International Telecommunications in Transition

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THE TERM *international telecommunications* encompasses a complex matrix of countries and issues. It is possible to view international telecommunications as merely a hodgepodge of national systems, each reflecting its society's history and economics, and each happily self-contained except for collaborations on technical issues. It is equally possible to see national developments as variations on a single global theme, inexorably driven by an underlying technology that is destiny, such as the convergence of telecommunications and computers. Or one can argue, as this article does, that a common development is changing all the institutions of international telecommunications today: the rent-seeking coalition that provided links of shared economic interests across frontiers is steadily breaking down. In this light the turmoil of telecommunications should be understood as nothing more than a normalization—one of the most tightly controlled sectors is becoming more like the rest of the economy, not necessarily deregulated but more "normal."

For a long time the traditional arrangement was remarkably stable, successful, and undisputed. For a number of years, however, it has been subject to forces of disintegration. While it was at first possible to dismiss changes as policy initiatives of a conservative American regime, later events in Britain, Japan, the Netherlands, Denmark, and other countries suggest that broader forces are at work. And now as third world countries such as Pakistan and Malaysia, and even a mainstay of the traditional system such as Germany, are seriously contemplating change, a trend can be discerned. I have discussed the causes of this change and its regulatory implications elsewhere.[1] The purpose of this paper is to provide a factual analysis of the international scene, survey the battles, link them to the

1. Eli M. Noam, "The Public Telecommunications Network: A Concept in Transition," *Journal of Communication*, vol. 37 (Winter 1987), pp. 30–48.

broad forces of change, and observe the defense strategies of the traditional institutions.

Origins of the Traditional Network

For almost a century the key institutional feature of traditional telephony around the world has been a ubiquitous network operated by a monopolist. The operating entity was usually a government administration known generically as a PTT (post, telegraph, and telephone administration). The United States split these three functions among three near-monopolists: American Telephone and Telegraph, Western Union, and the U.S. Postal Service.

Public telecommunications were not merely a technical system, but social, political, and economic institutions. One must go back to their origins, to the emergence of European postal monopolies in the sixteenth century. Much later the monopoly system was rationalized as based on technical economies of scale, strategic necessity, cross subsidies, or public infrastructure needs, but the early creators of the postal monopoly were quite forthright in their primary mission—to make profits for the state and its sovereign.[2] The postal system was a major source of revenue, just at a time when absolutist European rulers had insatiable needs for money. This goose with its golden eggs was ardently protected through the centuries against encroachment by private competitors and by other states.[3] When the telegraph and later the telephone emerged in the nineteenth century, they were rapidly integrated into the postal monopoly system and guarded by the same protective policies. Together they became the PTTs.

The PTTs were supported by a broad political coalition, a "postal-industrial complex." It included the PTT itself and the equipment industry as its supplier, together with residential and rural users, trade unions, the political left, the newspaper industry (whose postal and telegraph rates were heavily subsidized), and affiliated experts. The system worked in no small measure to the benefit of the equipment industry. The PTTs through their huge procurements, especially after World War II, provided large markets for the industry. Even better, buy-domestic policies substantially protected these markets from foreign competition and production. Within most advanced countries, domestic equipment manufacturers

2. Heinrich von Stephan, *Geschichte der Preussischen Post von ihrem Ursprunge bis auf die Gegenwart* (Glashütten im Taunus: Verlag Detlev Auvermann, KG, 1976; originally printed in Berlin: Unveränderter Nachdruck der Ausgabe, 1859).

3. Martin Dallmeier, *Quellen zur Geschichte des Europaischen Postwesens, 1501–1806*, pt. 1 (Verlag Michael Lassleben Kallmunz, 1977).

often collaborated with each other in formal or informal cartels that set prices and allocated shares of the large PTT contracts.

Political Télématique: The New Ideology of the Postal-Industrial Complex

For a long time the mission of the postal-industrial complex in developed countries centered on achieving universal penetration of basic telephone service. With this goal largely reached in effective collaboration of PTTs and industry, a new organizational ideology needed to be articulated, both to instill a sense of purpose internally and to legitimize the continuation of the institutional regime externally. An expression of the new direction was the influential 1978 Nora-Minc report commissioned by the French government.[4] This report broadened the range of telecommunications issues to encompass vital questions of national technological capabilities and sovereignty. It concerned itself at length with France's lack of control over the industry of the future, electronics. IBM, the electronics paragon, was viewed as a threat to French sovereignty by its control over technology. "As a controller of networks, the company would take on a dimension extending beyond the strictly industrial sphere; it would participate, whether it wanted to or not, in the government of the planet. In effect, it has everything it needs to become one of the great world regulatory systems."[5]

How does a government deal with "one of the great actors on the world stage"? The growing interaction between computer technology and telecommunications, what the authors termed *télématique*, provided the answer. Governmental influence over the computer industry was limited, but the industry's overlap with telecommunications—over which the state traditionally had tight control—provided the government with a lever of power. Governments need to "strengthen their bargaining position with a solid mastery of their communications media." Importantly, this needs to be coordinated with other governments because "the difficulty lies even more in the fact that no country can play that role alone."[6] This political analysis, which may be described as *political télématique*, became extraordinarily influential. PTTs embraced its notions, which assigned to them a central role in high-technology policy and in the preservation of

4. Simon Nora and Alain Minc, *The Computerization of Society: Report to the President of France* (MIT Press, 1980).
5. Ibid., p. 72.
6. Ibid.

the national interest against America (and later Japan). The equipment industry was similarly supportive, since political télématique notions created a presumption in favor of government subsidies and technological protectionism as a matter of national sovereignty.

Political télématique's defense of the telecommunications monopoly was carried forward in a series of lengthy articles assessing U.S. deregulation. Published in the influential French daily newspaper *Le Monde,* these articles described the United States as engaged in two wars: a military war against the Soviet Union and an industrial war against Japan. The advanced technologies of computers and communications were viewed as vital factors in both battles.[7]

To win this international war the United States deregulated and divested AT&T. At first glance this move may be surprising. "Why smash this power [AT&T] in the middle of a war against Japan?" The answer, said *Le Monde,* is that "deregulation of communication in the U.S. has as its main goal to give American industry a good 'kick in the pants' in order to get it to start a conquest of the rest of the world."

Given such energizing effects of deregulation, one would expect the United States to prefer to be the sole custodian and beneficiary of such a deregulated system. Nonetheless, *Le Monde* viewed the United States as proselytizing the rest of the world; opening the American equipment market to foreign imports was really part of a U.S. export offensive. International liberalization would give the United States several advantages. It would reduce the communications costs of its internationally active firms and pry open the European equipment market. Once "liberated," European telecommunications would be captured by American firms. "Would not abandonment of state control over communications cause them to fall under the control of IBM?" Having posed the issue in such a way, the analysis advocated domestic restrictions and international agreements. Liberalizing change was viewed as a profound threat to French and European economic and sovereignty interests; energetic containment was recommended.

Forces of Disintegration

Political télématique is colored by a Spenglerian pessimism about the ability of major European countries—despite their proud scientific and technological traditions, well-functioning research and development infra-

7. Eric le Boucher and Jean-Michel Quatrepoint, "La Guerre Mondiale de la Communication" (four parts), *Le Monde,* January 11–14, 1984.

structures, sophisticated users, and large financial markets—to succeed in the electronic field against rivals in the United States and Japan. It marshals new arguments in the service of an old cause, the preservation of a state-controlled monopoly in telecommunications.

And yet, for all its political strength, the traditional system has been subject to forces of disintegration. Technology is one of the reasons, though one should not exaggerate its contributions. A chief driving force has been the phenomenal growth of user demand for telecommunications, which in turn is based on the shift toward a service economy. Information-based services, including headquarters activities, emerged as a major comparative advantage of developed countries. These activities were reinforced by productivity increases in information transactions through computers and advanced office equipment. Consequently, electronic information transmission—that is, telecommunications—became of ever-increasing importance. It also became a major cost item. Specialized managers emerged whose function was to reduce telecommunications costs for their firms and enhance their internal infrastructure, and who for the first time established sophisticated telecommunications expertise outside the postal-industrial coalition. Once users on a large scale emerge, it becomes easier and more desirable for them to organize in a political pressure group of their own.

Traditional PTTs provided standardized and nationwide solutions, carefully planned and methodically executed. In the old days sharing a standardized solution was generally acceptable to users because the loss of choice was limited and outweighed by the benefits of the economics of scale gained. But as the significance and diversity of telecommunications services grew, this balance shifted, providing the incentive for private and group network solutions.

The globalization of commerce also created forces of centrifugalism. If one country's PTT exercises restrictive policies, its firms will be disadvantaged internationally, and foreign firms may choose not to locate there. Similarly, acquaintance with options available elsewhere creates pressures for change across borders. For example, in country after country the international electronic funds transfer network Swift (Society for Worldwide Interbank Financial Telecommunications) was able to force PTTs to change their rules on group networks as applied to Swift operations, or else the country's banks would have been left out.

For satellite transmission in particular, the marginal cost with respect to distance is low. Communication flows can be routed in indirect ways to circumvent regulatory barriers and restrictive prices. Arbitrage becomes

possible and with it the incentive for a country to become a "communications haven" by liberalizing its regulatory regime. This undermines the stability of administratively set rules for prices and service conditions.

The Technology Gap of the Traditional System

Meanwhile, traditional telecommunications firms were also losing their hold. Insulated from competition and secure in their profits, they were not particularly successful in technological terms relative to their resources. Almost all missed out on the development of computers or failed to stay on the industry's leading edge. Siemens A.G. in Europe and several Japanese firms are the main exceptions. This lack of success came despite major national efforts and subsidies.

The development of microelectronic components illustrates how the traditional equipment manufacturers fell behind technologically, and how they permitted the emergence of a "second" electronic industry that is now undermining them. Contrary to popular belief, the American advantage in electronic component development did not result from European devastation in World War II. The war had provided an impetus for innovation in Britain, Germany, Italy, and the Netherlands, and though many production facilities were destroyed, the technical know-how remained. European firms were as advanced in tube technology as their American counterparts, and they were doing sophisticated research in solid-state technology, such as the work that led to the development of semiconductor diodes.

In late 1947 the transistor was invented at Bell Laboratories, and its superiority soon became apparent. The large, established telecommunications suppliers moved into transistor manufacturing, and although the Americans had a head start, European companies managed to keep up with the new developments. N.V. Philips (with its various European subsidiaries), Siemens, AEG-Telefunken, Plessey, Ferranti, GEC, and Lucas were all doing quite well.[8]

But in the next stage of microcomponents—integrated circuits—different market structures evolved on the two sides of the Atlantic. The new technology was based on silicon instead of germanium, and on planar fabrication, which made mass production easier. And it made possible substantial component integration within one chip. In the United States these innovations were met not so much by traditional manufacturers as

8. Franco Malerba, *The Semiconductor Business: The Economics of Rapid Growth and Decline* (University of Wisconsin Press, 1985), p. 62.

by new firms. Furthermore, American computer manufacturers themselves went into component production. In Europe, much of the development of the new technology was left to the traditional manufacturers who were larger and slower to innovate than their counterparts in America—and later, Japan.

The integrated circuit period lasted from 1959 until the 1971 beginning of a new stage—large-scale integration (LSI) and microprocessors. Very large-scale integration (VLSI) began in the early 1980s. During the LSI period, American firms, mostly nonexistent or hardly known before 1945, were dominant. By then European public policy had focused on microelectronics and encouraged finished goods producers such as telecommunications and consumer electronics firms to integrate vertically into component manufacture. Government development projects provided investment funds. On the whole, however, none of these efforts significantly challenged the Americans and the Japanese. With the advent of the VLSI stage, Japanese firms took the lead in mass manufacturing of components.

Many attribute European firms' poor showing during the 1970s and 1980s to their lack of research and development funds. However, a survey found that research and development expenditures by the European computer and component industry were about $3.7 billion in 1982, compared with about $1.7 billion by Japanese firms and $4 billion to $5 billion by U.S. firms.[9] A high-technology and telecommunications specialist for the Organization for Economic Cooperation and Development (OECD) observed: "Per unit of output, and especially exports, the R&D spending of [European] high technology firms—notably that part of it financed by public money—vastly exceeds that of its trading partners. Whatever the cause of Europe's difficulties may be, it is not that too few resources are devoted to R&D."[10]

The Emergence of the "Second" Electronics Industry

Given the importance of electronics, elements of an independent computer and component industry evolved in most developed countries, forming a "second" electronics sector in contrast to the established telecommunications supply firms. In Europe, Nixdorf Computers and Ing. C. Olivetti are probably the best known among them. These firms are

9. Jim Kraus, "EEC Computer Manufacturers Tie R&D to Compete with U.S., Japan," *Electronic News*, September 10, 1984.

10. Henry Ergas, "Can Europe Catch Up? Exploding the Myths about What's Wrong," *Financial Times*, June 26, 1985, p. 15.

used to direct relations with the users without the mediation of the PTTs. They are an element of the new coalition that is challenging the postal-industrial complex—the alliance of large service users with the second electronics sector in a "services-information coalition." Examples in the United States are American Express, IBM, Time, TWA, Silicon Valley firms, and Citicorp. The traditional system has been defended primarily by AT&T—not enough to stem the tide. Hence the victory of the services-information coalition over the traditional forces was inevitable in the United States; Judge Harold Greene and antitrust chief William Baxter in the AT&T case merely fixed the details of a historic trend.

In Britain the new coalition was slower to gather, and the defense of the traditional industrial sector was more tenacious and ideological. But the balance of power swung in the 1970s. The British electronics industry was not successful internationally, particularly once one subtracts the United Kingdom's former colonies as a market. GEC, Plessey, and Standard Telephone and Cable (STC) were solid performers, but they were not successful in mass production of novel technology. British service industries such as banking, insurance, trading, publishing, and media were doing well, however. London is the preferred European headquarters of non-European firms and, along with New York, is a major center for international services. The Thatcher government advocated the deregulation of telecommunications largely to make British high technology more competitive, but the most important effect was to help make London the convenient center for European business transactions. Given its traditions, Britain was comfortable and familiar with this role.

In Japan the telecommunications equipment industry transformed itself into the new information industry better than anywhere else, and the changes were smoothest. Reform was accomplished as a continuation of industrial policy. Nippon Telegraph and Telephone (NTT) was privatized; and competition was introduced, under the prodding of the Japanese Ministry of International Trade and Industry (MITI), and without the public conflict that occurred in the United States and Western Europe.

In several other European countries the service sector is politically weak compared with manufacturing. French banks have long been nationalized and do not play the same role in international business as do London banks. At the same time the industrial sector has been a particular darling of the political left. This can be partly explained by a traditional socialist emphasis on the production of goods with its proletarian connotations, in contrast with the more middle-class-based, white-collar service activities. It also reflects the electoral base of socialist parties in the working class

and the trade union movement. And the emphasis on high technology fits neatly into France's traditional concern with national autonomy, which appeals to the political right, too.

Besides the external challenges, the traditional coalition weakened internally where its constituent parts began to redefine their advantages. A good example is the Netherlands. The 1985 report of the Steenbergen Commission led to a functional separation of the PTT's telecommunications activities into the basic network "social services" of the PTT, the PTT, and a "competitive services" complex of PTT and private suppliers, which included user group networks, value-added networks, and complex terminal equipment.

Perhaps the most significant aspect of the Dutch reform was the attitude of the PTT and its labor union. The PTT concluded that some change was in fact in its own self-interest. In particular, younger managers preferred the greater independence possible outside of the government civil service. The PTT labor union, for its part, concluded that wages, salaries, and especially pensions would be improved by a switch to an independent corporation status. Under the old system, employees were paid as civil servants and tied to the pay scale of the entire bureaucracy rather than of the electronics industry.

The Dutch example shows that a transition can be smooth when it is not enacted as a PTT-busting measure, but rather when the PTT embraces it as an opportunity. In Japan, too, the trade union Zendentsu went along with privatization in order to uncouple from the lower pay scale of the civil service. The union gained above-normal increases after privatization, while achieving job security in the reform legislation. Indeed, as the example of British Telecom will illustrate, invigorated and entrepreneurial PTT successor organizations may gain more power than before—and create a whole new set of problems.

Liberalization and Industrial Policy in the United Kingdom

Margaret Thatcher won the 1979 general election with the slogan "It's Time for a Change" and took a personal interest in applying it to telecommunications.

In its advocacy of reform the government emphasized industrial policy. It hoped to influence the structure of the telecommunications industry on the assumption that structure determines conduct, which in turn affects performance, the classical paradigm of industrial organization economics. The five distinct elements of government policy were (1) a formal sepa-

ration of telecommunications from the Post Office and establishment of British Telecom (BT) as an independent but regulated entity, (2) establishment of competition in services by permitting rival carriers and value-added network services, (3) privatization of the public network by selling a majority of British Telecom, (4) liberalization of the market for peripheral equipment, and (5) establishment of the regulatory body Oftel.

Thatcher and her advisers' plan of restructure was based on two partly conflicting policy goals: to encourage the service sector and to reverse the decline of British technological leadership. The British share in the world market of telecommunications equipment had fallen from 25 percent in 1960 to 5 percent by 1980. The government wanted to encourage industries with a future—electronics, information, biotechnology—industries that were, conveniently, closer to the interest of Tory followers than to traditional smokestack firms. A minister of state for industry and information technology, serving under the secretary of state for industry, was named, the first such appointment anywhere.

On the whole, Britain's encouragement of the service sector has succeeded, particularly in conjunction with other steps such as liberalization of financial services. It has proved more difficult, however, to change things for the electronics industry. Despite efforts to provide a competitive environment and public money, the electronics industry has continued to slide. Ironically, one factor that has pressured the industry is the increased cost consciousness of British Telecom and of the Ministry of Defense, by far the largest customers of electronic equipment.

The traditional British electronics firms were not doing well. At Standard Telephone and Cable, the chairman and chief executive, Sir Kenneth Corfield, resigned in August 1985, partly because Britain's major computer firm, ICL, which STC had acquired in 1984, performed poorly. STC also experienced problems in its traditional telecommunications equipment market. Meanwhile, STC's parent, International Telephone and Telegraph Corporation (ITT), was itself in need of money and reduced its ownership share successively. Eventually, ITT brought its telecommunications interests into the French-dominated Alcatel N.V., with the notable exception of STC, which therefore was left potentially stranded without a strong technology supplier.

The other main telecommunications equipment makers, Plessey and GEC, had their own problems. Development costs for their flagship "System X" digital switch were much higher than expected, production was delayed, and export orders were not forthcoming. In 1985 Plessey's profits

fell dramatically, and the company also had to carry the losses of its American acquisition, Stromberg-Carlson.

The response of the ailing firms was to seek a merger that would further reduce the already limited competition. In December 1985 GEC made a takeover offer of Plessey of about $1.7 billion. Plessey rejected the offer and counterproposed to take over all of GEC's System X digital switch operations. Each company argued that the other was attempting to end duplication.

Meanwhile, the smaller and newer semiconductor and computer companies were also performing poorly. Acorn Computers was largely taken over by the Italian firm Olivetti. Sinclair Research had to sell out. Inmos, Britain's most important developer of semiconductor technology, was an acquisition target for AT&T. For industrial policy reasons, a British "white knight" was promoted in the form of Thorn-EMI, which purchased the government's stake. Soon Thorn-EMI itself went through turmoil, with Inmos a major money loser.

Effects of Liberalization on End-Users and on British Telecom

If the traditional equipment industry has not greatly benefited yet from the reorganization of British telecommunications, who has? The answer is, not surprisingly, large service industry users and, much more than expected, British Telecom itself. The latter observation suggests a future general weakening of the alliance between network operators and equipment industry.

As a supplier, British Telecom became much more sensitive to its customers, particularly its business customers. Examples of improved service include a speedup in installation of private lines in the business district of London. Within the company, independent profit centers were established to control performance. Management employment contracts began to include performance clauses, and at high levels were limited to three years.

The United Kingdom's liberal telecommunications policy and low international telephone rates attracted traffic. One large user, the Ford Motor Company, set up its European communications center in the United Kingdom partly because of its operating flexibility. In 1986 about 40 percent of all North American private-line traffic to the European continent was routed through the United Kingdom.

In the meantime rates increased for small users; the rules established in the British Telecom license were to limit aggregate price increases on domestic calls for a five-year period to the rate of inflation minus 3 percent. In the first year after the license, long-distance call charges were increased for five types and reduced for four. Overall, the weighted average price increase was 3.7 percent. For low-volume users, rates went up 7.1 percent and for high-use residents, 5.7 percent. For a "moderately high" business user, telecommunications rates went up 2 percent.[11]

The following year, the inflation rate was 2.5 percent, which therefore required a price roll-back by British Telecom in absolute terms, somewhat mitigated by a small accumulated credit from the previous period. Overall rate reductions totaled 0.3 percent. But residential rental rates increased 3.7 percent, ahead of inflation.

Movements toward Vertical Integration

The strength of the postal-industrial complex derived from the strength of its members, and this strength existed even after liberalization. It would be naive to expect a newly reorganized telecommunications organization to strive only for an improvement in its efficiency. It finds itself in a double bind: if it takes seriously the exhortations to entrepreneurialism and expands, it is criticized for power grabbing and unfair competition; if it fails to embark on new activities, it is dismissed as hopelessly stagnant.

In Britain, British Telecom began to pursue several avenues of expansion by vertical integration. In the equipment field it purchased the Canadian private branch exchange (PBX) manufacturer Mitel. This led the regulatory body Oftel, and nearly the entire British equipment industry, to argue that the acquisition would not be in the public interest because it would strengthen British Telecom's power in terminal equipment and would threaten British PBX manufacturers. The Monopolies and Mergers Commission, though acknowledging the problem, accepted the merger with some tough conditions attached. But even those conditions were waived by the government when it approved the acquisition.

Another attempt at vertical integration by British Telecom was in advanced services. In June 1984 British Telecom and IBM/U.K. Ltd. announced their intention to establish a joint value-added network services (VANS) venture for data network management service, and they applied for a license. The plan set off strong domestic protests. About a hundred computer and communications companies registered their opposition. Some

11. "British Telecom's Price Changes," Oftel press notice, December 16, 1985.

were concerned with the reliance on IBM's Systems Network Architecture (SNA), while others feared the linking of two dominant firms in closely related markets. In the face of such pressure, the British government rejected the application but left the door open for either company to offer such services on its own.

British Telecom is not unique in seeking to expand its market power vertically in an (old) AT&T-like fashion. In Spain the telecommunications monopoly Compañia Telefónica Nacional de España (CTNE), which is partly private, has increasingly been involved in manufacturing. It holds a large interest in Alcatel's Standard Electrica, which is by far the largest electronics manufacturer in Spain, and owns a majority of the stock of twelve equipment firms and minority interests in seven others. Their aggregate output accounts for about a third of total Spanish telecommunications production.[12] CTNE also linked up with AT&T in semiconductor manufacturing, with Corning Glass in fiber optics, and with Fujitsu Ltd. in microcomputers.

Vertical integration also occurred in Sweden and Italy. In Italy the predominant telephone carrier Società Italiana per l'Esercizio Telefonico (SIP) is not run as a government administration but is largely owned by the Società Finanziaria Telefonica (STET), a company controlled by the government holding organization Instituto per la Recostruzione Industriale (IRI). STET also owns several major manufacturing firms, including Italtel, the country's largest telecommunications equipment firm, and several leaders in semiconductor components and robotics. In Japan the newly privatized NTT formed within a year almost seventy subsidiaries or new ventures, which have only begun to be active in new products, services, and marketing.

These instances of vertical integration by the network operators indicate how liberalization can transform the relationship between state PTTs and private equipment firms from one of partnership into one of conflict or, alternatively, can lead to an AT&T-style vertical integration of the two.

Liberalization of Services: The New Generation of Telecommunications Carriers

Liberalization has led to carriers outside the traditional PTTs. These can be either operators of new facilities, as in Britain or Japan, or enhancers

12. U.S. Department of Commerce, National Telecommunications and Information Administration, *Telecommunications Policies in Ten Countries: Prospects for Future Competitive Access*, NTIA-CR85-33 (Washington, D.C., 1985), pp. 131–45.

of regular PTT transmission capacity, as in the case of value-added service networks. To meet the challenge, the traditional networks have been upgrading their technology, but they have had increasing difficulty keeping together the traditional international cartel in the face of arbitrage, resale, breaches in cartel solidarity, and new international links.

Mercury and Japan's New Common Carriers

The British government encouraged three major companies—Cable and Wireless (C&W), British Petroleum Company (BP), and Barclay's Merchant Bank—to form an alternate long-distance carrier. Although this consortium, Mercury Communications Ltd., was modeled on the American MCI Telecommunications Corporation as a competitor to AT&T, there were great differences. MCI was an entrepreneurial maverick that entered the market by opposing federal authorities and prevailing in court. Mercury was born with three silver spoons in its mouth and the government as its godparent. (Within a short time, however, Mercury became wholly owned by C&W.) Mercury is less a response by entrepreneurs to the market than a government blueprint. The Conservative government staked the credibility of its telecommunications program on the effectiveness and survival of this particular enterprise. In 1982 it made Mercury the only licensee for the foreseeable future, thus giving it a monopoly on competition.

Mercury's permanent license, granted in 1984, permits it to run, install, and operate an independent national telecommunications system for at least twenty-five years. The license is similar to British Telecom's, but with several important differences. Mercury does not have to fulfill British Telecom's universal service obligations, and thus it need not operate a national system.

Mercury quickly established a microwave network within London in 1983. It later constructed a figure-eight fiber-optic trunk system centered in Birmingham. Full-scale operations started on May 15, 1986, with long-distance rates about 15 percent to 20 percent lower than British Telecom's, despite that firm's anticipatory tariff reductions. Mercury's goal is a 5 percent market share by 1990, but obviously a much larger share of large-user business. Price advantage is not the only reason why large users are likely to allocate part of their use to Mercury. Another is simple diversification. In a country as prone to strikes as Britain, dependence on one supplier seems unwise.

Mercury's main contribution in its initial phases was to lead British Telecom to reduce its long-distance rates. For example, anticipating Mer-

cury to be a potential competitor, British Telecom cut its prices to North America up to 20 percent in mid-1985.

As in the case of MCI in America, the issue of interconnection with the British Telecom network was central. In 1985 Oftel decided on a framework for the interconnection, largely in favor of Mercury. British Telecom must provide Mercury with local interconnections at both ends of a telephone conversation, and the compensation that Mercury must pay British Telecom will be set, in the absence of agreement, by regulation.

The issue of fair interconnection is complicated. In the United States it led to two decades of dispute and was a main cause of the AT&T divestiture, when the Justice Department, and with it Judge Greene, concluded that one could not expect genuinely nondiscriminating access by a local monopoly to its long-distance competitors. The divestiture established the principle of complete and equal access and of user choice of a "primary long-distance carrier." The issue of the cost for such access to the local network, whether by AT&T or its competitors, precipitated one of the fiercest battles between long-distance carriers and local-exchange companies, and among long-distance carriers themselves.

Interconnection is British Telecom's lever to control the competition. Thus the regulations governing that interconnection were critical. They affected how much British Telecom could charge, a murky area of conceptual and accounting issues, as well as the numbering system, the points of interconnections, the quality of service, the number of digits to be dialed, and other technical matters. In all these issues British Telecom has an understandable reason to be uncooperative. Even when British Telecom's proposals are fair by some objective standard, however, Mercury has an incentive to cry wolf and seek an advantageous interconnection arrangement. It can argue that, as an "infant" competitor, it needs a period of protection. Without protection Mercury could not compete with British Telecom, and this would undermine the entire basis of government policy on competition.

Hence Mercury has leverage over British policymakers out of proportion to its economic power. With the Labour party in power, the reverse is possible: Mercury could be choked to death by "technical" regulatory decisions rather than by policy decisions debated and passed by Parliament. Probably some form of tacit collaboration will occur. Mercury does not have much of a support base. At the same time, Mercury's existence provides BT with a useful argument against government interference in its operations. British Telecom is not necessarily interested in totally winning this contest.

In Japan seven domestic carriers, including NTT, received operating licenses in the first year of the new law that became effective in 1985. They are affiliated in several instances with major institutions—Japan National Railways, the Public Highway Authority, the Tokyo Electric Company, Mitsubishi/Ford, and Itoh/Mitsui/Hughes. Of these carriers two plan to use satellites, two fiber-optic cable, and the other microwave. The first alternative service began in August of 1986 by the National Railways' Japan Telecom Company in the Tokyo-Osaka corridor. Under government prodding NTT reached interconnection agreements with the "new" common carriers (NCCs) that were favorable to the latter.

In light of the American experience, it is questionable whether all these licensees will be profitable. In another liberalized service, mobile telephony, the PTT ministry already has been restrictive. The law suggests that telecommunications facilities should not exceed demand.

Value-Added Network Services: Hybrid Communications

Specialized network services can be offered by specialized providers, as well as by international and domestic carriers. Value-added network services play a much greater role in policy discussions in Europe and Japan than they do in the United States, and it is important to understand why. The fundamental interests of the traditional network operators and not technical or business reasons have led to the new regulatory category of value-added network (VAN) services. It is an intermediate step in the liberalization of services, and just as inevitably it is not the last one. The key problem that prompts the licensing of value-added networks is the potential resale of leased transmission to third parties. This form of arbitrage by a service reseller leads to loss of control by the basic network provider, to competition, and to a reduction in revenues, at least in the short term.

In the United States such resale is possible and widely practiced. Lessees can do almost anything they want. The regulatory constraints that do exist are largely to prevent the basic carriers from extending their market power over the network downstream into the applications stage by internal subsidies. But in other countries resale is prohibited, although it seems to exist unofficially in several instances. Some of these countries have realized, however, that the use of leased lines can provide communications applications of a sophisticated nature for use by third parties, and they do not wish to prevent these services from emerging. Thus they lean toward permitting the provision of "value-added" services, where something has

been added to basic transmission. This technical addition legally transforms into a sale what otherwise would have been a resale. (Another alternative is to establish usage-sensitive pricing to eliminate the incentive for retailing of services. But this creates other efficiency problems in pricing.) As in any attempt at price discrimination that is not cost-based, one should not underestimate the ingenuity of arbitrageurs. Those who wish to resell basic transmission (or switching services) but can sell only value-added service may try to add a trivial amount of value or an entirely unnecessary amount, solely to become legal. To prevent this, it is necessary to license value-added networks, after scrutinizing the nature of their "value added." A formal approval process is therefore needed, together with some form of ongoing monitoring, to protect the system of price discrimination. This restricts the range of services and limits the licensed network's operating flexibility. It is deemed to provide some protection to the monopolistic "basic" service, although the stability of this protection is illusory over time.

In the United States, as mentioned, such procedures do not exist. Value-added network services are merely a functional description and not a regulatory category. Since they are undefined officially, they mean different things to different people and often simply refer to packet switching networks. There is a regulatory distinction in the United States affecting VANs between "basic" and "enhanced" services, but it serves an entirely different purpose. Whereas PTT countries seek regulation of VANs to prevent the resale of leased capacity (that is, to protect the PTT service monopoly), the U.S. categories are to prevent the cross subsidization by a dominant carrier of its value-added services through revenue gained in those dominant activities. The United States distinguishes between basic and enhanced service in order to *prevent* the dominant carriers' exercise of market power—not to protect those carriers from competition.

The British Telecommunications Act of 1981 authorizes the secretary of state for industry to license value-added services. A general license is required that prevents interconnections except to a public telecommunications system. It also requires the use of approved equipment. Resale or shared use is not permitted.

New legislation governing value-added network and data services was passed in 1985. By that time there were 688 VANs operating under a general license, operated by 164 different companies.[13] Of these VANs the most popular were store and retrieve systems (89); mailbox service

13. "Future Licensing of VANs," *Oftel News*, no. 1 (December 1985), p. 7.

(71); protocol conversion between incompatible computers and terminals (71); customers' data bases (54); deferred transmission (50); user management packages (46); view data (49); word processor and facsimile interfacing (40); multiaddressing routing (49); and speed and code conversion between incompatible terminals (43). Other VANs include automatic ticket reservation, conference calls, long-term archiving, secure delivery services, telesoftware, retrieval, and text editing.

The "liberalized" licensing system quickly showed itself to be overly rigid. This led to still newer rules in 1986 and 1987 that substantially simplified and liberalized procedure and made, in effect, the resale of capacity for computer data transmission fairly unrestricted. Large VANs are subject to rules that prevent the establishment of a dominant market position. These limitations were aimed at British Telecom and IBM, which had unsuccessfully applied to establish a joint venture in value-added network services. Unlike its competitors, BT must provide these services nationwide. It is also subject to rules that prevent a cross subsidy out of other services.

In Japan two types of VANs were established by the 1984 reform: "special" type II carriers and "general" type II carriers. Special type II carriers resemble large packet data networks such as Tymnet and Telenet in the United States. Several networks of this kind have been established by the computer firms Hitachi Ltd. and Fujitsu Ltd. and by NTT itself jointly with IBM Japan (Japan Information Service), to name a few.

More than two hundred general type II carriers emerged after the law went into effect in 1985. By far the largest category is order networks of retailers and wholesalers (for example, for food and used cars), followed by credit card verification, financial networks, electronic mail services, voice mail services, and transportation. Also in this regulatory category are a dozen resale carriers, of which the largest are Recrute and K-VAN. They offer rates 20 to 30 percent lower than those of NTT. This resale, however, cannot include connection with the NTT public switched network, and therefore it makes economic sense only for larger users with private-line needs.

Japanese providers or VANs found themselves unable to offer international service under the recommendations by the International Telegraph and Telephone Consultative Committee (CCITT). To do so they had to be awarded by the government the status of a "recognized private operating agency" (RPOA). As both the British and Japanese experiences indicate, it is difficult to permit competition in new and advanced services while protecting the traditional services.

International Carriers

Cable and Wireless is the prototype for the new generation of international carriers. The company once operated telecommunications services for Britain's overseas colonial possessions. C&W was nationalized by the Labour government in 1947, and it remained state controlled for almost thirty-five years. In the mid-1980s it was still operating public telecommunications services in twenty-eight countries and territories on behalf of their national governments, with a major operation in Hong Kong.

In 1981 the Conservative government reprivatized C&W. Privatization made it possible for the firm to expand rapidly and to transform its somewhat sleepy image into what is arguably today the most interesting telephone company in the world.

C&W's announced goal is to become the first global telecommunications carrier. It aims to link the four major financial centers in the world: London, New York, Tokyo, and Hong Kong. Already it is a dominant presence in Hong Kong, where it owns the local telephone company. It is a major participant in a joint venture with Nynex for a private submarine fiber-optic cable to the United States, to be operational in 1989. C&W also hopes to participate in a transpacific fiber-cable venture. In Britain C&W has become the sole owner of Mercury, which provides it with a long-distance capability within Britain.

To compete with the former monopolist Kokusai Denshin Denwa (KDD), two Japanese consortia applied for a license to provide international service. One of them is International Telecom Japan (ITJ), owned by fifty-three large users including Mitsubishi, Sumitomo, Mitsui, the Bank of Tokyo, and Matsushita. ITJ planned to commence service at first on circuits leased from KDD. The second consortium is International Digital Communications, in which C. Itoh and Company and C&W, the largest partners (each with 20 percent), are joined by thirty-three others, including Toyota. The Ministry of Posts and Telecommunications tried to nudge the two ventures into a merger. Part of the agreement would have been to reduce C&W's share to 3 percent for reasons of "national security" and to exclude it from a role in management. This had the British and American governments up in arms. The example shows how difficult it is to reconcile the conflicting philosophies and interests in this field.

Integrated Services Digital Networks

The preceding discussion of new carriers should not lead one to believe that the traditional telecommunications coalition is technologically passive

in defending its position against challenges. One form of this defense is expansion into new and adjoining fields of activity such as cable television transmission and videotext. Another strategic move is the upgrading of the network in a way that raises barriers to entry. Monopoly, it is argued in the spirit of political télématique, is a condition for technological innovation. The primary initiative is known as the integrated services digital network (ISDN). At its most elementary, ISDN is an integration of voice, data, and telex networks into a unified "superpipe." Though hundreds of papers on ISDN have been published—almost all of them from a technical perspective—virtually no public discussion of the ISDN concept has taken place. Part of the problem is that the term *integrated services digital network* encompasses several subconcepts. As a move toward more *digitization* of the network, it is squarely and positively within the trend of technology. As an upgrading of the networks to *higher transmission* rates, it similarly responds to the need for greater data communications, particularly those of larger users; for residential users the need is less clear except to create the proverbial egg (the network) for future chickens (the applications).

The third element of ISDN is *integration*, and its rationale is much weaker. To put separate communications networks into one superpipe is elegant from a technologist's view, but from a user's perspective what count are the cost, performance, and choice of services. Integration is a standardization process, which is always a trade-off between the cost reduction of streamlining and benefits of diversity. Integration usually reduces options. Users are interested in choice for selection, at a price, while network operators may be more interested in providing standardized options.

The implicit assumption in the justification for the nonduplicating superpipe is that cost functions (for example, for telephone and telex networks) are static. Yet different services under rival control usually create a dynamic downward shift of the cost curves, because of the extra efforts of competitors, in contrast with the monopolistic situation of unified services. The effects of these downward shifts in costs can offset, partly or totally, the economies of scope of integration.

ISDN as a technical concept does not prevent multiple ISDN networks and networklets from coexisting, competing, and interconnecting. There is no notion of exclusivity in the technical integration, but anything less than exclusivity is almost impossible for ISDN's PTT promoters to accept. After all, eliminating duplication is the primary rationale for ISDN.

To permit multiple integrated networks would defeat the purpose.

For the equipment industry, ISDN is welcome. After several decades of enormous public investments to expand the public network, growth has declined. Export markets are limited because many of the larger ones are protected against imports. Therefore, one way to activate the sagging domestic market was to launch an ambitious program of upgrading.

Rate Differentials and Arbitrage

The traditional collaborative system has faced three main challenges: how to maintain control over the international segment of communications, how to deal with the new American carriers, and how to resolve disputes involving international satellite service.

The area of international communications has been a major contributor to PTT profits, but it is more vulnerable to rival service provision than is domestic communications, where both ends of the link tend to be under the control of the same PTT. International telecommunications is the soft underbelly of the traditionalist system. The need for international coordination and agreement has illuminated the different perspectives of the traditionalist coalition and its opponents. In consequence, disputes have been frequent and harsh. Profits on international service are high because costs have dropped faster than rates. The investment cost per transatlantic cable circuit has dramatically decreased, from $133,000 in 1940 and 1941 to a projected $670 for the fiber-optic cable TAT-8. For satellite circuits, costs have dropped from $86,000 on Early Bird to $450 in the Intelsat VI satellite generation. In 1981, according to one study, the yearly cost of a direct broadcast-grade connection between London, New York, and Frankfurt was $53,000 a year, but British Telecom charged $750,000.[14]

A U.S. Federal Communications Commission (FCC) study showed that the average rate from Europe to the United States exceeded that from the United States to Europe by 34 percent in 1981. After AT&T's 1981 price cut, the weighted-average foreign tariff was almost 95 percent higher than the American.[15] Another report shows that in 1982 a daytime telephone

14. Barry Stapley, "Managing Communications: The Value of Choice," quoted in Organization for Economic Cooperation and Development, *Telecommunications: Pressures and Policies for Change* (Paris: OECD, 1983), p. 106.

15. Evan Kwerel, "Promoting Competition Piecemeal in International Telecommunications," Working Paper Series 13 (Washington, D.C.: Federal Communications Commission, Office of Plans and Policy, December 1984), pp. 18–19; and U.S. General Accounting Office, "FCC Needs to Monitor a Changing International Telecommunications Market," GAO/RCED-83-92 (Washington, D.C., March 14, 1983), p. 17.

call from New York to Munich, Germany, cost $1.38 per minute, while the same call made from Munich to New York cost $3.03 per minute.

High profits encouraged the emergence of arbitrage. A Telex message from Germany directly to the United States cost $2.58 a minute in 1981, but only $1.76 if it was routed via the United Kingdom. This difference led to a substantial transatlantic traffic from the European continent via London telex bureaus. European PTTs fiercely tried to stamp out this arbitrage (citing CCITT rules on "golden handcuffs" of a high-priced cartel), but they were harshly rebuffed by the European Commission and the European High Court of Justice.

The legal foundations of the cartel have thus been shaken. One single country that breaks ranks—for reasons of economic ideology or a desire to profit as a "communications haven"—can undermine the profitable arrangements that have endured for a century.

The second area of challenge to cartel solidarity concerns the new American carriers. In 1984 the European PTTs reaffirmed their policy on the control and limitation of other common carrier (OCC) entry. The PTT organization (the European Conference of Postal and Telecommunications Administrations, or CEPT) advised its members to open their markets only to the traditional seven U.S. carriers (AT&T and the six international record carriers). The new guidelines stated that new carriers would have to provide better technical service at a lower cost than at present in order to be permitted entry into the European markets. New carriers would be permitted for new types of communications service (such as videotext, teletext, facsimile, and packet switching), but they would be restricted to one carrier for each new service.

The CEPT guidelines effectively limited the number of carriers PTTs were able to choose from. Normally, it is to the advantage of any party in a transaction to be able to pick and choose among competitors, and particularly if the party is a monopsonist. The PTTs, however, acted to restrict entry to prevent competitive bargaining between countries. A PTT presumably would not enter into an agreement with additional American carriers if it were not in its own self-interest, economically or technically. CEPT recommendations aim at collective forbearance from any future bidding for new carriers' entry by establishing cartel solidarity. They aim at preventing the establishment of telecommunications hubs such as Britain.

Given the hostile reception, it stands to reason that the new American carriers, in order to be admitted, must offer significantly more attractive deals to the PTTs than AT&T does. But the FCC, concerned about PTT

monopolists squeezing U.S. competitors, set rules against "whip sawing" that hinder the new carriers' ability to compete with AT&T and with each other for PTT business. Since uniformity tends to benefit the incumbent, AT&T's competitors were unhappy.

MCI tried to reduce the barriers to entry by buying from Xerox an existing carrier, Western Union International (renamed MCI International). This created a convenient international outlet for MCI's U.S. involvement in electronic mail and provided it with an already established relationship with the PTTs.

MCI actively sought to provide end-to-end international voice traffic, as had AT&T. It concluded agreements with several countries, in particular the United Kingdom and Hong Kong, which became its major international hubs. Like U.S. Sprint, MCI reaches other countries by transfer through these hubs. Overall, the other common carrier procedures can be complicated enough to prevent profitability in operations to many countries served by the OCCs. However, the OCCs require a full international service to compete with AT&T on equal footing in the United States.

The third type of dispute involves international satellite service. In an extension of its domestic "open skies" policy, the FCC accepted applications from a group of private entrepreneurs for a license to operate the private international satellite system Orion. This was followed by similar applications by International Satellite Inc. (ISI), PanAmSat, and Cygnus. All were fiercely resisted by Intelsat and the PTTs.

Ironically, the opponents of liberalization of international satellite communication are partially responsible for its emergence. Several regional and intercontinental satellite systems have been established outside the Intelsat organization. They include a Scandinavian satellite consortium, Arabsat, Eutelsat, and a French system that is "domestic" but stretches that term to encompass communications with French possessions in the Caribbean and South America. Several countries believed that they could follow their telecommunications goals better if they had more control over satellite communications. This is one reason for the emergence of these satellite projects. Moreover, various industrial policies promoted electronic development projects. These industrial policies undercut the argument that an international satellite system must be controlled by one organization for reasons of economical and technical efficiency.

Fearful of satellite competition undermining their highly profitable international service, the PTTs pursued several defenses. An "up-link" strategy was intended to prevent the FCC from granting private licenses

as a violation of the Intelsat agreement. A "preemptive" strategy sought to cut rates and offer new service options as a way to deter potential entry. A "down-link" strategy tried to prevent new satellite carriers from connecting into national networks. And a "third world" strategy rallied the less developed countries' PTTs, fearful of losing the cross subsidies to low-traffic routes.

In the end PanAmSat got a limited Intelsat approval, while the other applicants were stymied. But this was a rearguard action. Whatever one may think of the desirability of a single global system with its economies of scale, the simple fact is that a distance- and border-insensitive technology such as satellite transmission cannot be successfully restricted for long. Even without competing satellites, rivalry from private submarine cables threatens the Intelsat arrangements.

Equipment and Trade

In the past the traditional coalition was fairly successful in holding the line on equipment imports from the United States. Once divested, however, AT&T emerged as a competitor in international markets, a sharp break with the past. The divestiture received much attention. It was portrayed as part of an American telecommunications equipment offensive into the rest of the world. But for all the publicity, actually the opposite has happened: American equipment makers recently have been repulsed and almost expelled from the international markets, with ITT, GTE, and Honeywell mostly departing, and AT&T largely unsuccessful. Meanwhile, foreign manufacturers have rapidly gained a fairly large aggregate share of the market in the United States.

Containment of American Equipment Manufacturers in Europe

For more than fifty years AT&T had stayed out of international equipment activities, despite its position as the largest manufacturer of international equipment in the world. In the early years of telephony, the Bell System licensed several European equipment manufacturers, acquired others, built its own foreign facilities, and had a substantial manufacturing and distribution presence abroad. Then in the 1920s American critics of AT&T charged that American ratepayers were subsidizing its international operations. For that and other reasons, the company in the 1920s decided to sell its European operations to ITT, then a relatively insignificant firm

run by the Virgin Islands entrepreneur Sosthenes Behn. This purchase marked ITT's entry into the big league of telecommunications.

Following divestiture in the 1980s, the international field became interesting to AT&T once again. Because the domestic equipment market had been opened to all comers, its U.S. market share had nowhere to go but down. The rest of the world became its field of growth. AT&T's strategy was to align itself with domestic interests, thus lowering the barriers that an American company would face. A series of joint ventures emerged, some ad hoc, but in the aggregate part of a new orientation. The first such alliance was a joint venture with the Dutch electronics giant Philips, which had run out of steam in telecommunications development. The Netherlands, however, is a very limited market.

AT&T's second major international involvement was with Olivetti, the Italian manufacturer of office equipment and small computers. AT&T purchased 25 percent ownership of Olivetti for $260 million, with the option to acquire another 15 percent after four years. Olivetti's ambition is to become the major European player in world computer markets. Its main rival is IBM, with more than 50 percent of the European market. Olivetti's alliance with AT&T is a great advantage, given AT&T's own technological capabilities and capital.

AT&T, which had looked for a European beachhead and distribution system, found itself making a nice windfall profit on its Olivetti investment. Fueled by Carlo de Benedetti's success as Olivetti's chief executive officer and the rise of the Italian stock market in general, AT&T's investment quintupled in value. Olivetti's private branch exchanges, terminal equipment, and personal computers make it an increasingly strong rival to the STET group. STET, in turn, is collaborating with IBM. Thus the Olivetti-STET rivalry is joined by the American antagonists, AT&T and IBM, each the ally of a major Italian company.

Another major move by AT&T was to try for an agreement with the dominant French firm Compagnie Générale d'Electricité (CGE) group, and this unleashed another round of conflict-laden politics. Behind the story was the unresolved question of what to do with the remaining public switch manufacturer in France, Compagnie Générale de Constructions Téléphonique (CGCT), acquired by the government in 1982 from ITT. CGCT was losing money quite heavily, but it had one major paper asset: it was traditionally allocated 16 percent of the French public switching market, about 300,000 lines a year.

After the government-generated merger of the telecommunications activities of Thomson into CGE (and its Alcatel subsidiary), CGCT was the

only remaining second source for the Direction Générale des Télécommunications (DGT), which did not want to confront CGE as the only supplier. CGCT, in consequence, was given the task of manufacturing the Thomson digital switch under a license, but it was in no position to develop new equipment. Who, then, would be the second source supplier to the DGT? With 84 percent of the market, CGE negotiated with foreign firms to determine which of them should be admitted to the market; in effect, it was selling the small share of the French market that it did not hold for political reasons and selecting its own competition. Eventually, CGE agreed with ATT-Philips Telecommunications (APT) that APT would receive CGCT's market share of 16 percent for its 5-ESS PRX switch, which would be manufactured in France by CGCT and adapted to French standards. In return, AT&T would help CGE modify its E10-5 switch for North American use, include it in its product line, and pay certain indemnities if sales for that switch did not reach a specified amount. Furthermore, Philips would transfer the microwave equipment manufacturing of its French TRT subsidiary to a joint venture controlled by CGE, while AT&T would undertake to buy at least $200 million worth of microwave transmission equipment over four years. Lastly, CGE would receive $100 million.

CGCT was unenthusiastic about the deal with AT&T, preferring to deal with Siemens or L.M. Ericsson. But for CGE, AT&T was a more compliant partner. A company such as Siemens, once it had a toehold in the French market, could not be as easily contained, given the close European collaboration between France and Germany, which includes French companies' involvement in German television set manufacturing. In contrast, any AT&T involvement in France would be subject to much greater government scrutiny and future pressure, since public opposition against it could always be more easily organized.

The telephone administration (DGT) was in favor of the ATT-Philips deal because it wanted to use the AT&T Centrex capability. It wanted to get a better bargain, however. It pressured AT&T's equipment price down and called upon other firms to enter into negotiations. Left out were Plessey and GEC after British Telecom decided to use as a second source ("System Y") the Swedish firm Ericsson rather than CGE; this the French PTT minister considered to be un-European, despite the geographical facts to the contrary.

The story now gets a new twist: what started out as bargaining for more favorable terms from AT&T changed when CGE struck a historic deal with ITT and gained control over its telecommunications activities.

The French Conquest of ITT: The High Point of Political Télématique

To appreciate the significance of the acquisition by CGE of ITT's worldwide telecommunications operations, one must go back to the close of World War II, when the French telecommunications industry was almost nonexistent. There was CIT, part of CGE. And there were Le Matériel Téléphonique (LMT) and CGCT, both French subsidiaries of ITT, as well as the foreign-owned Ericsson-France and the Philips group. These companies were licensed by the PTT to manufacture items of foreign design.[16] Other companies that later joined the market were the French Thomson-CSF and AIOP. And yet by the mid-1980s, only one company, the French Alcatel, remained, with CGCT surviving artificially. When the French government expanded the national telecommunications network and therefore the market for equipment, the foreign presence was almost entirely eliminated. First, the government forced the transfer of ITT's LMT, and Ericsson's French subsidiary transferred to Thomson-CSF, a private firm that was later nationalized by the Socialist government. ITT's other subsidiary, CGCT, was nationalized in 1982. During that period CGE and Thomson-CSF also took over AIOP, a workers' cooperative. Later it transferred Thomson's telecommunications activities to CGE.

In July of 1986, CGE entered into an extraordinary transaction with ITT, leading to its taking control over the telecommunications operations of the American-based firm. Despite ITT's American headquarters, the company had only a limited equipment presence in the United States, and in the telecommunications equipment field it was a multinational firm without a home base. A far-flung conglomerate in the 1960s and 1970s under the leadership of Harold Geneen, ITT later came into hard times. It was losing money heavily, and its innovative telecommunications switch, System 12, had technical trouble. The company also had to concede humiliating defeat in adapting the European-developed switch to U.S. specifications.

Meanwhile, CGE's Alcatel telecommunications subsidiary had difficulties of its own, especially in export sales abroad; it had almost no public switch sales in Europe to match its French dominance, and many of its international sales were political deals, particularly with former French colonies, or part of foreign aid packages. Domestically, the golden years

16. Jacques Darmon, *Le Grand Dérangement: La Guerre du Téléphone* (Poitiers/Liguge: Editions Jean Claude Lattes, 1985), p. 79.

of the expansion of the French network were coming to a natural end, and orders were dropping. Its mainstay digital switch family, the E10, developed for the expansion, was showing signs of age. Having failed to penetrate foreign markets through its products, or by French diplomacy, CGE set out to purchase foreign toeholds by acquiring ITT.

Through a complex agreement, ITT merged its telecommunications equipment, office automation, and consumer electronics into the new entity. CGE contributed its own Alcatel equipment subsidiary. ITT kept a 37 percent share of the holding company, while CGE, together with other European firms, controlled the rest. ITT received $1.5 billion for giving up its share, and the holding company assumed $800 million of ITT debt. The new firm was named Alcatel N.V.

Because of the problems inherent in having a nationalized French company own the centerpieces of other countries' electronics industries, it was envisioned for several other entities to have a share in the new venture. But this proved difficult, and in the end only the Belgian holding company SGB participated in a limited way. Alcatel was headquartered, nonetheless, in the Netherlands, to provide for a less French image.

The merged firm became the second largest international telecommunications firm after AT&T, with $7 billion in assets, almost $10 billion in sales, and 150,000 employees. It accounted for 42.5 percent of European public telephone switches, by far the largest share. CGE heralded the agreement as establishing for the first time a large-scale European telecommunications firm; most European telecommunications experts, however, did not get enthusiastic over such a French government–dominated arrangement. CGE claimed that the merger was necessary for reasons of economies of scale. The notion that it takes almost one-half of the European market to be successful is part of the obsession with economies of scale that pervades the industry's thinking.

The deal put into question CGE's separate arrangement with AT&T for CGCT's market share. With CGE inheriting many of ITT's footholds in so many other European countries, a greater reciprocity probably would be expected by those countries, and the 16 percent market share, whose allocation had been anticipated by AT&T, might be needed instead to assuage one or several European countries. In particular, the German government began to be active on behalf of Siemens. It pressured the French government at the highest levels to substitute Siemens for AT&T-Philips in the spirit of European solidarity, as well as in reciprocity for the newly acquired German ITT subsidiary Standard Elektrik Lorenz (SEL). The tug-of-war grew acrimonious. FCC Chairman Fowler pointedly sent

inquiries to major American telephone companies about their use of equipment from countries that discriminate against U.S. firms. Within the French government, the DGT preferred APT, but other ministries did not wish to antagonize Germany. The rival companies successively sweetened their bids. In the end as a compromise, the government chose Ericsson, together with the French defense firm Matra, which thus gained a foothold in telecommunications.

Roughly at the same time, another U.S. telecommunications firm, GTE, stopped manufacturing international equipment. GTE had substantial manufacturing involvements in Italy and Belgium until a deal with Siemens transferred 80 percent of these interests to the German company.

The Failure of Political Télématique in Mainframe Computers

It is useful to contrast France's successful empire building in telecommunications with its lack of success in computers or components. Here monopoly leverage did not exist to the same extent as in telecommunications, and the performance of French firms was less impressive. The French government had long been worried about "computer sovereignty." De Gaulle unsuccessfully attempted to veto GE's ownership involvement with the French computer firm Compagnie des Machines Bull. The French had been rightly shocked when the U.S. State Department refused an export license for large scientific computers to the French atomic energy commission for use in H-bomb research. When the GE-Bull deal could not be prevented for financial reasons, the government formulated in 1966 its "Plan Calcul." Among the plan's projects was a merger between the two remaining French-owned computer manufacturers into the firm Compagnie Internationale de l'Informatique (CII). Bull was left out of the Plan Calcul because of its American links.

Plan Calcul established targets for development of scientific computers, leaving much of commercial office computing to IBM. This projection completely misjudged the explosive growth of business applications of computers and, in any event, never touched the predominance of the American Control Data Corporation in this field.

The product strategy behind the Plan Calcul missed other developments. Observing time-sharing use of computers in which terminals were linked to a powerful central computer, it predicted a future with a few giant mainframe computers only and began developing them. But the trend was almost the opposite: minicomputers and microcomputers proliferated. Also unanticipated was the main benefit from the Plan Calcul. It provided

technology skills to Thomson and to CGE that they later applied in their development of digital telecommunications switches.

General Electric, in the meantime, experienced major headaches with Bull. Later it sold its interest to Honeywell when it left the computer business altogether.

By 1976 neither CII nor Honeywell-Bull was doing well. With government pressure and financing, they were merged into CII-Honeywell-Bull, which was 53 percent French (private and governmental) and 47 percent Honeywell. During the next two years, the French government subsidized the merged firm with about $300 million and arranged loan guarantees for about $1 billion. In 1982 the Socialists nationalized the computer firm, and Honeywell was forced to reduce its involvement substantially. Because of its access to advanced technology and the American market, Honeywell was left with 19.9 percent of Bull and a ten-year marketing and technology agreement with its former subsidiary. In 1986 Honeywell exited from computer manufacturing altogether and sold its French interest. Bull's affiliations with American technology also included a 7 percent share in the U.S. company Trilogy, founded by Gene Amdahl in 1981 to advance the state of high-speed mainframe computers and VLSI components. Trilogy, however, was unsuccessful in its development efforts. After RCA, GE, and Honeywell, this was Bull's fourth luckless marriage with an American firm.

The costly subsidies to computer development were part of a large effort in electronics. Following its victory in 1981, the Socialist government nationalized twelve big industrial groups at a cost of about $6 billion. The electronics firms included CGE, Thomson-CSF, CGCT, Matra, and CII-Honeywell-Bull. The total losses that the government subsidized grew from $226 million in 1980, to $4.6 billion in 1982, to $4.2 billion in 1983. The subsidy of losses was more than two-thirds as high as the initial costs to the government of taking over the companies! Direct government aid for the electronics industry was $1 billion in 1983, $1.2 billion in 1984, and another $1.2 billion in 1985.[17] This does not include indirect support through the telephone administration, DGT. In 1985 Bull received $100 million in new equity, the same amount as the year before. Thomson got $100 million in 1984 and another $130 million in 1985, primarily for its electronic components division.

Eventually, ending the state companies' deficits became a government priority, and the nationalized companies began to cut jobs rapidly. By

17. *Electronic News*, February 25, 1985, p. 13.

1984 French unemployment was at a postwar high of 10 percent. The electronics companies, too, laid off workers during 1984 and 1985. For example, Alcatel cut 1,700 jobs, Thomson 4,000.

Does the French example mean that the industrial strategy of government subsidy is doomed to failure? Not necessarily, for there have been successes, too. Furthermore, the British example does not indicate that the free-market approach is superior. At the root of the problem is the inability of institutions to transform themselves and the considerable hold they have over public policy. If a free-market approach is to be superior at all, it cannot be simply an opening up from above as part of a policy blueprint. It requires a vigorous entrepreneurial element from below and support by the educational and financial institutions. Conversely, the efforts of the French government to finance and guide the electronics industry will create self-sustaining growth only if a dynamic rather than bureaucratized environment results. Large, established firms have benefited, but there has been no notable emergence of small and innovative firms.

Equipment Imports

Despite its criticism of U.S. liberalization, the traditional coalition benefited in trade at the same time that it resisted change in domestic procurement practices. This created problems of reciprocity in trade that spilled into the political arena. The models for American exporters, once one goes beyond official assertions of openness, have already been described. This section deals with trade to the United States.

The U.S. market is not only the largest domestic market in the world by a large margin, but it is also relatively free and has many independent telephone companies (roughly 1,500). There are more potential customers in the United States than in the rest of the world. (Many of these firms are, of course, quite small.)

The U.S. liberalization provided non-U.S. manufacturers with exciting opportunities. Before the divestiture of AT&T, the Bell operating companies relied largely on Western Electric for their equipment, thus giving AT&T a captive market of 80 percent of the total U.S. equipment market. After divestiture, they were free to buy equipment from other suppliers. They have actively done so, primarily from Canada's Northern Telecom, but also from Siemens.

Even before the AT&T divestiture, the Swedish firm L.M. Ericsson had been an active supplier to American independent telephone companies and to MCI, and the British company Plessey had purchased the public

switching business of the well-established American manufacturer Stromberg-Carlson.

The opening of the American market was some of the best news that many non-U.S. manufacturers had had for a long time. Other industrial countries' markets are largely closed to imports, even within the European community. Demand from the OPEC countries declined because of the fall in the price of oil and the fact that the initial large equipment orders had already been placed. Likewise, in the third world markets fewer funds than before were available for telecommunications investments, and many countries encouraged the development of a domestic telecommunications industry to spur their own industrial development. Thus open markets for telecommunications equipment were limited to less than 15 percent of the world market, according to a 1982 estimate by the Organization for Economic Cooperation and Development (OECD). Since then the United States has opened its market, more than doubling the total.

As Georges Pebereau, then president of CGE, declared,

> It is obvious that no European company, French or not, can remain a world company if it does not have a significant position in the American market, which represents 40 percent of the world market and, in addition, is from the point of view of technology the best testing grounds one can imagine. Fortunately, we have a historic opportunity to develop ourselves in the U.S., with the deregulation of ATT. . . . If, unfortunately, CGE's presence in the U.S. failed, we would need more than a decade to regain the confidence of our American customers. Thus the interest in finding a partner in place which would permit us to penetrate the American market faster, more surely and at a lesser cost. Of course, if such an occasion presented itself, we would seize it.[18]

Some of the strongest advocates of protectionist policy in telecommunications procurement subsequently began to seek their fortune in the newly liberalized U.S. market. But this asymmetric situation unavoidably created tensions. The U.S. government would not stand by as others sold freely in America but shut out U.S. manufacturers. It is therefore not surprising that the FCC took a first step in December 1986 and invited comments on whether there should be restrictions on the approval of equipment exported from countries that discriminated against American equipment.

18. "Pebereau Joue Quitte ou Double," *L'Expansion* (June 7–20, 1985), p. 73.

Thus the opportunity to enter the U.S. market is ultimately a double-edged sword, threatening to bring about a reduction of European and Japanese firms' own protected positions. It has the tendency to split the telecommunications industries of other countries. Strong and advanced manufacturers who can compete successfully in the American market and at home on the merits of their products could accept American entry in their home base, but weak firms in need of protectionism could have little to gain and much to lose from the lowering of the barriers.

Services Imports

Just as in the equipment market, deregulation of U.S. domestic telecommunications services gave foreign organizations new opportunities to enter the American market. Cable and Wireless established with Nynex a joint venture for fiber-optic transatlantic and transpacific cables. The liberalized environment makes it possible for European carriers to acquire American domestic long-distance carriers. Cable and Wireless owns TDX System Inc., an American discount long-distance carrier servicing business users. Likewise, France Cable et Radio, a subsidiary of the French DGT, in 1983 took a share in Argo Communications Corporation, a newly formed American interexchange, or long-distance, carrier that early on offered an ISDN-type service. The relative ease with which services can be offered in the United States contrasts strikingly with the barriers that prevent American carriers from even reaching international markets.

Cable and Wireless also attempted to acquire Pacnet Communications Corporation. Pacnet requested a data network identification code that would enable it to provide overseas customers with a U.S. resale packet switched network. Under the *Computer II* decision, Pacnet, as an enhanced service provider, would not have had to file with the FCC and could even have acquired satellite circuits from the Communications Satellite Corporation (Comsat) without authorization. Thus a PTT could set up its own unregulated distribution network in the United States. As a staff memorandum to the FCC concluded,

> It is fair to say that the ability of foreign telecommunication entities to enter the U.S. international telecommunications market is in large measure unprecedented and raises serious issues not presented by foreign entry into the U.S. domestic market. . . .
>
> In the U.S. international telecommunications market, an unregulated foreign enhanced service provider would have the ability to both prevent

> the entry of additional U.S. entities into the market for service between the U.S. and the home country of the foreign entity and to remove existing U.S. carriers competing in that sub-market, at least where the service involved is classified by the foreign country as a common carrier service to be provided by the telecommunications entity of the country. Such action by foreign entities would run directly counter to the U.S. policy of fostering increased competition in the provision of international telecommunications services.[19]

Although the Pacnet application was withdrawn, similar actions are a possibility. Argo provided long-distance service in the United States and also served as the sole connection for all American competitors to AT&T who wished to be routed to France. Just as in the case of the opening of the American market to European equipment sales, this potential of European service provision within the American domestic market, linked to a domestic monopoly position, raises issues of reciprocity of entry. It highlights again the problems inherent in coordinating a system of communication links when its two ends are controlled by fundamentally different concepts of the nature of telecommunications.

International Collaboration in Telecommunications

From the beginning, telecommunications have been highly internationalized. For a long time international organizations were used to shore up domestic arrangements and protect PTTs by creating welcome international restrictions. What started as technical collaboration across borders almost immediately became deeply involved in economic arrangements and the protective regulations of a cartel. This tradition goes back to the early period of postal systems when the checkered map of central Europe often permitted alternative routes and thus made intergovernmental agreements desirable for states in need of the postal revenue. The maintenance of stable international arrangements is a central policy concern for the postal-industrial complex. But times have been changing. Other international organizations have begun to disturb the established harmony, and private collaborative ventures also have affected the compartmentalization of national markets.

19. GAO, "FCC Needs to Monitor a Changing International Telecommunications Market," pp. 27–28.

The Traditionalist International Institutions

In 1865 several telegraph administrations founded the venerable International Telegraph Union (now the International Telecommunication Union, ITU). From the beginning the ITU was controlled by the major European powers. Not only were these countries at the forefront of telegraph technology and usage, but they also provided for themselves voting membership through the colonial telegraph administrations of their overseas colonies. In 1925 France, Great Britain, Italy, and Portugal all had seven votes in the ITU.

Technical coordination was only one aspect of the ITU's activities. The issue of international rate making, that is, of economic collaboration, was important from the beginning, and much time at ITU meetings was spent establishing uniform rates and agreeing upon the charges for coded messages.[20]

For years the United States regarded the ITU with benign neglect. It did not send delegates or observers to the International Telegraph Union and did not participate in the international consultative committees when they were formed in the 1920s. In the late 1920s the United States opposed the creation of the unified telecommunications ITU because it extended the potential for an international cartel. Following both world wars, the United States became more interested in international collaboration. This led to the 1947 Atlantic City conferences that reshaped international communications into arrangements that have lasted until today.

A majority of ITU members are against any form of liberalization. But the victories of the conservative majority would be hollow if the minority consists of the United States, the United Kingdom, and Japan, major telecommunications countries that may not abide by the recommendations.

Of particular importance in the telecommunications field is the International Telegraph and Telephone Consultative Committee, which has a subsidiary relationship with the ITU. The role of the CCITT is to harmonize operational, technical, and tariff issues of international telecommunications. It functions primarily through expert groups that deal with specific questions. It issues recommendations, but it has no enforcement power. It is not a treaty organization with binding resolutions. Instead, it functions as a de facto standards-setting organization, for which there is often a need. The emphasis on tidy standards was most appropriate in an

20. George A. Codding, Jr., and Anthony M. Rutkowski, *The International Telecommunication Union in a Changing World* (Dedham, Mass.: Artech House, 1982), p. 7.

era in telecommunications when technological change was relatively slow. In the present rapidly changing environment, however, standards can be used to establish artificial stability and to protect favored firms. CCITT recommendations can and do clash—not only with the liberalization of individual countries (as in the case of the Japanese VANs' ability to operate internationally), but also with other international agreements.

The European Community's Treaty of Rome provides for the elimination of restrictions in trade of goods and services among European countries. During the 1970s telex bureaus emerged in Britain to route telex messages from Europe to the United States through London (at a considerably cheaper rate than that charged by the European countries' PTTs for direct service). At that time CCITT recommendations prohibited such third-country traffic, and the PTTs sought to enforce them. The telex bureaus sued under the Rome Treaty and eventually won before the European Commission and the European High Court.

The European Conference of Postal and Telecommunications Administrations (CEPT) is another PTT organization. Established to represent the interests of twenty-six European countries, it harmonizes European positions for CCITT and ITU discussions.

Modernist International Institutions

Today telecommunications policy issues are addressed not only by the ITU, CCITT, and CEPT, but also by the OECD, the General Agreement on Tariffs and Trade (GATT), and the European Community. This is a reaction to the often narrow perspective of the PTTs in their own international bodies. Domestic conflicts in many advanced countries between the PTTs on the one hand and the ministries of economics or industry and of antimonopoly agencies on the other have been extended to the international level.

Yet one should not overestimate the divergence of interest. The ministries of industry, the OECD, and the EC primarily focus, not on services or on user interests, but on equipment issues. They are allied primarily with the "second" electronics industry rather than with service-industry users.

The OECD has taken a leading role in identifying and discussing the issue of transborder flows of data, privacy, and national sovereignty. With regard to the GATT, the United States has proposed to extend the GATT code to cover trade in services, including telecommunications services.

This was to match the GATT's liberal trade regime for goods and commodities, which did not apply to services.

For a long time telecommunications matters were outside the reach of the European Community and its commission. In June of 1983 the European Commission concluded that the fragmentation of European telecommunications into a nationally protected environment was an important element in Europe's falling behind the United States and Japan. This led to the formation of the European Strategic Program for Research in Information Technology (Esprit) development program, which excluded, however, telecommunications. In 1985 the Race program was added specifically for telecommunications, and Eureka was established in 1986.

The commission has pursued several cases against member states for discrimination against each other's equipment. It also has created links between firms in different countries, to dilute the notion of nationality, to strengthen Europeanism, and to encourage European high-technology development.

Private Collaborations

Even without EC subsidies numerous international joint ventures have been undertaken.[21] Olivetti owns a major part of the British firm Acorn Computers; Philips, besides its links with Siemens and AT&T, entered into joint ventures with Ericsson in Sweden and with Bull, Alcatel, and Thomson in France. In 1984 it took control of the German consumer electronics firm Grundig when that company had financial problems. Similarly, Thomson acquired in Germany the consumer electronics division of AEG-Telefunken and the consumer electronics firms Nordmende, Saba, and Dual. Siemens and ICL distribute Fujitsu computers under their labels. Siemens has a good number of U.S. ventures, including a joint one with Corning Glass for fiber optics. CGE and the Belgian holding company SGB acquired a majority share in the Belgian electronics company ACEC. SGB is also a part owner of the Alcatel venture. Alcatel, Siemens, Plessey, and Italtel have a joint research effort for telecommunications switches and transmission.

A major cooperative effort for the development of semiconductor components is the $600 million "Megaproject" of Siemens and Philips, to which the German and the Dutch governments have contributed about

21. Jonathan David Aronson and Peter F. Cowhey, *When Countries Talk: International Trade in Telecommunications Services* (Ballinger, 1988).

$100 million each. Another project has joined Siemens with ICL of Great Britain and Bull of France.

International joint ventures are often difficult. Besides the obstacle of incompatible products, they must overcome problems of selecting the physical location of a project, the language to be used, the composition of management, and labor sensitivities. Siemens, ICL, and Bull, in their collaborative effort to develop fifth-generation supercomputer technology, had an R&D lab in Germany, a French director, and English as the operational language. For the same reasons that firms like to see duplication of efforts reduced by joint ventures, trade unions are suspicious of such efforts. They are fearful of employment reduction and of the ability to deflect the effects of strikes in one country.

Because of difficulties in cooperation, several joint projects have collapsed. In the mid-1970s Unidata, a data processing venture of Philips, Bull, and Siemens, fell apart after bitter disputes about the French government's alleged overaggressive involvement in its affairs.

Multinational cooperation and mergers can also be hampered by some countries' promotion of high-technology companies as "national champions," making it difficult to have these firms as junior partners in a collaborative effort, as is often necessary. This was one of the factors that prevented the British firm GEC from acquiring its German counterpart AEG-Telefunken when the latter was having financial problems.

Joint ventures increase the importance of standardization. In March of 1984 the twelve leading European computer and communications firms agreed to draft common standards for the interconnection of their products. In 1985 six European computer manufacturers—STC, Nixdorf, Siemens, Olivetti, Philips, and Bull—decided to base their future computer systems on AT&T's Unix operating system and to develop software for such uses. The following year they agreed to collaborate on Open Systems Interconnection (OSI) standards. Membership was open to other European firms, but American and Japanese companies were pointedly excluded.

Outlook

Communications are becoming too varied, complex, and significant for one organization, together with a handful of favored suppliers, to cover the entire field well. The old arrangements may have been effective for earlier and simpler times, but circumstances change and so must institutions. Some contend that all communications flows should pass through one superpipe controlled by a single organization. This notion, however,

is hard to entertain on technical, economic, or political grounds in the information age and in societies operating largely on the market principle, except by reference to the present balance of power. But this condition is not likely to prevail. The traditional arrangement is being challenged from a multitude of centrifugal forces. Demand conditions are changing because the information-based service sector is growing. Technology is changing and merging and propelling the telecommunications industry into the broader electronics sector, with less cozy relations with the PTTs, more competition, and weaker protection. Moreover, the greatly increased volume of international transactions creates pressures of interjurisdictional competition. If one country's PTT exercises restrictive policies, its firms may be disadvantaged internationally, and foreign firms may choose not to locate in that country.

These forces, while having different manifestations in each developed country, are not peculiar to any of them. Consequently, the breakdown of the system of domestic monopoly and international cartel will continue and spread to other industrialized countries.

This does not mean that PTTs will cease to exist or to predominate. They will still function as the core of telecommunications service provision. And indeed, as has been argued above, their role may actually increase through vertical integration into equipment supply. But the exclusivity of their monopoly will become a thing of the past, and they will have to contend with domestic and international rivals. Such rivalry is likely to be the strongest for advanced services and to reach basic telephony later. As this process takes place, the telecommunications network changes from a hierarchical model built on the concept of a star (with PTT control at its center) to one of a matrix (with numerous connecting points between networks that partly collaborate and partly compete, and with software-defined, value-added networks superimposed). Such a configuration cannot be contained within the nation-state. It will require new forms of international cooperation. Because the traditional institutions are not ready to lead but rather will retard this development, new arrangements will emerge. There will be greater involvement of non-PTT international institutions and greater bilateralism. As in air transport, a loose international regime with numerous and specific bilateral agreements is likely to emerge as a transitory system.

Such a new network system will considerably lower terminal and central office equipment prices and reduce the profitability of the postal-industrial coalition. The equipment market will become much more open to foreign manufacturers as well as to members of the "second" electronics industry.

Traditional telecommunications firms will accelerate their rate of innovation or lose out; equipment itself will become unbundled, modular, and specialized so that multiple suppliers can seek their niches. The conventional wisdom that there is room for only six to eight switch manufacturers worldwide will prove as nearsighted as the "mainframe thinking" in the computer industry of the 1960s. Over time, developments will push telecommunications rates toward cost, particularly in the highly profitable international services. These prices will be unstable, since the excess capacity will lead to periodic price wars, and they will be de-averaged among routes of different traffic density and competitiveness.

Once the notions of the traditional network are breached in some respects, the dynamic process of change will be hard to contain; each step of liberalization will lead to a challenge of the next. In international communications the absence of an effective centralized regulatory mechanism leads one to expect the breakdown to be fastest. The growing complexity of the system will make it increasingly difficult to formulate consistent rules. And these rules are not likely to be enforceable. The subject of the regulation—streams of electrons and photons and patterns of signals that constitute information—are so elusive in physical and conceptual terms, and so fast and distance-insensitive, that a regulatory mechanism, to be effective, must be draconian, and for that the traditional system has neither the will nor the political support. Regulatory oversight under which networks and users will interrelate is still needed, but with less control than in the past.

These developments are inevitable, not because they lead necessarily to a superior result, but because the traditional centralized and protectionist network and its international extension into a cartel is an anomaly, though one almost too familiar to be noticed as such. As long as the economic system of Western industrialized democracies is based on markets supplied by private firms, the exclusion of major economic parties from a major field is an unstable affair at best. It is hard to keep a moat between telecommunications and the rest of the economy. To differentiate it as an infrastructure service is conceptually too vague to be useful. Telecommunications, unlike a lighthouse, is not a public good in the classic sense: users can be excluded, and charges can be assessed, breaching some of the criteria for a public good.

The traditional system was international in the sense of a collaboration on the level of government organizations. It held together well because of a similarity in perspective—the values of engineering and bureaucracy—and because of a common interest to protect the domestic arrange-

ments. For a long time national PTT administrations participated almost joyfully in the international sphere because they could return home with an international agreement that would buttress their domestic position. But in the age of satellites, internationalism has become a threat, since it is more and more difficult to reconcile the traditional arrangements with it. And there is much more change to come. For example, we still think of international telecommunications as a federation of networks that are legally, operationally, and territorially based on the nation-state. But the breakdown of the system will not stop at national borders. In the long run telecommunications networks will transcend the territorial concept, and the notion of each country having control over electronic communications may become archaic in the same sense that national control over the spoken and later the written word became largely outmoded in open societies.

As this process of normalization takes place, those identified with the traditional system, who are rightly proud of its technical and social accomplishments, will defend it as best as they can. The transition will therefore be a difficult one. The United States is at the leading edge of the long-term change in international telecommunications—no place to make many friends. Hence one should expect the future to be full of discord as the telecommunications of the developed world move reluctantly toward normalcy.