Non-Fixed and Fixed Networks, Complements or Alternatives? Background Issues

Yoshihiro Sato

Program on Information Resources Policy

Harvard University

Center for Information Policy Research

Cambridge, Massachusetts

A publication of the Program on Information Resources Policy.

Non-Fixed and Fixed Networks, Complements or Alternatives? Background Issues

Yoshihiro Sato
May 1996, P-96-3

The Program on Information Resources Policy is jointly sponsored by Harvard University and the Center for Information Policy Research.

Yoshihiro Sato is a Senior Manager in the Education and Training Department of NTT Learning Systems Corporation in Japan. He prepared this report as a research fellow with the Program.

ISBN 1-879716-33-x

Printing 5 4 3 2 1

PROGRAM ON INFORMATION RESOURCES POLICY

Harvard University **Center for Information Policy Research**

Affiliates

AT&T Corp.
BellSouth Corp.
The Boeing Company
Carvajal S.A., (Colombia)
Centro Studi San Salvador, Telecom Italia
The College Board
Commission of the European Communities
Computer & Communications Industry Assoc.
CSC Index (U.K.)
CyberMedia Group
DACOM (Korea)
Deloitte & Touche Consulting Group
Educational Testing Service
ETRI (Korea)
European Parliament
France Telecom
Grupo Clarin (Argentina)
GTE Corp.
Hitachi Research Institute (Japan)
IBM Corp.
Knight-Ridder Information, Inc.
KPN (Netherlands)
Lee Enterprises, Inc.
John and Mary R. Markle Foundation
McCaw Cellular Communications, Inc.
MeesPierson (U.K.)
Mead Data Central
Microsoft Corp.
MicroUnity Systems Engineering, Inc.
MITRE Corp.
National Telephone Cooperative Assoc.
NEC Corp. (Japan)
The New York Times Co.
Nippon Telegraph & Telephone Corp. (Japan)
NYNEX
OSCOM Communications, Inc.
Pacific Bell
Pacific Bell Directory
Pacific Telesis Group
The Post Office (U.K.)
Research Institute of Telecommunications and Economics (Japan)
Revista Nacional de Telematica (Brazil)
Samara Associates
Scaife Family Charitable Trusts
Scientific-Atlanta, Inc.
Siemens Corp.
Southern California Edison Co.
Sprint Communications Co. L.P.
State of California Public Utilities Commission
Strategy Assistance Services
Telstra Corp. Ltd. (Australia)
TRW, Inc.
United States Government:
- Department of Commerce
  - National Telecommunications and Information Administration
- Department of Defense
  - National Defense University
- Department of Health and Human Services
  - National Library of Medicine
- Federal Communications Commission
- National Security Agency

United States Postal Service
Viacom Broadcasting
VideoSoft Solutions, Inc.
Weyerhaeuser

Acknowledgements

The author gratefully acknowledges the following people who reviewed and commented critically on the draft version of this report. Without their consideration, input, and encouragement, this study could not have been completed: John Freidenfelds, Anthony T. Green, Koichi Harada, Lewis Kaye, Vincent Mosco, William H. Read, and Yoshihiro Tagawa.

These reviewers and the Program's affiliates, however, are not responsible for or necessarily in agreement with the views expressed here, nor should they be blamed for any errors of fact or interpretation.

Executive Summary

Since around 1990, non-fixed networks have increasingly become widely available in both the United States and Japan. Three background issues—spectrum scarcity and licensing, industry structure, and the advantages and disadvantages of standardization— need to be considered before the question of whether non-fixed networks are alternatives or complements to fixed networks can be addressed.

In both countries radio spectrum is considered scarce, and both are considering methods of spectrum management and allocation, such as licensing by auction and relocation of incumbent users. In the United States, regulators regard auctions and the collection of user fees as generating useful revenue. For new non-fixed network operators, however, auctions could delay the commercial launch of their services and make it difficult for them to lower their prices for years. For end-users, auctions could make new non-fixed network services more expensive than those of conventional fixed networks and, consequently, less attractive. In Japan, spectrum scarcity may delay the commercial start and spread of new non-fixed network services, although, as of 1994, operators of these networks, unlike those in the United States, have not had to pay high fees at auctions or for relocation of incumbent users.

In the United States, between the late 1980s and the mid-1990s, the issue of industry structure arose when both fixed and non-fixed network operators tried to merge with or acquire non-fixed network operators. The regulators' announced policy goal was to preserve competition and serve the public interest. For network operators, mergers and acquisitions (M&A) offer advantages, such as reduced costs, extended geographic reach, strengthened brand identity, and a broader menu of services, but they also offer disadvantages, such as diminishing competition and damaging competitors. For end-users, M&A offer benefits, such as a broader menu of services and simpler "roaming" arrangements, although they might also lead to a monopoly and raised prices. In Japan, the Ministry of Posts and Telecommunications (MPT) tried to promote competition within the telecommunications industry and to accelerate development of that industry, mainly by preventing Nippon Telegraph and Telephone from becoming dominant.

In the United States, as of September 1994, the telecommunications industry did not know which digital method, TDMA or CDMA, would be adopted or whether either would prevail in the marketplace. Non-fixed network operators and manufacturers faced the risks of selecting the "right" method and of market acceptance of an untested method. Without standardization of digital technologies, end-users may miss the opportunity to use non-fixed network services at lower prices, although standardization may limit their choice between services using multiple technologies. In Japan, the MPT promoted standardization for non-fixed networks, and other players appeared to support its position. The expected benefits of

standardization there include extension of a market for manufacturers using a standardized technology and, as a result, lower prices for handsets and other equipment.

Contents

Tables

Chapter One

Introduction

For many years, telecommunications networks have been mainly fixed or conventional wired networks, but since around 1990 non-fixed, or wireless, networks have increasingly become widely available.

In the United States, since cellular phone systems were launched in 1983, the number of subscribers has grown rapidly and beyond expectation. Several cellular phone operators report "robust growth" in their cellular phone services in 1994.[1]

In 1994, owing to improvements in technologies, new non-fixed network services began to emerge. Although air-to-ground calling had been possible for almost a decade, now airplane phone operators began to offer ground-to-air calling service; personal communications services were being tested; and new satellite communications services were proposed. At the same time, large fixed network operators tried to merge with or acquire non-fixed network operators. Non-fixed networks were still regarded as complements to conventional fixed networks in 1994, but they may in the future become an alternative to fixed networks.

This paper describes three background issues that need to be considered before the question of whether non-fixed networks are alternatives or complements to fixed networks can be addressed. The issues are approached through a comparison of cases in the United States and in Japan. **Chapter Two** presents an overview of non-fixed networks, including mid-1990s trends of major services, major players, and the advantages and disadvantages in comparison with fixed networks. The elaboration of the background issues begins with **Chapter Three**, a discussion of spectrum scarcity and licensing, moves in **Chapter Four** to focus on industry structure, and concludes in **Chapter Five** with the issue of standardization, its advantages and disadvantages. **Chapter Six** presents a summary of the discussion.

This paper reflects information current as of September 1994.

---

[1]Leslie Cauley, "Three Baby Bells Post Mixed Results for Second Quarter," *The Wall Street Journal*, Thursday, 21 July 1994, p. B4, Eastern Edition.

Chapter Two

Background: Mid-1990s Trends of Non-Fixed Networks in the United States and Japan

2.1 Major Services in the United States

Table 2-1 presents the major non-fixed network services in the United States as of September 1994.

2.1.1 Cellular

As of 1994, cellular phone service was one of the most popular non-fixed network services in the United States. In 1983, when the first cellular phone system was activated in Chicago, AT&T predicted that fewer than a million people would use this service by the year 2000. By the end of 1993, however, there were more than 16 million cellular phone subscribers, with 14,000 new users joining every day, according to the Cellular Telecommunications Industry Association (CTIA).[1]

In most areas, people could choose between two cellular phone operators.[2] In the metropolitan New York area, for example, consumers had a choice between NYNEX, a Regional Bell Operating Company (RBOC), and Cellular One, a unit of McCaw Cellular Communications, Inc., acquired by AT&T in September 1994.[3]

As of 1994, analog cellular phone service was widely available, with coverage everywhere except the most remote areas,[4] yet cellular operators were moving from analog to digital to improve radio spectrum efficiency, quality, and security (see section **5.1**). At the same time, digital cellular phone service was available in several major markets, but service was though to need time to become widely available.[5]

---

[1]Paul Eng, "Smart, Useful—and They Won't Put a Sag in Your Suit," *Business Week*, 3374, 30 May 1994, p. 141.

[2]Mark Lewyn, "Going Places," *Business Week, The Information Revolution 1994*, 3372, 18 May 1994 [special issue], p. 176.

[3]Eng, "Smart, Useful," p. 142.

[4]Mark Lewyn, "Welcome to the Wireless War," *Business Week—The Information Revolution 1994*, 3372, 18 May 1994 [special issue], p. 178.

[5]Ibid.

Table 2-1

Major Non-Fixed Network Services in the United States as of September 1994

Services	Extent of Commercialization
Cellular	
Analog cellular	Widely commercialized
Digital cellular	Partly commercialized
Personal Communications Services (PCS)	
So-called narrowband PCS	Not commercialized
So-called broadband PCS	Not commercialized
Specialized Mobile Radio (SMR) and Enhanced (Digital) SMR (ESMR)	
SMR	Commercialized
ESMR	Partly commercialized
Satellite Communications	
Satellite communications networks complementary to fixed networks	Commercialized
Mobile Satellite Services (MSS)	Not commercialized
Fixed Satellite Services (FSS)	Not commercialized
Airplane Phones	
Air-to-ground calling	Commercialized
Ground-to-air calling	Partly commercialized
Paging	Widely commercialized

2.1.2 Personal Communications Services (PCS)

Even though various players have proposed definitions of personal communications services, as of September 1994 there was no industry-wide definition of PCS.[6] In general, PCS was expected to offer many kinds of new wireless services, such as advanced paging and messaging services, and next-generation cellular phone services.

[6]Derrick C. Huang, *Up in the Air—New Wireless Communications* (Cambridge, Mass.: Program on Information Resources Policy, Harvard University, P-92-3, August 1992), p. 11.

So-called narrowband PCS was expected to offer advanced paging and messaging services, including two-way paging service, and the Federal Communications Commission (FCC) began spectrum auctions for narrowband PCS licenses in July 1994.[7]

So-called broadband PCS was expected to offer next-generation cellular phone services, and the FCC announced spectrum auctions for broadband PCS licenses to begin in December 1994.[8] The core service was said to be pocket-size phone service.[9] Like existing cellular phone service, this new service would use radio spectrum, but smaller handsets and lower prices were expected because the transmission towers could be lower-powered and closer together than those for existing cellular phone service.[10] In addition, potential broadband PCS operators said their systems would work indoors and out, so that only a single handset would be needed for both locations.[11]

Many users qualify the terms narrowband and broadband by the phrase "so-called," because, although used by the FCC, these terms are not yet common within the telecommunications industry. Narrowband PCS networks would use the 900 megahertz (MHz) band in chunks of 50, 62.5, and 100 kilohertz (kHz) spectrum blocks (or bandwidths),[12] and broadband PCS networks would use the 2 gigahertz (GHz) band in chunks of 10 and 30 MHz spectrum blocks.[13]

2.1.3 Specialized Mobile Radio (SMR) and Enhanced (Digital) SMR (ESMR)

Specialized mobile radio is a two-way radio dispatch service widely used for years by truck and taxi fleets. As of 1994, SMR operators such as Nextel Communications, Inc., were

---

[7]Mary Lu Carnevale, "FCC's Take of $617 Million for Licenses Shows Demand for New Paging Services," *The Wall Street Journal*, Monday, 1 Aug. 1994, p. A3, Eastern Edition; and "Narrowband PCS Auction Closes Out at $617 Million; IVDS Soars past the $200 Million Mark," *Telecommunications Reports*, **60**, 31, 1 Aug. 1994, p. 42.

[8]"FCC Will Begin Auction for Phone Licenses Dec. 5," *The Wall Street Journal*, Tuesday, 20 September 1994, p. B8, Eastern Edition, and "FCC Will Start Broadband PCS Auctions Dec. 5," *Telecommunications Reports*, **60**, 39, 26 Sept. 1994, p. 16.

[9]"FCC Today Begins Auctioning Licenses for Cellular Services," *The Wall Street Journal*, Monday, 5 Dec. 1994, p. B4, Eastern Edition.

[10]Catherine Arnst, "Dial 'R' for Revolution," *Business Week*, 3374, 30 May 1994, p. 142 E4.

[11]Kevin Kelly, "Wireless," *Business Week, The Information Revolution 1994*, 3372, 18 May 1994 [special issue], p. 72.

[12]"Everything You Wanted to Know About the Upcoming PCS Auctions," *Washington Telecom News*, **2**, 24, 13 June 1994, p. 6.

[13]"... FCC Releases New, Improved Broadband PCS Plan," *Washington Telecom News*, **2**, 24, 13 June 1994, p. 8.

converting their SMR networks to digital in order to deliver both voice and data to a single device and compete with cellular.[14]

As of 1994, digital SMR service, also called enhanced SMR service, was available only in limited markets such as Los Angeles, California, even though Nextel said its nationwide network would be in place in two years.[15] Nextel was said to be facing technical problems. Industry analysts said that "the voice quality of Nextel's service was sometimes poor, making some callers sound as if they were talking underwater."[16] Nextel confirmed that it was having quality problems, but "Customer satisfaction has improved dramatically," according to James M. Dixon, president of Nextel's Digital Mobile Networks Division.[17]

2.1.4 Satellite Communications

As of 1994, there were about ten U.S. mobile satellite service (MSS) and fixed satellite service (FSS) projects that planned to launch more than a thousand satellites in all, operating in low-earth orbit (LEO), medium-earth orbit (MEO), or geostationary orbit (GEO).[18] In geneeral, although with some exceptions, satellite services that use mobile terminals are called mobile satellite services (MSS), and satellite servicess that useThese MSS and FSS projects proposed to offer nationwide or worldwide satellite communications services that could link handsets directly to satellites or through existing terrestrial networks, including cellular phone and fixed networks, interconnected with gateway earth stations. Voice MSS operating in frequency bands above 1 GHz were called Big LEO MSS, nonvoice MSS below 1 GHz were called Little LEO.[19] Big LEO and Little LEO differ in frequency bands (i.e., above or below 1 GHz) and services (i.e., voice or nonvoice), but not in using terrestrial links.

So-called Big LEO MSS networks were expected to carry voice conversations, as well as data, facsimile (fax), and paging messages, over hand-held mobile phones and other

---

[14]Arnst, "Dial 'R' for Revolution," p. 142 E4.

[15]Ibid.

[16]Edmund L. Andrews, "MCI Cancels Investment in Nextel," *The New York Times*, Tuesday, 30 Aug. 1994, p. D2.

[17]Mark Lewyn, "How MCI Got a Bad Connection," *Business Week*, 3389, 12 Sept. 1994, p. 34.

[18]Karen Lynch and Graham Finnie, "LEO Satellite Plans in Orbit," *Communications Week International*, 25 April 1994, pp. 20-21.

[19]"Satellite Interests Urge U.S. Delegation to Focus on MSS Spectrum Needs at WRC-95," *Telecommunications Reports*, **60**, 30, 25 July 1994, p. 27.

lightweight devices, potentially worldwide.[20] Candidate Big LEO operators are slated to begin service in the late 1990s or early 2000s.[21]

The FCC is expected to hand out five Big LEO licenses in January 1995. Projects of formal applicants for the FCC licenses include Motorola's Iridium project, Loral-Qualcomm Partnership L.P.'s Globalstar, Mobile Communications Holdings's Ellipso,[22] Constellation Communications's Aries, and TRW's Odyssey.[23]

So-called Little LEO MSS networks were expected to offer nonvoice services such as data messaging and position location. As of September 1994, applicants for Little LEO licenses included Orbital Communications Corp. (Orbcomm), Leo One USA Corp., Volunteers in Technical Assistance, Inc. (VITA), and Starsys Global Positioning, Inc. Some of these applicants planned to launch and operate satellites in mid- or late 1990s.[24]

In addition, in March 1994, Teledesic Corp. proposed an FSS project, to begin in the year 2001, to provide fixed broadband communications worldwide using 840 satellites.[25]

Besides the U.S. MSS and FSS projects, the International Maritime Satellite Organization (Inmarsat), an international consortium that offered ship-to-shore phone service, proposed Inmarsat-P, which may compete against the U.S. Big LEO projects.[26] As of September 1994, one U.S. company, Comsat Corp., was a shareholder in Inmarsat-P, even though such U.S. Big LEO applicants as Motorola opposed Comsat's participation because that company is the federal government's representative in international satellite treaties.[27]

Although these MSS and FSS projects have attracted numerous international aerospace manufacturers, network operators, and other potential investors, as of September 1994, some projects were said not to have sufficient funding.[28]

---

[20]Mary Lu Carnevale, "FCC, Clinton Administration Both Move to Spur Satellite Network Competition," *The Wall Street Journal*, Friday, 18 Nov. 1994, p. B4, Eastern Edition.

[21]Lynch and Finnie, pp. 20-21.

[22]Mobile Communications Holdings, Inc., was formerly Ellipsat Corp.

[23]Carnevale, "FCC, Clinton Administration," p. B4.

[24]"FCC Grants Orbcomm First 'Little LEO' License; Initial 2 Satellites to Be Launched in 'Few Months,'" *Telecommunications Reports*, **60**, 43, 24 Oct. 1994, pp. 27-28; and "Rival Says VITA/CTA Is Building Unlicensed Satellite," *Telecommunications Reports*, **60**, 45, 7 Nov. 1994, pp. 35-36.

[25]Lynch and Finnie, pp. 20-21.

[26]Carnevale, "FCC, Clinton Administration," p. B4.

[27]Richard L. Hudson, "Inmarsat Begins Fund-Raising Drive for $2.6 Billion Satellite Phone System," *The Wall Street Journal*, Monday, 12 Sept. 1994, p. B8, Eastern Edition.

[28]Lynch and Finnie, p. 21.

2.1.5 Airplane Phones

Before 1994, airplane phones, though used since the mid-1980s, had severely limited functions. They could only place calls, not receive them, and quality was erratic.[29] Improvements in technologies have begun to address these problems. In 1994, companies such as GTE Airfone, Inc., began to offer ground-to-air calling service, which enables passengers to receive calls. New services available on some planes included facsimile transmission.[30]

2.1.6 Paging

From the viewpoint of number of subscribers, in 1994 paging appeared the most popular non-fixed network service in the United States, even though it did not transmit voice. At the end of 1993, in the United States, nearly 19 million people of all stripes were said to carry pagers, which once were associated primarily with doctors, sales representatives, and certain criminal elements (such as drug dealers).[31] As of 1994, most paging services were only one-way. A caller could send a message to someone's pager but couldn't get an immediate response. Some companies, such as so-called narrowband PCS licensees, were trying to begin two-way paging service, which would enable a caller to confirm receipt of a message immediately and even receive a limited message as a response (see section **2.1.2**).[32]

One major reason for the spread of paging service was price. As of 1994, monthly service fees ran from $8 to $15 on average, a fraction of the cost of cellular phone service, and pagers were usually much cheaper than cellular phones.[33]

2.2 Major Services in Japan

Table 2-2 presents major non-fixed network services in Japan as of September 1994.

2.2.1 Cellular

Japanese cellular phone service began in 1979. At the end of 1993, there were 2,008,700 cellular phone subscribers, and the penetration rate of cellular phones into the

---

[29]Lewyn, "Going Places," p. 177.

[30]Ibid., pp. 177-178.

[31]Eng, "Smart, Useful," p. 141.

[32]John J. Keller, "McCaw Cellular Plans Expansion for $1 Billion," *The Wall Street Journal*, Friday, 16 Sept. 1994, p. A3, Eastern Edition.

[33]Eng, "Smart, Useful," p. 142.

national population was still 1.6 percent as against more than 5 percent in the United States.[34]

Table 2-2

Major Non-Fixed Network Services in Japan as of September 1994

Services	Extent of Commercialization
Cellular	
Analog cellular	Widely commercialized
Digital cellular	Partly commercialized
Personal Handy-phone System (PHS)	Not commercialized
Marinet Telecommunications	Partly commercialized
Satellite Communications	
Satellite communications networks complementary to fixed networks	Commercialized
MSS	Not commercialized
Paging	Widely commercialized

Before April 1994, heavy regulation muted Japan's cellular phone market for years.[35] The Ministry of Posts and Telecommunications (MPT) did not allow end-users to purchase cellular phones but only to rent them from cellular phone operators. In April 1994, the MPT began to allow end-users not only to rent cellular phones but also to purchase them. Since then, the number of cellular phone subscribers has increased rapidly owing to the reduction in prices, including those for handsets, initial subscriber fees, monthly basic fees, and the per-minute rate. In June 1994, for the first time ever in one month, new subscribers exceeded the number for the fixed phone service of Nippon Telegraph and Telephone Corporation (NTT). The total cellular phone figure for that month was about 130,000, compared with 100,000 for NTT fixed lines.[36]

---

[34]Kyodo News Service, "Cellular Phone War Looms over Domestic Market," *The Japan Times*, Friday, 18 March 1994, p. 13.

[35]Neil Gross, "Come One, Come All to the Cellular Sweepstakes," *Business Week*, 3368, 25 April 1994, p. 50.

[36]"Ido Denwa Kanyu Kotei Denwa Uwamawaru" [New Cellular Subscriptions Exceeded Those for Fixed Phones], *Nihon Keizai Shimbun*, Wednesday, 14 Sept. 1994, p. 13, American Edition.

As in the United States, analog cellular phone service in 1994 was widely available. According to Koichi Seijo, Managing Director of NTT Mobile Communications Network, Inc. (NTT DoCoMo), analog cellular phones of the NTT DoCoMo Group were usable virtually all over Japan, because as of 1994 the Group had installed relay antennas in all urban areas.[37]

In March 1993, the NTT DoCoMo Group began to offer digital cellular phone service in the Tokyo metropolitan region and in 1994 tried to expand its service areas. Other companies, such as Nippon Idou Tsushin Corp. (IDO), Tokyo Digital Phone Co.,Ltd., and TU-KA Cellular Tokyo, Inc., also initiated digital cellular phone service in 1994 (see sections **4.2.1** and **5.2.2**).

2.2.2 Personal Handy-phone System (PHS)

In 1994, several companies and consortia including fixed network operators prepared to begin a new portable digital phone system, personal handy-phone system (see section **4.2.2**).[38]

Designed in Japan, PHS resembled broadband PCS in the United States. Handsets were to be used both indoors and out, even though they would not work in moving vehicles. The prices of PHS were expected to be far lower than those of existing cellular phone systems because of the potentially lower cost of base stations.[39] As of September 1994, PHS was expected to be commercialized in 1995.[40]

2.2.3 Marinet Telecommunications

Marinet telecommunications service in Japan is a cellular-like maritime telecommunications service mainly for small-size ships inside and around bays, such as Tokyo Bay. Commercialized in 1988, Marinet offered telecommunications service ship to ship, car to car, and between ship or car and terrestrial office or home sites.[41] As of 1994, however, Marinet was available only in and around Tokyo Bay, Osaka Bay, and the Inland Sea between

---

[37]Kyodo News Service, p. 13.

[38]This system was originally called personal handy phone (PHP) and was renamed personal handy-phone system in April, 1994. See "PHP kara PHS ni" [From PHP to PHS], *Nihon Keizai Shimbun*, Saturday, 23 April 1994, p. 8, American Edition.

[39]Gross, p. 50.

[40]Futaki Hanzawa, "Cellular Services Go for Leisure Market," *The Nikkei Weekly*, Monday, 19 Sept. 1994, p. 16.

[41]InfoCom Research, Inc., *Information Communications Almanac '94* (Tokyo: InfoCom Research, Inc., 1994) pp. 427-428.

Hiroshima and Ehime Prefectures, and the number of its subscribers was far smaller than that of cellular phone service.[42]

2.2.4 Satellite Communications

As of 1994, two Japanese satellite communications operators, Japan Satellite Systems, Inc. (JSAT), and Space Communications Corp. (SCC), were operating communications satellites and offering leased circuit services.[43] But the demand for their services was said to be smaller than had been expected before their satellites were launched.[44]

In 1993, some Japanese companies were joining MSS projects preparing to offer MSS internationally. For example, the DDI Corp. joined the Iridium project that year, and as of September 1994 Kokusai Denshin Denwa Co. (KDD) planned to join Inmarsat-P.[45]

In addition, the National Space Development Agency (NASDA) of Japan and the MPT were planning to offer MSS throughout Japan, not internationally.[46]

2.2.5 Paging

As in the United States, from the viewpoint of number of subscribers—eight million pager in Japan as of the end of March 1994[47]—paging appeared the most popular non-fixed network service in Japan owing to lower prices than those for cellular phone service.

As of 1994, pagers could only be rented from paging operators, but, as in the case of cellular phones, the MPT was expected to begin allowing end-users not only to rent pagers but also to purchase their own beginning March 1995. Similarly, pagers were expected to spread more rapidly than before the MPT's removal of its ban on handset sales.[48]

Further, as of 1994, more functions were added to pagers than ever before, which were expected to promote the spread of paging service. For example, some pagers now allowed

---

[42]Ibid.

[43]Ibid., pp. 205-214.

[44]"Eisei Tsushin de Atarashii Kyokumen wo Mukaeru Nettowaku" [Satellite Communications Makes Networks Enter upon a New Phase], *Business Communication*, **31**, 7, July 1994, p. 28.

[45]"'Irijiumu Keikaku' 98nen Shido" ['Iridium Project' Could Be Commercialized in 1998], *Nihon Keizai Shimbun*, Wednesday, 21 Sept. 1994, p. 11, American Edition.

[46]"Eisei Riyou no Keitai Denwa Koso" [A Plan of Mobile Satellite Service], *Nihon Keizai Shimbun*, Monday, 25 July 1994, p. 1, American Edition.

[47]"Shuhasu ga Tarinai" [Spectrum Is Scarce], *Nihon Keizai Shimbun*, Saturday, 23 July 1994, p. 3, American Edition.

[48]"Pager Makers Dial in on Teenagers," *The Nikkei Weekly*, Monday, 11 July 1994, p. 14.

end-users to send or receive short messages not only of numbers but also of Japanese characters or English letters.[49]

2.3 Major Players

The development of non-fixed networks and the relationship between them and fixed networks influence many private companies, public organizations, government departments and agencies, and end-users. In 1994, the number of players in non-fixed networks increased for a variety of reasons, including the development of new technologies and changes in regulations. The **Appendix** presents a table of the major players in non-fixed networks as of September 1994.

2.4 Advantages and Disadvantages of Non-Fixed vs. Fixed Networks

Both non-fixed and fixed networks have advantages and disadvantages. Changing conditions, such as the development of new technologies, result in changes in advantages and disadvantages. **Table 2-3** summarizes the advantages and disadvantages of non-fixed vs. fixed networks as seen by major players as of September 1994.

[49]"Smart Pocket Pagers Spawn New Businesses," *The Nikkei Weekly*, Monday, 4 July 1994, p. 13.

Table 2-3
Advantages and Disadvantages of Non-Fixed and Fixed Networks
Expressed by Major Players in the United States and Japan as of September 1994

Major Players	Non-Fixed Networks		Fixed Networks	
	Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
Regulators*	Become a solution when a disaster creates a communications crisis.	Radio spectrum is scarce, but the development of technologies might make scarcity less of a problem.		
Non-Fixed Network Operators	Become a solution when a disaster creates a communications crisis. Building new networks where no network exists might cost less.	Radio spectrum is scarce, but the development of technologies might make scarcity less of a problem. Service offering is geographically *more* fragmented than for fixed networks ("roaming" arrangements are complicated), but non-fixed network operators are trying to offer nationwide service.		
Fixed Network Operators			Service offering is geographically *less* fragmented. (Interconnection arrangements have become routine over the years.)	Building new networks where no network exists might cost more.
End-users	Become a solution when a disaster creates a communications crisis. Portability. End-users don't have to rely on pay phones when traveling. End-users could be reached more easily.	Service offering is geographically *more* fragmented than for fixed networks ("roaming" arrangements are complicated), but non-fixed network operators are trying to offer nationwide service. Prices are higher, but they might become lower. Quality of sound is often poor, but the development of technologies might make it better.	End-users themselves don't need to arrange interconnection. Prices are lower. Quality of sound is better. Service offering is more reliable than non-fixed networks, particularly for data communications.	

*In the U.S., the FCC, the Department of Justice, federal courts, public service commissions and public utility commissions. In Japan, the Ministry of Posts and Telecommunications.

Chapter Three

Issues in Spectrum and Licenses: The Impact of Scarcity of Radio Spectrum

3.1 In the United States

Non-fixed networks operate by using the radio spectrum. As various kinds of new non-fixed network services are proposed, the demand for the radio spectrum increases. In consequence, as of September 1994, the radio spectrum was considered scarce, and, despite some denials, spectrum allocations and licenses could be regarded as justified, for several reasons.[1]

First, spectrum management was needed to avoid radiowave interference. Second, spectrum allocation and licensing enabled regulators to choose spectrum users that could benefit the national economy or serve the public interest. Third, limiting the number of users would avoid having so many companies offer non-fixed network services that some of them or some existing network operators might go under. Fourth, regulators could promote national competitiveness by controlling or denying non-U.S. companies access to licenses.[2]

Nevertheless, spectrum allocation often takes a long time. Various methods of spectrum management had different effects on the improvement of non-fixed networks and the relationship between fixed and non-fixed networks.

Before the summer of 1994, the federal government granted frequencies either on through comparative hearings or by lottery.[3] When the FCC established rules for the creation of the cellular phone industry in the early 1980s, it decided to license cellular phone operators for no charge.[4]

But in an effort to cut the federal deficit in 1993, the government enacted the Budget Act, which authorized the FCC to auction spectrum licenses and put the money into the Treasury.[5]

---

[1]For an overall understanding of issues in spectrum management, see Derrick C. Huang, *Managing the Spectrum: Win, Lose, or Share* (Cambridge, Mass.: Program on Information Resources Policy, Harvard University, P-93-2, February 1993).

[2]Ibid., pp. 8-9.

[3]George Graham, "Washington Expects Bonanza with Auction of Airwaves," *Financial Times*, Wednesday, 2 Nov. 1994, p. 4.

[4]Andrew Kupfer, "The Future of the Phone Companies," *Fortune*, **130**, 7, 3 Oct. 1994, p. 102.

[5]Ibid.; and "Hundt Sets Timetable for Concluding Big LEO Rulemaking, Issuing Licenses; Intelsat/Inmarsat Privatization Debated," *Telecommunications Reports*, **60**, 31, 1 Aug, 1994, p. 40.

3.1.1 Cost of Auctions

In the first stage of the spectrum auctions, the adoption of auctions appeared to increase start-up costs. In the FCC auction of July 1994, buyers bid a total of $617 million for ten nationwide licenses to offer advanced paging and messaging services, a part of so-called narrowband PCS. Although in 1993, the FCC had awarded a license without fee to the Mobile Telecommunication Technologies Corp. (Mtel) for pioneering technology, in 1994 the FCC changed its mind and requested payment of $33.3 million, but whether this payment would be made was disputed by regulators, pioneer's preference winners, and other PCS operator candidates.[6] Several of the largest bidders for the ten nationwide licenses later defaulted.[7]

In the case of broadband PCS, the FCC expected much more money to be raised in auctions scheduled to begin in December 1994. As in the case of Mtel, the FCC voted in August 1994 to require payments from three companies—Omnipoint Communications, Inc., Cox Enterprises, Inc., and American Personal Communications (APC)—which were originally selected for free licenses as technological pioneers. In December 1993, when the FCC granted free licenses to those three companies, politicians at the federal level were upset that the licenses would therefore not raise money for the Treasury.[8] In September 1994, the Clinton administration formulated another "proposal to collect fees from the three broadband pioneers to help finance the implementation of a world trade agreement," although the payments were still disputed by regulators, pioneeer's preference winners, and other PCS operator candidates as of the end of that month.[9]

Observers feared that the initial, high auction prices might motivate the FCC to auction every license it possibly could, without serious consideration of the public interest. For example, the FCC adopted a definition of "modification of license" for paging systems, which the industry argued had no technical justification but resulted in the greatest number of paging applications becoming auctionable.[10]

According to the FCC, the auctions would

---

[6]Carnevale, "FCC's Take," p. A3.

[7]Graham, p. 4.

[8]Mary Lu Carnevale, "FCC to Make Three Concerns Pay for Licenses," *The Wall Street Journal*, Wednesday, 10 Aug. 1994, p. B2, Eastern Edition.

[9]"APC Calls for FCC Investigation of Pacific Telesis," *Telecommunications Reports*, **60**, 43, 24 Oct. 1994, p. 13.

[10]William J. Franklin, "Auctions: This Changes Everything," *Cellular Business*, **11**, 10, October 1994, p. 20.

> enable the Commission to assign licenses to those who value them most highly and who will make the most efficient use of the scarce spectrum resources and ultimately render the greatest benefits to the American public.[11]

Don Gips, deputy director of the FCC's Office of Plans and Policy, said, "Our primary goal is to create competition and economic growth, not to raise revenue."[12] But in the first auctions in 1994, the adoption of the auction method appeared to force companies to spend a great deal of money before they could offer new, non-fixed network services.

The more companies need to spend to acquire licenses and build networks, the higher prices for the new services may be.[13]

3.1.2 Cost of Relocation

As the radio spectrum became crowded, relocating incumbent users often became necessary in order to offer new non-fixed network services. This relocation could prove difficult and could cost a lot.

For example, winners of broadband PCS auctions, scheduled to begin in December 1994, might bear an additional expense. Under the PCS rules established by the FCC, if relocation of incumbent microwave users onto other microwave bands is necessary to eliminate interference, then broadband PCS licensees would be required to pay for it. The broadband PCS spectrum was home to approximately 4,000 microwave links, whose users included transportation and utility companies, public safety administrations, the federal government, and a large number of oil and petroleum companies. Relocation was estimated to cost between $50,000 and $500,000 per link, and most systems were duplex, that is, containing two links. Microwave relocation might collectively cost broadband PCS licensees an estimated $1 billion. If much relocation is required, the broadband PCS industry will face another major start-up cost.[14] Bryant Hilton, of the Personal Communications Industry

---

[11]"FCC Adopts Broadband PCS License Auction Rules, Gives Advantages to Minorities, Women, Small Businesses," *Telecommunications Reports*, **60**, 27, 4 July 1994, p. 5.

[12]Mary Lu Carnevale, "Bidding for Cellular Service Licenses Is Expected to Be Uneven across U.S.," *The Wall Street Journal*, Wednesday, 2 Nov. 1994, p. B13, Eastern Edition.

[13]Mary Lu Carnevale, "FCC's Auction of the Airwaves Proves Success As Offers Reach $500 Million," *The Wall Street Journal*, Thursday, 28 July 1994, p. B11, Eastern Edition.

[14]William J. Franklin, "New Wireless Regulations—How Will They Affect You?" *Cellular Business*, **11**, 5, May 1994, pp. 66, 68; and Lisa Armstrong, "Microwave Incumbents on the Move," *Cellular Business*, **11**, 10, October 1994, p. 23.

Association (PCIA), said, "From the minute that licenses are handed out, PCS companies will be losing money until their systems are set up."[15]

3.1.3 International Frictions

Spectrum allocation in one country can affect radio operation in others. International interests cannot be ignored, and coming to an international agreement has often proved difficult.[16] Frictions arose, for example, over spectrum allocations for MSS projects, such as Motorola's Iridium.

At the 1992 World Administrative Radio Conference (WARC '92) of the International Telecommunication Union (ITU), officials from around the world agreed to allocate radio spectrum for MSSs.[17] After the conference the FCC proposed a plan for spectrum allocation and licensing for so-called Big LEO MSS systems projected by several U.S. companies. The FCC's plan, however, depended on spectrum relocation of the Russian Glonass navigational satellite system.[18] Several European companies planned other MSS systems that would use the MSS spectrum intended for the U.S. LEO systems. Paul Verhoef, head of satellite policy for the European Commission, cited the concern of governments and industries in the members nations of the European Union (EU) that the FCC's licensing plan for LEO systems lacked international consensus and might bar the door to European LEO systems using spectrum allocated internationally for MSSs.[19]

Under WARC rules, the United States and European countries must negotiate for and coordinate systems within the limited spectrum available.[20] But reaching an agreement appeared to take a long time, and, as of September 1994, there was no authoritative organization to conclude such negotiations easily.

The U.S. LEO systems may be commercialized in the end. The need to negotiate with other countries could delay the commercial launch of new non-fixed network services in the

---

[15]Armstrong, p. 23.

[16]Huang, *Managing the Spectrum*, p. 48.

[17]Graham Finnie, "U.S. Takes Early Lead," *Communications Week International*, 25 April 1994, p. 22.

[18]"'Big LEO' Applicants Generally Support FCC Spectrum Plan; Glonass Migration a Key Issue," *Telecommunications Reports*, **60**, 20, 16 May 1994, p. 21.

[19]"European Commission Official Warns of 'Roadblocks' If U.S. Unilaterally Authorizes Global 'Big LEO' Systems," *Telecommunications Reports*, **60**, 23, 6 June 1994, pp. 25-26.

[20]Finnie, p. 22.

United States, especially MSS.[21] With the aim of solving such issues, international coordination or harmonization plans have repeatedly been proposed.[22]

3.1.4 Impact on Industry Structure

As a result of adoption of spectrum auctions, applicants need ample financial resources, and it appeared that larger companies would win licenses. The higher cost of auctions for applicants might make winning licenses more difficult for smaller companies.[23]

For this reason, Congress directed the FCC to help small companies and those owned by minorities, women, and telephone companies in remote rural areas get into the PCS industry.[24] In June 1994, the FCC therefore adopted rules for auctioning broadband PCS licenses, including a "competitive opportunity plan" to set aside part of spectrum blocks and establish a discount on a winning bid for "designated entities" (small businesses, rural telephone companies, and businesses owned by members of minorities or women).[25] About half—986 out of 2,074 broadband PCS licenses—would be set aside for "designated entities."[26]

In the case of the narrowband PCS auction in July 1994, the FCC gave limited bidding preferences to "designated entities," but it did not set aside spectrum blocks for them.[27] As a result, no small company won a license. "Designated entities" pressed the FCC to increase the bidding preferences, in particular larger discounts for them in succeeding auctions.[28] Small companies seeking narrowband PCS licenses complained that they were "elbowed out of the auction by deep-pocketed telephone, paging and cellular companies."[29] The FCC began to consider ways to change auction rules.[30]

---

[21]Ibid.

[22]"European Commission Official," p. 27.

[23]Huang, *Managing the Spectrum*, pp. 62-63.

[24]Jeanne Saddler, "Small Firms Hope FCC Will Help in Wireless Bidding," *The Wall Street Journal*, Tuesday, 30 Aug. 1994, p. B2, Eastern Edition.

[25]"FCC Adopts Broadband," p. 5.

[26]Ibid., p. 6.

[27]Mary Lu Carnevale, "FCC Problems in TV-Licenses Auction Grow as Interactive America Defaults," *The Wall Street Journal*, Thursday, 11 Aug. 1994, p. A3, Eastern Edition.

[28]Saddler, "Small Firms Hope," p. B2.

[29]Carnevale, "FCC Problems," p. A3.

[30]Ibid.

The adoption of spectrum auctions in mid-1994 promoted new alliances among companies trying to offer new non-fixed network services (see section **4.1**). In the months prior to the broadband PCS auctions, scheduled to begin in December 1994, potential broadband PCS operators rushed to unite. By forming alliances, they hope to share the enormous costs of bidding on licenses, paying for relocation of incumbents, and building networks that will offer broadband PCS.[31]

Bidders for broadband PCS licenses would include coalitions such as:

- of Sprint Corp. and three cable television operators, Tele-Communications, Comcast Corp., and Cox Enterprises;
- of Bell Atlantic, NYNEX, U S West, and AirTouch Communications; and
- of companies such as APC (part-owned by The Washington Post Co.) and BellSouth.[32]

Because broadband PCS would require enormous start-up costs, federal officials in the FCC encouraged alliances between large and small companies.[33] The rush for partners raised the question of "whether these alliances might produce even higher license prices—and less competition."[34] In advance of the auctions, the antitrust division of the Department of Justice (DOJ) began an investigation of the alliances.[35]

The FCC set aside part of the spectrum blocks for "designated entities" and encouraged alliances,[36] but it also set a limit on the number of broadband PCS licenses in the "designated entities' blocks" that a single entity could win: 10 percent of the licenses available in the "designated" blocks.[37] According to the FCC, "That provision will [would] ensure that many companies have a chance to win the PCS licenses, which will lead to a competitive marketplace for PCS services."[38]

---

[31]John J. Keller and Leslie Cauley, "Mad Scramble," *The Wall Street Journal*, Tuesday, 25 Oct.1994, p. A1, Eastern Edition.

[32]Carnevale, "Bidding for Cellular," p. B13, and "Broadband PCS Bidders Scramble for License Partners," *Telecommunications Reports*, **60**, 44, 31 Oct. 1994, p. 40.

[33]Jeanne Saddler, "Baby Bells Offer Wireless Help to Small Firms," *The Wall Street Journal*, Wednesday, 7 Sept. 1994, p. B3, Eastern Edition.

[34]Keller and Cauley, p. A1.

[35]Ibid.

[36]Saddler, "Baby Bells Offer," p. B3.

[37]"FCC Adopts Broadband," p. 8.

[38]Ibid.

The purpose of the FCC's encouragement of alliances was not to lessen competition but to promote it among operators.

3.1.5 Overview

The scarcity of the radio spectrum (although its reality was still disputed), the adoption of auctions, and the higher start-up costs resulting from the use of this method, may prove an entry barrier to new non-fixed network services. On one hand, applicants that can offer technically advanced and economically efficient services may fail to win a license because they lack sufficient financial resources with which to bid. On the other hand, new licensees that can afford to bid the highest price may not offer the most technically advanced or economically efficient services.[39] As of September 1994, the federal government planned to require even recipients with PCS pioneer's preference, such as APC, to pay for licenses. Relocation of incumbent users and international coordination could take a long time.

From the point of view of the regulators, spectrum auctions and user fees, if collected (another disputed notion), could generate revenues and cover spectrum management costs.[40]

But from the point of view of new non-fixed network operators, spectrum auctions could delay the commercial launch of their services and make it tough to undercut their prices for years.[41] As a result, their services might be much more expensive than those of conventional fixed networks.

From the point of view of end-users, spectrum auctions could make new non-fixed network services more expensive and, consequently, less attractive than conventional fixed network services, even though, as taxpayers, they might view raising money for the Treasury as desirable.

3.2 In Japan

In Japan, unlike in the United States, the MPT manages and allocates radio spectrum by official inspection of applicants, not by lottery or auction.[42] Thus, high costs such as the costs of auctions in the United States are not incurred. But in April 1993, the Japanese government began to collect annual radio spectrum user fees for licenses.[43]

---

[39]Huang, *Managing the Spectrum*, p. 41.

[40]Ibid., p. 59.

[41]Keller and Cauley, p. A8.

[42]InfoCom Research, Inc., *Information Communications Almanac '94*, p. 443.

[43]Ibid., p. 442.

With the spread of non-fixed network services, however, scarcity of the radio spectrum has increasingly serious effects on non-fixed networks in Japan.

3.2.1 Number of Subscribers

Scarcity of the radio spectrum sometimes was damaging to operation of non-fixed networks. In July 1994, Tokyo Telemessage, Inc., for example, a paging operator that offered paging service in the Tokyo metropolitan region, was forced to limit new subscribers for lack both of frequencies and equipment, in spite of great demand for its service. According to the company, it needed three months before it could accept new subscribers again, because it had to allocate more spectrum and increase equipment.[44]

3.2.2 Relocation of Incumbent Spectrum Users

As in the United States, in Japan spectrum allocations to operators of new non-fixed networks often required relocation of incumbent spectrum users. For example, the beginning of digital cellular phone service, operating in the 1.5 GHz frequency band, required relocating the Defense Agency to another band. And although the MPT's plan to increase frequencies for PHS assumed that most users of home cordless phones would use PHS instead of those phones, as of September 1994, whether this assumption would prove true was not known.[45] Unlike in the United States, the MPT managed relocation of incumbent spectrum users, if necessary, without requiring new users to bear the costs.

3.2.3 International Friction

As in the case of U.S. MSS projects, spectrum allocation in Japan caused friction more widely in East Asia, just as Japan was affected by spectrum allocation in other Asian countries.

In July 1994, APT Satellite, a Chinese telecommunications company based in Hong Kong, launched a telecommunications satellite, Apstar 1, into geostationary orbit very close to a Japanese satellite, Sakura No. 3a. The Japanese government and NTT were concerned that the Chinese satellite, which operated on the same frequency band, might interfere with Sakura, which NTT used as a communications link with Japan's outlying islands. Before Apstar 1 was launched, the MPT tried to convince the Chinese government to change the orbit of their satellite, but China ignored Japan's protests. After Apstar 1 was launched, the MPT continued to press China to switch to another frequency. The dispute could have been

---

[44]"Tokyo Teremesseji no Pokeberu 'Panku'" [Paging of Tokyo Telemessage was 'punctured'], *Nikkei Business*, 753, 22 Aug. 1994, p. 25.

[45]"Shuhasu ga Tarinai," p. 3.

avoided by a simple change of frequency, but the change might have delayed the launch of the satellite at considerable financial cost to the Chinese government.[46]

Geostationary satellites must maintain an orbit 36,000 kilometers above the equator, an orbital placement that limits the possible number of satellites. Only a few frequency bands were available for communications satellites in 1994, aggravating the problem of near-miss orbits. Figures from the MPT showed that, as of the end of 1993, East Asian nations were planning to orbit scores of satellites: seventeen were planned by China, sixteen by Japan, six by Singapore, three by Malaysia, and two by South Korea.[47]

3.2.4 Impact on Industry Structure

Even without spectrum auctions, the scarcity of the radio spectrum had an impact on industry structure of Japanese non-fixed networks. At the end of June 1994, when the MPT promulgated its guideline for commercialization of PHS, it limited the number of PHS operators in each region to three, giving as one reason for this limitation the scarcity of spectrum (see section **4.2.2**).[48]

3.2.5 Conclusion

Scarcity of spectrum has had a similar impact on non-fixed networks in both Japan and the United States. It may delay the commercial start of new non-fixed network services and the spread of their services.

In Japan so far, however, unlike in the United States, operators of new non-fixed networks have not had to pay high fees at spectrum auctions or for relocation of incumbent users, as of 1994, even though experts have proposed adoption of auctions because of the increasing demand for the radio spectrum.[49]

---

[46]"Eisei Jintori Gassen Shiretsu" [The Struggle for Positions of Satellites Becomes Severe], *Nihon Keizai Shimbun*, Wednesday, 3 Aug. 1994, p. 3, American Edition.

[47]Ibid.

[48]"Yuseisho NTT Hontai Sannyu Mitomezu" [The MPT Doesn't Allow NTT Itself to Enter the Market], *Nihon Keizai Shimbun*, Thursday, 16 June 1994, p. 1, American Edition; and MPT, Japan, "Guideline for Introducing PHS Established," *MPT News*, 5, 9, 1 Aug. 1994, p. 2.

[49]"Shuhasu ga Tarinai," p. 3.

Chapter Four

Issues in Industry Structure: Competition or Concentration?

4.1 In the United States

As of 1994, service areas of U.S. cellular phone service remained as fragmented as they had been at the beginning of cellular in the early 1980s, when the federal government had given out only two cellular operating licenses in each region, one for each of the established local telephone companies and one for a new, independent rival.[1] In 1984, the FCC gave each local exchange carrier (LEC) one of two cellular licenses in its region.[2] Consequently, the cellular phone operators enjoyed a relatively comfortable duopoly competition in each region.[3]

The results were high rates[4] (although experts disputed whether these actually were high), no widespread brand name recognition, and uneven service.[5] In 1994, the RBOCs charged about $2 per minute for a call made in their territory through a rival cellular phone operator.[6] Although local telephone companies purchased cellular licenses outside their own regions, cellular phone handsets purchased in one part of the United States did not always work in other parts without "roaming" arrangements, and "roaming" charges could be prohibitive.[7]

From the late 1980s through the mid-1990s, non-fixed network operators, led by cellular phone operators faced tough competition. In mid-1987, Morgan E. O'Brien, later (1993) chairman of Nextel Communications, Inc., began to amass SMR licenses (see section **4.1.3**). Around 1993–94, some of the large interexchange carriers (IXCs) began acquiring non-fixed network operators, and several RBOCs merged their cellular phone businesses with one another. In mid-1994, a number of companies were preparing to invest in PCS.

---

[1]Louise Kehoe, "Scramble for Licences," *Financial Times*, Monday, 5 Sept. 1994, p. vii.

[2]Mark Lewyn, "Grab Your Partners for the Wireless Ball," *Business Week*, 3385, 15 Aug. 1994, p. 95.

[3]Mary Lu Carnevale, "FCC Prepares the Airwaves for a New Look," *The Wall Street Journal*, Thursday, 9 June 1994, p. B7, Eastern Edition.

[4]Catherine Arnst, "The Baby Bells Should Put Washington on Hold," *Business Week*, 3381, 18 July 1994, p. 37.

[5]Ibid.

[6]Lewyn, "Grab Your Partners," p. 95.

[7]Kehoe, "Scramble for Licences," p. vii.

4.1.1 The Case of AT&T and McCaw: A Vertical Merger

In August 1993, AT&T, the largest IXC in the United States, reached an agreement to buy McCaw Cellular Communications, Inc., the nation's largest cellular phone operator. The proposed acquisition had an enormous impact on the telecommunications industry, fueling a race among IXCs and RBOCs to develop their own nationwide wireless networks.[8] In addition, some people said that McCaw's extensive wireless network could potentially bypass local telephone exchanges.[9] In 1993 all the IXCs were searching for ways to reduce the access charges they have to pay the LECs in order to reach the local providers' individual customers. These charges accounted for almost half the cost of long-distance telephone calls.[10]

Table 4-1 presents the major acquisitions by fixed network operators of non-fixed network operators.[11]

AT&T's plan needed the approval of such regulators as the federal courts, the DOJ, the FCC, and the state public service and public utility commissions, but approval was not gained easily. In April 1994, U.S. District Judge Harold H. Greene barred AT&T's plan, saying that the acquisition would violate the 1982 consent decree, which broke up the Bell System. Judge Greene also indicated that AT&T might be able to persuade him that the decree should be modified, and AT&T promptly began seeking a waiver.[12]

Some RBOCs opposed AT&T's plan. For example, at the beginning of August 1994, two RBOCs, Bell Atlantic and NYNEX, filed a federal lawsuit seeking to block AT&T's acquisition, saying it could "inflict severe damage" on competitors and customers.[13]

---

[8]Edmund L. Andrews, "Obstacle Is Cleared for AT&T," *The New York Times*, Friday, 26 Aug. 1994, p. D1.

[9]Daniel Pearl, "AT&T Gains Waiver of 1982 Decree, Clearing Hurdle in Bid to Buy McCaw," *The Wall Street Journal*, Friday, 26 Aug. 1994, p. B2, Eastern Edition.

[10]Edmund L. Andrews, "AT&T Completes Deal to Buy McCaw Cellular," *The New York Times*, Tuesday, 20 Sept. 1994, p. D5.

[11]For more examples of acquisitions and transfers of cellular operators, see Gustave Barth, *Cellular Phones: Is There Really Competition?* (Cambridge, Mass.: Program on Information Resources Policy, Harvard University, I-94-3, August 1994), p. 14.

[12]Susan Pulliam, "Buy McCaw and Put It on Hold, Analysts Say; It May Later Turn into AT&T at a Tidy Profit," *The Wall Street Journal*, Thursday, 9 June 1994, p. C2, Eastern Edition.

[13]Leslie Cauley, "Bell Atlantic and NYNEX Sue to Block AT&T's Planned Acquisition of McCaw," *The Wall Street Journal*, Tuesday, 9 Aug. 1994, p. B7, Eastern Edition.

Table 4-1

Major Acquisitions of Non-Fixed Network Operators by Fixed Network Operators in the United States as of September 1994

Acquiring Company	Acquired Company
AT&T Corp.	McCaw Cellular Communications, Inc.: cellular
MCI Communications Corp.	Nextel Communications, Inc.: SMR**
MCI Communications Corp.	In-Flight Phone Corp.: airplane phones***
Sprint Corp.	Centel Corp.: cellular
LDDS Communications, Inc.	IDB Communications Group, Inc.: satellite communications****
SBC Communications, Inc.*	Associated Communications Corp.: cellular****
GTE Corp.	Contel Cellular, Inc.: cellular
GTE Corp.	Airfone, Inc.: airplane phones

SMR = Specialized mobile radio
* Formerly Southwestern Bell Corp.
** Proposed but cancelled in August 1994.
*** In June 1994, MCI took a minority stake in In-Flight Phone, with an option to invest for a majority stake after 1994.
**** Transaction pending.

But the regulators began to support AT&T conditionally. In the mid-July 1994, AT&T and the DOJ signed an antitrust consent decree that allowed AT&T to proceed with its acquisition of McCaw. Steven Sunshine, Deputy Assistant Attorney General, said the proposed consent decree "protects consumers against the ability of a combined AT&T-McCaw to use vertical relationships to disadvantage competition."[14] Anne Bingaman, who headed the antitrust division of the DOJ, called the proposed decree "a major step toward bringing the benefits of competition to millions of consumers of cellular telephone service, one of the fastest growing segments of the telecommunications industry."[15]

At the end of August 1994, Judge Greene rejected arguments from RBOCs that the acquisition of McCaw was an attempt by AT&T to recreate the old Bell System.[16] "It is clear that the decree was never intended to prevent AT&T from competing in the cellular marketplace," Judge Greene wrote in a twenty-six-page opinion granting AT&T a waiver of

[14]Mary Lu Carnevale, "AT&T, U.S. Sign Antitrust Pact to Let McCaw Purchase Proceed with Limits," *The Wall Street Journal*, Monday, 18 July 1994, p. A4, Eastern Edition.

[15]Ibid.

[16]Pearl, p. B2.

the decree,[17] thus removing the main legal obstacle to the acquisition and setting the stage for a battle between AT&T and the RBOCs.[18]

In the middle of September 1994, the FCC removed the final regulatory obstacle to AT&T's plan to acquire McCaw, and the two companies closed their transaction,[19] although, as of September 1994, Bell Atlantic and NYNEX were suing to undo that acquisition; their fight was scheduled to go to trial in federal court in Brooklyn, New York, in November 1994.[20]

The DOJ, the FCC, and numerous state regulators concluded that the acquisition would generally benefit consumers. Many cellular phone executives thought AT&T's financial and marketing power would propel cellular phone subscriptions to new heights.[21] According to FCC Chairman Reed Hundt, the FCC's move "will benefit both consumers and the economy."[22] After studying the complex acquisition, FCC officials had concluded that the acquisition helped ensure a competitive marketplace for increasingly popular cellular phone service.[23]

The regulators' position was to approve the acquisition on the condition that it preserve competition in the industry and serve the public interest.

In order to win DOJ clearance, AT&T agreed to keep McCaw as a separate unit and pledged to allow McCaw customers to pick any IXC they want to handle long-distance calls made on their cellular phones.[24] The FCC prohibited AT&T and McCaw from sharing sensitive information about customers who use other cellular phone operators or IXCs. It also prohibited the combined company from unreasonably discriminating against other cellular phone operators that use AT&T's equipment or services.[25] For example, this company was not allowed to impose discriminatory prices.

---

[17]Ibid.

[18]Andrews, "Obstacle Is Cleared," p. D1.

[19]Mary Lu Carnevale, "AT&T Closes McCaw Merger After FCC Nod," *The Wall Street Journal*, Tuesday, 20 Sept. 1994, p. A3, Eastern Edition.

[20]John J. Keller, "AT&T Says McCaw Purchase Will Cut Profit in '94 But Sees Long-Term Gains," *The Wall Street Journal*, Wednesday, 21 Sept. 1994, p. B5, Eastern Edition.

[21]Carnevale, "AT&T Closes," p. A3.

[22]Ibid., p. A8.

[23]Ibid.

[24]Ibid., p. A3.

[25]Ibid., pp. A3, A8.

Several RBOCs said they would still try to block the acquisition. "We will appeal the ruling," said Walter Alford, general counsel for BellSouth Corp. "We're going to be at a competitive disadvantage because they can provide long-distance service over their cellular network and we can't."[26] Bell Atlantic and NYNEX said that the combination could diminish cellular phone competition.[27] Bell Atlantic argued that AT&T's role as a dominant equipment supplier could prove damaging to cellular phone rivals that use its equipment. "AT&T has a stranglehold on McCaw's most important competitors, because AT&T supplies the equipment they need to compete with McCaw," said John Thorne, associate general counsel for Bell Atlantic.[28]

4.1.2 The Cases of RBOCs: Horizontal Mergers

In June 1994, two RBOCs, Bell Atlantic and NYNEX, confirmed plans to merge their cellular phone businesses.[29] Lawrence T. Babbio, Jr., Bell Atlantic Executive Vice President and Chief Operating Officer, said to head the management team for the Bell Atlantic-NYNEX joint venture, told *Telecommunications Reports* that the new company would create a nationwide cellular network and would bid on PCS licenses to fill in where it did not offer cellular phone service.[30]

Also, in July 1994 U S West and AirTouch Communications, Inc., the cellular spinoff of the Pacific Telesis Group, announced that they planned to merge cellular phone operations in order to offer a nationwide service.[31] According to Richard McCormick, chairman and chief executive officer of U S West, the transaction would let U S West and AirTouch extend their geographic reach, combine marketing efforts eventually into a single brand name, and merge corporate functions such as billing.[32] In separate interviews about their transaction, Stephen Boyd, chief of PCS for U S West, and AirTouch Chairman Sam Ginn each cited the need for "scale and scope" to keep wireless operating costs competitively low.[33] "This partnership implements our strategy of expanding our wireless footprint," said Sam Ginn at a

---

[26]Andrews, "Obstacle Is Cleared," p. D11.

[27]Carnevale, "AT&T Closes," p. A8.

[28]Andrews, "Obstacle Is Cleared," p. D11.

[29]Leslie Cauley, "The Other Bells May Be Spurred by NYNEX Pact," *The Wall Street Journal*, Friday, 1 July 1994, p. B1, Eastern Edition.

[30]"Bell Atlantic-NYNEX Plan to Merge Wireless Businesses Seen as Harbinger of More Mobile 'Megadeals,'" *Telecommunications Reports*, **60**, 27, 4 July 1994, p. 9.

[31]Leslie Cauley, "U S West Inc., AirTouch Plan Cellular Venture," *The Wall Street Journal*, Tuesday, 26 July 1994, p. A3, Eastern Edition.

[32]Ibid., pp. A3, A9.

[33]Kupfer, p. 104.

press conference on 25 July 1994, adding that the goal of the combined companies was to create a national wireless operation through PCS and other growth opportunities.[34]

Another RBOC, Ameritech Corp., was seeking a similar alliance.[35]

Table 4-2 presents major mergers of cellular phone businesses between RBOCs.

Table 4-2

Major Mergers of Cellular Phone Businesses of RBOCs (Transactions Pending as of September 1994)

Major Mergers	1993 Combined Revenues
Bell Atlantic and NYNEX	$1.2 billion**
U S West and AirTouch Communications*	$1.3 billion ***

* Airtouch Communications was spun off from the Pacific Telesis Group in April 1994.
** "Bell Atlantic-NYNEX Plan to Merge Wireless Businesses Seen as Harbinger of More Mobile 'Megadeals,'" *Telecommunications Reports*, 60, 27 (4 July 1994), p. 9.
***"AirTouch, U S West Forming 'Management Company' to Address MFJ Issues in Cellular Merger," *Telecommunications Reports*, 60, 31 (1 Aug. 1994), p. 19.

All these RBOCs courtships were driven by the same goals: to line up deep-pocketed partners to compete with the largest cellular phone operator, McCaw, which was being acquired by AT&T, and to amass funds for the looming multibillion-dollar auctions for licenses to offer PCS.[36] "Bigger is better," said Steven Yanis of Kidder, Peabody. "It's a game where scale, scope and cost-efficiencies are critical."[37]

In the middle of September 1994, another major cellular rival, Sprint Corp., was in talks to merge its cellular phone business with those of Bell Atlantic and NYNEX, forming a

---

[34]"AirTouch, U S WEST Forming 'Management Company' to Address MFJ Issues in Cellular Merger," *Telecommunications Reports*, 60, 31, 1 Aug. 1994, pp. 18-19.

[35]Kehoe, "Scramble for Licences," p. vii.

[36]Leslie Cauley, "Ameritech Is Talking with Bell Atlantic And Nynex on Joining Cellular Merger," *The Wall Street Journal*, Wednesday, 3 Aug. 1994, p. A3, Eastern Edition.

[37]Ibid.

powerful alliance to compete with AT&T and McCaw.[38] The RBOCs coveted Sprint's nationally recognized brand name, something none of them had.[39]

By combining forces, companies could embrace major rivals in competition in the cellular phone markets.[40] Players hoped to gain ready access to funds as they compete in the FCC auctions for licenses to offer PCS, especially so-called broadband PCS, which could cost entrants $10 billion or more just for licenses, plus billions more for building new networks.[41]

The back-to-back mergers, however, worried some lesser rivals, concerned that the wireless industry was fast becoming a game of larger companies. "This isn't good for competition," said Wayne Schelle, chairman of APC, the Baltimore wireless company that teamed with The Washington Post Co. to compete in the FCC auctions for PCS licenses. He added, "This puts too many resources and too much power in the hands of the big guys. It's very troubling."[42]

4.1.3 The Case of Nextel

Another challenge to the established cellular phone operators was made by Nextel, an SMR operator with ambitious plans to build a nationwide wireless network combining voice, data, paging, and dispatch radio services.[43] In mid-1987, as said above, Morgan E. O'Brien began to accumulate licenses for SMR, which was traditionally used by truck and taxi fleets, through a series of nationwide acquisitions and license purchases.[44] **Table 4-3** presents Nextel's major acquisitions of other SMR operators.

In the summer of 1994, Nextel announced plans to acquire two SMR operators, OneComm Corp. (July) and Dial Page, Inc. (August), and to purchase Motorola's SMR licenses (August), mostly for stock.[45] According to OneComm President Justin L. Jaschke, OneComm had built the management team and market position needed to become the leading

---

[38]John J. Keller, "Sprint Talks with Bell Atlantic, Nynex about Merger of Cellular Businesses," *The Wall Street Journal*, Wednesday, 14 Sept. 1994, p. A3, Eastern Edition.

[39]Cauley, "Ameritech Is Talking," p. A3.

[40]Ibid.

[41]Ibid.

[42]Cauley, "U S West Inc., AirTouch," p. A3.

[43]Kehoe, "Scramble for Licences," p. vii.

[44]Gautam Naik and Dennis Kneale, "Radio Flier," *The Wall Street Journal*, Wednesday, 31 Aug. 1994, p. A4, Eastern Edition; and Kehoe, "Scramble for Licences," p. vii.

[45]Louise Kehoe, "MCI Drops Plan to Buy 17% Stake in Nextel," *Financial Times*, Tuesday, 30 Aug. 1994, p. 19.

Table 4-3

Major Acquisitions by Nextel of Other SMR Operators as of September 1994

Questar Telecom
Advanced MobileComm
OneComm Corp.*,**
Dial Page**
American Mobile Systems**

* Formerly CenCall Communications.
** Transaction pending.

wireless service provider across twenty-three states, and the combination would let Nextel become the leading wireless service provider across North America.[46] According to Nextel Chairman O'Brien, the completion of the OneComm, Dial Page, and Motorola transactions would make Nextel the only operator authorized to offer integrated wireless voice and data communications services nationwide.[47] O'Brien wanted to rebuild hundreds of local SMR networks to challenge the cellular phone operators in each local market:[48] "Our Nextel system is a replacement for the national telephone infrastructure."[49]

In February 1994, MCI Communications Corp. announced its agreement to pay $1.3 billion for 17 percent of Nextel shares. The second largest IXC in the United States was to become Nextel's marketing partner in its bid to build a nationwide wireless network,[50] but, at the end of August 1994, MCI canceled its plan to invest in Nextel. According to Dennis Leibowitz, who followed wireless communications for Donaldson, Lufkin & Jenrette, MCI and Nextel could still come to an agreement, because MCI had few other ways to build a nationwide wireless network quickly.[51] MCI was said to require a wireless partner to compete with AT&T and McCaw.[52]

---

[46]"Nextel, OneComm Plan Merger Valued at $650 Million," *Telecommunications Reports*, **60**, 29, 18 July 1994, p. 28.

[47]"Nextel to Acquire Dial Page, Motorola's SMR Business," *Telecommunications Reports*, **60**, 32, 8 Aug, 1994, p. 39.

[48]Naik and Kneale, "Radio Flier," p. A1.

[49]Ibid.

[50]Kehoe, "MCI Drops," p. 19.

[51]Andrews, "MCI Cancels Investment," p. D2.

[52]Naik and Kneale, "Radio Flier," p. A4.

Nextel was said really to need MCI. It lacked a national brand name, and its customer base consisted mainly of blue-collar workers.[53] With the help of MCI's brand name, Nextel could appeal to a broader clientele. Nextel badly needed the money that MCI had promised in February 1994. It said it planned to spend more than $3 billion by 1996 rebuilding its conventional SMR systems into an all-digital network. MCI's $1.3 billion offer would be of much help to Nextel in achieving that goal.[54]

Even after MCI cancelled the investment, Nextel Chairman O'Brien said that Nextel would continue to control much of the nationwide radio spectrum regardless of who its strategic partners would be.[55]

4.1.4 Conclusion

As was seen in the case of AT&T and McCaw, the announced policy goal of the regulators was to preserve competition and serve the public interest. In January 1994, Anne Bingaman, Assistant Attorney General for the antitrust division of the DOJ, said the DOJ might allow some mergers that generally would violate federal antitrust guidelines if these foster innovation.[56] According to Bingaman, from the vantage point of economies of scale or scope, mergers may be justified in certain cases if they are obviously needed to encourage innovation or to bring the benefits of significant innovation to market more quickly.[57]

As circumstances changed, the regulators' view of competition sometimes changed. For example, at the beginning of August 1994, the FCC proposed to eliminate its prohibition on wireline carriers providing SMR, reflecting increased competition in the wireless communications industry.[58] That prohibition was originally adopted when the service started in 1974, based on the FCC's view that the entry of wireline carriers could lessen competition in the fledgling SMR market.[59] But in August 1994, when the FCC proposed to eliminate the prohibition, it said that with cellular phone service and PCS and satellite and ground-based

---

[53]John J. Keller, "MCI Calls Off Plan to Buy 17% of Nextel," *The Wall Street Journal*, Tuesday, 30 Aug. 1994, p. A3, Eastern Edition.

[54]Ibid.

[55]"Nextel, MCI Scuttle Investment Plan, Rethink Options," *Telecommunications Reports*, **60**, 36, 5 Sept. 1994, p. 23.

[56]Joe Davidson, "Some Big Mergers May Be Justified in Certain Cases, Antitrust Official Says," *The Wall Street Journal*, Tuesday, 11 Jan. 1994, p. A2, Eastern Edition.

[57]Ibid.

[58]Mary Lu Carnevale, "FCC Proposes Crackdown on '800' Lines As More Companies Charge for Calls," *The Wall Street Journal*, Wednesday, 3 Aug. 1994, p. B8, Eastern Edition.

[59]"FCC Wants to End SMR Wireline Ban, Open Dispatch Service," *Telecommunications Reports*, **60**, 33, 15 Aug. 1994, p. 40.

data services, the twenty-year-old restriction on wireline carriers' eligibility for SMR licenses appeared outmoded.[60]

From the standpoint of end-users, some mergers and acquisitions were considered to bring several benefits. For example, a combination of fixed and non-fixed networks could offer end-users a broader menu of services. In September 1994, AT&T Chairman Robert E. Allen said the combination of AT&T and McCaw "will take wireless technology to places it has never been before...with a range of services that goes beyond anything most of us have ever imagined."[61] AT&T-McCaw executives began to outline new services that would be commercialized within a year of acquisition under the brand name of AT&T.[62]

In case of mergers between RBOCs such as Bell Atlantic and NYNEX, the underlying strength of the cellular merger lies in the two RBOCs' neighboring regions. People often travel among nearby states, presenting great opportunities for interregional calling and cellular "roaming," according to Lawrence Babbio.[63] Mergers between neighboring RBOCs could make "roaming" arrangements simpler.

Mergers and acquisitions, however, may not always benefit end-users. There was some possibility that mergers and acquisitions might lead to a monopoly and raise prices.

Table 4-4 summarizes positions of major U.S. players on issues of competition and concentration.[64]

4.2 In Japan

4.2.1 The Case of Cellular Phone Operators

Nippon Telegraph and Telephone Public Corporation (NTT), which was privatized in April 1985 and renamed Nippon Telegraph and Telephone Corporation (but still NTT), started cellular phone service in 1979 and was the only cellular phone operator for nearly a decade until IDO began cellular phone service in 1988. The following year cellular phone operators owned by the DDI Corp., a long-distance phone company, started service. As of 1994, this group, called the DDI Cellular Group, consisted of eight cellular phone operators.

---

[60]Carnevale, "FCC Proposes," p. B8.

[61]Keller, "AT&T Says," p. B5.

[62]Ibid.

[63]Cauley, "The Other Bells," p. B4.

[64]For details of issues in structure of the cellular industry, see Barth, *Cellular Phones: Is There Really Competition?*

Table 4-4

Positions of Major Players on Mergers and Acquisitions of Non-Fixed Networks in the United States as of September 1994

Regulators (e.g., FCC, DOJ, federal courts, PSCs, PUCs)	
	• Should serve the public interest. • Should benefit economy. • Those that foster innovation may be allowed. • Competition should be preserved.
Network Operators	
Pros	• Reduce costs such as access charges. • Extend geographic reach. In particular, M&A make it easy to develop nationwide non-fixed networks. • Strengthen brand identity. In particular, smaller companies can use nationally recognized brand names of larger companies. • Make it possible to offer a broader menu of services. In particular, M&A make it possible to amass capital for PCS auctions. • Economies of scale and scope work.
Cons	• Lessen competition. • Damage competitors, especially smaller rivals and start-up companies.
End-users	
Pros	• Offer a broader menu of services to end users. • Make "roaming" arrangements simpler for end-users. In particular, seamless nationwide coverage would be positive for end-users.
Cons	• Induce monopoly and raise end-user prices.

DOJ = Department of Justice
FCC = Federal Communications Commission
M&A = Mergers and acquisitions
PCS = Personal communications services
PSCs = Public service commissions
PUCs = Public utility commissions

During the period of NTT's monopoly the cellular phone market grew very slowly, reaching a subscriber level of 240,000 at the same time that other cellular phone operators began to enter the market. Since IDO and the DDI Cellular Group entered the cellular phone

market, prices have dropped, and in consequence the market has begun to grow rapidly.[65] According to the MPT, there were 2,008,700 cellular phone subscribers nationwide as of the end of 1993, only four years after the entrance of the DDI Cellular Group.[66]

In July 1992, following the MPT's direction, NTT established a subsidiary, NTT DoCoMo, as its cellular phone operation unit. In July 1993, NTT DoCoMo was diversified into nine regional companies, called the NTT DoCoMo Group, even though one of the nine companies retained the name NTT DoCoMo.

As of the end of March 1994, two cellular phone services operated in each of nine regions (for example, the Hokkaido or the Tohoku region), and one of these was offered by a company of the NTT DoCoMo Group, the other either by IDO or by a company of the DDI Cellular Group.[67]

Since April 1994, when the MPT began to allow end-users to purchase their own cellular phones, not just rent them from cellular phone operators,[68] other new operators entered an increasingly competitive market. Cellular phone operators repeatedly lowered prices, for example, for handsets, initial subscriber fees, monthly basic fees, and per-minute rates. As a result, as of 1994 the number of subscribers grew more rapidly than it had before (see section **2.2.1**). As of September 1994, four cellular phone operators competed in the Tokyo metropolitan region, the Chubu region, and the Kansai region.

Table 4-5 presents cellular phone operators in three major regions in Japan and their major investors as of September 1994.

As in the United States, most of the major cellular phone operators in Japan were owned by major fixed network operators such as NTT, DDI, Japan Telecom, and Teleway Japan. NTT's consolidated sales for fiscal year (FY) 1993, including sales by subsidiaries such as the NTT DoCoMo Group, rose in large part because of strong sales of the NTT DoCoMo cellular phone series,[69] and NTT's consolidated pretax profit for FY 1993 was nearly 1.3 times as high as its pretax profit, without its subsidiaries.[70] DDI's consolidated pretax profit for FY

---

[65]Toshiaki Sakurai, "Dejitaru Keitai Denwa" [Digital Cellular], *Nikkei Business*, No. 744, 13 June 1994, p. 73.

[66]Kyodo News Service, "Cellular Phone War Looms over Domestic Market," *The Japan Times*, Friday, 18 March 1994, p. 13.

[67]As of the end of March 1994, IDO offered cellular phone service in the Tokyo metropolitan region and the Chubu region, and the DDI Cellular Group offered cellular phone service in other regions.

[68]Before April 1994, end-users could only rent cellular phones from cellular phone operators.

[69]"Group Pretax Profit Fell 47% Despite 2.3% Revenue Gain," *The Wall Street Journal*, Tuesday, 31 May 1994, p. B7, Eastern Edition.

[70]Norri Kageki, "Caution Costs Japan Telecom Market Lead," *The Nikkei Weekly*, Monday, 12 Sept. 1994, p. 8.

1993 was more than double that of the parent company due to billions of yen made by its eight affiliated cellular companies,[71] the so-called DDI Cellular Group.

Table 4-5

Competition Among Cellular Phone Operators in Three Major Regions in Japan as of September 1994

Region	Cellular Phone Operators	Major Investors
Tokyo Metropolitan	NTT Mobile Communications Network, Inc. (NTT DoCoMo)	*NTT*: 95%
	Nippon Idou Tsushin Corp. (IDO)	*Teleway Japan Corp.*: 14%; Toyota Motor Corp.: 13%
	Tokyo Digital Phone Co. Ltd.	*Japan Telecom Co. Ltd.*: 23%
	TU-KA Cellular Tokyo, Inc.	Nissan Motor Co. Ltd.: 26%; *DDI Corp.*: 26%
Chubu	NTT Tokai Mobile Communications Network, Inc.	*NTT DoCoMo*: 85%
	Nippon Idou Tsushin Corp. (IDO)	*Teleway Japan Corp.*: 14%; Toyota Motor Corp.: 13%
	Central Japan Digital Phone Co. Ltd.	*Japan Telecom Co. Ltd.*: 24%
	TU-KA Cellular Tokai, Inc.	Nissan Motor Co. Ltd.: 26%; *DDI Corp.*: 26%
Kansai	NTT Kansai Mobile Communications Network, Inc.	*NTT DoCoMo*: 80%
	Kansai Cellular Telephone Co.	*DDI Corp.*: 64%
	Kansai Digital Phone Co. Ltd.	*Japan Telecom Co. Ltd.*: 22%
	TU-KA Phone Kansai, Inc.	Nissan Motor Co. Ltd.: 34%

Notes: *Italics* indicate fixed network operators or their subsidiaries. Percentages indicate shareholdings as of the end of March 1994.

Source: InfoCom Research, Inc., *Joho Tsushin Hando Bukku '95 Nenban* [Information and Communications in Japan 1995] (Tokyo: InfoCom Research, Inc., 1994), pp. 219–226.

[71]Ibid.

4.2.2 The Case of PHS Operators

As of September 1994, PHS was expected to debut in 1995.[72]

In mid-June 1994, the MPT decided not to allow NTT itself to offer PHS but, if the NTT group offers it, only NTT subsidiaries could do so. The aim of this decision was to promote competition between the NTT Group and other companies in the new PHS market. The MPT concluded that NTT was too powerful and could monopolize this market easily if allowed to enter and that therefore the MPT should prohibit it from entering.[73]

After NTT was privatized in 1985, the MPT directed it to separate not only its cellular phone and paging businesses[74] but also its PHS business. The MPT's aim was to prevent NTT from becoming dominant in the fixed and non-fixed telecommunications industry, even though the company could own subsidiaries that offered cellular phone, paging, and PHS services.

At the end of June 1994, the MPT promulgated the guideline for commercialization of PHS, which included the following points:

- Initially, among frequencies in the 1.9 GHz band, a 12-MHz bandwidth will be allocated to up to three PHS carriers in each regional block (Hokkaido, Tohoku, Kanto, Shinetsu, Tokai, Hokuriku, Kinki, Chugoku, Shikoku, Kyushu, and Okinawa).

- Within five years after each business is launched, each carrier should strive to provide PHS service over an area containing at least 50 percent of the population of the regional block.[75]

The guideline was based on the assumption that promoting competition in the PHS business while at the same time considering effective use of frequencies and securing conditions for fair competition would accelerate popularization of an affordable yet high-quality nationwide PHS service with a good regional balance at the earliest possible time.[76] The MPT concluded that the number of PHS operators in each region should be limited to three or fewer because of the scarcity of spectrum (see section **3.2**). It tried to avoid the possibility of having so many companies enter the PHS market that some would go under.

---

[72]Hanzawa, p. 16.

[73]"Yuseisho NTT Hontai Sannyu Mitomezu," p. 1.

[74]Ibid.

[75]MPT "Guideline for Introducing," p. 2.

[76]Ibid.

Following promulgation of the guideline, between June and September 1994 three groups announced PHS businesses:

• In early July, the DDI Corp., a fixed long-distance phone company, set up DDI Pocket Telephone, Inc., to provide PHS.[77] Instead of letting the DDI Cellular Group run this business, the DDI Corp. set up new subsidiaries to do so. The aim was to let both the cellular and PHS units compete, and thereby develop and improve, in the non-fixed network industry arena.[78]

• In September, ten companies, including Japan Telecom Co., Ltd. (a fixed long-distance phone company), Tokyo Telecommunication Network Co., Inc. (TTNet, a fixed local phone company), Teleway Japan Corp. (a fixed long-distance phone company), and KDD (an international phone company), banded together to form a consortium, Telewalker Tokyo, Inc., to provide PHS in the regional block of Kanto.[79]

• Also in September, NTT announced that in October it and NTT DoCoMo would establish a new group with nine regional branches to compete in the PHS market.[80] According to Masashi Kojima, president of NTT, prior to the announcement NTT had had in-house discussions about whether it should let NTT DoCoMo, a cellular phone subsidiary, run the PHS business. Although NTT DoCoMo was eager to handle it, according to Kojima of NTT, the company decided to separate the PHS and cellular phone businesses so the two could compete in the mobile telecommunications market.[81]

Table 4-6 presents major candidates for PHS operators as of September 1994.

In September 1994, these three groups, mainly fixed network operators, were expected to battle one another in the future.[82] Long-distance phone companies that did not have their own fixed local networks, called the new common carriers (NCCs), such as DDI, Japan Telecom, and Teleway Japan, may use PHS technology to create their own local networks, independent of NTT's fixed local network. This idea was particularly attractive to DDI, NTT's archrival in both the long-distance and cellular phone markets. NTT collected an

---

[77]Norri Kageki, "Handy Phones Poised for Boom Market," *The Nikkei Weekly*, Monday, 4 July 1994, p. 13.

[78]"PHS Unei Gaisha 10 Chiiki ni Wake Setsuritsu" [To Establish a PHS Operating Company in Each of Ten Regions], *Nihon Keizai Shimbun*, Sunday, 26 June 1994, p. 7, American Edition.

[79]"Kani Keitai Denwa Raishu Kanto de Sabisu" [PHS Will Be Offered in the Kanto Region in Autumn Next Year], *Nihon Keizai Shimbun*, Tuesday, 9 Aug. 1994, p. 8, American Edition.

[80]"Raigetsu Medo Junbi Gaisha" [A Plan to Establish New Companies Next Month], *Nihon Keizai Shimbun*, Thursday, 8 Sept. 1994, p. 13, American Edition.

[81]Norri Kageki, "NTT Rounds Out Handy-phone Rivalry," *The Nikkei Weekly*, Monday, 12 Sept. 1994, p. 8.

[82]Ibid.

access charge every time DDI's customers connected to NTT's fixed local network. Because PHS may offer a way of breaking this yoke, DDI was one of the new system's most generous backers.[83]

Table 4-6

Major Candidates for Personal Handy-phone System Operators in Japan as of September 1994

NTT's Subsidiary Group
DDI's Subsidiary Group
A Consortium of *Japan Telecom Co. Ltd.*: 14.5%; Mitsubishi Corp.: 14.5%; Mitsui & Co.: 14.5%; *Tokyo Telecommunication Network Co., Inc. (TTNet)*: 14.5%; East Japan Railway Co.: 8%; Sumitomo Corp.: 8%; *Teleway Japan Corp.*: 8%; Tokyo Electric Power Co.: 8%; Tokyo Telemessage, Inc.: 8%; and *Kokusai Denshin Denwa Co. (KDD)*: 2%.

Notes: *Italics* indicate fixed network operators.
Percentages indicate shareholdings.

Source: "Kani Keitai Denwa Raishu Kanto de Sabisu" [PHS Will Be Offered in the Kanto Region in Autumn Next Year], *Nihon Keizai Shimbun*, Tuesday, 9 Aug. 1994, p. 8, American Edition.

For NTT, which virtually monopolized the fixed local phone market, this was cause for alarm. Kojima of NTT said PHS might take away all of NTT's local phone revenue, almost 30 percent of its total sales in FY 1992.[84] If there were no considerable difference between the price of PHS and that of conventional fixed network services, people might subscribe to PHS, which they could use indoors and out, rather than to fixed phone services. NTT also backed PHS as a way to make up for the shrinking profits from its fixed local network.[85]

The MPT expected competition to occur not only among PHS operators but also between them and fixed local network operators.[86]

---

[83]Gross, p. 50.

[84]Kageki, "Handy Phones," p. 13.

[85]Gross, p. 50.

[86]"Kani Keitai Denwa 4 Sha Jigyoka" [Four Companies Will Offer PHS], *Nihon Keizai Shimbun*, Saturday, 25 June 1994, p. 10, American Edition.

4.2.3 The Case of Marinet Telecommunications Operators

In 1991, there were three Marinet telecommunications operators, but two of them were acquired by major cellular phone operators. The Tokyo Bay Marinet Telecommunications Co. was acquired by IDO in October 1992, and the Kansai Marinet Telecommunications Co., Ltd., by DDI's Kansai Cellular Telephone Co. in August 1994. As of September 1994, only one Marinet telecommunications operator remained, the Setouchi Marinet Telecommunications Co.

Table 4-7 presents the major acquisitions of Marinet telecommunications operators by cellular phone operators.

Table 4-7

Major Acquisitions by Cellular Phone Operators of Marinet Telecommunications Operators as of September 1994

Cellular Phone Operator	Acquisition	Approximate Number of Subscribers of Acquired Company
IDO	Tokyo Bay Marinet Telecommunications Co.	900*
Kansai Cellular Telephone Co.	Kansai Marinet Tele-communications Co. Ltd.	1,500**

* As of the end of June 1991. Source: InfoCom Research, Inc., *Information Communications Almanac '92* (Tokyo: InfoCom Research, Inc., 1991), p. 250.

**As of the end of March 1994. Source: InfoCom Research, Inc., *Joho Tsushin Hando Bukku '95 Nenban* [Information and Communications in Japan 1995] (Tokyo: InfoCom Research, Inc., 1994), p. 229.

4.2.4 The Case of Satellite Communications Operators

At the beginning of 1993, there were three satellite communications operators, Japan Communications Satellite Co., Inc. (JCSAT), Satellite Japan Communications Co. (SAJAC), and SCC. There was not enough demand then for satellite communications service, and in August 1993 one operator, SAJAC, which had not launched its own satellite, merged with JCSAT to form Japan Satellite Systems, Inc. (JSAT).[87]

---

[87]InfoCom Research, Inc., *Information & Communications in Japan 1993-1994* (Tokyo: InfoCom Research, Inc., 1994) p. 8.

Table 4-8 presents a major merger between satellite communications operators.

Table 4-8

Major Merger of Satellite Communications Operators in Japan as of September 1994

Japan Communications Satellite Co., Inc. (JCSAT): ¥24 billion*
merged with
Satellite Japan Communications Co. (SAJAC): ¥5 billion*
to form
Japan Satellite Systems, Inc. (JSAT).

*Capital as of end of March 1993. Source: InfoCom Research, Inc., *Joho Tsushin Hand Bukku '94 Nenban* [Information and Communications in Japan 1994] (Tokyo: InfoCom Research, Inc., 1993), p. 207.

4.2.5 Overview

The MPT exerted such great influence on the telecommunications industry structure that in many cases network operators had to follow its direction. For example, NTT separated its cellular phone and paging businesses and announced that it would separate its PHS business. As of September 1994, the number of PHS operators in each region would be limited to three. The establishment of three PHS groups, NTT's subsidiary group, DDI's subsidiary group, and a consortium set up by companies such as Japan Telecom and TTNet, was influenced by the MPT's guideline.

Basically, the MPT tried to promote competition within the telecommunications industry and to accelerate development of that industry, mainly by preventing NTT from becoming dominant.

As in the case of cellular phone operators and PHS operators, fixed network operators were the first to offer cellular phone service, and as of September 1994, they were expected to offer PHS. Without mergers nor acquisitions, the NTT Group and the DDI Group offered both fixed and non-fixed network services.

The reasons motivating fixed network operators to offer non-fixed network services varied. Long-distance phone companies that lacked their own fixed local networks (NCCs) may use PHS technology to create them, while the NTT Group considered that PHS might be a way to make up for shrinking profits from its fixed local network.

In the cases of Marinet telecommunications operators and satellite communications operators, mergers and acquisitions in 1992–94 were mainly due to unfavorable financial performance of acquired companies or a merged company.

Chapter Five

Standardization: Advantages and Disadvantages of Setting Standards

5.1 In the United States

5.1.1 Background: TDMA or CDMA?

In 1994, non-fixed networks were moving from analog to digital. In comparison to analog technologies, digital offered several advantages, including:

- higher spectrum efficiency;
- better quality of voice transmission and fewer dropped calls;
- extended talk-time and standby-time, implying less dependence for users of portable phones on recharging batteries; and
- greater security of calls, i.e., privacy and protection against eavesdropping.[1]

Analog technologies had a single standard, advanced mobile phone system (AMPS), but, in the case of digital technologies, two different methods were under consideration, time-division multiple-access (TDMA) and code-division multiple-access (CDMA). In theory, TDMA offers three times more capacity than analog, which means a threefold spectrum efficiency.[2] CDMA may offer up to twenty times more capacity than analog, but, as of September 1994, CDMA had not been thoroughly field-tested,[3] although Irwin M. Jacobs, president of CDMA developer Qualcomm, Inc., said that it would be widely available in 1995.[4] TDMA and CDMA are not at all compatible.

In 1988, following a request from the CTIA, the Telecommunications Industry Association (TIA) began work on a North American digital standard.[5] Initially, TDMA was adopted around 1990, but as a result of Qualcomm's development of CDMA, the latter also

---

[1]Gustave Barth, *Cellular Phones: Is There Really Competition?* (Cambridge, Mass.: Program on Information Resources Policy, Harvard University, I-94-3, August 1994), pp. 46-47.

[2]Kelly, p. 72.

[3]Arnst, "Dial 'R' for Revolution," p. 142 E4.

[4]Kelly, p. 72.

[5]Barth, *Cellular Phones: Is There Really Competition?*, p. 47.

was adopted, in 1993. Since then, both methods have been accepted as interim standards IS-54 and IS-95, respectively,[6] although as of September 1994 only TDMA was operational.

In September 1994, as the day drew near when both TDMA and CDMA would reach the market, the telecommunications industry did not know which method or whether either would prevail in the marketplace.[7] The issue of TDMA versus CDMA was one of the major disputed issues in standardization for non-fixed networks.[8]

5.1.2 The Case of Cellular Phone Service

As of September 1994, cellular phone service relied on analog technologies. "Dual mode" cellular phones, which incorporate both analog and digital technologies, are needed if the end-user moves from an area where digital is available to another where it is not.[9] With respect to adoption of digital technologies, cellular phone operators were divided over the two methods discussed above, TDMA and CDMA.[10]

As of that date, TDMA was commercially available in more than twenty-eight cellular phone markets.[11] It was embraced by companies such as McCaw and Southwestern Bell,[12] the nation's two largest cellular phone operators.[13] For example, in June 1994 the BellSouth Cellular Corp. announced it would begin deployment of digital cellular phone service using TDMA in 190 markets in fifteen states in the fourth quarter of 1994,[14] and in September 1994 McCaw had TDMA equipment in place in New York and other cities.[15]

---

[6]Ibid., p. 48.

[7]Julie M. Anthony, "Digital Status Report," *Cellular Business*, **11**, 6, June 1994, p. 44.

[8]For an overall understanding of issues in standardization, see Martin C. Libicki, *Standards: The Rough Road to the Common Byte* (Cambridge, Mass.: Program on Information Resources Policy, Harvard University, P-94-6, October 1994). An expanded version of this report under the title *Information Technology Standards: Quest for the Common Byte* (Stoneham, Mass.: Butterworth-Heinemann) is in press.

[9]Barth, *Cellular Phones: Is There Really Competition?*, p. 49.

[10]Arnst, "Dial 'R' for Revolution," p. 142 E4.

[11]Anthony, p. 44.

[12]In October, 1994, Southwestern Bell Corp. announced plans to do business as SBC Communications, Inc. See "SW Bell Changes Name to SBC Communications, Hopes to Shed Implied Geographic Limitations," *Telco Competition Report*, **3**, 21, 13 Oct. 1994, p. 7; McCaw was acquired by AT&T in September 1994.

[13]Arnst, "Dial 'R' for Revolution," p. 142 E4.

[14]"BellSouth Plans $100 Million TDMA Cellular Upgrade," *Telecommunications Reports*, **60**, 25, 20 June 1994, p. 28.

[15]Kelly, p. 72.

CDMA, although not yet commercially available as of September 1994, also was being considered by several large operators and was said to continue its advance with more testing and trials.[16] For example, in August 1994, a technology group was announced to develop the products and services necessary to bring CDMA to the cellular phone market. This group, called the CDMA Development Group (CDG), set up approximately a dozen technical teams with the support of seventeen companies, including AT&T, Sprint Cellular, AirTouch Communications, Ameritech Cellular Services, NYNEX, U S West Cellular, GTE, Motorola, and Qualcomm. The CDG shared working relationships with the TIA, the Cellular Digital Packet Data (CDPD) Forum, the CTIA, and the PCIA.[17]

5.1.3 The Case of PCS

In the case of PCS, as of September 1994 it was uncertain which method, TDMA[18] or CDMA, would be introduced or if both would be, even though the FCC's broadband PCS auctions were scheduled to begin in December 1994.

Candidates for PCS operators tested both TDMA and CDMA. In December 1993, Time Warner Telecommunications began tests of PCS using CDMA.[19] In July 1994, APC, which had tested CDMA for PCS, said that it would also test TDMA.[20] A few months before the FCC's scheduled auction, Qualcomm said that a group including U S West, Time Warner, Sprint, and Bell Atlantic would support CDMA for PCS, but added that there was no guarantee they would adopt it.[21] Qualcomm bet heavily on the success of CDMA. AT&T and Motorola tested both TDMA and CDMA, hoping to capture the new market no matter which becomes the standard. Some large telecommunications equipment manufacturers, including non-U.S. companies such as Telefonaktiebolaget (Telefon AB) L.M. Ericsson of Sweden and Northern Telecom Ltd. of Canada, supported TDMA.[22]

---

[16]Anthony, p. 44.

[17]"CDMA Development Group Focuses on Standards," *Telecommunications Reports*, **60**, 33, 15 Aug. 1994, p. 21.

[18]More precisely, technologies based on TDMA, including IS-54 (U.S. TDMA) and the Global System for Mobile Communications (GSM, the pan-European technology). Some people said that GSM was a more logical candidate standard for PCS than IS-54; see Charles F. Mason, "Will Regulatory Hurdles Trip Up PCS?" *Telephony*, **226**, 19, 9 May 1994, p. 33.

[19]"Time Warner Tests Cable/PCS Integration," *Telecommunications Reports*, **60**, 23, 6 June 1994, p. 8.

[20]"American Personal Communications Said Last Week That It Has Expanded the Range," *Telecommunications Reports*, **60**, 29, 18 July 1994, p. 28.

[21]Susan Pulliam, "Qualcomm's Digital Technology Wins Praise, But Marketing Delays Are Raising Questions," *The Wall Street Journal*, Tuesday, 11 Oct. 1994, p. C2, Eastern Edition.

[22]Huang, *Up in the Air*, pp. 82-83.

As of September 1994, the FCC had not yet acted to establish clear compatibility standards among PCS operators or manufacturers.[23] In its comment on the PCS rules proposed by the FCC in September 1993, Motorola requested the Commission to take a more active leadership role in PCS standards.[24] Even the Department of Defense provided comments to the FCC on its concerns about the absence of compatibility standards in the PCS rules of September 1993.[25] The FCC appeared firm in its position to limit its role in establishing PCS standards. The FCC provided very limited guidelines for the development of standards for PCS operations, leaving the responsibility for their development to the PCS industry.[26] Even in the text of the general docket 90-314 memorandum opinion and order released in June 1994, the FCC only approved of "compatible interoperability standards for all PCS spectrum blocks," but declined to mandate that the PCS industry should arrive at a single standard.[27]

5.1.4 The Case of Satellite Communications Service

MSS projects were supposed to introduce both TDMA and CDMA, as of September 1994. Among so-called Big LEO MSS projects, Motorola's Iridium was planning to use TDMA, while Loral/Qualcomm Partnership L.P.'s Globalstar, TRW's Odyssey, Mobile Communications Holdings's Ellipso,[28] and Constellation Communications's Aries were planning to use CDMA.[29]

The FCC appeared to approve of both TDMA and CDMA. In October 1994, it said that license winners of Big LEO MSS would be permitted to use their choice of either TDMA or CDMA architectures.[30]

---

[23]Thomas G. Adcock, "PCS Q&A," *Cellular Business*, **11**, 5, May 1994, p. 74.

[24]"Broadband PCS Order Attacked from All Sides as Industry Floods FCC with 'Recon' Requests," *Telecommunications Reports*, **59**, 50, 13 Dec. 1993, p. 18.

[25]Adcock, p. 74.

[26]Ibid.

[27]"FCC Moves Quickly to Issue Text Detailing Rationale for PCS Reconsideration Decisions," *Telecommunications Reports*, **60**, 25, 20 June 1994, pp. 26-27.

[28]Mobile Communications Holdings, Inc., was formerly Ellipsat Corp.

[29]Anthony, p. 50.

[30]"FCC Outlines Two-Tier 'Big LEO' Eligibility Rule That Hinges on When Financial Showing Is Made," *Telecommunications Reports*, **60**, 43, 24 Oct. 1994, p. 29.

5.1.5 Overview

As of September 1994, no one knew exactly what would happen once TDMA and CDMA were both on the market, competing for subscribers. No one knew how individual operators would handle competition between the methods, nor how big an issue compatibility would be. No one knew which or whether either would prevail in the long run.[31]

Non-fixed network operators faced the risks of selecting the "right" method to use and of market acceptance of an untested method. Problems in the premature introduction of either method could easily drive end-users away. Deployment of digital technology presented unknown financial risks to these operators, because a substantial investment was required. For example, cellular phone operators had to add digital transmission equipment to many existing cell-site base stations, regardless of the method selected.[32]

Manufacturers of subscriber equipment and infrastructure manufacturers both faced risks similar to those of network operators. As of September 1994, some manufacturers were still deciding which technology to back up with what products and how many.[33]

To a certain extent, the absence of standards for digital technology delayed development of digital non-fixed networks. In 1993, for example, PacTel Cellular (which was to spin off from the Pacific Telesis Group in April 1994 and then be renamed AirTouch Communications) announced it had decided to wait to deploy digital cellular technology until 1995, when CDMA would be available.[34] Digitization in the United States was still slow in 1993. As of the end of that year, less than 1 percent of cellular phone subscribers were served by digital technology.[35]

At the end of June 1994, when Bell Atlantic and NYNEX announced their agreement to combine their wireless businesses, both companies said that they were starting trials of TDMA and CDMA technologies. Bell Atlantic's Lawrence T. Babbio, Jr. stressed "that the digitization scheme selected is less important than adopting a common standard within the new company's national system, getting it deployed quickly, and driving manufacturers to develop affordable products for it."[36]

---

[31]Anthony, p. 50.

[32]Cliff Bean and Stephen R. Low, "Establishing Rural Cellular Company Values," *Cellular Business*, **11**, 10, October 1994, p. 54.

[33]Anthony, p. 50.

[34]"PacTel Backs CDMA," *TR Wireless News*, **3**, 23, 18 Nov. 1993, p. 12.

[35]Barth, *Cellular Phones: Is There Really Competition?*, p. 51.

[36]"Bell Atlantic–Nynex Plan," p. 12.

Early standardization, however, could limit improvement of new technologies. Had the FCC approved only TDMA as a single standard too early, CDMA might not have continued to be tested. Anticipatory setting of standards is risky, because technologies that become standards without being tested thoroughly in working products accepted by the market may prove unsuccessful.[37]

As far as end-users were concerned, this issue might not be serious, because handset manufacturers are expected to come out with not only "dual mode" phones (AMPS/TDMA or AMPS/CDMA) but also "triple mode" phones (AMPS/TDMA/CDMA).[38]

But one important factor affecting end-users' decision of whether to use non-fixed network services is price.[39] Standardization offers a greater chance of achieving volume sales and lower prices due to economies of scale.[40] Without standardization of digital technologies, end-users may miss the chance to use non-fixed network services at lower prices, although standardization may sometimes limit end-users' choice between services using multiple technologies.

Table 5-1 summarizes the advantages and disadvantages of standardization for non-fixed networks.

5.2 In Japan

5.2.1 Background: Standardization for Non-Fixed Networks

The MPT played a leading role in establishing standards for telecommunications, as the Research and Development Center for Radio Systems (RCR), a private institution founded in February 1985 by network operators, manufacturers, and other organizations concerned with use of the spectrum, did in standardization for non-fixed networks. The MPT established compulsory standards, while the RCR established private standards for wireless communications and promoted the spread of standardized technologies. The purpose of founding the RCR included efficient use of spectrum.[41]

---

[37]Libicki, p. 43.

[38]Barth, *Cellular Phones: Is There Really Competition?*, p. 49.

[39]Anthony, p. 50.

[40]Claire Gooding, "Mobile Communications," *Financial Times*, Friday, 14 Oct. 1994, p. 14.

[41]InfoCom Research, Inc., *Information Communications Almanac '94*, p. 776.

Table 5-1

Advantages and Disadvantages of Standardization for Non-Fixed Networks in the United States as of September 1994

Advantages	Disadvantages
• Standardization promotes deployment of technologies adopted as standards and, as a result, may promote development of non-fixed networks. • Helps network operators select methods (e.g., TDMA, CDMA). • Helps manufacturers select technologies for product development. • Makes volume sales and lower prices easier to achieve.	• Early standardization limits improvement of other new technologies not adopted as standards. • Technologies adopted as standards without thorough testing may prove unsuccessful.

5.2.2 The Case of Cellular Phone Service

In 1994, Japanese non-fixed networks were moving from analog to digital, as in the United States, but in the standardization of technologies, Japanese non-fixed networks differed from those in the U.S. Analog cellular phone operators in Japan adopted two different and incompatible methods, the NTT system and the Total Access Communications System (TACS).[42] The NTT system was developed by NTT's cellular phone operation section, as of 1994 the NTT DoCoMo Group, while TACS was developed by Motorola and based on the U.S. analog system, AMPS.[43] There was little difference between them in spectrum efficiency and quality of phone calls, but they used different transmission methods. In October 1993, the RCR accepted both as standards, RCR-STD-35 and RCR-STD-36, respectively.[44] In September 1994, the NTT DoCoMo Group offered analog cellular phone service using the NTT system, the DDI Cellular Group offered it using TACS, and IDO's analog cellular phone service used both.[45]

---

[42]Kazuo Enomoto, "Communication Q&A," *Nikkei Communications*, 176, 20 June 1994, pp. 80-81; and Sakurai, pp. 73-74.

[43]Ibid.

[44]Ibid.

[45]Ibid.

In the case of Japanese digital cellular phone service, the personal digital cellular system (PDC) was adopted as a single standard. Based on TDMA, PDC was developed mainly by the MPT and accepted by the RCR as RCR-STD-27.[46]

In March 1993, NTT DoCoMo, which as of the following July became the NTT DoCoMo Group, began to offer digital cellular phone service, and IDO, the DDI Cellular Group, the TU-KA Group affiliated with Nissan Motor Co. Ltd., and the Digital Phone Group affiliated with Japan Telecom Co. Ltd. all began it in 1994, all using PDC.[47]

PDC operated in two frequency bands, 800 MHz and 1.5 GHz. But because service in those frequencies used a common transmission method, the services were compatible.[48]

5.2.3 The Case of PHS

In the case of digital technology for PHS, a single standard, RCR-STD-28, based on TDMA, was established by the RCR in December 1993,[49] more than a year before PHS was commercialized.[50] In August 1994, Hong Kong announced it would adopt the Japanese PHS as its standard for wireless voice communications.[51] The introduction of PHS in Hong Kong would open up a new market for Japanese manufacturers, in addition to allowing Japanese travelers to use their PHS phones in Hong Kong, and increased use of PHS would help bring down the manufacturing costs of handsets and other system hardware.[52]

The MPT and an industry group comprising twenty-eight Japanese and non-Japanese companies (including NTT, KDD, NEC, and the Japanese subsidiaries of the U.S. company Motorola and the Swedish company Telefon AB L.M. Ericsson[53]) encouraged Hong Kong to adopt PHS. In August 1994, following the announcement of Hong Kong's decision, the MPT decided to set up a special task force to promote PHS as a pan-Asian standard and to establish other pan-Asian standards for wireless communications. It expected that standardization of

---

[46]Ibid.; and "Digital Format Reigns in Cellular Phone Market," *The Nikkei Weekly*, Monday, 4 July 1994, p. 14.

[47]Ibid.

[48]Ibid.

[49]Hideki Niimi, "PASSAGE ga Bijinesu Shiin wo Kaeru" [PASSAGE Will Change Business Scene], *Business Communication*, **31**, 9, September 1994, p. 62.

[50]As of September 1994, PHS was expected to be commercialized in 1995. See Futaki Hanzawa, "Cellular Services Go for Leisure Market," *The Nikkei Weekly*, Monday, 19 Sept. 1994, p. 16.

[51]"Hong Kong Adopts Japan's Phone Standard," *The Nikkei Weekly*, Monday, 15 Aug. 1994, p. 18.

[52]Ibid.

[53]Ibid.

technologies would extend a market for manufacturers using a standardized technology and bring down the prices of handsets.[54]

5.2.4 Overview

The MPT promoted standardization for non-fixed networks, and other players, such as network operators and manufacturers, seemed basically to support its position. The expected benefits of standardization include:

- extension of a market for manufacturers using a standardized technology, and, as a result,
- lower prices for handsets and other equipment.

[54]"Ajia Shokoku to Kyotsu Kiban Dukuri" [Establishment of Pan-Asian Standards], *Nihon Keizai Shimbun*, Wednesday, 10 Aug. 1994, p. 5, American Edition.

Chapter Six

Summary

This paper, describing the three background issues—spectrum scarcity and licensing, industry structure, and the advantages and disadvantages of standardization—that need to be considered before the question of whether non-fixed networks are alternatives or complements to fixed networks can be addressed, yields several findings:

(*i*) Since around 1990 non-fixed networks have increasingly become widely available in both the United States and Japan. In 1994, owing to improvements in technologies, new non-fixed network services began to emerge.

(*ii*) In the United States and Japan radio spectrum is considered scarce, and both countries are considering methods of spectrum management and allocation, such as licensing by auction and relocation of incumbent users.

(*iii*) In the United States, from the point of view of regulators, spectrum auctions and the collection of user fees could not only cover spectrum management costs but also generate other useful revenue. From the point of view of new non-fixed network operators, spectrum auctions could delay the commercial launch of their services and make it difficult to undercut their prices for years. From the point of view of end-users, auctions could make new non-fixed network services more expensive and, consequently, less attractive than conventional fixed network services.

(*iv*) In Japan, scarcity of radio spectrum may delay the commercial start and the spread of new non-fixed network services, although as of 1994 operators of these networks have not had to pay high fees either at auctions or for relocation of incumbent users.

(*v*) In the United States, between the late 1980s and the mid-1990s, the issue of industry structure arose when operators of large fixed networks tried to merge with or acquire non-fixed network operators, while non-fixed network operators tried to merge with or acquire other non-fixed network operators.

(*vi*) In the United States, the announced policy goal of the regulators was to preserve competition and serve the public interest. They might allow mergers that foster innovation. From the standpoint of network operators, mergers and acquisitions offer advantages, such as reducing costs, extending geographic reach, strengthening brand identity, and making offering a broader menu of services possible, but they also offer disadvantages, such as diminishing competition and damaging competitors. From the standpoint of end-users, mergers and

acquisitions offer benefits, such as a broader menu of services and simpler "roaming" arrangements, although they might also lead to a monopoly and raised prices.

(*vii*) In Japan, the MPT tried to promote competition within the telecommunications industry and to accelerate development of that industry, mainly by preventing NTT from becoming dominant.

(*viii*) In Japan, the reasons motivating fixed network operators to offer non-fixed network services varied.

(*ix*) In the United States, in September 1994, the telecommunications industry did not know which method, TDMA or CDMA, or whether either would prevail in the marketplace. Non-fixed network operators and manufacturers faced the risks of selecting the "right" method and of market acceptance of an untested method. On one hand, to a certain extent the absence of standards for digital technology delayed development of digital non-fixed networks. On the other, early standardization could limit improvements in new technologies.

(*x*) Without standardization of digital technologies, end-users in the United States may miss the opportunity to use non-fixed network services at lower prices, although standardization may limit their choice between services using multiple technologies.

(*xi*) In Japan, the MPT promoted standardization for non-fixed networks, and other players—such as network operators and manufacturers—seemed basically to support its position. The expected benefits of standardization include extension of a market for manufacturers using a standardized technology and, as a result, lower prices for handsets and other equipment.

This paper cannot say when, if, or how non-fixed networks will become alternatives to fixed networks. As of September 1994, in both the United States and Japan the players were trying to improve both non-fixed and fixed networks. Developing technologies were making both services available. How, if at all, the issues discussed here will be considered and what shape the relationship between non-fixed and fixed networks will take remains to be seen.

Appendix

Table A

Non-Fixed Networks: Major Players as of September 1994

International Organizations
International Telecommunication Union (ITU) • Telecommunication Standardization Sector (ITU-T) • Radiocommunication Sector (ITU-R) International Organization for Standardization (ISO) World Trade Organization (WTO)* International Maritime Satellite Organization (Inmarsat) International Telecommunications Satellite Organization (Intelsat)
Government
United States Federal Communications Commission (FCC) Congress Treasury Department of Justice (DOJ) Federal courts Department of Commerce (DOC) • National Institute of Standards and Technology (NIST) • National Telecommunications and Information Administration (NTIA) Department of Defense (DOD) Department of Energy (DOE) Department of State (DOS) Federal Aviation Administration (FAA) Federal Bureau of Investigation (FBI) General Services Administration (GSA) National Aeronautics and Space Administration (NASA) State Public Service Commissions (PSCs), State Public Utility Commissions (PUCs) **Japan** Ministry of Posts and Telecommunications (MPT) Ministry of International Trade and Industry (MITI) Ministry of Finance Science and Technology Agency • National Space Development Agency of Japan (NASDA) Fair Trade Commission (FTC) Defense Agency

*as of January 1995

Non-Fixed Network Operators and Candidates

United States

Cellular Phone Operators

RBOCs

Ameritech Corp.
Bell Atlantic Corp.
BellSouth Corp.
NYNEX Corp.
SBC Communications, Inc.: formerly Southwestern Bell Corp.
U S West, Inc.

AirTouch Communications, Inc.: spun off from Pacific Telesis Group in April 1994
McCaw Cellular Communications, Inc.: acquired by AT&T Corp. in September 1994
GTE Corp.
Sprint Corp.
Small companies, e.g., Alltel Corp.

Broadband PCS Operator Candidates

Pioneer's preference winners

American Personal Communications (APC)
Cox Enterprises, Inc.
Omnipoint Communications, Inc.

RBOCs

Ameritech Corp.
Bell Atlantic Corp.
BellSouth Corp.
NYNEX Corp.
Pacific Telesis Group
SBC Communications, Inc.: formerly Southwestern Bell Corp.
U S West, Inc.

AirTouch Communications, Inc.: spun off from Pacific Telesis Group in April 1994
GTE Corp.
AT&T
Sprint Corp.
Cable television operators

Tele-Communications, Inc.
Comcast Corp.
Cox Enterprises, Inc.

SMR Operators

Nextel Communications, Inc.
Motorola, Inc.
Questar Telecom, Inc.
Advanced MobileComm, Inc.
OneComm Corp.: formerly CenCall Communications, Inc.
Dial Page, Inc.
American Mobile Systems, Inc.
Geotek Communications, Inc.

Satellite Communications Operators and Candidates

MSS operator candidates

Big LEO applicants

- Motorola, Inc.
- Globalstar L.P. (Loral/Qualcomm Partnership L.P.)
- Mobile Communications Holdings, Inc. (MCHI): formerly Ellipsat Corp.
- Constellation Communications, Inc.
- TRW, Inc.
- American Mobile Satellite Corp. (AMSC)

Little LEO applicants

- Starsys Global Positioning, Inc.
- Orbital Communications Corp. (Orbcomm)
- Leo One USA Corp.
- Volunteers in Technical Assistance, Inc. (VITA)

FSS operator candidate

Teledesic Corp.

Comsat Corp.

IDB Communications Group, Inc.

Airplane Phone Operators

Claircom Communications Group L.P.

GTE Airfone, Inc.

In-Flight Phone Corp.

Paging Operators and Narrowband PCS Operator Candidates

Pioneer's preference winner of narrowband PCS

Mobile Telecommunication Technologies Corp. (Mtel)

Paging Network, Inc. (PageNet)

U.S. Paging Corp.

Metrocall, Inc.

USA Mobile Communications Holdings, Inc.

Premiere Page, Inc.

Arch Communications Group, Inc.

McCaw Cellular Communications, Inc.: acquired by AT&T Corp. in September 1994

Airtouch Paging: a unit of Airtouch Communications, Inc.

BellSouth Corp.

Pagemart, Inc.

Japan

Cellular Phone Operators

NTT DoCoMo Group

NTT Mobile Communications Network, Inc. (NTT DoCoMo)

NTT Hokkaido Mobile Communications Network, Inc.

NTT Tohoku Mobile Communications Network, Inc.

NTT Tokai Mobile Communications Network, Inc.

NTT Hokuriku Mobile Communications Network, Inc.

NTT Kansai Mobile Communications Network, Inc.

NTT Chugoku Mobile Communications Network, Inc.

NTT Shikoku Mobile Communications Network, Inc.
NTT Kyushu Mobile Communications Network, Inc.
Nippon Idou Tsushin Corp. (IDO)
DDI Cellular Group
Kansai Cellular Telephone Co.
Chugoku Cellular Telephone Co.
Kyushu Cellular Telephone Co.
Tohoku Cellular Telephone Co.
Hokkaido Cellular Telephone Co.
Hokuriku Cellular Telephone Co.
Shikoku Cellular Telephone Co.
Okinawa Cellular Telephone Co.
TU-KA Group affiliated with Nissan Motor Co. Ltd.
TU-KA Cellular Tokyo, Inc.
TU-KA Cellular Tokai, Inc.
TU-KA Phone Kansai, Inc.
Digital Phone Group affiliated with Japan Telecom Co. Ltd.
Tokyo Digital Phone Co. Ltd.
Central Japan Digital Phone Co. Ltd.
Kansai Digital Phone Co. Ltd.

PHS Operator Candidates

NTT's subsidiary group
DDI Corp.'s subsidiary group
Consortia of companies such as:
Japan Telecom Co. Ltd.
Mitsubishi Corp.
Mitsui & Co.
Tokyo Telecommunication Network Co., Inc. (TTNet)
East Japan Railway Co.
Sumitomo Corp.
Teleway Japan Corp.
Tokyo Electric Power Co.
Tokyo Telemessage, Inc.
Kokusai Denshin Denwa Co. (KDD)

Marinet Telecommunications Operators

Tokyo Bay Marinet Telecommunications Co.: acquired by IDO in October 1992
Kansai Marinet Telecommunications Co. Ltd.: acquired by Kansai Cellular Telephone Co. in August 1994
Setouchi Marinet Telecommunications Co.

Satellite Communications Operators

Japan Satellite Systems, Inc. (JSAT): formerly Japan Communications Satellite Co., Inc. (JCSAT) and Satellite Japan Communications Co. (SAJAC)
Space Communications Corp. (SCC)

Paging Operators
NTT DoCoMo Group
Tokyo Telemessage, Inc.

Manufacturers

United States
Motorola, Inc.
AT&T Corp.
Qualcomm, Inc.

Canada
Northern Telecom Ltd.

Japan
Matsushita Communication Industrial Co.
NEC Corp.
Kyocera Corp.
Fujitsu Ltd.
Toshiba Corp.
Mitsubishi Electric Corp.
Sony Corp.
Kenwood Corp.
Sanyo Electric Co.
Hitachi Ltd.
Pioneer Electronic Corp.
Sharp Corp.

Finland
Oy Nokia

Sweden
Telefonaktiebolaget (Telefon AB) L.M. Ericsson

Fixed Network Operators

United States
IXCs
AT&T Corp.
MCI Communications Corp.
Sprint Corp.
LDDS Communications, Inc.

LECs
RBOCs
Ameritech Corp.
Bell Atlantic Corp.
BellSouth Corp.
NYNEX Corp.

Pacific Telesis Group
SBC Communications, Inc.: formerly Southwestern Bell Corp.
U S West, Inc.
GTE Corp.
Smaller Independent Companies

CAPs
MFS Communications Corp.
Teleport Communications Group

Japan

Domestic Telecommunications Network Operators
NTT
DDI Corp.
Japan Telecom Co. Ltd.
Teleway Japan Corp.
Tokyo Telecommunication Network Co., Inc. (TTNet)

International Telecommunications Network Operators
Kokusai Denshin Denwa Co. (KDD)
International Digital Communications, Inc. (IDC)
International Telecom Japan, Inc. (ITJ)

Other Organizations

United States
Telecommunications Industry Association (TIA)
Cellular Digital Packet Data (CDPD) Forum
Cellular Telecommunications Industry Association (CTIA)
Personal Communications Industry Association (PCIA)
American National Standards Institute (ANSI)
Radiocommunications Technical Advisory Committee for aeronautical avionics (RTCA)

Japan
Research and Development Center for Radio Systems (RCR)

Other Spectrum Users

Broadcasting companies
Transportation companies
Utility companies
Public safety administrations

End-users

Acronyms

AMPS	advanced mobile phone system
AMSC	American Mobile Satellite Corporation
ANSI	American National Standards Institute
APC	American Personal Communications
CAP	competitive access provider
CDG	CDMA Development Group
CDMA	code-division multiple-access
CDPD	Cellular Digital Packet Data
CTIA	Cellular Telecommunications Industry Association
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOJ	Department of Justice
DOS	Department of State
ESMR	Enhanced (digital) SMR
EU	European Union
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FSS	fixed satellite service
FTC	Fair Trade Commission (Japan)
FY	fiscal year
GEO	geostationary orbit
GHz	gigahertz
GSA	General Services Administration
IDC	International Digital Communications, Inc.
IDO	Nippon Idou Tsushin Corp.
Inmarsat	International Maritime Satellite Organization
Intelsat	International Telecommunications Satellite Organization
ITU	International Telecommunication Union
ITU-R	ITU Radiocommunication Sector
IXC	interexchange carrier
JCSAT	Japan Communications Satellite Co., Inc.
JSAT	Japan Satellite Systems, Inc.
KDD	Kokusai Denshin Denwa Co.
kHz	kilohertz
LEC	local exchange carrier
LEO	low-earth orbit

M&A	mergers and acquisitions
MCHI	Mobile Communications Holdings, Inc.
MEO	medium-earth orbit
MHz	megahertz
MITI	Ministry of International Trade and Industry
MPT	Ministry of Posts and Telecommunications
MSS	mobile satellite service
Mtel	Mobile Telecommunication Technologies Corp.
NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NCC	new common carrier
NIST	National Institute of Standards and Technology
NTIA	National Telecommunications and Information Administration
NTT	Nippon Telegraph and Telephone Corporation Nippon Telegraph and Telephone Public Corporation
NTT DoCoMo	NTT Mobile Communications Network, Inc.
Orbcomm	Orbital Communications Corp.
PageNet	Paging Network, Inc.
PCIA	Personal Communications Industry Association
PCS	personal communications service
PDC	personal digital cellular system
PHS	personal handy-phone system
PSC	public service commission
PUC	public utility commission
RBOC	Regional Bell Operating Company
RCR	Research and Development Center for Radio Systems
RTCA	Radiocommunications Technical Advisory Committee (for aeronautical avionics)
SAJAC	Satellite Japan Communications Co.
SCC	Space Communications Corp.
SMR	Specialized Mobile Radio
TACS	Total Access Communications System
TDMA	time-division multiple-access
Telefon AB L.M. Ericsson	Telefonaktiebolaget L.M. Ericsson
TIA	Telecommunications Industry Association
TTNet	Tokyo Telecommunication Network Co., Inc.
VITA	Volunteers in Technical Assistance, Inc.
WARC '92	1992 World Administrative Radio Conference
WTO	World Trade Organization

PPSAT0

ISBN 1-879716-33-X