No Dialtone: The End of the Public Switched Telephone Network

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I. INTRODUCTION

All good things must come to an end. The Public Switched Telephone Network ("PSTN") is the foundation for the modern global communications system and the myriad benefits it delivers. Today, the era of the PSTN is swiftly coming to a close. The PSTN's technical, economic, and legal pillars have been undermined in the United States by three developments: the rise of the Internet; customers and providers abandoning wireline voice telephony; and the collapse of the regulatory theory for data services. This Article provides a framework for moving beyond the PSTN, by distinguishing the aspects of the existing system that should be retained, reconstituted, and abandoned.

The transition from the PSTN to a broadband network of networks is the most important communications policy event in at least half a century.[1] It calls into question the viability of the Federal Communications Commission ("FCC"), the Communications Act, and the telecommunications industry as we know it. Yet the significance of the transition is not widely recognized. Attention has focused on specific manifestations and consequences, such as the rise of "wireless-only" households and problems with rural call completion.

The time has come to address the situation squarely. The lesson from prior structural transitions in communications such as digital television, the AT&T divestiture, and the opening of local telephone competition is that, with good planning and the right policy decisions, such shifts can proceed smoothly and open new vistas for competition and innovation. Without this planning, structural transitions are dangerous opportunities for chaos that can gravely harm the public interest.

There are two mainstream views about how to handle the PSTN transition. One is that it represents the completion of a deregulatory arc begun at the AT&T divestiture and accelerated by the Telecommunications Act of 1996. The other is that longstanding regulatory obligations need only be extended to the new world. Both are wrong because they treat the PSTN as a unitary thing. What we call the PSTN is actually six different, but interrelated, concepts:

1) a technical architecture;
2) a regulatory arrangement;
3) a business and market structure;

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1. *See generally* JONATHAN E. NUECHTERLEIN & PHILIP J. WEISER, DIGITAL CROSSROADS: AMERICAN TELECOMMUNICATIONS POLICY IN THE INTERNET AGE (2005) (describing the transformation of communications networks); Michael K. Powell, Comm'r, FCC, The Great Digital Broadband Migration, Remarks Before the Progress and Freedom Foundation (Dec. 8, 2000) (arguing that all communications platforms were in the midst of a transformative "digital broadband migration"), *available at* http://www.fcc.gov/Speeches/Powell/2000/spmkp003.html.

4) universal connectivity;
5) strategic national infrastructure; and
6) a social contract.

The elements earlier on the list are rooted in the particular historical, legal, and technical circumstances that gave birth to the PSTN. They are anachronistic in the current environment. The later elements are public policy obligations that should be satisfied regardless of the historical circumstances. The question for regulators is how to do so in the most efficient and effective manner, given the changed circumstances.

The end of the PSTN involves two primary developments. First, customers are switching from the incumbent wireline telephone companies to alternatives using different networks or technologies, primarily wireless phones and voice over Internet protocol ("VoIP"). Second, those telephone companies themselves are migrating away from the technical underpinnings of the PSTN, seeking to move their own customers to wireless and VoIP-based alternatives.

The initial stage of the PSTN transition is occurring with surprising speed. The PSTN has been around for more than a century, and reached effective ubiquity in U.S. households in the middle of the last century.[2] It is deeply woven into the fabric of daily life and business. It seems unthinkable that it could disappear in a generation, let alone a decade. Yet for all intents and purposes, the era of the PSTN as the country's dominant communications network is already over. The FCC's Technology Advisory Committee has predicted that by 2018, the PSTN market will reach only six percent of the U.S. population.[3]

The PSTN is rapidly becoming an afterthought. Its market share will continue to shrink even if the incumbent network operators do nothing. And they are doing significantly more than that. They are putting into motion plans to transition their PSTN customers to VoIP or wireless connections. A small number of Verizon customers have already been transitioned to a wireless service that doesn't provide the full functionality of the PSTN as their only option for phone service.[4] And AT&T has petitioned the FCC for authorization to switch entire communities over to IP-based technology on an experimental basis.[5] The endgame for both, and

2. *See* MILTON L. MUELLER, JR., UNIVERSAL SERVICE: COMPETITION, INTERCONNECTION AND MONOPOLY IN THE MAKING OF THE AMERICAN TELEPHONE SYSTEM 146–48 (1997). Penetration numbers continued to creep up after that. Though some Americans in extremely rural areas of with low incomes never obtained telephone service, their numbers are miniscule.

3. TECH. ADVISORY COUNCIL, FCC, STATUS OF RECOMMENDATIONS (2011), *available at* http://transition.fcc.gov/oet/tac/TACJune2011mtgfullpresentation.pdf.

4. *See infra* Part II.A.4 (Fire Island discussion).

5. *See infra* Parts II.A.3 & IV.A (AT&T Petition discussion).

for virtually all PSTN providers, is to move to an all Internet Protocol ("IP") network with no switched wireline voice connections.[6]

The death of the PSTN is a good thing. The reason all new entrants are using IP-based technologies, and all existing providers want to, is that these technologies offer enhanced functionality and cost savings. Both customers and industry will benefit from the switchover. Yet there are two significant and related problems with the transition. The PSTN delivers highly important public interest benefits, not all of which will necessarily be preserved when moving away from traditional telephone service. These benefits range from consumer protections to public safety considerations. Second, the U.S. regulatory regime for telecommunications is tightly connected to the PSTN. Partly as a result, the business arrangements of the telecommunications sector assume the PSTN as a backstop. If all regulatory obligations disappear with the transition, the consequences could be dire.

The transition process is complicated by the past decade of telecommunications policy-making, which has left the legal regime for IP-based services a confusing mess. Fortunately, even without congressional action, the FCC retains sufficient legal authority to address the critical issues. The best way to do so is through the transition process itself, because telecommunications carriers are required to apply for FCC approval whenever they terminate service.[7] The statutory process under section 214 of the Communications Act offers a unique opportunity to facilitate the PSTN transition without being caught up in the detritus of other policy-making.[8]

The remainder of this paper is organized as follows: Part II describes the PSTN and the IP transition now underway; Part III offers a framework that eliminates legacy requirements while ensuring public interest protections going forward; and Part IV discusses the specifics of the transition process.

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6. *See* Kevin Werbach, *Off the Hook*, 95 CORNELL L. REV. 535, 543 (2010); Susan P. Crawford, *Transporting Communications*, 89 B.U. L. REV. 871, 874 (2009); 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, 211–12 (1999) ("The communications world is changing, and packet-switched networks are taking over."); Philip J. Weiser, *Toward a Next Generation Regulatory Strategy*, 35 LOY. U. CHI. L.J. 41, 41 (2003) ("[T]he advent of digital, packet-switched broadband networks that carry all forms of communication will restructure traditional telecommunications markets . . . .").

7. 47 U.S.C. § 214(a) (2006).

8. *Id.*

II. THE TRANSITION

A. Goodbye to All That

1. The Public Switched Telephone Network

The telephone is among the most profound inventions of the last 150 years.[9] It is how we stay in touch with friends and family, perform business transactions, and obtain vital information. Without the telephone, modern cities, transportation networks, corporations, law enforcement, and many other attributes of the world we live in would not be possible. The ability to, in the words of a famous AT&T slogan, "reach out and touch someone," in real time, anywhere, has brought massive efficiencies to business and altered the fabric of social interaction.[10] Many decades of technological evolution have led from rotary phones making calls connected by human operators to today's feature-laden digital devices, but the telephone as a universal communications tool has been a constant.

We take all this for granted. We assume we can call a doctor or summon public safety personnel in an emergency, obtain customer service from a business, or put children in touch with grandparents across the country. Like fish swimming in water, we have a hard time imagining a world in which reliable, universal telephone service could not be counted on. Yet today, such disruption is a real possibility.

The telephones in our homes, businesses, pockets, and purses are not islands. They are the visible endpoints of a vast and unbelievably complex edifice built at massive expense over the course of a century. Phones "just work" every day for hundreds of millions of Americans—and billions of people around the world—through the cooperative efforts of many companies, often direct competitors, of varying sizes and configurations. The hidden infrastructure supporting telephones gave us many other things that piggybacked on the network, not least of which is the Internet. The system that enables all this and more is the PSTN.

Colloquially, the PSTN refers to the wired telephone network that reaches into virtually every American home. However, such a definition is misleading. The PSTN is not a particular set of physical components. The same copper wires that deliver telephone service to the home can also

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9. *See generally* MASS. INST. OF TECH., THE SOCIAL IMPACT OF THE TELEPHONE 1 (Ithiel de Sola Pool ed., 1977) (offering various perspectives on the societal significance of telephone service delivered through the PSTN).

10. *See generally* Kevin Werbach, *Sensors and Sensibilities*, 28 CARDOZO L. REV. 2321, 2322 (2007) (describing the impact of changing communications technologies on modes of social interaction); *The Right Choice*, AT&T TECH CHANNEL (July 25, 2012), http://techchannel.att.com/play-video.cfm/2012/7/25/AT&T-Archives-The-Right-Choice (describing AT&T's "Reach Out and Touch Someone" advertising campaign including video example).

support non-PSTN services such as broadband Internet access and video programming.[11] At the same time, traditional telephone service can be delivered to the home over non-PSTN connections. A Comcast Digital Voice customer uses an ordinary telephone to dial ordinary telephone numbers to make and receive ordinary telephone calls, but technically that customer is using VoIP technology rather than the PSTN.[12]

A more precise definition is implicit in the term itself. The Code of Federal Regulations ("CFR") defines the Public Switched Network as "[a]ny common carrier switched network, whether by wire or radio, including local exchange carriers, interexchange carriers, and mobile service providers, that use the North American Numbering Plan in connection with the provision of switched services."[13] While this definition does not capture all the dimensions of the PSTN, it identifies its most basic elements.[14] As the CFR definition suggests, the PSTN is the interconnected network of communications networks that are:

- Public (available to all, which is implied by the CFR term "common carrier");[15]

11. For example, AT&T's U-verse service offers voice, broadband, and multichannel video over a new fiber-optic digital network infrastructure that still uses the existing copper wires for the final connection into the home. Om Malik, *Hey DSL, It's Time for Goodbye*, BLOOMBERGBUSINESSWEEK (Nov. 8, 2012), http://www.businessweek.com/articles/2012-11-08/hey-dsl-it-s-time-for-goodbye (explaining differences between FiOS and U-verse).

12. *See* IP-Enabled Servs.; E911 Requirements for IP-Enabled Serv. Providers, *First Report and Order and Notice of Proposed Rulemaking*, FCC 05-166, 20 FCC Rcd. 10245, para. 24 (2005) [hereinafter *VoIP 911 Order*], *aff'd*, Nuvio Corp. v. FCC, 473 F.3d 302 (D.C. Cir. 2006); 47 C.F.R. §§ 9.3, 54.5 (2013) (defining "interconnected VoIP service").

13. 47 C.F.R. § 20.3 (2013). "Public Switched Network" is not exactly the same phrase as "Public Switched Telephone Network," but the two are generally coterminous. It bears noting that this definition appears in the C.F.R., which collects rules issued by the FCC, and not in the FCC's authorizing statute, the Communications Act. Communications Act of 1934, Pub. L. No. 73-416, 48 Stat. 1064 (codified as amended at 47 U.S.C. §§ 151–615b (2006)). The Communications Act gives the FCC several grants of legal authority in the telecommunications space, but these are only indirectly tied to the concept of the PSTN. This creates significant problems in ascertaining the agency's authority to apply its public interest rules when network operators change from the PSTN to other network architectures. *See infra* Part II.B.

14. This paper focuses on the PSTN transition in the United States. The PSTN is a global system, and similar developments are occurring in other parts of the world. The ultimate transition from the PSTN to an Internet Protocol environment will be a worldwide phenomenon. The regulatory obligations on the network operators and other service providers involved in the PSTN, however, are specified on the national and sub-national levels. Each country (or region, in the case of the European Union) has its own telecommunications laws, which are better or worse adjusted in their current form to the evolution of the network. Thus, while there will be similar questions as France Telecom or Japan's NTT go through the transition, the specific legal considerations will differ.

15. Under the Communications Act, "[a] telecommunications carrier shall be treated as a common carrier under this chapter only to the extent that it is engaged in providing telecommunications services," 47 U.S.C. § 153(51) (2006), which are defined as "the

- Switched (routing calls within and between networks by creating a dedicated end-to-end communications path);[16] and
- Telephone (implied by the reference to the North American Numbering Plan,[17] which defines the familiar dialing system of a three-digit area code and seven-digit phone number).[18]

The CFR definition includes wireless networks as part of the interconnected mesh of the PSTN.[19] While this is accurate from a high-level perspective, the core of the PSTN is the legacy wireline infrastructure that was in place before the growth of mobile phones. That is the portion that functions as a bedrock reliable connection and is subject to special regulatory obligations.[20]

2. The Incredible Shrinking Network

For several decades, all but a small percentage of Americans used a home telephone. Those wires are still there today. Yet in just over a decade, there has been a massive shift away from the PSTN.[21] Whereas previously virtually all telephones were connected through the wired PSTN, today substantially less than half of American households use it for their primary telephone connection.[22] Subscribers are choosing in droves to give up their

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offering of telecommunications for a fee directly to the public, or to such classes of users as to be effectively available directly to the public." 47 U.S.C. § 153(53) (2006).

16. In telecommunications policy, "switched" refers to switching of dedicated circuits, rather than the switching of individual packets as on the Internet, a technology that developed much later. *See* Kevin Werbach, *Digital Tornado: The Internet and Telecommunications Policy* 10, 17 (FCC Office of Plans & Policy, Working Paper No. 29, 1997), *available at* http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp29pdf.html (describing packet switching); Access Charge Reform, *Notice of Proposed Rulemaking, Third Report and Order, and Notice of Inquiry*, FCC 96-488, 11 FCC Rcd. 21354, para. 311 (1996) (noting that "[o]ur existing rules have been designed for traditional circuit-switched voice networks, and thus may hinder the development of emerging packet-switched data networks").

17. *See* 47 C.F.R. § 52.5(c) (2013) ("The 'North American Numbering Plan' is the basic numbering scheme for the telecommunications networks located in [North America and the Caribbean].").

18. *See* 47 C.F.R. § 20.3 (2013).

19. *Id.*

20. *See* discussion *infra* Part II.B.–C.

21. *See generally* Richard Taylor, Issues in the Transition of the U.S. PSTN from TDM to IP (2013) (unpublished manuscript presented at the International Telecommunications Society 6th Africa-Asia-Australasia Regional Conference, Perth, Australia), *available at* http://psu-us.academia.edu/RichardTaylor (describing the transition away from the PSTN).

22. *Id.* at 5–6.

conventional landline telephones and replace them with services using different technologies.[23]

The pace of change has been breathtaking. The total number of residential switched access lines, the term used in FCC statistical reports for traditional local telephone service accounts, peaked at 194 million in 2000.[24] That number fell to 101 million in 2012,[25] a drop of 48% in a dozen years. As dramatic as those statistics are, they understate the trend. The U.S. population grew by over 30 million from 2000-2012, even as the number of switched access lines fell.[26] In total, according to USTelecom, the trade association for local telephone carriers, the percentage of U.S. households with traditional phone service fell from 93% in 2003 to 25% in 2013.[27]

Where are all those subscribers going? Virtually all of them still have telephone service.[28] They are simply obtaining it in different ways, primarily via wireless and VoIP.

As of December 2012, there were 326.4 million wireless subscriber connections in the U.S., counting phones, tablets, and other devices.[29] Most

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23. *Id.*

24. INDUS. ANALYSIS DIV., COMMON CARRIER BUREAU, FCC, LOCAL TELEPHONE COMPETITION: STATUS AS OF DEC. 31, 2000, at 1 (2001), *available at* http://transition.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/lcom0501.pdf.

25. INDUS. ANALYSIS & TECH. DIV., WIRELINE COMPETITION BUREAU, FCC, LOCAL TELEPHONE COMPETITION: STATUS AS OF JUNE 30, 2012, at 3 fig.2 (2013), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-321568A1.pdf.

26. *Resident Population Data*, U. S. CENSUS BUREAU, http://www.census.gov/2010census/data/apportionment-pop-text.php (last visited Jan. 24, 2014).

27. PATRICK BROGAN, USTELECOM, EVIDENCE OF VOICE COMPETITION AND ILEC NON-DOMINANCE MOUNTS 1 (2013), *available at* http://www.ustelecom.org/sites/default/files/documents/130403_Voice_Comp_Update.pdf. The report sourced data from several governmental sources including the FCC, Centers for Disease Control, and Census, as well as industry reports. *Id.* at 2. *See also* Reply Comments of AT&T at 21, Connect Am. Fund et al., FCC WC Docket No. 10-90 (rel. Apr. 2, 2012) (reporting that as of December 2012, only 29% of customers in the states where AT&T provides service were using residential wireline phone service from the incumbent local exchange carriers).

28. BROGAN, *supra* note 27, at 2. A portion of the fall-off in switched access lines is from households eliminating second phone lines that were purchased for fax machines or dial-up Internet access. With the shift to residential broadband since 2000, fewer households found a second line necessary, even if they kept their original wired phone connection. *See* INDUS. ANALYSIS & TECH. DIV., WIRELINE COMPETITION BUREAU, TRENDS IN TELEPHONE SERVICE 7-1 (2005), *available at* http://transition.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/trend605.pdf (noting the likely effects of broadband on second lines); Seth Schiesel, *The Bells Struggle to Survive a Changing Telephone Game*, N.Y. TIMES, Nov. 24, 2003, at C1 ("[C]onsumers started shutting off their second lines as they moved toward Internet services that do not require tying up a normal phone line."). The drop in access lines to the current number is therefore exaggerated somewhat, because the high point exceeded the total number of households in the U.S. by a significant amount. However, the current level is well below the baseline prior to the second-line boom.

29. *Wireless Quick Facts*, CTIA–THE WIRELESS ASSOCIATION, http://www.ctia.org/advocacy/research/index.cfm/aid/10323 (last updated Nov. 2013). Astute observers will note that this number exceeds the total U.S. population. The explanation is that some people

Americans who have a mobile phone also have a wired connection at home, but a growing percentage relies solely on their mobile device.[30] If a mobile phone can provide all the functionality of their traditional wired service, with the added benefits of mobility and smartphone features, many Americans have decided against continuing to pay a monthly fee for the landline as well. Although such "cord cutting" is especially prominent among young people, who had gotten used to mobile phones as their primary communications device before living on their own, the practice has now spread more broadly. The Centers for Disease Control, which conducts annual health surveys of U.S. households, has for several years asked about phone service. It found that 35.8% of households reported using only wireless service at home during the first half 0f 2012.[31]

The second major category of non-PSTN phone service is wireline service using VoIP. With a small converter device at the customer premises, it is possible to carry telephone calls from ordinary phones transparently through a broadband Internet connection.[32] The experience is effectively unchanged for the subscriber, but the PSTN has been removed from the connection.

This can be done in two ways.[33] First, an independent company can provide the VoIP service across the public Internet. Vonage, the largest such provider in the U.S., reported 2.3 million customers in the second quarter of 2013.[34] Vonage and other companies like it make voice into an

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have more than one wireless subscription, such as a personal mobile phone and one for work, or a mobile phone and a tablet with a cellular wireless data connection.

30. As noted above, the C.F.R. definition includes "mobile service providers" in its definition of "public switched network." 47 C.F.R. § 20.3 (2013). While it is true that today's mobile phone networks use the circuit-switching technology, mobile phones avoid the infrastructure of the landline PSTN. Home telephone subscribers who switch to a mobile phone as their primary connection are abandoning their existing connection for one that uses very different technology and has a somewhat different regulatory regime. *See generally* 47 U.S.C. § 332 (2006) (defining regulatory obligations for commercial mobile radio service). Further, mobile networks are evolving away from circuit-switching towards data-centric architectures. A technology called Voice Over Long Term Evolution (VoLTE) is now being deployed to handle wireless voice calls through VoIP. *See generally* MIIKKA POIKSELKÄ ET AL., VOICE OVER LTE (VOLTE) (2012).

31. STEPHEN J. BLUMBERG & JULIAN V. LUKE, NAT'L CTR. FOR HEALTH STATISTICS, CTR. FOR DISEASE CONTROL, WIRELESS SUBSTITUTION: EARLY RELEASE OF ESTIMATES FROM THE NATIONAL HEALTH INTERVIEW SURVEY, JANUARY–JUNE 2012, at 6 tbl.1 (2012).

32. This does not include services such as Skype that ride on top of a broadband connection and do not require dedicated hardware at the customer premises. While users employ these services to substitute for PSTN calls, especially for international connections, only a small percentage use them as their sole telecommunications link due to inconsistent reliability.

33. Both of these mechanisms are considered "interconnected VoIP service" under FCC rules. 47 C.F.R. §§ 9.3, 54.5 (2013).

34. Press Release, Vonage, Vonage Holdings Corp. Reports Second Quarter 2013 Results (July 31, 2013), *available at* http://pr.vonage.com/releasedetail.cfm?ReleaseID=781567.

application, similar to the way Netflix delivers video programming "over the top" of an Internet connection.

Alternatively, an Internet access provider can sell VoIP as a service offering, along with broadband data. In addition to the potential synergies in network operations and billing, the broadband providers can route the VoIP traffic over managed connections and voice peering links with other operators, resulting in improved performance and lower cost.[35] The largest cable VoIP provider, Comcast, now has over 10 million subscribers, making it the third largest local phone company after AT&T and Verizon.[36]

In all, the USTelecom report concluded that by the end of 2013, 43% of U.S. households would be wireless-only, and 32% would use VoIP or other non-PSTN landline technologies.[37] Taking into account homes that subscribe to landline service but use a mobile phone for all or almost all calls, the percentage of American households using any form of wired telephone fell below half in the first half of 2012, and has continued dropping since.[38] All indications are that these trends will continue.[39]

Wireless phone service was introduced in the U.S. at the end of the 1970s and was not a mainstream consumer service until the 1990s, while robust VoIP services only became available with the growth of broadband around the turn of the millennium. Yet in that short time period, these two alternatives have dethroned the mighty PSTN. The incumbent local telephone providers are looking to capitalize on this switch.

3. The Carriers Make Their Move

The major telephone companies that provide PSTN service are not ignorant of the massive shifts occurring around them. Even without changing their own operations, the incumbent local exchange carriers use the PSTN transition in their arguments to regulators. They claim that so many subscribers moving to other platforms means the market is sufficiently competitive to eliminate legacy obligations on incumbents.

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35. *See* Carol Wilson, *VON: Cable Close to National VoIP Peering*, CONNECTED PLANET (Mar. 21, 2007, 6:28 PM), http://connectedplanetonline.com/VoIP/technology/cable_VoIP_peering_032107/.

36. Press Release, Comcast, Comcast Reports 2nd Quarter 2013 Results (July 31, 2013), *available at* http://www.cmcsk.com/releasedetail.cfm?ReleaseID=781496; Karl Bode, *Comcast Now Third Largest Phone Company*, BROADBAND DSLREPORTS.COM (Mar. 11, 2009, 4:01 PM), http://www.dslreports.com/shownews/Comcast-Now-Third-Largest-Phone-Company-101317.

37. *See* BROGAN, *supra* note 27, at 1.

38. *See* Stacey Higginbotham, *Over Half of American Homes Don't Have or Use Their Landline*, GIGAOM (Dec. 26, 2012, 10:58 AM), http://gigaom.com/2012/12/26/over-half-of-american-homes-dont-have-or-use-their-landline/.

39. *See* TECH. ADVISORY COUNCIL, FCC, STATUS OF RECOMMENDATIONS (2011), *available at* http://transition.fcc.gov/oet/tac/TACJune2011mtgfullpresentation.pdf (predicting continued migration away from the PSTN).

However, they are not stopping there. They are moving to abandon the PSTN themselves.[40]

On November 7, 2012, AT&T filed a document with the FCC innocuously titled, "Petition to Launch a Proceeding Concerning the TDM-to-IP Transition."[41] AT&T asked the Commission to authorize a series of geographically limited experiments by what it called "the 'telephone' industry[]," pointedly adding quotes to reinforce its message.[42] According to AT&T, these "geographically limited trial runs . . . will help guide the Commission's nationwide efforts to facilitate the IP transition."[43] After listing what it claimed were outmoded regulatory obligations on telecommunications carriers, AT&T sought authorization to take three steps in specified wire centers:

- Remove legal requirements that carriers maintain legacy PSTN networks after IP-based alternatives are in place.
- Eliminate the carriers' obligation to interconnect with other TDM-based networks.
- Permit carriers to transition customers to alternative IP-based networks with notification, but without requiring subscriber approval.[44]

AT&T did not reject the notion that some FCC and state regulation might remain in place for IP-based networks, but it urged the Commission to "keep IP services free of legacy regulation so that the trial may proceed without the distorting and investment-chilling effects of such regulation."[45] In essence, these trial areas would inhabit a largely regulatory-free zone.

Though couched in limited terms, AT&T's petition is a dagger to the heart of the telecommunications regulatory structure of the Communications Act. The clear implication is that, if the trials AT&T proposes were implemented and were deemed successful, the FCC should expand the same approach to the entire industry. Under AT&T's proposed framework, the post-transition telecommunications network would start with a largely blank regulatory slate, rather than evolving from the

40. *See* Rob Frieden, *The Mixed Blessing of a Deregulatory Endpoint for the Public Switched Telephone Network*, 37 TELECOMM. POL'Y 400 (2013).

41. *See* AT&T Petition to Launch a Proceeding Concerning the TDM-to-IP Transition, FCC WC Docket No. 12-353 (rel. Dec. 18, 2012) [hereinafter AT&T Petition], *available at* http://apps.fcc.gov/ecfs/document/view?id=7022086087. AT&T's petition was consolidated with a similar request filed by the National Telecommunications Cooperative Association ("NTCA"), which represents certain rural carriers. Petition of the Nat'l Telecomms. Coop. Ass'n for a Rulemaking to Promote and Sustain the Ongoing TDM-to-IP Evolution, FCC WC Docket No. 12-353 (rel. Dec. 18, 2012), *available at* http://apps.fcc.gov/ecfs/document/view?id=7022086108.

42. AT&T Petition, *supra* note 41, at 1.

43. *Id* at 20.

44. *Id.* at 21–22.

45. *See id.* at 22.

regulatory obligations on TDM networks.[46] Under AT&T's three conditions, carriers could make the transition without requiring authorization from regulators, other networks they interconnect with, or customers.[47]

If the FCC implemented AT&T's proposed regime nationwide, it would be, in effect, formally abdicating its historic regulatory role. Whether the time has come to move in that direction is valid question, and AT&T's petition is a legitimate request. The point to emphasize is that the stakes are that high. AT&T acknowledged the magnitude of its request by proposing initially a set of trials limited in time and geographic scope. It framed these as opportunities for the FCC to gather data and evaluate the proper course forward, recognizing that a frontal assault on the agency would be less likely to succeed.[48] Of course, AT&T's petition didn't appear out of the blue. AT&T and other incumbent carriers have been pushing for the elimination of "outmoded" regulatory obligations for some time.[49] The petition represents a new stage of the debate, obliging the FCC to respond formally.

The same day it filed its petition with the FCC for "all-IP" experiments, AT&T made a major public announcement. The carrier declared it would spend an additional $14 billion over a three-year period to upgrade 75% of its customers to its U-verse IP-based broadband wireline platform, and cover virtually all the remainder with high-speed wireless connections.[50] AT&T stated this investment was part of an overall effort to decommission its copper infrastructure.[51] In effect, AT&T was saying that by the end of 2015, it anticipated being in position to transition completely away from the PSTN to an all-IP architecture. And in rural areas, where U-verse is uneconomical to deploy, AT&T plans to replace landlines with wireless alternatives.[52]

AT&T's primary competitor, Verizon, has similar plans. In transcribed remarks at an investor conference in July 2012, Verizon CEO Lowell McAdam indicated the company planned to shut down its copper

46. *See id.* at 21–22.

47. *See id.*

48. It is worth mentioning that the petition was filed the day after Barack Obama was re-elected. Had Republican Mitt Romney captured the White House, the environment for direct elimination of the FCC's primary regulatory functions would have been considerably more favorable.

49. *See, e.g.*, Comments of Verizon at 1, Petition of AT&T Inc. for Forbearance Under 47 U.S.C. § 160(c), FCC WC Docket No. 06-120 (rel. July 25, 2006).

50. *See* Anton Troianovski, *AT&T Move Signals End of the Copper-Wire Era*, WALL ST. J. (Nov. 7, 2012, 6:55 PM), http://online.wsj.com/news/articles/SB10001424127887324439804578104820999974556.

51. *Id.*

52. *See* Joan Engebretson, *Wireless Landline Replacement is Part of AT&T's Rural Plans*, TELECOMPETITOR (Nov. 15, 2012, 9:59 AM), http://www.telecompetitor.com/wireless-landline-replacement-is-part-of-atts-rural-plans/.

PSTN infrastructure.[53] In rural areas, he said, "we are going to cut the copper off there. We are going to do it over wireless."[54] McAdam also expressed his intent to eliminate copper within the footprint of Verizon's fiber-optic FiOS service, which reaches about 18 million homes.[55] "[E]very place we have FiOS, we are going to kill the copper. We are going to just take it out of service and we are going to move those services onto FiOS."[56] In contrast to AT&T, Verizon has not announced an all-IP upgrade for the non-rural portions of its network that do not have FiOS, but such a plan cannot be far from announcement.[57]

4. Changing Facts on the Ground

Verizon has also developed a product called Voice Link to replace PSTN phone service with wireless.[58] Voice Link offers the major voice features of the PSTN, such as 911 access and caller ID.[59] It also offers 36-hour battery backup power because wireless networks, unlike the wireline PSTN, depend on the commercial power grid.[60] However, Voice Link currently only supports voice calling, meaning that it does not handle faxing, dial-up modems, burglar alarm monitoring, or other activities that many subscribers engage in over the PSTN.[61]

Verizon in 2011 began promoting Voice Link to subscribers who had required frequent customer service visits because of connection problems.[62] A year or so later, it took a more significant step. Hurricane Sandy

53. *See* Phillip Dampier, *Verizon CEO Ponders Killing Off Rural Phone/Broadband Service & Rake in Wireless Profits*, STOP THE CAP! (July 17, 2012), http://stopthecap.com/2012/07/17/verizon-ceo-ponders-killing-off-rural-phonebroadband-service-rake-in-wireless-profits/.

54. *Id.*

55. *See* Jeff Baumgartner, *Verizon FiOS Rolls Out 500-Meg Internet Tier*, MULTICHANNEL NEWS, (July 22, 2013, 2:14 PM), http://www.multichannel.com/distribution/verizon-fios-rolls-out-500-meg-internet-tier/144521.

56. Dampier, *supra* note 53.

57. Under pressure from Wall Street, Verizon has said it plans no further geographic expansion of FiOS. *See* Susan P. Crawford, *The Communications Crisis in America*, 5 HARV. L. & POL'Y REV. 245 (2011); Peter Svensson, *Verizon Winds Down Expensive FiOS Expansion*, USA TODAY, (Mar. 26, 2010, 5:02 PM), http://usatoday30.usatoday.com/money/industries/telecom/2010-03-26-verizon-fios_n.htm. The company can be expected to fill in the donut hole between 4G wireless and FiOS with a hybrid fiber copper system along the lines of AT&T's U-verse.

58. *See* Samantha Bookman, *Verizon Goes on Offensive in Voice Link Deployment*, FIERCETELECOM (May 23, 2013), http://www.fiercetelecom.com/story/verizon-goes-offensive-voice-link-deployment/2013-05-23.

59. *Id.*

60. While this is not the same as the powered network of the wired PSTN, the battery power can be extended by the customer by replacing three ordinary AAA batteries. *See id.*

61. Verizon says it will offer this functionality in the future. *See id.*

62. Tom Maguire, *Setting the Record Straight on Fire Island and Voice Link*, VERIZON POLICY BLOG (Jul. 11, 2013), http://publicpolicy.verizon.com/blog/entry/setting-the-record-straight-on-fire-island-and-voice-link.

damaged or destroyed the PSTN connections to a few thousand subscribers on Fire Island in New York and coastal communities in New Jersey. Rather than rebuild the copper infrastructure, Verizon unilaterally replaced those PSTN connections with Voice Link.[63]

The Fire Island situation was unusual, in that it resulted from a natural disaster that literally destroyed significant portions of Verizon's physical plant. By deploying Voice Link, Verizon was restoring at least some form of home phone service to those subscribers. It is not surprising, therefore, that the New York Public Service Commission gave interim approval to Verizon's actions.[64] The net result, however, was the same as if Verizon itself had removed existing copper PSTN connections and replaced them with Voice Link.

After significant public outcry, Verizon eventually announced that it would deploy its FiOS fiber optic service on the Western portion of Fire Island, giving residents a more full-featured alternative to Voice Link.[65] It subsequently withdrew its petition to the New York Public Service Commission to allow Voice Link to serve as a replacement for its PSTN service on Fire Island.[66] This effectively ended the controversy, although Verizon never disclaimed the possibility that it would impose Voice Link elsewhere.

In fact, Verizon is still offering Voice Link to customers complaining about service quality problems in some other areas, allegedly on a purely voluntary basis. However, after consumers in the Catskills area of New York reported that Verizon customer service agents were insisting that Voice Link was their only alternative, the New York Attorney General's Office asked the state regulator to take action.[67] These scattered incidents, together with Fire Island, represent only a tiny percentage of Verizon's subscribers. There is no question, however, that Verizon, AT&T, and other major local exchange carriers are actively looking to transition away from their traditional PSTN connections.

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63. Jon Brodkin, Verizon Would End "Century of Regulation" by Killing Wireline Phone, Says NY AG, ARS TECHNICA (July 5 2013, 2:50 PM), http://arstechnica.com/information-technology/2013/07/verizon-would-end-century-of-regulation-by-killing-wireline-phone-says-ny-ag/. Verizon also used Voice Link as a replacement for wireline connetions damaged by Superstorm Sandy in Mantoloking, New Jersey. *See* Edward Wyatt, *On a New Jersey Islet, Twilight of the Landline*, N.Y. TIMES, Oct. 15, 2013, at B1.

64. *See* Bookman, *supra* note 58.

65. Candace Ruud, *Verizon Offers Alternative to Voice Link on Fire Island*, NEWSDAY (Sept. 10, 2013, 8:19 PM), http://www.newsday.com/long-island/towns/verizon-offers-alternative-to-voice-link-on-fire-island-1.6046505; Wyatt, *supra* note 63.

66. Letter from Keefe B. Clemons, Gen. Counsel, Verizon, to Kathleen H. Burgess, Sec'y, N.Y. State Pub. Serv. Comm'n (Sept. 11, 2013), *available at* http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={AC010697-BFCA-4C9C-851F-E62C138DA862}

67. Patrick McGeehan, *Fight With Verizon Over Ending Landline Service Has New Front: Catskills*, N.Y. TIMES (June 26, 2013), http://www.nytimes.com/2013/06/27/nyregion/fight-with-verizon-over-ending-landline-service-has-new-front-catskills.html?_r=0.

5. FCC Response

The FCC was established during the New Deal in 1934 as the federal regulator for the PSTN. For much of its history, its primary role in telecommunications consisted of overseeing AT&T, which was the government-sanctioned monopoly provider of telephone service to most Americans. In recent decades, it has shifted its efforts toward fostering and overseeing a competitive telecommunications marketplace. Throughout, however, its statutorily defined mission has been to promote a "rapid, efficient, nationwide . . . communications service with adequate facilities at reasonable charges."[68] The FCC is responsible for promoting the benefits of the PSTN through universal service programs,[69] consumer protection activities,[70] interconnection and non-discrimination policies,[71] network reliability coordination,[72] disability access requirements,[73] and many other initiatives.

The FCC has been monitoring the PSTN transition. It sought public comment on two petitions regarding copper loop retirement filed in 2007, but it has not acted on them.[74] As part of the run-up to the release of America's National Broadband Plan in 2009,[75] the FCC issued a public notice asking for input on the transition from the PSTN.[76] The FCC made no specific proposals at that time, but it highlighted the emerging issues. As the PSTN transition on the ground kicked into high gear, the FCC convened two experts' forums in 2011 and 2012.[77] More recently, the FCC's Technology Advisory Council ("TAC"), a group of outside experts who advise the agency, took on the sunset of the PSTN as one of its major

68. 47 U.S.C. § 151 (2006).

69. *See* 47 C.F.R. §§ 54.1–54.1010 (2013).

70. *See* 47 C.F.R. §§ 4.1–4.13 (2013).

71. *See, e.g.*, 47 C.F.R. §§ 64.1100–64.1195, 64.2001–64.2011, 64.2400–64.2401 (2013).

72. *See* 47 C.F.R. §§ 64.1401–64.1402 (2013).

73. *See* 47 C.F.R. §§ 64.601–64.636 (2013).

74. Petition for Rulemaking & Clarification of BridgeCom Int'l, Inc., et al., Policies & Rules Governing Retirement of Copper Loops, FCC WC Docket No. RM-11358 (rel. Jan. 23, 2007); Petition for Rulemaking XO Commc'ns, LLC, et al., Amend Certain Part 51 Rules Applicable to Incumbent LEC Retirement of Copper Loops & Copper Subloops, FCC WC Docket No. RM-11358 (rel. Jan. 23, 2007). In February 2013, petitions were filed with the FCC to update and refresh the record in those proceedings. *See* Wireline Competition Bureau Seeks Comment on Request to Refresh Record & Amend the Comm'n's Copper Retirement Rules, *Public Notice*, FCC WC Docket No. 12-353, at 1 (rel. Feb. 4, 2013), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-13-147A1.pdf.

75. FCC, CONNECTING AMERICA: THE NATIONAL BROADBAND PLAN (2010), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-296935A1.pdf.

76. Comment Sought on Transition from Circuit-Switched Network to All-IP Network, *NBP Public Notice #25*, FCC GN Docket Nos. 09-47, 09-51, 09-137 (rel. Dec. 1, 2009).

77. FCC Workshops on the Pub. Switched Tel. Network in Transition, *Public Notice*, DA 11-1882 (rel. Nov. 10, 2011).

projects.[78] Internally, the FCC formed a Technology Transitions Task Force in 2012, which has held its own public meetings to solicit input on various issues.[79]

In response to AT&T's petition, the FCC took the standard route of soliciting public comment.[80] It then issued a request of its own in May 2013.[81] The FCC asked for comment on potential trials to evaluate three specific issues: interconnection between VoIP networks; the transition of the 911 public safety system to an IP environment; and the substitution of wireline voice services with wireless connections.[82] In its public notice, the Commission briefly sought additional comment on AT&T's proposed "geographic all-IP" trials, but took no position on AT&T's petition.[83]

The May 2013 public notice is the first time the FCC has put concrete proposals on the table. In all likelihood, AT&T's filing was designed to force the FCC's hand, after several years of inconclusive discussion. The Fire Island situation may have done so anyway. The end of the PSTN is no longer merely a theoretical possibility.

The FCC took its next step forward in January 2014, following the confirmation of Tom Wheeler as its new Chairman.[84] It fully embraced the concept of the PSTN transition and declared its intent to manage the process in order to protect enduring public policy values.[85] It effectively granted AT&T's request for trials, but emphasized that the goal of such experiments would be to examine customer impacts, rather than to serve as a dry run for deregulation.[86] It also launched a set of research and data collection initiatives to understand better how the transition would impact on important policies such as universal service and 911 access.[87]

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78. *See* TECH. ADVISORY COMM., CRITICAL LEGACY TRANSITION WORKING GRP., FCC, SUN-SETTING THE PSTN (2011), *available at* http://transition.fcc.gov/oet/tac/tacdocs/meeting92711/Sun-Setting_the_PSTN_Paper_V03.docx.

79. Press Release, FCC, FCC Chairman Julius Genachowski Announces Formation of 'Tech. Transitions Pol'y Task Force,' (Dec. 10, 2012), *available at* http://www.fcc.gov/document/fcc-chairman-announces-technology-transitions-policy-task-force.

80. Pleading Cycle Established on AT&T and NTCA Petitions, *Public Notice*, FCC GN Docket No. 12-353 (rel. Dec. 14, 2012), *available at* http://www.fcc.gov/document/pleading-cycle-established-att-and-ntca-petitions.

81. Technology Transitions Policy Task Force Seeks Comment on Potential Trials, *Public Notice*, FCC GN Docket 13-5 (rel. May 10, 2013), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-13-1016A1.pdf.

82. *See id.*

83. *See id.*

84. *See* Technology Transitions, *Order, Report and Order and Further Notice of Proposed Rulemaking, Report and Order, Order and Further Notice of Proposed Rulemaking, Proposal for Ongoing Data Initiative*, FCC 14-5 (rel. Jan. 31, 2014) [hereinafter *Technology Transitions Order*].

85. "[W]e stand today at the precipice of a . . . technology transition – the turning off of the legacy suite of services that has served our nation well. Our mission and statutory responsibility are to ensure that the core statutory values endure as we embrace modernized communications networks." *Id.* at paras. 3–4.

86. *See id*. at para. 8.

87. *See id*. at paras. 6–7.

While it may seem that the PSTN transition is essentially a set of business decisions, the public policy implications are profound. The movement of subscribers and carriers away from wired PSTN connections has the potential to eviscerate the entire regulatory structure of telecommunications in America. Without careful management, the end of the PSTN may represent the end of much more. The attributes that made the PSTN such a beneficial force in society may be at risk.

B. What We Talk About When We Talk About the PSTN

1. Unpacking the Concept

In order to determine which aspects of the communications regulatory regime should remain in place through the PSTN transition, we must examine not just what the PSTN is, but what it represents.

The definition of the PSTN as the network of networks that is public, switched, and designed for telephone service[88] fails to adequately capture its significance. The function of the PSTN is to provide ubiquitous, open, reliable communications connectivity for all Americans.[89] Even when there are many competing networks that provide different levels of functionality to different groups of customers, such baseline features remain vitally important. In fact, ensuring that the benefits of universal connectivity continue to be available becomes an even more critical role for regulation when there is no dominant backstop network.

The essential character of the PSTN can be understood in more than one way. In fact, there are six common explanations:

1) Technical architecture
2) Regulatory arrangement
3) Market structure
4) Universal connectivity
5) Strategic infrastructure
6) Social contract

Some describe attributes that are historically contingent. These were important for the PSTN in the past, but they can be abandoned now without harming the public interest. Others, however, remain relevant in the current, converged digital competitive environment. The FCC's regulatory

88. *See supra* note 13 (describing FCC regulations defining the PSTN at 47 C.F.R. section 20.3).

89. The FCC adopted a similar viewpoint in the *Technology Transitions Order*, identifying the four "core statutory values" of the PSTN as public safety, ubiquitous and affordable access, competition, and consumer protection. *See Technology Transitions Order*, *supra* note 84, at para. 1.

regime may need to be revamped substantially, but it should remain capacious and flexible enough to ensure these objectives are met.

In essence, the first three conceptions of the PSTN are essentially descriptive while the other three are normative. What the PSTN *is*, should be allowed and even encouraged to change; what the PSTN *does*, should be protected.

2. The Legacy PSTN

The first three visions of the PSTN describe the network as it historically developed. Some of these attributes have already broken down, and the IP transition will accelerate those trends. Policy initiatives should not focus on preserving these aspects.

a. Technical Architecture

The PSTN was developed with engineering parameters geared to providing what is colloquially known as POTS: plain old telephone service. Technically, this has evolved over time to mean a real-time voice channel, touchtone dialing through the familiar 10-digit area code and numbering structure to reach any other subscriber, a basket of basic features such as busy signals, toll-free calling, E911 emergency calling,[90] caller ID, and a high level of reliability. When providing "universal service" subsidies for phone service in high-cost areas, these are the essential functions the FCC requires carriers to offer.[91]

To make connections, the PSTN uses a technology called circuit switching.[92] When you make a telephone call, a dedicated path is opened through the network from endpoint to endpoint, and kept open for the duration of the call.[93] Today's digital networks multiplex multiple calls onto the same lines for greater efficiency.[94] The PSTN uses an approach called time-division multiplexing ("TDM"), which is sometimes used as shorthand for circuit-switched PSTN connections.[95] Even with multiplexing, every part of the call travels the same physical route.[96]

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90. 47 U.S.C. § 251(e)(3) (2006). E911 refers to the 911 service that automatically identifies the location of the caller. *VoIP 911 Order*, *supra* note 12, at para. 13.

91. Fed.-State Joint Bd. on Universal Serv., *Report and Order*, FCC 97-157, 12 FCC Rcd. 8776, para. 61 (1997) [hereinafter *Joint Bd. on Universal Serv. Report and Order*] (defining features to be supported through universal service funding).

92. Douglas C. Sicker, *The End of Federalism in Telecommunication Regulations?*, 3 NW. J. TECH. & INTELL. PROP. 130, 147 (2005).

93. *Id.*

94. K.V. PRASAD, PRINCIPLES OF DIGITAL COMMUNICATION SYSTEMS AND COMPUTER NETWORKS 85 (2004).

95. *Id.*

96. *Id.* at 139.

Mainframe computers known as switches route the call across the country and onto other networks as needed. Since the 1980s, the PSTN has used parallel digital signaling channels, known as the signaling system 7 ("SS7") network to manage calls and associated functions. The dedicated SS7 network speeds the process of setting up and tearing down call circuits, and also supports billing and features such as call waiting and call forwarding.[97] In the PSTN architecture, therefore, call channels are reserved for voice and signaling channels are reserved for the special SS7 signals. The Internet architecture, by contrast, has only one channel, but it can carry any kind of information.

Based on specifications developed by Bell Labs when it was part of the old AT&T, the PSTN uses 64 kilobit per second (kbps) communications channels and 8 kilohertz (kHz) sampling for analog-to-digital audio conversion.[98] These provide for reliable and consistent voice quality, in contrast to mobile phones and some VoIP services where quality can vary based on congestion and other local conditions. On the other hand, the audio quality of a PSTN phone call will never be better than the specified encoding.[99] Anyone who has used Skype or a business VoIP phone system from vendors such as Cisco and Polycom has experienced clarity and sound quality far exceeding what we have come to expect from a telephone call.[100]

As noted, all these standards were devised to support voice phone service. However, because other forms of communication such as alarm monitoring systems and dial-up modems can convert their signals into formats intelligible to the PSTN, the network is not limited to that offering. The PSTN is a universal network offering "dialtone," so it supports whatever communication meets its technical requirements.[101] However, these requirements significantly limit the flexibility of the network. For example, the SS7 network is designed specifically to set up and tear down phone calls, not for carrying email or movies.

The PSTN is built on engineering trade-offs that made sense based on the state of technology at the time and the need to support voice calling. With massive advances in computing and networking, however, they no longer do.

The technical infrastructure of the legacy PSTN is fast reaching its end-of-life state. The switching fabric is based on room-filling, purpose-built mainframe computers. Most of these are now decades old, to the point at which parts are in short supply.[102] The VoIP infrastructure that replaces

97. *Id.* at 394–402.
98. *Id.*
99. *Id.*
100. *See id.* at 401, 536.
101. *See id.* at 140–43.
102. *See* Richard Shockey, Technical Challenges in the PSTN Transition from Plain Old Telephone Service (POTS) 3 (2012) (unpublished manuscript) (on file with the *Federal Communications Law Journal*). This problem of repairing and updating old switches is

circuit-switching, by contrast, uses "softswitches" based on general-purpose servers and easily-updated software.[103] No greenfield network operator today would deploy a circuit-switching infrastructure.[104] Instead, new entrants, even when providing telephone service, create networks based on the Internet Protocol and related technologies.[105] The major telephone companies that continue to operate PSTN networks are, understandably, looking to make that same leap.[106]

If the PSTN is defined solely as TDM and circuit switching, it should be allowed to die. IP-based networks can deliver the same basic telephone service more efficiently, at the same time as they enable an array of new broadband data services and applications.

b. Regulatory Arrangement

Many of the regulatory obligations associated with the PSTN predate the development of the telephone. The concept of common carriage—a set of requirements that operators treat customers equally and charge just and reasonable rates—was developed in the 19th century for other utilities.[107] The FCC, created in 1934, was in many ways modeled on the Interstate Commerce Commission that oversaw railroads.[108] The Communications Act of 1934 enshrined a set of requirements for common carriers, most notably that their charges be "just and reasonable,"[109] that they avoid "unjust or unreasonable discrimination" in provision of service,[110] and that they "establish physical connections with other carriers."[111]

Another set of requirements associated with the PSTN came not from administrative regulation but from antitrust. In 1913, AT&T and the U.S. Department of Justice entered into an agreement known as the Kingsbury commitment,[112] in which AT&T agreed to interconnect with independent

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accentuated by the fact that one of the two major switch vendors (Nortel) was liquidated in bankruptcy, while the other (Lucent) was substantially downsized and merged into another company, Alcatel.

103. *See* PRASAD, *supra* note 94, at 207.

104. *See* CRC HANDBOOK OF MODERN TELECOMMUNICATIONS § 1.2 (Patricia A. Morreale & Kornel Terplan eds., 2d ed. 2010).

105. *See id.*

106. *See id.*

107. BRUCE WYMAN, THE SPECIAL LAW GOVERNING PUBLIC SERVICE CORPORATIONS AND ALL OTHERS ENGAGED IN PUBLIC EMPLOYMENT 115–16 (1911); Kevin Werbach, *Only Connect*, 22 BERKELEY TECH. L.J. 1233, 1246–50 (2008).

108. *See* Werbach, *supra* note 107, at 1246–50.

109. 47 U.S.C. § 201(b) (2006).

110. 47 U.S.C. § 202(a) (2006).

111. 47 U.S.C. § 201(a) (2006).

112. Letter from N.C. Kingsbury, Vice President, AT&T, to J.C. McReynolds, Att'y Gen., U.S. Dep't of Justice (1913) (on file with the *Federal Communications Law Journal*) [hereinafter N.C. Kingsbury Letter]. *See generally* Mueller, *supra* note 2 (describing the antitrust case against AT&T).

telephone companies. Later consent decrees in 1956 and 1983 further defined expectations about the PSTN.[113] Although only binding on the old AT&T, which effectively disappeared after the post-1983 divestiture, the effects of these agreements are still being felt today. For example, the 1956 consent decree, by precluding AT&T from offering non-common carrier services, created the independent data processing industry that ultimately evolved into today's Internet services marketplace.[114] The most recent significant legal evolution was the Telecommunications Act of 1996 ("1996 Act").[115] The primary thrust of the 1996 Act was to open up local telephone markets to competition, while in return allowing the local incumbents to offer long-distance and other services.[116]

In addition to these specific requirements for network operators, the PSTN has been carved out of the normal regulatory regime for consumer protection superintended by the Federal Trade Commission ("FTC"). The Federal Trade Commission Act expressly excludes common carrier services from FTC jurisdiction.[117] This means consumers who feel, for example, that they have been misled by phone companies must use FCC processes rather than the processes available to similarly situated consumers in other contexts. Similarly, the Supreme Court has held that antitrust remedies that would otherwise be available are not applicable in the telecommunications context.[118]

Like the technical attributes, the regulatory structure for the PSTN is deeply rooted in history. Even after the 1996 Act, communications services are divided into all-or-nothing silos, even as convergence and competition undermine those distinctions.[119] Regulation, like technology, is a means to an end. If there are more effective ways to achieve the goals that the current regulatory structure serves, legacy rules need not be preserved. However, the regulator needs a statutory mandate or the legal authority to replace those rules with a new framework. As discussed below, the PSTN

113. *See* United States v. Am. Tel. & Tel. Co., 524 F. Supp. 1336, 1353 n.70 (D.D.C. 1981) (describing United States v. W. Elec. Co., 1956 Trade Cas. ¶ 68,246, 1956 WL 95755 (D.N.J. 1956)).

114. *See* Kevin Werbach, *The Network Utility*, 60 DUKE L.J. 1761, 1803–04 (2010) (discussing the importance of the 1956 consent decree).

115. Telecommunications Act of 1996, Pub. L. No 104-104 § 3(a)(2), 110 Stat. 56. (1996).

116. *See* NUECHTERLEIN & WEISER, *supra* note 1, at 69–74; Charles B. Goldfarb, *Telecommunications Act: Competition, Innovation, and Reform*, *in* TELECOMMUNICATIONS ACT: COMPETITION, INNOVATION, AND REFORM 1, 8–10 (Charles B. Goldfarb ed., 2006).

117. 15 U.S.C. § 45(a)(2) (2012).

118. Verizon Commc'ns Inc. v. Law Offices of Curtis V. Trinko, LLP, 540 U.S. 398 (2004). While this decision was not premised specifically on a distinction between the PSTN and other communications networks, it was based on the comprehensive regulatory scheme that Congress adopted in the Telecommunications Act of 1996 for the telephone market.

119. *See* Kevin Werbach, *A Layered Model for Internet Policy*, 1 J. ON TELECOMM. & HIGH TECH. L. 37, 58 (2002).

transition has the potential to undermine the FCC's authority over the telecommunications market across the board. That would threaten not only the old rules, but also the public policy objectives the rules were designed to achieve.

c. Market Structure

The PSTN has traditionally implied a market structure with one or more regulated dominant providers. Even after the nationwide AT&T monopoly was broken up, there were seven "Baby Bells" with monopolies on local service in their territories.[120] Those seven providers, and others, have since consolidated back to AT&T and Verizon, who are now also the largest wireless service providers.[121] The prevalence of monopolistic and oligopolistic providers in telecommunications led to regulatory categories such as "incumbent local exchange carrier"[122] and "dominant" provider, which imposed special obligations to protect against abuse of market power.[123]

The economics of the PSTN are driven by the fact that telephone networks involve huge fixed costs and relatively low variable costs, especially for the "last mile" connections into homes.[124] It was received economic wisdom for many years that telephone service was a natural monopoly. Even after AT&T was broken up and competition brought to long-distance service, local phone companies retained their monopoly status for more than a decade. Only recently has it been feasible for cable and wireless providers to offer facilities-based last-mile alternatives at scale, which they were able to do by selling customers services that initially supplemented, rather than replaced, conventional phone service.

The monopoly market structure that was historically associated with the PSTN has now given way in most of the country to oligopoly.[125] Virtually all Americans have alternatives for phone service, especially when VoIP and wireless options are included. However, high fixed costs and scale economies still mean that only a limited number of physical platforms provide direct connectivity to the home.[126] Those facilities-based providers, primarily the legacy telephone companies and cable television

120. *See* Susan P. Crawford, *Transporting Communications*, 89 B.U. L. REV. 871, 894–95 (2009).

121. *See id.* at 908–09.

122. 47 U.S.C. § 153(26) (2006).

123. *See* 47 C.F.R. § 51.5 (2013); *see, e.g.*, Qwest Corp. v. FCC, 689 F.3d 1214, 1217 (10th Cir. 2012) (noting special obligations on dominant provider).

124. *See* BRETT M. FRISCHMANN, INFRASTRUCTURE: THE SOCIAL VALUE OF SHARED RESOURCES 12–14 (2012).

125. *See* Howard Shelanski, *Adjusting Regulation to Competition: Toward a New Model for U.S. Telecommunications Policy*, 24 YALE J. ON REG. 55, 84 (2007).

126. *See* Crawford, *supra* note 57, at 248.

operators, are also now the dominant providers of Internet access.[127] Thus, while there is significant competition in many communications markets that previously were controlled by monopolies, substantial concentration remains, producing concerns about market power.[128]

3. Enduring Objectives

Despite everything that is changing in the telecommunications market, some aspects must stay the same. The PSTN has provided huge economic and social benefits to America. As the legacy technical, regulatory, and business elements of the PSTN change, those benefits should not be lost. The following goals, therefore, provide guidance on the proper role of public policy in the post-PSTN era.

a. Universal Connectivity

The PSTN allows anyone to connect to anyone. There are many other networks that offer voice telephony or similar services on a private basis, for example, by connecting different offices of a company or connecting account-holders of a specific service such as Skype. A core element of the PSTN is the idea that access to the network allows direct calling to and from any other subscriber.[129]

In the early years of the 20th century, AT&T's refusal to interconnect its long-haul network to competing local exchange carriers, or to exchange local traffic with those carriers, was its primary tool to consolidate market domination after the expiration of Alexander Graham Bell's foundational patents. AT&T understood as a matter of business strategy what economists and network scientists have now demonstrated formally as network effects.[130] All other things being equal, the largest network has a structural advantage over smaller networks, because the value of a service like telephony increases with the ability to call and be called by more people.[131]

AT&T's refusal to interconnect was its most powerful competitive weapon. Appropriately, it was there that the federal government targeted its efforts to regulate the dominant telephone network. In the Kingsbury Commitment, AT&T agreed to interconnect its long-distance network with independent local exchange carriers.[132] This became the foundation of

127. *See id.*

128. *See generally* SUSAN P. CRAWFORD, CAPTIVE AUDIENCE: THE TELECOM INDUSTRY AND MONOPOLY POWER IN THE NEW GILDED AGE (2013).

129. *See* Thomas B. Nachbar, *The Public Network*, 17 COMMLAW CONSPECTUS 67, 70 (2008).

130. *See generally* Mark A. Lemley & David McGowan, *Legal Implications of Network Economic Effects*, 86 CAL. L. REV. 479 (1998).

131. *See* Werbach, *supra* note 107, at 1246–50.

132. *See* N.C. Kingsbury Letter, *supra* note 112.

interconnection obligations in the 1934 Communications Act and the further requirements in the 1996 Act. For all this time, the concept of universal connectivity has been built into telephone service and the other functions delivered through the PSTN.

b. Strategic Infrastructure

Like the electricity grid, the PSTN has strategic national importance as a piece of critical infrastructure.[133] The PSTN is essential to the smooth functioning of the U.S. economy. For individuals, a PSTN connection is a lifeline to the world. A serious outage of the PSTN, or a PSTN that does not provide service to some Americans, would be far more harmful than a similar outage of a television network or a major highway.

Strategic aspects of the PSTN include reliability, security, law enforcement access, and public safety. In each case, there are either public processes or legislative requirements to ensure these functions are achieved. For example, carriers, including "interconnected" VoIP providers, are required to report outages above a specified threshold to the FCC.[134] Additionally, VoIP providers are required to make their networks accessible for law enforcement wiretaps, subject to search warrant requirements, under the Communications Assistance for Law Enforcement Act ("CALEA").[135]

As an interconnected network of networks touching billions of endpoints, the global PSTN has been called "possibly the largest distributed system in existence."[136] The technical and operational challenges of providing robust connectivity with minimal downtime are immense, even under normal conditions, let alone during natural disasters or in the face of attempted intrusions. As former FCC Chairman Julius Genachowski noted after Superstorm Sandy damaged communications networks on the East Coast, "Our nation's communications infrastructure is a vital part of our

133. *See* 42 U.S.C. § 5195c (2006) (defining "critical infrastructure").

134. *See* Proposed Extension of Part 4 of the Comm'n's Rules Regarding Outage Reporting to Interconnected Voice Over Internet Protocol Serv. Providers & Broadband Internet Serv. Providers, *Report and Order*, FCC 12-22, 27 FCC Rcd. 2650, paras. 89, 98 (2012) [hereinafter *Part 4 Extension to VoIP Order*].

135. Pub. L. No. 103-414, 108 Stat. 4279 (1994) (codified as amended at scattered sections of 18 U.S.C. and 47 U.S.C.); *see* Comm'cns Assistance for Law Enforcement Act & Broadband Access & Servs., *Second Report and Order and Memorandum Opinion and Order*, FCC 06-56, 21 FCC Rcd. 5360 (2006).

136. D. Richard Kuhn, *Sources of Failure in the Public Switched Telephone Network*, 30 COMPUTER 4, 31 (1997).

public safety and national security."[137] The FCC held field hearings after Sandy to identify ways to limit damage in future storms.[138]

The strategic importance of the PSTN makes telecommunications different from most other industries. The government has a strong interest in ensuring the PSTN's smooth functioning that does not depend on particular technologies or market conditions.

c. Social Contract

The final defining aspect of the PSTN is the notion of a social contract. Historically, this involved government tolerance of AT&T as a private monopoly in return for its commitment to provide affordable service to all Americans.[139]

Even after the opening of all telecommunications markets to competition, incumbent service providers supporting the PSTN still receive a variety of benefits.[140] These include low-cost access to pole attachments and rights-of-way, receipt of universal service subsidies when serving high-cost areas, free spectrum for the initial offering of mobile phone service, and protection against antitrust liability on the grounds that the Communications Act comprehensively regulates the field.[141]

The notion of the social contract is thus: In return for these benefits, the traditional telecommunications providers took on certain obligations.[142] For example, PSTN service providers had to provide universal service, protect subscribers' privacy, interconnect on reasonable terms, and charge just and reasonable rates.[143] Market changes that undermine either the benefits or the obligations side of the equation run the risk of destabilizing the arrangement.

Perhaps the clearest example of the social contract around the PSTN is universal service. Originally an AT&T marketing slogan, universal service came to be accepted as a national policy to provide ubiquitous phone service throughout the country.[144] For circuit-switched telephone service, the great challenges for universal service are density and geography. Because phone service requires a wire into every home and

137. Julius Genachowski, Chairman, FCC, Statement at Superstorm Sandy Field Hearing (Feb. 5, 2013), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-318754A1.pdf.

138. Press Release, FCC, Chairman Genachowski Convenes First Post-Sandy Field Hearing (Feb. 5, 2013), *available at* http://www.fcc.gov/document/chairman-genachowski-convenes-first-post-sandy-field-hearing.

139. *See* MUELLER, *supra* note 2, at 4–10.

140. *See* Frieden, *supra* note 40.

141. *Id.*; *see also Law Offices of Curtis V. Trinko*, 540 U.S. 398.

142. *See* Frieden, *supra* note 40; JODIE GRIFFIN & HAROLD FELD, FIVE FUNDAMENTALS FOR THE PHONE NETWORK TRANSITION (2013), *available at* http://www.publicknowledge.org/files/PKThinks5Fundamentals.pdf.

143. *See* 47 U.S.C. §§ 151, 251 (2006).

144. *See* MUELLER, *supra* note 2, at 96–101.

localized switching facilities, providing service in sparsely populated rural areas and difficult geographies is substantially more expensive than providing the same service in urban areas.[145] Universal service policy embodied a commitment to providing comparable service to any customer, regardless of the expense, and also embodied a commitment to pricing that service at a rate comparable to denser areas.

Historically, universal service involved a combination of service mandates, complicated hidden cross-subsidies, rate-averaging requirements, and other regulatory arrangements. Many of these mechanisms depended on the absence of competition, and thus had to be dramatically revamped after the 1996 Act. The PSTN transition puts further strain on the system.

C. The Regulatory Dead-End

1. All or Nothing

The changeover from circuit-switched landline connections to VoIP and wireless may seem like a straightforward evolution. Subscribers are still getting something that feels like the PSTN phone service they always had, especially for those using interconnected wireline VoIP. The problem is that, from a regulatory standpoint, the change is significantly more dramatic.

Over the past ten years, the FCC has interpreted the Communications Act, its authorizing statute, in a way that has backed it into a corner. The things the FCC retains clear authority to regulate are increasingly not the things that network operators do. A growing share of communications—even voice or video communications that directly substitute for telephone calls—inhabit an area of uncertain regulatory status. And if they wanted to, the major regulated carriers could quickly reconfigure themselves into the same legal white space.[146] That they have failed to do so yet seems purely a matter of strategic calculus. This seemingly odd result is an unintended consequence of years of well-meaning but shortsighted FCC decisions. As a consequence, unless the FCC intends to go out of business, it must take action.

Most of the rules governing the PSTN apply to providers of "telecommunications," which is defined as "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."[147] The statute contrasts these telecommunications services with

145. *See* Jim Chen, *Subsidized Rural Telephony and the Public Interest: A Case Study in Cooperative Federalism and Its Pitfalls*, 2 J. TELECOMM. & HIGH TECH. L. 307, 318–23 (2003).

146. *See* Werbach, *supra* note 6, at 541–45.

147. 47 U.S.C. § 153(50) (2006).

"information services."[148] However, the 1996 Act, which inserted these two terms, gives the FCC no specific direction on the treatment of information services. And this lack of direction creates inherent confusion.[149] A circuit-switched wireline voice telephone connection is clearly a telecommunications service. A VoIP call, even one between two ordinary telephones, is not. And if a VoIP call is an information service, the FCC's ability to impose any obligations on the providers involved is contestable.

The FCC and others saw the 1996 Act's distinction as a continuation of prior FCC practice.[150] Before the Communications Act created a category for information services, the FCC had developed a parallel distinction between "basic" and "enhanced" services in its *Computer II* proceeding.[151] Enhanced services were unregulated, but there was a critical difference from the information service classification in the 1996 Act: local telephone carriers could only provide enhanced services subject to stringent restrictions.[152] The 1996 Act contained no restrictions on who could provide information services, and no distinctions between information service providers.[153] Accordingly, local phone providers now offer information services without the previous stringent restrictions.

The FCC compounded this problem by holding that "telecommunications services" and "information services" were mutually exclusive.[154] Something could be one or the other, but not both. This decision created a conundrum. Either something is "telecommunications" and thus subject to a wide variety of rules designed for traditional

148. Information service is defined as "the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications, and includes electronic publishing, but does not include any use of any such capability for the management, control, or operation of a telecommunications system or the management of a telecommunications service." 47 U.S.C. § 153(24) (2006).

149. *See* Werbach, *supra* note 6, at 543–45.

150. *See* Werbach, *supra* note 114, at 1774; Appropriate Framework for Broadband Access to the Internet over Wireline Facilities, *Report and Order and Notice of Proposed Rulemaking*, FCC 05-150, 20 FCC Rcd. 1, para. 29 (2005) ("[T]he Commission has previously determined that Congress intended the statutory categories [of information service and telecommunications service] to parallel the categories [of enhanced service and basic service that] the Commission established in the *Computer Inquiry* proceeding.").

151. *See* Werbach, *supra* note 114, at 1788; Robert Cannon, *The Legacy of the Federal Communications Commission's Computer Inquiries*, 55 FED. COMM. L.J. 167, 191 (2003); *See generally* Amendment of Section 64.702 of the Comm'n's Rules & Regulations (Second Computer Inquiry), *Final Decision*, FCC 80-189, 77 F.C.C. 2d 384 (1980).

152. *See generally* Amendment of Sections 64.702 of the Comm'n's Rules & Regulations (Third Computer Inquiry) (Computer III), *Report and Order*, FCC 86-252, 104 F.C.C. 2d 958 (1986).

153. *See generally* Telecommunications Act, *supra* note 115.

154. Fed.-State Joint Bd. on Universal Serv., *Report to Congress*, FCC 98-67, 13 FCC Rcd. 1, para. 13 (1998) [hereinafter *VoIP Report to Congress*]; *see also* Inquiry Concerning High-Speed Access to the Internet Over Cable & Other Facilities, *Declaratory Ruling and Notice of Proposed Rulemaking*, FCC 02-77, 17 FCC Rcd. 1, para. 41 (2002), *aff'd*, Nat'l Cable & Telecomms. Ass'n v. Brand X Internet Servs., 545 U.S. 967 (2005).

telephony, or it is an "information service" arguably subject to no rules at all. In other words, the FCC now faces the choice of regulating too much or not enough.

2. The Perseverance of Unregulation

The FCC's initial concern was to avoid over-regulating nascent Internet-based services.[155] It systematically avoided classifying Internet-based services as "telecommunications," out of concern that doing so might chill innovation and investment.[156] The FCC's hesitation to impose rules designed for legacy industries and market structures to the emerging Internet was a powerful spur to the subsequent flowering of Internet development.[157] However, the agency's actions also had a downside. By placing virtually all Internet-based services outside the statutory provisions where the FCC's authority is clear, the agency created the hole that the major telecommunications carriers are now attempting to run through.

Beginning in 2002, the FCC classified broadband Internet access as an information service.[158] Even though broadband involves both a pure transmission function and information processing, the FCC determined that it was impossible to split off the telecommunications functionality.[159] This decision became problematic when the Commission later decided to impose network neutrality obligations to prevent those broadband providers from blocking or discriminating against unaffiliated content, applications, or devices.[160]

The FCC unambiguously has legal authority to adopt such rules for telecommunications services.[161] For information services, by contrast, the statute is silent about the scope of FCC authority. The FCC attempted to justify its network neutrality rules based on its "ancillary authority" under

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155. *See* Werbach, *supra* note 6, at 564–65; Rob Frieden, *The FCC's Name Game: How Shifting Regulatory Classifications Affect Competition*, 19 BERKELEY TECH. L.J. 1275, 1286–87 (2004); Jason Oxman, *The FCC and the Unregulation of the Internet* 11 n.27 (FCC Office of Plans & Policy, Working Paper No. 31, 1999), *available at* http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp31.pdf.

156. *See* Kathleen Q. Abernathy, Comm'r, FCC, Remarks Before the Federal Communications Bar Association: The Nascent Services Doctrine 1, 3 (July 11, 2002).

157. *See* Werbach, *supra* note 6. The FCC's "unregulation" of Internet-based services was only part of the equation. The Internet was about to develop and thrive because the FCC also took affirmative steps to prevent telephone network operators and other incumbents from stifling it. *See* Kevin Werbach, *The Federal Computer Commission*, 84 N.C. L. REV 1, 8 (2005); Steve Bickerstaff, *Shackles on the Giant: How the Federal Government Created Microsoft, Personal Computers, and the Internet*, 78 TEX. L. REV. 1, 6 (1999).

158. *See* Werbach, *supra* note 6, at 576 (discussing the FCC's broadband classification proceedings).

159. *Id.* at 590–91.

160. *See id*. at 548–49; *see also* Preserving the Open Internet, *Report and Order*, FCC 10-201, 25 FCC Rcd. 17905 (2010) [hereinafter *Open Internet Order*].

161. *See, e.g.*, 47 U.S.C. §§ 201, 202 (2006).

Title I of the Communication Act[162] and specifically the advanced services provisions of section 706.[163] In *Verizon v. FCC*, decided in January 2014, the U.S. Court of Appeals for the D.C. Circuit upheld the FCC's authority to adopt network neutrality provisions, but overturned the non-blocking and non-discrimination requirements as impermissibly similar to common carrier regulation.[164] As the decision demonstrates, the FCC's power under its current classification of broadband Internet access is circumscribed.[165] Just how far its authority under *Verizon v. FCC* extends is yet to be seen.

The FCC's treatment of VoIP has proven especially problematic. The FCC was understandably reluctant early in the history of VoIP to impose unnecessary rules on a nascent industry.[166] It was also legitimately concerned that a blanket decision to regulate VoIP as a telecommunications service would sweep in many offerings, such as free end-user software, that were not appropriately treated as carriers.[167] When pressured by Congress in 1998 to impose per-minute access charges on all VoIP providers, the FCC was right to demur.[168]

However, that was fifteen years ago. VoIP then was used by a relatively small number of hobbyists, typically communicating through software on their personal computers that allowed for private real-time voice connections. VoIP today is something quite different. Legitimate concerns remain about the potential for unnecessary obligations on some VoIP services, but exempting all forms of VoIP from all telecommunications regulation purely on the basis of the protocol used would be illogical and problematic. For example, a customer picking up her home telephone and dialing 911 in an emergency should be able to reach an emergency operator regardless of whether that phone happens to connect to a circuit-switched network.

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162. The FCC's ancillary authority was first affirmed in *United States v. Southwestern Cable Co.*, 392 U.S. 157 (1968). There, the FCC attempted to impose requirements on cable television service, which at the time it had no statutory grant of regulatory authority over. The Supreme Court concluded that the FCC could take action "reasonably ancillary to the effective performance of the Commission's various responsibilities." *Id.* at 178. In *Southwestern Cable*, that holding pertained to the FCC's authority over television broadcasters, who were subject to competition from the new cable TV providers.

163. *See Open Internet Order*, *supra* note 160, at para. 155.

164. Verizon v. FCC, 740 F.3d 623 (D.C. Cir. 2014).

165. Similarly, the FCC failed in its attempt to use ancillary authority to justify its "broadcast flag" mandates to protect intellectual property distributed through television broadcasts. *See* Am. Library Ass'n v. FCC, 406 F.3d 689 (D.C. Cir. 2005) (finding that the FCC had insufficient legal authority to adopt the broadcast flag rules).

166. *See* Rob Frieden, *What Do Pizza Delivery and Information Services Have in Common? Lessons from Recent Judicial and Regulatory Struggles with Convergence*, 32 RUTGERS COMPUTER & TECH. L.J. 247, 274–77 (2006).

167. *Id.*

168. *See VoIP Report to Congress*, *supra* note 154. The Commission carefully worded its statements to suggest that "phone to phone" VoIP might ultimately be classified as a telecommunications service, without formally reaching that conclusion.

Rather than confront these issues directly and consistently, the FCC addressed them in an ad hoc manner.[169] The Commission was willing to act in particular cases, but refused to adopt general principles. Thus, in 2004, it preempted a Minnesota decision that would have subjected Vonage's VoIP service to traditional state telephone rules and taxes, but it refused to determine the status of VoIP under federal law.[170] That same year, when AT&T attempted to evade obligations to pay interstate "access charges" to local telephone companies by converting its existing traffic into VoIP form, the FCC rejected its argument, again limiting its decision to the facts at hand.[171]

Today, not only are VoIP solutions such as Skype significant businesses with hundreds of millions of users and hundreds of millions of dollars in annual revenue, but VoIP has become the core technology for all new telephone service offerings.[172] Cable operators have built their telephony offerings, which they bundle on top of their broadband and television packages, using VoIP technology.[173] Comcast is now the third-largest local telephone company in America, and it exclusively uses VoIP for transmission.[174] To end-users, the Comcast Digital Voice service works exactly like its traditional telephone service: it involves the same phones, telephone numbers, features, and other aspects. Overall, roughly a third of Americans get their home phone service through VoIP.[175] Yet the FCC has failed to squarely declare that such VoIP-based services fall under the same rules as other forms of telephony.

The FCC could take the step it has heretofore resisted and declare some forms of VoIP to be telecommunications services. However, such authority would be limited to retail VoIP service offerings, so long as the FCC maintains its current classification of broadband. Within the network,

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169. *See* GRIFFIN & FELD, *supra* note 142, at 7 ("[T]he result is an inconsistent hodge-podge that has segregated nearly all critical policy obligations to the 'copper safety net' of the traditional phone system.").

170. Vonage Holdings Corp. v. Minn. Pub. Utils. Comm'n, 290 F. Supp. 2d 993, 999 (D. Minn. 2003); Vonage Holdings Corp. Petition for Declaratory Ruling Concerning an Order of the Minn. Pub. Utils. Comm'n, *Memorandum Opinion and Order*, FCC 04-267, 19 FCC Rcd. 22404 (2004); Sunny Lu, Cellco Partnership v. FCC & Vonage Holdings Corp. v. Minnesota Public Utilities Commission*: VoIP's Shifting Legal and Political Landscape*, 20 BERKELEY TECH. L.J. 859, 860 (2005).

171. *See* Petition for Declaratory Ruling that AT&T's Phone-to-Phone IP Telephony Servs. are Exempt from Access Charges, *Order*, FCC 04-97, 19 FCC Rcd. 7457, paras. 12–17 (2004) [hereinafter *AT&T Phone-to-Phone Order*].

172. *See, e.g.*, *Comcast Now the Third Largest Residential Phone Services Provider in the U.S.*, COMCAST (March 11, 2009), http://corporate.comcast.com/news-information/news-feed/comcast-now-the-third-largest-residential-phone-services-provider-in-the-us.

173. *See* Werbach, *supra* note 107, at 1267; Crawford, *supra* note 57, at 245; CRAWFORD, *supra* note 128, at 224 (describing the growing power of cable operators offering "triple play" services including VoIP).

174. *See Comcast*, *supra* note 172.

175. *See* BROGAN, *supra* note 27, at 2–3.

VoIP traffic is just data, and the FCC has already concluded that broadband data transmission is an information service.[176]

Regulations operating at the wholesale level, most notably interconnection obligations, would not automatically be extended to a VoIP world, even if the FCC took action for retail VoIP services. Nor would such a step solve new problems that arise in a VoIP-centric world, such as numbering conversion and service continuity in emergencies. These issues turn out to be critically important to preserving the normative goals of the PSTN.

The result of a decade and a half of FCC efforts to wrestle with the regulatory status of Internet-based communications services is a confusing amalgam of distinctions, exceptions, and uncertainties. There is no question that the things the FCC has always regulated are increasingly moving from the world of circuit switching to the world of packet switching. Nor is there any doubt that the policy considerations animating that regulation remain important, and in some cases have grown in significance. And yet, what happens next is far from clear. There is no guarantee that the FCC, without further action, will be able to maintain its historic role as the safeguard of essential values and economic opportunities in the post-PSTN era.

III. RECONCEIVING THE INTERNETWORK

A. What Falls Away

The switched telephone network and its accompanying regulatory and business arrangements deserve to die. Their era has passed. However, that does not mean that the idea of a public network has no enduring relevance.[177] To the contrary, some aspects of the PSTN are not tied to the particular technical, legal, or economic conditions that prevailed in 1934 or 1996. There are good economic and public interest reasons to continue treating communications network operators differently than ordinary businesses. The task is therefore to define a regime for today's world that preserves the enduring aspects of the PSTN and jettisons those that are no longer applicable.

176. The exception is if a regulated carrier took circuit-switched voice traffic, converted it within the network to IP format, and then converted it back solely for the purpose of avoiding regulatory obligations or fees. The FCC rejected one such attempt by AT&T, which was a pure long-distance carrier prior to its merger with SBC, in 2004. *See AT&T Phone-to-Phone Order*, *supra* note 171, paras. 12–17 (2004).

177. In fact, the concept of a "public network" is at the heart of the common carriage regime that predates the Communications Act. *See* Nachbar, *supra* note 129, at 68. Nachbar locates the essential "publicness" of the network in term of rules barring user discrimination, as opposed to use discrimination. *See id.* at 70. The concept described here is broader, referring to the network of interconnected networks rather than the carriage policies of a particular network operator.

In effect, the Internet will become the new PSTN. In the process, however, the Internet has already changed and will continue to do so. As it becomes the default communications infrastructure, the Internet can no longer depend, as it has to date, on access to physical infrastructure regulated as telecommunications. Moreover, public policy considerations such as universal access, interoperability, reliability, privacy, access for persons with disabilities, emergency services, and law enforcement access become questions for Internet-based services.[178] As noted above, the last two decades of communications policy have created largely incompatible regulatory domains for the Internet and the PSTN at the same time as market forces joined them together.

The FCC has taken some steps in this direction in its treatment of VoIP. In a series of proceedings, it extended telecommunications regulation to "interconnected" VoIP providers; that is, those offering the familiar experience of dialing a telephone number on an ordinary phone.[179] Interconnected VoIP providers must now contribute to universal service funding,[180] offer access to E911 emergency service,[181] provide access to law enforcement subject to legitimate wiretaps,[182] accommodate persons with disabilities,[183] adhere to privacy rules for the customer information they use to complete calls,[184] support the ability of existing subscribers to

178. Public Knowledge, a public interest and advocacy group in Washington, D.C., has proposed "five fundamentals" to guide FCC involvement after the PSTN transition. These include service to all Americans, interconnection and competition, consumer protection, network reliability, and public safety. *See* Comments of Public Knowledge at 14, Technological Transition of the Nation's Commc'ns Infrastructure, FCC GN Docket No. 12-353 (rel. Jan. 28, 2013).

179. *See* Frieden, *supra* note 40.

180. *See* Universal Serv. Contribution Methodology, *Report and Order and Notice of Proposed Rulemaking*, FCC 06-94, 21 FCC Rcd. 7518, para. 2 (2006), *aff'd*, Vonage Holdings Corp. v. FCC, 489 F.3d 1232, 1241 (D.C. Cir. 2007) (upholding universal service contribution obligations on interconnected VoIP providers).

181. *See VoIP 911 Order*, *supra* note 12, at para. 1.

182. *See* Commc'ns Assistance for Law Enforcement Act & Broadband Access & Servs., *First Report and Order and Further Notice of Proposed Rulemaking*, FCC 05-153, 20 FCC Rcd. 14989, paras. 1, 4 (2005).

183. *See* IP-Enabled Servs., *Report and Order*, FCC 07-110, 22 FCC Rcd. 11275, para. 1 (2007); IP-Enabled Servs., Implementation of Sections 255 & 251(a)(2) of the Communications Act of 1934, *Order and Public Notice*, DA 07-4178, 22 FCC Rcd. 18319, paras. 1–3 (2007) (granting in part and denying in part waivers of the FCC order); *see also* Contributions to the Telecomms. Relay Servs. Fund, *Report and Order*, FCC 11-150, 26 FCC Rcd. 3285, para. 1 (2011).

184. *See* Telecomms. Carriers' Use of Customer Proprietary Network Info. & Other Customer Info., *Report and Order and Further Notice of Proposed Rulemaking*, FCC 07-22, 22 FCC Rcd. 6927, para. 1 (2007), *aff'd*, Nat'l Cable & Telecomms. Ass'n v. FCC, 555 F.3d 996, 1003 (D.C. Cir. 2009) (upholding customer privacy requirements on interconnected VoIP providers).

keep their existing telephone numbers when switching services,[185] and report service outages to the Commission.[186]

One problem with the FCC's approach is that it imposed these obligations pursuant to its ancillary authority under Title I of the Communications Act.[187] It thus did not have to decide whether any component of the VoIP offerings was a telecommunications service subject to Title II. In most cases, the FCC justified its actions on the grounds that even if VoIP was an information service, interconnected VoIP calls were likely to pass over the regulated telecommunications networks of the PSTN.[188] If and when those networks themselves move to VoIP, the legal rationale evaporates.

A second problem with the FCC's actions is they are ad hoc. The FCC has not adopted principles for what forms of regulation should remain in the shift from TDM to IP and what may be abandoned. The six dimensions of the PSTN offer a framework for making such decisions.[189] Rules that are rooted in technology, regulatory arrangements, or market structure are likely to be anachronisms that can be abandoned. Those based around universal connectivity, strategic infrastructure, and a social contract retain their significance as the network evolves.[190] The regulatory framework for the PSTN transition should be based on evolving regulatory policies to support these goals in a new environment.

Pulling apart and constituting the PSTN in this way clarifies that two kinds of regulatory initiatives should endure: those involving interconnection and coordination. The first involves rules to ensure the network of networks retains its universal character. The second reflects the persistence of the PSTN as critical and essential infrastructure. Together, they form the nucleus of a new social contract for the emerging IP-based communications environment.

B. Interconnection

1. Importance of Interconnection

Smooth interconnection between communications networks is necessary to support many essential functions, but often goes unnoticed

185. *See* Tel. No. Requirements for IP-Enabled Servs. Providers, *Report and Order, Declaratory Ruling, Order on Remand, and Notice of Proposed Rulemaking*, FCC 07-188, 22 FCC Rcd. 19531, para. 1 (2007) (imposing local number portability requirements on interconnected VoIP providers).

186. *See Part 4 Extension to VoIP Order*, *supra* note 134, at para. 1.

187. *See* Werbach, *supra* note 6, at 550; *Southwestern Cable*, 392 U.S. at 178 (concluding that the FCC could regulate cable television under its ancillary authority, even though it had no specific grant of authority over cable in the Communications Act).

188. *See VoIP 911 Order*, *supra* note 12, at para. 128.

189. *See supra* Part II.B.

190. *See id.*

until something goes wrong. State troopers in western Montana found this out in summer 2013.[191] The mobile phones they carried with them, and the laptop computers in their cruisers, had service provided by Verizon Wireless.[192] However, because Verizon's network coverage wasn't ubiquitous in the rural area, the troopers—and all other mobile phone subscribers in the area—were actually "roaming" on a network owned by AT&T.[193] When the roaming agreement between the two companies expired, things changed. Suddenly, areas that previously had good service provided no reception at all.[194] The state troopers often had to drive thirty miles or more to get a usable signal.[195] Public safety services were adversely affected for residents of that part of Montana.[196]

This example illustrates the power of interconnection. Few communications networks, services, or applications can survive without linkages to other networks. The only player to be successful without interconnection is an operator sufficiently ubiquitous to reach a substantial portion of the market on its own—as in the case of pre-divestiture AT&T. For anyone else seeking to deliver a network-based service, reaching customers requires some path through networks controlled by others.

In telecommunications, interconnection is, in the words of Eli Noam, "the paramount tool of regulation."[197] This is true at every stage of competition. In an era of regulated monopoly, the government mandates interconnection to ensure ubiquitous service and regulates interconnection charges to allocate costs across the network.[198] In a period of market opening, such as prevailed in the U.S. in the 1980s and 1990s, interconnection rules are the means of breaking down monopolies.[199] And as markets become competitive, interconnection prevents holdouts and fosters efficient network integration.[200]

As Howard Shelanski observes, the rationale for interconnection obligations differs from that for most other telecommunications

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191. *See* Phillip Dampier, *AT&T/Verizon Roaming Agreement Ends in Montana; Rural Customers Left Without Service*, STOP THE CAP! (July 9, 2013), http://stopthecap.com/2013/07/09/verizon-ends-at-rural-customers-left-without-service/.

192. *Id.*

193. *Id.* Such roaming arrangements are common, especially in more rural areas.

194. *Id.*

195. *Id.*

196. *Id.*

197. Eli Noam, *Interconnection Practices*, *in* 1 HANDBOOK OF TELECOMMUNICATIONS ECONOMICS 385, 387 (Martin E. Cave et al. eds., 2002).

198. *See id.* at 389.

199. *See id.*; *see also* Werbach, *supra* note 107, at 1294–1301 (describing the centrality of interconnection to communications regulation).

200. *See* GRIFFIN & FELD, *supra* note 142, at 11 ("As we saw more than 100 years ago, without mandatory interconnection the phone network will slide inevitably toward monopoly as the largest carriers can gain anticompetitive advantages by withholding access to their customers from competitors.").

regulation.[201] It is not necessarily tied to the monopoly history of the U.S. telecommunications market because interconnection remains important even when there are multiple competitors with significant market shares.[202] As Noam explains, interconnection is a kind of anti-fragmentation policy that reduces transaction costs.[203] Having more competing networks doesn't eliminate the need for interconnection; in fact, it amplifies it.[204] An uneven interconnection environment produces situations like the one in Montana, which belie the universality of the PSTN.

In the traditional PSTN environment, interconnection obligations are clear. Section 201(a) of the Communications Act obligates all common carriers "to establish physical connections with other carriers."[205] Section 251, added by the Telecommunications Act of 1996, further states, "Each telecommunications carrier has the duty . . . to interconnect directly or indirectly with the facilities and equipment of other telecommunications carriers." [206] A network operator simply cannot refuse to offer interconnection to another network, although there is room for negotiation on some economic terms and the physical points of connection.[207] Nor can carriers refuse to carry certain traffic across their interconnection links, because they are bound by the non-discrimination provisions of section 202.[208]

When carriers have failed to honor their connectivity obligations, the FCC has been willing to step in. When conference calling services began to offer free services by exploiting high terminating access charges in rural areas, some telephone companies responded by blocking calls to those numbers.[209] The FCC acknowledged the services were problematic but ordered the carriers not to engage in "self help."[210] More recently, the FCC adopted rules to address problems of calls not being completed to some rural subscribers.[211] The problem appears to be the inadvertent result of a variety of technical decisions, but the FCC recognized that non-universal connectivity undermines the essential promise of the PSTN.[212]

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201. *See* Shelanski, *supra* note 125, at 68.
202. *Id.*
203. ELI M. NOAM, INTERCONNECTING THE NETWORK OF NETWORKS 15 (2001).
204. *Id.*
205. 47 U.S.C. § 201 (2006).
206. 47 U.S.C. § 251(a) (2006).
207. 47 U.S.C. § 251(c) (2006).
208. 47 U.S.C. § 202 (2006).
209. Establishing Just & Reasonable Rates for Local Exch. Carriers, *Declaratory Ruling and Order*, FCC 07-2863, 22 FCC Rcd. 11629, para. 5 (2007).
210. *See id.*
211. Rural Call Completion, *Report and Order and Further Notice of Proposed Rulemaking*, FCC 13-135 (2013), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-13-135A1.pdf.
212. *See id.* at para. 13 ("The inability to complete calls reliably threatens public safety and contravenes the public interest.").

In some markets, pressure to interconnect is sufficiently great that competitors are able to negotiate reasonable commercial arrangements on a private basis.[213] The fact that private interconnection regimes sometimes develop, however, does not mean that they always do or that they necessarily produce a well-functioning market.[214] An interconnection dispute that cuts off service for some customers to other subscribers is a major public policy harm.[215] This is true regardless of the underlying technology involved.

The Montana situation illustrates the challenge in a post-PSTN world. On the wireline PSTN, it would be impermissible for AT&T to cut off Verizon customers. Because this was a roaming arrangement between two mobile phone networks, however, it was essentially an unregulated commercial arrangement. As mobile and VoIP connections become the new PSTN, this dichotomy becomes increasingly untenable.

2. Internet Interconnection Disputes

The Internet provides a glimpse of the post-PSTN future of interconnection. Interconnection is as important to the Internet as to the PSTN, but it has traditionally operated differently, both in technical and regulatory terms.[216] In recent years, however, the Internet's model of purely voluntary, private interconnection has begun to fray, as the Internet and legacy communications networks converge.

Internet service providers can choose whether to interconnect with one another.[217] Any provider offering transmission using the Internet protocol is technically free to interconnect and join the Internet, but companies must agree on the terms and location of interconnection.[218] Unlike the PSTN, the Internet uses a packet-switching architecture, with traffic routed dynamically from router to router.[219] The same traffic can be

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213. RICHARD LEVINE & RANDOLPH MAY, INTERCONNECTION WITHOUT REGULATION: LESSONS FOR TELECOMMUNICATIONS REFORM FROM FOUR NETWORK INDUSTRIES 3 (2005), *available at* http://www.pff.org/issues-pubs/communications/books/051018Interconnection.pdf.

214. *See generally* Frieden, *supra* note 40 (describing examples of interconnection failures).

215. *See* GRIFFIN & FELD, *supra* note 142, at 12 ("If NBC and AT&T have a retransmission dispute and AT&T video subscribers temporarily lose NBC programs, it is annoying. But if Comcast and AT&T have a 'peering dispute' and millions of AT&T wireless customers can't call Comcast landlines, it is a communications disaster.").

216. *See generally* Werbach, *supra* note 107.

217. *See* Michael Kende, *The Digital Handshake: Connecting Internet Backbones*, 11 COMMLAW CONSPECTUS 45, 45–46 (2003). The situation is similar in Europe. *See* INGO VOGELSANG, THE FUTURE OF IP INTERCONNECTION: TECHNICAL, ECONOMIC, AND PUBLIC POLICY ASPECTS (2008) (prepared for the European Commission).

218. *Id.* at 45, 49–52.

219. *See* Werbach, *supra* note 16, at 10, 17 (explaining packet switching).

routed between endpoints through multiple paths, with different financial terms and technical conditions.

Traditionally, interconnection between Internet networks used one of two arrangements: peering and transit.[220] Peering agreements were historically done on a settlement-free basis between the largest, so-called "Tier 1" networks.[221] The other distinctive feature of a peering arrangement is that it involves the agreement only to route traffic to customers of the terminating network.[222] A transit agreement, by contrast, involves a payment by one network to another network, which agrees to deliver traffic anywhere on the Internet.[223]

In recent years, more complex arrangements have developed, as companies constantly seek to optimize performance along both financial and engineering dimensions.[224] Some networks now pay for peering in order to guarantee performance on the terminating network.[225] The rise of content delivery networks, which store content close to its destination using caching servers for improved performance, has also changed Internet interconnection dynamics[226] The environment is considerably more complex today than in the days of "Tier 1" peering.[227]

The FCC has declined to address backbone interconnection, finding it unnecessary because the market is sufficiently competitive.[228] Nonetheless, some authors have pointed out the similarity between Internet interconnection issues and those the FCC regulates.[229] And thanks to the growth of video streaming services such as Netflix and YouTube, Internet interconnection disputes have become more prominent.[230] Because it uses

220. *See* Kende, *supra* note 217, at 45.

221. *See id.* at 49, 51; *see also* Peyman Faratin et al., *The Growing Complexity of Internet Interconnection*, COMM. & STRATEGIES, 4th Quarter 2008, at 51, *available at* http://www.akamai.de/dl/technical_publications/growing_complexity_of_internet.pdf.

222. David Clark et al., Interconnection in the Internet: The Policy Challenge 2–3 (Aug. 9, 2011) (unpublished manuscript) (prepared for the 39th Research Conference on Communication, Information and Internet Policy), *available at* http://ssrn.com/abstract=1992641.

223. *See id.*

224. *See generally* Faratin et al., *supra* note 221.

225. *See id.* at 58–61.

226. *See generally* Faratin et al., *supra* note 221; Werbach, *supra* note 107, at 1254.

227. *See* Faratin et al., *supra* note 221, at 65–67.

228. *See* Kende, *supra* note 217, at 52.

229. *See generally* James Speta, *A Common Carrier Approach to Internet Interconnection*, 54 FED. COMM. L.J. 225 (2002); Werbach, *supra* note 107, at 1255–57.

230. *See* Jon Brodkin, *Why YouTube Buffers: The Secret Deals That Make—and Break—Online Video*, ARS TECHNICA (Jul. 28, 2013, 9:00 PM), http://arstechnica.com/information-technology/2013/07/why-youtube-buffers-the-secret-deals-that-make-and-break-online-video/ (noting recent examples from 2010–2013 of Internet interconnection disputes).

such enormous bandwidth, video content now comprises the dominant share of Internet traffic.[231]

As the Internet becomes the medium for voice traffic and other essential communications services, the question of whether a totally unconstrained interconnection environment can function effectively becomes increasingly salient. Because Internet interconnection agreements are private, it is impossible to get a full picture of the marketplace. However, a number of recent disputes have flared up in public and highlighted potential concerns.[232]

In 2010, after Level 3 became a major delivery network for Netflix, an interconnection dispute erupted between Level 3 and Comcast.[233] Comcast previously had been paying Level 3 for transit, but Level 3 was now delivering huge volumes of Netflix video traffic to Comcast's network.[234] Comcast therefore insisted that Level 3 pay it a termination fee.[235] The disagreement threatened to disrupt the connection between the country's largest broadband access provider and the largest source of Internet traffic.[236] The FCC, however, declined to intervene, even as it adopted open Internet rules prohibiting broadband providers such as Comcast from blocking content and services to their end-users.[237]

In July 2013, the two companies issued a terse press release stating that they had "resolved their prior interconnection dispute on mutually satisfactory terms."[238] Presumably, the companies had continued to exchange traffic the past three years under some interim arrangement,

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231. *See* SANDVINE INTELLIGENT BROADBAND NETWORKS, GLOBAL INTERNET PHENOMENA REPORT (2013) [hereinafter SANDVINE GLOBAL INTERNET REPORT], *available at* http://www.sandvine.com/downloads/documents/Phenomena_1H_2013/Sandvine_Global_Internet_Phenomena_Report_1H_2013.pdf.

232. *See, e.g.*, Werbach, *supra* note 114, at 1779–83.

233. *See* Daniel L. Brenner & Winston Maxwell, *The Network Neutrality and the Netflix Dispute: Upcoming Challenges for Content Providers in Europe and the United States*, 23 INTELL. PROP. & TECH. L.J. 3, 4 (2011); Cecilia Kang, *Level 3 Communications Calls Comcast Fees for Netflix Feeds Unfair*, WASH. POST (Nov. 29, 2010), http://www.washingtonpost.com/wp-dyn/content/article/2010/11/29/AR2010112907024.html; Nate Anderson, *Peering Problems: Digging into the Comcast/Level 3 Grudgematch*, ARS TECHNICA (Dec. 9, 2010), http://arstechnica.com/tech-policy/news/2010/12/comcast level3.ars; *Peer Pressure*, ECONOMIST (Dec. 23, 2010), http://www.economist.com/blogs/babbage/2010/12/connecting_internets; Brian Stelter, *Netflix Partner Says Comcast 'Toll' Threatens Online Video Delivery*, N.Y. TIMES (Nov. 29, 2010, 6:13 PM), http://mediadecoder.blogs.nytimes.com/2010/11/29/netflix-partner-says-comcast-toll-threatens-online-video-delivery; Frieden, *supra* note 40.

234. *See* Brenner & Maxwell, *supra* note 233, at 4.

235. *See id.* at 4.

236. *See* SANDVINE GLOBAL INTERNET REPORT, *supra* note 231; Stelter, *supra* note 233.

237. *See Open Internet Order*, *supra* note 160.

238. *Level 3 and Comcast Issue Statement*, LEVEL 3 (July 16, 2013), http://level3.mediaroom.com/index.php?s=23600&item=136853; *see also* Joan Engebretson, *Behind the Level 3-Comcast Peering Settlement*, TELECOMPETITOR (July 17, 2013, 11:42 AM), http://www.telecompetitor.com/behind-the-level-3-comcast-peering-settlement/.

before agreeing to new terms. While their agreement could be seen as evidence that the market can resolve backbone interconnection disputes without interference, the fact that it took three years (an eternity in Internet time) should give one pause. As with most Internet interconnection arrangements, the terms are private, so there is no way to evaluate the agreement.[239] The fact that both parties agreed to a deal does not prove the deal was favorable to competition and innovation; only that the less-powerful party felt signing was better than walking away.

In June 2013, Cogent Communications, another major Internet backbone provider, complained that Verizon was allowing connection quality to degrade across its peering points with Cogent, by not upgrading equipment to handle the volume of traffic.[240] Verizon argued that, because Cogent was sending significantly more traffic than it was receiving from Verizon customers, it should instead use Verizon's paid peering option to deliver content closer to end users for better performance.[241] Of course, that would also impose additional costs on Cogent compared to the current peering arrangement.[242] The future of the Internet video market, and other markets dependent on significant broadband capacity, hinges on the terms spelled out in these interconnection agreements.

The major incumbent telephone companies argue that the competitive concerns that motivated interconnection obligations for the PSTN are unnecessary for IP services.[243] Competition, however, may not be a sufficient check. Even when there is widespread competition to provide IP transit, access providers still have market power in controlling the ability to reach their customers.[244] In other words, a network seeking to deliver video or voice content to an AT&T U-verse broadband access

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239. *See, e.g.*, *Level 3 and Comcast Issue Statement*, LEVEL 3 (July 16, 2013), http://level3.mediaroom.com/index.php?s=23600&item=136853 (providing that the details of the agreement between Level 3 and Comcast will not be released); *see also* William B. Norton, *A Study of 28 Peering Policies*, DRPEERING INT'L, http://drpeering.net/white-papers/Peering-Policies/StudyOf28/Contracts-and-NDA-Peering-Policy-Clause.html (last visited Feb. 6, 2014) (describing some of the privacy-related contractual provisions in the peering policies of several ISPs).

240. Joan Engebretson, *Verizon, Netflix Dispute Not Just Over Peering; Servers are New Battlefield*, TELECOMPETITOR (June 20, 2103, 12:26 PM), http://www.telecompetitor.com/verizon-netflix-dispute-not-just-over-peering-servers-are-new-battlefield/.

241. *See* David Young, *Unbalanced Peering, and the Real Story Behind the Verizon/Cogent Dispute*, VERIZON POLICY BLOG (June 19, 2013), http://publicpolicy.verizon.com/blog/entry/unbalanced-peering-and-the-real-story-behind-the-verizon-cogent-dispute.

242. *See id.* ("When the traffic loads are not symmetric, the provider with the heavier load typically pays the other for transit.").

243. *See, e.g.*, Comments of AT&T at 7, Connect Am. Fund, FCC WC Docket No. 10-90 (rel. Feb. 24, 2013) [hereinafter *AT&T Universal Service Comments*] (arguing that IP interconnection obligations are unnecessary).

244. *See* Letter from Global Crossing at 2, Preserving the Open Internet, FCC GN Docket No. 09-191 (rel. Feb. 4, 2011); Letter from Level 3 at 1–2, Preserving the Open Internet, FCC GN Docket No. 09-191 (rel. Feb. 16, 2011).

subscriber needs to terminate that traffic on AT&T's network.[245] The fact that AT&T has many broadband competitors is irrelevant once the customer has chosen a particular one.[246] In the telecommunications market, this concept is known as the terminating access monopoly.[247]

The difference between the PSTN and the Internet is that there can be multiple paths between two points.[248] A network seeking to reach AT&T's customers that finds AT&T's peering terms excessive can instead pay transit to an intermediary network that has a peering arrangement with AT&T.[249] According to AT&T, "the multiplicity of alternative transit routes into a given ISP's network, combined with the interdependence of every IP network on every other, deprives any ISP of the ability to coerce inefficiently high payments from any other IP network."[250]

There are, however, reasons for skepticism. It is questionable whether alternative transit will be a sufficiently coercive mechanism on broadband access providers. The use of an intermediary network makes it difficult to ensure end-to-end performance.[251] The need for reliable performance and the efficiencies involved in caching content closer to its destination is the very reason network providers have gone to paid peering and content delivery networks.[252] Broadband access providers can make this problem worse by refusing to upgrade the port capacity on interconnection links, as Cogent alleged Verizon was doing.[253] European antitrust authorities are examining similar complaints that failure to upgrade a congested Internet interconnection link constitutes anticompetitive conduct.[254]

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245. *See* Patrick DeGraba, *Bill and Keep at the Central Office as the Efficient Interconnection Regime* 25–26 (FCC Office of Plans & Policy, Working Paper No. 33, 2000), *available at* http://transition.fcc.gov/Bureaus/OPP/working_papers/oppwp33.pdf.

246. *See id.*

247. *See id.*

248. Werbach, *supra* note 107, at 1294 (describing Internet interconnection as a means of "routing around" hold-ups).

249. *See* Clark et al., *supra* note 222, at 2.

250. *See AT&T Universal Service Comments*, *supra* note 243, at 2.

251. The content provider does not control the performance of the transit network, nor does it control the interconnection relationship between that network and the broadband ISP. Furthermore, unlike peering, transit intermingles traffic from many providers to many destinations, which makes it harder to optimize performance. There have been efforts to standardize so-called interdomain quality of service ("QOS") mechanisms that would provide greater guarantees across third-party networks, but implementation of these technologies has proven significantly more difficult than engineers anticipated. *See* Werbach, *supra* note 107, at 1284.

252. Dennis Weller, *Blurring Boundaries: Global and Regional IP Interconnection*, *in* INT'L TELECOMM. UNION, TRENDS IN TELECOMMUNICATION REFORM 2013: TRANSNATIONAL ASPECTS OF REGULATION IN A NETWORKED SOCIETY 101, 108 (2013), *available at* http://www.iadb.org/intal/intalcdi/PE/2013/12850.pdf.

253. *See* Brad Reed, *Verizon Accused of Throttling Netflix Traffic*, BGR (June 19, 2013, 11:30 AM), http://bgr.com/2013/06/19/verizon-netflix-traffic-throttling-accusations/.

254. *See* James Kanter, *Antitrust Scrutiny of Telecoms in Europe*, N.Y. TIMES (July 11, 2013), http://www.nytimes.com/2013/07/12/business/global/eu-investigates-telecom-firms-

The other development that could change the dynamics of Internet interconnection involves the end-user pricing. Broadband access providers have been exploring the use of data caps and usage based pricing, allegedly to deal with network congestion caused by the rise in high-bandwidth video traffic.[255] They have also begun to enter into agreements, such as a recent arrangement between Comcast and Microsoft for content delivered through Xbox 360 consoles in the home, which exempt certain traffic from those restrictions.[256]

As David Clark, Bill Lehr, and Steven Bauer explain in their analysis of Internet interconnection questions, such end-user policies allow broadband access providers to neutralize transit as a disciplining factor on peering practices.[257] Data caps or usage charges could make watching videos on a regular Internet connection less desirable or overly expensive. Content received by the broadband ISP through direct paid-peering arrangements would still be available to subscribers without caps or additional charges. Such arrangements could force originators or distributors of content to pay the peering charges for riding on the "favored" connection.[258]

3. VoIP Interconnection

The end of the PSTN means that carriers will switch from TDM to IP-based transmission. During a transitional period, some networks will continue to interconnect through TDM connections, either because one party still operates a legacy network, or by converting from IP to TDM and

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over-internet-access.html; Benoît Felten, There's No Economic Imperative to Reconsider an Open Internet (Apr. 3, 2013) (unpublished manuscript), *available at* http://ssrn.com/abstract=2244335 (describing allegations in France that broadband provider Free is deliberately under-provisioning interconnection links).

255. *See* Jacob Minne, *Data Caps: How ISPs are Stunting the Growth of Online Video Distributors and What Regulators Can Do About It*, 65 FED. COMM. L.J. 233, 246 (2013); Stacey Higginbotham, *Which ISPs are Capping Your Broadband, and Why?*, GIGAOM (Oct. 1, 2012, 12:03 PM) http://gigaom.com/2012/10/01/datacaps-chart/; Roger Yu, *Cable Companies Cap Data Use for Revenue*, USA TODAY (Oct. 1, 2012), http://www.usatoday.com/story/tech/2012/10/01/internet-datacap/1595683/.

256. *See* Stacey Higginbotham, *The Technical and Legal Realities of Comcast's Xbox Cap Spat*, GIGAOM (Mar. 27, 2012, 12:53 PM), http://gigaom.com/2012/03/27/the-technical-and-legal-realities-of-comcasts-xbox-cap-spat/.

257. *See* Clark et al., *supra* note 222, at 6.

258. Pricing structures that advantage content through the broadband access provider's "fast lane" in this manner might run afoul of the FCC's Open Internet Rules. *See Open Internet Order*, *supra* note 160. However, portions of those rules were recently struck down by the D.C. Circuit. *See Verizon*, 740 F.3d 623. Even if they had been upheld, it is not certain that the FCC's rules would cover these practices. Usage-based pricing and data caps are arguably neutral mechanisms that affect all content equally. The question is whether the arrangement to exempt traffic through certain peering arrangements from the cap changes the outcome. The FCC did not act to prohibit Comcast's partnership with Microsoft to offer such an exemption for the Xbox. *See* Higginbotham, *supra* note 255. The Open Internet rules allow for "managed services" to be treated differently than general Internet traffic.

back. Ultimately, though, the efficient interconnection of post-PSTN networks will involve direct IP links.[259]

VoIP-based service providers can voluntarily connect their networks, and indeed several cable operators reportedly have done so.[260] However, most interconnection for voice services, even when delivered through VoIP, today still involves conversion to TDM in the middle.[261] Telecommunications service providers are required to provide TDM interconnection by section 251 of the Communications Act.[262] Because the FCC has never decided the legal status of VoIP, however, carriers currently do not have to offer IP interconnection, even where it is technically feasible and the networks involved use IP on both ends.[263]

Even worse, because interconnection negotiations outside the Communications Act are private business transactions, most agreements are treated as confidential. A few disputes have become public when one party goes to the media or the FCC, but there is no reason to believe those are the only ones that have occurred. AT&T has suggested to the FCC that, prior to imposing any regulatory obligations, the FCC should "compile hard evidence of how IP-to-IP interconnection arrangements have played out in practice."[264] This comment is unintentionally ironic. It would be next to impossible to compile such information, because the agreements are confidential, and the FCC's ability to compel data collection is limited because the IP providers are not regulated as carriers.

In 2011, as part of the reform of its inter-carrier compensation rules, the FCC sought comment on direct IP interconnection for VoIP.[265] While it reached no tentative conclusions, the agency made an intriguing statement in the notice of proposed rulemaking:

> We recognize the importance of interconnection to competition and the associated consumer benefits. . . . We also make clear that even while our FNPRM is pending, we expect all carriers

259. *See* Connect Am. Fund, *Report and Order and Further Notice of Proposed Rulemaking*, FCC 11-161, 26 FCC Rcd. 17663, paras. 1009–11, 1335–73 (2011) [hereinafter *VoIP Interconnection Notice*].

260. *See* Wilson, *supra* note 35; *VoIP Peering Shapes Up to Disrupt*, FIERCEENTERPRISE COMM. (Aug. 16, 2007), http://www.fierceenterprisecommunications.com/story/VoIP-peering-shapes-disrupt/2007-08-16. Sprint, which provides wholesale services to cable VoIP operators, established a direct voice peering exchange service in 2009. *See* Press Release, Sprint, Sprint Establishes New Voice over IP (VoIP) Community Solution to Provide Significant Cost Savings to Wholesale VoIP Customers (Oct. 12, 2009), *available at* http://newsroom.sprint.com/article_print.cfm?article_id=1258.

261. *See VoIP Interconnection Notice*, *supra* note 259, at paras. 1336–39.

262. 47 U.S.C. § 251 (2006).

263. *VoIP Interconnection Notice*, *supra* note 259, at para. 1339. The FCC has sought comment on this issue, as discussed below.

264. Reply Comments of AT&T at 19, Connect Am. Fund, FCC WC Docket No. 10-90 (rel. Mar. 30, 2013).

265. *See VoIP Interconnection Notice*, *supra* note 259.

> to negotiate in good faith in response to requests for IP-to-IP interconnection for the exchange of voice traffic.[266]

Such a good faith requirement seems reasonable, but without FCC legal authority and rules obligating carriers to interconnect through IP, it is entirely hortatory.[267] Clearly, the FCC recognizes that as the PSTN migrates to IP technology, the need for interconnection to ensure universal connectivity does not evaporate.

AT&T and Verizon claim that the FCC has no authority to mandate interconnection when either the requesting or the interconnecting operator uses VoIP.[268] Carriers are also making this argument at the state level, where VoIP-based operators have been rebuffed when seeking direct IP interconnection.[269] At first glance, the FCC's determination that broadband Internet access is an integrated information service would seem to bar imposition of Title II interconnection obligations.[270] As I have elsewhere

266. *Id.* at para. 42.

267. The "good faith" language parallels the FCC's mandate in another controversial area involving distribution arrangements between content producers and distributors: the retransmission consent process between television broadcasters and cable television providers (or their competitors). One notable difference is that the FCC has direct statutory authority to define and impose good-faith obligations on retransmission consent agreements. *See* 47 U.S.C. § 325(b)(3)(C)(ii)–(iii) (2006) (directing the commission to promulgate rules requiring broadcast stations and MVPDs to negotiate in good faith); Amendment of the Comm'n's Rules Related to Retransmission Consent, *Notice of Proposed Rulemaking*, FCC 11-31, 26 FCC Rcd. 2718 (2011).

268. *See AT&T Universal Service Comments*, *supra* note 243, at 4.

269. *See* GRIFFIN & FELD, *supra* note 142, at 12; Petition for a Determination that Verizon IP-to-IP Interconnection Agreements Must Be Filed for Review & Approval & for Associated Relief, *Order Opening an Investigation, Declining to Issue an Advisory Ruling, and Denying Verizon MA's Motion to Dismiss or Stay the Proceeding*, D.T.C. 13-2 (Mass. Dep't of Telecomms. & Cable 2013), *available at* http://www.mass.gov/ocabr/docs/dtc/dockets/13-2/end132open136.pdf (considering a request from competitors for IP interconnection with Verizon).

270. The FCC theoretically could reverse itself and reclassify some portion of Internet access as a telecommunications service. The *Verizon* court recognized that the FCC's existing classification was not compelled by the statute. *See Verizon*, 740 F.3d at 628 ("[T]he Commission has chosen to classify broadband providers in a manner that exempts them from treatment as common carriers . . . ."). The fact of the matter is that the FCC's classification of broadband access has now been in force for a decade, and it has been repeatedly reaffirmed, creating settled expectations in the marketplace that the agency will hesitate to overturn. Moreover, the intense opposition to Title II reclassification that the FCC declined to confront when adopting the *Open Internet Order* in 2010 will no doubt reappear if it attempts to move in that direction now. On February 19, 2014, FCC Chairman Wheeler announced that the agency would move forward under the section 706 theory it used in the *Open Internet Order*. Although the docket regarding Title II reclassification remains open, Wheeler was clear that his preference was not to go that route. *See Statement by FCC Chairman Tom Wheeler on the FCC's Open Internet Rules*, FCC (Feb. 19, 2014), http://www.fcc.gov/document/statement-fcc-chairman-tom-wheeler-fccs-open-internet-rules.

explained, however, the statutory scheme of the 1996 Act is more nuanced.[271]

While the old section 201 applies to the narrower class of common carriers, section 251 applies to "telecommunications carriers."[272] That is defined as all providers of "telecommunications service,"[273] which is in turn defined as provision of telecommunication to the public for a fee.[274] The interconnection obligation applies under section 251(a) to any telecommunications carrier; it is not limited to interconnection for provision of telecommunications service.[275] Thus, any company that, in some capacity, provides "telecommunications" to the public for a fee must interconnect with other such providers. The "telecommunications service" definition in the statute expressly applies "regardless of the facilities used."[276] Congress understood that voice services would not always be delivered over the same technical platform.

Although it has not yet moved forward on IP interconnection for VoIP, the FCC has taken action to require interconnection between the data services offered by mobile phone providers on a roaming basis.[277] Roaming, the kind of arrangement that allows subscribers of one network to get service from a cellular tower on another network, subject to a charge, is common in the mobile phone world and particularly important to ensure service in rural areas where every carrier cannot economically build out a complete network. The FCC has existing roaming rules for voice service, but its recent decision extended those to mobile data connectivity.[278]

Data roaming provides a template for VoIP interconnection. The data-roaming rule requires providers to "offer data roaming arrangements on commercially reasonable terms and conditions."[279] In contrast to common carriage, however, carriers may "negotiate the terms of their roaming arrangements on an individualized basis."[280] They may also

271. *See* Werbach, *supra* note 6, at 585–92 (discussing the nuances of sections 251 and 256 interconnection language).

272. 47 U.S.C. § 251(a) (2006).

273. 47 U.S.C. § 153(51) (2006).

274. 47 U.S.C. § 153(53) (2006).

275. 47 U.S.C. § 251(a) (2006); *see also* Werbach, *supra* note 6, at 585–89 (explaining the scope of interconnection obligations under the 1996 Act).

276. 47 U.S.C. § 153(53) (2006).

277. Reexamination of Roaming Obligations of Commercial Mobile Radio Serv. Providers & Other Providers of Mobile Data Servs., *Second Report and Order*, FCC 11-52, 26 FCC Rcd. 5411, paras. 1–2 (2011) [hereinafter *Data Roaming Order*], *aff'd*, Cellco P'ship v. FCC, 700 F.3d 534 (D.C. Cir. 2012); *see also* Dampier, *supra* note 191 (involving a roaming agreement that lapsed and was not renewed).

278. *See Data Roaming Order*, *supra* note 277.

279. *Data Roaming Order*, *supra* note 277, at para. 43.

280. *Id.*

decline data roaming interconnection if it is not technically feasible.[281] Where conflicts arise, there is a dispute resolution process.[282]

Limited rules of this sort would ensure that the universality of the PSTN endures in the new IP-based communications environment, without retaining the burdensome aspects of legacy telecommunications regulation.

C. Coordination

1. Role of Coordination

The PSTN, the Internet, and whatever comes of their union share a fundamental characteristic: they are networks of networks. No one entity serves every customer, partly because of the massive capital costs involved, and partly because providers can no longer monopolize the market. As a system, therefore, the PSTN and its successors are modular in structure, with functionality divided among different entities.[283]

The challenge in any modular system is that those entities make independent decisions about investments, technologies, and business models. When each provider optimizes for its own needs, the overall result may not be optimal.[284] This is true even when all the participants would agree on certain system-wide goals. Unlike interconnection, where every network has a private incentive to limit connectivity but a public incentive to expand it, coordination issues are fundamentally collective action problems.

Modular systems, by definition, lack a strong central control mechanism that controls the actions of all participants.[285] Therefore, the only means of addressing areas of global concern that may be poorly served by local decisions is for the government to impose system-wide mandates, or for the participants to communicate directly and make commitments through some coordination mechanism. The social policy aspects of the PSTN can be seen as examples of the former approach. Communications networks are unlikely to be fully accessible to those with

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281. *Id*.

282. *Id*. at para. 74.

283. *See generally* CARLISS Y. BALDWIN & KIM B. CLARK, DESIGN RULES: THE POWER OF MODULARITY (2000); *see also* 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, 90–96 (2003).

284. Christopher Yoo, Modularity Theory and Internet Policy 34–36 (May 2013) (unpublished manuscript), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2032221; Henry W. Chesbrough & David J. Teece, *When Is Virtual Virtuous?: Organizing for Innovation*, HARV. BUS. REV., Jan.–Feb. 1996, at 65, 67–69 (describing how going "virtual" for an organization does not necessarily mean more innovation).

285. *See, e.g.*, BALDWIN & CLARK, *supra* note 283, at 63 ("A module is a unit whose structural elements are powerfully connected among themselves and relatively weakly connected to elements in other units. . . . [T]here are degrees of connection, thus there are gradations of modularity.").

disabilities, and the costs of building and managing E911 emergency service infrastructure are unlikely to be borne, for example, if the decisions rest solely in the hands of individual providers. Here, government serves the role of spreading a collective burden across all market participants.

In other areas, however, government mandates are less appropriate. When it comes to the management and operation of networks, the providers themselves are best positioned to make the requisite technical decisions. Sometimes the most essential need is for all providers to come to the table to work out cooperative arrangements. And in some cases, the market failure is primarily informational: the industry participants need to give government and the public appropriate data to make decisions.

In recent years, scholars of administrative law have increasingly looked to cooperative "new governance" mechanisms instead of traditional direct mandates.[286] In Internet policy specifically, "co-regulation" and "multi-stakeholder processes" have generated significant interest as means of addressing thorny issues related to Internet governance, content regulation, and network neutrality.[287] With these mechanisms, government can set a policy goal while allowing industry and public interest representatives to define and commit to specific requirements.[288] Alternatively, the multi-stakeholder process may narrow the scope of disagreement and identify safe harbors that are clearly permissible or impermissible.[289]

When the PSTN was primarily operated by AT&T, coordination functions could be handled within that corporate entity or through affiliates such as Bell Labs. In today's environment, where all providers are independent, there is a need for separate coordination mechanisms. The Communications Act recognizes this. Section 256, for example, directs the FCC to "establish procedures for Commission oversight of coordinated network planning by telecommunications carriers and other providers of telecommunications service."[290]

Section 256 is limited on its face to providers of telecommunications service.[291] The FCC would need to articulate a theory of legal authority to continue acting in this area following the PSTN transition. Under the FCC's current interpretation of telecommunications and information

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286. *See generally* Richard Stewart, *Administrative Law in the Twenty-First Century*, 78 N.Y.U. L. REV. 437, 448–55 (2003) (assessing the new methods for achieving regulatory goals and their implications).

287. Joe Waz & Phil Weiser, *Internet Governance: The Role of Multistakeholder Organizations*, 10 J. ON TELECOMM. & HIGH TECH. L. 331, 334 (2013); CHRISTOPHER MARSDEN, INTERNET CO-REGULATION: EUROPEAN LAW, REGULATORY GOVERNANCE AND LEGITIMACY IN CYBERSPACE 68 (2011).

288. *See* Waz & Weiser, *supra* note 287, at 336 n.15; MARSDEN, *supra* note 287, at ch. 4.

289. *See* Waz & Weiser, *supra* note 287, at 338.

290. 47 U.S.C. § 256(b)(1) (2006).

291. *See id.*

services, the easiest way to do so is under ancillary authority.[292] Coordination activities are not about promoting competition or overcoming market power; they are about reducing transaction costs and ensuring public interest goals are met for the network as a whole.

The two most essential areas for coordination in the post-PSTN environment are numbering and network reliability.

2. Numbering

Any communications network requires a system of identifiers. The nodes on the network can only route information correctly if endpoints are uniquely identified in some consistent manner. Similarly, end users need some way to specify which users or systems they wish to contact. The end-user identifiers must be simple enough for people to remember and use. Coordination is essential so that two endpoints are not assigned the same identifier, and to ensure that connections are made smoothly to the desired destination across independent networks.[293]

The system of using numbers to dial telephone calls has been around since the 19th century.[294] The international technical standard for the familiar arrangement of country code, area code, and telephone number (seven digits in the U.S.) is called E.164.[295] Local and regional authorities around the world handle the allocation and management of numbers within their territories.[296] Section 251(e)(1) of the Communications Act directs the FCC to "create or designate one or more impartial entities to administer telecommunications numbering and to make such numbers available on an equitable basis."[297] The FCC oversees processes such as adding new area codes when numbers are exhausted, and establishing special numbers such as 311 for non-emergency local services.[298] The NANP administrator assigns blocks of numbers to carriers, who then assign them to end-users.[299]

VoIP developed outside the numbering framework of the PSTN.[300] Standalone VoIP services such as Skype could assign their own private

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292. *See* Werbach, *supra* note 6, at 571–85.

293. Rudolf van der Berg, *ENUM: Dragging Telephone Numbers into the Internet Age*, ARS TECHNICA (Jan. 14, 2010, 12:30 AM), http://arstechnica.com/business/2010/01/enum-dragging-telephone-numbers-into-the-internet-age/ (explaining the importance and value of unique identifiers).

294. *See id*.

295. *See* Craig McTaggart, *The ENUM Protocol, Telecommunications Numbering, and Internet Governance*, 12 CARDOZO J. INT'L & COMP. L. 507, 510–11 (2004).

296. For the United States, the overall structure is called the North American Numbering Plan. *See* 47 C.F.R. § 52.5(c) (2013).

297. 47 U.S.C. § 251(e)(1) (2006).

298. *Services: Code Administration*, NANPA, http://www.nanpa.com/number_resource_info/code_admin.html (last visited Feb. 6, 2014).

299. *See id*.

300. *See* Numbering Policies for Modern Commc'ns, *Notice of Proposed Rulemaking, Order, and Notice of Inquiry*, FCC 13-51, 28 FCC Rcd. 5842, para. 7 (2013).

identifiers tied directly to usernames.[301] Interconnected VoIP services such as Vonage and Comcast Digital Voice connect to ordinary telephones, and therefore must somehow interoperate with the E.164 numbering system.[302] However, because these providers are not formally classified as telecommunications carriers, they cannot participate directly in the NANP.[303] Instead, they must buy blocks numbers from carriers.[304] The FCC has initiated a proceeding and begun trials designed to give interconnected VoIP providers direct access to numbers.[305]

The coordination issue around numbering primarily concerns the internal routing process in the network.[306] VoIP systems use the routing structure of the Internet, based on IP numbers identifying devices, rather than the traditional PSTN mechanisms designed for circuit switches.[307] But when a VoIP subscriber makes a call with a PSTN user on the other end, the communication must be converted in the middle to TDM.[308] Moreover, there is no central database for converting between IP numbers and E.164 telephone numbers.[309] Thus, even when a call is made between two interconnected VoIP subscribers, it typically must be converted to TDM, passed through a legacy PSTN device called a tandem switch to look up the location of the terminating phone number, and then reconverted to IP.[310] Some companies, most notably cable operators, have reached bilateral agreements for direct IP interconnection.[311] However, traditional telecommunications carriers generally require interconnection through TDM.

The precedents for coordination around E.164 to IP numbering are equal access and number portability. When AT&T agreed to divest its local affiliates and open the long-distance market to competition, one of the requirements of the consent decree was equal access: the ability for subscribers to use competitive long-distance carriers as easily as AT&T.[312] This meant the creation of a database system identifying the presubscribed interexchange carrier ("PIC") for each subscriber, and mechanisms in the network to route long-distance calls to that carrier's network.[313] Equal access was a requirement imposed on AT&T, but it set a precedent for later coordination mechanisms.

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301. *See id.* at para. 117 n.283.
302. *See id.* at para. 7.
303. *See id.*
304. *See id.*
305. *Id.* at para. 2.
306. *See id.* at para. 14.
307. *See id.*
308. *See id.*
309. *AT&T Universal Service Comments*, *supra* note 243, at 33.
310. *See id.* at 28–29.
311. *See id.* at 33.
312. *See* GERALD M. BROCK, TELECOMMUNICATIONS POLICY FOR THE INFORMATION AGE 163 (1994).
313. *See id.*

Number portability refers to the opportunity for customers to take their assigned phone numbers to a new provider. This was not necessary at divestiture, because local service, where phone numbers were generally assigned, remained a monopoly. It first became an issue in the late 1980s with toll-free service, which was provided by long-distance companies. Customers who advertised toll-free numbers for their businesses, especially those with mnemonic numbers such as 1-800-FLOWERS, were unwilling to change providers if they had to obtain a new number.[314] Eliminating this requirement, however, required the creation of a new industry-wide toll-free number database.[315] Every call to a toll-free number then required a database lookup to identify the associated carrier.

The establishment of local competition after the 1996 Act necessitated a new form of portability.[316] Now it was not just toll-free numbers that required a database lookup to identify the associated carrier. Customers needed the ability to take a local phone number assigned by one carrier and "port" it to another. This meant the incumbent network operator providing the wire into their home would have to perform a database lookup before connecting every call.[317] Despite the technical difficulty involved, such a system was in fact deployed and operated smoothly.

An IP-to-E.164 numbering database poses no major technical challenges beyond those that were successfully addressed for local number portability.[318] And the Internet technical community has for several years been developing a protocol called ENUM for mapping IP addresses to telephone numbers.[319] The issue is a collective action problem. An IP interconnection database would benefit everyone, but no individual company wants to build and pay for that infrastructure.

Moreover, any system of this type needs to meet reliability standards to ensure a seamless experience for customers. The FCC may need to play a facilitator role to ensure the creation of such a database. As a starting point, the Commission should bring together leading PSTN and VoIP providers to develop an outline of an IP interconnection database. Such a system could be operated by a neutral third party and funded through small

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314. *See* Tel. No. Portability, *First Report and Order and Further Notice of Proposed Rulemaking*, FCC 96-286, 11 FCC Rcd. 8352, para. 31 (1996) [hereinafter *Tel. No. Portability Order*].

315. *See* Provision of Access for 800 Serv., *Report and Order*, FCC 89-106, 4 FCC Rcd. 2824 (1989).

316. *See Tel. No. Portability Order*, *supra* note 314, at para. 31.

317. *See id.* at para. 15.

318. *See* Geoff Huston, *ENUM—Mapping the E.164 Number Space into the DNS*, INTERNET PROTOCOL J., June 2002, at 13, *available at* http://www.cisco.com/web/about/ac123/ac147/archived_issues/ipj_5-2/enum.html.

319. *See generally* McTaggart, *supra* note 295; Huston, *supra* note 318; Memorandum from Patrik Faltstrom on E.164 Number and DNS (Sept. 2000), *available at* http://www.ietf.org/rfc/rfc2916.txt (defining the ENUM protocol).

minimal charges on each call, along the lines of the PSTN number portability mechanisms.[320]

3. Reliability

Reliability is essential for critical infrastructure such as the telecommunications network. No network is perfectly reliable, especially one as complex as the PSTN. Increasing reliability also imposes costs, and the most reliable network may not be worth it in terms of the added expense passed on to subscribers. Today, when most Americans have mobile phones in addition to (or instead of) their landline PSTN connections, as well as potentially other communications alternatives, the PSTN may not be the one essential network it once was. Nonetheless, some baseline level of service is necessary to ensure public safety and emergency connectivity. The FCC convened the Communications Security, Reliability and Interoperability Council ("CSRIC"), a federal advisory committee, to bring together major network operators to develop reports and recommendations on reliability-related matters. The CSRIC's charter was recently renewed through March 2015. [321]

In recent years, weather-related events have caused significant disruptions of PSTN functionality. For example, in June 2012, an unusual windstorm called a derecho disrupted communications networks in the area near Washington, D.C. [322] Subsequently, Superstorm Sandy caused widespread devastation throughout the East Coast.[323] In both cases, the FCC investigated how networks fared and developed recommendations to ensure that customers would not face unnecessary outages in times of significant need.[324] Other possible causes of significant outages are surges in demand and the interconnection of the traditional TDM network infrastructure to new IP-based networks.

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320. The North American Numbering Plan for telephone numbers, for example, is administered by a private company, Neustar, pursuant to an FCC selection and oversight process. *See* Press Release, Neustar, Neustar Awarded North American Numbering Contract for a Third Term (June 18, 2012), *available* http://www.neustar.biz/about-us/news-room/press-releases/2012/neustar_awarded_north_american_numbering_contract_for_a_third_term#.UvRIrEJdVfk.

321. FCC Announces Membership of the Commc'ns Sec., Reliability, & Interoperability Council, *Public Notice*, DA 13-985 (2013), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-13-985A1.pdf.

322. PUB. SAFETY & HOMELAND SEC. BUREAU, FCC, IMPACT OF THE JUNE 2012 DERECHO ON COMMUNICATIONS NETWORKS AND SERVICES: REPORT AND RECOMMENDATIONS 18 (2013), *available at* http://transition.fcc.gov/Daily_Releases/Daily_Business/2013/db0110/DOC-318331A1.pdf.

323. FCC Announces Date and Locations for the First Post-Superstorm Sandy Field Hearing, *Public Notice*, DA 13-19, (Jan. 2013), *available at* http://transition.fcc.gov/Daily_Releases/Daily_Business/2013/db0108/DA-13-19A1.pdf.

324. *See id.*

The FCC should ensure that the industry is able to articulate and adhere to appropriate reliability standards for the post-PSTN network. The Internet was traditionally a "best efforts" network, meaning that service quality levels were not guaranteed.[325] As the Internet has grown and become more of a foundation for commercial activity and real-time voice or video services, operators have engineered their networks to enhance reliability. However, when IP-based networks are used to provide critical services such as telephony, the stakes are raised.

The FCC has already required interconnected VoIP providers to report outages.[326] It should reconstitute an advisory committee on network reliability, along the lines of the old Network Reliability and Interoperability Council ("NRIC"), to identify emerging issues associated with the PSTN transition. An industry-based group may be able to address network reliability on a voluntary basis, but FCC initiative will be required for all major network operators to participate.

A related reliability issue concerns battery backup.[327] The copper wires used for the PSTN are self-powered. Telephone companies provide power for the telephone system directly over the lines.[328] They run their own backup generators that operate even when the public power grid goes down. This is important in natural disasters. VoIP systems are not self-powered. They rely on the commercial power grid to power devices at the customer premises.[329]

Therefore, to keep a connection operating when the power goes out, these systems generally provide local battery backup.[330] For example, Verizon's Voice Link product deployed on Fire Island promises battery backup for two hours of talk time and thirty-six hours of standby time.[331] Whether that level is sufficient is a public policy question. Leaving the decision of whether and how long to provide battery backup to each operator will not ensure that customers can count on their phone service in emergencies.

IV. TRANSITION MECHANISMS

Interconnection and coordination form the basis for a regulatory approach that meets the enduring policy needs of the post-PSTN

325. *See* Werbach, *supra* note 114, at 1832.

326. *See Part 4 Extension to VoIP Order*, *supra* note 134, at paras. 56–57.

327. *See* DAVID GABEL & STEVEN BURNS, NAT'L REGULATORY RESEARCH INST., THE TRANSITION FROM THE LEGACY PUBLIC SWITCHED TELEPHONE NETWORK TO MODERN TECHNOLOGIES 17–19 (2012), *available at* https://prodnet.www.neca.org/publicationsdocs/wwpdf/111212nrri.pdf.

326. *See id.* at 16.

329. *See id.*

330. *Id.* at 17–18.

331. *Fire Island, NY*, VERIZON (Feb. 6, 2014, 11:11 PM), http://www22.verizon.com/about/community/fireislandny.htm.

communications environment. The practical challenge now facing the FCC is how to cross the Rubicon from the current PSTN to that world. An orderly transition is essential to ensure that subscribers are not excessively harmed by the changeover from TDM to IP. Two mechanisms can help: the section 214 approval process, and a date-certain deadline.

A. Section 214

1. The Approval Requirement

Section 214(a)(3) of the Communications Act states, "No carrier shall discontinue, reduce, or impair service to a community, or part of a community, unless and until there shall first have been obtained from the Commission a certificate that neither the present nor future public convenience and necessity will be adversely affected thereby." [332] Under this provision, carriers cannot shut down their networks without authorization from the FCC.[333] Doing so would violate the PSTN's social contract, by potentially leaving subscribers with no viable communications option.

Of course, network operators are not proposing to cease operations due to the PSTN transition; rather, they are asking to shut down the legacy PSTN and transfer customers to new IP-based platforms. For instance, AT&T argues that it needs no section 214 authorization to decommission PSTN equipment, because it will not "discontinue, reduce, or impair service" in the process. [334] Instead, it claims, it intends to replace inferior circuit-switching equipment with superior IP-based connections.[335] AT&T supports its claim by pointing out that section 214(a)(3) emphasizes that no authorization is required for changes "which will not impair the adequacy or quality of service provided." [336]

It bears noting that despite their claims that section 214 does not apply, both AT&T (through its proposal for field trials) and Verizon (through its petition for approval of its actions on Fire Island) formally requested FCC approval. It remains to be seen whether the carriers would challenge a negative decision by the FCC in court, but neither company has yet been willing to test its legal claim.

Contrary to the network operators' assertions, IP-based networks are not inherently superior to the TDM-based infrastructure of the PSTN. The question is not the novelty of the underlying technology, but the nature of

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332. 47 U.S.C. § 214(a)(3) (2006).

333. *See id.*

334. *See* AT&T Petition, *supra* note 41, at 13 ("AT&T believes that this provision is simply inapplicable where a carrier transitions from legacy TDM-based services to superior IP-based ones . . . .").

335. *Id.* at 8, 13.

336. *See id.* at 14; 47 U.S.C. § 214(a)(3) (2006).

service offerings available to customers. IP may be a better overall technology than TDM, but that does not mean that every IP-based connection offers superior performance to every TDM connection. A change could be "impairment" subject to section 214 authorization even if the replacement is more efficient and potentially more functional overall, so long as the service customers receive is inferior in some respects to what they had before.

Indeed, Verizon's Voice Link product deployed on Fire Island fails to support numerous services that could be used through the wired PSTN[337]:

- Medical alert home monitoring services
- Telecommunications relay service for the deaf and hard of hearing
- Digital Video Recorder ("DVR") program guide downloads
- Credit card processing terminals for small businesses
- ATM machines for small businesses
- Home alarm monitoring
- Calling to 900-number (paid) services
- Collect calls
- Calling cards or other dial-around calls
- International dialing (without a supplemental plan)

In effect, Voice Link turns a home into a big mobile phone. This also means that it has the same capacity and reliability limits as a wireless device. Voice Link does not provide its own power for backup, relying instead on batteries that last thirty-six hours.[338] And though it provides E911 emergency service, the terms of service for Voice Link expressly disclaim liability for E911 connection failures.[339]

Verizon initially delayed filing a section 214 application with the FCC for Fire Island, but it eventually did so.[340] As Verizon appears to have acknowledged by its FCC filing, Voice Link was in many ways an impairment of the service its customers on Fire Island previously received.[341]

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337. *New Networks: Plain Old Telephone Service (POTS) vs. Verizon Voice Link Wireless*, TELETRUTH, http://teletruth.org/POTSvsvoicelink.pdf (last visited Feb. 6, 2014).

338. *See* Bookman, *supra* note 58. As noted, the battery power can be extended by the customer by replacing three ordinary AAA batteries. *See id.*

339. VERIZON, VERIZON VOICE LINK: TERMS OF SERVICE 5–6 (2103), *available at* http://www.verizon.com/idc/groups/public/documents/adacct/fire_island_ny_voice_link.pdf.

340. Section 63.71 App'n of Verizon N.Y. Inc. & Verizon N.J. Inc. to Discontinue the Provision of Serv., FCC WC Docket No. 13-150 (rel. June 12, 2013).

341. Verizon's subsequent decision to deploy its FiOS fiber optic service to Western Fire Island residents as an alternative can be taken as a further acknowledgement that Voice Link is not a comparable offering to the legacy wireline network. *See supra* note 65.

This does not necessarily mean the switch should be prohibited. Verizon will have to invest significant capital to deploy its wireline FiOS service on Fire Island, a community with a small number of mostly seasonal customers.[342] With the potential exception of service guarantees for E911 connections, none of the limitations of Voice Link are elements of the minimal required functionality defined for universal service purposes.[343] The Communications Act does not direct the FCC to ensure that telecommunications service levels never decline; it merely requires a showing that a significant change of this sort, on balance, serves the public interest.[344]

The terms of section 214 approval for termination of legacy PSTN service will not be resolved over Fire Island. After announcing that it would deploy FiOS on the island as an alternative to Voice Link, Verizon withdrew its petition to the FCC.[345]

2. Cutting the Regulatory Gordian Knot

The FCC should clarify that section 214 approval is required for any transition from the PSTN to IP or other forms of service that result in some functions or activities no longer being supported. Approval should also be required whenever a change no longer provides the same reliability or support, such as backup power, that customers previously enjoyed. Such a requirement will force carriers to be explicit about their plans and the implications for subscribers. The execution of this public process creates incentives, a record, and the opportunity for comment to protect important public policy interests in the inevitable transition from the PSTN.

Beyond that, the section 214 process is not just a mechanism to determine if changes meet the public interest test. It offers a way to cut through the Gordian knot of legal uncertainty surrounding the FCC's authority over broadband. Section 214 is tied to the old network, so it requires no resort to ancillary authority or other fancy legal footwork to justify regulatory action.[346] So long as the impairment test is met, approval is a clear statutory requirement for any carrier that currently offers PSTN service.[347]

The FCC should declare that section 214 approval for terminating PSTN service and replacing it with IP-based or wireless alternatives

342. *See* Scott Moritz & Todd Shields, *Fire Island Becomes Test Case as Verizon Abandons Copper*, BLOOMBERG TECH. (July 9, 2013, 4:31 PM), http://www.bloomberg.com/news/2013-07-08/fire-island-becomes-a-test-case-as-verizon-abandons-copper-tech.html.

343. *See Joint Bd. on Universal Serv. Report and Order*, *supra* note 91, at para. 61.

344. *See* 47 U.S.C. § 214(c) (2006).

345. Letter from Maggie McCready, Vice President, Verizon, to Marlene H. Dortch, Sec'y, FCC (Sept. 11, 2013), *available at* http://apps.fcc.gov/ecfs/document/view?id=7520942941.

346. 47 U.S.C. § 214 (2006).

347. *Id.*

includes a set of affirmative commitments related to interconnection, coordination, and social obligations. Specifically, operators should commit to the following:

- Offer interconnection on commercially reasonable terms, subject to a backstop arbitration mechanism and a requirement to disclose terms of signed interconnection agreements.
- Participate in coordination mechanisms for PSTN-to-IP numbering integration and network reliability.
- Continue to meet social obligations previously mandated by the FCC for interconnected VoIP, such as E911 service, universal service contribution, and disability access.

The rationale for each of these obligations has been developed earlier in this article. Mandatory interconnection, using a loose standard analogous to the FCC's data roaming rules, ensures that the universal connectivity at the heart of the PSTN is not abandoned in the IP transition. An arbitration process prevents the FCC and state regulators from getting too bogged down in setting terms for specific interconnection agreements when parties are unable to reach agreement. A mechanism such as the "baseball-style" process in which each party offers a best and final proposal, and the arbitrator chooses between them, creates strong incentives for both sides to deal in good faith.[348] Making interconnection agreements public provides data for regulators to assess market performance and aids the development of best practices and customary terms. [349]

These terms could be set as default or presumptive obligations that the FCC would recognize as meeting the public interest test. Network operators could propose alternative mechanisms of achieving similar goals. Or they could argue that the default requirements were infeasible or counterproductive under the specific circumstances of their application. It may be reasonable, for example, to make accommodations in rural areas.

There is precedent for using the FCC's approval authority to fashion substantive rules that define industry structure and ensure important public interest obligations continue to be achieved. The FCC must approve all significant telecommunications mergers involving either common carriers

348. *See* Mark Lemley & Carl Shapiro, *A Simple Approach to Setting Reasonable Royalties for Standard-Essential Patents* (Stanford Pub. Law Working Paper No. 2243026, 2013), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2243026 (explaining the benefits of baseball-style arbitration).

349. The network operators are likely to complain that disclosure of interconnection terms would reveal proprietary information. However, it is difficult to see how this would be the case. PSTN interconnection agreements are public. And many large backbone networks, including those owned by broadband access providers, such as AT&T, Verizon, and Comcast, already publish their peering policies for exchange of IP traffic, even though they are not required to do so. *See* Norton, *supra* note 239.

or transfer of spectrum licenses.[350] Often, mergers raise a variety of complicated competitive issues. The FCC in recent years has often attached conditions to its approval of such mergers.[351] The FCC's expansive use of merger conditions has been criticized as an invitation for unconstrained regulatory and political meddling.[352] The primary objection, however, has been the use of conditions or concessions not directly tied to the competitive issues at hand.[353]

In the PSTN transition, the proposed requirements go directly to the public interest objectives underlying the section 214 requirement. The reason carriers must petition for approval to impair or terminate service is so that customers are not left in the lurch. Interconnection and coordination requirements are narrowly tailored, as described above, to preserve the essential aspects of the PSTN while allowing the unnecessary legacy requirements to wither away.

B. Date Certain

In discussions about the PSTN transition, the FCC TAC has suggested a "date certain" at which point the FCC would formally decommission the old network, typically set at 2018.[354] Network operators such as AT&T have endorsed a date certain for the PSTN transition.[355] The Commission itself has not taken up this suggestion.

A date certain would focus industry attention on the transition and potentially facilitate an orderly transition schedule.[356] It might allow network operators and others to make plans with certainty about the future environment.[357] However, there is some vagueness on what exactly a date certain means.[358] The concept evokes a strong analogy to the recent digital television transition.

In the transition to digital broadcast television ("DTV"), Congress adopted a date-certain mandate when it became clear broadcasters were

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350. *See* Thomas Koutsky & Lawrence Spiwak, *Separating Politics from Policy in FCC Merger Reviews: A Basic Legal Primer of the Public Interest Standard*, 18 COMMLAW CONSPECTUS 329 (2009).

351. *See id.*

352. *See id.* at 330.

353. *See id.*

354. Om Malik, *When Will the (Traditional) Telephone Hang Up?*, GIGAOM (July 7, 2011, 9:30 AM), http://gigaom.com/2011/07/07/when-will-the-traditional-telephone-hang-up/; Bernie Arnason, *Bye-Bye PSTN. It's Been Real*, TELECOMPETITOR (July 6, 2011, 12:22 PM), http://www.telecompetitor.com/bye-bye-pstn-its-been-real/; TECH. ADVISORY COUNCIL, *supra* note 39.

355. *See AT&T Universal Service Comments*, *supra* note 243.

356. *See* TECH. ADVISORY COMM., CRITICAL LEGACY TRANSITION WORKING GRP., *supra* note 78, at 3–4.

357. *See id.*

358. *See* Arnason, *supra* note 354.

unlikely to change over without it.[359] After some wrangling, Congress set a hard deadline of February 17, 2009, after which television broadcasters could no longer transmit on their original analog frequencies, which they were required to return to the FCC for re-auctioning.[360] The hard deadline for the transition was important to focus efforts and ensure the necessary investments as well as consumer education took place.

There are, however, significant differences between DTV and the PSTN. The DTV transition involved strong network effects.[361] It only made sense for broadcasters to invest the resources to switch when enough customers owned digital televisions or converters, but those purchases only made sense for viewers when there was enough digital programming on the air. [362] With the PSTN transition, customers do not necessarily have to throw away their existing equipment. Moreover, broadcasters didn't foresee substantial additional revenue from the digital broadcasts, so their private incentives to make the necessary upgrade investments were limited.[363] By contrast, telephone companies have strong incentives to switch to IP, even without the potential regulatory freedom it provides. Finally, the FCC played a necessary role in approving the technical standard for digital broadcasting, which was tied to broadcasters' FCC-granted spectrum licenses.[364]

The precise meaning of a date certain for the PSTN transition is unclear. In the DTV context, broadcasters shut down one form of transmission and turned on another. Network operators, however, can move from the PSTN to IP on the same physical facilities. More importantly, those operators do not lack incentives to make the changeover; rather, the public policy concerns involve the potential negative consequences for customers, competitors, and other providers when they make the transition.

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359. Balanced Budget Act of 1997, Pub. L. No. 105-33, § 3003, 11 Stat. 251, 265 (1997).

360. *See* Digital Television Transition and Public Safety Act of 2005 ("DTV Act"), Pub. L. No. 109-171, §§ 3001–3013, 120 Stat. 4, 21–28 (2006). In the end, the deadline was pushed back to June 12, 2009, when last-minute concerns arose about readiness for the transition. *See* DTV Delay Act, Pub. L. No. 111-4, 123 Stat. 112 (2009) (extending the deadline).

361. *See generally* Lemley & McGowan, *supra* note 130 (discussing network effects).

362. *See generally* JOEL BRINKLEY, DEFINING VISION: HOW BROADCASTERS LURED THE GOVERNMENT INTO INCITING A REVOLUTION IN TELEVISION (1997) (describing the perspectives of broadcasters leading up to the DTV transition mandate); NUECHTERLEIN & WEISER, *supra* note 1, at 395–406 (using the DTV transition as a case study for issues in government intervention in standard-setting).

363. *See* NUECHTERLEIN & WEISER, *supra* note 1, at 398; James Miller & James E. Prieger, *The Broadcasters' Transition Date Roulette: Strategic Aspects of the DTV Transition*, 9 J. ON TELECOMM. & HIGH TECH. L. 437 (2011) (analyzing strategic and cost factors for broadcasters in the transition to DTV).

364. *See* Advanced TV Sys. & Their Impact Upon the Existing TV Broad. Serv., *Fourth Report and Order*, FCC 96-493, 11 FCC Rcd. 17771, paras. 4–7 (1996) (adopting the DTV standard).

AT&T's proposal for a date certain PSTN transition is that, after a certain date, service providers could no longer request TDM interconnection.[365] In other words, section 251 interconnection obligations would end at that time. Of course, in AT&T's view, the FCC has no authority to impose interconnection obligations on IP networks.[366] To AT&T, therefore, the PSTN transition means the full deregulation of interconnection.

A better approach is to view the date certain not in terms of the rights of competitors, but in terms of the obligations of incumbents. At the sunset date of the PSTN, traditional telecommunications providers meeting the IP interconnection, coordination, and social contract obligations identified in connection with the section 214 process above would be freed from obligations associated with the legacy PSTN. For the primarily rural carriers who are less eager to transition their networks voluntarily, the FCC could transition universal service funding support to be available only to carriers who move to IP. Legacy TDM interconnection obligations could be removed so long as viable IP interconnection options were available as an alternative.

The exact details of the "zero day" for the PSTN transition could be worked out with significant input from a multi-stakeholder body. The date should be set far enough ahead so that all industry participants have a reasonable opportunity to work through issues and implement any needed changes to their systems. This may be particularly challenging in rural areas. On the other hand, it might be possible to allow early termination of the PSTN in areas where sufficient arrangements are in place, along the lines of AT&T's proposed "all-IP" trials.[367]

V. CONCLUSION

The PSTN is going away. This should be an opportunity to rejoice, but not to abandon the public policy objectives the PSTN has served for so long. A smooth transition from the PSTN to the all-IP future requires a conscious effort to identify those features of the legacy regime that should be preserved, those that should be reformulated, and those that should be abandoned. The best way to do so is to examine closely what the PSTN offers, and then distinguish aspects that are historical accidents from those that should apply regardless of the prevailing technology or market conditions.

Though it may appear the FCC has painted itself into a regulatory corner with its classification of broadband as an information service, it retains sufficient power to adopt a workable framework for a post-PSTN

365. *See AT&T Universal Service Comments*, *supra* note 243, at 5.
366. *Id.* at 34.
367. *See* AT&T Petition, *supra* note 41, at 20.

world. Such a structure would most easily be implemented through the section 214 approval process, although it would likely also involve some measures based on ancillary authority. The FCC should oversee transition based on the principles of interconnection, coordination, and preservation of important social obligations. How the FCC manages this process is the most important task it faces for the future of wireline communications networks.