold a license to provide all mobile satellite services (MSS), AMSC launched its satellite, AMSC-1, in April 1995, from Cape Canaveral Air Force Station in Florida. The satellite, which orbits the Earth 22,300 miles above the equator at 101 degrees west longitude, measures almost 62 feet across with its antennas fully opened. The solar panel that, along with a 28-cell nickel hydrogen battery, powers the satellite has a "wingspan" of nearly 70 feet. AMSC-1 can support 2,000 simultaneous voice channels and covers the entire continental United States plus Alaska, Hawaii, Puerto Rico, the U.S. Virgin Islands, and hundreds of miles of coastal waters. Companies that subscribe to the SKYCELL Plus service can define talk groups, allowing dispatchers to communicate with an individual user, a group of users, or the entire fleet at the touch of a button. All conversations within a talk group have complete digital privacy. The SKYCELL direct dial satellite telephone service can be used with land mobile, transportable, maritime, and fixed-site equipment for a variety of fleet and mission-critical applications.

SKYCELL's mobile satellite telephones are easy to set up and use, providing high-quality voice and data communications in areas where cellular or wired phone networks are not available. AMSC also offers satellite-based two-way mobile data and GPS (global positioning system) reporting capabilities for applications in which fleets of trucks, trains, or ships must be continually tracked.

Edward Hoaks Photonica

PCs are plugging into the wireless world

Lucent Technologies Provides End-to-End Solutions for Wireless Service Providers and Their Customers

Lucent Technologies, which was formed as a result of AT&T's recent restructuring, became a fully independent company on September 30, 1996. The result, according to one company spokesperson, is "a 'start-up' with 125 years of experience and $20 billion in revenues."

The company designs, builds, and delivers a wide range of public and private networks, communications systems and software, consumer and business telephone systems, and microelectronic components. The research arm for Lucent Technologies is the highly regarded Bell Laboratories, headquartered in Murray Hill, New Jersey. Lucent Technologies leads the North American market—the world's largest—and has won more than half the infrastructure contracts for digital wireless personal communications systems. Now independent from AT&T, the company is making inroads with companies like Sprint and has signed contracts for digital network equipment in global markets such as Korea, India, and Germany.

Unlike many of its competitors, Lucent offers a full spectrum of wireless equipment, from mobile telephones and the integrated circuits they contain (its chips are in 50%+ of all digital cell phones) to large digital switches, base stations, and sophisticated software that form complete wireless networks.

These integrated solutions are compatible with all major wireless access technologies including CDMA, TDMA, GSM, and AMPS.

Lucent Technologies products are recognized for their high reliability, a key feature in wireless networks supporting critical business applications. For instance, the company's 5ESS®-2000 Switch, which services both wireless and wireline networks, demonstrated only 1.6 minutes of downtime for 10,000 installed lines during a one-year FCC study—a tenfold improvement over the next-best performing competitor.

The company says it has reinvented its design, manufacture, order, and delivery procedures to dramatically cut cycle times. For example, while in 1983 it took 24 weeks to ship wireless stations once they were ordered, today the entire process takes just 11 days. This new "built to order" philosophy helps Lucent Technologies customers launch their wireless ventures more rapidly.

Edward Hollo/Photonica

Texas Instruments Puts Wireless Data in the User's Lap(top)

With the growth of the digital technologies—CDMA and TDMA—wireless communication isn't just for making conversation. Now mobile PC users with laptops or notebooks are gearing up to transmit data over the airways, without having to be tethered to a desktop with LAN cables. Anticipating this trend, Texas Instruments is offering wireless LAN adapters for its line of personal computers. Manufactured for TI by

Netwave Technologies, the wireless card fits into an open slot on the portable PC.

The AirSurfer™ wireless LAN PC card adapter, available through TI's livegear accessory line, transmits data to access points that communicate with the network server. Access points can be placed within a building or campus so the user is never out of range to access the LAN over the wireless extension. The AirSurfer wireless LAN PC card is fully self-contained—no wires are needed to connect to the network from the laptop or notebook PC, and no bulky antenna is required to send radio signals.

"Mobile computer users can now move freely within their building or campus while staying connected to the network," says Texas Instruments vice president Steve Lair. "Complete, uninterrupted networked mobility is transparent."

TI's wireless adapter card has a typical indoor range of 150 feet, extending up to 650 feet in open areas. The device uses a 2.4 GHz frequency-hopping radio operating at low power levels to preserve the mobile computer's battery life while providing fast LAN connections at 1 Mbps.

Smart Modular Makes Smart Choices in Product Planning and Development

Ideally, wireless technology should provide users with ubiquitous communication—continuity of phone service wherever the subscriber roams. "Digital access technologies are not there yet, and only analog currently provides true ubiquitous coverage," says Ross Forman, director of wireless technology, Smart Modular.

Based on the success of its analog landline modem, which is approved for use in 70 countries worldwide, Smart Modular, under its Apex Data Products brand, has introduced an analog wireless modem incorporating advanced circuit-switched technology. Customers include phone manufacturers, and cellular carriers.

"Although analog will continue to provide the most ubiquitous coverage for the next few years, we are now introducing modems that support CDMA, since CDMA is the most promising of the digital technologies," says Forman, noting that sales of CDMA equipment in 1996 were 60 times the volume sold in 1995.

The Apex Data cellular-ready modems, which work with more than 50 models of cellular phones, are available in two different landline speeds. The V.32 version can transmit fax and data at 14.4 Kbps. In the V.34 version, data transmission is 33.6 Kbps—and as high as 115.2 Kbps with data compression. For cellular usage, the modems can transmit data at speeds from 9.6 Kbps to 12 Kbps.

To switch between landline and cellular operation, the user simply inserts either a landline or cellular cable. The modem selects the correct modem profiles. When a cellular cable is inserted, the modem automatically loads a cellular driver, which is software that helps transfer data between the phone and the computer. Profiles and cell phone drivers are stored in a read-only memory, or ROM, eliminating the need to load cell phone drivers every time you use the modem.

Plexsys Wireless Systems Provides Cost-Effective Communications for 50,000-Subscriber Service Areas

Although many people think of wireless communications strictly in terms of car phones or neon-colored pagers, the technology has other applications. In fact, for many parts of the world mobile systems are the primary phone links.

That's where Plexsys Wireless Systems, an equity investment of COMSAT Corporation, comes in. The company designs and manufactures wireless networks, the key components of which are its PlexCell series of switches and base stations. Many of Plexsys's customers are located in rural and emerging markets with small populations—and 75% of the company's business is international.

A pioneer in the industry, Plexsys continues to introduce new and enhanced products, including the PlexCell PCS with SuperAMPS, an upbanded AMPS system, which with the arrival of dual-band handsets, will support both 800 and 1900 MHz. Plexsys has recently secured a U.S. contract for its new system, which will link PCS operators to other PCS SuperAMPS or cellular operators.

Plexsys Wireless Systems' mission is to be the most economical wireless infrastructure supplier in the world. With Plexsys equipment a service provider can cost-effectively build an infrastructure, or network, to start up service at an affordable price with products and value-added services tailored to each customer's requirements. By adding equipment modularly, the cellular carrier can expand a wireless system economically through a much quicker positive cash flow to accommodate additional subscribers and broader coverage areas.

Considerable repeat business indicates that customers feel that Plexsys is fulfilling its mission with quality systems. The company has numerous installations with Cable and Wireless in the Caribbean and was the initial supplier of systems for Vimpelcom, a Russian operator that recently became the first Russian communications company to be listed on the New York Stock Exchange. Winning a hotly

contested contract with Metrosel in Indonesia has expanded the Plexsys customer base to over 35 countries.

Since 1995 the company has increased staff by over 60 employees, with many new hires bringing extensive experience and special expertise. Plexsys's associates have helped expand the line of products and services and build customer loyalty, moving the company to the #1 position in small-switch vendors worldwide and doubling revenue in the last year.

CBIS: Customer Care for the Converging Communications Marketplace

Southern short story writer Flannery O'Connor once noted that everything that rises must converge. The communications industry is on the rise, and CBIS, Cincinnati Bell Information Systems, is positioned to help the various carriers—wireless, wireline, local, long-distance, and even cable—provide seamless, customer-focused solutions.

Since 1983, CBIS has focused on providing customer care and billing services to carriers and service providers in the communications industry. Billing, of course, means processing the bill the user gets each month. Customer care refers to interactions between the communication user and his or her service provider.

"Carriers need to focus on their core competencies," says CBIS President and CEO Robert Marino. "They can get better value and deploy capital more effectively by outsourcing customer care and billing to CBIS."

Today, CBIS provides customer care and billing services to wireless, wireline, local, long-distance, cable TV, and emerging service providers worldwide. The firm is unique in that it specializes in the communications industry exclusively. According to Marino, CBIS covers two-thirds of the PCS population and almost one-fourth of the cellular population with its billing services. "The wireless user doesn't know that we are even there," says Marino, "but our service provides a more positive experience whenever a wireless customer or potential customer communicates with the service provider."

CBIS solutions are helping carriers address key market drivers to increase revenue and productivity and decrease operating costs with end-to-end

solutions. One of the carrier's major customer-service challenges is churn. Next to cost of service, problems with customer care and billing are the major reason why customers switch services and carriers. By providing superior customer care and billing, CBIS solutions help service providers reduce churn and build a more loyal customer base.

CBIS's billing solutions can also help a service provider address the issue of price. With access to more detailed usage data, the service provider can call customers and proactively suggest different calling plans, which, based on their usage, can better meet customers' needs and enhance the carrier-client relationship, explains Marino.

Prior to becoming an independent company in 1983, CBIS was part of Cincinnati Bell Telephone. This heritage of more than a century in telecommunications customer care and billing experience gives CBIS an edge over other customer care and billing solutions providers in this industry, says Marino.

Because it offers solutions in all areas of the communications marketplace—wireless, wireline, local, long-distance, and cable—Marino notes that CBIS is well positioned to take advantage of the growing industry trend toward consolidation, in which users would get a single bill from a single provider for all their communications services.

Toward this end, CBIS recently acquired several billing companies including the third-largest cable biller in the U.S., which now functions as CBIS's cable and broadband solutions group. CBIS also operates two national data centers equipped with extensive built-in redundancy and disaster recovery capabilities to ensure continuous service to its clients.

"We provide an enabling technology that lets our clients compete in a very dynamic marketplace by giving them the opportunity to differentiate themselves through superior customer care," says Marino. "We are pleased to be in our current leadership position and will work hard to maintain it into the 21st century."

Boosting the Corporate Bottom Line

Aside from status, convenience, and the attraction of yet another high-tech "toy," wireless telephones and computers, along with other modes of

PCIA & PCS '97

PUTTING WIRELESS COMMUNICATIONS TO WORK FOR YOU

Members of the Personal Communications Industry Association (PCIA) are changing the way the world communicates through wireless technologies and services.

As "anywhere, anytime" wireless innovations reshape our lives and businesses, it is important for corporate leaders, entrepreneurs, and consumers alike to keep up with advancing developments. At times it seems that if you blink, you'll miss the wave to the future and be left behind—unable to advance—let alone compete. That's where PCIA and the Personal—Communications Showcase (PCS '97) can make a difference for you.

Sponsored by PCIA, PCS '97 is the premier event for the wireless industry. Offering the latest product introductions from the most progressive wireless developers and unparalleled education programs, this one-of-a-kind trade show is a "must go" for those companies who want to succeed in the next century.

"Companies who want to be ranked at the top of their industry cannot afford to miss this show," says Jay Kitchen, president of PCIA. "It truly is the difference between being a player in the future or being left behind in the past."

PCS '97 is in Dallas, Texas September 10-12, 1997. For information on the wireless industry, contact PCIA at (800) 759-0300 or find them at http://www.pcia.com

remote access, can have a positive impact on your firm's competitiveness.

Almost 40% of today's workers consider themselves "mobile," and seven out of ten of all U.S. professionals spend more than 20% of their time away from their desks. By enabling more workers to be mobile or telecommute, wireless technology can significantly lower facilities costs while increasing worker productivity by as much as 25% or more, according to several independent surveys and studies.

Like the CD-ROM and the Internet, wireless communication is here to stay. The organization that evaluates acquisition of wireless technology with the same care and effort their IS departments use to evaluate new computer systems can reap many benefits while preventing costly obsolescence and systems incompatibility. ■

For more information on wireless communication, visit http://pathfinder.com/offers/wireless

Reprints of this Wireless section are available in quantities of 100 or more. To obtain a reprint order form, please fax your request to Cara Molyneux at (212) 522-0999 no later than December 16, 1996.

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