

THE Telecommunications Revolution

past, present and future

Edited by
Harvey M. Sapolsky
Rhonda J. Crane
W. Russell Neuman
and Eli M. Noam

ROUTLEDGE


WHY ARE COUNTRIES WORLDWIDE REMOVING TRADITIONAL MONOPOLY STRUCTURES AND OPENING TELECOMMUNICATIONS MARKETS TO COMPETITION?

Regulatory or legislative authorities are causing the restructuring of telecommunications industries away from the monopoly structures that characterized telecommunications in the past and towards increased competition, deregulation and privatization. In *The Telecommunications Revolution* international policy-makers and scholars seek to explain the roots and consequences of the changes, exploring the past and present and looking towards the future. The book thus presents a unique perspective on the dramatic changes sweeping telecommunications worldwide, putting the regulatory environment into a theoretical and historical context of the times.

The book's in-depth analysis of the US case, important because of its widespread international influence, is balanced by a world survey, with specific contributions on Great Britain, France, Germany and Japan, and on the politics of international telecommunications.

This book is aimed at professionals with an interest in the telecommunications industry, at policy-makers and at students of media and communications, public policy, economics, business, politics and sociology.

Media and communications/public policy/economics/business/
politics/sociology



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Preface: Decentralization and deregulation on the march

Harvey M. Sapolsky

These are heady, confusing times in the telecommunications business. What until recently has been in most countries a very predictable, largely bureaucratic undertaking that provided basic telephone service and little else is being transformed nearly everywhere into a dynamic, mainly commercial enterprise that offers consumers a growing, some would say bewildering, number of sophisticated communications options. Privatization is reducing the scope of public administration in telecommunications. Competition rather than monopoly is increasingly the market norm. Telecommunication suppliers, managers, and regulators, whose comfort was guaranteed in past regimes, are groping desperately to find places in a rapidly evolving, very challenging system.

The demand for telecommunication services is expanding, but so too is the capacity to provide them. The pace of technological progress has been great, perhaps causing, certainly benefiting from the significant structural changes that have been occurring in the industry. On the horizon is the promise of even more progress as once intentionally separated technologies begin to blend together and find complementarity.

This book examines the origins and likely consequences of the great changes currently affecting telecommunications policy worldwide. A major focus of attention appropriately is the situation in the United States because it significantly influences policy elsewhere. Nevertheless, several studies of other leading industrial countries are included and a number of the essays seek explicitly to identify the political and policy differences that persist among these countries.

The book grew out of a symposium held to commemorate the many contributions of Ithiel de Sola Pool to the field of communications research. During the three decades that Ithiel was a member of the

political science faculty at the Massachusetts Institute of Technology (MIT), he influenced the careers and work of hundreds of students and colleagues. Although most can recall some uniquely helpful suggestion that was offered while collaborating on a project or during a seminar discussion, all were inspired by Ithiel's ability to combine so effectively on an international scale a deep involvement in practical affairs with enduring scholarship. It is appropriate that this volume include essays by academics, officials, and executives from around the world.

Ithiel's interests were catholic. He made significant contributions to social science methodology (including pioneering work in content analysis, in structure of social networks, and in the computer simulation of political phenomena), to the understanding of social and political development in which, in Ithiel's view, communications played a central role, and to the effects of changing communications technologies on the exercise of liberty. He was a master builder of institutions – not least of which were MIT's Political Science Department, its Center for International Studies, and its Communications Policy Research Program and Communications Forum. And in his role of wise and demanding teacher, he never failed to motivate students, encouraging them to seek out new paths just as Ithiel did himself. Ithiel focused on telecommunications policy in his last decade, as found in his award-winning *Technologies of Freedom* which has gained ever increasing scholarly attention and admiration. This work tells us that, if we are to achieve the full benefits of liberty, we must think about the structure of the systems by which we communicate as much as we think about what we say.

Revolutionary is a descriptive over-used by social scientists to trumpet changes both small and large. Ithiel early claimed that developments in communications technologies would have revolutionary impact on many aspects of society. Once skeptical about Ithiel's tenaciously held pronouncement, Lester Thurow, the Dean of the MIT School of Management and author of our first chapter, is now almost a believer. Thurow thinks it is possible that the computer and associated technologies may deserve rank with the most profound inventions of modern times, but he wonders when their envisioned benefits will be fully realized. The office and the city, he argues, still function much the same way they did before billions were invested in advanced business communications. Most machines sit idle on office desks and the centers of cities remain crowded. Perhaps, he suggests, we need to rethink the uses of these technologies.

Some new thinking has been done, if not about the efficient application of communications technologies then about their regulation. Eli

Noam, a lawyer, an economist, a professor at Columbia University, and recently a member of the New York Public Service Commission, believes that the restructuring of communications is following a broader social pattern visible in several fields – the breakup of integrative networks. Large, sophisticated users find advantage in separating from public networks to establish their own. Noam argues we may need to build a global regulatory framework to reassert integrating values once so much the goal of communication expansion.

The origins of the regulatory changes that led to the restructuring of telecommunications in the United States is the subject of Alan Altshuler's chapter. Altshuler, a political scientist who directs the Taubman Center at Harvard University's Kennedy School of Government, traces the intellectual history of deregulation in the United States. He argues that the recent wave of deregulation marks an important and perhaps rare triumph of ideas in the policymaking process. Good fortune and persistence permitted the economists' concern for enhanced competition to overcome long dominant interests that wished to limit the free functioning of markets.

Peter Temin, a leading economic historian and the author of *The Fall of the Bell System*, elaborates on the deregulation theme by examining the famous Carterfone and MCI cases. An important issue in debates over regulation is whether or not regulation can keep pace with technological change. Temin maintains that regulation does not always lag technology; at times regulators may intentionally seek to stimulate technological change. He worries that excessive enthusiasm for technological change will not permit full consideration of the economic consequences of major innovations for industry and especially for market-leading firms.

In the hope to avoid random policy change, the United States government has periodically reviewed the nation's opportunities and needs in telecommunications. Kenneth Robinson, a senior civil servant who directed *NTIA Telecom 2000*, the most recent report on telecommunications, describes the purpose of the study and its major findings. *NTIA Telecom 2000* argued that the same technological, economic, and social forces that led to deregulation in the United States affect other nations and mandate removal of restrictions on competition for them as well. The report records the significant beneficial impacts telecommunications developments have on society, noting that these benefits will accumulate faster if markets for telecommunications goods and services are unfettered.

Agreeing on the desirability of increasing competition is not enough. Needed also is a clear understanding of how and when it is achieved. Michael Porter of the Harvard Business School examines the ways by which regulators have pursued the supposedly common goal of increasing competition in telecommunications. He notes their frequent failure to view competition as a dynamic process with the prevailing tendency being to draw narrow definitions of markets, to ignore the power of buyers, and to overestimate barriers to entry. A better approach, he suggests, is to view competition as companies do, as the elusive search for advantage in a strategically uncertain environment. Forced into this situation, some companies at least will innovate, providing consumers with the enormous benefits of increased choice.

The divestiture by AT&T of its local operating units, the recent major watershed in United States telecommunications policy, is the topic of the chapter by Kevin Morgan and Douglas Pitt, British researchers who are acute observers of the American scene. Morgan and Pitt use the term 'regulatory turbulence' to describe the disjointed, often conflicting policy mandates that the American political system offers its domestic communications industry. Competition for control among political authorities and jurisdictions yields incoherent guidance to an industry struggling to adjust to the vastly more competitive equipment and service markets that resulted from divestiture. The pushing and hauling among domestic interests, they argue, leaves the American industry vulnerable to competitive erosion from foreign rivals, many of which have the strong support of their governments in trade matters. Deregulation in one country, the thrust of US policy to date, it seems has serious consequences which Morgan and Pitt believe need a more unified, interventionist approach to telecommunications by government agencies to correct than the US political system is likely to muster.

William Dutton, a political scientist at the University of Southern California, places the complexities of telecommunications regulation in a theoretical context. Dutton suggests that an ecology of games perspective best explains the politics that underlie the regulation. The incoherence so visible in the practice is the product of different sets of interests seeking to fulfill independent and even unrelated agendas involving overlapping resources. One set worries about anti-trust matters, another about trade, still another rate and service regulation with interacting, but uncoordinated effects. The decentralized nature of the system and its incoherent goals stand in sharp contrast to that of other nations and not necessarily favorably.

The chaos of American policy debates notwithstanding, one issue – the deterioration in America's trade position – has gained extraordinary attention. Of course, solutions vary. Some wish management reforms. Others blame a decline in national research and education investments. Still others prefer a mercantilistic alternative if only to counter what they see as the similar policies of America's major trading partners. But Charles Jonscher, a London-based observer of the communications industry, views the American trade dilemma differently. It is the product, he argues, not of corporate inefficiency, government under-spending, or open markets, but rather of gluttony. Americans have had a party, a very big party, he says, with borrowed money. No one should fault Americans for wanting a party, Jonscher says, but only for avoiding the tab. Other countries, with a bit more self-discipline, he suggests, could benefit by moving toward the liberalization that characterizes American trade policy.

This liberalization can and will spread internationally, Alfred Sikes argues in the next chapter. Sikes, Assistant Secretary of Commerce in the Reagan Administration and now Chairman of the Federal Communications Commission, believes that deregulation in the United States is stimulating liberalizing reform in the telecommunications policies of other countries. He cites a number of initiatives taken and reports prepared by the leading industrialized nations favoring increased competition and open markets for telecommunications. These nations recognize that the opportunities provided by new communications technologies can be realized fully only when liberalization occurs. The policy changes are not without risks, he points out, especially in short-term trade balances, but they are the key to long-term productivity and prosperity.

As if to second these thoughts, Eberhard Witte and Karl-Heinz Neumann recount the German experience in telecommunications. Witte, a professor at the University of Munich, was the chair of a commission that reviewed the policy options for Germany. Although there are constitutional obstacles in Germany to the privatization of all telecommunications functions, the recommendation was for substantial institutional change to permit greater competition. Karl-Heinz Neumann of the Bundespost reports on progress toward that objective. The political consensus achieved by the Witte commission, he indicates, has led to a freeing of several important communications markets, but only with the establishment of certain regulatory controls and with the maintenance of the monopoly for the basic telephone network. Although

these changes may not satisfy every advocate of competition, they do represent major liberalization steps in the German context.

Jean-Pierre Chamoux, Director of Regulation in the French Ministry of Posts, Telecommunications, and Space, outlines the reforms that over the past two decades have revitalized the telecommunications field in France. What was once one of Europe's most limited telephone systems has been transformed into its most pioneering. Especially affected have been new services which are mainly privatized and competitive. But as Chamoux points out, the basic telecommunication system remains publicly owned and thus subject to the vagaries of politics despite its recent modernization.

In telecommunications, world attention is focused increasingly on Japan which has taken a dominating lead in many user equipment markets and which has yet to exercise its full economic strength. Tetsuro Tomita describes the history of Japanese telecommunications policy including some pending reforms. It's a history that Tomita knows well for throughout his tenure as an official in the overseeing ministry he was an advocate for increased liberalization of Japanese markets and practices. From the Geisha house communications network which he sought to create in anticipation of the 1964 Olympics but which was only realized after the event, to the 1985 Telecommunications Business Law, Tomita pressed for reductions in monopoly powers assigned to the major national carriers. The success of these efforts has important implications for progress in both international trade and domestic Japanese services.

Jill Hills of London City University provides a comparative perspective on attempts at structural reform in telecommunications. In a comprehensive essay she traces the experience in the United States, Britain, and Japan. Policy options, Hills argues, are broadly limited by the opportunities afforded nations by their technological prowess and their international competitive positions, but within these bounds variations in traditions of business-government relations are largely determinant. But in each of these nations bureaucratic competition for jurisdiction is becoming a more important factor, she notes. As a result, there is an increasing politicization of telecommunications policy-making.

Delineation of the power struggle within telecommunications policymaking is the task Marvin Sirbu undertakes in the chapter that follows Hills'. Sirbu, a professor of engineering and public policy at Carnegie-Mellon University in Pittsburgh, describes a multi-dimensional battle for network control among users, suppliers, and

carriers. Each of the contenders attempts to define network relationships for special advantage and seeks to promote technologies that reinforce their power relative to the others. The outcome, Sirbu foresees, raises again the concern expressed earlier by Noam for the loss of integration in a world of many networks.

Peter Cowhey, a political economist on the faculty of the University of California at San Diego, examines the trade implications of the evolving telecommunications regime. Although throughout the world liberalization is on the march, Cowhey notes that there is also increasing emphasis on verification of the promised results and protection of rights for users. Corporate alliances will develop across national boundaries, he believes, and these alliances will both desire and force the creation of an international regulatory system. In turn, international developments will mandate further alterations in domestic regulatory arrangements. There is, it seems, a circle to close. What begins in one country reverberates around the world, affecting the originating agent eventually.

Some of the consequences of a failure to bound international trade competition are revealed in Rhonda Crane's chapter. Crane, recently the Senior Advisor for Science and Technology and American Electronics Association Fellow in the Office of the US Trade Representative, reviews the history of color television standards and the current debate on policy for high definition television, which she describes as a major development with potential for wide impact on the future of the telecommunications industry. Winning the standard for the new television system will bring billions in manufacturing opportunities. She argues that without better coordination within government and better cooperation between government and business than so far has been demonstrated, the United States is likely to lose this contest and perhaps much more.

What is at stake are shares of the world information economy according to Geza Feketekuty, a policy authority on trade issues and currently on loan to the International Trade Commission from the Office of the US Trade Representative. The combination of computers and telecommunications technologies permits the global management of enterprise based on the rapid and long distance exchange of information. The international trade system is beginning to recognize this new reality and the opportunities it permits for increased consumer welfare. Negotiations to secure the benefits are underway although they will be complex because of the many issues involved.

Theory has become practice. Throughout the world, deregulation is now the policy guide in telecommunications. And with the triumph of

deregulation, the challenge, as Russell Neuman, Director of the Audience Research Program at the Media Laboratory, MIT, points out in the Epilogue, becomes to develop new theories and to improve practice to cope with greater domestic and international competition, accelerated technological change, and expanded diversity and decentralization in telecommunication networks.

* * *

Several of those forever in Ithiel Pool's debt collaborated to make this volume possible. Ivan Shefrin, one of Ithiel's last students, suggested the theme and the format for the symposium at which several of the papers collected here were originally presented. Joining the program committee for the symposium were two of Ithiel's doctoral students, Rhonda Crane and Richard Solomon; an undergraduate thesis student, Carolyn Cook; Ithiel's son Adam; a research associate, David Allen; and three of Ithiel's faculty colleagues, Eugene Skolnikoff, Russell Neuman, and myself. Eli Noam, one of Ithiel's intellectual disciples, stepped forward from the symposium rostrum to aid in converting the proceedings into a book and in attracting new contributors. AT&T kindly provided a grant that facilitated MIT sponsorship of both the symposium and the book. It was, as I believe will be obvious from this volume, a collaboration that was both enjoyable and enlightening. We are grateful to the many who assisted us in this fitting tribute to a major communications visionary, but especially to Jean Pool whose interest in the project provided great encouragement.

Harvey M. Sapolsky
for the editors
Cambridge, Massachusetts

Is telecommunications truly revolutionary?

Lester C. Thurow

More than a decade ago I heard Ithiel Pool say there was going to be a computer telecommunications revolution. I was skeptical. Now I am much less of a skeptic. Historically only two inventions have revolutionized our industrial world.

The train speeded up transportation from one point to another. I much remember a history book pointing out that Napoleon's army did not move any faster than Julius Caesar's army. Two thousand years, and armies moved exactly the same way with horses and carts moving as fast as human beings could walk. The internal combustion engine and the automobile are not that important. If they had not been invented, we would have had a lot more street railways, and perhaps not quite as much suburbanization, but the world would look approximately the same without the automobile as it looks with it.

The other major invention is electricity. It clearly revolutionized the world in all kinds of ways. It made night usable. I periodically climb mountains in the Himalayas and get to villages where there is still no electricity. To live in a world with absolutely no electricity, no batteries, no lights, is a very different experience from the life most of us are used to. Electricity essentially changed night into day and altered human habits in profound ways.

Is the computer telecommunications revolution equivalent to trains and electricity? We will not be sure until we look back on it, but I am more persuaded today that Ithiel Pool was on to something, and that this could be a third major revolution.

In business schools we talk about MIS (management information systems) and refer to telecommunications systems as if they were ways to bring information to managers for them to do a better job. I am convinced that what is going on is more fundamental in the sense that

the telecommunications industry is becoming the production technology of many industries. Finance is a good example. Finance has become a technological enterprise. The financial institution that can bring information from Hong Kong to New York five seconds faster than some other group does not make part of the arbitrage profits – it makes all of the arbitrage profits.

Look at who the banks have been hiring recently. Salomon Brothers last year hired as many computer programmers and telecommunications experts as they did financial experts. A gentleman came into my office the other day and was absolutely convinced that the Japanese banks were going to drive every other bank in the world out of business because they were willing to put up satellites and build better telecommunications networks than the banks in Europe and the United States. They were going to be able to move information around the world faster and a few pennies cheaper per document than anybody else. They were going to turn finance into manufacturing. The one who can produce a product the cheapest and the fastest wins; and they were going to win because of their superior technology. He may be wrong about the Japanese advantage. At Citibank the person in charge of computer telecommunications has a budget of one billion dollars. One company one billion dollars to invest in telecommunications in one year.

Technology certainly changes the world capital markets. In one sense, Alan Greenspan, the Chairman of the Federal Reserve Board, and every other central banker in the world, has become technologically obsolete. Alan Greenspan is in charge of *the* American money supply. But in today's world, because of technology, there is no '*the* American money supply.' There is a world money supply. We can instantly borrow dollars or Euro dollars or Euro yen or Euro marks in London without ever being there. Those transactions do not have anything to do with any central banker in the world. I could buy and sell a house in Boston by using German marks. You could do a deal in the Bahamas without ever being in the Bahamas. We have major institutions like national central banks that are becoming obsolete.

Central banks can collectively control *the* world money supply – and there is a world money supply – but they cannot control it individually. The way we regulate, operate, and do our economics will have to be quite different because of the telecommunications revolution that has occurred.

After the Second World War, we had capital controls. They were difficult to enforce in the good old days, but today we could not make

them work at all. How would you monitor financial transactions across national boundaries if they are done with personal computers (PCs)?

If you look at the Brady Commission's report on why the stock market fell in October 1987, it perfectly illustrates a group of human beings who are presumably intelligent, writing a report that is technologically obsolete. The Brady Commission wrote about the fall of the American stock market as if it was the only stock market in the world that fell. Almost no word about any other markets falling. They blamed the fall on telecommunications computer trading. Portfolio insurance and program trading supposedly brought the system down. The interesting point is that London was crashing for five hours before New York crashed and London does very little portfolio insurance or computer trading compared to New York. Stock markets have also managed to crash hundreds of times, hundreds of years before anybody invented this technology. The Mississippi Bubble, Tulip Mania, the South Sea Bubble, the Great Crash of 1929, all managed to occur without computers and telecommunications.

If one reflects on the Brady recommendations, how would you stop program trading? Suppose you wanted to stop it. How would you do that, in a technical sense? This is a little like stopping sex between consenting adults. Can one really stop people in the privacy of their own office from looking at their computers and using their telephone to trade stocks, bonds, and commodities around the world?

Computer telecommunications has effectively become the modern devil that is blamed for everything wrong. If a package does not get delivered to my house, what went wrong? Well, the computer did it. Exactly the same thing happening on the stock market. We needed a convenient scapegoat to blame for what went wrong, and computer telecommunications took the blame.

The telecommunications revolution has two important economic puzzles. It was widely predicted when the revolution began that computer telecommunications would decentralize economic activity because it would make it much cheaper to move information from one place to another. And you can find examples of decentralization, like Citibank processing all its credit cards in Sioux Falls, South Dakota rather than in New York City. But the aggregate data show precisely the opposite. We *are* piling up, in record amounts, in narrower geographic areas. Big central cities around the world are growing. If a city is a financial capital plus a government capital, probably 40 per cent of all the people in the entire country live there. This is true in South America,

in Japan, in Britain. Where you would predict decentralization, the technology somehow seems to be contributing to centralization. It is clear that, in the aggregate – despite dramatic examples like Citibank out in Sioux Falls – something very different is happening.

The second puzzle concerns productivity. Computer telecommunications is a wonderful new technology, with wondrous capabilities. It should make productivity grow faster, which makes the standard of living grow faster. Thus this technology is going to pay off in a higher standard of living than we would otherwise have.

Again, the data belie these expectations. Precisely those industries that are most intensively using this technology have the worst productivity performance. In fact, the industries using it the most generally have negative productivity growth, like financial services. Financial services are certainly using telecommunications to move information around the world, to do new things such as computer accounting, to service customers with ATM machines, the robots of the financial world. But no matter how you measure productivity in financial services in the United States, it is falling. For every employee exiled from a little branch bank that no longer has any employees in it, banks are adding two employees in the telecommunications office to replace the one from the old-fashioned office.

Financial services in the United States have had negative productivity growth for the last ten years. Every year productivity is falling about 1 percent. Part of the explanation is reasonably clear. We find that maintenance expenses are soaring. The conventional computer system that a company might buy requires annual maintenance expenses that are half the original purchase price. It takes an enormous amount of labor and supplies to keep these systems running. The enormous labor force necessary to maintain the systems has more than offset the productivity gains.

This problem is not limited to finance. The worse the productivity performance the more that industry is using computer telecommunications systems. Is this just a temporary phenomenon – that it takes a while to get used to new technology so people can use it efficiently? Or is this something where the payoff ultimately comes much later when ways of doing business actually change? One could argue the issue both ways. One answer may be that Ithiel Pool was right: It is a real revolution, which means we have to do things differently as opposed to just automate the old.

Consider office automation. If you think about the model office, it is remarkably similar to the office that was invented in Florence during the

Renaissance. The way we shuffle paper around the system has not changed much in 500 years. And then we bring in office automation and we simply automate exactly the same paper shuffling that we were doing before we automated. That may very well be a way you cannot make the system pay off. When I walk into business firms in the United States, every desk has a computer terminal and a telecommunications system attached to it, and I would bet that 95 percent of them are seldom turned on.

Recently we have been putting about half of the total investment in the United States into computers and telecommunications. Putting half of the investment for an entire country into an area that does not pay off in productivity creates a major problem. At some point we will either have to do it differently or quit doing it at all. From an industrial point of view, that is going to be the key question over the next five or ten years.

Beyond the Golden Age of the public network

Eli M. Noam

Telecommunications policy today is an environment in which there are many battle-hardened troops, but too few strategists. There is an abundance of activities, plans, facts, fights, but only a limited analytical apparatus. We are in short supply of the Ithiel de Sola Pools, just who we need the most to get us beyond the traditional concepts that have organized thinking in this field.

What are these concepts? I find four main ones that are the golden calves worshipped by professional associations and denominations. For technologists, the primary organizing concepts in telecommunications policy are economies of scale and their first cousin, standardization. Economists worship at the altar of competition – in this case genuflecting to the triad of structure, conduct, and performance. What is an increasing disenchantment with this view is represented more in academia than in the regulatory environment. Lawyers, third in this field, judge policy issues in terms of conflict of interest, which translates here into a potential for cross-subsidies. Structures that make such cross-subsidies theoretically possible must be avoided, hence the AT&T divestiture. Finally, many social scientists, as well as most politicians and journalists, organize reality in telecommunications policy around the concept of income distribution, that is, around the question of who pays more, who pays less.

All of these concepts have legitimacy but they have been carried by their proponents to the edge of explanatory power and then some. Used single-mindedly, these notions have degenerated to rallying slogans. Perhaps the greatest common failing is that they engage in what I would call supply-side telecommunications. That is, they look at the subject from the angle of production and producers: AT&T versus MCI, inter-exchange carriers versus local exchange companies, enhanced versus basic services providers, voice versus record, and so on.

It is not surprising that this should be the natural way to look at things. After all, regulators deal primarily with carriers, technologists with networks, economists with competitors, and journalists have a horse race angle to their coverage. But this supply-oriented perspective obscures its reverse. What we need to do is engage in what could be called a demand-side telecommunications analysis. What does this perspective mean? At its most basic, we should not think of telecommunications as a service produced by carriers but as an interaction of groups and subgroups in society, facilitated by service vendors that we call carriers. The supply structure, if left to its own devices, is a reflection of the underlying interaction of communication users with each other within an all-encompassing user coalition, which we call the public network, or in several smaller user groupings along other dimensions.

Thus, we should not see deregulation and divestiture as a policy of primarily liberalizing the entry of suppliers. Just as important, it is the liberalization of an exit by some partners from a previously existing sharing coalition. Telecommunications are only one instance for widespread ascendancy in recent years of centrifugalism in previously shared social arrangements. Wherever you look, people break up all kinds of networks of interaction and form new ones. Examples abound – the public school system, the mass transit system, public safety, dispute resolution, health provision, to name a few. The departure from the public school system, for example, cannot be explained primarily by the supply of new options or by new technology but rather by an increased demand to exit. In a similar sense, recent centrifugal development in independent electric power generation had very little to do with new technology.

Perhaps it is useful to ask ourselves why it seems that there is usually only one public telephone network in each country. It is not the interconnectedness of all participants or else we would have only one large bank for all financial transactions. Interaction does not usually require institutional integrations, and this was one of Adam Smith's major insights. To distinguish telecommunications from this observation by labeling it 'infrastructure' requires us to define that term, which is almost impossible to do.

No explanation is natural monopoly. Maybe it exists for a local exchange area, but the examples of the United States, Canada, Denmark, Finland, and several other countries show that this does not prove that a widespread horizontal integration of local exchange areas is required. And if it were, why do they miraculously have national frontiers? If we

look at the birth of the monopoly system in the sixteenth and seventeenth centuries and the establishment of European postal monopolies, we see that the monopoly was unnaturally caused by politics of the revenue needs of the state, rather than by second-order conditions of production functions.

Perhaps the best way to look at the network is as a cost sharing arrangement among several users. If fixed costs are low, a new participant C can help A and B to lower the costs. This situation could be compared with the economics of swimming pools or national defense, both of which may be regarded as a public good. But although there is only one national defense system, there are many swimming pools – some of them public communals, others private communals, and still others exclusive ones.

There is a wide spectrum between the pure private good and the pure public good. We may want to share the pool with a few dozen families but not necessarily with thousands. A few might admit everyone; some maybe only admit one. The many cases in between include the telecommunications network. It is not a private good, yet it does not meet the two conditions for a public good, namely non-excludability and non-rival consumption. Indeed, non-excludability had to be established by law, and we call it universal service obligation.

What has been happening in recent years to telecommunications is what goes by the more dramatic label of 'divestiture.' Deregulation is merely a shift in the degree of intermediateness – of the intermediate position between public and private. The formation of such intermediate collective consumption and production arrangements is carefully analyzed by theorists of clubs. One can apply economic club theory to networks and show that different user groups tend to cluster together in associations according to dimensions of price, interactive density, and ease of internal decisionmaking, provided that they have mobility of choice. This can be called voting with one's telecommunications node. A reasonable assumption is that economically optimal association size will not encompass the entire population. Alfred Kahn used to put it as follows, 'People who don't have a telephone, I don't want to talk to.'

It is generally inefficient to attempt income transfers by integrating diverse groups and imposing varying cost shares according to some equity criteria. It is more efficient to allow homogeneous groups to form their own associations and then redistribute by imposing charges on some groups and distribute to others. The incentives to group formation can lead, where legally permitted to do so, to arrangements shared by alternative network associations. The process could be called the

tragedy of the common network because it is not the failing of the traditional arrangement but, ironically, its success that undermines it. The success of communalism creates the forces of particularism. In the early stages, the first network participants affirmatively seek additional participants to share costs and enhance their reach. They try to prevent new arrangements, but in time they pay a price for it because democratizing participation leads to democratizing of the control of cost sharing in a way that is redistributory. And over time the redistributory burden grows.

Furthermore, in time, the volume of the first users, who ultimately become the largest users, has risen so high that they can account for much of the cost savings of sharing just among themselves. They therefore try to form alternative network associations for large parts of their communication needs – first in-house and later with their closest suppliers, customers, and market participants. An illustration of this is found in Wall Street's 1987 Black Monday, where one would expect an enormous increase in communications traffic but the public network in lower Manhattan and the financial district increased its usage by only 10 percent over normal.

In the United States, the Golden Age of the public network, in which substantial universal service coincided with group substantial monopoly, was as brief and romanticized as the cowboy era; it lasted about twenty years from 1950, but in the mid-1960s centrifugal forces began their assault. This time-span coincides with the beginning of computer data communications as a major form of usage. In Western Europe and Japan, universal service was behind that of the United States; but it was achieved in the last ten years or so and now centrifugal forces have begun to gather there too.

Where does this all lead? It leads to normalization – nothing dramatic. Normalization simply means that telecommunications network provision will resemble much of the rest of the economy. The network environment will be essentially a pluralistic network of user associations, a network of networks that are partly overlapping and partly specialized along various dimensions such as geography, price, size, performance, virtualness, value added, ownership status, access rights, kind of specialization, extent of internationalization, and so forth.

This is not to say that domestic economies of scale and scope will become irrelevant. There still will be broad-based public networks, powerfully integrated networks with broad-band capability. But just as important will be economies of group specialization, economies of clustering, and economies of trans-nationalism.

Where does such normalization lead future regulators? It would be naive to expect less regulatory tasks. To the contrary, many disputes become less intramural and more public in that they form the regulatory realm. The main regulatory tasks that normalization raises are as follows: protection of interconnection and protection of access; establishment of new mechanisms of redistribution; prevention of oligopolistic behavior and of cyclical instability; establishment of new global regulatory arrangements to match the global scope of networks. None of these tasks is beyond our grasp in relation to their complexity or political feasibility, but they require us to end the palpable nostalgia for the simplicity of the Golden Age, and to imagine a very different environment – one in which the public network is replaced by the pluralized network.