

# BREAKING THE ICE: RETHINKING TELECOMMUNICATIONS LAW FOR THE DIGITAL AGE

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## ABSTRACT

Telecommunications is a trillion-dollar industry undergoing a massive transformation, both in its technological underpinnings and its market dynamics. As technology and market developments undermine long-standing business models and value chains, existing legal frameworks are failing. A “layered” model for communications policy would provide a better foundation for competition, investment, and innovation than the legacy “silo” model.

Just as water exists in three forms – solid ice, liquid water, and gaseous steam – digital networks manifest themselves in functional layers of physical connectivity, applications, and content, which interact with one another through technical interfaces. The unstable conversion points between forms of water are called phase transitions. The phase transitions in digital communications networks are the logical layer, which connects users and resources to networks, and the interface layer, which connects users and information to devices. Legislators and regulators traditionally ignore these “connective layers.” Yet as the layered model reveals, they are central to the emerging policy challenges of a converged world. Phone numbers, Internet protocol routing techniques, and digital rights management technologies are examples of logical and interface-layer features that are determining the complexion of converged digital networks, and the business opportunities that depend on them.

A layered approach would use connective layer tools to reconceptualize traditional elements of communications policy. This would eliminate uncertainties about the legal status of voice over IP, mitigate concerns about a subsidy shortfall for rural phone customers, and lay the groundwork to address emerging competitive, governance, privacy, and other issues around digital identity. Moreover, by pinpointing these hid-

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den chokepoints, a layered approach would reduce the overall level of regulation. Adopting the layered model would ensure that emerging technologies can flourish while creating a transition path from the communications world of the past to the converged digital universe of the future.

INTRODUCTION.....	60
I. TELECOM IN THE AGE OF CONVERGENCE.....	61
II. THE LAYERED APPROACH.....	65
A. Introduction to Layers.....	66
B. Layers and Communications Policy.....	68
C. A Double-Necked Hourglass.....	71
D. The End of the Ice Age.....	73
III. THE CONNECTIVE LAYERS.....	80
A. Making the Connective Layers Primary.....	80
B. Historical Cases.....	82
1. Network-attached equipment (Part 68).....	82
2. The Computer Inquiries.....	84
3. Numbering and Addressing.....	86
IV. HOW TO BREAK THE ICE.....	89
A. The Interface Layer.....	90
B. The Logical Layer.....	91
C. By the Numbers.....	93
CONCLUSION.....	95

## INTRODUCTION

Telecommunications is a trillion-dollar industry undergoing a massive transformation, both in its technological underpinnings and its market dynamics. As technology and market developments undermine long-standing business models and value chains, existing legal frameworks are failing as well. The current structure of American communications regulation is a direct descendent of railroad laws developed in the 19th century. As we move deeper into the 21st century, such a framework is no longer tenable. Moreover, the harmful consequences of the legacy legal environment are not limited to the telecommunications sector. The Internet and nascent digital media services operate on top of communications networks. Decisions about telecommunications policy are crucial to the future of these markets as well.

Despite all this, the debate over reforming America's telecommunications laws is trapped in the assumptions of the past.<sup>1</sup> The primary dis-

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1. This paper focuses on the U.S. legal environment, although the thrust of the argument is applicable globally.

discussion in Washington today concerns whether—and how far—to “de-regulate” incumbent network operators, and whether – and how much – to “regulate” the Internet, all the while presuming a constant meaning for “regulation.” Meanwhile, new technologies such as Voice over Internet Protocol (VoIP) create both regulatory uncertainty and significant economic dislocations. A change in approach is warranted. That new approach must offer not just fresh policy recommendations, but an entirely new way to think about – and talk about – the challenges facing the converging telecommunications and Internet markets.

This paper maps out a new grammar for telecommunications policy. Part II analyzes the inter-connected technology, legal, and business developments responsible for the current impasse. Part III introduces the layered model, outlining prior work and further developing the concept with an analogical assist from high school chemistry. Part IV drills down on two previously under-appreciated transition points: the logical layer and the interface layer, reinterpreting historical policy initiatives in layered terms. Part V identifies some of the key questions likely to emerge in these connective layers in the future, and offers suggestions for policy-makers.

## I. TELECOM IN THE AGE OF CONVERGENCE

The telecommunications industry is facing a dramatic upheaval thanks to one basic phenomenon: convergence.<sup>2</sup> In essence, convergence means that historical distinctions between communications networks are melting away.<sup>3</sup>

In analog form, every communications medium is unique. An analog telephone call, for example, cannot be turned into a cable television broadcast. And even though a recorded telephone call could be played over a radio channel, the broadcast radio transmitter couldn't be used to send a call between just two individuals, as the phone network does countless times each day.<sup>4</sup>

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2. For an early overview of the impacts of the Internet and convergence on the telecommunications industry and its regulation, see KEVIN WERBACH, *DIGITAL TORNADO: THE INTERNET AND TELECOMMUNICATIONS POLICY* (FCC Office of Plans and Policy, Working Paper No. 29, Mar. 29, 1997), available at [http://www.fcc.gov/Bureaus/OPP/working\\_papers/oppwp29pdf.html](http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp29pdf.html) [hereinafter *DIGITAL TORNADO*].

3. See JONATHAN NUECHTERLEIN & PHILIP J. WEISER, *DIGITAL CROSSROADS: AMERICAN TELECOMMUNICATIONS POLICY IN THE INTERNET AGE* 24 (2005) (describing convergence as “the coming together of different technologies to provide similar services”).

4. Even in analog form, all communications networks used one of two fundamental mechanisms for transmitting information: electrical signals across a wire (telephone and cable), or electrical signals across the air (radio, TV, mobile phones, and satellite). Today networks also use optical signals across both the airwaves and wires. My point is that, even though a radio broadcast and a mobile phone conversation in the analog domain have certain technical commonalities, each network is optimized and locked into a particular service. Radio equip-

Everything starts to change when information is transmitted in digital form. Digital communications are fundamentally just strings of ones and zeroes. They are ultimately interchangeable, meaning that any communications platform can, in theory, offer any service. Networks may still be physically distinct and offer unique attributes, such as the mobility that only wireless connections can deliver. From a user perspective, however, the divisions between different network technologies are becoming far less significant.

In a converging world, network platforms which formerly had no competitive overlap now can offer the same services. Your cable TV operator can be your phone company, while your wireless phone provider gives you Internet access, and your wired telephone company provides your television. Moreover, it becomes significantly easier for all of those platforms to add new functionality. Intelligence moves to the edges of the network, thereby reducing the need for network-wide upgrades to core infrastructure, allowing many more companies to create new services, and taking advantage of common standards.<sup>5</sup> Convergence also means that, instead of expensive, proprietary equipment, telecommunications networks can use the same kinds of software and hardware as computer networks. As a result, prices fall, new competitors enter, service offerings multiply, and walls between industries collapse.<sup>6</sup>

The telecommunications industry that developed over the course of the 20th century, before convergence, was based on vertical integration of the carrier function.<sup>7</sup> Traffic was subject to a variety of different rules and pricing regimes because of legacy business structures and regulatory imperatives, rather than underlying economics.<sup>8</sup> Each phone company operated as a silo of its own. The carrier determined the suite of services it would offer to customers, and managed the internal addressing and directory processes as an integral part of those offerings. Because voice telephony was the primary purpose of the network, and could be rated in terms of time and distance, operators developed intricate billing systems to meter calls.

When carriers interconnected with one another to hand off traffic, they did so pursuant to inflated regulated rates, designed in part to maintain cross-subsidies between local and long-distance calls. Regulators

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ment is designed for one-to-many broadcast, not one-to-one telephony.

5. See David Isenberg, *The Rise of the Stupid Network* (1998), available at <http://www.rageboy.com/stupidnet.html>.

6. See Ken Belson, *Phone Line Alchemy: Copper Into Fiber*, N.Y. TIMES, Oct. 11, 2004, at C1.

7. For example, the AT&T divestiture created a patchwork of administratively-defined "local access and transport areas" (LATAs), in order to create a competitive long-distance market alongside the still-monopolized local market.

8. See Kevin Werbach, *A Layered Model for Internet Policy*, 1 J. TELECOMM. & HIGH TECH. L. 37, 58-64 (2002) [hereinafter, *Layered Model*].

could collect universal service subsidy levies from operators based on interstate revenues, because traffic was easy to segment and track. Even when the market began to change, with the end of the AT&T monopoly and the early stages of convergence, the need to preserve existing revenue and subsidy flows was a strong roadblock to any changes.

Today, technological and business trends have undermined both pillars of the old order – vertical integration and cross-subsidies. The layered nature of digital networks, as described below, disaggregates the vertically integrated structure of telephone companies.<sup>9</sup> It becomes possible to deliver voice – the core telephone offering – on top of an Internet data stream, which itself rides on top of the existing telephone transport infrastructure. This indirection, known as voice over IP, decouples telephony from network infrastructure.<sup>10</sup> It also makes it difficult, if not impossible, to continue splitting up and metering traffic on a geographic basis. Unlike a circuit-switched telephone call, which always has a definite origination and termination point, a VoIP communication flows over multiple indeterminate paths determined in real-time by swarms of routers.<sup>11</sup> Moreover, although a VoIP connection may originate and terminate at identifiable machines, those machines have no necessary connection to physical geography.

As VoIP grows, the traditional business model for telecom operators is coming under pressure.<sup>12</sup> Residential VoIP providers such as AT&T and Vonage charge roughly \$25 per month for unlimited nationwide VoIP calls, significantly below what incumbents charge for their traditional telephony services.<sup>13</sup> And competitive pressure is bound to drive that number lower, perhaps even to zero.<sup>14</sup> Moreover, because VoIP is nothing more than a data application, it can be delivered entirely through application-level software.<sup>15</sup> The leading example of software-based VoIP is Skype, a peer-to-peer application from the same team that developed the popular Kazaa file-sharing software.<sup>16</sup> Remarkably, even

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9. *See id.*

10. *See* IP-Enabled Services, *Notice of Proposed Rulemaking*, 19 FCC Rcd. 4863 (Feb. 12, 2004); Voice Over Internet Protocol: Hearing Before the Sen. Comm. on Commerce, Sci. and Transp. (Feb. 24, 2004) (testimony of Kevin Werbach), *available at* [http://commerce.senate.gov/hearings/testimony.cfm?id=1065&cwit\\_id=2993](http://commerce.senate.gov/hearings/testimony.cfm?id=1065&cwit_id=2993).

11. *See* DIGITAL TORNADO, *supra* note 2.

12. *See* *The Phone Call is Dead; Long Live the Phone Call*, THE ECONOMIST, Dec. 4, 2004.

13. This cost savings is due, in part, to the fact that VoIP customers already purchase broadband Internet access. Thus, the base-level transport functionality is already paid for.

14. If voice services were free, carriers would generate revenue through other means, such as advertising and value-added services. *See* Alex Salkever, *Phone Service the “Zero Cost” Way*, BUS.WK., Jan. 6, 2004.

15. *See* Thomas J. Fitzgerald, *Should Your PC Be Your Telephone?*, N.Y. TIMES, Dec. 2, 2004, at G1.

16. <http://www.skype.com>; James Fallows, *In Internet Calling, Skype Is Living Up to*

though it uses a distributed peer-to-peer architecture and rides on shared public Internet links, Skype often provides higher-quality voice transmissions than the public switched network. Skype does not charge for basic phone calls between Skype users, since it rides on top of an existing broadband connection.<sup>17</sup> It also confounds the traditional linkage between telephone companies and physical geography. The software is produced by a Luxembourg company, managed from London and Stockholm, with software development in Estonia, and with a truly global user base unlike any phone company in history. As of October 2004, the software had over 12 million users worldwide, had handled over two billion minutes of traffic, and typically had over one million simultaneous online users at any given time.<sup>18</sup>

And Skype, at least in its current form, may be a relatively easy case for regulators to address. At least Skype is selling the familiar ability to make phone calls. Other examples of VoIP, though technically similar to Skype, look nothing like the phone services of yesteryear. For example, Microsoft and Sony both provide built-in VoIP capabilities for their multi-player online console gaming services. Every customer of Microsoft's Xbox Live service receives a headset that plugs into the game console. Players of certain games can chat with one another across the Internet to coordinate their activities in the game, or just have a conversation. With over one million Xbox Live subscribers, this arguably makes Microsoft the largest paid voice over broadband service provider in the U.S.<sup>19</sup> Yet none of those users think of Microsoft as their phone company. Instead, Xbox Live is effectively a species of instant messaging (IM). And, as it turns out, leading IM services such as Yahoo! Messenger now offer voice chat among their capabilities.

The mobile phone market provides a final vision of where the telecom industry as a whole might be going: toward flat-rate pricing based more on data usage than voice. Mobile phone usage has grown rapidly, with worldwide subscribers passing landline subscribers in 2004.<sup>20</sup> A significant and growing number of subscribers, especially young people,

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*the Hype*, N.Y. TIMES, Sept. 5, 2004; Andy Reinhardt, *Net Phone Calls, Free—And Clear: Skype's Radical Technology and Marketing Threaten the Very Foundations of Telecom*, BUS.WK. Nov. 1, 2004, at 60.

17. Skype does charge per-minute for making calls to non-Skype users, a service it calls "SkypeOut." This service works through interconnection points with the public switched telephone network. See Kevin Werbach, *Tune In, Turn On, Skype Out*, TECH CENTRAL STATION (July 1, 2004), at <http://www.techcentralstation.com/070104F.html>.

18. Press Release, Skype, One Million Simultaneous Users on Skype (Oct. 20, 2004), at [http://www.skype.com/company/news/2004/1million\\_online.html](http://www.skype.com/company/news/2004/1million_online.html).

19. See Kevin Werbach, *Not Your Parents' Phone System*, TECH CENTRAL STATION (Aug. 25, 2004), at <http://www.techcentralstation.com/082504E.html>.

20. See *Battling for the Palm of Your Hand - Mobile Phones*, THE ECONOMIST, May 1, 2004, at 71.

use their mobile phone as their sole phone line.<sup>21</sup> In recent years, mobile phone operators have upgraded their networks to offer increasingly sophisticated data capabilities. Although data still represents the minority of operator revenues, it is growing significantly faster than voice revenues. Competition and network capacity growth have produced a pricing model that looks more like residential broadband than traditional phone service. Carriers originally charged high per-minute rates, but in recent years service plans have shifted almost entirely to flat monthly fees.

Moreover, ancillary services such as downloadable ringtones and games are fast becoming a significant chunk of the mobile phone business model. Ringtones alone now generate over \$3 billion in annual revenue, roughly ten percent of the size of the entire global music industry.<sup>22</sup> It's not that far-fetched to imagine a mobile phone market in the not-to-distant future where users get the calls for free, but pay for the ringtones.

These examples demonstrate that what it means to operate as a telecom company is changing dramatically. A sector that used to be based on one well-defined product (phone calls), a well-defined unit of measurement (minutes), and a strong connection to physical geography is turning into something else entirely. That something is data-centric, distributed, application-agnostic, self-organizing, and rapidly evolving. In other words, it is the Internet.<sup>23</sup>

## II. THE LAYERED APPROACH

The radical upheaval in telecom described in the previous section calls for new conceptual models.<sup>24</sup> The engineering concept of layers provides a useful heuristic for analyzing and answering the policy challenges of the Internet and convergence.

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21. See MICHAEL R. WARD & GLENN A. WOROCH, USAGE SUBSTITUTION BETWEEN FIXED AND MOBILE TELEPHONY IN THE U.S., (CRTP, Working Paper, Oct. 2004), <http://elsa.berkeley.edu/~worocho/usage%20substitutiongawvita.pdf>; Geoffrey Nairn, *The Cost of Cutting the Cord*, FINANCIAL TIMES, Oct. 6, 2004. This trend has been a significant factor in the recent decline in wireline access lines.

22. See Jason Ankeny, *Interoperable MMS Set to Explode*, TELEPHONY, Nov. 8, 2004; *Music's Brighter Future*, THE ECONOMIST, Oct. 30, 2004 at 71.

23. See *Layered Model*, *supra* note 8 (claiming that telecommunications policy will become a subset of Internet policy).

24. Other scholars have recognized the need for a new approach to telecom policy. See, e.g., Philip J. Weiser, *Toward a Next Generation Regulatory Regime*, 35 LOY. U. CHI. L.J. 41 (2003).

### A. Introduction to Layers

A layered analysis divides a networked information system into a hierarchical “stack.” Each layer describes a category of functionality that is self-contained, but necessary to deliver the functions available higher up. Layers are connected to one another through technical interfaces known as protocols.

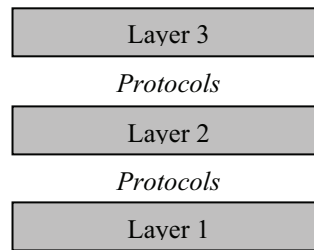


Figure 1

Conceptually, layers can be thought of as modules.<sup>25</sup> Instead of a system that is tightly integrated, and created by a single provider as a unit, a modular structure is disaggregated into separate markets, with competition in each of them. The personal computer industry is a classic case of a modular business.<sup>26</sup> Dell may sell the PC to a user, but Intel provides the microprocessors, Microsoft the operating system, Hitachi the disk drives, and so forth. Dell’s primary functions are to select and integrate the component modules, and to provide customer support and other ancillary services. This market structure has proven extremely effective for promoting innovation and price/performance improvements.<sup>27</sup>

Layers are a special case in which there is a fixed, linear relationship between the modules. Also, in a layered environment, there need not be a single integration point, analogous to Dell in the PC example, where all the modules come together into a package sold to end-users.

There are several technical benefits to a layered approach.<sup>28</sup> Layering as a design concept allows developers and providers to separate out

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25. I use modularity here in the sense developed by Carliss Baldwin and Kim Clark. See CARLISS BALDWIN & KIM CLARK, *DESIGN RULES: THE POWER OF MODULARITY* (2000).

26. *See id.*

27. *See id.* Another take on this market dynamic is that the company controlling the crucial “platform” integration point has incentives not only to extract monopoly rents, but to facilitate activity and innovation by companies using the platform. See Joseph Farrell & Philip J. Weiser, *Modularity, Vertical Integration and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age*, 17 HARV. J.L. & TECH. 85 (2003).

28. *See Layered Model, supra* note 8.



levels of functionality, each of which can be optimized independently.<sup>29</sup> A service provider at one layer – say, an e-commerce retailer such as Amazon.com – need not concern itself with the mechanisms by which data moves from its servers to its customers, or the difference between telephone wires and coaxial cable for carrying data traffic. Each provider can focus on what it does best. Moreover, a market that does not depend on a small number of vertically integrated providers can produce greater innovation, by unlocking the potential of all market participants.<sup>30</sup>

Layering also establishes the competitive stage for firms that operate in and around those networks. For example, a “layer two” device, such as an Ethernet bridge, performs only basic traffic forwarding between two machines, while “layer three” equipment, such as switches and routers, handle more complex tasks. A “layer four” switch adds an understanding of end-to-end network traffic flows and performance, while a “layer seven” switch differentiates among the applications the traffic is carrying. Layers effectively define the value chain through which products and services are ultimately delivered to end-users.<sup>31</sup> Amazon.com, as a provider of Web-based applications and content, relies on physical connections from ISPs and broadband network operators, as well as logical addressing mechanisms, to ensure its information reaches its customers.

Although the layers of the communications stack are distinct, they are composed of the same basic stuff. All of the layers are, fundamentally, software code that manipulates bits of information to form a networked communications system.<sup>32</sup> Even the physical layer, the most rigidly fixed, includes software and protocols that define how information travels across physical links. Moreover, functions that were previously delivered at one layer may, in some cases, migrate to other layers. In the legacy telephone network, basic voice communications were hard-wired into the physical infrastructure. With VoIP, they become an application that can ride on any physical-layer platform.

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29. See Ashish Shah, et al., *Thinking About Openness in the Telecommunications Policy Context*, Paper Presented at The Thirty-First Telecommunications Policy Research Conference 13 (Sept. 20, 2003), available at <http://intel.si.umich.edu/tprc.org/papers/2003/244/openness2.pdf>.

30. Baldwin and Clark explain this value proposition in connection with modularity. See BALDWIN & CLARK, *supra* note 25.

31. One complication is that the same functionality can sometimes be delivered at different layers. Voice over IP, an application-layer reformulation of the voice telephony functionality formerly tied to the physical layer, is an example.

32. Cf. LAWRENCE LESSIG, *CODE AND OTHER LAWS OF CYBERSPACE* (1999) (arguing that the “West Coast Code” of software regulates online activity as much as traditional laws).

### B. *Layers and Communications Policy*

Historically, communications regulation developed around a series of unconnected vertical silos.<sup>33</sup> Telephone networks were regulated as “common carriers,” based on models first developed in the 19th century for railroads and the telegraph.<sup>34</sup> Wireless communications systems were subjected to an entirely different set of regulations, designed with radio broadcasting in mind.<sup>35</sup> Newer communications networks, including cable television, cellular telephony, and satellite communications, were each given their own set of tailor-made rules. A federal agency, the Federal Communications Commission (FCC) regulated interstate and international communications, while many local activities fell under the purview of state public utility commissions and municipal authorities.

In the days when each network delivered a different service, using different basic technologies, this division made sense.<sup>36</sup> Connections started and stopped at discrete points, allowing for relatively neat geographical separations. The issues confronting telephone companies were different from those facing cable television operators, and the companies operated in distinct markets. Data services, such as they were, could be kept outside the legacy regulatory system altogether, without causing much disruption.<sup>37</sup>

Today, however, telephone and cable companies compete head-to-head in broadband Internet access. They will soon compete in most markets for voice telephony (traditionally the sole province of phone companies), as well as for multi-channel video programming (the traditional birthright of cable). Data represents the major growth area for most communications companies. Applications such as VoIP, which is inextricably both voice and data, straddle the legacy legal divisions. The result is a series of distortions and uncertainties, as like services are regulated differently, and as the FCC struggles to define a coherent framework within the bounds of its statutory authority.

In the past five years, legal and policy analysts have appropriated the

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33. I have previously described the silo model as “horizontal” and the layered model as “vertical.” See *Layered Model*, *supra* note 8. However, most other commentators find the opposite terminology more intuitive. See Whitt, *infra* note 45. Therefore, I adopt it here. The difference is purely semantic.

34. See Adam Candeb, *Network Interconnection and Takings*, 54 SYRACUSE L. REV. 369 (2004).

35. See Kevin Werbach, *Supercommons: Toward a Unified Theory of Wireless Communication*, 82 TEX. L. REV. 863 (2004).

36. See *Layered Model*, *supra* note 8.

37. See DIGITAL TORNADO, *supra* note 2; JASON OXMAN, THE FCC AND THE UNREGULATION OF THE INTERNET (FCC Office of Plans and Policy, Working Paper No. 31, July 1999), available at [http://www.fcc.gov/Bureaus/OPP/working\\_papers/oppwp31.pdf](http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp31.pdf); Robert Cannon, *The Legacy of the Federal Communications Commission's Computer Inquiries*, 55 FED. COMM. L.J. 167 (2003).

concept of layers as a means to address these challenges.<sup>38</sup> A layered model for communications policy is a schematic of layer divisions, along with rules or guidelines for policy-makers. Layered thinking helps tackle difficult communications policy questions by separating out questions, and by revealing previously un-recognized issues. Moreover, the history of the Internet shows the value of respecting layer independence.<sup>39</sup> Actions by service providers to erase the distinctions between layers tend to threaten innovation, because they reduce opportunities for new competitive entry at different layers.<sup>40</sup> Similarly, actions by regulators should be targeted to the appropriate layer for the problem at hand to avoid unnecessary spillover effects.<sup>41</sup>

By shifting regulatory structures from vertical silos based on network platform to horizontal layers, the layered approach tracks the reality of convergence. The important question is not whether bits fly through the air or over a wire, let alone whether that wire is twisted pair or coax, but what is happening to those bits. A layered model defines a hierarchy of stepping stones, with basic physical connectivity on the bottom and content at the top. Every step serves as a platform for the step above it.

Layered models are becoming a common tool for analyzing questions in telecommunications policy, Internet regulation, and cyberlaw.<sup>42</sup> After several legal scholars developed the basic contours of the layered approach, policy advocates began to translate those arguments into concrete proposals.<sup>43</sup> The European Union independently used a framework similar to the layered model as the basis for its overhaul of communications regulation.<sup>44</sup> MCI became a particular champion of the layered

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38. See Yochai Benkler, *From Consumers to Users: Shifting the Deeper Structures of Regulation Toward Sustainable Commons and User Access*, 52 FED. COMM. L.J. 561, 562 (2000); Jeff Mackie-Mason, *Leveraging and Layering: Making Sense of Telecom, Computing and Data Market Structure*, Unpublished Presentation to the FCC (July 23, 1996), available at <http://www-personal.umich.edu/~jmm/presentations/fcc96-layering.pdf>; LAWRENCE LESSIG, *THE FUTURE OF IDEAS: THE FATE OF THE COMMONS IN A CONNECTED WORLD* 23-25 (2001); Timothy Wu, *Application-Centered Internet Analysis*, 85 VA. L. REV. 1163, 1164 (1999); Lawrence B. Solum & Minn Chung, *The Layers Principle: Internet Architecture and the Law*, 79 NOTRE DAME L. REV. 815, 815 (2004).

39. See Solum & Chung, *supra* note 38.

40. See *id.*

41. See *id.*

42. See *id.*

43. See Richard S. Whitt, *Codifying the Network Layers Model: MCI's Proposal for New Federal Legislation Reforming U.S. Communications Law*, (March 2004), available at <http://global.mci.com/about/publicpolicy/presentations/layersmodelfederallegislation.pdf>.

44. See Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a Common Regulatory Framework for Electronic Communications Networks and Service (L. 108/33); Doug Sicker & Joshua Mindel, *Comparing the Layered Model for Telecommunications Policy with the EU's Newly Adopted Framework* (2005), available at <http://spot.colorado.edu/~sicker/PolicyPubs.html> (pending publication in TELECOMM. POLICY); Rob Frieden, *Adjusting the Horizontal and Vertical in Telecommunications Regu-*

model, developing white papers, model statutes, and other materials extolling the virtues of a layered approach.<sup>45</sup>

Predictably, MCI's advocacy provoked a response from the local phone companies that are MCI's traditional enemies in regulatory debates. A group called the New Millennium Research Council assembled an entire book of essays criticizing the layered model.<sup>46</sup> The thrust of most of the attacks is that a layered approach mandates heavy-handed regulatory disaggregation of networks into commodity components, thwarting market efficiencies.<sup>47</sup> Yet this conclusion is specious. Just because MCI supports the layered model doesn't mean all of MCI's positions necessarily flow from that approach. In particular, there is nothing in the model that necessarily precludes combinations of multiple layers. The layered model simply frames the analysis under which such actions can be evaluated.

A great virtue of the layered approach to communications policy is that it aligns legal structures with the real world. Data networks *are* designed, deployed, and used with layers. And the infrastructure of telecommunications increasingly is comprised of data networks. Virtually every phone call is already carried over a digital connection. Major carriers are beginning a slow but inevitable transition away from the circuit-switched telecom architecture dating back to Alexander Graham Bell, deploying VoIP in its place.<sup>48</sup> Business factors are driving this shift as much as technological ones. For the first time, wireline access lines are declining, and competition is putting pressure on telephone service margins.<sup>49</sup> To make up the slack, carriers are investing heavily in broadband as a new growth area.<sup>50</sup> The plasticity of digital communications – everything ultimately reduces to identical ones and zeros – means that different services can more easily be combined into packages. Add rapid industry consolidation, and the near-to-intermediate-term future of telecom looks to be a “battle of the bundles” among providers of integrated

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*lation: A Comparison of the Traditional and a New Layered Approach*, 55 FED. COMM. L.J. 207, 246 (2003).

45. See Richard S. Whitt, *A Horizontal Leap Forward, Formulating A New Public Policy Framework Based On The Network Layers Model*, 56 FED. COMM. L.J. 587 (2004) (identifying author as working for MCI).

46. See New Millennium Research Council, *Free Ride: Deficiencies of the MCI 'Layers' Policy Model and the Need For Principles that Encourage Competition in the New IP World* (July 2004), at [http://www.newmillenniumresearch.org/news/071304\\_report.pdf](http://www.newmillenniumresearch.org/news/071304_report.pdf).

47. See *id.*

48. See *The Phone Call is Dead*, *supra* note 12; Bernard Simon, *A Bright New Day for the Telecom Industry, if the Public Will Go Along*, N.Y. TIMES, Jan. 12, 2004, at C3.

49. See Seth Schiesel, *The Bells Struggle to Survive A Changing Telephone Game*, N.Y. TIMES, Nov. 24, 2003, at C1.

50. See Julie Creswell, *Is the Most Powerful Man in Telecom Pulling a Megabluff?*, FORTUNE, May 31, 2004; Ken Belson, *Bells Are Catching Up In Battle for Broadband*, N.Y. TIMES, July 28, 2004, at C4.

data-centric offerings.<sup>51</sup>

If they are to continue performing their mission, communications regulators need a way to define rules governing the industry, and to evaluate actions by industry participants. Layered models fill that role.

### C. *A Double-Necked Hourglass*

In the past, I have described a four-layer model: physical, logical, applications, content.<sup>52</sup> This model, with some variations, is the most commonly used set of layers in current scholarship and policy advocacy.<sup>53</sup> As a conceptual tool, however, layered models need not be uniform. We need not agree completely on the best way to slice the pie, so long as we agree the pie must be sliced, and in which direction. Different conceptual models may be appropriate for different situations. For example, a layered model that serves as a blueprint for legislation might not be the best model for engineers to use in designing networks.

In this paper, I would like to develop a modified layered model. The four-layer framework is still the best compromise between accuracy and simplicity. However, it – and most of the other layered models proposed heretofore – suffers from the limitation of treating all layers equally. There is a subtle but significant difference between the roles certain layers play in the overall stack.

The modified layered model is shaped like a double-necked hourglass. Depending on one's viewpoint it has either three or five layers:

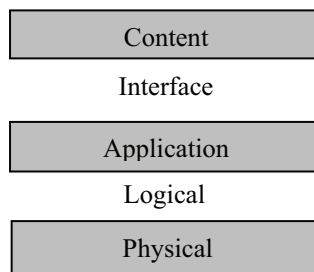


Figure 2

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51. See Ken Belson, *Cable's Rivals Lure Customers With Packages*, N.Y. TIMES, Nov. 22, 2004, at C1; Blair Levin, *The Broadband Bundle Battles Ahead*, Presentation to the Council for Entrepreneurial Development (Oct. 8, 2004), [http://www.cednc.org/conferences/infotech/2004/speakers/blair\\_levin.ppt](http://www.cednc.org/conferences/infotech/2004/speakers/blair_levin.ppt); Sandra Ward, *Battle of the Nets: An Interview with Blair Levin*, BARRON'S, July 18, 2003.

52. See *Layered Model*, *supra* note 8.

53. See, e.g., Benkler, *supra* note 39; LESSIG, *supra* note 38; Whitt, *supra* note 45. The four-layer model appears to have gained traction because it balances simplicity and accuracy, highlighting the network components most important for policy-makers.

The PHYSICAL layer is the baseline infrastructure that transports bits from place to place.<sup>54</sup> It comprises the physical “roadbeds” of the information superhighway: the twisted pair copper loops, coaxial cables, fiber optic lines, radio transmissions, and other carrier technologies.<sup>55</sup> It can be called the “where” layer.

A step up is the LOGICAL layer, which is the “who.” The logical layer ensures that the right bits get to the right place.<sup>56</sup> It therefore includes identity and identifier information, such as phone numbers and other addresses, which allows the network to know where bits should flow.

Next is the APPLICATION layer.<sup>57</sup> This is the “why,” in that it defines the purpose of moving those bits between those users of the network. Applications control how information is used. They produce the valuable functionality, whether it be sharing photographs or real-time voice conversations, that the network delivers. Voice telephony, in a data-centric network, resides at the application layer, as does AOL’s instant messaging service and eBay’s virtual marketplace.<sup>58</sup>

Above that is the INTERFACE layer, the “how.” Interfaces are how users interact with applications.<sup>59</sup> Some manifestations of the interface layer are physical: the standards for connecting devices to the network.

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54. A bit, as defined by Claude Shannon in his foundational works on information theory, is the basic unit of digital information. See Claude Shannon, *A Mathematical Theory of Communication*, 27 BELL SYS. TECH. J. 379, 623 (1948), available at <http://cm.bell-labs.com/cm/ms/what/shannonday/shannon1948.pdf>. It is typically represented as a counter that can show either zero or one. Bits are distinguished from atoms, the units of physical entities. See NICHOLAS NEGROPONTE, *BEING DIGITAL* (Vintage 1996).

55. There is software at the physical layer, in the form of low-level protocols that define how packets are encoded on the physical transport mechanisms. The key distinction is not between software and hardware, but between pure physical location and other constructs.

56. I use the term “logical layer” in a slightly different way than Benkler and Lessig. They use it to describe all the software code in the network, as distinguished from the physical hardware. See Benkler, *supra* note 38; LESSIG, *supra* note 38.

57. I am not using “application” here in the common sense of an individual software program. Skype is a software application that users install on their personal computers, but the conceptual “application” involved, from the perspective of the network, is real-time voice communication.

58. Applications can be combined or manipulated in various ways. What is important is not the particular software involved, but the capabilities made available to users.

59. As with “application,” see *supra* note 57, the term “interface” is used here in a special sense. In common parlance, software programs have “user interfaces” such as windows and menus and they also have “application programming interfaces” (APIs) to connect with other software. The interface layer is both narrower and broader. It is narrower because it refers only to interactions between applications and end-users; interfaces between applications reside at the application layer. The interface layer is broader than the common usage, however, in that it describes everything between the user and the application, not just the elements displayed on screen. That is why the computer operating system, a piece of software that controls how users interact with both local software and network-based applications, falls within the interface layer for purposes of this model.

This layer also includes the operating system software that manages applications on the user's local computer, as well as hooks between that device and the rest of the network.<sup>60</sup> As will be discussed below, digital rights management looms as a significant area of interface-layer communications regulation.

Finally, the CONTENT layer is the "what." It is the content of the phone calls, the text of Web pages, the books purchased on Amazon.com, and the music transferred to an iPod. The content layer is largely unregulated, with the large exception of over-the-air radio and television broadcasting.

The salient feature of the modified layered model is that it distinguishes between two kinds of layers: functional and connective. The three functional layers – content, application, and physical – represent the primary services delivered to end-users. The two connective layers – interface and logical – face inward, toward the other parts of the network. Their primary mission is to interconnect the layers above and below. As such, these connective layers are often viewed as merely "glue:" behind-the-scenes code that performs un-interesting clerical or logistical functions. Nothing could be further from the truth. As will be discussed below, the connective layers are, in fact, the most crucial points in the communications system stack for purposes of public policy. Communications policy heretofore has largely concerned itself with the functional layers and ignored the connective layers. In the future, that balance should be reversed.

#### *D. The End of the Ice Age*

The chemical properties of water represent a good analogy to a layered communications system. Water, as most people remember from high-school chemistry, is a substance comprised of two hydrogen atoms and one oxygen atom. Depending on temperature, water exists in one of three forms: solid, liquid, or gas. The solid is ice; the liquid is water; and the gas is steam. Though chemically identical, the three phases exhibit very different physical properties. To an observer, it is far from obvious that ice, water, and steam are even related.

Between the three states of water are two "phase transitions," where water changes from one form into another, known as the boiling point and the melting point. The system therefore mirrors the connective layers of networked communications systems described above:

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60. Thus, both the interface and application layers can be composed of software. The distinction is that applications provide a capability users desire, while interfaces modulate how users take advantage of that capability.

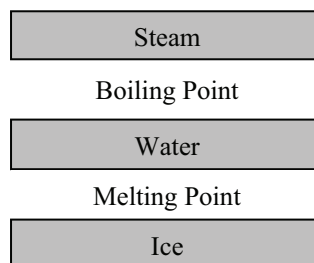


Figure 3

Phase transitions are points of rapid change. Physical properties shift dramatically once key temperature thresholds have been passed.<sup>61</sup> The boiling point and melting point of any substance are important identifying characteristics because they shape the practical uses of the substance and also reveal aspects of molecular structure.

The water analogy helps to illustrate the differences among layers in the data communications stack. Ice and steam are both forms of the same substance, but their properties vary dramatically. Similarly, all layers of the communications policy stack are essentially software code, but they exhibit very different features.

The physical layer, like ice, is the most rigid. It is tied to lines and switches located in particular physical locations, and subject to particular technical constraints. Being built more on atoms than bits, the physical layer is subject to somewhat different economic factors than the layers above. Physical infrastructure has high fixed costs, for example: every mile of wiring or telephone switch is a significant additional cost. And once deployed, physical infrastructure is difficult to modify. These characteristics tend to facilitate concentrations of market power.<sup>62</sup> Moreover, higher layers are dependent on lower layers. An application like eBay's online auctions needs network addressing and physical connectivity in order to serve its users.

As a result, the physical layer has historically been the focus of communications regulation. The FCC, for the most part, regulates owners of physical networks, not the users of those networks. In the world of telephony, it regulates providers of "telecommunications," which essentially means transmission.<sup>63</sup> The owners of the physical networks are the

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61. Careful procedures can produce strange intermediate states, but these are artificial.

62. High fixed costs relative to variable costs mean that there are likely to be significant economies of scale. This gives larger players an advantage, and can create a feedback loop that fosters monopolies. See Eli Noam, *How Telecom is Becoming a Cyclical Industry, And What To Do About It* (June 28, 2002), at <http://www.citi.columbia.edu/elinoam/articles/cyclicality.htm>.

63. "The term 'telecommunications' means the transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent and received." 47 U.S.C. § 153(43) (Supp. V 1999).



ones providing that transmission function. The FCC does not directly regulate other companies that purchase that transmission capacity, whether to access the network as end-users, or to deliver “enhanced services” such as voicemail or Internet access to their own customers.<sup>64</sup> Similarly, in wireless communication, the FCC oversees the allocation and use of spectrum frequencies, the physical infrastructure of the air, and the associated transmitters that operate in those frequencies. It has not traditionally exercised direct regulation over receivers, such as television sets.<sup>65</sup>

The Commission’s proclivity toward regulating the physical layer continued amid the early stages of convergence. Even though DSL and cable modem service are direct competitors in many markets, the FCC treated each under entirely separate legal rules.<sup>66</sup> It required DSL operators to provide “unbundled network elements” to competitors, and to offer “line-sharing” specifically for independent providers of DSL.<sup>67</sup> There were good competitive and legal reasons for these steps. However, at the same time, the Commission continued to treat cable modem service under the rules governing cable television, which has no unbundling obligations.<sup>68</sup> This decision was consistent with the legislative history of the 1996 Act, and reflected an understandable desire to protect cable operators from “double regulation” under both Title II and Title VI of the statute. However, it created a clear arbitrage situation. Phone companies had every incentive to roll back unbundling obligations on their data offerings, while cable companies had a strong incentive to block efforts to

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64. See MTS and WATS Market Structure, *Memorandum Opinion and Order*, 97 F.C.C.2d 682, 711-22 (1983), *reconsidered in part*, MTS and WATS Market Structure, *Memorandum Opinion and Order*, 97 F.C.C.2d 834 (1984) (concluding that “enhanced service providers” should be treated as end-users for regulatory purposes); DIGITAL TORNADO, *supra* note 2, at 50.

65. See FCC SPECTRUM POLICY TASK FORCE REPORT, ET Dkt. No. 02-135, (Nov. 15, 2002), *available at* [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/DOC-228542A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-228542A1.pdf). The exceptions are generally cases, such as the “V-Chip,” to block violent or sexual television content, where Congress has specifically directed the FCC to adopt rules governing receivers.

66. The Commission, to be fair, had little leeway on this matter. The Telecommunications Act of 1996 largely preserved the silo-oriented framework of the 1934 Communications Act. See *Layered Model*, *supra* note 8.

67. See Implementation of the Local Competition Provision of the Telecommunications Act of 1996, *Third Report and Order and Fourth Further Notice of Proposed Rule Making*, 15 FCC Rcd. 3696 (1999) (establishing rules for unbundled network elements); Deployment of Wireline Services Offering Advanced Telecommunications Capability and Implementation of the Local Competition Provisions of the Telecommunications Act of 1996, *Third Report and Order in CC Dkt. No. 98-147 and Fourth Report in CC Dkt. No. 96-98*, 14 FCC Rcd. 20912, 20916, para.20,912 ¶ 5 (1999) (requiring line sharing).

68. See BARBARA ESBIN, INTERNET OVER CABLE: DEFINING THE FUTURE IN TERMS OF THE PAST (FCC Office of Plans and Policy, Working Paper No. 30, Aug. 1998), *available at* [http://www.fcc.gov/Bureaus/OPP/working\\_papers/oppwp30.pdf](http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp30.pdf).

impose unbundling obligations on their offerings.

The first significant battle over the physical layer began in late 1998, under the rallying cry of “open access.”<sup>69</sup> As cable operators built out their broadband infrastructure, advocates, including myself, argued that they should be required to allow independent Internet service providers access to their networks. The argument was that the open platform model used for the phone network had been the foundation for the Internet’s spectacular growth.<sup>70</sup> Open access to networks not only fostered innovation by small new entrants, it created a virtuous circle that benefited incumbents as well. Allowing cable operators to build closed access into their physical plant would forever foreclose that kind of open connectivity in the cable broadband environment, which, then and now, represents the largest share of residential broadband customers.<sup>71</sup> Moreover, once cable had established its freedom from open access, phone companies were bound to push hard for similar rules as a matter of competitive parity.<sup>72</sup> And that is precisely what happened.

When Michael Powell took over as FCC Chairman in 2001, he made clear his desire to eliminate many of the unbundling requirements and wholesale pricing restrictions on incumbent local phone companies.<sup>73</sup> Powell pushed through FCC decisions in separate proceedings classifying both DSL and cable modem offerings as unregulated “information services,” meaning they were not subject to unbundling requirements.<sup>74</sup> As with the Commission’s previous decisions, Powell could claim a strong public policy foundation for his actions. The previous unbundling requirements were blamed for facilitating the vast capital destruction of

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69. See Mark A. Lemley & Lawrence Lessig, *The End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era*, 48 UCLA L. REV. 925 (2001); Mark Cooper, *Open Access to the Broadband Internet: Technical and Economic Discrimination in Closed, Proprietary Networks*, 71 U. COLO. L. REV. 1011 (2000). One reason for the virulence of the open access debate in 1998-2000 was AT&T’s acquisition during that time period of TCI and MediaOne, two of the largest cable television operators. The fear at the time was that AT&T would use its leverage as the largest cable player against unaffiliated service providers. As it turns out, AT&T’s strategy failed for business reasons, and the company later sold its cable assets to Comcast.

70. See *Layered Model*, *supra* note 8.

71. See *id.*

72. See *id.* This point addressed the argument of cable operators that, even if the cable broadband platform was proprietary, competing ISPs had the option of reaching their customers through interconnection with the phone network. See James Speta, *The Vertical Dimension of Cable Access*, 71 U. COLO. L. REV. 975, 1004-07 (2000).

73. See Yochi Dreazen, *FCC’s Chairman Axes Long-term Policy*, WALL ST. J., May 1, 2001, at A28; Paul Krugman, *Digital Robber Barons?*, N.Y. TIMES, Dec. 6, 2002, at A35.

74. See *Appropriate Framework for Broadband Access to the Internet over Wireline Facilities*, *Notice of Proposed Rulemaking*, 17 FCC Rcd. 3019, 3027 (2002) (concerning DSL service); *Inquiry Concerning High-Speed Access to the Internet over Cable and Other Facilities*, *Declaratory Ruling and Notice of Proposed Rulemaking*, 17 FCC Rcd. 4798, 4802 (2002) (concerning cable modem service).

the telecom bust. The FCC's earlier decisions had been rejected by courts repeatedly.<sup>75</sup> Incumbents complained that they had no economic incentive to invest in new infrastructure if they had to share the benefits with competitors, while the erstwhile competitors who supposedly benefited from the policy were filing for bankruptcy at a rapid pace.

Unfortunately for Powell, his actions proved both politically and legally difficult to sustain. In *Brand X Internet Services v. FCC*, the Ninth Circuit rejected the FCC's conclusion that cable modem offerings are unregulated information services.<sup>76</sup> The FCC's efforts to fix the telephone unbundling rules created similar confusion when a dissident block of Commissioners were able to reverse Powell's proposed decision, only to have the subsequent order – itself a response to a judicial remand – overturned by the courts.<sup>77</sup>

Meanwhile, a new concept, network neutrality, began to enter the communications policy debate.<sup>78</sup> Unlike open access, which focused on physical interconnection with Internet service providers, network neutrality considers whether network operators can block or disadvantage competing providers of higher-level functionality. Specifically, the concern is that broadband providers, seeking to capture rents, will restrict users' ability to run applications, access resources, transmit content, or connect devices that are not affiliated with the broadband provider itself.<sup>79</sup> Chairman Powell has stated forcefully that broadband providers should not interfere with what he calls the Internet's "Four Freedoms:" end-users' freedom to access content, use applications, attach personal devices, and obtain service plan information.<sup>80</sup> However, he has so far

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75. *United States Telecom Ass'n v. F.C.C.*, 290 F.3d 415 (D.C. Cir. 2002), *cert. denied sub nom.*, *WorldCom, Inc. v. United States Telecom Ass'n*, 538 U.S. 940 (2003).

76. *See Brand X Internet Servs. v. F.C.C.*, 345 F.3d 1120 (9th Cir. 2003). The decision was based largely on the application of *stare decisis* to an earlier Ninth Circuit decision finding cable modem service to be a "telecommunications service." *See AT&T Corp. v. City of Portland*, 216 F.3d 871 (9th Cir. 2000). The Supreme Court subsequently reinstated the FCC ruling. *See Nat'l Cable & Telecomms. Assoc. v. Brand X Internet Servs.*, 535 U.S. 467 (2005). However, the damage to Chairman Powell's agenda, and to investor confidence that the regulatory system could facilitate significant broadband adoption, had already been done.

77. *See Review of the Section 251 Unbundling Obligations of Incumbent Local Exch. Carriers, Report and Order and Order on Remand and Further Notice of Proposed Rulemaking*, 18 F.C.C.R. 16,978 (2003), *reversed*. *United States Telecom Ass'n v. F.C.C.*, 359 F.3d 554 (D.C. Cir. 2004).

78. *See* Timothy Wu, *Network Neutrality, Broadband Discrimination*, 2 J. TELECOMM. & HIGH TECH L. 141 (2003); Declan McCullagh, *Tech Companies Ask for Unfiltered Net*, NEWS.COM (Nov. 18, 2002), at [http://news.com.com/2100-1023-966307.html?tag=fd\\_top](http://news.com.com/2100-1023-966307.html?tag=fd_top) (describing network neutrality advocacy by the Coalition for Broadband Users and Innovators, a group of technology companies including Microsoft).

79. *See id.*

80. Michael Powell, *Remarks at the Fall 2004 Voice on the Net Conference*, October 19, 2004, available at [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/DOC-253325A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-253325A1.pdf); Michael Powell, *Preserving Internet Freedom: Guiding Principles for the Industry*, Remarks

resisted calls to make that policy mandatory.<sup>81</sup> As with open access, broadband operators claim they need the ability to bundle services, and disclaim any intention to limit user choice.

The root problem the FCC faces in the unbundling mess is that there simply is no good answer under the current regulatory paradigm.<sup>82</sup> The silo-based classification into telecommunications and information services is a blunt instrument. Either something is “telecommunications” – and subject to the full panoply of FCC regulation – or it is information service – and thus in a vaguely defined zone of “unregulation.”<sup>83</sup> That creates strong pressure to keep as much as possible out of the telecommunications abyss.

This decision, moreover, is essentially a muddled layering exercise. Under the 1996 Act, “telecommunications” essentially represents physical transmission, and “information services,” which are offered “via telecommunications” represent some combination of higher-level functionality.<sup>84</sup> However, because the statute doesn’t subdivide the network stack further, or provide any guidance for the treatment of non-telecommunications services, the decision is always subject to challenge.

In essence, the legacy regulatory structure harbors a nascent two-layer framework.<sup>85</sup> The bottom half, the physical layer, is heavily regulated, while the upper half is regulated only in specific, well-defined cases. Broadcast media content, for example, is regulated under public interest and indecency guidelines because of its pervasiveness and its association with government-granted spectrum licenses.<sup>86</sup> Cable TV programming is subject to pro-competitive regulation under the 1992 Cable Act, to address concerns about market power in the video programming market.<sup>87</sup> These are essentially special-case regulations of the content

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at the Silicon Flatirons Symposium, Feb. 8, 2004, *available at* [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/DOC-243556A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-243556A1.pdf).

81. *See id.* (challenging the broadband network industry to adopt the “four freedoms”, but not advocating any formal FCC action to enshrine them). The Commission recently adopted a policy statement that promotes principles similar to former Chairman Powell’s “Four Freedoms.” *See* News Release, FCC Adopts Policy Statement, Aug. 5, 2005, *available at* [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/DOC-260435A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-260435A1.pdf). However, the policy statement still lacks any binding legal force.

82. For a different approach that addresses many of the same questions, *see* Farrell & Weiser, *supra* note 27.

83. *See Layered Model, supra* note 8. For a detailed analysis of the FCC’s “unregulation” policy, *see* OXMAN, *supra* note 38.

84. 47 U.S.C. § 153 (20), (43) (Supp. V 1999).

85. *See Layered Model, supra* note 8.

86. *See* Red Lion Broad. Co. v. FCC, 395 U.S. 367 (1969) (explaining “pervasiveness” rationale); FCC v. Pacifica Found., 438 U.S. 726 (1978) (upholding indecency regulation); Nat’l Broad. Co. v. United States, 319 U.S. 190 (1943) (authorizing content regulation on the basis of scarcity of spectrum)

87. Cable Television Consumer Protection and Competition Act of 1992, Pub. L. No. 102-385, 106 Stat. 1460 (codified in scattered sections 47 U.S.C. §§ 521-611 (Supp. V

layer. The interface, application, and logical layers are essentially ignored under the current statutory scheme. That is one reason issues such as open access are so troublesome. Most of the concerns about anti-competitive behavior by physical network owners concern leveraging that physical-layer dominance not just into content, but through the other layers in between.<sup>88</sup> There is no good way to analyze problems at the logical layer in a regime that does not acknowledge that layer exists.

Moreover, layer-violating activity does not necessarily proceed in one direction. The legacy regulatory structure, by treating the physical layer as the place to impose regulation, implies that layer is the necessary source of anti-competitive activity. While that is certainly a possible scenario, it is not the only one. The program access rules in the 1992 Cable Act, for example, were designed to prevent cable operators from using their dominance of certain high-value content to prevent competition at the physical layer, from competitors such as direct broadcast satellite providers<sup>89</sup>

The issues become even harder in the future. A company such as Microsoft could use its dominance of the operating system, an artifact of the interface layer, to exercise market power over both content above and everything below.<sup>90</sup> Or a company such as VeriSign, which controls key logical-layer assets associated with the domain name system and the ENUM protocol for translating between phone numbers and Internet addresses, could exert market power up and down from its leverage point.<sup>91</sup> There is simply no way to even analyze such competitive issues under the current communications policy framework. Neither Microsoft nor VeriSign controls any physical infrastructure. Neither is a carrier under any reasonable definition. Yet, under some scenarios, both could exercise a level of market power that raised the same public policy concerns as the physical layer carrier networks the Commission has long regulated.<sup>92</sup>

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1993)).

88. The potential use of deep packet inspection at the logical layer is an example.

89. See John H. Barton, *The International Video Industry: Principles For Vertical Agreements And Integration*, 22 CARDOZO ARTS & ENT. L.J. 67 (2004). Similar concerns arise in the United Kingdom, where there have been accusations that Rupert Murdoch is using his control over valuable sports content to block competition by cable against his BSkyB satellite service. See Alex Salkever, *Microsoft: Your Next Phone Company?*, BUS.WK., March 2, 2004; Microsoft's Full-Court Broadband Press, TELECOM POLICY REPORT (Nov. 17, 2004), available at [http://www.findarticles.com/p/articles/mi\\_m0PJR/VOIPis\\_44\\_2/ai\\_n7586312](http://www.findarticles.com/p/articles/mi_m0PJR/VOIPis_44_2/ai_n7586312).

91. See Alex Salkever, *Microsoft: Your Next Phone Company?*, BUS. WK., March 2, 2004; *Microsoft's Full-Court Broadband Press*, TELECOM POLICY REPORT (Nov. 17, 2004), [http://www.findarticles.com/p/articles/mi\\_m0PJR/is\\_44\\_2/ai\\_n7586312](http://www.findarticles.com/p/articles/mi_m0PJR/is_44_2/ai_n7586312).

91. See Kevin Werbach, *The Microsoft of VOIP?*, VON MAG. (Feb. 2005), at [www.vonmag.com/issue/2005/feb/columns/werbach.htm](http://www.vonmag.com/issue/2005/feb/columns/werbach.htm).

92. See *supra* pp. 67-68.

What is needed, therefore, is not just a layered model, but a way of thinking about telecommunications policy that doesn't presuppose a hard division between a regulated physical layer and everything else. In the "Ice Age" of telecommunications, through most of the 20th century, the physical layer was a reasonable proxy for the kind of market power that necessitated regulation. The competitive issues of today and the future, however, are different.

### III. THE CONNECTIVE LAYERS

#### *A. Making the Connective Layers Primary*

Historically, communications policy has failed to acknowledge the connective layers. In fact, legacy communications regulation collapses the layered model entirely, by regulating applications (such as voice telephony and broadcast video) through differential treatment of physical-layer networks. This approach quickly breaks down when the same application (such as VoIP) runs on any transport platform. A less-obvious consequence of convergence, however, is the growing significance of the connective layers. When networks are no longer separated from one another, the key to seamless delivery of services is the connective tissue among networks, identity, and user experience.

A successful next-generation communications regulatory framework must incorporate effective targeting. In other words, law should concentrate on the most efficient leverage points for effecting public policy objectives. The silo model of regulation presupposes that physical infrastructure is the source of market power, and that high-level categorization decisions should trigger a laundry list of regulatory obligations. In both cases, the regulatory obligations involved may have been reasonable for the problem and market environment they were originally designed to address. Now, however, they create significant distortions and strong incentives for regulatory arbitrage.

The layered model reveals two critical leverage points—the connective layers – that have not traditionally factored into communications policy. Neither one does much of anything that users see. Yet, as discussed above, both are increasingly important competitive control points. In the silo model of regulation, the Commission is often forced either to regulate heavily or not at all. The open access debate is a good example. Because the issue was framed in terms of market power based on physical infrastructure, the issues before the FCC were whether to mandate physical layer network unbundling and mandatory interconnection with unaffiliated ISPs. The cable operators and their supporters understandably made the case that any such mandated open access would inevitably

force the Commission to establish regulated prices, terms, and conditions.<sup>93</sup> The return to such interventionist price regulation would have been at odds with the process of deregulation the Commission has undertaken for the past twenty years. By importing mandatory interconnection concepts from the telephone world, it also would have conflicted with the silo model and its embodiment in the Communications Act, under which different networks are subject to different rules and obligations.

So the Commission rejected open access. Only later has it become apparent that the real threat from closed broadband networks is not their ability to disadvantage unaffiliated ISPs, but instead is their ability to foreclose innovation and competition on top of the network. Open access was a case of horizontal foreclosure, involving two participants operating at the same layer. Even under such conditions, ISPs still have some alternatives, including interconnecting with DSL providers, using wireless to route around incumbent last-mile infrastructure entirely, and negotiating access arrangements privately.

More worrisome is the possibility of vertical distortions. When a company that dominates one layer of the broadband communications stack forecloses or disadvantages innovation at other layers, users lose out entirely. They simply cannot get the functionality they might otherwise receive, unless they can find a complete substitute for the competitive bottleneck. This makes network neutrality in many ways more critical than open access.<sup>94</sup>

When network operators provide their own applications and content, they do not necessarily crowd out competitors. Because the Internet is an open platform, their offerings can compete with those non-facilities-based providers. Comcast can strike a deal with Barnes & Noble to refer customers to the BN.com online bookstore through its customer portal, but customers are always free to ignore that link and use their Web browser to go directly to Amazon.com. Even bundling of the higher-level offerings with the physical access doesn't necessarily raise competitive concerns. SBC's partnership with Yahoo! for DSL access and content, though apparently beneficial for both parties, hasn't foreclosed opportunities for innovation and competition by competitors at either level. Not so, however, if the connective layers are involved. If SBC's DSL service were bundled at the interface layer with Microsoft's Windows Media technology for rich media and digital rights management, it would create a roadblock to competing technologies.<sup>95</sup>

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93. See James B. Speta, *Handicapping the Race for the Last Mile?: A Critique of Open Access Rules for Broadband Platforms*, 17 YALE J. ON REG. 39 (2000).

94. See Wu, *supra* note 78.

95. If SBC simply offered the Windows Media Player software to its customers, that

Moreover, a focus on the connective layers would reduce the aggregate level of regulation. Openness at these two key chokepoints would ensure sufficient competition to allow for less regulatory intervention at other layers. To take one example from the world of cellular telephony, Qualcomm owns key patents in a technology called Code Division Multiplexing (CDMA), which is used by many digital cellular networks. CDMA is proprietary, giving Qualcomm a powerful and lucrative position. Nonetheless, Qualcomm's dominance at the physical layer does not necessarily create the kind of market power that calls for regulation. Logical layer interconnection of mobile phone networks is open, thanks to standards-based telephone numbers and SS7 signaling networks. Application layer interconnection is also widely available. For example, roaming arrangements among SMS text messaging services and competing application software platforms such as Microsoft's Windows Mobile, Nokia's Series 60, PalmSource's PalmOS, Sun's Java J2ME, and Qualcomm's own BREW.

### B. Historical Cases

Although the FCC and other governmental entities haven't expressly acknowledged the layered nature of the networks they are addressing, they have at times taken steps targeted to the connective layers, in particular the logical layer. These actions have a mixed track record. A review of historical cases shows that delving deeply into the logical layer and directly organizing markets or protocols is dangerous, but policing the logical layer as a competitive boundary is generally effective.

#### 1. Network-attached equipment (Part 68)

Until 1968, AT&T and its affiliated telephone companies had provisions in their tariffs prohibiting "foreign attachments" to the network.<sup>96</sup> In other words, users could not plug into the network anything not specifically approved by the phone company. At the time, AT&T was the dominant monopoly provider of both local and long-distance phone service for the vast majority of Americans. The foreign attachment rules thus effectively prevented the creation of a third-party market for phone equipment such as telephone handsets. Customers could purchase only

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would constitute applications layer functionality. Customers could always download and use competing media players. If, however, the media player and its associated digital rights management technology were embedded in the interface layer, it would be tightly coupled with the broadband access service itself. It might be difficult or impossible to use competing technologies.

<sup>96</sup> Use of the Carterfone Device in Message Toll Telephone Services, *Decision*, 13 F.C.C.2d 420 (1968), *reconsideration denied*, 14 F.C.C.2d 571 (1968) [hereinafter Carterfone].



from AT&T's affiliated manufacturing arm, only on a monthly rental basis, with no ability to add additional features.

All that changed with the adoption of the FCC's *Carterphone* rules in 1968.<sup>97</sup> As recently as 1956, the FCC had upheld the use of the foreign attachment rules to prohibit the sale of the Hush-a-phone, a simple rubber cup that fit on a telephone receiver to provide greater privacy.<sup>98</sup> By 1968, however, the winds had shifted. Presented with the Carterphone, a device for patching wireline telephone calls into a two-way wireless radio connection, the Commission reversed its prior decision.<sup>99</sup> Not only did it find the Carterphone no threat to the phone network, it struck down all the foreign attachment provisions as anti-competitive. In their place, the FCC created the Part 68 rules, which governed the end-user phone equipment market for more than 30 years.<sup>100</sup>

The Part 68 rules are an example of interface-layer regulation. The FCC set the terms under which users and their "content" (speech) could connect to the voice application that defined the phone network. In fact, it was Part 68 that arguably created the interface layer in communications networks. Without it, everything up to and including the equipment at a user's premises was an extension of the physical network and its hidden logical interfaces. Once the connective interface layer was created through Part 68, the content and application layers followed. Only with a choice of equipment could users specify different applications or alternate forms of content.

Part 68 was thus a success story for regulation of the interface layer. Two characteristics of the FCC's action stand out: it was user-empowering, and it involved clear guidelines and well-understood technical standards. Part 68 intervened in the logical layer to give users more choices, and to create more opportunities for manufacturers selling to those users. It expanded opportunities rather than reducing them. Furthermore, Part 68 was implemented in a way that minimized possibilities for confusion and regulatory gamesmanship. The rules themselves included technical drawings to assist would-be equipment vendors. The standards for connecting equipment were derived from existing internal

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97. *See id.*

98. *See Hush-A-Phone Corp. v. United States*, 238 F.2d 266, 268 (D.C. Cir. 1956). The Commission's – and AT&T's – rationale was that the Hush-a-Phone could slightly distort the sound that the other party in the conversation heard. This was considered "harm to the network," equivalent to electrical manipulation that could injure phone company personnel or damage phone company equipment.

99. *See Carterphone*, *supra* note 96.

100. In 2000, the FCC found there was no need for the government to continue to manage the technical standards for phone equipment, because the market was sufficiently robust and competitive. Therefore, it devolved its authority to a private standards body. *See* 2000 Biennial Regulatory Review of Part 68 of the Commission's Rules and Regulations, *Report and Order*, 15 FCC Rcd. 24,944 (2000).

AT&T interfaces, preventing any requirement of network re-engineering. Manufacturers could use a streamlined process, largely involving self-certification, to put their products into the market. And Part 68 replaced the blanket prohibitions in the foreign attachment tariff provisions with a limited set of conditions that would justify rejection of a device – primarily direct physical harm to phone company employees or equipment.<sup>101</sup>

Part 68 made possible a network equipment business that today generates billions of dollars in annual revenues. Even more important, it opened up the possibility of attaching devices to the phone network that offered new and different functionality. Fax machines, answering machines, and computer modems are all children of Part 68.<sup>102</sup> The consumer Internet could not have happened if users didn't have the ability to attach devices to their telephone lines that transformed the phone network into a channel for data communications.

## 2. The Computer Inquiries

The *Computer III* rules are another example of successful regulation of the connective layers. The FCC's *Computer Inquiry* line of proceedings began in the late 1960s and continues to this day.<sup>103</sup> *Computer I* created an initial, flawed model for the treatment of computer processing functions in the phone network.<sup>104</sup> *Computer II* established a new framework that distinguished unregulated "enhanced services" from the regulated "basic services" the phone companies provided.<sup>105</sup> This division was, in an unacknowledged way, the FCC's first foray into layered policy-making. Essentially, the basic/enhanced distinction tracked the division between the content, interface, and application layers on one side, and the logical and physical layers on the other. Network operators could not use their control over the lower layers to preclude competition at the higher layers, nor would the FCC impose the same regulatory obligations on companies operating at the higher levels as it traditionally had on phone companies.

*Computer II* imposed "structural separation" of enhanced services

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101. 47 C.F.R. §§ 68.1-.506 (2005).

102. See Tim Wu & Lawrence Lessig, *Ex Parte Submission in CS Dkt. No. 02-52* (2003), [http://faculty.virginia.edu/timwu/wu\\_lessig\\_fcc.pdf](http://faculty.virginia.edu/timwu/wu_lessig_fcc.pdf).

103. See Cannon, *supra* note 37.

104. Regulatory and Policy Problems Presented by the Interdependence of Computer and Communication Services and Facilities, *Final Decision and Order*, 28 F.C.C.2d 267 (1971). *Computer I* failed because it presumed most services could be divided into pure communications or pure data processing, a division that became untenable as computer processing became an integral element of virtually all communications functions.

105. Amendment of Section 64.702 of the Commission's Rules and Regulations (Second Computer Inquiry), *Final Decision*, 77 F.C.C.2d 384 (1980).

provided by the incumbent Bell Operating Companies.<sup>106</sup> They could only offer enhanced services through wholly separate subsidiary companies, through arms-length relationships, in order to safeguard against anti-competitive behavior. *Computer III* left the basic framework in place, but shifted to non-structural safeguards such as Comparably Efficient Interconnection (CEI), which required phone companies to document and make available to competitors any basic services they used for their own enhanced services.<sup>107</sup>

Just as Part 68 helped make the Internet possible by giving users the opportunity to connect data communications devices to the network, *Computer III* did the same by giving Internet service providers the opportunity to route their data traffic easily over the phone network.<sup>108</sup> Where Part 68 operates at the interface layer, the *Computer III* rules work at the logical layer, ensuring that applications are able to work across existing physical networks. The *Computer III* rules, like Part 68, are credited for spurring innovation and competition. However, because *Computer III*'s non-structural safeguards involve a great deal of complexity and ongoing FCC management of interconnection terms, the implementation road has been bumpier. The courts have vacated and remanded some of the FCC's implementation decisions for not providing sufficient justification.<sup>109</sup>

The Commission experienced even greater difficulty with Open Network Architecture (ONA), which was supposed to be the follow-on to *Computer III*'s safeguards.<sup>110</sup> With ONA, the FCC envisioned breaking up the telephone network into modular components. Phone companies would make new modules available on request by independent enhanced service providers, with a private process available to resolve potential technical disputes. The ONA vision was, in short, to turn the phone network into a truly modular system.<sup>111</sup> It represented a bold effort to re-architect the telecom industry through an open logical layer, which would be the entry point for new innovations and competitive opportunities.

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106. *See id.*

107. Amendment of Sections 64.702 of the Commission's Rules and Regulations (Third Computer Inquiry), *Report and Order*, 104 F.C.C.2d 958 (1986); Computer III Further Remand Proceedings: Bell Operating Company Provision of Enhanced Services, *Order*, 14 FCC Red. 21,628 (1999) [hereinafter Computer III Further Remand Order].

108. *See Cannon, supra* note 37.

109. *See California v. FCC*, 39 F.3d 919, 933 (9th Cir. 1994), *cert. denied*, 514 U.S. 1050 (1995). Specifically, the court found the FCC had not sufficiently justified the elimination of Computer II structural safeguards.

110. *See Computer III Further Remand Order, supra* note 107, ¶ 8 n.17 (defining ONA).

111. *See BALDWIN & CLARK, supra* note 25.

ONA never really got off the ground.<sup>112</sup> It was an inspiring vision, but in practice implementation was a nightmare. Phone companies rejected requests for new modules, claiming excessive technical and economic burdens relative to the demand level. Enhanced service providers felt the phone companies were stonewalling, deliberately frustrating the FCC's intentions. Both sides went back to the Commission, seeking clarifications and modifications. In the end, although the phone companies did file the required ONA plans and make some changes to their network architecture, the vision of a modular phone network was never realized.

The lesson here is that regulation that requires detailed supervision and technical implementation may not be worth it, even when the objective of that regulation is worthwhile. Many of the benefits expected from ONA are starting to be realized today through VoIP, which generally operates at the higher application layer, independent of the network operators. The phone network is indeed advancing towards a more modular system, but it is happening more gradually, based on economic decisions of the network providers.

The problem with the fully modular ONA vision is that it sounds to phone companies much the way Napster sounds to record companies. If everything is broken up, modularized, standardized, and commoditized, the traditional opportunities for revenue generation and competitive differentiation go away. The fact that end-users pay less in a world where infrastructure providers make no money is cold comfort for those infrastructure providers. They can be expected to fight any effort perceived to put them in that position, not just at the FCC, but in implementation.

### 3. Numbering and Addressing

A final example of existing regulation in the connective layers is numbering. Phone numbers are the identity mechanism of the legacy telephone network. Numbers are subject to a technical standard, E.164, and to overlapping national, supra-national, and international regulatory mechanisms.<sup>113</sup> The FCC oversees the process of assigning numbers in the US, under a regional organization called the North American Numbering Plan.<sup>114</sup> At the highest level, the International Telecommunications Union (ITU), a UN agency, defines global numbering policy

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112. See Chris L. Kelley, Comment, *The Contestability of the Local Network: The FCC's Open Network Architecture Policy*, 45 FED. COMM. L.J. 89 (1992).

113. International Telecommunication Union Telecommunications Standardization Sector ("ITU-T"), *ITU-T Recommendation E.164, The International Public Telecommunication Numbering Plan* (1997), at <http://www.itu.int/itudoc/itu-t/rec/e/e164.html>.

114. See Telephone Number Portability, *First Report & Order & Further Notice of Proposed Rulemaking*, 11 FCC Rcd. 8352, 8358 (1996).

through its governmental members.

Numbering sounds like a mundane and mechanical area. In reality, it raises a host of important policy issues. Without a number, a connection to the phone network is meaningless. Numbers as standard, unique identifiers make it possible for any new phone subscriber to connect to any other subscriber anywhere, regardless of service provider or location. There are, however, only so many valid phone numbers. Exhaustion of available numbers in an area forces either an overlay of a new area code – which creates confusion since neither code has a unique geographical location – or a split of the existing area code, which forces a large number of subscribers to change their phone numbers. Both steps are thus controversial, and raise competitive concerns. Moreover, numbers are valuable as advertised contact points for businesses. Yet, technically, subscribers do not own phone numbers.<sup>115</sup> The numbers are a public resource, managed by carriers and loaned to subscribers.

Finally, numbers are a source of competitive lock-in. If you have to change your phone number in order to switch carriers, you will be much less likely to switch. For that reason, the FCC required long-distance number portability (known as “equal access”) when it implemented the AT&T breakup, and the 1996 Communications Act required local number portability to enable competition for local phone service.<sup>116</sup> The Commission has also recently supervised the implementation of wireless number portability for mobile phone carriers.<sup>117</sup>

The hidden difficulties of number assignment became apparent when toll-free “800” numbers came near exhaustion. AT&T developed toll-free calling in 1967, and it was a huge hit. Today, toll-free calls represent more than half of US long-distance traffic.<sup>118</sup> By 1995, almost all the available 800 numbers had been assigned. The FCC established a process to open up a series of new toll-free area codes, starting with 888.<sup>119</sup> The problem was that many businesses associated their brands and goodwill with their 800 numbers, either through the number itself, or through a mnemonic association such as 1-800-FLOWERS. A company that spent millions of dollars building brand equity in its phone number, and seeing it as a key intangible asset, wouldn’t take kindly to

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115. See Toll Free Service Access Codes, *Notice of Proposed Rulemaking*, 10 FCC Rcd. 13,692, 13,702 (1995); *Burris v. S. Cent. Bell Tel. Co.*, 540 F. Supp. 905, 908 (S.D. Miss. 1982).

116. See Telephone Number Portability, *supra* note 114, at 8354.

117. See Telephone Number Portability, *Memorandum Opinion & Order & Further Notice of Proposed Rulemaking*, 18 FCC Rcd. 23,697, 23,698 (2003).

118. Toll-Free Numbers FAQ, at [http://www.whoscalling.com/cmm\\_tollFree\\_FAQ.php](http://www.whoscalling.com/cmm_tollFree_FAQ.php).

119. See Toll Free Service Access Codes, *Second Report & Order & Further Notice of Proposed Rulemaking*, 12 FCC Rcd. 11,162 (1997).

some other business obtaining the equivalent 888 number. So the FCC created a process to allow businesses with valuable numbers to free the equivalent number in the new area code.<sup>120</sup> This limited the new numbers that became available. Not surprisingly, it created incentives for companies to claim that their numbers were valuable even if they really weren't. Although the new toll-free codes eventually launched, the process was fraught with difficulty.<sup>121</sup>

The next frontier of numbering is the convergence of telephone numbers with Internet identifiers. Addressing on the Internet works differently than on the phone network. Instead of a single telephone number, users have multiple identifiers for different purposes. A single user might have several email addresses, an instant messaging screen name, a website domain name, and a numeric Internet Protocol (IP) address dynamically assigned to his or her computer at each Internet log-in. Many of those addressing systems are privately managed, or based on compliance with open technical standards. The domain name system (DNS), however, is subject to a contentious governance mechanism.<sup>122</sup>

The DNS was originally managed by a private company under contract with the National Science Foundation, back in the days when the Internet was a non-profit research network.<sup>123</sup> Later, the US government established a quasi-private international governance organization called the Internet Corporation for Assigned Names and Numbers (ICANN).<sup>124</sup> ICANN oversees the difficult processes of creating new top-level domain names, resolving disputes over the proper ownership of individual domain names, ensuring the system's reliability, and addressing other policy issues that get dragged into the discussion.

The details of ICANN challenges and failings have been amply discussed elsewhere.<sup>125</sup> Yet perhaps ICANN's greatest challenge lies in the future. With the growth of VoIP, the phone network and the Internet

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120. See Diana Lock, Comment, *Toll-Free Vanity Telephone Numbers: Structuring a Trademark Registration and Dispute Settlement Regime*, 87 CALIF. L. REV. 371, 378 (1999).

121. See *id.*

122. IP addresses also require some governance. Because they are subject to greater technical constraints and do not raise the intellectual property and branding issues that domain names do, however, those governance issues have been much less significant than for domain names.

123. See MILTON L. MUELLER, RULING THE ROOT: INTERNET GOVERNANCE AND THE TAMING OF CYBERSPACE 10 (2002); Michael Froomkin, *Wrong Turn in Cyberspace: Using ICANN to Route Around the APA and the Constitution*, 50 DUKE L.J. 17, 21-22 (2000); Jonathan Weinberg, *ICANN and the Problem of Legitimacy*, 50 DUKE L.J. 187, 198 (2000).

124. See MUELLER, *supra* note 123, at 3; Froomkin, *supra* note 123, at 209; Weinberg, *supra* note 123, at 20; Susan P. Crawford, *The ICANN Experiment*, 12 CARDOZO J. INT'L & COMP. L. 409, 413 (2004).

125. See MUELLER, *supra* note 123; Froomkin, *supra* note 123; Weinberg, *supra* note 123.

are coming together. Today, VoIP providers can create their own private online addresses, but they cannot directly assign E.164 phone numbers. To allow calls to and from phone numbers, they must interconnect with a carrier that controls numbering resources, and translate their VoIP traffic onto or off the public switched telephone network. A protocol called ENUM, for electronic numbering, promises to streamline that process. It would directly map between IP addresses and phone numbers.<sup>126</sup> And it wouldn't stop there. The ENUM system involves a database lookup every time an ENUM identifier is invoked.<sup>127</sup> That database lookup can retrieve other information beyond the simple voice/data translation. For example, a user's ENUM record could contain all that user's network identifiers, along with instructions about which of those identifiers to make available to others. The ENUM record could also be used for advanced call routing, allowing a user to specify parameters for which contact mechanism will be used under which circumstances.

All well and good. The problem with ENUM is that it raises all the challenges of domain names, and then some. Because ENUM bridges the gap between Internet addresses and phone numbers, it gives governments that want a greater role in Internet regulation a hook to become involved.<sup>128</sup> If ENUM is a successor to E.164 phone numbers, they argue, the governmental organizations and processes that hold sway for E.164 should apply to ENUM. Though the FCC has so far shied away from the ENUM debate, expressing an unwillingness to dive to far into the murky realm of Internet governance, it will inevitably be dragged in. That makes it all the more important for the FCC to think through its approach toward regulation of the connective layers.

#### IV. HOW TO BREAK THE ICE

Both the legacy regulatory system and the legacy business models for the industry encouraged segregation and metering of traffic in ways that are increasingly unsustainable in a converged world. Not only does a layered framework help to diagnose these problems, it points the way toward solutions.<sup>129</sup> Below, I describe some of the impending conflicts

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126. See Craig McTaggart, *The ENUM Protocol, Telecommunications Numbering, And Internet Governance*, 12 CARDOZO J. INT'L & COMP. L. 507, 509 (2004); Anthony M. Rutkowski, *The ENUM Golden Tree: The Quest For A Universal Communications Identifier* (2001), available at [http://www.ngi.org/enum/pub/info\\_rutkowski.pdf](http://www.ngi.org/enum/pub/info_rutkowski.pdf); Robert Cannon, *ENUM: The Collision of Telephony and DNS Policy*, in COMMUNICATIONS POLICY AND INFORMATION TECHNOLOGY (Lorrie Faith Cranor & Shane Greenstein eds., 2002).

127. The technical architecture is similar to that of domain names.

128. See McTaggart, *supra* note 126.

129. For example, Solum and Chung derive a set of principles from the layered model, including disfavoring layer-violating regulation and targeting regulatory intervention to the appropriate layer. See Solum and Chung, *supra* note 38.

arising at the connective layers, and suggest how to extend the focus on these critical areas into affirmative policy reforms.

### A. *The Interface Layer*

The interface layer is the first major phase transition, where content meets networks. In the argot of network engineers, content is fundamentally “data at rest:” information accessed at a single location. The user experience of listening to a CD playing locally on your computer, an MP3 music file that was downloaded over the Internet, and a streaming audio file that is delivered across the network as you listen to it, is basically the same. What you as the user care about is the music, not how it got there. How it gets there, however, is precisely the function of the network. The interface layer turns content into “data in motion,” capable of being transmitted in real-time or asynchronously across the global network.

There are two major public policy issues arising today at the interface layer: privacy and digital access controls.

The “content” delivered through digital networks is not just commercial broadcast programming, such as Hollywood feature films and television shows. Converged digital networks are bidirectional, allowing users to send as well as receive content. Many people use the Internet to share digital photos, send email or instant messages, and operate Websites. Going forward, VoIP and video (both live webcam transmissions and pre-recorded video mail) will be an increasingly significant share of traffic.<sup>130</sup> Moreover, even when they aren’t sending content of their own, users often send important personal information such as credit card numbers over the network. Privacy and security are thus important considerations. For the most part, such questions are in the purview of the Federal Trade Commission rather than the FCC.

Digital access controls address the opposite problem: instead of how to secure the user’s content through the network, they try to secure the content the user receives by preventing unauthorized use or redistribution through digital access controls, and in particular digital rights management. The FCC has waded into this mire with its Broadcast Flag proposal.<sup>131</sup> Under pressure from content owners, who argued that they

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130. See Kevin Werbach, *The Implications of Video P2P on Network Usage*, in VIDEO PEER TO PEER, Columbia Institute for Tele-Information (forthcoming 2005), available at <http://werbach.com/docs/VideoP2P.pdf>. Already 35 percent of overall Internet traffic is estimated to be associated with BitTorrent, the most popular video peer-to-peer technology. See Andrew Parker, *The True Picture of Peer-to-Peer Filesharing*, at [http://www.cachelogic.com/press/CacheLogic\\_Press\\_and\\_Analyst\\_Presentation\\_July2004.pdf](http://www.cachelogic.com/press/CacheLogic_Press_and_Analyst_Presentation_July2004.pdf).

131. See Digital Broadcast Content Protection, *Report & Order & Further Notice of Proposed Rulemaking*, 18 FCC Rcd. 23,550 (2003).



would not make digital programming available without assurances that receivers would be capable of enforcing DRM, the FCC adopted rules mandating that all devices capable of receiving digital television transmissions incorporate a so-called “Broadcast Flag.”<sup>132</sup> Devices capable of receiving over-the-air digital television streams would have to incorporate technology that recognized and obeyed embedded right management instructions in the stream itself.

The broadcast flag is a classic interface layer issue. What sorts of legally-mandated restrictions should be interposed between content and the applications that process that content? Yet because the current structure of telecom law doesn’t expressly incorporate a layered model, let alone one that recognizes the existence of connective layers, the Commission was forced to cast in the dark for justifications. And in the end, the District of Columbia Circuit Court of Appeals concluded that the Commission did not have sufficient legal authority for its actions.<sup>133</sup>

A legal and regulatory framework that surfaces the interface layer would not necessarily provide greater justification for the Commission’s broadcast flag decision. On the contrary, a layered analysis could well provide a more direct route to the conclusion that such rules are a harmful roadblock to connectivity between two network layers, with spillover effects far beyond the intended problem. The value of the layered approach is that it focuses the debate on these issues, allowing policy-makers to weigh the proper pros and cons before moving forward. It also emphasizes the value of open connectivity to the network as a whole.

### *B. The Logical Layer*

The logical layer is the point of demarcation between systems that talk to the network and systems that talk to users. It is also the point that transforms streams of bits passing between machines into information moving to and from people. This is because the logical layer includes addressing and routing functions which associate traffic with individuals and their devices at the edges of the network. To the extent the logical layer has been regulated in the past, it is through the management of telephone numbers, as discussed below, and law enforcement access. Under the Communications Assistance to Law Enforcement Act (CALEA), telephone companies are required to modify their digital networks to facilitate authorized wiretapping by law enforcement.<sup>134</sup> Recently, the FBI has expressed concern that VoIP calls might not be sub-

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132. See *id.*; Susan P. Crawford, *The Biology of the Broadcast Flag*, 25 HASTINGS COMM. & ENT. L.J. 603 (2003).

133. *Am. Library Assoc. v. FCC*, 406 F.3d. 689, 708 (D.C.Cir. 2005).

134. 47 U.S.C. §§ 1001-1021 (2000).

ject to CALEA, and has strongly urged the FCC to bring VoIP within the law's scope.<sup>135</sup> In August, the FCC tentatively concluded that "managed" VoIP and broadband access services are subject to CALEA obligations.<sup>136</sup>

Like the interface layer, the logical layer seems bound to play a greater role in communications policy in the future. Until recently, it has been difficult for any company to turn the logical layer into a point of control because of the way the Internet works. Unlike the circuit-switched phone network, the Internet employs packet switching. Traffic is broken up into small chunks and reassembled at the receiving end.<sup>137</sup> There is no necessary distinction between one kind of traffic and another. Thus, a packet carrying a tiny snippet of a voice conversation looks essentially identical to a packet carrying a snippet of a Web page or music file. The opacity of Internet traffic can be accentuated through encryption, which hides the content of packets from anyone except the intended recipient. Furthermore, applications can make traffic identification more difficult by shifting port numbers and other technical parameters.<sup>138</sup> This last technique is especially common for peer-to-peer file-sharing applications, which seek to avoid interference by both content owners fighting copyright violations and service providers facing huge bandwidth utilization. Even when traffic can be identified, the sheer speed of transmissions across network backbones makes it technically challenging to classify traffic flows while they are actually moving across the network.

A new technology called deep packet inspection promises to overcome some of these limitations.<sup>139</sup> Deep packet inspection uses specialized high-speed hardware and software that can identify packets in real-time. A service provider could use deep packet inspection to distinguish peer-to-peer traffic, or even just traffic from a single peer-to-peer file-sharing application, and either block it or reduce its available bandwidth. Without deep packet inspection, service providers and others could only resort to crude application-level techniques, such as cutting off all streaming video clips using standard formats after a certain time.<sup>140</sup>

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135. See Department of Justice, Federal Bureau of Investigation, and Drug Enforcement Administration, *Joint Petition for Expedited Rulemaking*, RM 10,865, (March 10, 2004), available at <http://www.askcalea.com/docs/20040310.calea.jper.pdf>.

136. See Communications Assistance for Law Enforcement Act and Broadband Access and Services, *Notice Of Proposed Rulemaking & Declaratory Ruling*, 19 FCC Rcd. 15,676, 15,677 (2004).

137. See DIGITAL TORNADO, *supra* note 2.

138. See Werbach, *supra* note 130.

139. See *id.*

140. This is in fact what early cable broadband provider @Home did. See Lemley & Lessig, *supra* note 70, at 393.

Deep packet inspection allows true logical-layer control based on ownership of the physical layer.

Service providers may deploy deep packet inspection gear for several reasons.<sup>141</sup> With peer-to-peer applications representing more than half of the total traffic on the Internet,<sup>142</sup> broadband service providers have incentives to limit those applications' bandwidth utilization. Separately, the FCC's CALEA proposal would require network owners to facilitate wiretapping of VoIP calls. Deep packet inspection could make that easier to accomplish, by isolating VoIP traffic flows. Cisco recently paid \$200 million to acquire P-Cube, a deep packet inspection startup, indicating the level of interest in the potential market for such technology.<sup>143</sup>

CALEA implementation and traffic peer-to-peer shaping are relatively innocuous uses of deep packet inspection, at least from a competition policy standpoint. Once these devices are installed in the network, however, they can be employed for entirely different purposes. Segmenting applications at the logical layer could allow broadband providers to either block or degrade independent application and content providers. In particular, deep packet inspection could be employed against third-party VoIP providers.<sup>144</sup> Network owners have incentives to favor their own VoIP offerings, which they can promote as offering higher quality than competitors.<sup>145</sup> An indication of the attitude that operators harbor toward independent VoIP providers was suggested in mid-2004, when a P-Cube executive told *Barron's* that VoIP services "raped" cable broadband networks.<sup>146</sup>

### C. *By the Numbers*

In addition to policing the connective layers, the FCC could use numbers as an affirmative basis for a new policy approach. A number-based approach would be particularly valuable for addressing the thorny challenge of universal service. As noted at the outset, the perceived need to preserve universal service subsidy flows is a significant factor propping up the anachronistic geographic- and minutes-based structure of the telecom industry. Moreover, so long as new forms of competition and innovation are seen as a threat to the stability of universal service subsi-

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141. See Werbach, *supra* note 130.

142. See Parker, *supra* note 131.

143. See *Cisco Systems to Acquire P-Cube, Inc.*, BUS. WIRE, Aug. 23, 2004, (LEXIS, News Library).

144. See Nuvio, Corp., *Notice of Written Ex Parte Presentation in IP-Enabled Services*, WC Dkt. No. 04-36, filed Sept. 13, 2004, available at [http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native\\_or\\_pdf=pdf&id\\_document=6516483690](http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6516483690).

145. See Wu and Lessig, *supra* note 103.

146. Eric J. Savitz, *Talk Gets Cheap*, BARRON'S, May 24, 2004, at 19.

dies, there will be calls to regulate those innovations first and ask questions later.<sup>147</sup>

One basic problem is that universal service contribution rates are currently derived from minutes of use. This metric makes no sense in an Internet environment, because the Internet does not tie up specific resources for defined periods of time. Moreover, a minutes-based system either requires all VoIP traffic to be tracked and metered in order to facilitate collection of universal service subsidies, or it faces a downward spiral as traffic leaks out into VoIP networks. Already, because access lines are falling, universal service surcharges have increased substantially.<sup>148</sup>

An alternative approach is to impose universal service contributions not on networks, but on numbers. When a user signs up for a phone number, or to renew an existing number, he or she would pay an annual fee, which would be used to fund subsidy programs for high-cost areas. The arrangement would resemble the current process of obtaining an Internet domain name. Users would gain limited property rights in the numbers they use, but would have to pay to maintain their rights.

Such an approach would provide a stable foundation for universal service funding, because it would make no distinction between circuit-switched and VoIP calls. Any connection involving a phone number would pay in. On the other hand, connections to private services using their own identifiers would not be subject to universal service contribution obligations. Few users will give up the ability to receive calls from the two billion or so E.164 phone number users, which dwarfs any private VoIP or IM service.

If, over time, users start to migrate away from phone numbers, the FCC has two options. It can bring the largest addressing systems into the universal service funding pool. Or, it can decide that, with phone service now decisively changed from a service tied to the physical layer into an application for broadband connections, the justification for physical-layer subsidy flows has been eroded. By drastically reducing the cost of voice communication, VoIP may also reduce the need for subsidies to keep prices in rural areas at affordable levels. Perhaps there will remain a need to subsidize local broadband access in rural areas. Any such subsidy program, however, can and should be distinguished from an effort to en-

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147. See Jonathan Weinberg, *The Internet and "Telecommunications Services," Universal Service Mechanisms, Access Charges, and Other Flotsam of the Regulatory System*, 16 YALE J. ON REG. 211 (1999). A good example of this dynamic was the effort by Senator Ted Stevens, then chairman of the Senate Appropriations Committee, to pressure the FCC to regulate VoIP, out of concern about universal service subsidies. See *Layered Model*, *supra* note 8.

148. See Donny Jackson, *Universal Concerns*, TELEPHONY (Dec. 13, 2004), available at [http://telephonyonline.com/mag/telecom\\_universal\\_concerns/index.html](http://telephonyonline.com/mag/telecom_universal_concerns/index.html).

sure universal deployment of basic telephone connections.

Beyond universal service, numbers could be used a dividing line for other regulatory obligations. Rather than engage in a metaphysical debate about the nature of “telecommunications” and “information services,” the FCC could use a bright line test. Either a service incorporates E.164 phone numbers, or it doesn’t. Furthermore, by raising the profile of numbering in its regulatory calculus, the FCC would be in a better position to address the significant logical-layer questions that are likely to come before it in the near future.

#### CONCLUSION

Whichever direction telecom policy goes in the years ahead, the status quo is not a satisfactory option. The industry and its underlying technology have changed too dramatically to function under a regulatory paradigm that traces its history directly back to the 1800s. Following the spectacular boom and equally spectacular crash between 1998 and 2002, the telecom world is continuing to gradually warm up. New technologies such as VoIP and peer-to-peer video are changing the way networks are used, and new competitive lines are being drawn among the providers of those networks. Through this process, the old silo approach to regulation is melting away.

The layered model provides a fresh way of thinking about telecom policy. It is perhaps most useful in framing questions, helping policymakers identify hidden tension points and giving them a better vocabulary to craft solutions. As telecom comes to a boil, the challenge is to use the layered model as a framework for a new policy agenda. That agenda should start with the interface and logical layers. They ought to be the centerpieces of 21<sup>st</sup> century communications policy, just as restraining the exercise of market power based on control of the physical layer was the dominant theme in the last century.

