FURTHER DEFINING A LAYERED MODEL FOR TELECOMMUNICATIONS POLICY

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ABSTRACT

Traditionally, specific telecommunications services were essentially confined to certain types of networks; e.g., television over broadcast networks or cable and voice service over wireline or wireless networks. Regulations were built around the underlying infrastructure. The regulations imposed on these providers were as stratified as the networks and the services they carried. Convergence of services onto non-traditional platforms creates a dilemma where the rules no longer conform to the infrastructure. This creates inconsistencies and gives rise to problems such as: market, investment, and interconnection distortions, as well as universal service, accessibility (for the disabled) and public safety concerns.

One of the most relevant of these services is voice, specifically voice over the internet protocols. While several authors have suggested alternative regulatory models to deal with these changes, these models tend to ignore important aspects of market power, network design and technology evolution. One proposed solution to this problem is based on a layered model similar to that used in the development of technical communications protocols. The consistency and modularity of such an approach may be a workable alternative to the current title-based policy. However, a layered model in and of itself is insufficient. A layered model solution must reflect the reality of network design and business arrangements, and, to be viable, it requires a transition policy to get there from the existing policy regime. Emerging policy must address the diversity of existing access technologies (e.g., cable networks versus common carrier wireline networks), the disparity within industry segments (e.g., ILEC vs. CLEC use of last mile) and the strong influence of present policy on these various segments when implementing a transition to new policy. It is important to realize that interconnection will remain at the core of any competitive telecommunications policy. There is always some physical or logical interconnection that must be resolved and this involves pricing. Without the correct incentives or obligations in place, providers will not be motivated to interconnect.

The theory behind our model is to separate policy issues along what we see as logical boundaries; ones that make sense in terms of such issues as cost, technology and network design. The method we apply is simply to consider the problems of the

existing policy and show how a layered model might be used to resolve them. As we move toward more fully converged networks, we will need to understand how best to revise policy. A general direction should be to simplify the rules and to minimize regulation where necessary. We believe that a layered model could provide this simplification.

In previous work, the author described the general notion of a layered model for telecommunications policy. In this paper, we examine the application of this model for voice over internet protocols. We begin by describing the existing policy environment. Next, we rationalize why a layered model makes sense in a converged environment. We then consider the transition into such a model and a number of associated issues. Finally, we apply this layered model to a few vexing policy problems. Specifically, we look at how a layered model allows us to frame the issue of Voice over IP and the closely related issue of Universal Service in a consistent and logical manner.

I. INTRODUCTION

In this section we discuss the existing telecommunications policy model and the rationale for such a model. We then briefly discuss some of the problems with this model.[1]

Regulation has been applied in heavy measure to the traditional telecommunications sector; while regulation of the Internet has been applied sparingly. Regulation within the communications sectors varies significantly depending on how a service provider is classified. This classification is based in many ways on the underlining network/technology on which the provider offers its services. However, services that were once confined to certain types of networks are now being offered across varied networks. This is occurring because of developments within packet based technology.[2]

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[1] First, I would like to thank the reviewers for their very helpful comments. Next, I would like to thank Robert Cannon and Dale Hatfield for their assistance on this paper. Finally, I would like to acknowledge Joshua Mindel and Kevin Werbach for their work in developing the layered model concept. Much of this paper is taken from papers I authored with Joshua Mindel, see [Sicker Mindel] and [Sicker, et. al.].

[2] This model is not necessarily based on any specific technology or protocol, although in this paper we consider TCP/IP as the model.

It might also be useful to briefly consider the role of regulation, as many unfamiliar with the topic have an almost instinctive negative reaction without understanding the topic. Regulations are applied to promote certain desirable goals, such as ubiquity of service, efficiency of commerce, public safety, national security, innovation, and education.[Sicker, 2000] The problem is that regulation is a difficult balancing act, where the goals may stand in opposition to each other. Regulation has traditionally been applied in heavy measure to the communications sector; while regulation of the Internet has been applied sparingly.

In the current policy structure, regulatory conditions are based on the type of infrastructure on which a telecommunications service is offered. For example, Title VI regulates cable networks, Title III regulates wireless and Title II regulates wireline telephone networks as common carriers. This regulatory structure is often referred to as the "silo model" of regulation, in that each network and service is regulated separately from the other. In such a silo model, the top defines the regulatory Title, beneath this is the service and the bottom is the network over which the service is provided.

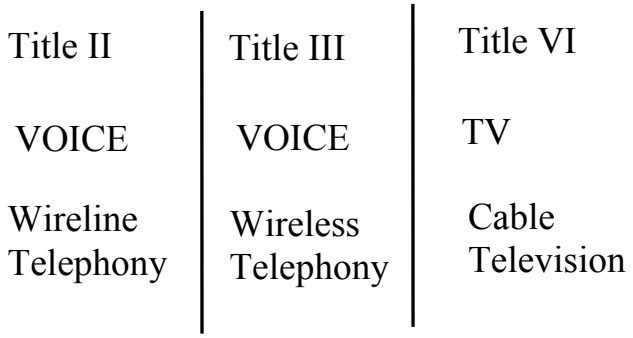

Figure 1. The present policy model

In today's networks, we find voice services carried over cable networks and efforts are (again) underway to carry video signals over copper pair telephony networks. It is this introduction of new services onto non-traditional transport modes that is causing much of the discordance. This has been made possible by the developments of digital technology and the push of computing devices further to the edge of the network.

One might argue from a historical perspective that it was the introduction of computers into the network several decades ago that began the regulatory dilemma we

are now experiencing. These early networks were generally regulated as common carriers, but the computer service riding on top of these networks was viewed as being different and regulated under a different set of rules. This different set of rules was addressed by the Computer Inquiry (CI) (see [CI] and [Cannon]). This led to the second CI and the creation of two classifications, basic and enhanced. Basic service obligates common-carrier regulation, while enhanced service does not. Several decades passed with the refinement and application of this general separation. In fact, the CI decisions have had a profound impact on how network services developed within the US, particularly those relating to the Internet.[3] It should be pointed out that the CIs set out the original layered model; separation of the basic transport network from that of the services. We contend that the layered model we now discuss is merely a logical extension of this earlier work.

Through the Telecommunications Act of 1996 (96 Act), Congress directed the FCC to reform several areas within the telecommunications sector with the intent of developing competition and fostering innovation. The 96 Act further defined the notion of basic and enhanced services through the new distinction of Telecommunications and Information Services. A *telecommunications service* is defined as "the transmission, between or among points specified by the user, or information of the user's choosing, without change in the form or content of the information as sent and received," while an *information service* is defined as "the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications." [96 Act] When a service is provided on top of an internet service, it does not fall under the traditional regulatory constructs of the underlying network type. The internet service creates a layer above which the traditional regulation applied to that network does not apply.

This brings us to the issue of the voice services running over these packet based network, and the issues this creates. A distinction to initially consider is that of voice services running over the Internet versus voice services running over internet protocols. Clearly, there are service providers who are using IP as a transport mechanism for

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[3] There have been three Computer Inquiries over the last decades; for more information see, "The Legacy of the FCC's Computer Inquiries: 35 Years of Unregulation," Robert Cannon, Washington Internet Project, www.cybertelecom.org.

voice. They are interconnecting with other voice service providers, carrying voice over "private" IP networks and terminating back on the public switched voice network. This type of service is significantly different from one in which a user places calls over the "public" Internet without the use of a distinct voice service provider. There are also many shades between these two examples. Another distinction alluded to above is that of self provisioned and services that one obtains from a service provider. The distinction of whether or not there is a "holding out of a service" should be considered by policy makers. The difference may reflect on what obligations should or should not be placed on the service. A final thought to consider is whether or not obligations on IP or Internet based services should by viewed as in their infancy and therefore should be free of burdensome obligations in order to get off the ground. While there is validity in the argument, it is important to recognize that this should be a transition period and that certain obligations, such as public safety and security, may be still be required regardless.

Now that we have described the existing model, let us turn our attention to the problems that the existing model creates. At the heart of this paper is the dilemma that arises when providers of similar services are regulated differently for little reason other than their regulatory legacy. With convergence of services onto non-traditional platforms the inconsistencies among these policies drive on the other distortions discussed below. Many of these problems stem from regulatory arbitrage, where a provider exploits certain policy conditions to gain certain competitive advantages over other providers.[4] Other distortions center on more general issues of public good, such as public safety and accessibility.

Interconnection distortions

Problems arise when a provider of a service is not required to interconnect because of policy distinctions. The obligation to interconnect differs not on the basis of the service offered but on how a provider is classified. An example of how the existing model created such distortions was demonstrated by the rush of ISPs to be classified as CLECs in the late 90s to obtain interconnection with the

[4] Much of this problem rests on notions of pricing and economic efficiencies. Since I am not an economist I do not dwell deeply into these areas. However, I do believe that such an analysis would contribute significantly to this model.

ILECs. Another example is the interconnection problems that arose in ISP peering space, where the existing tier 1 ISPs were able to force costly interconnection agreements on other ISPs, essentially creating a competitive lockout.

Universal service concerns

There is much debate over who should contribute to universal service and why. The problem with the current model is that it conflates the network with the applications. Universal service is about building networks and providing services to the under served. The distance sensitive aspect of building a network does not apply to the application space. Much of the debate stems from the issue of why certain carriers are able to get access to these funds while others cannot.

Bundling discrimination

Certain players may be in a position to restrict access to content. For example, cable providers have bundled content and resisted allowing this content to be offered by satellite providers (this was eventually mandated by FCC action).

Content discrimination

Certain players are in a position to dictate the terms of content and conduit delivery to their customers, while others are not. This is the problem that arises in a vertically integrated ownership model – when a player owns the conduit, the application and the content (or some combination).

Accessibility concerns

There are specific obligations on the traditional voice providers to facilitate accessibility for individuals with disabilities, while these obligations do not exist on all voice service providers

Security concerns

While CALEA (loosely stated, the modern wiretap law) is broad in its application, there are still differences in how the law applies to providers of traditional voice versus other service providers. This, among other things, makes legal wiretaps of VoIP more difficult.

Safety concerns

There are various concerns that exist in terms of the support for emergency service (E911 service) as we move into a voice over packet environment. The

problem again is one of whether policy obligates a provider to offer such a service.

Market distortion

Problems arise when price does not reflect the cost of the service. An example of this behavior may be realized when we examine international VoIP services. Here an arbitrage is carried out by providers of services into countries without contributing to that country's settlements. The problem is that many of these countries rely on these contributions to support the cost of their communications networks.

Investment and deployment distortion

Problems arise when providers make choices about where to invest based on policy. The dot.com spending frenzy was influenced by this distinction of regulatory treatment. Further, incumbents claim that there is not incentive to invest because of the regulatory burden placed on them in terms of unbundling requirements.[5] Other examples of distortions arise when a provider is unable to get access to rights of way, cellular tower or pole attachments.

Within the last few years, a number of authors have considered ways of addressing these problems with the existing telecommunications policy by modeling it after the well-understood notion of a layered protocol model.[6] This paper focuses on the specifics of implementing a layered regulatory model approach. We extend our earlier work by considering the details of a layered model and applying this model to a few existing VoIP policy problems. We begin by setting forth the existing regulatory structure

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[5] A related area of concern is that of technology distortions that might arise from the present policy model. For example, a provider might select a technology not because of its technical or cost attributes, but because of the regulatory conditions that apply to that technology.

[6] D. C. Sicker, J. Mindel, & C. Cooper, The Internet Interconnection Conundrum (1999) (unpublished FCC working paper); K. Werbach, A Layered Model for Internet Policy, The Regulation of Information Platforms, J. Telecomm & High Tech. Law, 2002; Sicker, D.C., Mindel, J., Refinements on a Layered Model for Telecommunications Policy, Silicon Flatirons Journal (2002).J. Weinberg, The Internet and Telecommunications Services, Universal Service Mechanisms, Access Charges and Other Flotsam of the Regulatory System, Telecommunications Policy Research Conference (1998).

and describing the problems policy makers face. Later we describe a conceptual framework that could serve as the basis for a layered policy model.

II. A LAYERED MODEL

In this section, we describe some of the rationale and motivation for restructuring the previously described vertical model along the horizontal. This layered model provides a number of advantages that we will now consider.

In such a model, we could define three or four layers; the fourth being a layer defining the treatment of content.[7] By dividing the model horizontally, we are able to place general regulatory requirements on similar aspects of the network. Most importantly we are able to separate service aspects of the network in a manner consistent with the design of network. The real value is that regulation can be minimized or compartmentalized by considering the role of regulation on each layer distinct from the layer above or below it. We see a process where policy makers would start at the lowest sub-layer (maybe rights-of-way or telephone pole attachments) and examine whether or not there are competitive or social reasons to apply a regulation to that layer. The analysis would continue up the "stack" through the access and transport network to the applications and content.

This model allows us to set up the policy questions without confusing the physical network with the applications and services that run over that physical network. It does not necessarily provide the policy answers, but it provides a framework for better resolving policy issues. This model does not purport that all layers will be regulated equally; rather that the providers at the lowest layer of this model will continue to be regulated differently from one another; not on the basis of network type, but rather on the basis of market power. Framing the problem in the manner above provides a consistent structure for contemplating the policy and regulatory details that would follow.[8] The consistency is that similar serves at equivalent layers are viewed in a similar manner.

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[7] This issue of content, e.g., copyright, digital rights management and royalties, will continue to be a huge problem within communications networks, but is largely outside the scope of this paper.

[8] We do not describe the specific regulation that would be applied within each layer; we only provide the framework for considering this regulation.

Figure 2 depicts the generalized model. While this figure looks similar to the TCP/IP protocol suite, one should not assume that these layers relate directly to the layers of the protocol suite.[9] While it is true that the TCP/IP protocol suite serves as a common and open protocol for many communications services, these specifications deal with the technical characteristics of the protocol and not the business or policy characteristics. While there is a correspondence, the policy layers represent the providers of the services, not the protocols or the implementation of these protocols. It is the consequence of the protocol design that allows us to divide the network as we do. By providing a network model where the layers are fairly agnostic of neighboring layers, TCP/IP supports the separation of the content, application and delivery services. Further, it should be mentioned that TCP/IP can be implemented in a closed manner.[10] Therefore, we should not confuse the technical implementation of the Internet with the policy goals of a layered model. What we should take away from the protocol design is its design philosophy; including things like decentralized control, autonomy, efficiency, etc.

Some authors have suggested what amounts to an "internetworking layer." [see Werbach] In our model the physical network and internetworking are treated as one. However, a distinction is made to separate the access providers from that of the transport providers. Nonetheless, in both access and transport the Internetworking layer is merely a means of interconnection. It should be mentioned that this model does not necessarily prescribe the Internet Protocol as a layer; in fact, this model does not prescribe ANY technology.

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[9] In this paper, we loosely use TCP/IP and IP interchangeably to represent the TCP/IP protocol suite.

[10] TCP/IP is not inherently open. Many TCP/IP based networks now exist that are not part of the global Internet. Also, an IP based network can be combined with other protocols to create closed design. See [Kende and Sicker]

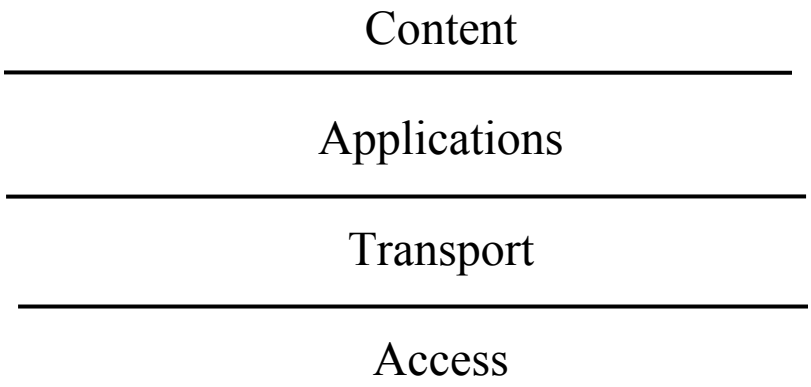

Figure 2: A horizontal policy model

The separation of the access network from the transport network and the separation of these networks from the applications is critical to the success of this model. By making this division, the proper incentives could be introduced (through regulation or economic incentive) to encourage providers of the various services to interconnect on reasonable terms. Where a provider might own multiple layers, regulation might be imposed to ensure that this player would provide reasonable interconnection or a provider might not be allowed to own and operate multiple layers. This logical boundary between content and conduit is important to maintain and has long been a tenet of public policy.

Other models have proposed similar layered approaches to policy for converged networks. Each of these models has its own weakness. In [Sicker, et al], the focus was directly on interconnection of carriers and did not specifically consider a means of addressing market power issues. Other models tend not to consider the issues of interconnection, market power or the transition to such a layered model. We think that each of these issues is critical in creating a workable model. Further, none of the proposed models have specified a rule set. It is this type of specificity that is the most difficult to develop. A less specified model can provide a grand vision but it is the implementation details that are the biggest challenges.

We do not see a reason for defining a “logical” layer (based on some aspect of TCP/IP) as some authors have suggested; nor do we see a reason for defining a “code” layer. Rather, we believe that there are logical separations that exist among the network that transports the data, the applications that operate on the data and the data itself. While TCP/IP provides a useful method of moving packets and separating the transport

from the application, it is not itself a separate element of the network. Further, describing a layer as "code" fails to recognize that all the layers contain code. While we do agree that both TCP/IP and the associated code play vital roles in a converged environment, they are not themselves policy layers.

The goal of our model is to create a framework that logically divides the network (and services provided over that network) so that policy can then be applied in a more consistent manner. The separation that we describe between the access and transport providers maps to the design of networks. Even future policy such as the Bill and Keep model maintains this division.[11] While the separation of the application is described in more detail later, it is worth mentioning that the application market has very different development characteristics from the network environment, in that innovation is rapid and non-predictable. Also the application space is characterized by very different investment models from that of the network space. The costs of applications are not distance sensitive as are network costs.

The Computer Inquires established a useful precedent for justifying a transport layer separate from that which rides on it.[12] However, while one could argue that things like the Open Network Architecture and aspects of the 1996 Act are in the spirit of a layered model, they fall short of providing a complete framework. Even with the separation of basic (telecommunications) from enhanced (information) services, there is nothing to provide the proper guidance on emerging services or the interconnection issues that will arise. Further, we contend that this past regulatory framework has been misapplied (or stretched), leading to some of the discrepancies we see today. Therefore this layered model is not such a novel concept, but rather something of a logical extension of recent policy. It is the application of this concept to the broader area of telecommunications that is the twist that we suggest. The rationale behind such a move is as follows: It was the difficulties that arose when computers were interconnected to

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[11] This model is discussed in detail in a recent OPP working paper by Pat DeGraba.

[12] See "The Legacy of the FCC's Computer Inquiries: 35 Years of Unregulation," Robert Cannon, Washington Internet Project, www.cybertelecom.org. For more on the first Computer Inquiry , see Regulatory and Policy Problems Presented by the Interdependence of Computer and Communication Services and Facilities, Notice of Inquiry, 7 F.C.C.2d 11 (1966) [hereinafter Computer Inquiry].

network that started the Inquiries. What has occurred is that computing devises are being interconnected by other networks not originally considered.

From a theoretical perspective, the point that we would like to stress is that policy issues at one layer should be recognized as different from policy layers at another. By taking a layered view we can separate access and transport issues from application issues. The present model conflates policy issues that are in actuality separate. This makes for policy that appears contrived in many ways to address this mismatch.

The question to now consider is whether this layered model addresses the concerns we highlighted in the previous section of this paper. To answer this question we revisit these issues below.

Policy distortions

One of the main advantages of a layered policy approach is that it should reduce policy inconsistencies. However, it is important to recognize that the present regulatory structure allows policy makers to make decisions separately with respect to each segment (Title), and without concern for what this might mean for the others.[13] This creates a great deal of flexibility and lends itself well to tailoring solutions. By employing layers, policies may be applied on the same service regardless of the technology.

Market and Investment distortion

The application market has very different development characteristics from the network environment, in that innovation is rapid and non-predictable. By separating these layers we may allow each market to operate more efficiently. Further, the application space is characterized by very different cost models from that of the network space. The costs of applications are not distance sensitive as are network costs. This means that the costs associated with each is quite different.

Interconnection distortions

As stated, the separation of the access network from the transport network (and the separation of these networks from the applications) is basis of this model. By making this division, the proper incentives could be introduced (through

[13] *See* 1996 Act, *supra* note 4.

regulation or economic incentive) to encourage providers of the various services to interconnect on reasonable terms.

Universal service concerns

While this issue is examined more closely later, one should consider the economics of providing universal service. The point of applying a layered model to Universal Service is that it separates the distance sensitive component (the physical network) from the non-distance sensitive component (the application or content). One might argue that all segments of the communications industry should fund Universal Service or that support should come from the general tax coffers.

Deployment concerns

Some believe that the only way to create an incentive for broadband deployment is vertical integration. We view this as an invitation for abuse. While we believe that physical network providers need a return on investment, we do not believe that this should come at the expense of eliminating competition in higher layer to create that incentive. There is just no reason to destroy the competitive application market that has developed in the name of broadband deployment. There is great value in having a rich content environment, including such things as freedom of expression, diversity in media, and innovation. The control of the media by a small number of individuals can have negative consequences. The ability to freely and easily access content and communicate with others is of paramount importance in a democratic society. This ideal does not receive sufficient attention within today's policy. If we want to drive broadband deployment, then we should look closely at the barriers associated with that service. What we should not do is kill a richly competitive environment. One possible solution to market abuse is to construct a new separations model for content/conduit owners. We do not consider the details of such a model in this paper.

Bundling discrimination

By separating the provision of transport from the provision of services, we could create a mechanism to examine such bundling systematically across providers.

Content discrimination

We will not even feign to address this issue in this paper. Clearly, a number of huge issues still need to be resolved, such as copyright, privacy and digital rights management.

Safety concerns

As mentioned previously, the point of this model is not to unnecessarily exclude all application and content providers from regulation, as there are regulatory obligations that will need to be considered for these upper layers. As more individuals move toward VoIP services (knowingly or otherwise), the need for E911 capabilities becomes vital.

Security concerns

By defining a layered model, we are able to create a logical definition of the service provider and the obligations that should be placed on this provider.

Accessibility concerns

A common set of goals and recommendations should be made to the FCC regarding how best to serve those with special accessibility requirements. A layered model allows the policy makers to consider the implications of changes in technology and ownership in a more systematic manner. We believe that as time passes and the network evolves toward broadband that the accessibility focus will shift up to the application and content layer.[14] Rather than rely solely on regulating accessibility, government, industry and interested parties should work together to inform the service providers of the needs and do so early in the development or deployment process to minimize the difficulties (cost, time or other) of supporting such needs. It would be useful for product developers and providers to have available documentation to consider during product development. At this point, government should focus on creating the documentation and raising awareness.

One additional step to consider (although not considered in this paper) is what new problems a layered model creates. After scoping these problems, the question

[14] This is not to say that there are not substantial physical and encoding issues.

becomes one of a cost/benefits analysis of moving to this new model versus staying with the existing model.

III. A SIMPLIFIED MODEL

In this section, we provide a more detailed description of how we see this model applied. We apply the layered model described in the previous section to the general issue of interconnection.[15] In previous work [Sicker, et al], the authors proposed a conceptual framework based on service and network structure. This framework was intended to allow policy makers to systematically evaluate interconnection relationships between providers of service layers. The service layers distinguish between types of physical services (e.g., access, transport), application services (e.g., directories, caching, voice, electronic mail), content (e.g., music, video programming), and legacy telecommunications services (i.e., traditional PSTN telephony). These categories are described below:

- Physical services: Providers of 1) Access and 2) Transport Services; including both best-effort and QoS services.
- Applications services: Providers of application services that rely on underlying access and transport services can be further subdivided into three subcategories: 1) directory service providers (e.g., DNS and other naming/numbering functions); 2) intermediate or middle service providers (e.g., multicasting and caching); and 3) end user service providers (e.g., voice, email, and hosting). One could argue that these three subcategories are distinct and should be treated as such, but this broad categorization is sufficient for this context. The point is to distinguish between the provision of a data delivery service and the applications that use or support the data delivery service. The specific interconnection differences that arise for each of these three subcategories are beyond the scope of this paper.
- Content: Content providers that rely on underlying transport, access, Application-directory, and Application-intermediate services. Examples of content include video, music, and telephony services.

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[15] This section is based extensively on previous published and unpublished work, [Sicker, Mindel] and [Sicker, et. al.].

- Legacy telecommunications services: Telecommunications service providers as generally defined in the Communications Act.

Services and service providers are the focus of this model, rather than those parties that might develop the services on behalf of the service providers. One could also argue that software developers and consumers are also crucial to the deployment and use of the infrastructure, and should therefore be included in the framework.

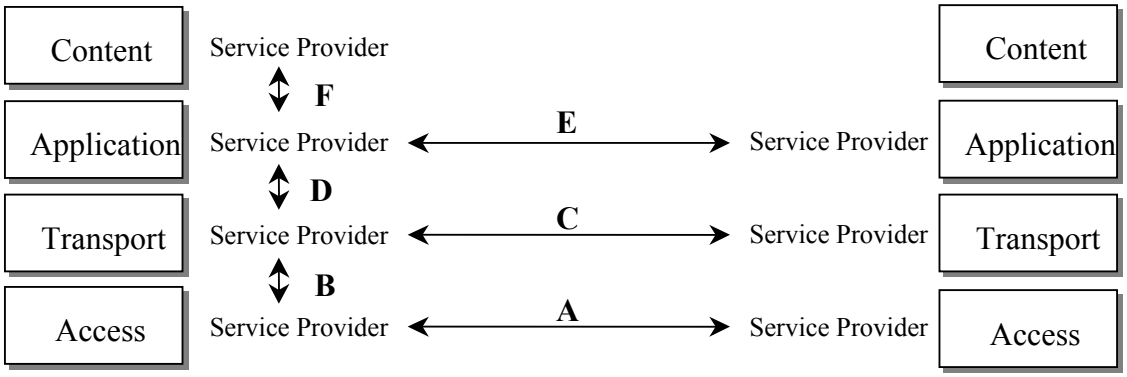


Figure 3a: Relationships among Infrastructure Service Providers

Figure 3a should be viewed as a conceptual model of the service providers. From a telecommunications policy perspective – and the perspective of this paper in particular – these are the relationships of primary interest. For example, an IP transport provider will use applications on their network, but since they offer the transport service to the public for a fee, the transport is the service of interest. Similarly, an application provider will employ network infrastructure (access and transport) to connect their applications to the public network, but the service is the application not their network. For more on the details of this model, see [Sicker and Mindel].

This layered stack provides a framework for systematic evaluation of the interconnection relationships between the layers. From the perspective of interconnection policy, the most important provider relationships are:

A - Access Provider to Access Provider

B - Access Provider to IP Transport Provider

C - IP Transport Provider to IP Transport Provider

D - IP Transport Provider to Application Service Provider

E - Application Service Provider to Application Service Provider

F - Application Service Provider to Content Provider

G – Internet Service Providers to Telecommunications Service Provider

Relationships A through F are depicted in Figure 3a. An application service provider may directly connect with an access provider, but for purposes of simplification we leave this relationship out.

Figure 3b depicts relationship G, between Internet Service Providers and Telecommunications Service Providers. The diagonal layering implies that PSTN voice and PSTN transport services are more tightly coupled than are the modular layers in the emerging IP infrastructure.

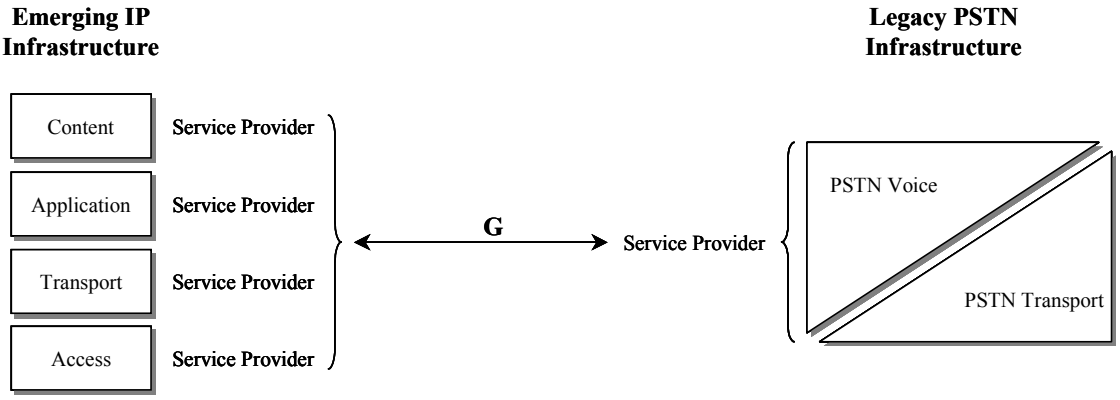


Figure 3b: Relationship between IP and PSTN Infrastructure Providers

In Figure 3b, services that would be considered an application service in an IP context (e.g., SS7/IN and directory services) are in the upper diagonal, and those services that would be considered a transport service are in the lower diagonal. Both are considered telecommunications services in legacy PSTN regulation.

IV. TRANSITIONING

In this section, we examine the issues that must be considered for a transition to a layered model. Moving to such a model will require more than Congress handing down a new set of laws for the policy makers to implement. It will require change in how the regulatory agencies operate, as well as change in how these rules are enforced. As these changes relate to numerous areas, we briefly consider what may develop.

First steps

A logical place to start this type of transition is by initiating an NOI on voice services, specifically including voice over packet networks. There would be a number of issues to consider; such as defining the differences among the various types of voice services, decide the relevance of these differences, determining who offers these services and how that influences such issues as market power, and deciding on what obligations (and rights) to mandate and what to relax or omit. The idea would be to look at the issue of voice service as separate from the platform.

Stating that one player must interconnect with another player is rather simple, but defining the terms and conditions of the interconnection is another thing. To maintain some level of competition, we believe that pricing conditions and market power analysis will become more important as communications players continue to drift into providing both the content and the conduit. Too much of the market has slipped into a consolidated service model (with too few players) to depend on free market mechanisms to control pricing. While setting such terms and conditions is not an easy task, we see no escape short of the very unlikely divesture of multi-layer players. Keep in mind that the goal of this model is to create consistency in policy; it is not to necessarily deregulate. In fact, as content and conduit owners combine, we see the increased need for regulation to address abuses. Ultimately, we see that a logical separation of the content provider from the conduit provider as being the best policy.

Transitioning

One of the strongest motivations for moving toward the proposed framework is that there exists significant precedence. It is not a radical departure from the basic regulatory structure and precedent of the last four decades. To begin a transition to a layer-based approach to telecommunications policy, policy makers should consider how this transition will change the rule making process. This change will require traditionally disparate groups (different bureaus and offices) to now work together on rulemakings.

There is precedent in that this occurred in the notice of inquiry ("NOI") on high-speed access, where the inquiry considered multiple forms of high speed access, each of which was regulated under a different Title. Additionally, the FCC has restructured its bureaus and offices toward a similar goal. Regulators will need to move away from specifically defined regulatory solutions toward more generalized solutions based on a set of key policy goals. While the structure of the rulemaking is disparate among the various Titles, there is consistency as it relates to the general policy goals; which should drive decision making.

Interconnection

Interconnection is at the heart of this model. We believe that by defining interconnection correctly, we have solved a substantial part of the problem. Providers of access, transport, and applications may be subject to interconnection obligations on terms defined by their market power.

Market power

While similar policy will be applied to all service providers, those determined as having significant market power will have additional obligations. When a player is determined to have significant market power, a pricing condition will be invoked. This condition will vary depending on power exerted; whether the player controls multiple layers or significantly controls a particular layer. For example, many cable and LECs would be viewed as significantly controlling the access layer. Other players, such as AOL/TW, would be viewed as operating in multiple layers.

Pricing

The specifics of pricing are outside of the scope of this paper, but would depend on interconnection and market power issues discussed above.

Enforcement

While the hammer of divestiture could be used to threaten dominant players, it is unlikely to create any response, particularly in a meaningful timeline. Therefore, an improved ability to monitor and fine players that violate the interconnection and pricing rules will be needed. The question that remains is whether government will aggressively enforce penalties for players who fail to cooperate. The FCC has recently received the ability to levy more substantial fines.

V. APPLICATION OF MODEL

Most of this paper has focused on the general description of this framework. In this section, we apply this framework to some issues surrounding voice over IP. We begin by considering the issue of universal service.

UNIVERSAL SERVICE

As we move toward broadband access for the general public, one of the more trying tasks is that of Universal Service funding. We see two viable options for Universal Service funding. The first being that of a generalized tax, where Universal Service funds could come from the federal tax coffer and be available to all players interested in building infrastructure to the underserved population. Structures loans, much like that of RUS, could also be made available to interested parties. Funds, in a form similar to food stamps, should be made available to disadvantaged users. The second option is closer to today's method, where the funds would come from the telecommunications industry. In one model, the funding would come from the providers of the physical networks, as depicted below in Figure 4. By separating out the applications and content from the physical network on which it rides, we can recommend policies that align with the economic reality of servicing under-served areas. In this model, an application such as voice over IP would not be subject to Universal Service requirements.

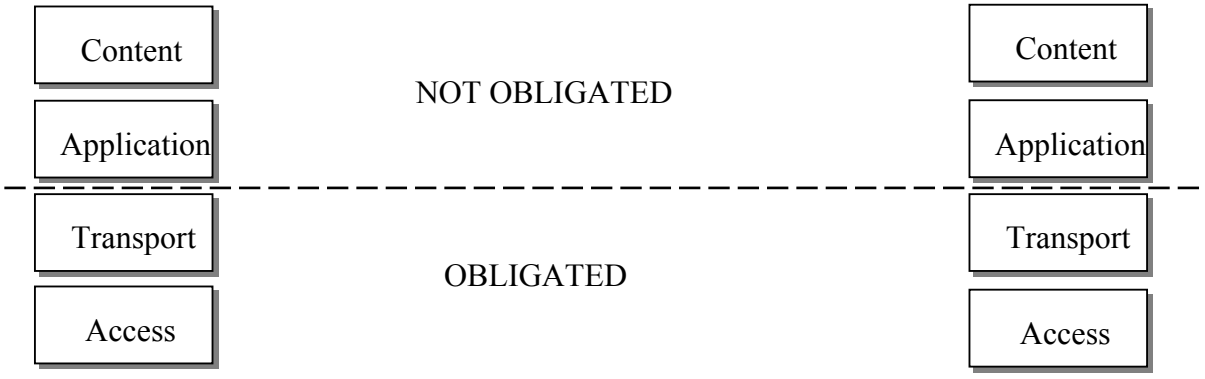


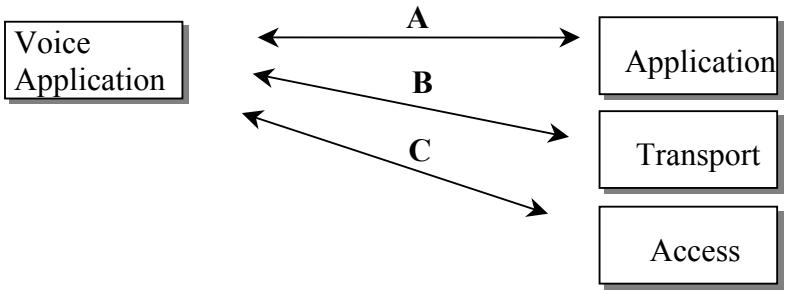
Figure 4: Obligations for Universal Service

The point of applying a layered model to Universal Service is that it separates the distance sensitive component (the physical network) from the non-distance sensitive component (the application or content). One might argue that all segments of the communications industry should fund Universal Service. However, we believe that this would place a burden on the wrong market segment. The subsidy should come from the same segment as where it is applied.

While we rationalize this separation, it may be that a general industry tax is the most efficient method of ensuring the continuity of universal service. The point is not to unnecessarily exclude all application and content providers from regulation, as there are other regulatory obligations that will need to be imposed on these upper layers. It is just not clear that universal service is one of these regulatory issues to be imposed on application and content providers. If we decide that it is, then we might want to think about appropriate models. One model suggests attributing contribution requirements to owners of telephone numbers (NANP assigned numbers). While this is generally a logical approach, it may tie Universal Service to telephony by this association with telephone numbers.

VOIP

The same argument that we make for Universal Service could be made for VoIP. The premise being that voice is an application and is separate from the network on which it operates. This means that voice as a service should not be subject to the same regulatory conditions as the physical network.[16]



[16] The exception to this rule might be traditional telephony service, where the transport and the service are so closely tied.

Figure 5: Relationships among VoIP and other Service Providers

In the figure above we see relationships between the voice application provider and other application providers, transport providers and access providers. The role of the application provider may include being the provider of the voice service, the directory services and the signaling functions. The interrelationship of the various application providers would include such things as a voice provider needing access to directory information or interconnecting with another voice provider. This type of interconnection will become increasing more important as VoIP gains in popularity. We now look briefly at each of these relationships.

a) Access/Transport Provider to Application Service Provider

These relationships enable application service providers to access the transport networks that carry their traffic. The relationship between the voice application provider and the physical network provider will also grow in importance as the characteristics of service providers change. There is already a basis for this type of regulatory requirements through the existing interconnection rules.[17]

b) Application Service Provider to Application Service Provider

The end user subset of the Applications Services market sector is characterized by low economies of scale. This factor will keep this market sector competitive. Intermediate applications, however, such as those that facilitate end user applications (e.g., telephony signaling and directory services) may become important from a public policy perspective if a single provider dominates and has the power to thrive without interconnection to other application service providers. The need to consider how this layer interconnects will grow in importance as more functions move from traditional voice platforms onto Internet based platforms.

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[17] The reality of regulation is that it is used as a competitive (or anti-competitive) tool, where players try to hide behind the advantages that the regulation provides. Interestingly, the interconnection obligations placed on the LECs for voice services require that they interconnect with competing providers. This is an example of worthwhile transition regulation as we move toward a new framework. It creates a virtual gateway through which interconnection can occur [Sicker, Kende]. It is interesting that these requirements are not placed on all competitors. In this way, competing providers can make chooses about the manner in which they interconnect in ways the incumbents cannot.

c) Internet Services Provider to Telecommunications Service Provider

For the foreseeable future, the emerging IP infrastructure needs to interconnect with selected parts of the legacy PSTN infrastructure. With the current regulatory status of Internet Services as information services, a telecommunications service provider with market power may be able to erect barriers to entry. These barriers may include restricted access to rights-of-way, restricted access to signaling for call routing and completion, and restricted access to 911/E911 services.

As mentioned previously, the point of this model is not to unnecessarily exclude all application and content providers from regulation, as there are regulatory obligations that will need to be considered for these upper layers. As more individuals move toward VoIP services (knowingly or otherwise), the need for E911 capabilities becomes vital. Accessibility issues for those with disabilities must also not be overlooked. This is not to suggest that regulation is the only answer, but policy makers must be cognizant of the issues. Voice over IP is not necessarily the same as voice over the Internet. How the service is offered will influence the regulation that is applied; a self provided service may not have the same expectation as a “for fee” service.

It is important to recognize that new applications can quickly enter this space and radically change the landscape. Napster is an example of such an application. In less than a year, Napster raised a number of legal, policy, and architectural issues. Assuming that we do indeed value this type of rapid innovation, it is this dynamic nature of the application space that suggests that the government to use prudence when considering policy.

While we have described the structure of this framework as it applies to Universal Service and VoIP, we leave the specification of regulatory requirements as later work.

VI. CONCLUSION

In this paper, we have discussed the dilemma facing policy making as a result of the misalignment of traditional regulations with evolving IP service networks. More specifically, we examined the impact of voice over IP services on traditional models of regulation. While this issue presently represents a small threat to the entrenched industry and regulation, in time VoIP services will represent a significant amount of the total voice traffic. As such, this issue will likely require the development of a new regulatory model.

In this paper, we proposed a model that allows regulators to move to a more consistent policy framework while recognizing the differences between the services and the network on which these services ride. The ultimate point is that policy issues at one layer are not the same as policy issues at another. This model does not purport to eliminate the regulatory disparity among all providers of communications services; in fact, we believe that there is sound reason to treat providers with market dominance differently from providers without. What this model does provide is a framework that will allow the services riding over the network to be treated independently from that network. This consistency may actual mean new regulatory obligations for some providers, so as to ensure such things as interconnection and emergency services.

Whether this type of model is ever implemented will depend on such factors as the resistance of the industry, the desire of the Congress, and the ability of the FCC and the states to act. At the very least, we believe that the layered concept could be applied to voice service and universal service.

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