

Mandatory Interconnection: Should the FCC Serve as Internet Traffic Cop?



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Since the agreement between Comcast and Netflix was struck in February 2014, several parties have called on the Federal Communications Commission (FCC) to regulate dealings between networks that comprise the Internet generally, and to dictate the terms of interconnection by Internet service providers (ISPs) in particular. This Policy Brief considers the costs and benefits to consumers if the FCC interferes with the terms under which ISPs connect with transit providers, content providers, and others. A key lesson from the economics literature that informs this question is that antitrust enforcement acts as a substitute for sector-specific interconnection obligations in industries that have made sufficient progress along the “deregulatory arc.” Because the communications sector was set on a deregulatory path nearly 20 years ago, has the time come to rely on anti-trust to adjudicate interconnection disputes on the Internet?

Introduction

To date, interconnection agreements between the networks that comprise the Internet have been privately negotiated without a regulatory backstop.¹ The vast majority of these negotiations have gone down without a hitch. Some notable interconnection disputes in the United States involved Cogent-AOL (2002), Cogent-Level 3 (2005), and Cogent-Sprint (2008).² While transit companies such as Cogent and Level 3 have complained about the quality of interconnection with certain Internet service providers (ISPs),³ consumers have largely been unaffected; rarely does a dispute turn into a prolonged service disruption for customers. Yet the question of the FCC’s role in dealings among these “core” networks is front and center inside the Beltway.

The interconnection controversy is playing out as the FCC grapples with new rules to “Protect and Promote an Open Internet,”⁴ which are designed to protect “edge” providers such as content providers, application providers, and device makers. In its May 2014 Notice of Proposed Rulemaking, the FCC tried to distinguish interconnection from so-called “net neutrality” issues:

Separate and apart from this connectivity [to the Internet by the ISP] is the question of interconnection (‘peering’) between the consumer’s network provider and the various networks that deliver to that ISP. That is a different matter that is better addressed separately. Today’s proposal is all about what happens on the broadband provider’s network and how the consumer’s connection to the Internet may not be interfered with or otherwise compromised.⁵

Although the Open Internet proposals are designed to address the management of traffic *within* an ISP’s network, the FCC also seeks comment on how it can ensure that an ISP “would not be able to evade [its] open Internet rules by engaging in traffic exchange practices that would be outside the scope of the rules as proposed.”⁶ The issue is clearly timely and ripe for resolution.

Some scholars have advocated for greater FCC involvement in interconnection disputes. For example, Werbach (2014) suggests that the FCC’s mobile-data-roaming order could serve as a regulatory template for compelling interconnection on the Internet.⁷ Under this approach, networks could negotiate terms for interconnection; where conflicts arise, the FCC would provide a backstop for dispute resolution.⁸ Narechana and Wu (2014) advocate that the FCC classify the ISP’s transfer of data from content providers to consumers as a telecommunications service, subject to “common carrier” regulation.⁹ The authors argue that “because such sender-side regulation focuses on incoming traffic, it also provides a useful framework for addressing interconnection disputes between broadband carriers and content providers.”¹⁰ This more invasive approach would give the FCC power to compel interconnection without need for voluntary negotiations, and interconnection rates could be set by regulatory fiat.

Missing from much of this debate is an analysis of the social costs and benefits associated with mandatory interconnection. This Policy Brief seeks to identify these effects from the consumers’ vantage and offers an economic principle that may guide policymakers to a narrowly tailored solution. In their review of interconnection obligations across several network industries, Carlton and Picker (2006) explain that sector-specific interconnection obligations and antitrust enforcement serve as *complements* in partially deregulated industries; in fully deregulated industries, antitrust enforcement acts as a *substitute* for sector-specific interconnection obligation.¹¹ Because the communications sector was set on a deregulatory path nearly 20 years ago, has the time has come to rely on antitrust to adjudicate interconnection disputes on the Internet?

Is There a Case for Mandatory Interconnection?

The original basis for mandatory interconnection was to address a monopoly problem in long-distance service. In particular, interconnection was designed to provide ubiquitous coverage by supporting independent local networks in their dealings with a dominant long-distance network.¹² The 1934 Act required interconnection only if the FCC found that it would be in the public interest.¹³ The gen-

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eral duty to interconnect did not arise until the modern era, and began with mandatory interconnection for complementary offerings such as equipment or long-distance services.¹⁴ The 1996 Act imposed interconnection obligations on providers of local telephone services with horizontal rivals. During the late 1990s, regulators were concerned about interconnection among backbone providers, under the rationale that a large provider may have less incentive to interconnect with smaller rivals; without interconnection, customers may have an incentive to buy service from the largest provider with the best-connected network, risking monopolization of the industry.¹⁵

The 1996 Act set the communications industry on a deregulatory path, with the aim of spurring competitive entry into local voice and video services. As developed more fully in Part IV, whether a sector-specific interconnection obligation is still needed for communications depends on our progress along the “deregulatory arc.”¹⁶ To the extent that such an obligation was designed to address a monopoly problem, absence of a monopoly and evidence of competitive supply suggests mandatory interconnection regulations are unnecessary. And if that original basis is eroded, is there some alternative basis for mandatory interconnection not rooted in monopoly power?

Before exploring an alternative basis, let’s quickly dispose of the monopoly justification. While we may not have arrived at some competitive nirvana, there is no debate as to whether the communications market may be fairly characterized as a monopoly nearly 20 years after the 1996 Act. The majority of residential voice service has shifted to wireless networks,¹⁷ and prices for those voice services have been steadily declining over time. According to the FCC’s most recent data, monthly average revenue *per unit* for wireless service declined from \$48.04 in 2006 to \$46.63 in 2011;¹⁸ wireless voice revenue *per minute* has declined from \$0.06 to \$0.05 over the same period.¹⁹ And voice revenue per minute in the United States (\$0.033) is less than one third of the European average.²⁰ Residential consumers can choose among three technologies—wireless, telephone-based VOIP, or cable-based VOIP—for voice service, and can choose among four nationwide providers of wireless voice service.

Broadband data prices are harder to pin down, but the evidence is also inconsistent with monopoly. According to a 2010 survey by Pew Research, the average price for broadband service was roughly \$41 per month.²¹ A 2013 study by ITIF estimated the average price of a connection with 5 to 20 Mbps was \$35.33 per month, which ranked favorably compared to other countries.²² Cable modem providers compete with fiber-based telcos (including fast variants of DSL) capable of delivering download speeds in excess of 6 Mbps in the vast majority (about 71 percent) of U.S. households,²³ leaving about 27 percent households with a choice between cable modem and slow variants of DSL (and another two percent with none). And when wireless networks are overlaid on wireline networks, less than four percent of U.S. homes were beholden to a single provider of broadband service capable of delivering download speeds of 6 Mbps as of December 2012.²⁴ To

the extent that mobile broadband or DSL restrains the price of cable modem service,²⁵ monopoly provision is moot.

Given the massive economies of scale in the supply of broadband, there should be no expectation of myriad suppliers. Fortunately, empirical evidence suggests that entry by a *single* broadband provider generates significant price effects. Using a regression model on an FCC dataset on residential broadband subscribership and speeds at the census tract level, Wallsten and Mallahan (2010) demonstrated that prices for cable modem service were up to \$4.84 per month lower where cable faced an overbuilder (a firm that builds a rival broadband delivery system for the same set of consumers).²⁶ They also found that cable modem speeds were faster in the overbuild areas.²⁷ These results suggest the competitive outcomes are achievable with a modest degree of entry, which will likely be realized through a combination of fiber-based and wireless broadband.

Finally, the market for business customers appears to be increasingly competitive. Cable providers are making inroads in the Ethernet segment of the business broadband market. According to *Cable Industry Insider*, cable operators provided one quarter of the U.S. Ethernet services by the end of 2012, and cable's share is expected to reach one third (and even higher in metro areas) over the next few years.²⁸ According to another survey by Vertical Systems, by mid-2013, cable providers accounted for one fifth of the total U.S. Ethernet retail port base; indeed, cable operators installed more new retail Ethernet ports than the big telcos over the first six months of 2013.²⁹

In light of this evidence, it is a stretch to defend an interconnection obligation as a means to address monopoly. But perhaps there is some other compelling basis for interconnection not rooted in monopoly? Werbach (2014) offers a number of alternative reasons for why mandatory interconnection is needed in the Internet era. Citing several notable interconnection disputes, he argues the mandatory interconnection serves as an “anti-fragmentation policy” that prevents service disruptions, reduces transaction costs, and fosters efficient integration.³⁰ He points out that the Comcast-Level 3 kerfuffle took three years to hammer out (although a standstill agreement preserved the flow of traffic in the interim),³¹ and that some Verizon customers may have experienced degraded service before Verizon resolved its dispute with Cogent by upgrading port capacity on certain interconnection links.

In addition to these benefits, Werbach notes two other bases for mandatory interconnection that may exist even in reasonably competitive industries. The first, which he refers to as the “terminating-access-monopoly” problem,³² suggests that even if there are choices for ISPs, conditional on a customer's choosing a particular ISP, a network seeking to deliver data to that ISP's customers needs access for the handoff. In the absence of an interconnection obligation at commercially reasonable rates, the ISP could exercise market power.³³ Second, Werbach explains that, even in the absence of monopoly, mandatory interconnection ensures uni-

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versal connectivity, particularly in rural areas where some broadband access is lacking.³⁴

Of these bases, the most compelling benefit of mandatory interconnection is the reduction in the length of service reductions.³⁵ For example, Cogent attributed the following disruption in Boston to its failure to reach an interconnection agreement with Comcast:

The resulting traffic jam hurt Comcast subscribers and Cogent customers. For example, one of our business customers in the Boston area has many employees who telecommute from home. Those employees with Comcast Internet service at home experienced problems accessing and using their company’s network because of the traffic jam.³⁶

The Sprint-Cogent dispute in 2008 reportedly interfered with certain users’ (whose ISPs relied on Cogent) ability to send emails to or access the websites of other users (whose ISP relied on Sprint) and vice versa.³⁷ The table below lists the major interconnection disputes in the United States, as well as the associated impact on Internet customers.

Major U.S. Interconnection Disputes

Parties	Year	Service Disruption	Service Outage
Cogent-AOL	2002	“left several educational institutions without service”	7 days
Cogent-Level 3	2005	“blacked out connections between their customers”	3 days
Sprint-Cogent	2008	“no longer possible for many Sprint customers and Cogent customers to directly communicate across the Internet”	4 days
Comcast-Level 3	2010	No evidence of customer impact	0 days
Verizon-Cogent	2013	“many Verizon customers had serious trouble connecting to websites that rely on Cogent for Internet connectivity”	0 days
Comcast-Cogent	2014	“employees with Comcast Internet service at home experienced problems accessing and using their company’s network”	0 days

Sources: Karl Bode, AOL. Cogent Peering Spat, DSL Reports, Dec. 31, 2002; Level 3, Cogent resolve peering dispute, renew deal, Computer World, Oct. 28, 2005; Cogent becomes transit-free, renesys.com, June 26, 2008; Sprint, Cogent Resume Peering, Keep Arguing, Data Center Knowledge, Nov. 2, 2008; Brian Stelter, Netflix Partner Says Comcast ‘Toll’ Threatens Online Video Delivery, New York Times, Nov. 29, 2010; April Glaser & Seth Schoen, Peering into the Soft Underbelly of Net Neutrality, Electronic Frontier Foundation, Feb. 19, 2014; Schaeffer Testimony at 6.

Three of the major interconnection disputes did not lead to service outages, and even those that did were resolved within a week. There is no doubt, however, that such disruptions could be costly assuming they are not resolved quickly.

When assessing the purported benefits of mandatory interconnection, the relevant question is whether the likelihood that such a disruption will occur in the absence of a regulatory obligation is significantly greater than zero. Stated differ-

ently, of the 250-plus exabytes of projected U.S. IP traffic during 2014,³⁸ what fraction is at risk of being disrupted given the likelihood of an interconnection dispute? One estimate of that probability is the historical frequency of disputes that lead to service disruptions.³⁹ Based on the data in the above table, the historical disruption rate seems very small. If so, then no matter what the associated disruption costs, the *expected* cost of not imposing an interconnection obligation is likely small. Moreover, to the extent that having a regulatory backstop to air one's grievances causes access-seeking networks to drive a harder bargain, mandatory interconnection could perversely increase the likelihood of disputes.⁴⁰

Finally, the cost of adjudicating these disputes must be netted out of the social benefits. The adjudication costs may not be trivial: For example, the dispute resolution process could get bogged down over the appropriate price for interconnection, raising the cost of adjudication. Should the rates be cost-based (like TDM interconnection) or inversely related to elasticities (a la Ramsey pricing)? Baseball-style arbitration of the kind endorsed by Werbach requires the existence of (competitive) market comparables to determine fair-market value. It is not clear whether any obvious comparables exist. And to the extent that state public utility commissions are involved in setting rates, as they were in the interconnection proceedings associated with implementing the 1996 Act,⁴¹ the costs of adjudicating disputes could be even greater. It is a mistake to presume that regulator-driven interconnection arrangements are always more efficient than commercial ones, particularly when regulators have no way of knowing what solutions are most efficient.

The Social Costs of Government-Mandated Interconnection Obligations

Against these suggested benefits, one must weigh the social costs of imposing mandatory interconnection obligations on ISPs. It is beyond the scope of this Policy Brief to quantify all of these costs. Enumerating and categorizing them, however, may be helpful.

First, mandatory interconnection could undermine the incentive of ISPs to expand or enhance broadband networks. To use Werbach's Montana-roaming example,⁴² if one mobile carrier covered the northern part of the state, and a second mobile carrier covered the southern part, the best outcome for consumers would be an invasion of each network into the other's territory—duopoly is better than monopoly. But if interconnection rates are mandated at zero (or sufficiently below the incremental cost of self-provision), it may not pay for either carrier to expand its network. Some have blamed mandatory roaming for Sprint's and T-Mobile's decision not to build out in high-cost areas (but rather rely on roaming), even in Sprint's home state of Kansas.

Applied to wireline broadband networks, if a telecom believed that it could not be compensated for upgrading its capacity (either from DSL to fiber or increase the density of a fiber network) due to restrictions on what it could charge for paid

peering, then it might abandon or curtail the investment decision. The experience of mandatory unbundling in Europe has likewise shown the decreased incentive for network operators to invest in fiber. In a similar vein, interconnection-pricing rules determined on a case-by-case basis could create investment-detering uncertainty relating to the implementation of regulations. This uncertainty could be exacerbated if multiple state regulators are involved in the rate-setting process.

Second, mandatory interconnection could undermine the incentive of transit providers to extend their reach into the last mile. Just as mandatory interconnection (and unbundling) undermined the CLECs' incentive to invest in their own facilities,⁴³ regulated interconnection rates could deter transit or even content providers from building the last-mile connections. Google has started laying its own fiber in select cities through the country. And Level 3 and Cogent both offer Internet access in addition to transit and content delivery network (CDN) services. It is therefore not a stretch to consider these access-seeking network owners as potential entrants in last-mile connectivity. Any interconnection regime should carefully consider an entrant's tradeoffs in making versus buying terminating access; if the terms of buying are too generous, then deploying last-mile networks become relatively less attractive.

Third, mandatory interconnection could unravel paid arrangements between content providers and ISPs if "better terms" could be secured via intermediary networks through regulation. The most likely explanation for why Netflix's CEO advocated for "strong net neutrality" protections for Cogent and Level 3 is that, to the extent those intermediaries can secure better interconnection terms via regulation than Netflix via negotiation, Netflix could reduce its transit costs. In other words, Netflix would not get zero-price connection but Cogent might, setting up arbitrage opportunities. Regulatory uncertainty about if and when mandatory interconnection is imposed could induce large content providers such as Google and Amazon to refrain from entering paid-peering arrangements with ISPs.

A duty to interconnect is arguably more invasive than a non-discrimination requirement.

Fourth, CDNs or transit providers might not contribute significant value to certain transactions, such as those involving large content providers that have vertically integrated into "middle-mile" services. There seems to be a continuing role, however, for these intermediaries for moving or augmenting the traffic of small to medium-sized content providers. Regulatory life support for intermediaries on transitions for which they bring questionable value could attract rent-seeking behavior. Inefficiencies could arise as the regulator caters to special interests or makes mistakes.

Fifth, mandatory interconnection could reduce the incentive of two parties to reach an agreement to minimize total costs. Besen and Israel give an example in which a CDN could be relieved of \$2 million in costs so long as the ISP incurred a \$1 million investment. If the mandatory interconnection rate were set below \$1 million, the cost-saving technology would not be adopted.⁴⁴

Sixth, policies that thwart negotiations between content providers and ISPs—whether they concern quality of service or involve paid peering—could lead to higher broadband access prices via the “seesaw principle.” The economics of two-sided markets suggests that raising money from one side of the market (advertisers) puts downward pressure on prices for the other side of the market (end users). Preventing network providers from exercising pricing flexibility could increase the proportion of the network costs that providers must recover directly from end users.

Seventh, given that Netflix represents roughly one third of download traffic during peak hours,⁴⁵ the recently adopted arrangements between content providers and ISPs can be viewed as an efficient solution to the classic peak load pricing problem. While peak-load pricing is often associated with regulated utilities, it has frequently been applied in competitive industries with periodic demand fluctuations for a non-storable good. Peak-load pricing efficiently allocates the scarce resource (bandwidth at peak hours), by raising the price to those who demand it most (Friday night movie viewers). Preventing network providers from exercising pricing flexibility could force high-intensity users to be inefficiently subsidized by everyone else, causing ISPs to raise rates to end-users across the board.

Eighth, proponents of mandatory interconnection should be careful what they wish for. While they may be able to convince the FCC that it should require interconnection (at potentially a zero rate), it is unlikely that they could convince every regulator around the world of that. And once the FCC had set the precedent that these IP interconnection matters should not be left to commercial negotiations, other regulators around the globe would be free to determine the terms and rates for interconnection as they see fit, with no guarantee that regulators across the globe would successfully coordinate their policies. This, in turn, could dramatically increase regulatory uncertainty and the frequency of service disruptions.

Policy Implications

Assuming the social costs of mandatory interconnection exceed the benefits, what might some alternative, less-invasive policy look like? Two considerations are worth keeping in mind. First, the interconnection debate is not proceeding in a vacuum: The FCC is developing certain protections for content providers in its revised Open Internet rules, including non-discrimination and a no-blocking rule. A duty to interconnect is arguably more invasive than a non-discrimination requirement.⁴⁶ Non-discrimination would require ISPs to offer quality-of-service agreements to all similarly situated content providers at the same terms; by comparison, mandatory interconnection would require ISPs to deal with any content provider or transit provider that wished to terminate traffic on the ISP’s network. In other words, interconnection is a duty to deal in the first instance.

When deciding whether to overlay an interconnection obligation on top of protections for content providers, one must articulate the *incremental* benefits that are derived from the added layer of protection. To the extent that content providers

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(as well as application, service providers, and device providers) could be protected by an effective Open Internet regime, including a “minimum level of access”⁴⁷ established by the no-blocking rule, the only remaining class of providers that could benefit from mandatory interconnection would consist of intermediaries that operate at the core of the network, such as standalone CDN or transit providers. Unlike content providers, who generate positive spillovers (information and artistic content can be viewed as “public goods”) and thus cannot be expected to monetize their investment, the rationale for protecting these intermediaries is less compelling. Although these intermediaries might be marginalized in the absence of regulatory protection on transactions involving large content providers—Netflix and Google have developed their own CDNs⁴⁸—it is not clear how consumers would benefit from rules that reinserted the presence of these intermediaries. It is not even clear whether these intermediaries need interconnection revenues to thrive. For example, Level 3 acknowledged in a first quarter 2014 earnings call that Netflix is “not even in our top 30 customers, so the revenue impact is relatively small.”⁴⁹ Small and mid-sized content providers will continue to rely on third party CDNs and transit providers in the absence of mandatory interconnection.⁵⁰

Second, there is always the antitrust backstop for excluded networks. In their review of interconnection obligations across several network industries, Carlton and Picker explain that sector-specific “interconnection policies” and antitrust enforcement serve as complements in partially deregulated industries.⁵¹ In fully deregulated industries, however, antitrust acts as a substitute for sector-specific interconnection obligations.⁵² The role of mandatory interconnection has waned in network industries as they become competitive:

The deregulated network industries that we examined all show a similar pattern: after deregulation, there is massive consolidation, *a lessening of the reliance on interconnection from other firms*, a decline in either wages or employment or both, and a fall in prices with a reduction or end to any cross subsidy. Consumers benefit, special interests are harmed.⁵³

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So where does this leave us? In the absence of mandatory interconnection, content providers can deal with ISPs directly for enhanced quality of service pursuant to a paid-peering arrangement; they are free to turn down enhanced quality of service for standard treatment. As explained above, content providers may be able to avail themselves of non-discrimination protections that could come out of new Open Internet proceeding, if they can prove they are not receiving equal treatment for reasons relating to affiliation or favored status.

Transit providers, CDNs, and other intermediary networks can avail themselves of antitrust courts if ISPs refuse to deal as a means of extending their (alleged) market power into adjacent markets. In *Otter Tail*,⁵⁴ the Supreme Court found antitrust liability for an electric utility company for failure to interconnect with another utility even though the Federal Power Commission could order such interconnection. To be fair, antitrust cases do not proceed quickly. And with the exception of cases like *Aspen Skiing* and *AT&T*, antitrust rarely imposes mandatory obligations to interconnect, other than as a remedy for an independent antitrust violation. In *Trinko*, the Supreme Court recognized that antitrust has only weakly embraced affirmative duties to interconnect. Accordingly, while the path is not clear, excluded networks should have a reasonable chance of prevailing so long as they can establish monopoly power (presumably in terminating access) and antitrust impact (in the form of higher prices or reduced output in some relevant product market).

Finally, there are other ways to create a backstop without imposing a duty to interconnect. For example, Weiser (2009) proposes the development of a self-regulating organization (SRO) that wields decision-making authority and over which the FCC has authority. The SRO would act like a standard-setting body. Under this approach, the FCC must first develop norms such as requirements to provide some level of transparency over the terms of peering as well as pre-announced standards for how to “de-peer” an Internet backbone provider. Weiser suggests that matters that cannot be resolved in SRO can be appealed to the FCC.⁵⁵

Conclusion

This Policy Brief examines the benefits and costs of dictating the terms of interconnection on the Internet. Based on a preliminary review of the evidence, the benefits (net of enforcement costs) appear to be slight, whereas the costs could be economically significant. In light of these tradeoffs, the FCC should be hesitant to dictate the terms of interconnection. Additional layers of protection, including non-discrimination requirements and antitrust enforcement, as well as the continued private negotiation of interconnection, should be more than sufficient to keep the Internet humming along on all cylinders and ensure we get to see the next installment of *House of Cards* without any delay.

Endnotes

1. For an early primer on interconnection, see General Accounting Office, Characteristics and Competitiveness of the Internet Backbone Market, GAO-02-16, Oct. 2001 [hereafter *GAO Study*].
2. Cogent has been involved in similar disputes outside of the United States. See, e.g., Karl Bode, *Cogent Involved in Another Peering Dispute*, DSL REPORTS, Mar. 18, 2008 (describing dispute with Swedish telecom operator Telia). Other major interconnection disputes are described in Part II.

3. Cogent claimed that after it began carrying Netflix traffic in mid-2012, its relation with Comcast soured, at which point Comcast allegedly refused to augment capacity at Cogent's interconnection points and demanded that Cogent pay to connect to Comcast's network. *See* Written Statement of Dave Schaeffer Chairman and Chief Executive Officer Cogent Communications Group, Inc, Before the U.S. House of Representatives Committee on the Judiciary Subcommittee on Regulatory Reform, Commercial and Antitrust Law, May 8, 2014 [hereafter *Schaeffer Testimony*]. In a May 2014 blog post, Level 3 claimed that several ISPs were refusing to upgrade their peering connections for the past year. *See* Observations of an Internet Middleman, available at <http://blog.level3.com/global-connectivity/observations-internet-middleman/>.
4. Notice of Proposed Rulemaking, In the Matter of Protecting and Promoting the Open Internet, May 15, 2014 [hereafter *2014 Open Internet NPRM*].
5. *Id.* at 87.
6. *Id.* at 22. Some commenters argue that interconnection is related to "net neutrality" in the sense that ISPs "can block traffic, discriminate, or impose access fees either once traffic is within their network . . . or when the traffic is at the edge of their network (through interconnection)." *See, e.g.,* Marvin Ammori, Interconnection disputes are net neutrality issues, Apr. 7, 2014, available at <http://ammori.org/2014/04/07/interconnection-disputes-are-network-neutrality-issues-of-netflix-comcast-and-the-fcc/>. Others explain that the issues are in fact separate, and that the Netflix-Comcast dispute is highly specialized due to the unusually large amount of traffic created by a single content provider. *See, e.g.,* Marguerite Reardon, *Comcast vs. Netflix: Is this really about Net neutrality?*, CNET, May 15, 2014, available at http://www.cnet.com/news/comcast-vs-netflix-is-this-really-about-net-neutrality/?tag=nl.e703&s_cid=e703&ttag=e703&ftag=CAD090e536.
7. Kevin Werbach, *No Dialtone: The End of the Public Switched Telephone Network*, 66 FED. COMM. L. J. (2014).
8. As part of the "IP transition" from the public switched telephone network, ISPs could commit to offer interconnection on commercially reasonable terms, subject to a back-stop arbitration mechanism. Werbach further suggests that ISPs be required to disclose terms of signed interconnection agreements, and that "baseball-style" arbitration (where each party offers last-and-final proposal and the arbitrator chooses the offer closest to fair-market value) could be used to adjudicate pricing disputes. *See id.* Although *No Dialtone* addresses the need for interconnection for VOIP only, Werbach has argued for a broader mandate for all Internet traffic in prior writings. *See, e.g.,* Kevin Werbach, *Only Connect*, 22 BERKELEY TECH. L.J. 1233 (2007).
9. Tejas N. Narechania & Tim Wu, Sender Side Transmission Rules for the Internet, Filed Comments with the FCC, Apr. 14, 2014.
10. *Id.* at 2. *See also* Brian Fung, *The decades-old idea that could break the net neutrality logjam*, WASH. POST, Apr. 21, 2014 ("It's a way of giving the commission interconnection and net neutrality at the same time; we have the magic formula and it'll solve all your problems.") (quoting Wu), available at <http://www.washingtonpost.com/blogs/the-switch/wp/2014/04/21/the-decades-old-idea-that-could-break-the-net-neutrality-logjam/>.
11. Dennis Carlton & Randal Picker, Antitrust and Regulation, John M. Olin Law & Economics Working Paper (2006).
12. *No Dialtone* at 35 ("In an era of regulated monopoly, the government mandates interconnection to ensure ubiquitous service, and regulates interconnection charges to allocate costs across the network."). Some scholars view the 1913 Kingsbury Commitment as the beginning of a compact between regulator and monopolist. Under this interpretation, in return for the government's agreement not to pursue its case against AT&T as a monopolist, AT&T agreed to allow independent telephone companies to interconnect with AT&T's long-distance network.
13. Christopher Yoo, *Is There a Role for Common Carriage in an Internet-Based World*, 51 HOUSTON LAW REVIEW 545-608 (2013).
14. In the 1960s, the FCC imposed a duty to interconnect with complementary services with *Hush-a-Phone* and *Carterfone* (customer-premise equipment), and *Execunet I* and II (long-distance service). These decisions were reinterpretations of the traditional common carrier obligations. Other enforcement episodes in the modern era highlight the nexus between mandatory interconnection and monopoly. For example, in 1978, as a remedy to a monopolization claim, the D.C. Circuit ordered AT&T to interconnect with MCI's long-distance network.
15. *GAO Study* at 19.

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16. *No Dialtone* at 2 (“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 to be extended to a new world.”). It bears noting that an IP interconnection is different from PSTN interconnection because of the nature of the Internet. For example, a large content provider might connect to an ISP via hundreds of Ethernet ports in myriad locations. Accordingly, there is no clear boundary around the ISP’s network because there are so many paths between Internet exchanges and neighborhoods.
 17. According to the CDC, nearly 40 percent of U.S. homes had only wireless telephones during the first half of 2013, and another 16% received all or almost all calls on wireless telephones despite also having a landline telephone. Stephen J. Blumberg, Ph.D., and Julian V. Luke, CDC, *Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, January–June 2013*, available at <http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201312.pdf>.
 18. Federal Communications Commission, *Annual Report and Analysis of Competitive Market Conditions With Respect to Mobile Wireless, Including Commercial Mobile Services*, Sixteenth Report, Mar. 21, 2013, at 186.
 19. *Id.* at 179.
 20. *Id.* at 257.
 21. Pew Research, *Trends in Broadband Adoption*, available at <http://www.pewinternet.org/2010/08/11/trends-in-broadband-adoption/>.
 22. Richard Bennett, Luke A. Stewart, and Robert D. Atkinson, *The Whole Picture: Where America’s Broadband Networks Really Stand*, ITIF, Feb. 2013, at 49-50, available at <http://www2.itif.org/2013-whole-picture-america-broadband-networks.pdf>.
 23. Internet Access Services: Status as of December 31, 2012, Figure 5(a), available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2013/db1224/DOC-324884A1.pdf.
 24. *Id.* at Figure 5(b).
 25. Aaron Smith, “Cell Internet Use 2012,” Pew Internet and American Life Project, June 26, 2012 (www.pewinternet.org/Reports/2012/Cell-Internet-Use-2012.aspx) (showing that 17 percent of cell phone owners do most of their online browsing on their phone, rather than on a computer or other device); Joan Engebretson, “Pew: Smartphones Fueling Wireless Broadband Substitution?” *Telecompetitor*, July 11, 2011 (www.telecompetitor.com/pew-smartphones-fueling-wireless-broadband-substitution) (showing that a quarter of smartphone owners reported that for the most part they went online by using their phone rather than a computer and roughly one-third of those owners lacked a high-speed home broadband connection); Cisco, “To Prevent 15% of Customers from Cord-Cutting, Fixed Broadband SPs Consider WiFi Solutions to Deliver the Mobility Customers Seek,” October 2011 (www.cisco.com/web/about/ac79/docs/FastFacts/FastFacts_WiFi_Defense_against_BB_Cord_Cutting_Oct2011.pdf) (estimating that up to 15 percent of U.S. consumers could cut their broadband wireline in favor of a mobile data connection by 2016).
 26. Scott Wallsten and Colleen Mallahan, “Residential Broadband Competition in the United States,” BE Press Working Paper, March 2010, at 32, table 7 (http://works.bepress.com/cgi/viewcontent.cgi?article=1105&context=scott_wallsten). The authors found that cable modem prices declined between \$1.25 (cable speed tier 6) and \$4.84 (cable speed tier 5) per month when cable modem providers faced an overbuilder. Coefficients were estimated at the 1 percent significance level. In contrast, the authors found that cable modem prices did not decline significantly when cable providers faced DSL or fiber to the home providers (their “two-provider” results), suggesting either that DSL did not constrain the price of cable modem service, thereby neutralizing the impact of fiber competition, or that neither DSL nor fiber constrained the price of cable modem service. Unfortunately, the authors did not estimate the incremental price-constraining effect of fiber only.
 27. *Id.* 29.
 28. Cable Industry Insider, *Cable Operators & Ethernet: Serious Market Share (2013)*, available at http://www.heavyreading.com/cable/details.asp?sku_id=3060&skuitem_itemid=1505.
 29. Vertical Systems Group, *Mid-Year 2013 U.S. Carrier Ethernet Leaderboard*, Aug. 20, 2013, available at <http://www.verticalsystems.com/vsglb/mid-year-2013-u-s-carrier-ethernet-leaderboard/>.

30. See, e.g., David A. Malueg & Marius Schwartz, *Compatibility Incentives Of A Large Network Facing Multiple Rivals*, JOURNAL OF INDUSTRIAL ECONOMICS (2006) (“An installed-base share of at least 50% is necessary but not sufficient to make autarky [non-compatibility with rival networks] unambiguously profitable.”).
31. *Id.* at 40 (“Presumably, the companies had continued to exchange traffic the past three years under some interim arrangement, before agreeing to new terms.”).
32. *Id.* at 41 (“In other words, a network seeking to deliver video or voice content to an AT&T U-verse broadband access subscriber needs to terminate that traffic on AT&T’s network. The fact that AT&T has many broadband competitors is irrelevant once the customer has chosen a particular one. In the telecommunications market, this is known as the terminating access monopoly.”).
33. A hypothetical retail monopoly does not by itself imply that market power will be exercised in upstream interconnection. Put another way, monopoly is a necessary condition for certain anticompetitive acts, but is not sufficient.
34. *Id.* at 45 (“Clearly, the FCC recognizes that as the PSTN migrates to IP technology, the need for interconnection to ensure universal connectivity does not evaporate.”). The likely reason why PSTN interconnection terms and conditions needed to be regulated is because interconnection was mandated. An interconnection obligation can encourage certain parties to seek excessive access rates. Commercial negotiations for IP interconnection have worked well in the absence of a mandate, as no party wants to deny a commercially sensible agreement. See, e.g., Dennis Weller & Bill Woodcock, *Internet Traffic Exchange: Market Development and Policy Challenges*, OECD Digital Economy Papers at 62 (2013) (finding that the vast majority of IP interconnection agreements are carried out based on a “handshake,” compared with multi-thousand page PSTN interconnection tariffs that are often litigated).
35. The terminating-access monopoly seems to have no limiting principle: An ISP with 1 percent market share could be subjected to any number of regulatory obligations pursuant to this basis. And while ubiquitous coverage is laudable, there are more direct approaches to encouraging broadband deployment into rural areas, including subsidies.
36. Schaeffer Testimony at 6.
37. Mikael Ricknäs, *Sprint Reconnects Cogent, But Differences Are Unresolved*, NETWORK WORLD (Nov. 3, 2008), available at <http://www.networkworld.com/news/2008/110308-sprint-reconnects-cogent-butdifferences.html?fsrc=netflash-rss>.
38. Cisco Visual Networking Index, available at <http://www.ciscovni.com/forecast-widget/index.html>.
39. One economic model demonstrates that networks with a non-dominant market share have strong incentives to interconnect, suggesting that the probability of disruptions flowing from interconnection disputes is small. See, e.g., David A. Malueg & Marius Schwartz, *Compatibility Incentives Of A Large Network Facing Multiple Rivals*, JOURNAL OF INDUSTRIAL ECONOMICS (2006) (“An installed-base share of at least 50% is necessary but not sufficient to make autarky [non-compatibility unambiguously profitable.”). Their model was designed to address issues of interconnection between horizontal rivals such as instant-messaging providers or pure backbone providers; its policy implication may be limited in the case of interconnection between an ISP and a backbone provider.
40. Assume for simplicity there are two networks that have an interconnection agreement that must be renewed each year. Let p_1 and p_0 be the probability of a dispute with and without mandatory interconnection, respectively, and q be the conditional probability of a dispute leading to a service disruption. Assuming generously that an adjudication regime could drive the expected costs of service disruptions to zero, then the net benefit of mandating interconnection would be $p_0 \times q \times C - p_1 \times D$, where p_0 is the probability of a dispute in the absence of a regulatory backstop, p_1 is the probability of a dispute in the presence of a regulatory backstop, and D is the cost to arbitrate a dispute. Crediting a regime with driving the costs to zero would require that the arbitrator resolve the dispute instantaneously and thereby head off any associated disruption costs. In reality, the arbitrator would have to gather facts, build a record, and then hold a hearing. And if the arbitrator’s decision were subject to appeal, the process could take even longer. Moreover, the mandatory-interconnection regime should not be credited for heading off service disruptions associated with disputes that the regime itself created—these would be the “benefits” given by $(p_1 - p_0) \times q \times C$.
41. OECD, Working Party on Telecommunication and Information Services Policies Interconnection and Local Competition, Figure 4, available at

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- <http://www.oecd.org/sti/ieconomy/1894706.pdf> (showing that in 1999, the regulated interconnection charge for call termination on Bell Atlantic New York's network was roughly one cent per minute).
42. *No Dialtone* at 35 (“The [Montana] state troopers often had to drive 30 miles or more to get a usable signal. Public safety services were adversely affected for residents of that part of Montana. This example illustrates the power of interconnection.”). Werbach presumes that the cause of the outage was a failed roaming agreement between AT&T and Verizon. But AT&T's conversion of Alltel's CDMA network to GSM was likely to blame, as old CDMA phones used by certain Verizon customers would not work on the GSM network.
 43. Robert W. Crandall, Allan T. Ingraham & Hal Singer, *Do Unbundling Policies Discourage CLEC Facilities-Based Investment?*, 4 TOPICS IN ECONOMIC ANALYSIS AND POLICY (2004).
 44. Stanley M. Besen & Mark A. Israel, *The Evolution of Internet Interconnection from Hierarchy to “Mesh”*: Implications for Government Regulation, Tech Policy Institute (2012).
 45. Peter Kafka, *Netflix Still Eats a Third of the Web Every Night; Amazon, HBO and Hulu Trail Behind, All Things D*, May 14, 2014.
 46. Edward Wyatt, *F.C.C., in a Shift, Backs Fast Lanes for Web Traffic*, NEW YORK TIMES, Apr. 23, 2014, available at http://www.nytimes.com/2014/04/24/technology/fcc-new-net-neutrality-rules.html?_r=0.
 47. *2014 Open Internet NPRM* at 37.
 48. Richard Bennett, *Netflix and Comcast Declare Peace*, High Tech Forum, Feb. 23, 2014, available at <http://www.hightechforum.org/netflix-and-comcast-declare-peace/> (explaining that Google and Netflix have built their own CDNs).
 49. Level 3 Communications Management Discusses Q1 2014 Results - Earnings Call Transcript (quoting Jeffrey K. Storey).
 50. *Id.* (“There's a new Netflix coming along. I don't know what the next one will be, but there are other companies out there trying to grow and trying to have the success that they've had. We will continue to serve those customers, use our infrastructure.”).
 51. Carlton & Picker at 40 (“The trends in network industries indicate that regulators, not antitrust courts, will bear the responsibility for formulating interconnection policies in *partially deregulated industries*, but antitrust will remain in the background as a club that firms can use if regulators allow incumbents to acquire market power either through merger or predatory acts.” (emphasis added)).
 52. *Id.* at 22 (“This recent history highlights a move away from regulation towards anti-trust as a means to control competition and reveals how regulation and antitrust can be both substitutes and, in some settings, complements. The substitution involves the complete replacement of regulation with antitrust, as occurs when *industries become deregulated* (e.g., airlines and trucks).” (emphasis added)).
 53. *Id.* at 39 (emphasis added).
 54. 410 U.S. 366 (1973).
 55. Phil Weiser, *The Future of Internet Regulation*, Colorado Law Legal Studies Research Paper Series, Working Paper 09-02, Feb. 2009.

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