

**THE SUPERSTRUCTURE OF INFRASTRUCTURE:
Thinking about a Future without a
Public Network,
or
Principles for the Communications Act of 2034**

by

Eli M. Noam
Professor of Finance and Economics
and
Director, Columbia Institute for Tele-Information
Graduate School of Business
Columbia University

Presented to the MIT Symposium
Building the Information Marketplace

October, 1991

The basic question about telecommunication regulation is, after deregulation, what? In the recent past, debates centered on the opening of the telecommunications, television, and cable. Is competition sustainable? Is it advisable? Who gains? Who loses?

Regulation had been essential to the old system, partly to protect against monopoly, partly to protect the monopoly itself. In the transition to competition, what was left was seen as temporary, as shrinking reciprocally with the growth of competition. In time, it would come down to nothing.

At that point, what would happen? Advocates of competition were always a bit vague on that question, like the old Bolsheviks who were not sure, as they were storming the Winter Palace, what communism might actually look like. And you see what happened. Suppose we have all these networks proliferating. VANs, MANs, LANs, WANs, CANs, and also-RANs. Could we expect the resultant network of networks to be totally self-regulating? In other words, can we expect there to be some sort of an invisible-hand mechanism that works, with no role for government?

The notion of an invisible hand mechanism, the idea that out of numerous decentralized sub-optimizing actions there would emerge, without any central direction, some overall and beneficial equilibrium, is perhaps Adam Smith's major insight as a philosopher. Its importance goes way beyond economics, and has been observed for the evolution of species, as well as for the functioning of bee and ant colonies, for population migration, for organizational hierarchies, and many other systems. [Nozick, Robert, 1974, Anarchy, State, and Utopia, New York: Basic Books: p. 20-21.] Can electronic communications function as if guided by an invisible hand, optimally arranging themselves in the absence of an overall plan?

The notion is almost incomprehensible to telecommunications traditionalists. They argue that the more complex the technology and the network become, the more necessary it is to plan it in some centralized fashion. This type of argument was countered by the Austrian economist Friedrich von Hayek half a century ago, when he pointed out that, to the contrary, the more complex and advanced an economy becomes, the less it is possible to guide it centrally. [Friedrich von Hayek, 1942, The Road to Serfdom, Chicago: University of Chicago Press.] Recent collapses in Eastern European economies seem to prove Hayek right. Complexity is neither a necessary nor sufficient condition for justifying centralized control.

On the other hand, there is also the opposite belief, equally simplistic, that more advanced technology makes regulation unnecessary. But consider as a real-life counter example, nuclear power, a complex technology that is tightly regulated. Technology does not abolish negative externalities; it may in fact increase their threat by orders of magnitude. Or consider air transportation, which is much more tightly regulated than horse carriages. Didn't Alfred Kahn deregulate air transport? Yes, but only for entry and prices. In almost every technical and operational aspect, it's a real police state up there. And we are all safer for it.

If the ACLU, or Ayn Rand, were in charge of air traffic control, I'd rather walk. Of course, the FAA, which has so prudently tried to close the federal budget deficit by not having redundancy in its communication network system may not be much better.

When it comes to rules, it is perhaps best to think in terms of a hierarchy, just like in the world of computers, with its hierarchy of control instructions such as assembly language, machine language, and programming languages. In the regulation of telecommunications, one can have *rules of detail*, such as how many seconds to get a dial tone, or the exact price that can be charged for a local call at 3 p.m. At the other extreme, there are *fundamental societal tenets* such as freedom of speech, property rights, or freedom from taking without compensation. In between there are intermediate *rules of principle*, often codified by statutes of varying specificity.

The U.S. is pretty good about rules of detail, being a pragmatic society. It is also surprisingly good about the fundamental tenets, a legacy from brief but creative historic periods in which big-picture issues were taken very seriously. The weak link in the hierarchy of rules is the intermediate range. In telecommunications, that means primarily the 1934 Communications Act, and the assorted state public utility statutes. These laws persist largely unchanged because various interest groups, including state regulators themselves, fear losing out by change. But self-interest is only one part of the reason. The other is that we are not really sure what such a set of intermediate rules would look like, if one could write it.

The conventional way to think of deregulation is as a reduction of rules of detail. If you had 20 such rules, and now only 10, that's deregulation. But it may be more useful to think of it as a shift *upwards* in the hierarchy of rules — from details towards fundamental rules. After all, even in a deregulated environment, one has property rights or contracts, which become even more important than in the past, and all backed up by the full might of the state.

I don't know when the last time any of you actually looked at the 1934 Communications Act. It was written before TV was out of the labs; before microwave transmission; before satellites; before micro-electronics; before computers; before real data communications; and before transatlantic voice cables. Title II of the 1934 Act, which deals with telephony, is basically the ICC's 1910 Mann-Elkins Act provisions of railroad regulatory principles, which themselves date back to 1887. Read the 1934 Act and you feel like you are watching a silent black and white cowboy and indian movie.

Now it may be objected that the U.S. Constitution is much older and yet it is not anachronistic. Sure, there are a few sections about quartering of soldiers and letters of Marque and Reprisal that are a bit dusty, but at least it has majestic scope — "Congress shall make no law respecting an establishment of religion" or "The right of the people to keep and bear arms shall not be infringed." These phrases were written, it seems, without much stylistic benefit of legal counsel. The details are left for future generations.

The 1934 Act, in contrast, is a heap of excruciatingly specific details written by government and private sector utility lawyers, for utility lawyers, and of utility lawyers. If you edited all those parts out of the Act that have become irrelevant and eliminated legal verbirosities such as never using one verb if you can use four synonyms in a string, and if you dropped the Mickey Mouse provisions on how many copies must be filed when, then the Act's 46 pages would collapse into fewer than 10.

At that point, one could search for some structure, some principles. But what one would find would be disappointing. This is no job for telecommunications experts. It's a job for literary deconstructionists, people who will interpret what was behind those dusty phrases.

There is an excellent book, *A Legislative History of the Communications Act of 1934*, edited by Max Paglin (Oxford University Press), with several major academic experts as interpreters of various chapters of the Act. I looked in the book for guidance on those principles. There was very little. The Act is largely a string of provisions, with several implicit or explicit values — in other words, the Act is a typical piece of legislation, cobbled together to pass Congressional muster, rather than a blueprint for regulating the communications industries, which are in a constant process of transformation. And its legislative history reminds one of Bismarck's observation that one should not look too closely into how sausages and laws are made.

The Act's major problem, from tomorrow's perspective, is that it deals with separate transmission media differently. In other words, it is not transmission-path neutral. This was fine in the past, but is not where technology and applications are taking us.

The Act has survived contempt and irrelevance because various interest groups fear change, because of the investment of the legal system in litigating the meaning of obscure phrases, and because few normal people care about the 1934 Act. The latter is almost tautological. But can this benign neglect be maintained for long?

The Need for New Principles

In the past decade, policy was correctly focused on creating openness by reducing barriers and permitting entry. Now, with fragmentation of the network environment proceeding apace, the primary issue is to create tools, rules, and pools for integration that permit the functioning of the emerging "network of networks" I'd call the "triple integrated" network, or I³SDN.

Simple ISDN integrates the various narrowband telecommunications services such as voice and data. But now, it has a third dimension: I²SDN, the doubly integrated network, integrates across carriers, still narrowband, point-to-point communications. I³SDN, the triply-integrated network, will integrate narrowband and various broadband media such as cable TV and broadcasting, provided by various carriers. This goes far beyond the concept

of all communications, including video, flowing over one fiber-super-pipe. I³SDN is not primarily a technology; it is an interoperability concept, with legal, financial, technical and content dimensions.

On the content side, entirely different regulatory models exist for the different segments of the communications system, such as common carriage, private network status, cable television regulation, or the publishing model. Ithiel de Sola Pool did much to clarify these issues for us. The difference in regulatory status is sustainable only as long as the underlying media are kept apart. As they grow together and interconnect, these differing rules must be reconciled.

What the existing governing principles need therefore are some principles that tie together common carriage, private carriage, cable television and broadcasting, and publishing. As communications media merge, the invisible hand must ultimately be connected to a body of law. We need a superstructure to the infrastructure. In telecommunications, the basic documents are first, the creaky 1934 Communications Act; the controversial 1984 Cable Act; the embattled antitrust law as interpreted by the vilified Judge Greene; the ancient common law principles of common carriage; and the motley collection of state utility laws, as amended by legislatures of widely varying outlook and competence. For example, the Washington State legislature recently had before it a bill to outlaw sexual activity by teenagers. Colorado considered a law to protect fruits and vegetables from libel and slander. So you see what I mean.

The private sector is not much better. To protect today's guilty, I'll use as an example a 1882 report by Western Union, which argued "that [Alexander Graham] Bell's proposal to place [the telephone] in every home and business is, of course, fantastic in view of the capital costs involved in installing endless numbers of wires."

Rather than thinking of regulatory policy as the pacification of interest groups, partly in order to maximize the agency's budget, which seems to be the cynical orthodoxy, let us instead think of ourselves as part of an original social contract, meeting on some remote meadow on the banks of the Charles River. Suppose telecommunications were only an idea on the drawing board, and we were starting a network system from scratch, though with today's technology at our disposal. Do not think in terms of the traditional "public network" with peripheral networks attached to it. There is no such thing as a "public network." Furthermore, do not think in terms of telecommunications, broadcasting, cable, wireless, etc. Instead, a variety of providers of conduit and content are likely to participate in offering content and conduit. None of us know whether we will be either a user or a provider. None of us know if we will be large or small. Let us think of ourselves as a kind of electronic constitutional convention, as the Founding Grand-children. What should the principles of this communications system look like?

1. Preamble

▣ We, the people, in order to create a more perfect union of various transmission and content media, have established principles by which all electronic communications should be governed, with the goals of encouraging the production of information of many types, sources, and destinations; assuring the existence of multiple pathways of information; encouraging their spread across society, the economy, and the world; and enhancing social and economic well-being, technology, and education.

2. Freedoms of Speech and Transmission

▣ Freedom of content is technology neutral. Government shall not prohibit the free exercise of communications or abridge the freedom of electronic speech, or of content provided by the electronic press, or of the right of the people to peaceably assemble electronically.

This is the basic 1st Amendment, applied to electronics. Prof. Tribe has recently suggested the need for a 27th Amendment to say something like that. But he also seems to agree that it might be enough to persuade courts to read this into the 1st Amendment.

3. Common Carriage

First Amendment protection helps against governmental restriction. It does not deal with the private sector. Here, common carriage is the foundation of free speech. It is often a misunderstood concept. Common carriage does not mean universal service, or regulated monopoly, or price or rate of return regulation. It means non-discriminatory conduit service, neutral as to content, users and usage. FCC Chairman Alfred Sikes' concept of the video dial tone has such a common carrier orientation.

Common carriage is not only a free speech matter. The reason for common carriage generally, whether in transportation or communication, is to foster infrastructure and its easy use.

Information travels across numerous subnetworks until it reaches its destination. If each of these networks sets its own rules about which information is carried and which is not, information cannot flow easily. While it may be in the interest of every carrier to maintain full control over "its" segments, in the aggregate this would be as dysfunctional as if each bank had its own money as opposed to a common legal tender.

At present, who is a common carrier? Basically, the providers of the "public switched telecommunications network." But with competition, one cannot maintain over the long run

a system of "official" public networks with special rights and burdens. Or designating some new networks as public networks and not others. Alternatively, one would have to abolish all private carriage. Yet that would violate principles of property, freedom of association, and encouragement of innovation. What is needed instead is the establishment of a mixed private-public network system. Instead of the present system of some carriers being public and others private, a system of partial common carriage would apply to all carriers who participate in an interconnected network of networks. There would be no such thing as the public network.

▣ All electrons and photons are created equal. Carriers operating as a common carrier must be neutral as to content, use, and users. The transmission of lawful communications shall not be restricted by a common carrier. Common carriers are not liable for the use to which their conduit is put.

This is the basic definition of common carriage. The term "conduit" is not used here in the strictly "conduit" versus "content" technical sense, but rather in the sense of "transmission path."

Now who is a common carrier?

▣ Where no competition exists in a conduit, it must be offered on a common carrier basis on at least part of the capacity.

▣ Competitive transmission segments need not be common carriers. But if a transmission segment interconnects with or accesses other networks by taking advantage of common carrier access rights, then it must offer such rights reciprocally on part of its capacity, without discriminatory terms or conditions of service.

Thus a purely private network which does not demand interconnection with a common carrier may refuse to carry the signals of any user or of other network. It is not a common carrier. However, once it does make use of common carrier access to another carrier, it must reciprocally open up part of its own capacity to others. Where common carriage is claimed in a downstream direction, it must also be offered in an upstream direction. In such a fashion, one creates common carriage "rights-of-way." Such rights-of-way would function like public roads and highways that pass private property, or like easements that allow public passage through private land. They would permit the unimpeded transmission of content and services across the various interconnected networks and enable end-to-end connectivity, although not on the entire bandwidth of a transmission. Some rights-of-way would be quite wide superhighways, while others could be narrow but otherwise unobstructed lanes.

▣ Any party complying with a conduit's reasonable technical specification may interconnect into, access, or exit any common carrier conduit segments at interface points, which must be provided at technologically and economically reasonable intervals.

This is, in effect, an open network architecture provision.

4. Market Structure

▣ Government shall make no law establishing a network privileged in terms of territory, function, or national origin. Nor shall it burden any network more than its competitors, except with compensation.

▣ A conduit may offer carriage of any type of service over its conduit, and interconnect with any type of carrier. Monopolistic conduit segments can be accessed by their own content services only where adequate capacity is available for common carrier access and subject to antitrust principles.

This provision deals with market segmentation, and with information provision by carriers.

▣ Competitive conduits and all content can be priced freely. Prices for non-competitive conduit segments are presumptively regulated where their increase exceeds inflation, taking into account other important factors, too. Prices for non-competitive conduit segments cannot be set such that they distort competition for non-monopolistic services.

As far as a definition of what "competitive" is, here is one attempt:

▣ For competitive conditions in a market segment to be said to exist, three or more offerors of substantially similar or equivalent services constitute a rebuttable presumption. With two, evidence for vigorous price competition is necessary.

And for the treatment of electromagnetic spectrum:

▣ Spectrum use is a property right that is sold or leased out by the government, and can be used flexibly. Frequency zoning for the clustering of services may be instituted.

5. Privacy

Information needs to be protected against piracy, trespass by private parties and government, and tampering by virus. There needs to be protection against the dissemination, without consent, of transaction information. The provisions are the following:

Against the state:

▣ Electronic information cannot be searched and seized arbitrarily by the state.

Against abuse by private parties:

▣ **Electronic information is the property of its creators or assignees. Where information is created by a transaction involving two parties, they normally hold the property jointly, and the consent of both is needed for the use of the information. Each party should disclose jeopardies of privacy to the other.**

6. Subsidized Services

▣ **Financial support for some users (e.g., universal service), and to content providers, content, or technologies, where instituted by government, must be generated and allocated explicitly, and the burden of such support be placed on general revenue or equally on all competitors.**

This is one of the more sensitive issues. At present, redistribution operates inside the public network across its customers. But this system cannot be stable over time. Instead, explicit subsidies will be a better system.

▣ **Where the development of new communications services or technologies requires coordination efforts and the creation of a critical mass of users, and where the service in question is of clear societal benefit, government may support such efforts in their infancy stages.**

7. Jurisdiction

The traditional notion of jurisdictional separation was based on a linear, spatial concept of what a network was. To simplify somewhat, networks were configured to minimize transmission distance. As transmission costs decline, telecommunications becomes distance-insensitive. Notions of interstate and intrastate services become increasingly unimportant because the component modules of each service cross state and national jurisdictions. Networks become relational, not locational.

Principles for international jurisdiction:

▣ **Information must move freely across interstate and international borders, without unreasonable burdens by state or national jurisdictions. No content or carrier should be treated in a country more restrictively than domestic providers are. But the right to equivalent treatment in another country requires reciprocity at home.**

And for U.S. jurisdiction:

▣ **The federal jurisdiction sets basic national telecommunications policy where it deems national solutions to be clearly necessary. It may delegate flexibility in application and implementation to lower-level governmental bodies, who may also set policy for**

functions of clearly local nature. (This is the jurisdictional division.)

And another provision deals with self-regulation:

▣ Where a non-common carrier serves horizontal groupings of users in the same industry, its exclusion of other users is subject to antitrust principles.

Conclusion: The Role of Government in the '90s

None of these principles is especially earth-shaking. But in the aggregate, they provide a framework that actually provides an integration of common carrier of private carriage, of telcos, cable companies, and broadcasters. And they do so without the existence of a public network. Instead, we have a network of networks, operating under some rules of the road.

The proposed principles listed should not be read too strictly. First, because they are a first draft and in need of comments, additions, and beta-testing for consistency. And I encourage you to provide me other principles. Second, because the principles should in any event not be seen as strict rules, but more in the nature of rebuttable presumptions, subject to differing applications where a situation warrants different treatment or interpretation. Third, obviously we do not start with a clean slate. Established interests exist. We cannot reach the ideal, nor would it necessarily be fair to change the rules on some people in mid-stream. It is one thing to auction off a vacant radio frequency, quite another to sell it off if it has been used by a station for fifty years. Similar observations apply to cable.

At the same time, these rules offer a change from the practices of the past. The technological change from public to private networks, and further to the personal networks that are on the horizon demands new regulatory approaches for the '90s. Government needs to get out of the retail business of *rules of detail* and move into the more wholesale principle business. One needs a compass, and "competition" is not enough of a direction finder anymore, just as a magnetic compass doesn't help much when one is high or north, or turns or accelerates.

Second, government must provide the glue that keeps the network system together. Its role becomes that of the **national systems-integrator**. It must assure open interconnection, including among different media; assure performance quality; anticipate disaster recovery; assure disclosure and information flows; etc.

To return, therefore, to the original question whether telecommunications will operate effectively under the guidance of an invisible hand mechanism — the answer is, to a large extent, yes. But only on a foundation of a set of basic rules of the road, which will require the investment of substantial up-front effort. And this is not easy. There may be no invisible hand in Washington yet, but there sure are a lot of visible toes to step on. But sooner or later we will have it, the brand new Communications Act of 2034.