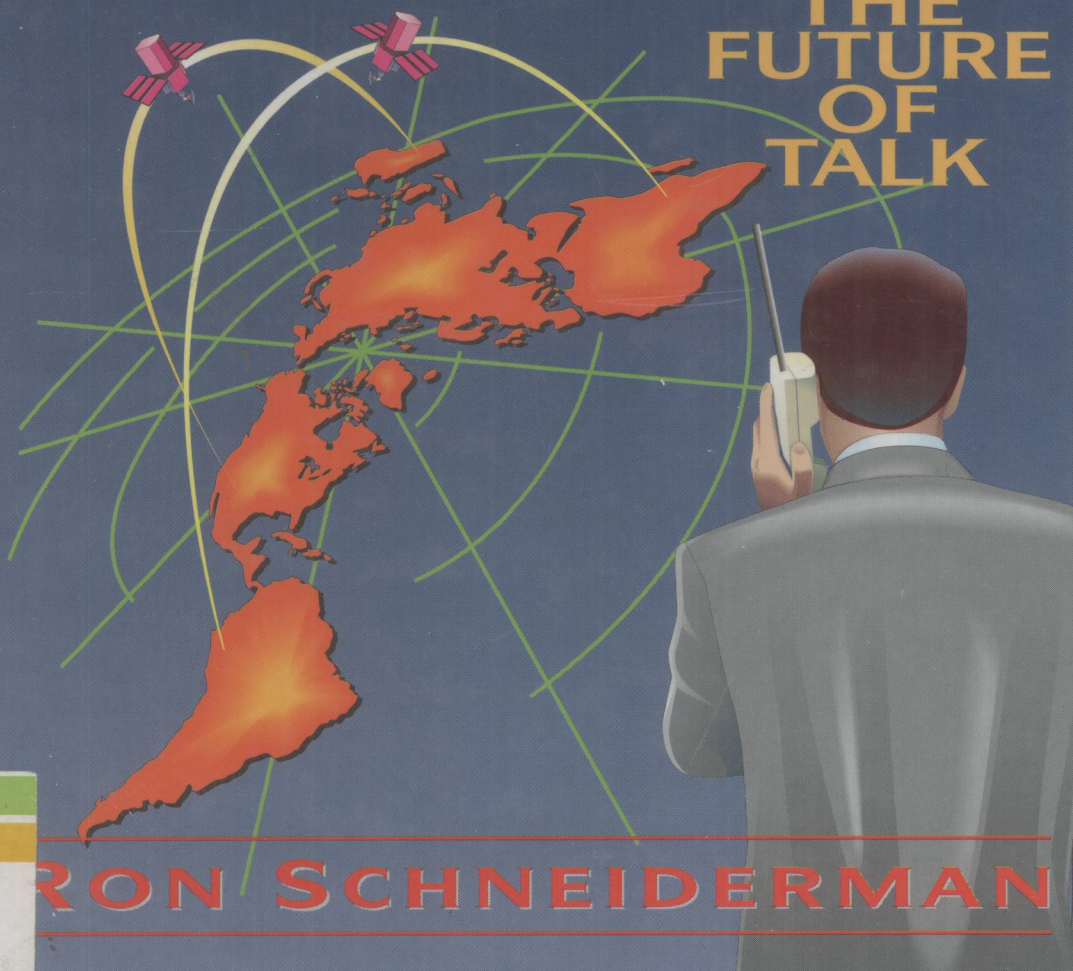


WIRELESS

PERSONAL COMMUNICATIONS

THE
FUTURE
OF
TALK



RON SCHNEIDERMAN

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*For Susan, who wanted to edit this book;
Dr. Todd, who wanted to dissect it,
and Josh, who wants to make a movie out of it.*

PREFACE

People love to talk, and at the rate things are going they have never had a better opportunity. There are more cellular and cordless telephones currently in use around the world than ever before and the market is growing fast (the cellular market is growing at the rate of almost 50 percent a year). At the same time, new personal wireless communications products and services are being introduced around the world.

As this book goes to press, the Personal Communications Industry Association was projecting a total of 88.3 million subscribers to New Personal Communications Services (PCS), Paging, Cellular, Enhanced Specialized Mobile Radio (ESMR/SMR), Dedicated Data, and Mobile Satellite Services by 1998—climbing rapidly to 167.4 million subscribers in 2003. That's a huge jump over the 33.7 million subscribers to wireless services in 1993.

Data, barely 1 percent of the wireless market today, is poised to explode. Wireless personal communicators, which are expected to account for a major segment of the data market, may never become quite as ubiquitous as the wrist watch or even the calculator, but their utility in a world where information is life itself could very well create the fastest growing consumer electronic market since the introduction of the transistor radio.

The market offers a huge new opportunity for the global electronics industry, including telecommunications, semiconductor/components, test and measurement, and computer equipment manufacturers; network service providers, software developers, distributors, and retailers.

This book offers a very detailed look at wireless communications. It covers major issues, such as market projections, strategies, and alliances; product development programs and patterns; emerging technologies; regulatory issues; software developments, and standards, as well as long-term opportunities in personal wireless communications.

As one trade magazine reporting on the current boom in personal wireless communications put it, "If it moves, you may be able to communicate with it."

It is dangerous to put limits on wireless.

Guglielmo Marconi (1932)

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CHAPTER 1

AN OVERVIEW OF MARKETS, PRODUCTS, AND SERVICES

There's a wonderful scene in the Woody Allen film *Play It Again, Sam* in which actor Tony Roberts, who plays a hardworking and somewhat obsessed businessman, calls his office frequently to make sure everyone knows where he is at all times. "Let me tell you where you can reach me, George. I'll be at 362-9296 for awhile. Then I'll be at 648-0024 for about 15 minutes. Then I'll be at 752-0420, and then I'll be home at 621-4598."

At which point, co-star Diane Keaton, looking exasperated at the Roberts character, says, "There's a phone booth on the corner. You want me to run downstairs and get the number? You'll be passing it."

A very funny bit, but also very prophetic. In the new world of personal telecommunications, the wire in the wall will no longer dictate where we must be in order to use a telephone. Calls will go to people, not places. The caller will not even have to know the location of the person being called. Everyone will need only one phone number. You can be reached by phone by anyone, anywhere, at anytime.

The generic terminology for this fast-emerging market is "wireless personal communications," it's the new hot button in telecommunications and consumer electronics.

"Wireless" has all the elements of a fantasy market: tremen-

dous growth potential, global in scope, technology-driven, and capable of producing a virtual endless stream of new products to a market that cuts across commercial, consumer, even military applications. The Cellular Telecommunications Industry Association (CTIA) believes that over the next decade, “wireless devices and wireless networks will be the dominant mode of communications in the United States.” Arthur D. Little, Inc., agrees. The Boston-based management and technology consultant has told its clients that half of all telecommunications traffic in North America will be wireless by the year 2000.

In more down-to-earth terms, the cellular industry’s vision of the future looks something like this:

- A corporate executive in a hotel room hundreds of miles from home puts the finishing touches on her proposal for a new product line. She hits the “transmit” key on her notebook computer. No wires, no modems. The proposal zips through the air back to the home office.
- A student is sitting in the school library doing her homework. Her electronic notepad contains a calculator, encyclopedia, dictionary, science assignment, and even her homework. The message light flashes; she presses it. “Don’t forget to be home by 4:00. You have a dentist appointment. Love, Mom.”
- You’re driving down a dark and icy road. You lose control of your car, run off the road, and hit a tree. Your air bag inflates instantly, transmitting an emergency message and your precise location to a nearby ambulance service.

Ironically, independent market researchers and industry analysts, who frequently go overboard in their market projections, have been much too conservative in estimating the rate of growth of wireless personal communication products and services. When cellular technology was inaugurated in the United States just over 10 years ago, McKinsey & Co. told AT&T, which invented cellular, that no more than 900,000 cellular phones would be in use by the year 2000. At the rate the cellular industry is signing up new subscribers, McKinsey’s forecast may be off by about 20 million. How could McKinsey be so far off in its projections? For one thing, its projections were based on technologies and market demand assumptions that existed at the time, when a cellular

telephone was a 25-pound piece of equipment installed in a car trunk, cost almost \$3,000, and service was limited to only a few major market areas.

Even more recent, and presumably more sophisticated, market forecasts have completely missed the mark. Dataquest Inc.'s 1989 forecast of cellular phone users in the U.S. for 1991 was nearly half the actual number for that year when more cellular phones were put into service than wired residential phone lines—2.5 million versus 1.9 million. By the end of 1992, there were more than 11 million cellular subscribers in the U.S. alone. That's enough "early adopters" to put the cellular telephone in the same league as the VCR as the world's fastest-selling consumer electronics product.

The most recent market projections are staggering. Motorola, the world's leading supplier of telecommunication equipment, expects the market for wireless equipment and services to grow to \$600 billion by the year 2010; that's 20 percent of the projected \$3 trillion worldwide telecommunications market. BIS Strategic Decisions, an international technology consultant and market analyst, believes the number of cellular and cordless phones worldwide will grow from 22.5 million in 1992 to 40.9 million in 1996. At the same time, The Gartner Group says it expects the overall mobile communications satellite market to surpass cellular telephones and digital paging combined, and will ultimately match the installed base of personal computers.

Cellular phones continue to sell at a record pace, with more than 9,000 new subscribers signing up for cellular service in the U.S. every day, bringing the total number of subscribers at the end of 1993 to more than 13 million in the U.S. alone. Paging, with more than 11 million users in the U.S., remains the technology of choice for those who need mobile communications, but do not require voice communications, and it is rapidly penetrating the consumer market with new features and products.

But new wireless services are emerging:

- ☐ Mobile satellite services (MSS), which are still in the technical development and regulatory stage, could evolve into a multibillion-dollar business by the turn of the century.
- ☐ Specialized mobile radios (SMR), used by fleet dispatchers such as taxis and delivery services and led by companies like Motorola and NEXTEL Communications (formerly Fleet Call), have only

around 1.4 million users, but that's about to change. The Federal Communications Commission (FCC) has decided to allow NEXTEL to compete with cellular carriers by constructing its own regional, digital wireless network. Other SMRs are moving in the same direction. In time, NEXTEL hopes to interconnect its system with other SMR operators to form a national network.

- ☐ Mobile computing, only now beginning to emerge for the masses, suffers from high prices and a lack of standards. Once those problems are solved, it's going to be another huge market with tremendous potential for new product development and services.
- ☐ Personal Communications Services, or PCS, the highly touted "anyone, anywhere, anytime" service, is an ill-defined concept that will likely consist of a new class of very small telephone handsets that combine some of the best features of cordless, cellular, and basic telephone services, including data communications. PCS phones are expected to be much cheaper than cellular, but with less range than cellular phones. Based on that description, The Personal Communications Industry Association believes that if the FCC licenses PCS by 1994, as expected, the market could reach 56 million subscribers by the year 2002. In Arthur D. Little's scenario, a shirt-pocket communicator that costs less than \$50 a month to operate could generate annual revenues of \$40 billion within 10 years after market launch.

PCS PROJECTIONS**

	1991	1992	1993	1994	1995	1996	1997	1998
Cellular Subscribers	7.6	10.5	13.5	16.5	20.0	24.0	28.0	32.0
PCS	0.0	0.0	0.1	0.5	1.0	1.5	2.1	2.6
Paging Subscribers	11.5	13.2	15.2	17.2	19.2	22.0	24.0	26.0
Mobile Data	0.25	0.50	1.2	2.1	3.0	4.3	5.7	7.4
Mobile Computers*	0.0	0.0	0.023	0.075	0.255	0.795	1.515	2.595
PDA's	0.0	0.0	0.002	0.022	0.094	0.289	0.889	1.795

Source: The Yankee Group, 1993

* Portable computers with integrated wireless communications capability

** Users in millions

The Yankee Group is projecting enormous growth for all categories of wireless personal communications products.

More and more, these services will begin to overlap and compete. EO, Inc.'s notebook-size pen-based wireless communicator, for example, features a built-in cellular phone. Apple Computer's highly-touted Newton MessagePad was introduced without a communications capability, but that's being fixed. Pricing will become a larger issue as the market shifts from professional and business users to the mass market. This is already evident from the declining national average of monthly bills of cellular subscribers—down from \$95 three years ago to \$68 today.

PCS grew out of a report published in Britain in 1989 called "Phones on the Move: Personal Communications in the 1990s." Barely seven pages long, the report got the telecommunications community in the United Kingdom to thinking that the U.K. had the potential to become a "world leader" in mobile telecommunications. "More and more," the report stated, "U.K. business is coming to rely on mobile communications, and government has acted as an enabler, making sure they get the services they need...." The British government didn't disappoint. It quickly licensed four companies to provide so-called telepoint services. Also known as CT-2 (cordless telephone—second generation), telepoint is essentially a cordless pay phone, allowing subscribers to originate, but not receive, short-range phone calls in public areas equipped with telepoint base stations, such as shopping centers, train stations, and airports.

Telepoint seemed like a good idea at the time; London has very few public pay phones. But high subscriber costs (\$200 for a handset, plus a \$60 service connection fee and a monthly service charge of \$15) didn't play well in a weak British economy. Also, the systems licensed by the government were not compatible. Today, only one company is offering limited telepoint service in the U.K.

With all its problems, the introduction of telepoint in the U.K. sent a wake-up call to the rest of the world. In the U.S., the FCC responded by issuing more than 200 experimental licenses for PCS trials. Cellular telephone carriers, cable television system operators, and independent telecommunications operators are spending millions of dollars to develop new products and services based on PCS concepts. Europe's cellular phone market hasn't grown as rapidly as the U.S. market, possibly because many countries have different technical standards, making

“roaming” between countries virtually impossible. Car phones that work in Germany, for example, won’t work in France, and vice versa. That’s changing with the introduction of the Global System for Mobile Communications (GSM), the digital cellular standard for Europe established by the European Telecommunications Standards Institute (ETSI) (see Chapter 6).

Europe offers a unique opportunity for new telecom services because there are fewer entrenched players and spectrum use is lighter and less of an issue than in the U.S. Japan’s cellular telephone market has grown at the rate of 80 percent annually in each of the last three years. But its market penetration rate remains low—slightly more than 1 percent of Japan’s population uses a cellular phone. (At the end of 1992, the total U.S. penetration rate was 4.37 percent, and the average penetration rate in major metropolitan markets was 5.15 percent.) Nippon Telegraph & Telephone (NTT), which accounts for about 550,000 of the country’s 870,000 cellular subscribers, expects the market penetration in Japan to double by the year 2000. As a result, virtually every major U.S. cellular system operator and equipment supplier is pursuing these markets.

Based on an optimistic timetable for FCC action on spectrum allocation for PCS and an ambitious rollout schedule for commercial PCS service, the FCC expects to begin granting PCS licenses in early 1994. The questions the industry is wrestling with today are, “Who really needs, or wants, PCS?” “Who will use PCS?” “Can portable phones get much smaller than the 5.9-ounce, cigarette pack-size models that are available today?” “If the service isn’t a lot cheaper than cellular and doesn’t offer the same features as cellular, won’t PCS providers have a tough time shifting cellular users to less functional services?”

There’s also a burgeoning market in wireless office equipment, with wireless local-area networks (WLANs) and wireless private branch exchanges (WPBXs) getting most of the attention.

WLANs, which can transfer data and share resources such as printers without physically connecting them, have received most of the attention from equipment manufacturers because they represent two of the fastest-growing segments of the computer industry—local-area networks (LANs) and mobile computing. The

big advantage with WLANs is that they eliminate the cost of re-wiring an office every time it is reorganized or repartitioned. It's already a fast-growing market: Market research by International Data Corp. (IDC) and studies on worker mobility by Steelcase, a major supplier of office furniture, estimate the number of wireless connections in U.S. offices will grow from 68,000 in 1992 to 538,000 in 1994, and to well over 1 million in 1995. Still, few computer system managers would be willing to rip out their wired LAN, which represents a significant investment and can move data much faster than wireless LANs.

WPBX offers business users the ability to make and receive calls using cordless phones anywhere on or near company premises. As with WLANs, wireless WPBXs should increase the use of computers, including laptops and the even smaller notebook models, and should help satisfy what the North American Telecommunications Association (NATA) says is the "enormous pent up demand" for wireless business communications systems.

Needless to say, industry companies are getting the message:

- ☐ American Telephone & Telegraph Co., the largest long-distance telephone company in the U.S., has announced plans to acquire McCaw Cellular Communications, the largest cellular carrier in the country, with operations in more than 100 cities.
- ☐ Motorola, the largest telecommunications equipment supplier in the world, has organized an international consortium of more than 30 companies to finance and launch its global satellite Iridium network.
- ☐ American Mobile Satellite Corp. (AMSC) has signed agreements with 60 cellular-service providers, allowing them to offer their customers access to AMSC's mobile satellite services anywhere in North America.
- ☐ MCI Communications Corp., the second largest long-distance carrier in the U.S., has formed a consortium of 200 companies to create a national PCS network. MCI and British Telecommunications Plc (BT) are also working toward the joint development of common international telecommunications products and services, with MCI covering the Western Hemisphere and BT focusing on the Eastern Hemisphere. BT plans to invest \$4.3 billion in MCI, giving it a 20 percent stake in the U.S. company, putting MCI in a stronger position to compete with its U.S. long-distance rival, AT&T. MCI has already said that much of the new BT funding