A Taxonomy of Networks: Is It Public or not?

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1. Purpose

This paper, prepared within the scope of the Columbia Project, discusses use of the terms "public network" and "private network," and offers a contemporary model for analyzing distinctions based on various notions of public and private. These terms have been extensively used within the telecommunications industry over the past several decades - generally posing a dichotomy. Within the past few years, a number of factors have rendered the boundaries of the dichotomy increasingly impossible to establish. The Information Array Model, as well as the five-fold *Public* Indicia, represent a new perspective on an old subject.

2. Background

❑ International

The terms "public" and "private" in telecommunication instruments can be traced back to the very earliest international agreements. Indeed, the first multilateral treaty for telecommunications begins with the preamble "With the intention of enabling both public and private traffic..." *See* State Treaty Between Austria, Prussia, Bavaria and Saxony of 25 July 1850 (official ITU translation), generally referred to as the Dresden Convention.

In this context, the term "public" in the preamble is synonymous with "State," while "private" had the connotation of non-State messages. However, the Dresden Convention also introduces another notion regarding public access that has subsequently emerged as a key concept. Art 6 states that "The use of the telegraphs of the Union Governments shall be open to all, without any exceptions."

Several years later when the Conférence de Paris adopted the 1865 Convention that established the International Telegraph Union, a three-fold distinction is made between *dépêches d'État, dépêches de service,*and *dépêches privées. Dépêches de service* are basically messages relating to running the network. The Convention also uses the term "private" in the context of States dealing with a compagnie privée owning and/or operating an interconnecting telegraph network.

The Paris Convention enshrined the notion of open to the public in Art. 4 which obliges that "The contracting High Parties recognize for all persons the right of correspondence by means of international telegraphs." The Convention also obliges States in their important cities to maintain "offices open to the public" during certain hours.

It is worth noting that when an international regime for radiocommunication first began to emerge in 1903, the whole issue of public versus private was effectively sidestepped. Private sector entrepreneurs had already effectively established private telecommunication networks and services. By taking a facilities-based approach which involved sovereign States licensing radio station operators, there was no need to deal with the question of "private networks" as long as the stations were licensed to operate in the respective countries. In practice, this potential leak of revenue earning public correspondence traffic was partially plugged through a special supplementary group of international Radio Regulations.

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Another factor of major importance is the traditional national distrust of "bigness" - especially monopolies public or private. Antitrust concerns are a fundamental part of the American culture. Indeed, it is amazing that the AT&T monopoly held as long as it did. The emergence of digital technologies, however, effectively spelled the end of the monopoly era in telecommunications. There is no "natural monopoly" in today's information-telecommunication world.

❑ **Dominant Carriers and Public Obligations**

The primary problems of "public" communications policy today fall into two areas involving market distortions:

- How do you continue to deal with organizations - public or private - that acquired their facilities and their market share based on public largesse in granting them monopoly privileges?
- How do you continue to deal with organizations - that operate under legal obligations to provide certain kinds of telecommunication capabilities they might not otherwise provide?

Practically all our telecommunication "regulatory" activities worldwide today focus on one or both of these domains.

These problems have special relevance for the Columbia Project, because they arise out of legal, social and government policy concerns, not technical. Whatever indicia are fashioned for "public" must be directly relevant to the two major policy problems, above.

However, the information systems/digital technology is not going to make this an easy task. In any kind of exacting sense, the task is impossible. There are no magic solutions, no opportunities to do things with smoke and mirrors. The variables are too numerous and complex, with all kinds of entrenched interests.

On the other hand, there may be opportunities to encourage shared models. There are some good examples already with various "open network" regulatory approaches at national, regional and global levels. The trick will be to avoid details that are either technology dependent, or have anti-competitive trap doors, or have the potential to be used in anti-competitive ways. The OSI model and many of its siblings are a good example of all three.

A.D. Little's Hugh Small raised a very significant point at the recent Financial Times Conference - noting that the time is now ripe for "building in" opportunities for competition in many of the facilities and network models now being constructed. In the same sense, it is also now possible to build in some solutions to the two primary problems raised above, by developing some good, widely shared models.

3. The Information Array Model

Today's networking world can be described as a combination of physical facilities and virtual everything. It's virtual reality riding on top of a web of glass. The classical old link and node definitions have no relevance. Dave Farber who heads the University of Pennsylania's Distributed Systems Lab describes what he calls the emerging "National Backplane." The national (if not international) fiber grid is simply conceptualized as a big, distributed computer bus.

We're not there yet - but it's where we are heading. Bob Kahn's Gigabit Testbeds are already bearing lots of interesting options. Any model that the Columbia Project develops must accommodate this emerging environment if the model is to be useful.

Along these lines, for purposes of developing a network taxonomy for parsing things public and private, the following definition of *network* might be useful:

> **A network is an interoperating array of information objects whose prime function is to allow the sharing of information or information processes among multiple objects.**

This model is also useful - if a bit abstract - because it's similar to the approaches actually being taken by information systems people trying to deal with their own boundary problems. It's beauty is the elementary simplicity. You can apply it to everything from three tin-cans with strings to knowbots® traversing the Internet. See Figure 1.

An *information object* is simply a discrete, definable information function that can be used or acted upon. Basic service elements can be regarded as information objects. A computer file can be an information object. So if you create a network, you are simply establishing a known structured relationship among information objects - an architecture - through which the objects can interoperate.

It is further useful to elaborate some of the basic properties of such a network:

Networks are scaleable, nestable, and capable of multiple gateways in both physical and logical dimensions.

Scaleable means basically that you can make the network bigger, following a similar architecture. Nestable means that you can imbed one network within another network. Multiple gateways means that you can have separate networks that have multiple means dedicated avenues of interoperation between them.

This model is useful for purposes of the Project because information objects can then be characterized as possessing varying degrees of being "public" or "private". This shifts the problem away from dealing with public or private networks - which is a basicly hopeless if not meaningless task - and focusing instead on individual information objects. In a sense, the FCC did the same thing in the Computer III Inquiry with the concept of Basic Service Elements (BSEs). BSE's are defined public information objects that are made available through networks. We don't worry about characterizing the networks themselves.

Or course, if some network exists somewhere that is not connected to anything else, and all the information objects were purely private, then the network could be comfortably be characterized as private. And vice versa. Relatively few networks in this world are so simple and bounded.

4. *Public* Indicia

Ultimately, however it is necessary to begin dealing with the properties that make an information object "public." Private can simply be regarded as whatever is left, i.e., non-public.

Five prominent properties seem relevant for the purposes of the study:

Who provides it? In other words, who makes the information object available? If it is a public body that makes it available, or a non-public body acting under an obligation established by a public body, then the object can be said to be at least partially public. Under old legal regimes this property was very important.

Who can access it? In other words, who can effect communication with the object. If this can be done anonymously, i.e., anyone, then the object can be said to be at least partially public. For example, anonymous File Transfer Protocol (FTP) servers on the Internet are usually regarded as having these public qualities.

In our increasingly complex information infrastructure environment, this property of access may be the most significant one. Another way of portraying accessability is connectivity; and connectivity is a big issue today. It was one of the more interesting new requirements embedded in the new International Telecommunication Regulations adopted by WATTC'88. Connectivity might become the new "public" good. In a sense, government already overtly funds connectivity. The big policy question however is how much connectivity is enough?

Who owns it? In other words, who has title. This can involve ownership of real physical property, or of intellectual property. If a public body owns the object, or if it is in the public domain, the object is at least partially public. The characterization becomes more difficult when you attempt to deal with the issue of acquisition of facilities (and customers) arising from former public largesse? One could even argue that where the property is subject to government regulation, that at least some of the rights of use have been effectively ceded to the government.

Who controls it? This is one step beyond access. It involves giving the object an instruction if it is involves an information process; or moving or altering it if it is pure information. Once the object is accessed, what can be done with it?

This property is made more complex because there can be widely varying degrees of control. There may also be a time factor. Control for how long? In complex network

management processes, there may also be different priority levels invoked under failure conditions. In the case of a simple information file, read/write permissions are a good example of different kinds of control. In electronic news networks today, editors or monitors frequently exercise control functions over distribution capabilities. Stodolsky's INET'91 presentation, for example, examines the public policy options and considerations underlying this aspect of control.

Generally, if the control of an information object is anonymously equal, it can be regarded as public. Real world environments, however, are fairly complex. The providers or owners of objects usually exercise some control, and objects necessarily exist under the control of operating or network management systems.

Who pays for it?

Information objects and their array in networks have associated economic costs. If those costs are borne by or otherwise underwritten by public bodies, the object may be described at least partially as public.

The National Science Foundation, for example, pays for all the information objects associated with a major Internet backbone. The DOD pays for MilNet. The General Services Administration pays for FTS2000. The Swiss federal government and cantons similarly pay for SWITCH. This property is obviously rather tempered by other properties in determining the overall characterization of the object or network as public or not.

5. Conclusions

The use of the term "public" with respect to telecommunication or to information communication networks is highly complex. To even attempt to make a characterisation in all but the most simple situations, it is useful to proceed through a two-step analytical process.

First the network architecture must be examined and be parsed into an array of information objects. Each one of those objects must then be examined in light of five properties: who provides it, who can access it, who owns it, who controls it, and who pays for it. On the basis of the combined aggregate of all the results, it is possible to say that the object has a certain "public index factor." For example, on a scale of one to one hundred, a central office telephone switching object might rate a 70.

It seems, however, that continued use of the term "public" only has meaning today with respect to residual historical developments (regulation of dominant carriers, international legal obligations, etc), potential disputes over unfair trade practices, or achieving a meaningful current public good like promoting connectivity.

In these contexts, it seems necessary to focus more on information objects than networks because of the essential impossibility today to characterize most networks as public in any kind of consistent or definitive way. In addition, there may be individual information objects that represent such an important public asset, that they should be effect with a high "public index factor."

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Subject: Citations

Eli,

In the Taxonomy of Networks working paper I sent to you, please amend it
by adding a footnote "1/" after the sentence in the text referencing
Dave Farber's work and concepts; and add at the end the following citation

1/ See David J. Farber, A Tale of Two Major Netowrking Problems - One Organizational and One Technical, The Harvard Information Quarterly,Fall 1989; David J Farber, Some Thoughts on the Impact of Ultra-High-Speed Networking on Processor Interfaces, distributed through the Internet from <farber@cis.upenn.edu>, May 1988.

Thanks, Tony