

## INTRODUCTION BY EDITOR

*As recounted in the paper by Irwin Dorros following, the divestiture of AT&T went officially into effect January 1, 1984, 25 years ago. This momentous event irreversibly changed the state of telecommunications in the United States, and, in the years following, throughout the world, as country after country privatized their previously government-owned telecommunication systems. This year of 2009 therefore offers us the opportunity to look back and see what has happened to our field as a result. We are fortunate to have the views of Irwin Dorros on this occasion, since he was a key AT&T executive charged with working out, and helping to resolve, the complex issues of divestiture, both during the negotiations between AT&T and the U.S. government, and in the period following the agreement of divestiture. He describes the nature of the telecommunications industry prior to divestiture and the factors leading to the divestiture agreement. He also provides his own views on the communications industry after divestiture. He pulls no punches in his candid remarks,*

*indicating where AT&T, in his opinion, which had been in the forefront of much of the worldwide innovation in voice telephony, fell behind in the broad area of computer communications. We commend this article to your attention.*

*Note: The first History session at a ComSoc conference was held in early December 2008 in New Orleans at IEEE GLOBE-COM '08. All attending agreed the session was an unqualified success. The second such session, again organized by the ComSoc History Committee, which is also responsible for this History Column, will take place at GLOBECOM 2009, to be held late this year in Hawaii. A panel discussion on divestiture and privatization of the telecom industry worldwide is planned as part of that session. We urge all readers of this column to plan to attend. Papers for the regular papers part of this special session are being solicited as well.*

—Mischa Schwartz

## RETROSPECTIVE — 25 YEARS LATER

IRWIN DORROS

On January 1, 1984, 25 years ago this year, the telecommunications industry in the United States changed forever. AT&T broke itself apart by spinning off seven separate regional telecommunications operating companies and an R&D organization jointly owned by those seven companies. AT&T became a much smaller company that continued to operate its intercity network and its equipment manufacturing businesses. This breakup was in accordance with a U.S. District Court approved settlement with the U.S. Department of Justice that was called the “Modified Final Judgment.” The settlement was of a government anti-trust suit against AT&T filed in 1974. The “final judgment” that was modified was the 1956 consent decree that settled an earlier government anti-trust suit filed in 1949.

The AT&T breakup and the related court and regulatory requirements changed the industry. But this breakup was more of a symbolic milestone than the key event that enabled the highly competitive marketplace in telecommunications today. The real enabler of competition was, and is, the steady march of technology over the years prior to 1982 and especially since then. Competition, enabled by pre-1982 technology, was being tested, and AT&T resisted inroads opposing its monopoly business model. The Federal Communications Commission (FCC) and the U.S. Department of Justice recognized the value, and the inevitability, of competition, and they helped it along.

But the barriers to entry were steadily being lowered by technology, and the challenges to the monopoly were accelerating. Low-cost microwave radio relay and computer controlled call setup, direction, and billing gave MCI and others the impetus to challenge the intercity monopoly; and the emerging foreign supply of low-cost telephones and other customer premises equipment (CPE) stimulated the challenge to the telephone instrument monopoly.

Today's telecom marketplace and the business entity structures are not what were envisioned by those of us on the scene on January 8, 1982, the date AT&T and the Department of Justice agreed on the settlement that finally took effect January 1, 1984. The offerings today, and the low prices for them, turned out to be much broader and richer than were

then expected. Let's first look at where we were.

## TELECOMMUNICATIONS IN 1982

We had what was generally believed to be the best telephone system in the world. We had achieved the long-term goal of “universal telephone service,” where nearly everyone in the country had telephone service — or at least access to service. We supported high-cost rural service by cross-subsidies from long distance service — a noble concept for a monopoly supplier sanctioned by the government regulators. The network nearly always worked effectively, and it kept operating even when the electric power failed. During emergencies, such as storms, earthquakes, disasters, or stimulated heavy calling, the one network was managed centrally for maximum efficiency.

The pioneering cell phone concept of reusing a limited set of frequencies in non-adjacent geographic cells was being implemented, but it was envisioned as a replacement for the small number of channels then available for car phones. The FCC was slowing deployment by AT&T because it was seeking to establish a competitive environment for what appeared to be a budding new segment of the industry. It was Motorola, in the early 1980s, that started the pocket phone industry we have today with its small handheld MicroTac, which worked over the emerging cell networks. Some of us believed the MicroTac never would be practical because it didn't emit enough transmit power, compared with the higher power that was emitted from the larger car-mounted cell phones. Wrong! Handheld cell phones today far outnumber the car mounted versions, such as with OnStar.

Data communications were principally carried by Data-phone data service over regular dialup telephone lines, where data, through a modem, were made to fit into a voice channel, or by private lines rented from the telephone companies, including competitive entrants such as MCI, SBS, and USTS. Some larger users owned their own lines. The AT&T switched network that evolved for voice calling was rapidly being converted to digital electronic switching, where voice calls are encoded into 56 kb/s and switched in digital form. Switched service at 56 kb/s was in its early stages, but it was not widely available. Packet switching, the workhorse of today's Internet,

was in limited use, mostly by university researchers, on the DARPA NET, funded by the Department of Defense. AT&T's vision regarding data communications was to evolve its growing 56 kb/s capability into a ubiquitous network that would switch data and voice interchangeably at the 56 kb/s rate. The access lines to all customers would eventually be digital at 56 kb/s. The concept was called integrated switched digital network (ISDN). Also, large enterprises could lease T1 lines (1.544 Mb/s) from the telephone companies as bulk links in their own networks.

Network planners in 1982 were debating whether network intelligence, including certain applications, would be provided best at the periphery of the network on the customer's premises or in the innards of the network. Typically, the position taken in the debate depended on whether the debater was a network provider or a computer provider. The concept of packet switching for mass networking, with the intelligence distributed throughout the network, only existed in research laboratories. The rapid growth of the Internet and the World Wide Web in the ensuing years settled that question. Servers with intelligence and massive memory spread across a composite network that includes servers on customer premises were not on the 1982 public network planning radar screen — except, I'm sure, in research programs.

## AT&T BEFORE 1982 [1]

AT&T was a government sanctioned and regulated monopoly throughout most of its existence. As a private company, it raised money as other companies do, made a reasonable profit that was regulated, and its stability made it the premier investment for conservative portfolios — including those of “widows and orphans.” There were challenges, however, to its role and its behavior at various points in its history. Those challenges resulted in shaping the role of the company, which changed as part of the resolution of each challenge.

Let us briefly review the major events that shaped AT&T and, with it, the telephone industry in the United States and perhaps the world. The telephone was invented by Alexander Graham Bell in 1876. He received several patents and formed the Bell Telephone Company in 1877 with seven original shareholders. The first telephone exchange opened in New Haven, Connecticut in 1878 under license from Bell Telephone. Within a few years, every major city had such an exchange under license from Bell Telephone. In 1882 American Bell Telephone acquired a majority interest in the Western Electric Company, as its supplier of telephone equipment. In 1885 the American Telephone & Telegraph Company (AT&T) was formed, as a subsidiary of American Bell Telephone, to build a nationwide intercity network.

In 1894 Bell's patents expired. This opened the industry to competition. Within 10 years there were 6000 companies in the telephone business in localities across the United States. In 1899 Michael Pupin of Columbia University and George Campbell of AT&T independently developed the theory of loading coils. This opened the way to much longer telephone transmission lines. In a corporate reorganization, AT&T acquired the assets of its parent, American Bell Telephone. Thus, AT&T became the parent of the Bell System.

In 1908 Theodore Vail, president of AT&T, formulated the philosophy, strategy, and structure that guided AT&T's business for many years. He introduced the slogan “One System, One Policy, Universal Service.” But AT&T was not regulated and made its business decisions in the interest of its own shareholders. It was sued by the government under the existing anti-trust laws, which resulted in a 1913 settlement called the Kingsbury Commitment. It established AT&T as a gov-

ernment sanctioned monopoly, and in return AT&T agreed to divest the Western Union Company, which it had acquired, and to connect all noncompeting independent telephone companies with its long distance network. Under this agreement, AT&T grew and thrived for the next half century.

In 1925 Bell Telephone Laboratories was established as a subsidiary of AT&T as its research and development arm. During World War II, the Bell System played key roles in military telecommunications. All Bell System entities worked together to provide support to the U.S. military. Such support of the military continued for several more decades. As AT&T thrived, it branched into new directions, including radio and television. In 1949, the U.S. Department of Justice again sued AT&T for anti-trust behavior. That resulted in the 1956 consent decree in which AT&T agreed to confine its business to running the national telephone system and special projects for the federal government.

There followed several decades of what I consider the golden years of AT&T technology innovation and application, driven by the well funded and top-notch personnel at Bell Telephone Laboratories. Without dwelling on each, a partial list of those innovations and applications include the first trans-Atlantic telephone cable, the first commercial data modem, the first active communications satellite, Touch-Tone “dialing,” the first electronic central office, 911 calling, international dialing, UNIX, which later became the underlying language of the Internet, fiber optic cables, and cellular telephony.

But emerging competitors utilized technology to seek opportunities to enter the telecommunications marketplace. AT&T resisted, using its regulated monopoly status and the potential harms to the network — and to the bulk of the users — to argue against allowing competition enabled by connections to AT&T's network. There were a number of regulatory and legal challenges that sought to allow various forms of connection to AT&T's network, including recording devices, privacy devices, mobile connections, acoustic coupling, private branch exchanges (PBXs), and other means<sup>1</sup> [2]. AT&T largely deflected those challenges by requiring cumbersome protective devices. Also, those inroads that were successful were not yet a major threat to AT&T's basic revenues. Once again, in 1974 the U.S. Department of Justice sued AT&T for violation of U.S. anti-trust laws by its resistance to these connections, and also by keeping its procurement of equipment almost exclusively from AT&T's own captive supplier, the Western Electric Company.

## UNITED STATES VS. AT&T — MY PERSPECTIVE

I was invited to submit this paper by the recently formed ComSoc History Committee because I was the network planning officer at AT&T and the chief technical witness in the anti-trust trial, after which I oversaw the creation of the ground rules for dividing the AT&T network assets among the newly created entities. From 1954 through 1978, I worked on many programs at Bell Telephone Laboratories (BTL), including early electronic switching, digital transmission, early data communications, Picturephone, centralized operations support systems, and cellular radio. I left BTL in 1978, as Executive Director of Network Planning, to head network planning at AT&T headquarters for the Bell System. I was to provide the planning techniques for the introduction of new technology and new services.

Actually, I spent much of my time over the next four years helping AT&T defend the challenges to its monopoly by its

<sup>1</sup> For example, *Hush-a-Phone*, *Carterfone*, *Litton Systems vs. AT&T*.

competitors, the regulators, and the Department of Justice. I negotiated connecting arrangements with AT&T's competitors when they were supported by the regulators and the courts. During the anti-trust trial in 1981, I submitted three testimonies to the Court, testified orally once, and was preempted from my oral testimony on my final testimony by the settlement announced in January 1982. With the breakup of AT&T on January 1, 1984, I became Executive Vice President and chief technical officer of Bell Communications Research (Bellcore), owned by the seven newly formed regional operating companies (the RBOCs), a position from which I retired almost 10 years later in 1993.

AT&T believed it had a mandate to continue providing universal telephone service to the people of the United States under its central planning, manufacturing, and operation arrangements as a regulated monopoly. Its management genuinely believed that the public interest would be served best by those arrangements. By the early 1970s, however, there were three areas of significant challenges by competitors to the AT&T monopoly: CPE, long distance calling, and the sale of non-Western Electric equipment to the Bell System companies. This, of course, was in addition to the competitive provision of equipment and services for private networks, not connected to the Bell System network, to which AT&T could not, and did not, object. Advancing telecommunications technology made it feasible for the competitors to succeed — if they were allowed to offer their alternative equipment and services.

In the area of CPE, which AT&T called “foreign attachments” when provided by non-Bell System sources, AT&T believed these foreign attachments would harm the network by reducing call quality for the bulk of the users because their designs and their use were not controlled by the meticulous end-to-end systems engineering that AT&T and Bell Telephone Laboratories had developed over a half century. Challenged by the regulators, AT&T set out on a program to define and perhaps measure harms to the network. My organization at Bell Labs participated in this program. What we found was not definitive, nor convincing, to the regulators, the competitors, or their customers.

In the area of long distance calling, the events were especially contentious. Using microwave radio relay technology, of designs costing much less than the older and more conservative Western Electric versions, MCI, led by their colorful leader, Bill McGowen, entered the private line business in the mid-west. This competed with AT&T, but it was not an issue until MCI sought, in 1975, to provide competitive MTS/WATS service, a dialup service into the public network from corporate networks, using MCI's growing microwave facilities, and their small-computer-controlled switching — another impact enabled by advancing technology. In 1976 the FCC sided with AT&T against MCI, supporting the regulated monopoly concept and the perceived difficulty of use, lower standards, and cream skimming effects that the public would see.

MCI did not give up. It took its case to federal court. MCI was now joined by other competitive common carriers, collectively called the OCCs. On appeal, the DC Court of Appeals ruled against the FCC and in favor of the OCCs in the landmark Execunet I decision. The next year, the same DC Court of Appeals again reversed an additional FCC ruling by its Execunet II decision that broadened the required interconnection arrangements, which were supposed to be limited to business exchange and FX lines. MCI represented to the Court, disingenuously, that it had no intention of providing competing dialup telephone service. The ink wasn't dry on the Execunet II decision when MCI began offering competing

telephone service to the public, using its Execunet enabled arrangement to connect to the public network.

The third area that was being challenged to open to competition was the supply of telephone equipment to the AT&T operating units. While there were some sales to the Bell companies of non-Western Electric equipment, it was carefully controlled and limited. The suppliers wanted a more open market to the Bell Companies.

The purpose of the 1974 filed anti-trust suit against AT&T by the U.S. Department of Justice was to open the Bell Companies to competing equipment from non-Western Electric sources and allow CPE to attach to the network. The spinoff of the Western Electric Company looked like it was the remedy sought in the suit. Long distance competition was not a major issue then. However, by the time the suit came to trial in 1981, long distance competition was a major part of it.

My first testimony in the anti-trust court [3] presided over by Judge Harold Greene was to support AT&T's claim that it was fully cooperative in implementing the interconnections mandated by the Court of Appeals ruling in the Execunet decisions. Since I was the lead engineering negotiator, I was picked for the role. I testified that we were doing all that was possible in the short term, but complete equality with AT&T's own long distance network access would have to await redesign of the network, including the switching software, to create a manageable interface, across which the OCCs would have access equal to that of AT&T. I thought I was convincing, and I may have been.

As it turned out, the competitive model to which AT&T was responding was not the one that applied after the breakup of AT&T. The OCCs were requesting, and we were responding to, call by call competition, where the user would select the carrier he/she wanted to use for each intercity call. The caller would dial an access code for a particular carrier for each call. As we know, today's intercity competition is by pre-subscription to an intercity carrier, arranged through the local access telephone company. Today, we also have other options, such as through our cell phones, through the cable companies, directly through the Internet, and through Internet-based services such as Skype.

Toward the end of 1981, the government filed a proposed remedy with the court, should the court rule in the government's favor. The Department of Justice offered two options for the court to consider. Both options required the Bell operating companies (BOCs) to be separated from AT&T and its long distance services. The basic difference between the two options was that Option 2 would also separate the Western Electric Company from all of the operating units. Also, in both options, the offering of CPE was to be through separate subsidiaries that were to be treated equally with the competitive suppliers of CPE.

The written version of my next testimony was filed in December 1981 [4]. My role was to discuss what I called “dire consequences for the general American public, for the more specialized network users, for the Federal Government, and for the competitive providers of telecommunications services.” I reviewed all the difficulties of breaking apart an integrated network that evolved over nearly 100 years, where end-to-end optimization was a key consideration. I described the difficulty of introducing new technology and new services, where investment in one part of the network optimizes investment in the total network, despite divided ownership of the end-to-end network. I put a price tag on reconfiguring the network over a three- to six-year period to provide equal access for OCCs. I made detailed estimates that added to \$20 billion, compared with an investment base of \$100 billion for the entire Bell Sys-

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tem network. I submitted all this in 121 pages.

I never got to the oral testimony in court, since it was scheduled for late January 1982, and on January 8 an agreement between AT&T and the Department of Justice was announced. By then, AT&T saw the signs that the court probably was going to rule against it, and a breakup along the lines that AT&T could help design would serve it better than whatever the court thought the remedy should be. Once the parties agreed on the outcome, the court had little leeway to change the terms. In August 1982 Judge Greene, after requiring a few modifications, endorsed the agreement, and the die was cast for the AT&T divestiture to take effect January 1, 1984.

AT&T was to spin off seven separate RBOCs, each comprising one or more of the 21 operating companies for which it owned the majority of shares. AT&T was also to provide the personnel and assets to a “Central Services Organization” (later named Bell Communications Research) that was to be owned jointly and equally by the seven RBOCs.

For the balance of 1982, my role changed to that of the neutral party producing the rule book for dividing the assets between AT&T and the seven RBOCs. It was as complicated as we made it out to be in our various testimonies. Buildings had to be shared, equipment had to be reconfigured, work spaces had to be rearranged, personnel had to be divided according to their function, and equipment had to be inventoried. Between the paper generated during the trial and the binders generated during the asset division, the stationery industry must have paid extra dividends to its shareholders.

In 1983 I accepted the job as chief technical officer of the Central Services Organization (CSO). I now concentrated on building a first-rate technical organization to provide research and development and other central services to the seven RBOCs. We recruited nearly 3000 engineers, scientists, and staff from Bell Telephone Laboratories and another 1000 or so from AT&T headquarters and the Western Electric Company. We named the organization Bell Communications Research (Bellcore). At its peak in subsequent years, there were over 8000 employees. Bellcore was born with the RBOCs on January 1, 1984.

In the ensuing years, the new Bellcore, and the ongoing Bell Labs, continued to carry out excellent work in their new roles. But funding limitations brought about by the increasingly competitive marketplace and new metrics for results imposed by the owners of Bellcore and the new leadership of AT&T resulted in the Bell Telephone Laboratories we knew and loved being gone forever.

## COMPETITION IN TELECOMMUNICATIONS

The newly formed companies embraced the world of competition as well as they knew how. The past monopoly business models rapidly became obsolete. Fortunately, at the outset, the customers for telephone service were still there, as was the cash flow from their revenue. But competition rapidly developed on all fronts, aided by an acceleration of new technology, and regulatory artificial imbalances to aid the competitors to AT&T and the RBOCs. For example, MCI’s long distance customers made local calls to gain access to intercity calls; but the FCC required dialed intercity calls through AT&T to heavily subsidize local access, making MCI calls artificially less expensive.

Internationally, many countries followed with versions of

the new industry model in the United States. Today, the industry models worldwide vary from wide open competition to government owned monopolies that are not much different from 50 years ago.

Since I have been retired for 15 years, and during the 10 years prior to that, I focused on telecommunications technologies at Bellcore, I am not really equipped to describe the industry today in any authoritative way. But it is of interest to me to observe how some of the services and technologies I helped create have evolved in a competitive marketplace. Most have gone in directions I never anticipated. For example, not in my wildest dreams could I have imagined today’s iPhone coming to the marketplace using the cell phone technology we developed 40 years ago.

From the opposite perspective, certain telecom basics we take for granted would never have evolved the way they did in a competitive marketplace. For example, touch tone “dialing” could not be introduced today in a divided competitive marketplace, where the investment in touch tone dials would have to be made by one company and investment in touch tone receivers by another, perhaps competing, company, all in the same timeframe.

An example of a service that never happened, and probably never will, is *personal number calling*. At the time of the breakup, we were on the verge of offering a service, based on a single telephone number for an individual, that would find the person and ring the telephone at his/her disposal — cell phone, office phone, home phone — all by dialing the personal number of the *individual*. So, nobody would need multiple numbers, as is the case today.<sup>2</sup> Central end-to-end planning and execution have advantages that were sacrificed for the competitive marketplace we have today. I believe the trade-off was beneficial. So, it is my take that the regulated monopoly served us well in creating the best telephone infrastructure in the world, and it was then time to open the gates to build on it with the tremendous innovations we are seeing today.

Since divestiture, we are paying far less for our basic telephone services, but we are paying more for our telecommunications because we now pay for cable or satellite TV, cell phones, and high-speed Internet access. And these added capabilities have improved our quality of life. Given that there is a buyer’s choice as to whether or not to subscribe to these added services, they must be worth it, because all of us (nearly all of us) are indeed paying for them, by choice.

The two most important surprises to me are the game-changing role of cellular telephony and the life-changing role of the Internet. Both were anticipated in my era, but not on the scale at which they materialized. My grandchildren’s lifestyle is almost driven by these two offerings.

There are more than three billion cell phones in use worldwide! And we thought we were just improving the rinkydink car phones we had. Who would have thought that each kid wants one — and many have them — glued to their ears for most of the day? And even we adults depend on cell phones for untethered anytime, almost anywhere, communications. The FCC insisted on a competitive market for cell phone service, and they got it by mandating frequencies dedicated to non-telephone companies, as well as to telephone companies. The telephone companies had the most cash flow to invest, and they probably had the best management experience appropriate to a telephone service, so, over time, the telephone companies, through their unregulated competitive cell phone companies, absorbed the bulk of the smaller cell phone companies. But there is still serious competition, which keeps

<sup>2</sup> Some cell phone users come close to this by discontinuing landline service.

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the prices reasonable and the service good.

In the case of the Internet, AT&T, despite its early offering of Dataphone Data Service over switched and nonswitched voice channels, missed the opportunity to become the dominant supplier of data communications to America. Its offerings tended to be too little and too late. But it probably didn't matter anyway. The use of packet switching of information by relaying through hundreds and thousands of servers embedded in a vast interconnected network was a brilliant concept developed by DARPA and the academic research community. This, guided by visionary ground rules developed by volunteers worldwide, was unbeatable. The timing was perfect. The opening of telecommunications to competition, and the availability of new technology and capital, stimulated a large wave of overbuilding transmission capacity. This capacity then became available at very low cost to Internet users. And the servers, which provide memory and data processing, became less and less expensive. They were made available by various enterprises to relay packets in return for the other servers handling the packets their organizations generated. Any switched data service offered by AT&T could not compete with this cooperative business model for the Internet.

## CONCLUSION

In retrospect, competition, capitalism, and democracy are all great! The way may not always be smooth, but these concepts

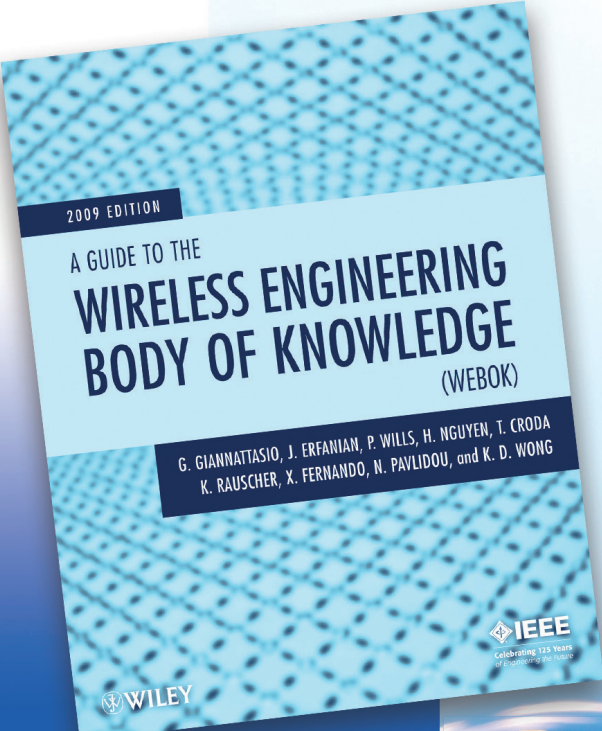
ultimately bring out innovation, optimum cost, best service, and wider choice. We can pine for the days when there were one telephone company, one monthly bill, regulated rates, and top-quality service. However, despite our telecommunications world being more complex today, we have services and capabilities that would have been much slower in coming, if they came at all. And the costs to us would likely be higher.

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## BIOGRAPHY

IRWIN DORROS [F] ([idorros@comcast.net](mailto:idorros@comcast.net)) received S.B. and S.M. degrees in 1956 from MIT and an Eng.Sc.D. degree in 1962 from Columbia University, all in electrical engineering. From 1956 to 1978 he worked at Bell Telephone Laboratories on a variety of programs. From 1978 to 1984 he served as network planning officer at AT&T. From 1984 to 1993 he served as chief technical officer of Bellcore (now called Telcordia Technologies). He retired in 1993 and is currently a consultant. He is a member of the National Academy of Engineering. He received the IEEE Founders Medal in 1991 and the Third Millennium Medal in 2000.



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