Liberalization of Telecommunications in the U.S., Europe and Japan

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I. THE TREND TOWARDS POLICY REFORM

A. Liberalization

In the US, Europe and Japan, telecommunications policy debates have centered on liberalization. Is competition sustainable? Is it advisable? Who wins? Who loses? Liberalization means entry into previously monopolized markets, and the lowering of restrictions. For telecommunications equipment, the opening involves the adoption of standards which do not favor any single or group of suppliers, simple procedures for type approvals, and non-discriminatory procurement. For infrastructure, liberalization includes the opening, to new service providers, of already established markets such as long-distance telephony and of new services such as cellular telephony. For computer-enhanced value-added services, it means access to the main network and central office functions.

Liberalization should not be confused with deregulation. Deregulation is a reduction in government-imposed constraints on the behavior of firms. It is also used to mean a reduction in red tape and government involvement. It does not necessarily mean a diverse market. One may have a deregulated monopoly, or, conversely, a tightly regulated multi-carrier system. The experiences in the U.S. and the U.K., two of the most liberalized markets, reveal that more rather than less regulation emerged, at least initially, after markets were opened.

B. Devolution

Devolution is a policy of dismantling a single monolithic structure into several units. On one level, this has occurred wherever the postal and the telecommunications authorities were split. A more significant reorganization is the devolution within telecommunications organizations, along lines of functional operations or geography.

The prime example of devolution is the divestiture of AT&T in America into regional and long distance operations. So far, no other country has pursued devolution, but it is under consideration in Japan. Devolution is not a necessary condition for either liberalization or privatization, although it tries to address the problems of competitive barriers to new entrants. Devolution serves the long term policy objective of isolating market segments which may at some point be subject to competition. Devolution can also be part of liberalization, where some segments of the market are opened up to competitors, and others are not.

C. Consolidation

The opposite strategy to devolution is consolidation. Consolidation has occurred where a country's telecommunications were divided for various historical reasons along geographic or functional lines. The rationale for consolidation is to capture the economies of scale and scope of a single monopolist.

In Denmark, the country's four regional service providers were merged with the national PTT that provided long-distance service to create a single operator, TeleDanmark. Similar plans to create national integrated "super-carriers" were advanced in Italy and Portugal. The East German network was absorbed into the West German Deutsche Bundespost Telekom system after unification.

Consolidation has also been a major trend in the equipment industry. With the rising costs of research and development, especially for digital switch software, the number of major manufacturers has been shrinking through mergers, and licensing arrangements.

D. Deregulation

Deregulation is an imprecise concept and is often used as a synonym for liberalization, that is, for a lowering of entry barriers or other restrictions. More basically, it means a reduction in government-set constraints. As mentioned, deregulation can be at odds with liberalization: the entry of new competitors tends to complicate things much more than an outright monopoly and can lead to a more extensive set of rules. For example, the need to keep an interoperating system functioning requires access and interconnection rules, such as Open Network Provision in Europe and Open Network Architecture in the U.S..

Typically, full deregulation is not an early option, because of the unequal power of competitors on the one hand, and the politics of protecting the monopoly system, on the other. Also, governments are typically unwilling to cede all control over the vital telecommunications infrastructure.

E. Corporatization

Corporatization is the transformation of the PTT into a structure semi-autonomous from government, which may still be state owned, but controls its own managerial and administrative functions. The monopoly status is not touched by corporatization as such, though once the close link to the government is severed, a process is set in

motion that makes further changes more likely. Sometimes the corporatized entity is described as a "private" firm, in the sense that it may be organized under private law provisions, which determines its status under, for example, contract and labor law. But that description confuses legal detail with the reality of control, which is still governmental. In other instances, a minority or shares may be issued to the public, though control is still retained by the state.

Corporatization may be a first step on the road to privatization. It is often sought by the PTOs themselves, who need greater managerial and budgetary autonomy to pursue long range investment projects and the ability to raise investment capital outside of government borrowing ceilings. Corporatization may also derive from a public desire to inject new life into sleepy monopoly bureaucracies.

F. **Privatization**

Privatization involves the government sale of shares in the PTT to private investors. However, ownership need not affect the monopoly status. In the United States, AT&T was private and a near monopoly for a very long period. In Canada, private regional monopolies exist, and long distance competition has only recently been introduced. Most European privatizations are only partial. In the 1980s, the Italian government sold shares totalling 40 percent of the Italian monopoly local carrier SIP. It also sold 42 percent of SIP's parent company STET, but retained overall control. In Spain, the government sold 65 percent of Telefónica, yet still controlled the appointment of its chief executive and top management. In Denmark, the state sold 49 percent of the shares in the newly created TeleDanmark, but a large block was purchased by the state pension fund. Non-telecommunications concerns have often intruded into privatization decisions. Sweden put the partial privatization of Televerket on hold until the Swedish stock market recovered from a recession. In the U.K., Conservatives pressed for the sale of the remaining shares of British Telecom before a general election which the Labour Party might have won.

G. **Transnationalization**

Transnationalization is a strategy of large and advanced PTOs, to expand beyond national markets. As these PTOs achieved universal telephone penetration, they expanded their sights geographically. This strategy has been pursued through acquisitions, international service offerings (such as network software or management) and by establishing foreign subsidiaries. British Telecom, for example, purchased a leading U.S. value-added service provider (Tymnet) and a large stake in a major U.S. carrier (MCI), and established a firm to serve the network management

needs of large multinational users (Syncordia). France Télécom acquired part of the Mexican telecommunications monopoly, TelMex, and entered the U.K. by providing packet-switched network service in partnership with the London Underground. Spain's Telefónica sought to leverage its linguistic affinities with Latin America through investments in the national carriers in Argentina, Venezuela and Chile. The U.K.'s Cable & Wireless has long been a transnational carrier, providing local service in Hong Kong and the Caribbean and international services, with the strategy of linking the world's major financial centers. It participated in fiber optic cable projects crossing the Atlantic, Pacific and North America, and established with US Sprint a global virtual private network service.

U.S. firms, specifically the Bell companies, have also sought to transnationalize their operations. Nynex provides telephone service in Gibraltar. Bell Atlantic and Ameritech acquired Telecom New Zealand. Southwestern Bell bought a stake in Mexico's TelMex. US West sought to join a coalition providing trans-Siberian service. Several U.S. companies were involved in cellular services in Western and Eastern Europe, and won cable television franchises in Britain.

H. **International Alliances**

International alliances offer another method for PTOs to expand their markets. Across Europe, most PTOs have entered joint ventures and service consortia. Such partnerships allow PTOs to gain some access to heavily monopolized markets where they are not allowed to compete with the local operator. Alliances also spread the risk of new service ventures across multiple participants. This has traditionally been the case with consortia such as Intelsat and Eutelsat for satellites and the TATs for transoceanic cable. The participation of multiple PTOs ensures a larger target market and customer base for new services, and helps PTOs to acquire expertise, and provides a defense against the entry of established foreign carriers into domestic markets. For example, competition between France Télécom and DBP Telekom is less likely if they are engaged in multiple joint ventures and alliances.

I. **Harmonization**

Harmonization is the coordination of telecommunications policy among countries. Harmonization may include the creation of common standards for equipment or the development of common policies for provision of service. Harmonization can be managed through regional bodies such as the European Commission and multilateral groups such as the International Telecommunications Union and its coordinating body (Consultative Committee on Telephone and Telegraph). CCITT, as well as through

bilateral negotiations. It may lower barriers to entry in markets by providing a single set of regulations. But such rules may also be set in a restrictive fashion, such as a cartel-like prevention of certain forms of competition to monopolies.

II. REVIEWING THE RECORD OF LIBERALIZATION IN THE U.S.

What have been the effects of liberalization? Many of its benefits were asserted as a matter of theoretical analysis or ideological conviction rather than proven with data or evidence. But by now we have had more time and data. Let us therefore look at some of the impacts. The information is for the United States.

A. Universality

Partly because of subsidized "lifeline" service to needy individuals and other protections, and partly due to the low demand elasticity for telephone service with respect to price, overall telephone penetration did not decline with liberalization, but actually increased, from 91.4% in 1983 to 93.6% in 1991.[1] Though the rate of change for penetration has slowed[2], one would expect an asymptotic leveling off of growth rates as one approaches 100%. For the middle class ($30,000/yr household income) penetration was 98% and higher.[3] For the poor (e.g., income of $5,000 - 7,500), it rose from 82.7% to 84.9% in 1989 before sliding back to 82.8% in 1991. (The official poverty line for a household of 4 was $11,012 in 1987).

Nor do rural telephone subscribers seem to have been pushed off the network. Rural U.S. states such as Iowa, Nebraska and North Dakota have telephone penetration well above the national average (95.6%, 96.0%, and 96.6%, compared to the 93.6% national average as of 1991). On average, 95% of all farms have telephones, according to the Rural Electrification Administration. Telephone rates for rural areas are often (but not always) lower than in urban areas, because flat rate service is cheaper for small exchanges, because of various subsidy mechanisms, and because of lower overheads.

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[1] FCC Industry Analysis Division, 1991, *Trends in Telephone Service*, Washington, D.C., p. 3, Table 1.

[2] Kimmelman and Cooper, 1991, p. 384, figure 9.10.

[3] FCC Industry Analysis Division, *Monitoring Report, CC Docket No. 87-339, July 1991*, p. 39.

B. Prices

One of the major questions raised was the likely impact of on residential subscribers. A tripling of rates was frequently predicted. But the reality has been different. Nationwide since the AT&T divestiture, the Consumer Price Index (CPI) for all telephone service rose just over half as fast as the CPI for all goods and services in the same period. Telephone service climbed from 99.8 in 1983 to 119.5 in 1991, a rise of 19.7%, while the CPI for all goods and services during that time rose about 34%.[4] Local telephone service increased from 98.3 in 1983 to 153.6 in 1991, an increase of 56.2%. During the same period, interstate toll service fell from 101.3 to 67.5, a decline of 33%.

C. Equity

The benefits of liberalization and divestiture were not shared equally. Among residential subscribers, the extent of benefits enjoyed as a result of telephone repricing correlated positively with income. Crandall[5] calculating both the direct and indirect effects of these shifting patterns in telephone prices, concluded that the overall effect has been "mildly regressive." By assigning values to the indirect benefits when business users enjoy lower telecommunications costs, he finds that the lowest income households paid approximately $16.00 more per year due to telephone service repricing, while the wealthiest saved close to $15.00 per year.

D. Service Quality and Reliability

Another projected impact of competition was a decline in service quality, and a number of well-publicized recent incidents have raised this issue again. But we should recognize that there never was a golden age of quality. In the U.S. in the late 1960s and early 1970s, several major cities experienced serious service problems. The *New York Times*, in an editorial in August 1969, called telephone service "miserable," "wretched," and "the worst in the memory of older New Yorkers..."[6]

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4 FCC Industry Analysis Bureau, *Monitoring Report, CC Docket No. 87-339, July 1991.*

5 Crandall, 1991, *supra*, pp. 112-115.

6 Richard Stannard, "Integrating Quality of Service Standards with Incentive Regulation," New York PSC, speech given to the NARUC Regulatory Workshop, Michigan State University, August 1989.

The FCC's measures for national quality trends show that dial-tone delay has been slightly improved; that technical transmission quality had generally risen; that the labor-intensive on-time service performance on orders for residences have suffered a steady if minor decay since 1987; and that intraLATA calls have maintained an admirably high level of call completions (over 99.5%), while interLATA completion rates have climbed steadily since 1986.[7] As for customer satisfaction, large businesses seem to have benefitted the most, rising from 91.5% of these customers reporting satisfaction in 1985 to 93.5% in 1989, while small businesses in the same period moved from 92.25% to 93.5% and residential consumers reporting satisfaction rates of 93.5% in 1985 to 94% four-and-one-half years later.[8]

Long-distance service seems to be improved in sound quality and reduced blockage. 13 long-distance firms sampled by the Florida PSC perform at a much higher level than the required 90% call completion rate. AT&T, despite its economies of scale and experience, was ranked only fourth, but the differences are really quite small.

E. **Productivity**

Productivity measures for the American telecommunications sector throughout the 1980s show steady improvement. For example, labor productivity for the seven Baby Bells, when measured in terms of lines per employee, show a cumulative gain from 1983 to 1988 of 34.9%.[9] Annual average total factor productivity (TFP) growth between 1971 and 1983 in U.S. telecommunications, using total deflated real revenues for output, was estimated as 3.8%. Following divestiture (1984-1988), the Bell System's TFP growth
slowed to 3.13, while the TFP growth for the total sector grew at 3.94.[10]

F. **Research and Development**

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[7] See Jonathan M. Kraushaar, 1991, "Service Quality," Cole, p. 256. The FCC has adopted this method on the premise that the magnitude of change in service quality as it is reported may be affected by extraneous factors, while the important variable is the nature or direction of the change.

[8] *Ibid*, based on FCC, Common Carrier Bureau, "Update on Quality of Service for the Bell Operating Companies," June 1990.

[9] Bolter, Walter G. & James W. McConnaughey, "Innovation and New Services," in Cole, p. 295.

[10] Crandall, Robert W. & Jonathan Galst, 1991, "Productivity Growth in the U.S. Telecommunications Sector: The Impact of the AT&T Divestiture," unpublished paper, The Brookings Institution, Table 1.

Liberalization also raised the fear about a technological decline in that AT&T's research arm Bell Labs might be curtailed by profit-minded corporate management. But the opposite occurred. Total R&D employment rose from 24,100 in 1981 to 33,500 in 1985. (AT&T and the regionals' joint R&D firm, Bellcore, combined.)[11] By 1988, the regional companies were adding their own laboratories, and total R&D employment rose to an estimated 35,600. According to a 1991 *Business Week* survey, the telecommunications industry's average R&D spending per employee for the years 1986-1990 was ($9,858.20), or when figured as a percentage of 1990 sales 3.6%, and outpaced the all-industry figures in those categories ($7053.5 and 3.4%, respectively). Bell Lab's R&D budget increased from $2 bil. to $2.7 bil., of which about 10% went to basic research.[12]

G. **Long Distance Competition**

AT&T's long-distance rates were reduced about 45% in real terms between 1984 and 1991.[13] (However, the end-user line charge partly offset this saving.) As a percentage of all users, however, AT&T's share is higher because it has more small subscribers. If short-haul interexchange service is included in the market definition (i.e. including the local exchange companies regional (intra-LATA) service, AT&T share is about 60%.

AT&T's volume increased 57.9%, but that of its competitors rose almost 400% from their much smaller base. Americans make substantially more phone calls per capita (1700) than users in other countries — two and three times as many in 1988 as the British (800), Japanese (550), Germans (500) and French (400).

The number of competitors increased from 42 in 1982 to 451 in 1987 to 611 in 1990, before backing down to 597 in 1991.[14] Of these, most are only resellers. MCI, the strongest of AT&T's rivals, had grown to a $6.4 billion company in 1989 with an ever-increasing line of services. Its revenues grew after divestiture at 27% a year. US Sprint successfully completed a $3 billion network, and got 40% of the large

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[11] Noll, A. Michael, 1987, "The Effects of Divestiture on Telecommunications Research," Journal of Communications, Vol. 37 no. 1, pp.73-80.

[12] Labich, op. cit.

[13] FCC 1 AD, Monitoring Rpt, July 1991, p.154

[14] FCC Industry Analysis Division, 1991, *Trends in Telephone Service*, p. 29.

contract for the federal network, FTS-2000.

H. Local Competition

Local competition for business customers is emerging principally through fiber optic-based metropolitan area networks (MANs), also knows as alternative local telecommunications systems (ALTS), alternative access vendors (AAVs), or competitive access providers (CAPs). ALTs revenues have been growing at a rate of about 22% per year. Residential competition in the local loop is likely to emerge from access based on cable television infrastructure, and from radio-based and micro-cellular carriers.

I. Equipment Prices

The US market network equipment was fairly closed in the past. The vast Bell system and all of its customers -- comprising 80% of the total market -- were foreclosed to other suppliers in favor of AT&T's manufacturing subsidiary, Western Electric. Because of the divestiture, the BOCs no longer have any incentive to increase AT&T profits, since none of those profits are returned to the BOCs. Equipment prices fell as the BOCs and end users gained the freedom to go shopping at many other suppliers. AT&T's national market share for central office switches dropped from 70% in 1983 to 51% in 1990, with Northern Telecom reaching 40%.

J. Trade

The flip side of liberalization of equipment is that US firms lost market share. The U.S. trade balance for telecommunications equipment, which had been positive although shrinking in 1981 and 1982, became a $1.15 billion deficit in 1984, a $2.3 billion deficit by 1989, though it improved slightly to $2.1 billion in 1991. Official trade statistics suggest a small improvement to $2.0 billion in 1992. Imports increased from $1.6 billion in 1983 to $4.7 billion in 1991, while exports grew markedly from $.8 billion to over $3.3 billion, a four-fold increase.[15] The amount of foreign equipment imported continued to be a dominant factor, in particular from Asian suppliers; in 1992, 52% of total telecommunications imports were from Asian

[15] U.S. Department of Commerce, U.S. Industrial Outlook, 1993.

suppliers, with Japan accounting for about a third.[16] All these tendencies created an unanticipated problem for U.S. foreign trade which is likely to be a major political issue for U.S. policy makers.

K. Employment

The number of employees at AT&T and its successor companies fell. By 1990, AT&T had reduced its work force by 90,000 jobs, 25,000 of which were cut in 1989 alone, from their pre-divestiture total of about 370,000. The RHCs dropped from 583,332 employees at divestiture to 542,170 by 1991, a loss of 41,162 jobs, or about 7%. The most dramatic RHC cuts were made in 1984 and 1985 (2.8% and 3.1%, respectively). In 1990 and 1991, RHC cutbacks continued,[17] and these trends are likely to go on.

Many of the employment losses were in manufacturing and are part of the more general decline of US-based electronics manufacturing. On the other hand, if equipment is defined more broadly to include also computers, "smart" office equipment, etc., the number of jobs has increased as the total pie becomes larger.

L. Conclusion On Liberalization In The US

Based on this admittedly partial evidence, one may conclude that the divestiture and liberalization have not been as bad as many anticipated, and as many earnestly persist in believing. The system proved itself capable of adjusting to major and rapid change. Some of the negative fall-out was moderated by regulatory actions. In other cases, offsetting economic adjustments took place.

Although the benefits have not been shared equally, the worst fears were not realized, and the U.S. telecommunications sector is clearly more dynamic and innovative than it had been under the old monopoly. Thus, concern with impending calamities due to liberalization should cease to obsessively preoccupy the policy agenda, and make room for new issues which require thought and attention.

III. LIBERALIZATION IN OTHER COUNTRIES.

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[16] *Ibid.*

[17] Marianne G. Bye, *Telecommunications Services Industry Follow-up: Regional Holding Companies Third-Quarter 1991 Results; 1984-91 Quarterly Data Sheets*. New York: Shearson Lehman Brothers, November 19, 1991.

While much of the developed world embraced liberalization in the 1980s, in the area of *market structure* such change had its limits. An infrastructure monopoly still predominates almost everywhere. Basically, only the US, Japan, the UK, Sweden, and New Zealand permit alternative physical non-mobile networks. Almost everywhere the monopoly over voice service is still strong, and even resale is rarely permitted.

The actual reduction of monopoly often tends to be exaggerated. A Danish political agreement illustrates the doublespeak: "There will be competition within all spheres of telecommunications in the next few years, apart from telex, ordinary telephony, radio-based mobile services, satellite services, the infrastructure and the use of the telecommunications network for broadcasting radio and television programmes."[18] In other words, "everything" is liberalized, except for the remaining 95 percent. Similarly, though EC laws instituted in principle the right to offer value-added services in any country, the details in many countries tended to be restrictive.

Another limit on liberalization is the pace of its actual implementation. After eight years in the U.K. market, Mercury has under 3 percent total market share and its core business remains serving firms in London's City as a second source for data transmission capacity, and the carriage of trunk calls for businesses. Its residential service failed to gain even one percent of the market.[19] Where no entrenched incumbent existed, competition is better developed. For example, BT's competitor in the cellular service duopoly, Racal Vodafone, holds over 50 percent market share. Because the value of a headstart, the launch of second cellular carriers in competition with the national PTO was delayed in Germany, Italy, and Spain. The EC has likewise suffered numerous delays in its efforts to implement liberalized rules for service provision. Thus, where competition with a monopoly exists, it is often a David versus Goliath contest.[20] In such a situation, deregulation strengthened the PTO (public telecommunications organizations), because restrictions on them were lifted while competition was still embryonic.

In the equipment market, the liberalization of procurement sources actually enhanced the power of the monopoly PTOs. By opening the public procurement process to additional vendors, PTOs are in a better bargaining position to obtain favorable contract terms. They are no longer tied in to the technology developed by national champion equipment firms. Yet

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[18] Danish Ministry of Communications, 1990, "Political Agreement on Telecommunications Structure," Press Release, 22 June.

[19] Oftel, 1991, Annual Report, London: Her Majesty's Stationery Office.

[20] Kramer, Richard, 1991, A Faith That Divides; Competition Policy in European Telecommunications, Philadelphia, PA: University of Pennsylvania, Annenberg School for Communication.

the larger PTOs can still dictate technical specifications to manufacturers. Only the liberalization of terminal equipment has reduced PTO powers, but such liberalization was largely an accommodation to reality. The market had already liberalized itself by numerous consumers simply but illegally buying cheaper and more varied equipment outside the official PTT distribution.

Corporatization substituted managerial and financial autonomy for the direct governmental operational control of PTOs and the political accountability that came with it. At the same time, the government ministries which assumed regulatory power tended to be ineffective. These ministries have only a handful of experts to confront the huge telephone organizations.

Similarly, privatization has strengthened PTOs. The presence of shareholders to which the PTO must answer has added new incentives for improved performance which were largely absent in the past. Privatization also curbed some market liberalization by creating a wide constituency of shareholders who oppose sweeping reforms. This used to be the case in the US in the past, and is now with Telefonica and British Telecom. Similarly, NTT's remaining shares have not been sold by the government in order not to depress the share price and hence hurt millions of investors.

Several of the PTOs are becoming far-flung global organizations, involved in numerous activities that cease to be transparent to governments. Many PTOs have also formed alliances among themselves, often as a market sharing arrangement.

Cooperation is also manifest in policy harmonization, which also often leads to a continuation of the traditional stability. While harmonization may eliminate restrictive national rules, it is just as likely to be used to prevent competitive behavior by establishing a policy cartel.

What have the reforms meant to the traditional telecommunications organizations? PTOs enjoy a dominant position in the market. They have been energized. Their competitors are tiny, regulatory authorities are frequently underperforming, and their role is enhanced by national industrial policies. (This is not to say that some users and competitors have not also benefitted. Telecommunications are a growth field rather than a zero-sum game.)

But will the present dominance last? Given the dynamic forces of a liberalized telecommunications market, this is unlikely. In time, PTO market share will decline as their competitors will grow in size and gain interconnection right; presently unprepared regulators will become more effective; the PTO's national role in industrial development policies will be shared with other firms; PTO cartel collaboration will change to more head-to-head competition. New domestic entrants will seek opportunities in specialized and general markets, as will foreign entrants, some of them PTOs themselves. Liberalization at home will become critical to PTOs seeking reciprocal market access abroad. Other entrants will be specialized carriers, such as cellular companies, cable TV providers, and VAN resellers.

The notion of the single territorially defined carrier for an entire country's electronic information flows is not sustainable in the long run. The strategies followed in the 1980s and 1990s have set forces in motion that will in time assert themselves. What we are witnessing today is the golden age of the traditional organization, but it will not last, as it did not in the United States.

IV. ASSUMING THIS TREND TOWARD COMPETITION CONTINUES WHERE WILL IT LEAVE US?

The conventional scenario for the evolution of telecommunications, offered by traditional state monopoly carriers around the world as their vision of the future was the *integrated single superpipe* merging all communications links into a single conduit controlled by themselves, and interconnected internationally with similar territorially exclusive superpipes. This scenario of technological integration took no account of the simultaneous liberalization that was taking place, first in the U.S. and now increasingly in other countries, and which was accompanied by considerable organizational centrifugalism. Instead of consolidating, the network environment kept diversifying.

In contrast to the *integrated single superpipe*, the various physical network elements become linked with each other through various interconnection arrangements, and form what can be described as the "network of networks". Yet this is not the end of the story. Competition begets diversity; diversity begets complexity; and complexity leads to efforts at simplification. Thus, how will the actual user of telecommunications handle this balkanized environment that is so totally different and so much more complex than the technologists' model of the single superpipe?

The most promising way of putting together the various bits and pieces of networks and services is for a new category of 'systems integrators' to emerge which provide the end user (corporate, governmental, affinity groups) with access to a variety of services, in a one-stop fashion. These specialized integrators might typically assemble packages of various types of services and equipment, etc, and customize these packages to the specific requirements of their customers. They could operate a least-cost-routing system, switching users around from carrier to carrier, depending on the best deal available for a given time and route.

Systems integrators are similar to general contractors in construction projects, to travel packagers, insurance agents, or to computer service firms. The characteristic of "pure" systems integrators -- for there will be various hybrids -- is that they do not own or operate the various sub-production activities but rather select optimal elements in terms of price and performance, package them together, manage the bundles, and offer it to the customer on a one-stop basis. They relieve customers from the responsibility of integration for which expertise is required. To these customers, the identity of the underlying carriers and their

technology might be unknown and transparent as transmission becomes a commodity.

In head-to-head competition between a common carrier and a private contract carrier or systems integrator, the former is at an inherent disadvantage:

1. A common carrier cannot use differentiated pricing due to its non-discrimination obligation and because it cannot prevent arbitrage. Non-common carriers' rivals can offer services to some customers at a low enough price to induce them to sign up, and use their contribution to revenues to underprice a common carrier for low-elasticity customers.

2. A common carrier must serve a contract carrier or systems integrator, but not vice-versa. There is no reciprocity. Competitors can use valuable parts of a common carriers operations, but need not share their own unique features.

3. A common carrier cannot pick customers.

4. A common carrier cannot manage the competition among its customers and benefit from it.

5. In putting together a service package, the systems integrator can pick-and-choose among the lowest-price component providers, while the common carrier is likely to offer only its own.

6. Competition for transmission and other services will lower their price for systems integrators to marginal cost, which is likely to be lower than the average cost for both common and contract carriers of providing it.

As a result, a systems integrator may provide services more cheaply, even though they use the carriers' underlying transmission facilities!

Today, systems integrators exist only for large customers and customer groups. But tomorrow things may be quite different. The additional step would be for systems integrators to emerge that put together individualized networks for personal use, or *personal* networks, and after them directly to endusers. This means individually tailored "virtual" network arrangements that serve individualized communications needs and providing access to frequent personal and business contacts, data sources, transaction programs, video and audio publishers, data processing and storage, bulletin boards, and personal information screening.

As these systems integrator-provided networks develop, they access and interconnect into each other and form a complex interconnected whole sprawling across carriers, service providers, and national frontiers. The telecommunications environment evolves from

the"network of networks", in which carriers interconnect, to a "system of systems", in which systems integrators link up with each other.

V. WHAT WILL HAPPEN TO TRADITIONAL REGULATION?

The structure of telecommunications, as far as endusers are concerned, will change significantly. Instead of dealing with *carriers*, they will transact with *systems integrators*. In such an environment, what will happen to traditional regulation? How are consumer protection and universal service affected? What safeguards do we need to establish? Can one expect the future network environment "system of systems" to be totally self-regulating, with no role for government? Will liberalization lead to libertarianism in telecommunications?

Regulation had been essential to the old system, partly to protect against users monopoly, partly to protect the monopoly itself. In telecommunications, regulation by government existed partly to effect the balance of power between huge monopoly suppliers on the one hand, and small and technically ignorant users on the other hand. It inserted the political and administrative process to alter unconstrained market outcomes which might negatively affect consumers and competitors. In return, the dominant carriers received protection from competition. Even where competition emerged with rival carriers emerging, customers still had no expertise in dealing with a complex set of services and products.

In a system of systems, on the other hand, the imbalance changes drastically. Now, systems integrators, competing with each other for customers, act as these users' agents toward carriers. They can protect users against carriers' under-performance and power, and get them the best deal. This should resolve many traditional problems of price, quality, market power, security, even privacy. Business communications should be more effective than ever. Technological innovation is likely to be accelerated by knowledgeable buyers and marketers of services. Thus, assuming that users have a choice among systems integrators and that systems integrators have a choice among non-colluding suppliers of underlying services, the need for government intervention declines drastically. Direct regulation could often be transformed into standby alertness.

The emerging systems of systems will exert competitive pressures on cost and therefore on many prices, thus making telecommunications more affordable to some. But, it will be impossible to maintain the traditional redistributive system of generating subsidies and transferring them internally within the same carrier from one category of users to another category. Several things will disrupt this arrangement. In a network of competing carriers, an internal redistribution is not sustainable once other carriers without redistributive burdens target the users whose price is above cost as the most likely customers.

If one wants to support some categories of service or users such as rural America or the poor -- either for reasons of social and regional policy, or for the positive externalities their participation offers to others who can reach them -- it is still possible to do so, only in different ways. One alternative mechanism might draw on general government revenue or on specialized communications charges such as a communications value-added tax. The moneys raised might go to a "universal service fund" which would be used to support certain network providers or categories of users. This charge would replace the present opaque system and would make it transparent and accountable. It would also uncouple the discussion of optimal industry structure from those of optimal social policy.

The economic rationale behind the tension between the integrative and pluralistic forces is most pronounced on the front where they intersect: the rules of interconnection of the multiple hardware and software sub-networks and their access into the integrated whole. As various discrete networks grow, they must inter-operate in terms of technical standards, protocols, and boundaries. Yet interconnectivity is not normally granted by incumbent firms. That is the lesson of decades of American experience. Regulatory requirements such as open network architecture, comparably efficient interconnection, or collocation were part of the evolution towards competition. In effect, these provisions regulated in order to deregulate.

The system of systems works as long as it is competitive in each of its stages, or as long as regulation establishes non-discrimination. However, in an international setting neither of these conditions is likely to be met. Most countries lag the U.S. and Japan in the evolution of networks. The traditional monopoly carrier is almost always firmly entrenched, and operating in all stages of communications. In consequence, systems integrators cannot truly compete against these governmental or the PTOs in systems integration, except in market niches. This might be considered to be an internal issue for these countries, except that it has a global anti-competitive impact. This is because some of these PTOs are pursuing international systems integration themselves, while at the same time holding gate-keeper powers over entry into their own home markets. Thus, the PTO of an important European country could restrict the effectiveness of an American systems integrator to offer global services, while at the same time entering the more liberalized environment in America.

Will there be a role for traditional carriers in systems integration? Traditional carriers have some advantages. These include the coordination of planning, advance information, established goodwill, brand identity, and reduced transaction costs for operations, all under one corporate roof. These carriers are therefore well-positioned to become systems integrators. Carriers functioning in this fashion could favor their own segments of service or equipment. Furthermore, they have the foundation of a major transmission element. However, this base is also a burden. To be truly competitive as a systems integrator, a traditional carrier's systems integration operation must be willing to compete against its own carrier, use alternative carriers, etc, and in effect become independent. While this might be conceivable, it might require significant rethinking by these carriers. Such re-thinking has

recently begun in the telephone industry. In the U.S., The Rochester Telephone Co. has proposed to separate itself into a carrier (R-Net) open to all, and a services operator (R-Com); Ameritech proposed to separate its carrier from its switching functions, subject to several conditions.

Looking at the reverse side of a vertical relationship, couldn't a carrier provide preferential service to its own systems integrators? In a competitive environment in a commodity service it is not economically rational to limit one's sales to one's own outlets. And where market power exists in the carrier's service segment, regulators are likely to assure non-discriminatory service.
Thus, the competitive advantage of the established reputation of traditional carriers should not be overestimated. One must resist the temptation to think in narrow telecommunications terms when it comes to integration. Traditional carriers may have the edge in basic transmission and switching. But as communications include more and more "upper level" services, they are more often than not in uncharted waters. A customer might well prefer a computer firm to a telecommunications carrier, reasoning that it is easier to migrate down rather than up in the hierarchy of communications. This might be the reason why computer-based firms are serious players in the systems integration business, for example DEC, IBM, or EDS. Digital, for example, replaced Sprint as the systems integrator for Citicorp's global network. Other systems integrators are high technology firms such as GE, or defense contractors with a desire for civilian diversification and with experience in large-scale turnkey projects. For example, Martin Marietta was a bidder for the U.S. federal government's huge FTS-2000 network.

Thus, it does not seem likely that a carrier would be dominant in systems integration; but if extension of market power is real, other protections could be instituted. Again, there will be much need for creative rethinking of new policy approaches.