1. Introduction

A layered policy model for regulation of telecommunications, as proposed by Kevin Werbach [Werbach] and Rick Whitt [Whitt], has many attractions. The telecommunications industry used to consist of a collection of separate and vertically integrated sectors providing different services. Currently it appears to be evolving towards a collection of heterogeneous networks that will be unified at the Internet Protocol (IP) layer, so that even though a variety of technologies will continue to be employed, they will not be visible to users (and most developers), who will see a uniform interface. In this converged network, a growing variety of services will be provided on top of the basic connection. If regulation is to be applied in the future, it should work along the lines of natural technological and economic trends, and not at cross purposes to them.

An extreme example of a layered policy model would force structural separation on the industry. Some of the layers, primarily the ones without adequate competition, would then be provided by companies that could work in those layers only. That would conform to general trends in the economy. Largely because of better communications and the resulting lowered transaction costs, most industries have been restructuring into entities that operate on larger scale, but smaller scope. The computer industry is an example par excellence of this evolution, moving from the vertically integrated mainframe manufacturers of a few decades ago to specialists supplying operating systems (such as Microsoft), microprocessors (Intel), memories (Micron), hard disks (Seagate), as well as systems integrators (such as Dell).

Even the telecommunications industry has learned the benefits of horizontal layering. Such layering had been in use in internal operations for a long time, to get the usual benefits of such structures. But at the corporate level, the story was different. The U.S. federal government had to fight hard in the 1960s and 1970s to allow competition in customer premise equipment, and in the 1970s and 1980s to introduce competition in long distance services (culminating in the forced breakup of the Bell System in 1984). But as time passed, and the benefits of horizontal layering became greater and clearer, AT&T in 1995–96 voluntarily separated out its service provider part from its supplier arm (which became Lucent).

There are extensive historical precedents for a layered policy model in transportation. Those precedents, together with the historical record of regulation in telecommunications, suggest, though, that it will not be easy to implement the Werbach-Whitt model in the U.S., and that even when it is implemented, it will not be a panacea. The main problem is that even though technology does not in general diffuse on "Internet time," these days it does move faster than the political and regulatory processes. This is aggravated by the difficulties in demarcating layers, and the somewhat unstable nature of layered structures that are often observed. Moreover, layered regulation might make it hard to obtain full benefits from price discrimination, one of the key elements of most regulatory schemes.

2. Historical precedents

Telecommunications services (including postal systems) have traditionally been operated as monopolies, often run by governments. Even when run by private enterprises, they have generally been heavily regulated, with separate regulatory regimes for different services. Thus there are few precedents for the Werbach-Whitt proposal in telecommunications. On the other hand, transportation offers a rich source of examples that one can draw analogies from. In particular, in Britain and in the United...
States, river navigation projects, canals, and turnpikes in the 18th and 19th centuries generally had structural separation imposed on them at inception. They could not provide complete transportation services, and could only offer their facilities to carriers who transported goods and passengers in their own boats and carriages. (See [Odlyzko2] for a brief historical account, many references, and some analyses of the possible applications to telecommunications.) Charters for river navigation projects, canals, and turnpikes provided for differential tolls, depending on the goods being transported, thus responding to the incentives to price discriminate. (These tolls were prescribed in detail, unlike the technologies to be used, which were left to operators to choose.) This structural separation and the carefully constructed toll schedules were a compromise between the desire to avoid a monopoly and the need to provide adequate incentives for construction and operation.

Although structural separation generally did the job it was assigned, it was not perfect, as there were attempts to bypass the limits imposed by charters. For example, canals often controlled all the convenient storage warehouses. A more serious problem was that the tolls imposed by the charters were only maxima. Operators, although possessing a local monopoly, often found it more profitable to charge lower tolls, and that allowed them freedom to engage in unpopular pricing practices even without violating their charters.

Early railroad charters in both Britain and the United States were patterned after canal charters, and also envisaged structural separation (as well as differential tolls). It was expected that independent carriers would bring their own wagons and run them on the rails of the new iron roads. However, this arrangement, while it did persist on some railroads for a while, in most cases broke down very quickly (and governments accepted this quickly). Railroads decided to control all carriage on their facilities. The reasons were a combination of safety issues as well as economic incentives. Railroads were able to accomplish this in spite of their charter because they had ways of impeding operations of rivals (such as denying them access to unloading facilities, or water for their locomotives, as well as just plain refusal to deal).

The main lesson from the transportation experience is that for structural separation (or milder forms of layer regulation) to work when that is not in the interests of the service providers, the interfaces between the layers have to be simple ones. That has already been pointed out by Gerry Faulhaber [Faulhaber] in an analysis of the United States telecommunications market. In particular, he found striking contrast in the degree of competition that emerged in long distance access in intrastate markets, which demonstrates how incumbents can impede competition when it is in their interests to do so.

3. Problems with layers model

The layered model has often worked in the past in transportation. But it has not worked without difficulties, and sometimes broke down. With rapidly changing technologies and rapidly evolving industry structure, there would be many temptations and opportunities for service providers to evade limitations through either technical or political means (as has happened in the past, [Faulhaber, Odlyzko2]). There would be the added complexity of trying to impose the new regulatory model on an existing and very complicated industry structure. In particular, wireless service providers and cable networks, which have been very lightly regulated so far, would have to be brought into the system, a move they would surely resist. Hence it is hard to imagine most of the players in the industry coming to a consensus in a timely fashion. But if they do not reach a consensus, imposing a new regulatory model would take many years, given how slowly the U.S. legislative, regulatory, and legal systems move.

The technical challenges of imposing a layers model should not be underestimated. The definition of equal access becomes difficult when the underlying technology inherently involves statistical multiplexing of traffic from a variety of users (as happens on a cable channel at the physical layer, or on just about any Internet Protocol link at the packet level). Moreover, this issue can be made even more difficult than absolutely necessary by various actions of the service providers,
and so regulatory models might heavily influence technological choices, sometimes in undesirable ways. In any case, these technical difficulties would undoubtedly be exploited by opponents of the layers model to impede its introduction.

There is also a very fundamental problem with the layer model, related to the inhibiting effect it would have on price discrimination. Differential pricing, in which customers pay varying prices for what may be essentially the same goods or services, are at the heart of regulation. In telecommunications, we observe (see Table 1 in [Odlyzko2], for example) that users pay rates per megabyte of data varying between $0.0001 (for movies delivered over cable) to $3000 (for text messages over wireless). This creates strong economic incentives for price discrimination, and against charging per byte or per packet. A physical layer service provider that charged just by the volume of traffic could not take advantage of the variation in willingness to pay. But it is the basic connectivity provider that has the high costs that are of greatest concern in discussions about deployment of broadband, at least for residential users (cf. [Odlyzko1]). In transportation systems in the 18th and 19th centuries, the compromise between public policy of structural separation and the incentive to price discriminate in order to obtain enough funding for buildout of networks was to allow the turnpikes, canals, and railroads to charge according to the nature of the cargo. For example, on the Beverley Beck navigation, sand paid 2 pence per ton, while iron and lead paid 12 pence [Odlyzko2]. These differential tolls were set through a complicated political process, and were based on the relative stability of valuations, and on inability of carriers to camouflage one type of good as another. In today’s telecommunications, neither assumption applies, as where the value resides in the network is subject to rapid migration, and many types of traffic can be concealed as others. Thus if price discrimination is really important for the future of telecommunications, the physical layer carrier may have to be integrated vertically with higher level service providers.

4. Conclusions

The layered policy model for regulation of telecommunications is attractive, and some form of it is may very well arise. It is the only model for regulation that conforms to the technological and economic trends in the industry. However, we should not expect this model to arise quickly or painlessly, and even if it does arrive, it will not solve all problems. The two main problems are that the political process needed to introduce this model is not fast, and that such a model might inhibit differential charging.

There is a possibility that only a very weak form of the layer model might be needed. At present, there is little competition and little choice. However, it appears that technology and financial market dynamics might lead to several competing access methods (in particular DSL, cable, and wireless [Odlyzko1]) being widely available to most customers, with each providing an essentially complete suite of telecom services. This is likely to happen considerably faster than a layers model for regulation could be implemented. While there is no certainty that such a competitive landscape will emerge, there is a good chance that it might. Its arrival could be facilitated by relatively easy steps on the part of government, namely freeing up more spectrum for wireless communication. If such a competitive landscape does emerge, we might end up with a multi-modal telecommunications system, somewhat similar to the current transportation system, in which regulation can be very light.


[Odlyzko1] A. M. Odlyzko, The many paradoxes of

