

# The Case for Meaningful Network Neutrality Rules

Barbara van Schewick <sup>1</sup>

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<sup>1</sup> Professor of Law and Helen L. Crocker Faculty Scholar at Stanford Law School, Director of Stanford Law School's Center for Internet and Society, and Associate Professor (by courtesy) of Electrical Engineering, Stanford University.

## Goals of Network Neutrality Rules<sup>2</sup>

The proposal for network neutrality rules is guided by the following principles:<sup>3</sup>

*First*, the FCC should adopt strong network neutrality rules that preserve the factors that have allowed the Internet to foster application innovation and economic growth, improve democratic discourse, facilitate political organization and action, and provide a more decentralized environment for social, cultural and political interaction in which anybody can participate. These factors that have allowed this are user choice, application-agnosticism, innovation without permission, and low costs of application innovation.<sup>4</sup>

*Second*, the FCC should adopt rules that provide certainty to innovators, investors, and ISPs alike. ISPs need to know how they can manage their networks. Innovators and their investors need to know that they won't be discriminated against and that ISPs cannot create new barriers to innovation by charging access fees.

*Third*, start-ups are small and don't have many resources, let alone a legal team. So the FCC should adopt rules that can be enforced through simple, straightforward legal processes, not rules that tilt the playing field in favor of large, established companies that can pay armies of lawyers and expert witnesses and afford long, costly proceedings at the FCC.

*Fourth*, the FCC should adopt rules that give ISPs flexibility to realize their legitimate goals such as network management, price discrimination, or product differentiation, albeit through means that do not distort competition, harm application innovation, or violate user choice.

*Fifth*, the FCC should adopt that do not overly constrain the evolution of the Internet infrastructure and keep the costs of regulation low.

## Terminology

Throughout this document, the term “applications” is used as shorthand for Internet applications, content, services, uses; the term “user” is used as shorthand for subscriber to Internet access

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<sup>2</sup> This paper builds on and draws on my earlier writings on network neutrality, including, but not limited to van Schewick, Barbara. 2010. *Internet Architecture and Innovation*. Cambridge, MA: MIT Press; van Schewick, Barbara. 2014. "The Case for Rebooting the Network-Neutrality Debate." *The Atlantic*. May 6. <http://www.theatlantic.com/technology/archive/2014/05/the-case-for-rebooting-the-network-neutrality-debate/361809/>; van Schewick, Barbara. 2014. *The FCC Changed Course on Network Neutrality. Here is Why You Should Care*. <http://cyberlaw.stanford.edu/blog/2014/04/fcc-changed-course-network-neutrality-here-why-you-should-care>; van Schewick, Barbara. 2015. "Network Neutrality and Quality of Service: What a Nondiscrimination Rule Should Look Like." *Stanford Law Review*, 67(1). [http://www.stanfordlawreview.org/sites/default/files/67\\_Stan\\_L\\_Rev\\_1\\_van\\_Schewick.pdf](http://www.stanfordlawreview.org/sites/default/files/67_Stan_L_Rev_1_van_Schewick.pdf); van Schewick, Barbara & Morgan Weiland. 2015. "New Republican Bill Is Network Neutrality in Name Only." *Stanford Law Review*. January 20. [http://www.stanfordlawreview.org/sites/default/files/online/articles/67\\_Stan\\_L\\_Rev\\_Online\\_85\\_vanSchewick\\_Weiland.pdf](http://www.stanfordlawreview.org/sites/default/files/online/articles/67_Stan_L_Rev_Online_85_vanSchewick_Weiland.pdf).

<sup>3</sup> For a justification and fuller discussion of these principles, see Barbara van Schewick, *Network Neutrality and Quality of Service: What a Nondiscrimination Rule Should Look Like*, 67 STAN. L. REV. 1, 16-26 (2015).

<sup>4</sup> These principles are set out in more detail in van Schewick, *Network Neutrality and Quality of Service*, at 19-23.

service, and “provider of Internet access service” is used interchangeably with Internet service provider and network provider.

## **No blocking**

*The FCC should prohibit providers of Internet access (ISPs) from blocking Internet applications, content, services or uses (“applications”), subject to reasonable network management.*

Without a rule banning blocking, ISPs have the ability and incentive to block certain applications or to discriminate against them – to increase profits, to block unwanted content, or to manage their networks. As the European experience shows, blocking is not a theoretical concern. European Law allows blocking and discrimination, as long as it is disclosed, and blocking and discrimination have been widespread. In the absence of rules banning blocking and discrimination, Skype fought for years (with limited success) to get mobile carriers in Europe to lift the technical and contractual bans on using Internet telephony on mobile networks. On mobile Internet service plans, text messaging applications like WhatsApp were often banned or only available to those willing to buy an expensive “text messaging option” (where you pay an extra fee to your ISP to get the right to use a third-party text messaging application).

Seeking to stifle speech it perceived as harmful to its business interests, a German ISP blocked access to websites that were criticizing its business practices and offering advice to users affected by these practices. In the UK, network-level filters designed to filter out content that is harmful to children regularly block access to non-adult content, including the websites of churches, small businesses, GigaOm (an American news website dedicated to the analysis of emerging technologies), and La Quadrature du Net (the European equivalent of Free Press).

ISPs in the UK routinely manage congestion by singling out specific applications or classes of applications. These practices not only prevent users from using the Internet as they want during peak times (when everyone is watching the new Game of Thrones episode) and make it impossible for affected applications to reach their users, but also interfere with applications like online gaming that are inadvertently caught up in discriminatory network management practices not targeted at them.

By contrast, there have been fewer incidents of blocking and discrimination in the United States. That’s because the United States have always had a de facto network neutrality regime in the United States that prevented or at least deterred blocking and discrimination. Originally, the Internet’s architecture protected applications against blocking and discrimination. And while the FCC only adopted formal network neutrality rules in December 2010, it has strongly supported Open Internet principles since 2004, has expressed its expectation that Internet service providers would live by these principles, and has consistently acted to enforce these principles in various ways over the past decade. But even in the United States, ISPs have blocked competing applications (e.g. Madison River, AT&T Wireless/Skype for the iPhone, Google Wallet), hijacked search queries to earn referral fees, injected their own advertising into unaffiliated websites to earn advertising fees, interfered with peer-to-peer file-sharing applications to

manage congestion on their networks, and prohibited the use of certain applications unless users paid extra fees (e.g., Verizon/tethering applications, Apple/ Facetime).

Blocking interferes with user choice, distorts competition among applications or classes of applications, and reduces application innovation. Blocking prevents users from using the applications and accessing the content of their choice. Affected applications are unable to reach their users, reducing the provider’s ability to benefit from the application. The threat of blocking reduces innovators’ incentives to innovate and reduces their ability to get funding.

Thus, without a rule against blocking, we will get less application innovation. And since applications, services and content are what makes the Internet useful to us, an Internet without meaningful network neutrality rules will be less useful to us in the future.

## **No application-specific discrimination**

*The FCC should adopt a bright-line rule nondiscrimination rule that applies to any forms of differential treatment that falls short of blocking. Substantively, the rule should ban discrimination based on sender, receiver, application or class of application (“application-specific discrimination”), subject to reasonable network management. This non-discrimination rule would allow ISPs to engage in application-agnostic discrimination.*<sup>5</sup>

Any meaningful network neutrality regime includes a nondiscrimination rule that constrains ISPs’ ability to engage in forms of differential treatment that fall short of blocking. Such behavior is often an attractive alternative to blocking, since it allows an ISP to make certain applications more or less attractive in a less drastic way—obtaining the same effect as outright blocking but at lower costs to the ISP. Thus, differential treatment provides another mechanism for an ISP to distort competition and user choice. Without a nondiscrimination rule, ISPs—and not the market—can pick winners and losers online.

The FCC’s nondiscrimination rule should apply to all forms of differential treatment, not just to technical discrimination, i.e. the differential handling of packets in the network. If a rule only bans technical discrimination, ISPs can still distort competition and interfere with user choice using non-technical means. For example, an ISP could exempt its own application from subscribers’ monthly bandwidth caps, but still count competing applications against the cap, a common practice in Europe. Like technical discrimination, these exemptions from bandwidth caps, also called zero-rating, artificially make some applications more attractive than others. And just like technical discrimination, zero-rating allows ISPs to tilt the market in favor of specific applications and to “pick winners and losers” on the Internet.<sup>6</sup>

Similarly, a rule that doesn’t apply to economic discrimination would also allow ISPs to vary charges for Internet access depending on the applications used by a subscriber. For

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<sup>5</sup> For a more detailed description and analysis of this rule, see van Schewick, *Network Neutrality and Quality of Service*, at 124-152.

<sup>6</sup> For a more detailed analysis, see van Schewick, *Network Neutrality and Zero-rating*. Attachment to Barbara van Schewick Ex Parte Letter, GN Dkt. No. 14-28, February 19, 2015, at 1-3, 5-8; van Schewick, *Network Neutrality and Quality of Service*, at 30-33.

example, in Europe, many mobile ISPs ban the use of Internet telephony applications such as Skype; people who want to use these applications on their mobile devices can buy an “Internet telephony option” that allows them to use Internet telephony for an extra fee. This allows ISPs to effectively tax certain applications and make them less attractive to users, or to extract more of the value that users derive from the use of those applications.

Substantively, the FCC should adopt a bright-line rule that clearly specifies in advance which behavior should be allowed, while accurately separating beneficial from harmful differential treatment. In over ten years of debate, network neutrality proponents have struggled to come up with a rule that clearly specifies in advance which forms of differential treatment should be allowed. As a result, they had to fall back on all-or-nothing approaches or standards-based approaches, both of which create considerable social costs. The rule I propose – ban application-specific discrimination, allow application-agnostic discrimination – solves this problem. It accurately distinguishes between socially beneficial and socially harmful conduct (avoiding the problems of the all-or-nothing approaches), but does so *ex ante* (avoiding the social costs of the standards-based approaches).

Discrimination is application-specific if it is based on a particular application or class of applications, or, in other words, if it is based on criteria that depend on an application’s characteristics (“application-specific criteria”). Application-specific criteria include “application”—the specific instance of an application a user is using, e.g., *Vonage vs. Skype*—, application type (e.g., e-mail vs. Internet telephony), the application-layer protocol or transport-layer protocol the application is using (e.g., Session Initiation Protocol (SIP) vs. Skype’s proprietary protocol, or TCP vs. User Datagram Protocol (UDP)), or the application’s technical requirements (e.g., latency-sensitive vs. non-latency-sensitive applications). Since the term “applications” stands for applications, content, services, and uses, the ban on application-specific discrimination applies equally to discrimination based on criteria that depend on characteristics of content or of a service or use. Thus, discrimination against certain content based on, for example, publisher, author, content type, subject matter, or viewpoint would also all be prohibited by this rule.

Under this rule, a network provider would not be allowed to treat Vonage differently from Skype, or Comcast’s online video streaming differently from Hulu. That would be discrimination based on application. Nor would it be allowed to treat online video differently from e-mail, treat applications that use the BitTorrent protocol differently from applications that do not use this protocol, or treat applications that are sensitive to delay differently from those that are not. That would be discrimination based on class of application. But it would be allowed to treat data packets differently based on criteria that have nothing to do with the application or class of application – e.g., based on how much someone has paid or how much they have used. For example, an ISP could give one person a larger share of the available bandwidth if that person has paid for a higher tier of Internet service (e.g., if that person has paid for the “Up to 6 Mbps” Internet service packet instead of the “Up to 3 Mbps”), charge users based on how much bandwidth they use, or give a discount to students or seniors.

Substantively, the rule balances the public interest in network neutrality with the legitimate interests of network providers. By making it impossible to single out specific applications or classes of applications, the rule prevents network providers from interfering with user choice or distorting competition among applications or classes of applications, while giving them broad flexibility to differentiate and price their Internet service offerings and manage their network in application-agnostic ways. Network providers can, for example, manage their networks in application-agnostic ways, price-discriminate based on application-agnostic criteria, or differentiate their services by offering Quality of Service in line with the rule. The rule allows network providers to offer some forms of user-controlled Quality of Service and provides certainty to market participants. Technically, it reinforces key architectural principles on which the Internet was based without locking in the original architecture of the Internet itself.

The rule needs to ban discrimination against applications *and* classes of applications.<sup>7</sup> Otherwise, ISPs could still distort competition and interfere with user choice by discriminating against classes of applications. For example, ISPs might limit the use of online streaming services during times of congestion, while continuing to allow the use of other bandwidth-intensive types of applications. Or they could slow down all Internet telephony applications that let users make calls over their Internet connection, like Skype or Vonage, to make them less competitive with their own traditional telephony offering. The power to choose winners and losers online should belong to the market, not to ISPs.

This proposal isn't new. In the FCC's Open Internet proceeding, it was supported by networking experts, investors, entrepreneurs, and non-profit organizations.<sup>8</sup> The FCC's Open Internet Order adopted this rule at least in part.<sup>9</sup> According to the text of the order, the FCC would have evaluated discriminatory conduct based on whether it is "use-agnostic" or "application-agnostic" (i.e. whether it "does not discriminate among specific uses of the network

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<sup>7</sup> For a more detailed analysis, see van Schewick, Analysis of Proposed Network Neutrality Rules. Attachment to Barbara van Schewick Ex Parte Letter, GN Dkt. No. 14-28, February 18, 2015, at 3-5; van Schewick, *Network Neutrality and Quality of Service*, at 107-124.

<sup>8</sup> Networking experts, e.g., Comments of NYSERNet, Preserving the Open Internet, GN Docket No. 09-191, WC Docket No. 07-52 (Dec. 13, 2010), available at <http://apps.fcc.gov/ecfs/document/view?id=7020923371>; David P. Reed, *A Response to Barbara van Schewick: Code Needs (Only a Little) Help from the Law*, DPR (Dec. 15, 2010), <http://www.reed.com/blog-dpr/?p=85>; investors, e.g., Brad Burnham, *Internet Access Should Be Application-Agnostic*, HUFFINGTON POST (Dec. 20, 2010, 9:44 AM ET), [http://www.huffingtonpost.com/brad-burnham/internet-access-should-be\\_b\\_799028.html](http://www.huffingtonpost.com/brad-burnham/internet-access-should-be_b_799028.html); *Regulation Strangulation*, AVC (Aug. 12, 2010), [http://www.avc.com/a\\_vc/2010/08/regulation-strangulation.html](http://www.avc.com/a_vc/2010/08/regulation-strangulation.html); entrepreneurs, e.g., Ex Parte Letter by the founders of the online video company Zediva, Preserving the Open Internet, GN Docket No. 09-191, Broadband Industry Practices, WC Docket No. 07-52 (Dec. 10, 2010), available at <http://apps.fcc.gov/ecfs/document/view?id=7020923207>; John Borthwick, *Neutrality or Bust*, TECHCRUNCH (Dec. 19, 2010), <http://techcrunch.com/2010/12/19/neutrality>; and nonprofit organizations, e.g., Comments of Council of Scientific Society Presidents, Preserving the Open Internet, GN Docket No. 09-191, WC Docket No. 07-52 (Dec. 13, 2010), available at <http://apps.fcc.gov/ecfs/document/view?id=7020923181>; North American Benthological Society Comments, Preserving the Open Internet, GN Docket No. 09-191, WC Docket No. 07-52 (Dec. 13, 2010), available at <http://apps.fcc.gov/ecfs/document/view?id=7020923349>; Botanical Society of America Comments, Preserving the Open Internet, GN Docket No. 09-191, WC Docket No. 07-52 (Dec. 8, 2010), available at <http://apps.fcc.gov/ecfs/document/view?id=7020922879>.

<sup>9</sup> See van Schewick, *Network Neutrality and Quality of Service*, at 152-162.

*or classes of uses*”).<sup>10</sup> According to the Order, use-agnostic discrimination is likely to be reasonable, which suggests, in turn, that differential treatment that discriminates among specific uses of the network or classes of uses is likely to be unreasonable.<sup>11</sup>

As the attached appendix shows, the bright-line nondiscrimination rule proposed here – i.e. a nondiscrimination rule that applies to technical *and* economic forms of differential treatment and prohibits discrimination against applications *and* classes of applications – was supported by many commenters in this proceeding.<sup>12</sup>

### **Exception for reasonable network management**

*The rules for blocking and discrimination should be subject to an exception for reasonable network management. That exception should require network management to be appropriate, tailored, and as application-agnostic as possible.*<sup>13</sup>

In the context of network neutrality rules, the term “network management” refers to technical measures whose purpose is “to maintain, protect, and ensure the efficient operation of a network.”<sup>14</sup> Network management includes, for example, managing congestion or protecting the security of a network.<sup>15</sup> The exception allows the use of narrowly tailored application-specific measures only if a problem cannot be solved in an application-agnostic manner.

Requiring network management to be only appropriate and tailored is not enough. The exception also must require network management to be as application-agnostic as possible. Otherwise, ISPs could justify network management practices targeting specific applications or classes of applications as a tailored, and therefore permissible, approach to managing congestion, as long as the discrimination is limited to times of congestion.

This would be a real problem. As experience from the United States, Canada, and the United Kingdom has shown, ISPs have routinely blocked or discriminated against specific applications or types of applications to manage congestion when they were not required to manage their networks in an application-agnostic manner.

In Canada, the 2009 investigation of the CRTC into Internet service providers’ network management practices showed that, at the time, many Canadian ISPs were singling out peer-to-peer file-sharing applications for special treatment, throttling the bandwidth available to them or

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<sup>10</sup> Federal Communications Commission (2010), pp. 17,945-17,946, para. 73 (emphasis added).

<sup>11</sup> Federal Communications Commission (2010), para 73.

<sup>12</sup> See Appendix titled “The Record Demonstrates Significant Support for Strong Rules,” at 6-10 (nondiscrimination rule should apply to all forms of differential treatment), 11-12 (nondiscrimination rule should ban discrimination against applications and classes of applications).

<sup>13</sup> For a more detailed description and analysis of the exception for reasonable network management proposed here, see van Schewick, *Network Neutrality and Quality of Service*, at 137-140.

<sup>14</sup> Center for Media Justice, et al. (2010), at 37.

<sup>15</sup> On the definition of network management, see Center for Democracy & Technology Comments, 2010 Open Internet Proceeding, GN Docket 09-19,1 at 41-43; Center for Media Justice, et al. (2010)2010 Open Internet Proceeding, GN Docket 09-191, at37-41.

interfering with these applications in other ways.<sup>16</sup> In the United States, Comcast, RCN, and, most likely, Cox for a while managed traffic on their networks by selectively interfering with BitTorrent and other peer-to-peer file-sharing applications but not with other applications.<sup>17</sup> In 2009, BT throttled streaming video of users subscribing to its “Up to 8 Mbps Option 1” broadband plan to 896 kilobits per second between 5:00 PM and midnight to manage congestion, limiting users’ ability to watch video when most users would like to do so, while allowing the use of other applications that might be equally bandwidth intensive.<sup>18</sup> A recent study showed widespread discriminatory network management in the United Kingdom.<sup>19</sup> And according to Neelie Kroes, who at the time was Vice President of the European Commission responsible for the Digital Agenda, data published by BEREC in June 2012 show that around twenty percent of fixed Internet service providers (spread across virtually all EU member states) impose

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<sup>16</sup> For an overview of Canadian providers’ network management practices as disclosed during the proceeding, see CHRISTOPHER PARSONS, SUMMARY OF JANUARY 13, 2009 CRTC FILINGS BY MAJOR ISPS IN RESPONSE TO INTERROGATORY PN 2008-19 WITH FEBRUARY 9, 2009 UPDATES 15-31 (2009), available at [http://www.christopher-parsons.com/PublicUpload/Summary\\_of\\_January\\_13\\_2009\\_ISP\\_filings\\_with\\_February\\_9\\_2009\\_Updates\\_version\\_1.0\(for\\_web\).pdf](http://www.christopher-parsons.com/PublicUpload/Summary_of_January_13_2009_ISP_filings_with_February_9_2009_Updates_version_1.0(for_web).pdf). Since then, most of the larger Canadian Internet service providers, most recently Bell Canada and Bell Aliant, have changed their practices in response to the regulations regarding network management that the CRTC adopted following its investigation. In January 2012, Rogers remained the only larger Canadian provider that was still engaging in discriminatory network management. See Sarah Schmidt, Complaints About Online Traffic Delays Accelerating, Says CRTC, Canada.com (Jan. 12, 2012), <http://www.canada.com/life/Complaints+about+online+traffic+delays+accelerating+says+CRTC/5986923/story.html>; see also Michael Geist, Op-Ed., *ISP Must Come Clean on ‘Traffic Shaping,’* THESTAR.COM (Apr. 16, 2007), [http://www.thestar.com/business/2007/04/16/isp\\_must\\_come\\_clean\\_on\\_traffic\\_shaping.html](http://www.thestar.com/business/2007/04/16/isp_must_come_clean_on_traffic_shaping.html).

<sup>17</sup> Comcast Corp. Description of Current Network Management Practices, Letter from Kathryn A. Zachem, Vice President, Regulatory Affairs, Comcast Corp., to Marlene Dortch, Sec’y, FCC, Attachment A, Formal Complaint of Free Press & Public Knowledge Against Comcast Corp. for Secretly Degrading Peer-to-Peer Applications, No. EB-08-IH-1518, Broadband Industry Practices, WC Docket No. 07-52 (Sept. 19, 2008), available at <http://apps.fcc.gov/ecfs/document/view?id=6520172537> Comcast Corporation (2008), at 1, 9; RCN Corp., Ex Parte Notice at 1-4, Preserving the Open Internet, GN Docket No. 09-191, Broadband Industry Practices, WC Docket No. 07-52 (May 7, 2010) [hereinafter RCN Letter], available at <http://apps.fcc.gov/ecfs/document/view?id=7020450131>.

RCN Corporation (2010), at 2, 4. Cox seems to have actively managed peer-to-peer filesharing in 2008 as well. Susan Davis, Cox About to Feel Wrath of Net Neutrality Activists, Wall St. J. Wash. Wire (May 15, 2008, 5:44 PM ET), <http://blogs.wsj.com/washwire/2008/05/15/cox-about-to-feel-wrath-of-net-neutrality-activists> (citing a Cox statement that “Cox allows the use of file-sharing and peer-to-peer services for uploads and downloads, and we allow access to all legal content, but we must manage the traffic impact of peer-to-peer services, as most ISPs do for the benefit of the customer” (internal quotation marks omitted)); Marcel Dischinger et al., Detecting BitTorrent Blocking, 2008 Proc. 8th ACM SIGCOMM Conf. on Internet Measurement 3, 7-8 (study finding evidence of BitTorrent blocking by Comcast and Cox).

<sup>18</sup> Rory Cellan-Jones, *iPlayer: BBC v BT*, BBC NEWS DOT.LIFE (June 2, 2009, 9:20 AM GMT), [http://bbc.co.uk/blogs/technology/2009/06/iplayerbbc\\_v\\_bt.html](http://bbc.co.uk/blogs/technology/2009/06/iplayerbbc_v_bt.html). See also Alissa Cooper, How Competition Drives Discrimination: An Analysis of Broadband Traffic Management in the UK (Aug. 2013) (unpublished manuscript), available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2241562](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2241562), at 21-22; and Alissa Cooper, How Regulation and Competition Influence Discrimination in Broadband Traffic Management: A Comparative Study of Net Neutrality in the United States and the United Kingdom chs. 5-7, at 105-211 (Sept. 2013) (unpublished Ph.D. thesis, University of Oxford), available at <http://www.alissacooper.com/files/Thesis.pdf> (same) (documenting widespread discriminatory network management in the United Kingdom).

<sup>19</sup> Cooper (2013)18; Cooper, Thesis, *supra* note 18, at ch. 6, at 131-70.



restrictions on peer-to-peer file-sharing applications during peak times. These restrictions can affect up to ninety-five percent of users in a country.<sup>20</sup>

Such discriminatory network management practices significantly constrain users' ability to use the Internet as they like during peak times and make it more difficult for affected applications to reach their users. As online video company Zediva explained to the FCC in 2010,

*Discriminatory network management of this type would put the affected applications at a severe disadvantage. Companies that offer these applications and services will be less able to reach their users during times of congestion, which in turn may affect their success in the market (who wants to use an application or service that is less usable during peak time, when most people actually want to use the Internet?) and their ability to get funding—thus squashing innovation before it has had a chance to prove itself in the marketplace.*<sup>21</sup>

Discriminatory network management also creates considerable collateral damage. In the UK, application-specific traffic management not only negatively affected targeted applications, but also interfered with applications like online gaming that the Internet service providers did not intend to target. This created considerable performance problems for affected applications. In response, application developers and network operators often had to expend significant resources to address these problems, and had to do so on an ongoing basis.<sup>22</sup> In addition, network management practices that single out specific applications or classes of applications for special treatment often motivate application developers to masquerade their applications to evade performance-reducing practices targeting their applications or to take advantage of performance-enhancing treatment provided to other applications, resulting in a cat-and-mouse game between network providers on the one hand and application developers and users on the other hand. Application-agnostic network management practices remove this incentive, freeing resources for network providers, application developers, and users.

Thus, application-specific network management practices are just as harmful as other forms of blocking and application-specific discrimination. For the user or provider of the affected application, it doesn't matter whether an ISP engages in blocking or discrimination to increase its profits or manage its network. In both cases, users can't use the application of their choice, and application providers have problems reaching their users.

By contrast, requiring network management to be tailored, appropriate, *and* application-agnostic as possible gives network providers the tools they need to manage their networks and maintain a quality experience for all Internet users, while protecting the Internet as

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<sup>20</sup> The text closely paraphrases European Commissioner Neelie Kroes' description of these findings in her blog, Neelie Kroes, Next Steps on Net Neutrality—Making Sure You Get Champagne Service if That's What You're Paying for, Eur. Commission Neelie Kroes' Blog (May 29, 2012), <http://blogs.ec.europa.eu/neelie-kroes/netneutrality>. For the detailed findings, see BEREC View of Traffic Management.

<sup>21</sup> Ex Parte Letter of Zediva at 3-4, Preserving the Open Internet, GN Docket No. 09-191, Broadband Industry Practices, WC Docket No. 07-52 (Dec. 10, 2010), *available at* <http://apps.fcc.gov/ecfs/document/view?id=7020923207>.

<sup>22</sup> Ex parte <http://apps.fcc.gov/ecfs/document/view?id=7521087920>, Cooper (2013b), chapter 7, pp. 197-210.

a level playing field and supporting user choice even during times of congestion. At the same time, the exception provides a safety valve that allows network providers to react in more application-specific ways if a problem cannot be solved in an application-agnostic way.

Since network providers can allocate bandwidth among users using application-agnostic criteria, they can prevent aggressive users from overwhelming the network and ensure fairness among users during times of congestion. For example, under the proposed exception, a network provider could give one person a larger share of the available bandwidth than another, for example, because this person pays more for Internet access or has used the Internet less over a certain period of time. That would be application-agnostic discrimination. But it could not throttle the bandwidth available to a specific online video application such as Hulu in particular or to online video in general. That would be application-specific discrimination.

Thus, under the proposed reasonable network management exception, the amount of bandwidth available to users during times of congestion may be limited. But how users use the bandwidth available to them, and whether they would like to give some of their applications priority over others, would be choices left to the users.

To the extent that applications benefit from relative prioritization or other forms of differentiated treatment during times of congestion (i.e., during times when a link's average utilization is high), network providers could allow users to choose which applications to prioritize or otherwise treat differently during these times. As long as the option to be prioritized or be treated differently is offered equally to all applications or classes of applications (i.e., not tied or restricted to specific applications or classes of applications) and the choice of which applications to prioritize or treat differently is left to the user, this form of network management would be consistent with the nondiscrimination rule and reasonable network management exception proposed above. Network management solutions that allow the network provider to allocate bandwidth among users in an application-agnostic manner, while letting users choose the relative priority of applications within the bandwidth allocated to them, are available today.

This approach has been successfully applied in the US and Canada for many years. The FCC has required network management to be as application-agnostic as possible since 2008, when it adopted its order against Comcast,<sup>23</sup> and included this requirement in the Open Internet Order's exception for reasonable network management.<sup>24</sup> The FCC's Canadian counterpart, the Canadian Radio-Television and Telecommunications Commission, did the same in 2009.<sup>25</sup> In line with these regulatory requirements, large and small ISPs in the US and Canada have successfully managed congestion on fixed networks in an application-agnostic manner for many years.<sup>26</sup> Many wireless ISPs in the United States manage congestion that way, too.<sup>27</sup>

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<sup>23</sup> Federal Communications Commission (2008), paras 47-50.

<sup>24</sup> Federal Communications Commission (2010), para 87.

<sup>25</sup> Canadian Radio-Television and Telecommunications Commission (2009), para 43 (asking, among other questions, whether a discriminatory network management practice results "in discrimination or preference as little as reasonably possible").

<sup>26</sup> For the US, see, e.g., Comcast (2015); Bastian, et al. (2010); Meisner (2008); Frontier (2015); Lightstream (2015); Bretton Woods Telephone Company (2011); Plateau (2013). Canada: Since the CRTC's decision, most of

The proposed exception for reasonable network management finds broad support in the record.<sup>28</sup>

## **No access fees**

*The FCC should adopt a bright-line ban on all forms of access fees. This rule would prohibit ISPs from charging application providers for access to users or for any form of preferential treatment (e.g., priority, a guaranteed amount of bandwidth, or zero-rating) that gives application providers that pay the fee an advantage over those who don't. This rule should not be subject to reasonable network management.*

Access fees come in two variants: In the first variant, an ISP charges application or content providers for the right to access the network provider's Internet service customers. Applications whose providers do not pay the access fee cannot be used on the network provider's access network.<sup>29</sup> In the second variant, a network provider charges application providers for prioritized or otherwise enhanced access to the network provider's Internet service customers. For example, if an application provider has paid such an access fee, the application's data packets may receive a better type of service (e.g., priority or a guaranteed amount of bandwidth) on the network provider's access network or may not count against a user's monthly bandwidth cap ("zero-rating").

Allowing access fees would fundamentally change how the Internet has operated for the past decades. In the United States, application providers have never paid access fees.<sup>30</sup> Access fees would significantly increase the costs of offering applications, content and services, which would fundamentally change the environment for innovation and free speech on the Internet and harm all sectors of the economy.

### ***Allowing access fees would harm start-up innovation and American technology leadership***

Access fees reduce the profits of application providers who can pay these fees, reducing their incentives to innovate. Worse, ISPs have a so-called "terminating monopoly" over access to their subscribers: If an application provider wants to reach me, they have to go through my ISP, and this gives my ISP a monopoly over access to me. As a result, ISPs will be able to charge monopoly prices to application providers, which will reduce application providers' incentives to innovate even further. This problem persists even if there is competition in the market for Internet access services.

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the larger Canadian Internet service providers have changed their practices in response to the regulations regarding network management that the CRTC adopted following its investigation. In January 2012, Rogers remained the only larger Canadian provider that was still engaging in discriminatory network management that had not announced an intention to phase out that policy. Geist (2007); Schmidt (2012).

<sup>27</sup> Mosaic Telecom (2011); HardyNet (2015); Telispire (2014); Carolina West Wireless (2011); Wireless Hometown (2011); Anderson (2008).

<sup>28</sup> See Appendix titled "The Record Demonstrates Significant Support for Strong Rules," at 21-23.

<sup>29</sup> A ban on fees for access to users is supported by many commenters. See Appendix titled "The Record Demonstrates Significant Support for Strong Rules," at 13-16.

<sup>30</sup> This statement applies to companies that do not interconnect with a last-mile ISP directly.

On the Internet as we know it, the costs of developing an application have been incredibly low. Because the biggest investment is often the design and programming of the application itself, innovators can develop an application in their free time or as a side project; they don't necessarily need outside funding to realize their idea for an application. And even where applications require the application developer to operate servers, which is more costly, recent developments have drastically reduced the minimum level of investment needed to do so,<sup>31</sup> making it feasible to develop server-based applications with smaller investments from family, friends, or angel investors. This has allowed everyone from students working in a dorm room to entrepreneurs without outside funding to realize their bright ideas for an application, creating the Internet version of the American dream.<sup>32</sup> In turn, the Internet has become a gigantic petri dish for hundreds of thousands of innovators in the United States.

Allowing access fees would change that. For a number of reasons, start-ups often won't be able to pay these fees.<sup>33</sup> But if established companies can pay so that their content loads faster or does not count against users' monthly bandwidth caps, those who can't pay won't have a chance to compete. Thus, allowing access fees increases the level of investment needed to start an application, making it more difficult for innovators without significant outside funding to realize their idea for a new app.

The impact of this change would be severe: Reducing the ability of low-cost innovators to innovate will significantly reduce the amount, diversity and quality of Internet applications, content and services.<sup>34</sup>

Throughout the history of the Internet, innovators with little or no outside funding have produced some of the most important applications – including Google, Facebook, Yahoo, or eBay. Many of these innovators tried to get venture capital, but failed. This applies, for example, to Google, eBay, Flickr or Blogger.<sup>35</sup>

As the record shows, the low costs of innovation continue to fuel start-up innovation today. For example, Foursquare grew to 100,000 users on \$25,000, and Tumblr reached millions of users before they hired their tenth employee.<sup>36</sup> Reddit, a Top 50 website with over 110 million monthly unique visitors -- more traffic than CNN.com or NYTimes.com – was started by “two

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<sup>31</sup> <http://www.wsj.com/articles/SB10001424053111903480904576512250915629460>.

<sup>32</sup> For a short version of the argument, see van Schewick (2010e), pp. 2-3, 5-6; and van Schewick (2010c), pp. 4-5. On the low cost of application innovation in the original Internet, see van Schewick (2010b), pp. 138-48, 204-05, 289-90. On the impact of low-cost innovation on who can innovate, see *id.* at 204-13, 292-93. See also Balkin (2009) (focusing on the social, cultural, and political implications); Benkler (2000), pp. 565-68 (same).

<sup>33</sup> Barbara van Schewick, Assistant Professor of Law, Stanford Law Sch., Opening Statement at the Federal Communications Commission's Workshop on Approaches to Preserving the Open Internet (Apr. 28, 2010), available at <https://www.law.stanford.edu/sites/default/files/publication/259136/doc/slspublic/schewick-statement-20100428.pdf>;

<sup>34</sup> For a short version of the argument with links to the relevant literature, see van Schewick, Network Neutrality and Quality of Service, at 22-23.

<sup>35</sup> See van Schewick (2010c), pp. 3-5; van Schewick (2010b), pp. 204-213, 310-314, 318-328, 334-345 (discussing the importance of different types of low-cost innovators, including many examples).

<sup>36</sup> Brad Burnham Notice of ex parte meetings, May 6, 2014, p. 1, <http://apps.fcc.gov/ecfs/document/view?id=7521115343>

recent college graduates with no connections and \$12,000 in funding.”<sup>37</sup> In the current proceedings, many start-ups explained how they were founded and how they would not exist in a world in which access fees had been allowed. Their stories are collected in the appendix entitled “Internet Startups Need a Non-Discriminatory Internet.”

Economic research suggests that innovators with little or no outside funding will continue to be important sources of innovation – if we let them.<sup>38</sup> By contrast, without the many low-cost innovators, our Internet innovation ecosystem will be significantly less vibrant and will produce fewer, less diverse, and lower-quality applications.

According to investors, access fees will fundamentally change the environment for investing in Internet applications, content, and services, making it more difficult for entrepreneurs to get outside funding.<sup>39</sup> The current investment model for Internet applications is simple: Because the costs of innovation are so low, entrepreneurs don’t need outside funding before they can make their apps available to users. Only after an application has proven that it can attract users will venture capitalists invest the millions of dollars needed to turn the product into a viable business. This approach significantly reduces the likelihood that an investment will fail.

In a world with access fees, this investment model breaks down. Suddenly, start-ups with new apps need significant up-front capital just to be able to compete with established companies that can pay to play. As a result, investors can’t rely on the market to identify those startups that are likely to succeed before they invest larger sums. This dramatically increases the risk that the investment will fail, reducing investors’ willingness to invest. This is not a hypothetical concern: in the music industry, new companies must pay huge up-front licensing fees to rights holders before they can get their service in front of users. And because few entrepreneurs and investors are willing to invest millions of dollars in start-ups that are likely to fail, we have seen fewer start-ups providing innovative services in music than in other product categories.

The harm from access fees is not restricted to applications that are particularly sensitive to delay, nor can it be prevented by regulating the quality of Internet service to make sure that the slow lane is not too slow, as originally proposed by the FCC.

If the slow lane is good enough, some have argued, those who can't pay can still get to their users and have a chance to compete. But it's not the quality of the slow lane that is the problem; it's that there IS a faster lane that provides a better experience. According to research, [increasing load times](#) by as little as 100 milliseconds reduces the amount of time people spend on a site, how much they buy, and whether they come back.

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<sup>37</sup> Comments of Y Combinator, July 14, 2014, p. 1, <http://apps.fcc.gov/ecfs/document/view?id=7521383177>.

<sup>38</sup> van Schewick (2010b), pp. 204-213, 310-314, 318-328, 334-345 (discussing the importance of different types of low-cost innovators, including many examples).

<sup>39</sup> See, e.g., Brad Burnham Notice of ex parte meetings, May 6, 2014, pp. 1-2, <http://apps.fcc.gov/ecfs/document/view?id=7521115343>; Fred Wilson, Safe Harbors, A VC blog, May 7, 2014, <http://avc.com/2014/05/safe-harbors/>; Letter of 129 investors to Chairman Wheeler, <http://apps.fcc.gov/ecfs/document/view?id=7521121517>, 1-2.

Thus, if the FCC allows access fees, those who can't pay to be in the faster lane will have fewer users or readers, fewer sales, and less advertising revenue. This problem affects every application, website and service, not just delay-sensitive applications like online video. Improving the quality of the slower lane does not remove that problem. Users and applications are still stuck with the quality differential between paying and nonpaying applications.

In sum, allowing access fees will increase the costs of innovation for companies that can pay access fees, reducing their incentives to innovate. It will make it more difficult, if not impossible, for innovators without significant outside funding to innovate and compete, killing the Internet version of the American dream. It will make it more difficult for start-ups to get venture capital. And the resulting reduction in the size and diversity of the innovator pool will ultimately reduce the amount, diversity, and quality of application innovation, ultimately threatening American leadership in the technology space.

***Allowing access fees would harm all sectors of the economy***

The impact of access fees is not restricted to the technology industry. Allowing access fees would harm all sectors of the economy. As the Ad Hoc Telecommunications User Committee has pointed out, “every retailer with an online catalogue, every manufacturer with online product specifications, every insurance company with online claims processing, every bank offering online account management, every company with a web site – every business in America interacting with its customers online is dependent upon an open Internet.”<sup>40</sup> In May 2015, more than 150 companies from all sectors of the economy filed a letter with the FCC calling proposals to allow access fees “a grave threat to the Internet.”<sup>41</sup>

Today, companies that rely on the Internet to interact with their customers only pay for their own access to the Internet. They do not pay additional fees to their customers’ ISPs. Allowing access fees would change that. Large corporations that pay to be in the fast lane will have higher costs. They, too, will be subject to the ISP’s terminating monopoly and will have to pay excessive prices. Ultimately, these costs will be passed through to customers – whether in the form of higher prices or additional exposure to advertising.

Small businesses would be affected as well. As the record shows, many small businesses around the country rely on the Internet to reach their customers. As small business owners explained in thousands of filings, small businesses would not be able to pay fees for preferential treatment and would not be able to compete with companies that can pay. A selection of submissions by small business owners from all states is included in the appendix “Small Business Across the U.S. Oppose Discriminatory Fees.” They explain why small businesses would not be able to pay these fees, and how allowing access fees would harm them.

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<sup>40</sup> Comments of the Ad Hoc Telecommunications User Committee, July 18, p. 1, <http://apps.fcc.gov/ecfs/document/view?id=7521707093>. The Ad Hoc Telecommunications User Committee “consists of Fortune 500 companies from a variety of industry verticals including banking, construction, financial services, information services, insurance, manufacturing, payment processing, shipping and logistics, and systems integration.” Ad Hoc Telecommunications User Committee Notice of Ex parte meeting, November 12, 2014, p. 1, <http://apps.fcc.gov/ecfs/document/view?id=60000982524>.

<sup>41</sup> <http://www.theverge.com/2014/5/7/5692578/tech-coalition-challenges-fcc>.

***Allowing access fees harms free expression, cultural diversity and democratic discourse***

Finally, access fees may impose serious collateral damage on values like free speech, cultural diversity and democratic discourse by making it more difficult for individuals or non-profits to be heard or to find an audience for their creative works. Today, the Internet is space where all Americans, no matter the color of their skin or size of their wallets, have an equal opportunity to express themselves, organize politically, and connect with one another. Individuals and non-profits can put their content online at low cost, and when it travels across the network, that content receives the same service from the network as commercial content. By contrast, access fees would create two classes of speakers – those who can pay to receive better treatment (e.g., large, established companies or wealthy individuals) and those who cannot afford to do so – often individuals and groups with unpopular or new viewpoints, like activists and artists. But if the videos produced by public interest groups to educate the public or the online classes offered by universities count against users' bandwidth caps or stutter because these entities were unable to pay for better treatment, while commercial content does not count against users' bandwidth caps or loads smoothly even during times of congestion, non-commercial content will become relatively less attractive, making it more difficult to find an audience.

For these reasons, numerous non-commercial entities have filed comments in the record opposing access fees and explaining how they would be hurt. The appendix titled “A Diverse Range of Communities Support Net Neutrality” collects the relevant passages from filings from a diverse range of communities, including from faith communities, communities of color, rural communities, disability communities, artists and educators.

***Allowing access fees creates incentives to degrade the quality of unpaid service.***

If ISPs are allowed to charge application providers for preferential treatment, they have an incentive to reduce the quality of the “normal” service to make it more attractive to pay for preferential treatment. Allowing payment for technical forms of preferential treatment, ISPs have an incentive to lower the quality of the baseline service or not to upgrade in additional capacity over time. Allowing payment for economic forms of preferential treatment such as zero-rating creates an incentive to reduce bandwidth caps or to increase the price users have to pay for unrestricted bandwidth. The resulting reduction in the quality of the normal service hurts users and all application providers that cannot afford to pay for better treatment.

***The ban on access fees should apply to all forms of preferential treatment.***

Some commenters would restrict a ban on fees for preferential treatment to payments for technical forms of preferential treatment.<sup>42</sup>

However, fees in exchange for zero-rating pose the same threat to innovation and free speech as fees in exchange for technical forms of preferential treatment.<sup>43</sup> As the record shows, start-ups, small businesses and low-cost speakers will often be unable to pay to be in the fast

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<sup>42</sup> For a more detailed discussion of this question, see van Schewick, Network Neutrality and Zero-rating. Attachment to Barbara van Schewick Ex Parte Letter, GN Dkt. No. 14-28, February 19, 2015, at 1-5.

<sup>43</sup> van Schewick (2014c); van Schewick & Weiland (2015), p. 87.

lane; they won't be able to pay for zero-rating, either. But if some companies can pay so that their content loads faster or does not count against users' bandwidth cap, then those who can't pay won't have a chance to compete and be heard.

In addition, ISPs would have an incentive to lower monthly bandwidth caps or increase the per-byte price for unrestricted Internet use in order to make it more attractive for application providers to pay for zero-rating, harming users and providers of applications that do not pay for exclusion from the cap.<sup>44</sup> This effect can already be observed in Europe.<sup>45</sup>

Not banning zero-rating against a fee would be a significant step back from the FCC's 2010 Open Internet rules. The text of the order effectively prohibited ISPs from striking deals with application providers "to directly or indirectly favor some traffic over other traffic."<sup>46</sup> As Verizon explained in a recent *ex parte* letter, the Open Internet rules prohibited it from entering into commercial arrangements that would allow application providers to pay for zero-rating; Verizon appealed the rules because it was interested in exploring such arrangements.<sup>47</sup>

As the appendix shows, this approach has strong support in the record.<sup>48</sup>

***A bright-line ban on access fees is justified.***

Network neutrality rules should impose a bright-line ban on all forms of access fees. As 36 scholars explained in a recent letter to the FCC and the FTC, "Even low fees for preferential treatment can chill speech and raise barriers to entry for start-ups, stifling the vibrant experimentation by low-cost innovators that drives innovation on the Internet. Thus, the harms from these fees are not limited to excessive fees or to discriminatory or exclusive offerings."<sup>49</sup>

To the extent that there is a need for certain forms of preferential treatment, the regulatory framework described here is flexible enough to accommodate this need. First, as I explain below, network neutrality rules should allow certain forms of user-controlled Quality of Service that is paid for only by the user, subject to the conditions outlined below. Second, the emergency exception allows prioritization for emergency services. Finally, the reasonable network management exception would allow certain forms of preferential treatment if a network management problem cannot be solved in an application-agnostic way. (The exception would not, however allow ISPs to charge application providers for these services. This would be prohibited by the rules' ban on access fees.) Thus, socially beneficial forms of preferential treatment can still be realized under the proposed set of rules.

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<sup>44</sup> See, e.g., Ananny, et al. (2015), p. 3.

<sup>45</sup> Rewheel (2014a); Rewheel (2014b); Digital Fuel Monitor (2015).

<sup>46</sup> FCC Open Internet Order, p. 43, para 76.

<sup>47</sup> Verizon (2015) ("As we explained to the court in our briefs, the Commission's earlier rules foreclosed voluntary business arrangements, such as 'innovative arrangements (such as advertiser-supported services) that would help recover the costs of building and maintaining broadband networks.' These types of 'sponsored data' arrangements – where online content or service providers voluntarily pick up the tab for usage associated with their traffic, rather than the end user doing so – also hold promise for saving consumers money and enabling interested providers to differentiate themselves and better compete.", *ibid.* at 2)

<sup>48</sup> See Appendix titled "The Record Demonstrates Significant Support for Strong Rules," at 18-20.

<sup>49</sup> Ananny, et al. (2015), at 6.



In addition, bright-line rules have many advantages that have been described by numerous commenters in the record. They provide certainty to the market, keep the costs of regulation low and make it feasible for users, start-ups and non-profits to bring successful complaints. By limiting FCC discretion in specific cases, they also limit opportunities for FCC overreach.<sup>50</sup> The appendix titled “Entities Calling for Bright Line Rules” collects quotes from filings making the case for bright-line rules.

### **No restrictions on the attachment of non-harmful devices**

*The rules should allow users to attach the devices of their choice to their Internet access service, as long as the devices do not harm the network.*

### **User-controlled Quality of Service paid by the user**

*The rules should allow the ISP to offer different classes of service as part of their Internet access service if they meet the following conditions: (1) the different classes of service are available equally to all applications and classes of applications; (2) user is able to choose whether, when, and for which applications to use which class of service; and (3) the network provider is allowed to charge only its own Internet service customers for the use of the different classes of service.*

The network neutrality debate is often framed as a debate for or against Quality of Service.<sup>51</sup> However, the reality is much more nuanced. Some proposals take an all-or-nothing approach to discrimination. They ban or allow all forms of discrimination and, consequently, Quality of Service. Most proposals take a more nuanced position. They allow some, but not all forms of Quality of Service, with different proposals drawing the line between acceptable and unacceptable forms of Quality of Service in different ways.

What is Quality of Service? Different applications have different requirements with respect to reliability, bandwidth or delay.<sup>52</sup> While the original Internet provides a single best-effort service for all packets (that is, the network does its best to deliver data packets, but does not provide any guarantees with respect to delay, bandwidth or losses),<sup>53</sup> a network that provides

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<sup>50</sup> van Schewick (2014d).

<sup>51</sup> For an in-depth analysis of the relationship between network neutrality and Quality of Service, see van Schewick, Network Neutrality and Quality of Service.

<sup>52</sup> For example, Internet telephony is very sensitive to delay above a certain level, but does not care about occasional packet loss. Users usually do not notice a one-way, mouth-to-ear delay of less than 150ms. A delay of more than 400 ms makes voice calls frustrating or unintelligible. (International Telecommunication Union (2003); Kurose & Ross (2010), p. 601.) Depending on the encoding and loss-concealment mechanisms used, Internet telephony applications can tolerate between 1% and 20% of packet loss. (Kurose & Ross (2010), p. 617.) By contrast, e-mail is very sensitive to packet loss, but does not care about some delay. (See, e.g., Kurose & Ross (2010), pp. 92-94 and p. 95, Figure 2.4.) E-Mail applications rely on a transport layer protocol called the Transmission Control Protocol (TCP) to get reliable data delivery. On the needs of applications more generally, see, e.g., Kurose & Ross (2010), pp. 92-95; Peterson & Davie (2012), pp. 530-37.

<sup>53</sup> Thus, the network operates like the default service offered by the postal service, which does not guarantee when a letter will arrive or whether it will arrive at all. Contrary to the postal service, which lets users choose services other than the default service like two-day shipping, the original Internet provides only best-effort service. Peterson & Davie (2012), pp.206-07.

Quality of Service offers different types of service to different data packets.<sup>54</sup> For example, a particular service may guarantee a minimum bandwidth or maximum delay, or it may give some data packets priority over others without giving absolute guarantees.<sup>55</sup> While many applications function well with best-effort service, some applications may benefit from types of service that are more closely tailored to their needs. Whether network providers are able to offer Quality of Service may therefore have implications for the types of applications that the Internet can support.<sup>56</sup>

Proponents of a ban on all forms of Quality of Service are concerned that network providers may use the provision of Quality of Service as a tool to distort competition among applications or classes of applications. For example, they are concerned that a network provider may offer Quality of Service exclusively to its own application, but not to other, competing applications, or may sell Quality of Service exclusively to one of several competing applications.<sup>57</sup> They also point out that network providers who offer Quality of Service and are allowed to charge for it have an incentive to reduce the quality of the baseline service below acceptable levels to motivate users to pay for better service.<sup>58</sup> Moreover, selling Quality of Service allows network providers to profit from bandwidth scarcity, which reduces their incentives to increase the capacity of their networks.<sup>59</sup> While these arguments all have merit, these problems can be solved without totally banning Quality of Service. Ultimately, it is sufficient to constrain how Quality of Service can be offered and charged for.<sup>60</sup>

Supporters of banning Quality of Service also question the need for Quality of Service.<sup>61</sup> If there is no need for Quality of Service, banning it creates limited social costs.<sup>62</sup> So far,

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<sup>54</sup> On Quality of Service, see, e.g., Kurose & Ross (2010), pp. 647-72; Peterson & Davie (2012), pp. 530-57.

<sup>55</sup> For example, of the two Quality of Service architectures that were standardized by the Internet Engineering Task Force, the Intserv architecture provides specific QoS guarantees to particular application sessions, while the Diffserv architecture provides different levels of performance to different classes of traffic without providing specific guarantees. On Intserv, see Kurose & Ross (2010), pp. 669-72. On Diffserv, see Kurose & Ross (2010), pp. 660-65.

<sup>56</sup> For a more detailed discussion of Quality of Service and of the conditions under which it is useful, see Section “Ban All Discrimination” below.

<sup>57</sup> Free Press (2010), pp. 21-23; Center for Media Justice, et al. (2010), p. 48, 51.

<sup>58</sup> See, e.g., Economides (2010), p. 8.

<sup>59</sup> Center for Democracy & Technology (2010), pp. 28-29; Economides (2010), pp. 6, 13; Free Press (2010), p. 22; Open Internet Coalition (2010), p. 46; Center for Media Justice, et al. (2010), p. 45.

<sup>60</sup> First, the non-discrimination rule I propose below allows only certain forms of Quality of Service. The constraints imposed by the rule make it impossible for network providers to use the provision of Quality of Service to distort competition among applications or classes of applications. Second, my proposal requires the regulatory agency in charge of enforcing network neutrality rules to monitor the quality of the baseline service and set minimum quality standards, if the quality of the baseline service drops below acceptable levels. This prevents Internet service providers from degrading the quality of the baseline, best-effort service (e.g., by allocating less bandwidth to the best-effort service or by refraining from adding needed network capacity) to motivate users to pay for an enhanced type of service. (See van Schewick, *Network Neutrality and Quality of Service*, footnote 479 and accompanying text and van Schewick (2010a), pp. 10-11.) Third, the proposed rule constrains how network providers can charge for Quality of Service. These constraints prevent network providers from charging in ways that would distort competition or harm application innovation. (See van Schewick, *Network Neutrality and Quality of Service*, footnote 473 and accompanying text and van Schewick (2010c); van Schewick (2010d); van Schewick (2010a), pp. 10-12.)

<sup>61</sup> Center for Media Justice, et al. (2010), p. 49-50; Open Internet Coalition (2010), pp. 33-35.

<sup>62</sup> For a similar interpretation, see Clark, Lehr & Bauer (2010), p.10.

proponents of a ban point out, the lack of Quality of Service has not prevented real-time applications from becoming successful on the public Internet.<sup>63</sup> For example, although Internet telephony is sensitive to delay and high variations in delay (“jitter”) and may benefit from a network service that provides low delay and low jitter, Internet telephony applications such as Skype or Vonage work in the current Internet.<sup>64</sup> Video telephony applications like Skype or Google Video Chat function over today’s broadband connections.<sup>65</sup> Pointing to this experience, proponents of a ban argue that capacity increases, combined with end-host based measures, are sufficient to meet the needs of applications that require low delay or low jitter.<sup>66</sup>

However, the value of Quality of Service is not restricted to networks with high average utilization which are often congested.<sup>67</sup> While Quality of Service is only useful if there is congestion (i.e. if queues build up in routers), increasing capacity does not necessarily prevent congestion and therefore, Quality of Service may be useful in networks with more capacity as well. In networks that have low average utilization, but are not over-provisioned,<sup>68</sup> Quality of Service may give users the option to improve the performance of existing applications by using classes of service that provide more reliable or potentially better performance than best-effort service if congestion occurs. For example, while Skype’s quality will often be good enough, some users (or users who are not using Skype in the current Internet because Skype’s performance is not good enough for them) may value (and be willing to pay for) the option of using a different class of service that would allow them to get reliably good or even excellent call quality for selected Skype calls. Quality of Service may also enable new applications that we have not thought of yet that cannot function in a best-effort Internet or that would benefit from classes of service other than best-effort. And it may allow users whose bandwidth is limited to use that limited amount of bandwidth more efficiently. While the relative value of Quality of Service is likely to decline as a network’s capacity approaches the capacity required for over-provisioning, Quality of Service may provide benefits even in over-provisioned networks by allowing users to protect selected applications against the residual risk of congestion. Thus, banning Quality of Service has social costs, and these costs exist over a wide range of network capacities.

Thus, at least some forms of Quality of Service may provide social benefits over a wide range of network capacity. And while there are legitimate concerns about the consequences of allowing Quality of Service on competition among applications or investment in the network, these concerns can be mitigated without totally banning Quality of Service. Different forms of Quality of Service have different social benefits and social costs, so a more nuanced treatment is needed.

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<sup>63</sup> Center for Media Justice, et al. (2010), p. 49-50; Open Internet Coalition (2010), pp. 33-35.

<sup>64</sup> Peterson & Davie (2012), p. 531.

<sup>65</sup> For example, Skype video requires a high-speed broad connection of at least 512kbps down / 128kbps up. For best quality, Skype recommends “a high-speed broadband connection of 4Mbps down / 512kbps up”. Skype (2012).

<sup>66</sup> See, e.g., Open Internet Coalition (2010), pp. 43-46; Frischmann (2012), pp. 353-355

<sup>67</sup> For a detailed discussion of the potential social benefits of allowing certain kinds of Quality of Service, see van Schewick, *Network Neutrality and Quality of Service*, at 39-53.

<sup>68</sup> Over-provisioning requires considerably more capacity than ensuring low average utilization, so a lot of networks may belong to this category.

Ultimately, network neutrality rules are the result of a trade-off. They impose some constraints on the evolution of the network in order to allow the Internet to continue to foster application innovation, preserve user choice or foster democratic discourse. Policy makers need to decide whether restrictions on the evolution of the network (here: banning Quality of Service) are necessary to protect the values that network neutrality rules are designed to protect. If the restrictions are not necessary to protect these values, they should not be imposed. By contrast, whether introducing Quality of Service makes sense from a technical or business perspective is a question that should be left to network engineers and network providers.<sup>69</sup> If regulators adopt non-discrimination rules that allow certain forms of Quality of Service, they do not pick winners and losers in this debate. Such non-discrimination rules do not require network providers to introduce Quality of Service; they only allow them to do so within the constraints imposed by the rules. If network providers decide that over-provisioning offers a better cost-benefit trade-off than offering Quality of Service in line with the rules, they are free to go down that route.

There are different types of Quality of Service, and I evaluate them in detail elsewhere.<sup>70</sup> Ultimately, there is only one type of Quality of Service that does not threaten the values that network neutrality is designed to protect. This is the kind of Quality of Service that network neutrality rules should allow.

As described above, the non-discrimination rule I propose would prohibit all application-specific discrimination and would allow all application-agnostic discrimination. This rule allows network providers to offer certain (though not all) forms of Quality of Service.

In particular, it allows network providers to offer different classes of service if they meet the following conditions:

- (1) the different classes of service are available equally to all applications and classes of applications;
- (2) the user is able to choose whether, when and for which application to use which class of service;
- (3) the network provider is allowed to charge only its own Internet service customers for the use of the different classes of service.<sup>71</sup>

For example, a network provider could offer a low-delay service, a best-efforts service, a less-than-best-efforts service, and a guaranteed-bandwidth service. The decision of whether and when to use which service would be left to the user. For example, one user could use the low-delay service for Internet telephony, another may use it for online gaming, and a third user may

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<sup>69</sup> Of course, the constraints imposed by a non-discrimination rule that allows all or some forms of Quality of Service will influence network providers' private costs and benefits of over-provisioning and Quality of Service. For example, other things being equal, introducing Quality of Service may be more attractive under a regime that allows network providers to charge whomever they like for the provision of different classes of service, and less attractive under a regime that prohibits network providers from charging for Quality of Service.

<sup>70</sup> van Schewick, *Network Neutrality and Quality of Service*.

<sup>71</sup> I explain the rationale for this criterion in van Schewick (2010c); van Schewick (2014b), Section "3. Allowing access fees is bad policy"; van Schewick (2014a), Section "Tough Lessons From Mobile and Music."

use it for e-mail, if that is what that user wants. This type of user-controlled Quality of Service is technically feasible.<sup>72</sup>

While the first two conditions directly flow from the proposed non-discrimination rule,<sup>73</sup> the third condition is based on additional considerations and would need to be encoded separately.

A network provider who is allowed to charge for Quality of Service has an incentive to degrade the quality of the baseline, best-effort service to motivate users to pay for an enhanced type of service. The existence of this incentive is well-documented in the economic literature on price discrimination and one of the main motivations behind proposals to ban Quality of Service. To mitigate this problem, the rules should require the regulatory agency in charge of enforcing the network neutrality rules to monitor the quality of the baseline service and set minimum quality standards, if the quality of the baseline service drops below appropriate levels.<sup>74, 75</sup>

This type of user-controlled Quality of Service offers the same potential social benefits as other, discriminatory or provider-controlled forms of Quality of Service without the social costs and should therefore be allowed.

In particular, it does not raise any of the problems associated with “like treatment” outlined below. Contrary to like treatment, it preserves the application-agnosticism of the network, the principle of user choice, and the principle of innovation without permission:

*First*, this type of Quality of Service preserve the *application-agnosticism* of the network: The provision of Quality of Service is not dependent on which applications users are using, but on the Quality-of-Service-related choices that users make; thus, the network providers does not need to know anything about which applications are using its network in order for this scheme to work. The network provider only makes different classes of service available, but does not have any role in deciding which application gets which Quality of Service; this choice is for users to make. As a result, network providers cannot use the provision of Quality of Service as a

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<sup>72</sup> The technical feasibility of this type of Quality of Service and other questions regarding the impact of the proposed rule on Quality of Service are discussed in van Schewick, *Network Neutrality and Quality of Service*, at 143-152.

<sup>73</sup> Deviating from the first condition by making a specific type of service available only to some applications or classes of applications (e.g., only to the provider’s own online video application, or only to online gaming, but not Internet telephony) would make distinctions among applications and classes of applications based on application-specific criteria (here: application or application type) and would thus violate the requirement that differential treatment must be application-agnostic. The second condition ensures that the differential treatment associated with the actual provision of the different types of services in the network happens based on an application-agnostic criterion (here: the type of service chosen by the user for that particular packet).

<sup>74</sup> The incentive to degrade the quality of the baseline service arises only if network providers are allowed to charge for Quality of Service. If they are not allowed to charge for it, they do not benefit from users’ increased use of better-than-best-effort services and, therefore, do not have an incentive to degrade the quality of the baseline, best-effort service to motivate users to use more enhanced services. Thus, instead of adopting the solution proposed in the text, regulators could mitigate this problem by prohibiting network providers from charging for the provision of Quality of Service. Such a ban creates its own social costs, though.

<sup>75</sup> The European Union has adopted a similar rule following its review of the regulatory framework for telecommunications services. See Article 22(3) of the Universal Service Directive; European Commission (2007), pp. 92, 95-97, 101.

mechanism to distort competition among applications or classes of applications. *Second*, since users choose when and for which applications to use which type of service (in line with the principle of *user choice*), they can get exactly the Quality of Service that meets their preferences, even if these preferences differ across users or (for a single user) over time. *Third*, in line with the principle of *innovation without permission*, an innovator does not need support from the network provider in order for his application to get the Quality of Service it needs. The only actors who need to be convinced that the application needs Quality of Service are the innovator, who needs to communicate this to the user, and the user, who wants to use the application. This greatly increases the chance that an application can get the type of service it needs.

By contrast, network neutrality rules should *not allow network providers to offer different types of service to different provider-defined classes of applications, even if the network provider treats like traffic alike*. In other words, the rules should not allow network providers to provide different types of service to different provider-defined classes of applications that are not alike, as long as they do not discriminate among classes of applications that are alike or among applications within a class of like applications. This requirement is often called “like treatment.”<sup>76</sup> Under this approach, a network provider would be allowed to offer low-delay service to Internet telephony, but not to e-mail, as long as it does not treat Vonage differently from Skype, or Gmail differently from Hotmail.<sup>77</sup> In the US, the AT&T BellSouth Merger conditions and various draft bills in Congress allowed this form of Quality of Service.

Those who would allow forms of Quality of Service that provide like treatment assume that discriminating among classes of applications that are not alike is socially harmless and should therefore be allowed. As the article shows, this assumption is not correct. In many cases, discrimination among classes of applications hurts some classes of applications, even if the classes are not alike. For example, some Internet applications such as Internet telephony applications, Internet messaging applications or Internet video offerings compete with network-provider services that are sold separately from Internet access and do not run over the Internet-access portion of the network provider’s access network. In these cases, discriminating against all applications in that class allows the network provider to favor its own offering without discriminating among applications within the class. Moreover, applications in a class can be harmed by differential treatment even if they do not compete directly with applications in other classes that are treated more favorably.

In addition, like treatment negatively affects several of the factors that have fostered application innovation in the past. *First*, like treatment removes the *application-agnosticism* of the network. Allowing network providers to treat classes of applications differently requires the network provider to identify the different applications on its network in order to decide which class they belong to and determine the appropriate type of service. Thus, like treatment requires network providers to treat data packets differently based on information about the applications on the network. Since the concept of “like applications” is not well defined, network providers

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<sup>76</sup> On this form of Quality of Service, see Section “Allow Discrimination Among Classes of Applications That Are Not Alike” in van Schewick, *Network Neutrality and Quality of Service*.

<sup>77</sup> Internet telephony is sensitive to delay, but e-mail is not, so the two classes of applications are not alike.

have broad discretion to decide which applications are alike, which allows them to deliberately or inadvertently distort competition among applications or classes of applications. *Second*, like treatment violates the principle of *user choice*. Under like treatment, network providers, not users, choose which application should get which Quality of Service. Since users' preferences for Quality of Service are not necessarily the same across users and may even vary for the same user over time, letting network providers determine which applications gets which Quality of Service will result in levels of Quality of Service that do not meet users' needs. *Third*, like treatment harms application innovation by requiring innovators to convince network providers that their application belongs to a certain class. Requiring network providers to take action before an application can get the Quality of Service it needs violates the principle of *innovation without permission* and reduces the chance that new applications actually get the type of service they need. *Finally*, disputes over which classes of applications are alike, or whether a certain application belongs to a certain class, are likely to be frequent and difficult to resolve, creating high costs of regulation.

Thus, forms of Quality of Service that respect the principle of like treatment do not adequately protect the values that network neutrality is designed to protect and should not be allowed under a network neutrality regime.

## **Equal protections for mobile and fixed networks**

*The network neutrality rules should apply equally to mobile and fixed networks.*

It should not matter over which network technology users access the Internet. The threats for application innovation, free speech and user choice are the same. Wireless networks have been historically controlled by network providers, so the bias towards network provider control may be even stronger in wireless networks. Thus, the rationale for protection is the same.

At the same time, wireless technology is evolving rapidly. In the absence of strong protections, technology may evolve in a way that will make it more difficult to protect the values that network neutrality rules are designed to protect in the future. Since mobility or location-awareness are specific to mobile services, the space of potential applications is larger and even less explored than in the wireline space. Thus, the potential for application innovation (and the dampening effect of a lack of protections against discriminatory behavior on investment) is particularly large.

Any technical differences between wireless and wireline networks – to the extent they exist – can be accounted for when applying the reasonable network management exception. For example, there may be some technical characteristics of specific wireless technologies or special problems associated with mobility that make it impossible to solve certain network management problems in an application-agnostic way. In these cases, the reasonable network management exception described above would allow network providers to solve these problems in more application-specific ways. Thus, these problems, to the extent they exist, can be accounted for when applying the reasonable network management exception. But they will be problems

associated with specific wireless technologies (for example, industry participants usually agree that LTE does not pose any issues that are fundamentally different from the issues faced by the provider of a DSL network). They do not justify applying fundamentally different levels of protection to wireline and wireless networks in general.

While the market for wireless Internet services is more competitive than the market for wireline services, this does not remove the need for meaningful network neutrality rules.<sup>78</sup>

Some participants in the debate assume that competition in the market for Internet services removes the need for substantive network neutrality rules. This approach is based on the idea that if a network provider discriminates against an application that users would like to use, users can switch to another network provider that does not discriminate against the affected application. The threat of switching, proponents of this approach assume, will discipline providers.

These arguments fail to recognize that the market for Internet services is characterized by a number of factors—incomplete customer information, product differentiation in the market for Internet access and for wireline and wireless bundles, and switching costs—that limit the effectiveness of competition and reduce consumers’ willingness to switch. These factors leave the network provider with a substantial degree of market power over its customers, enabling it to restrict some applications and content on its network without losing too many Internet service customers. Thus, competition in the market for Internet access services does not remove the need for rules against blocking and discrimination. The problems with access fees are independent of the amount of competition in that market as well.

The experience in Europe and Canada and in the market for mobile Internet services in the United States supports this view.<sup>79</sup>

The markets for wireline Internet service in Europe and Canada are considerably more competitive than the market for wireline, fixed Internet services in the United States. The European legal framework does not prohibit restrictions on end users’ use of applications or services, but it requires Internet access service providers to disclose them. Still, as the results of an investigation by the Body of European Regulators for Electronic Communications (BEREC) showed, many Internet service customers in the European Union are subject to restrictions on their fixed or mobile Internet services. A recent study showed widespread discriminatory network management in the United Kingdom. In Canada, the 2009 investigation of the CRTC into Internet service providers’ network management practices showed that, at the time, many Canadian providers were singling out peer-to-peer file-sharing applications for special treatment, throttling the bandwidth available to them or interfering with these applications in other ways.

Under the FCC’s Open Internet Order, providers of mobile Internet services in the United States were subject to limited restrictions on their ability to block applications and were free to

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<sup>78</sup> For a fuller analysis and references to the literature, see van Schewick, *Network Neutrality and Quality of Service*, at 83-96.

<sup>79</sup> For a fuller analysis and references to the literature, see van Schewick, *Network Neutrality and Quality of Service*, at 96-98.



discriminate, but were required to disclose, among other things, blocking of or discrimination against applications.<sup>80</sup> Since the adoption of the Open Internet Order, wireless carriers have engaged in various forms of discriminatory conduct, even though the market for mobile Internet services in the United States is considerably more competitive than the market for wireline Internet services. Examples are Verizon Wireless’s conduct towards tethering applications;<sup>81</sup> Verizon Wireless’s, AT&T’s, and T-Mobile’s actions towards Google Wallet;<sup>82</sup> and AT&T’s actions towards FaceTime.<sup>83</sup>

These examples suggest that—at least in the market for wireline Internet service in Europe and Canada and in the market for mobile Internet services in the United States—competition does not prevent Internet service providers from interfering with applications, content, or services on their networks, even if, as in the United States and the European Union, network providers are required to disclose any discriminatory conduct that occurs.<sup>84</sup>

Equal protections for mobile and fixed service are supported by a wide range of commenters.<sup>85</sup>

## Interconnection

*Network neutrality rules should prohibit providers of last-mile Internet access services from charging interconnecting networks, application providers and content delivery networks fees for access to their subscribers and clarify that last-mile ISPs can’t use practices related to interconnection to evade the FCC’s network neutrality rules.*

Any network neutrality rules need to cover interconnection. Unless network neutrality rules prohibit last-mile ISPs from charging interconnecting networks, application providers and content delivery networks fees for access to their subscribers, the rules will not address the very

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<sup>80</sup> 47 C.F.R. §§ 8.3, 8.5(a) (2014); *see also* *Open Internet Order*, 25 FCC Rcd. 17,905, 17,938-39 (2010) (report and order)(describing the obligation to disclose “[a]pplication-[s]pecific[b]ehavior” under 47 C.F.R. § 8.3 (italics omitted)), *vacated in part*, *Verizon v. FCC*, 740 F.3d 623 (D.C. Cir. 2014).

<sup>81</sup> Barbara van Schewick, *Public Interest Requires Public Input: Verizon/Android Tethering*, INTERNET ARCHITECTURE & INNOVATION (June 30, 2011), <https://netarchitecture.org/2011/06/public-interest-requires-public-input-verizonandroid-tethering>.

<sup>82</sup> Barbara van Schewick, *Is Verizon Wireless Illegally Blocking Google Wallet? It’s Time for the FCC to Investigate*, INTERNET ARCHITECTURE & INNOVATION (Dec. 19, 2011), <https://netarchitecture.org/2011/12/is-verizon-wireless-illegally-blocking-google-wallet-its-time-for-the-fcc-to-investigate>.

<sup>83</sup> Cecilia Kang, *AT&T Faces Complaint over iPhone FaceTime Blocking*, WASH. POST POST TECH (Sept. 18, 2012, 9:08 AM ET), <http://wapo.st/1yRD4ql>; Chris Ziegler, *AT&T Only Allowing FaceTime over Cellular on Mobile Share Plans, No Extra Charge*, VERGE (Aug. 17, 2012, 4:29 PM), <http://www.theverge.com/2012/8/17/3250228/att-facetime-over-cellular-ios-6-mobile-share>.

<sup>84</sup> One could argue that the existence of restricted offerings is less problematic if there are unrestricted offerings available that users can switch to. As I have explained elsewhere, this argument is not correct. The restricted offerings harm users and reduce application innovation, even if unrestricted offerings are available. *See* Barbara van Schewick, *Comments on the European Commission’s Public Consultation on Specific Aspects of Transparency, Traffic Management and Switching in an Open Internet* 19-21 (Oct. 15, 2012), *available at* [http://ec.europa.eu/information\\_society/newsroom/cf/dae/document.cfm?doc\\_id=3168](http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=3168).

<sup>85</sup> *See* Appendix titled “The Record Demonstrates Significant Support for Strong Rules,” at 28-35.

real, ongoing problems in the market for interconnection with last-mile ISPs that continue to harm millions of users, companies, application providers and interconnecting providers.<sup>86</sup>

While Netflix has received adequate performance since it agreed to pay a fee for access to several large last-mile ISPs including Comcast, connections by Level 3, Cogent and other interconnecting providers that refuse to pay are still congested, harming every user and edge provider whose traffic enters these networks via these providers.<sup>87</sup>

Prohibiting last-mile ISPs from charging interconnecting networks, application providers and content delivery networks fees for access to their subscribers is good policy and is strongly supported by Commission precedent.

*First*, banning these fees prevents last-mile ISPs from exploiting their terminating monopoly by charging interconnecting entities excessive prices for access to the ISPs' subscribers or enhanced access to these subscribers.<sup>88</sup> Excessive fees not only hurt large

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86 See, e.g., The Open Technology Institute at New America Foundation (2014); Crawford (2014); Measurement Lab (2014). Petition to Deny of Cogent Communications Group, Inc., Declaration of Henry (Hank) Kilmer, Vice President of IP Engineering, Cogent Communications Holdings, Inc., Applications of Comcast Corp. and Time Warner Cable Inc. For Consent To Assign or Transfer Control of Licenses and Authorizations, MB Docket No. 14-57, August 25, 2014, pp. 12-13, available at <http://apps.fcc.gov/ecfs/document/view?id=7521817735>; 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, "Competition in the Video and Broadband Markets: the Proposed Merger of Comcast and Time Warner Cable," May 8, 2014, pp. 5-6, available at <http://judiciary.house.gov/cache/files/d89e8174-d014-4ade-8a00-58c5b9350dd4/schaeffer-testimony.pdf>; Letter from Netflix Inc. to Senator Al Franken, April 23, 2014, pp. 1-2, available at <http://www.franken.senate.gov/files/letter/140424NetflixResponse.pdf>; Petition to Deny of Netflix, Inc., Declaration of Ken Florance, Vice President of Content Delivery, Netflix Inc., Applications of Comcast Corp. and Time Warner Cable Inc. For Consent To Assign or Transfer Control of Licenses and Authorizations, MB Docket No. 14-57, August 25, 2014, pp. 11-18, available at <http://apps.fcc.gov/ecfs/document/view?id=7521819696>; Comment of Packet Host, Inc., Protecting and Promoting the Open Internet, GN Docket No. 14-28, Oct. 2, 2014, p. 2, available at <http://apps.fcc.gov/ecfs/document/view?id=60000870476>; Mark Taylor, "Observations of an Internet Middleman," Level3 Blog, May 5, 2014, available at <http://blog.level3.com/open-internet/observations-internet-middleman/>; Adam Rothschild, "Peering disputes: Comcast, Level 3 and You," Voxel via Internap Blog, Dec. 2, 2010, available at <http://www.internap.com/2010/12/02/peering-disputes-comcast-level-3-and-you/>; Letter from Adam Rothschild, Vice President of Network Architecture, Voxel dot Net, Inc. to Marlene Dortch, Applications of Comcast Corp. and General Electric Company and NBC Universal, Inc. For Consent To Assign or Transfer Control of Licenses, MB Docket No. 10-56, Jan. 11, 2011, available at <http://apps.fcc.gov/ecfs/document/view?id=7021025553>.

87 See, e.g., Measurement Lab (2014); Anderson (2015) (presenting data showing that congestion is not limited to Cogent or specific services and is ongoing as of Q4 2014); Comment of Packet Host, Inc., Protecting and Promoting the Open Internet, GN Docket No. 14-28, Oct. 2, 2014, p. 2, available at <http://apps.fcc.gov/ecfs/document/view?id=60000870476>; Collin Anderson, "Internet Observatory Updates and Improvements," M-Lab Blog, Feb. 12, 2015, available at <http://www.measurementlab.net/blog/internet-observatory-update>; M-Lab Observatory, "Download Speed for AT&T, Comcast on GTT in Chicago – Hourly Median for Jan 2015," Accessed Feb. 19, 2015, available at [http://www.measurementlab.net/observatory#tab=explore&metric=download\\_throughput&metro=Chicago&combos=ord04\\_att.ord04\\_comcast&time=01022015-02022015&timeView=hourly&](http://www.measurementlab.net/observatory#tab=explore&metric=download_throughput&metro=Chicago&combos=ord04_att.ord04_comcast&time=01022015-02022015&timeView=hourly&).

88 As the FCC recognized in its 2010 Open Internet rules, last-mile ISPs have a terminating monopoly over access to their users. This terminating monopoly allows them to charge monopoly prices to application providers for access to their users or enhanced access to users, regardless of the amount of competition in the market for broadband Internet access services. Federal Communications Commission (2010), para 21, 24-26, 32. See also Notice of Ex Parte for COMPTTEL, CCIA, New America Foundation, Free Press, Internet Freedom Business Alliance and Ad Hoc Telecommunications Users Committee, Protecting and Promoting the Open Internet, GN

application providers like Netflix that directly interconnect with last-mile ISPs, but also are likely to increase the costs for large and small companies that rely on the services of content delivery networks or transit providers like Level 3 and Cogent to reach subscribers around the country.<sup>89</sup>

By contrast, reviewing access fees case-by-case to ensure they are just and reasonable would effectively require the FCC to engage in rate regulation – a complex, messy, and costly process.

*Second*, banning access fees at the point of interconnection is in line with principles of cost causation, since the ISPs’ subscribers are the ones who request the traffic delivered by the interconnecting entity.<sup>90</sup>

*Third*, as long as last-mile ISPs are allowed to charge fees for access to their subscribers in the context of interconnection, they have an incentive to let unpaid routes into the network congest in order to motivate interconnecting providers to pay for good-quality interconnection. Thus, allowing these fees imposes considerable collateral damage on users and application providers (including small startups, small businesses or nonprofit sites) whose traffic enters last-mile networks via unpaid routes. Only a ban removes that incentive.<sup>91</sup>

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Docket No. 14-28, Feb. 12, 2015, available at <http://apps.fcc.gov/ecfs/comment/view?id=60001016425>; Notice of Ex Parte for Netflix, Level 3, Cogent, Amazon and COMPTTEL, Protecting and Promoting the Open Internet, GN Docket No. 14-28, Nov. 12, 2014, available at <http://apps.fcc.gov/ecfs/comment/view?id=60000979029>; Comments of Engine Advocacy, Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 18, 2014, p. 6, available at <http://apps.fcc.gov/ecfs/document/view?id=7521702004>; Notice of Ex Parte for Writers Guild of America, West, Inc., Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 31, 2014, pp. 1-2, available at <http://apps.fcc.gov/ecfs/comment/view?id=6018249012>;

89 Vimeo LLC (2014) (“Because video hosting and sharing is a high-bandwidth business, Vimeo views terminating access fees as a significant threat to its current and future growth. The ability of consumers to access our content at the highest possible speed—and thus highest possible video resolution—is essential to our business. Like other similarly situated content providers, Vimeo purchases third-party CDN services to deliver videos to customers. [...] Vimeo strenuously disagrees with Comcast that interconnection costs “are irrelevant to small OVDs because they would have no need for direct interconnection.” When a CDN pays an interconnection fee to a large ISP, that fee is passed to the CDN’s customers through increased CDN charges. This makes interconnection fees directly relevant to our business and our bottom line. Moreover, as we grow, developing and deploying our own CDN will be a natural step—at which point the interconnection fee will be directly, rather than indirectly, assessed on our services.”, *ibid.*, p. 2); Comments of Ad Hoc Telecommunications User Committee, Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 18, 2014, p. 13, available at <http://apps.fcc.gov/ecfs/document/view?id=7521707093>; Notice of Ex Parte for Etsy, Tumblr, VHX, Kickstarter, Foursquare, Meetup, General Assembly, Spotify, Gilt, Warby Parker, Dwolla, CodeAcademy, Upworthy, BuzzFeed, Reddit, Vimeo and Union Square Ventures, Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 18, 2014, p. 2, available at <http://apps.fcc.gov/ecfs/document/view?id=7521680048>; Comments of Contextly, Protecting and Promoting the Open Internet, Framework for Broadband Internet Service, GN Docket No. 14-28, GN Docket 10-127, June 3, 2014, p. 8, available at <http://apps.fcc.gov/ecfs/document/view?id=7521195149>.

90 Comments of Ad Hoc Telecommunications User Committee, Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 18, 2014, p. 13, available at <http://apps.fcc.gov/ecfs/document/view?id=7521707093>; Notice of Ex Parte for COMPTTEL, Level 3, Cogent and Netflix, Protecting and Promoting the Open Internet, GN Docket No. 14-28, June 13, 2015, p. 3, available at <http://apps.fcc.gov/ecfs/document/view?id=60001013288>; Notice of Ex Parte for Data Foundry and Golden Frog, Protecting and Promoting the Open Internet, GN Docket No. 14-28, Nov. 25, 2014, p. 6, available at <http://apps.fcc.gov/ecfs/document/view?id=60000988218>.

91 See, e.g., Level 3 Communications LLC (2014), pp. 2-3; Notice of Ex Parte for Netflix, Protecting and Promoting the Open Internet, GN Docket No. 14-28, Nov. 5, 2014, p. 5, available at

*Fourth*, banning these fees creates lower costs of regulation and provides more certainty to the market than reviewing such fees case by case under an unjust and unreasonable standard.

A ban on access fees would be narrowly tailored to address these harms. The ban would prohibit last-mile ISPs from charging interconnecting providers fees for the transmission of data between the point of interconnection and an ISP’s subscribers. But it would not prevent the interconnecting parties from sharing the costs of “physical” interconnection (i.e. the non-recurring costs of purchasing ports and cross-connect cable to establish the interconnection),<sup>92</sup> nor would it affect ISPs’ ability to buy or sell transit services (which provide access to the entire Internet, not just to a last-mile ISP’s own subscribers) or to offer and charge for CDN services.<sup>93</sup>

Commission precedents in the areas of interconnection and network neutrality strongly support a ban. In the telephony context, the FCC has long regulated local exchange carriers to prevent them from exploiting their terminating monopoly by charging excessive prices to interconnecting providers.<sup>94</sup> In the Intercarrier Compensation Reform Order, the FCC finally prohibited access charges for access to users based on policy arguments directly applicable here.<sup>95</sup>

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<http://apps.fcc.gov/ecfs/document/view?id=60000979153>; Reply Comments of the Open Technology Institute at New America, Protecting and Promoting the Open Internet, GN Docket No. 14-28, Sept. 15, 2014, p. 18, available at <http://apps.fcc.gov/ecfs/document/view?id=7522726666>; Comments of the Open Technology Institute at New America, Protecting and Promoting the Open Internet, GN Docket No. 14-28, Sept. 15, 2014, pp. 16-17, available at <http://apps.fcc.gov/ecfs/document/view?id=7522638911>; Comments of AARP, Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 15, 2014, pp. 32-3, available at <http://apps.fcc.gov/ecfs/document/view?id=7521705861>; Comments of Reddit, Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 15, 2014, p. 5, available at <http://apps.fcc.gov/ecfs/document/view?id=7521679127>; Comments of AOL Inc., Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 15, 2014, p. 6, available at <http://apps.fcc.gov/ecfs/document/view?id=7521485473>; Comments of AOL Inc., Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 15, 2014, p. 9, available at <http://apps.fcc.gov/ecfs/document/view?id=7521394546>.

<sup>92</sup> Comments of Cogent Communications, Protecting and Promoting the Open Internet, GN Docket No. 14-28, Sept. 15, 2014, pp. 22-4, available at <http://apps.fcc.gov/ecfs/document/view?id=7522662146>; Reply Comments of Netflix, Inc., Protecting and Promoting the Open Internet, GN Docket No. 14-28, Sept. 15, 2014, pp. 17-18 available at <http://apps.fcc.gov/ecfs/document/view?id=7522679249>; Reply Comments of Level 3 Communications, LLC, Protecting and Promoting the Open Internet, GN Docket No. 14-28, Sept. 15, 2014, p. 9, available at <http://apps.fcc.gov/ecfs/document/view?id=7522620642>; Comments of Level 3 Communications, LLC, Protecting and Promoting the Open Internet, GN Docket No. 14-28, March 21, 2014, p. 7, available at <http://apps.fcc.gov/ecfs/document/view?id=7521094640>;

<sup>93</sup> Notice of Ex Parte of COMPTTEL, Protecting and Promoting the Open Internet, GN Docket No. 14-28, Jan. 21, 2015, p. 5, available at <http://apps.fcc.gov/ecfs/document/view?id=60001015055>; Comments of Level 3, Protecting and Promoting the Open Internet, GN Docket No. 14-28, March 21, 2014, p. 12 available at <http://apps.fcc.gov/ecfs/document/view?id=7521094640>.

<sup>94</sup> See the overview in Ad Hoc Telecommunications Users Committee (2014), pp. 9-13.

<sup>95</sup> Federal Communications Commission (2011), paras 741-756. See, e.g., Ad Hoc Telecommunications Users Committee (2014), pp. 16-23; Comments of Microsoft Corporation, Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 18, 2014, p. 10, available at <http://apps.fcc.gov/ecfs/document/view?id=7521701839>; Notice of Ex Parte of Free Press, Protecting and Promoting the Open Internet, GN Docket No. 14-28, Nov. 5, 2014, p. 5, available at <http://apps.fcc.gov/ecfs/document/view?id=60000979162>; Reply Comments of Vonage Holdings Corp., Protecting and Promoting the Open Internet, GN Docket No. 14-28, Sept. 15, 2014, pp. 28-30, available at <http://apps.fcc.gov/ecfs/document/view?id=7522672565>; Comments of New America – Open Technology Institute,

In addition, the arguments in the FCC’s Open Internet Order that supported a ban on fees for access to end users equally justify a ban on access fees in the context of interconnection.<sup>96</sup>

A ban on access fees in the context of interconnection receives broad support in the record.<sup>97</sup>

In addition, the FCC should clarify that interconnection with the last mile cannot be used as means to circumvent the Commission’s bright line rules against blocking, throttling, and paid prioritization.<sup>98</sup>

As the past few years have shown, ISPs can block, discriminate, or impose access fees either while data is traveling across the ISP’s last-mile access network or when it enters that network at the point of interconnection. Although the interference happens at a different point in the network, the impact of blocking, discrimination, or access fees on users and application providers is the same, as is the harm to innovation and free speech. Users don’t care whether the eagerly awaited new season of *House of Cards* buffers because their video encounters congestion when entering the last-mile network at the point of interconnection or after it has entered that network. Application providers don’t care whether the fee they have to pay to get acceptable quality and remain competitive is for interconnection or for transport across the end users’ access network. Under these circumstances, prohibiting practices only on the access network, but not necessarily at the point of interconnection with last-mile networks will ultimately be ineffective and irrelevant—allowing ISPs to evade the ban by engaging in the banned practices at point of interconnection.<sup>99</sup>

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Protecting and Promoting the Open Internet, GN Docket No. 14-28, Sept. 15, 2014, p. 18, available at <http://apps.fcc.gov/ecfs/document/view?id=7522726666>; Comments of COMPTTEL, Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 15, 2014, pp. 10-12, available at <http://apps.fcc.gov/ecfs/document/view?id=7521480266>.

<sup>96</sup> Federal Communications Commission (2010), paras 21, 24, 25, 29, 32, 128. See also, e.g., Level 3 Communications LLC (2014), pp. 2-3; Notice of Ex Parte of Open Technology Institute at New America, Protecting and Promoting the Open Internet, GN Docket No. 14-28, Dec. 22, 2014, p. 6, available at <http://apps.fcc.gov/ecfs/document/view?id=60001010771>; Notice of Ex Parte of COMPTTEL, Protecting and Promoting the Open Internet, GN Docket No. 14-28, Jan. 23, 2015, available at <http://apps.fcc.gov/ecfs/comment/view?id=60001010738>; Reply Comments of Netflix, Inc., Protecting and Promoting the Open Internet, GN Docket No. 14-28, Sept. 15, 2014, p. 19, available at <http://apps.fcc.gov/ecfs/document/view?id=7522679249>;

<sup>97</sup> See the references cited in this section and Appendix titled “The Record Demonstrates Significant Support for Strong Rules,” at 23-27.

<sup>98</sup> Comments of Writers Guild of America, West, Inc., Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 15, 2014, p. 18, available at <http://apps.fcc.gov/ecfs/document/view?id=7521496915>; Comments of AOL, Inc., Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 15, 2014, p. 8, available at <http://apps.fcc.gov/ecfs/document/view?id=7521485473>; Notice of Ex Parte of COMPTTEL, CCIA, New America Foundation, Free Press, IFBA and Ad Hoc Telecommunications Users Committee, Protecting and Promoting the Open Internet, GN Docket No. 14-28, Feb. 12, 2015, available at <http://apps.fcc.gov/ecfs/document/view?id=60001029257>; Notice of Ex Parte of Netflix, Inc., Protecting and Promoting the Open Internet, GN Docket No. 14-28, Aug. 1, 2014, p. 3, available at <http://apps.fcc.gov/ecfs/document/view?id=7521748026>; Comments of Microsoft, Inc., Protecting and Promoting the Open Internet, GN Docket No. 14-28, July 18, 2014, p. 29, available at <http://apps.fcc.gov/ecfs/document/view?id=7521701839>.

<sup>99</sup> van Schewick & Weiland (2015), pp. 94-95.

## Specialized services

ISPs have long been pushing for a broad exception to any network neutrality regime that allows them to offer additional services over a user’s Internet connection and claim that these additional services are not part of their broadband Internet access service and not subject to network neutrality rules. Although the FCC asked for additional comment on specialized services in 2010,<sup>100</sup> it is not clear what kind of specialized services ISPs have in mind or whether these services could be offered over a properly regulated broadband Internet access service.<sup>101</sup>

A vague “specialized services” provision could be the sort of loophole that you could drive a truck through, enabling ISPs to circumvent network neutrality rules.<sup>102</sup> For example, as Harold Feld, Senior Vice President of Public Knowledge, has pointed out, a vague specialized service exception might allow “Comcast or AT&T or any other provider [to] offer its over-the-top online streaming service as a ‘specialized service’ and give itself prioritized service. Companies could essentially sell prioritized service to specific applications or content simply by calling these fast lanes ‘specialized services.’”<sup>103</sup> One could argue that this kind of service is “designed to evade the purposes of” the bill’s network neutrality rules and would therefore be prohibited by the bill, but it is not clear how this language would be applied. After all, from the perspective of ISPs, being able to offer services that are not subject to network neutrality rules is the whole point of the specialized services exception.

Therefore, clarifying that ISPs can’t use specialized services to evade network neutrality rules is essential. In addition, the FCC should clarify that offering preferential treatment to application providers for a fee as a “specialized service” would be considered a circumvention, if similar functionality could be offered as part of the normal Internet access in a way that is compatible with network neutrality rules. For example, given that the proposed rules allow ISPs to user-controlled and user-paid Quality of service, offering preferential treatment to application providers for a fee should be considered an evasion of the rules and be prohibited. Only if a service cannot be realized in this way at all, should it be possible to offer the underlying functionality as a specialized service.

Additionally, exempting specialized services might give ISPs an incentive to limit (or fail to upgrade) the amount of capacity available for normal, regulated broadband Internet access service in order to have more capacity for unregulated specialized services. In the Open Internet

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<sup>100</sup> Public Notice at 2-4, GN Docket No. 09-191, WC Docket No. 07-52 (FCC Sept. 1, 2010), *available at* <http://apps.fcc.gov/ecfs/document/view?id=7020912392>.

<sup>101</sup> For example, allowing ISPs to offer certain forms of user-controlled Quality of Service under the conditions described in Subpart 4 might remove one of the main justifications for specialized services.

<sup>102</sup> *See, e.g.*, Comments of Free Press Regarding Further Inquiry at 6-19, Preserving the Open Internet, GN Docket No. 09-191, Broadband Industry Practices, WC Docket No. 07-52 (Oct. 12, 2010), *available at* <http://apps.fcc.gov/ecfs/document/view?id=7020916539>; Marvin Ammori, *A Guide to the Network Neutrality Discussions at the FCC*, HUFFINGTON POST (Aug. 4, 2010, 3:08 PM EDT), [http://www.huffingtonpost.com/marvin-ammori/a-guide-to-the-network-ne\\_b\\_670784.html](http://www.huffingtonpost.com/marvin-ammori/a-guide-to-the-network-ne_b_670784.html) (discussing the different options for introducing loopholes into network neutrality rules).

<sup>103</sup> Shiva Stella, *Public Knowledge Expresses Strong Concerns About Sen. Thune’s Net Neutrality Discussion Draft*, PUB. KNOWLEDGE (Jan. 16, 2015), <https://www.publicknowledge.org/press-release/public-knowledge-expresses-strong-concerns-about-sen-thunes-net-neutrality>.

Order, the FCC shared this concern, expressed stringent expectations for how it expected ISPs to address them, and committed itself to monitoring the issue, all steps in the right direction.<sup>104</sup>

Finally, network neutrality proponents have argued that ISPs might offer specialized services in a way that distorts competition—for example, by offering them exclusively to themselves or their partners, or by charging different prices for the same service. The Open Internet Order acknowledged these concerns, and the FCC committed to monitoring the issue, leaving its resolution to subsequent rulemakings.<sup>105</sup>

## References

- Ananny, Mike, Jonathan Askin, Patricia Aufderheide, Jonathan B. Baker, Carliss Y. Baldwin, Jack Balkin, et al. 2015. *Protecting and Promoting the Open Internet*. Attachment to Ex Parte letter in the Matter of Protecting and Promoting the Open Internet submitted February 2, 2015 to the Federal Communications Commission GN Dkt. No. 14-28. <http://apps.fcc.gov/ecfs/document/view?id=60001025192>
- Anderson, Nate. 2008. "WiMAX networks: we won't single out P2P for punishment." *Ars Technica*. <http://arstechnica.com/uncategorized/2008/10/wimax-traffic-management-to-be-application-agnostic/>
- Balkin, Jack M. 2009. *Testimony before the Federal Communications Commission at its Workshop on Speech, Democratic Engagement, and the Open Internet*. Federal Communications Commission. <http://apps.fcc.gov/ecfs/comment/view?id=6015504602>
- Bastian, C., T. Klieber, J. Livingood, J. Mills & R. Woundy. 2010. "Comcast's Protocol-Agnostic Congestion Management System." Request for Comments 6057. IETF.
- Benkler, Yochai. 2000. "From Consumers to Users: Shifting the Deeper Structures of Regulation Towards Sustainable Commons and User Access." *Federal Communications Law Journal*, 52(3): 561-579.
- Bretton Woods Telephone Company. 2011. "Network Management." *Bretton Woods Telephone Company*. <http://bwtc.net/networkmanagement>
- Canadian Radio-Television and Telecommunications Commission. 2009. "Review of the Internet Traffic Management Practices of Internet Service Providers. Telecom Regulatory Policy". CRTC 2011-657. <http://www.crtc.gc.ca/eng/archive/2009/2009-657.htm>
- Carolina West Wireless. 2011. "Open Internet Policy." *Carolina West Wireless*. <https://www.carolinawest.com/open-internet-policy/>
- Center for Democracy & Technology. 2010. Comments to Federal Communications Commission. GN Docket No. 09-191. January 14. <http://fjallfoss.fcc.gov/ecfs/document/view?id=7020378292>
- Center for Media Justice, Consumers Union, Media Access Project, New America Foundation & Public Knowledge. 2010. Comments of Public Interest Commenters to Federal Communications Commission. GN Docket No. 09-191. January 14. <http://apps.fcc.gov/ecfs/document/view?id=7020378818>

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<sup>104</sup> *Open Internet Order*, 25 FCC Rcd. 17,905, 17,965-66 (2010) (report and order), *vacated in part*, *Verizon v. FCC*, 740 F.3d 623 (D.C. Cir. 2014).

<sup>105</sup> *Id.*

- Clark, David, William Lehr & Steven Bauer. 2010. Comments to Federal Communications Commission. GN Dkt. No. 09-191. January 14. <http://apps.fcc.gov/ecfs/document/view?id=7020373725>
- Comcast. 2015. "Understand congestion management on our network." *Comcast*. February 11. <http://customer.comcast.com/help-and-support/internet/network-management-information/>
- Comcast Corporation. 2008. *Comcast Corporation Description of Current Network Management Practices*. Attachment A to Comcast Corporation's Filing In the Matter of Formal Complaint of Free Press and Public Knowledge Against Comcast Corporation for Secretly Degrading Peer-to-Peer Applications submitted September 19, 2008. WC Dkt. No. 07-52. <http://apps.fcc.gov/ecfs/document/view?id=6520172537>
- Cooper, Alissa. 2013. "How Competition Drives Discrimination: An Analysis of Broadband Traffic Management in the UK." Paper presented at 41st Research Conference on Communication, Information and Internet Policy (TPRC 41). Arlington, Virginia, USA.
- Digital Fuel Monitor. 2015. *In the Netherlands, where zero-rating is banned, KPN just doubled (free of charge) the mobile internet volume caps to encourage a carefree usage of its online videos.* [http://dfmonitor.eu/downloads/Banning\\_zerorating\\_leads\\_to\\_higher\\_volume\\_caps\\_0602\\_2015.pdf](http://dfmonitor.eu/downloads/Banning_zerorating_leads_to_higher_volume_caps_0602_2015.pdf)
- Economides, Nicholas. 2010. *Why Imposing New Tolls on Third-Party Content and Applications Threatens Innovation and will not Improve Broadband Providers' Investment*. Appendix A of Google's Comments to Federal Communications Commission submitted January 14, 2010 GN Docket No. 09-101. <http://fjallfoss.fcc.gov/ecfs/document/view?id=7020378726>
- European Commission. 2007. "Commission Staff Working Document. Impact Assessment". SEC(2007) 1472. [http://ec.europa.eu/information\\_society/policy/ecomm/doc/library/proposals/1472/comm\\_pdf\\_sec\\_2007\\_1472\\_1\\_en\\_documentdetravail.pdf.pdf](http://ec.europa.eu/information_society/policy/ecomm/doc/library/proposals/1472/comm_pdf_sec_2007_1472_1_en_documentdetravail.pdf.pdf)
- Federal Communications Commission. 2008. "Formal Complaint of Free Press and Public Knowledge Against Comcast Corporation for Secretly Degrading Peer-to-Peer Applications. Memorandum Opinion and Order". FCC 08-183.
- Federal Communications Commission. 2010. "Preserving the Open Internet. Report and Order". FCC 10-201. [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/FCC-10-201A1.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-10-201A1.pdf)
- Free Press. 2010. Comments to Federal Communications Commission. GN Docket No. 09-191. January 14. <http://fjallfoss.fcc.gov/ecfs/document/view?id=7020378751>
- Frischmann, Brett. 2012. *Infrastructure: The Social Value of Shared Resources*. New York, NY: Oxford University Press.
- Frontier. 2015. "Network Management Policy." *Frontier*. <https://frontier.com/networkmanagement/>
- Geist, Michael. 2007. "ISP Must come Clean on 'Traffic Shaping'." *The Star*. April 16. <http://www.thestar.com/sciencetech/article/203408>
- HardyNet. 2015. "HardyNet Network Management Practices Policy Disclosure." *HardyNet*. February. <http://hardynet.net/wp-content/uploads/2015/02/HardyNet-Network-Management-Policies-Disclosure-4-13-Ver.-3b-CURRENT.pdf>
- International Telecommunication Union. 2003. *ITU-T Recommendation G.114: One-way transmission time*. International Telecommunication Union. G.114. [http://www.itu.int/rec/dologin\\_pub.asp?lang=e&id=T-REC-G.114-200305-I!!PDF-E&type=items](http://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-G.114-200305-I!!PDF-E&type=items)



- Kurose, James F. & Keith W. Ross. 2010. *Computer Networking: A Top-Down Approach*. 5th ed. Boston, MA: Pearson/Addison Wesley.
- Lightstream. 2015. "Network Management Policy." *Lightstream*. <http://www.lightstreamin.com/network-management-policy/>
- Meisner, Jeff. 2008. "Internet Congestion: ISPs Don Traffic Cop Uniforms." *ECommerce Times*. October 18. <http://www.ecommercetimes.com/story/64861.html>
- Mosaic Telecom. 2011. "Mosaic Telecom Open Internet Policy." *Mosaic Telecom*. November 20. <http://www.mosaictelecom.com/termsandconditions/OpenInternetPolicy.html>
- Open Internet Coalition. 2010. Comments to Federal Communications Commission. GN Dkt. No. 09-191. January 14. <http://apps.fcc.gov/ecfs/document/view?id=7020377928>
- Peterson, Larry L. & Bruce S. Davie. 2012. *Computer Networks: A Systems Approach*. 5th ed. Burlington, MA: Morgan Kaufmann.
- Plateau. 2013. "Plateau Network Management Policy." *Plateau*. [http://www.plateautel.com/legal\\_net\\_mgmt.asp](http://www.plateautel.com/legal_net_mgmt.asp)
- RCN Corporation. 2010. Ex Parte Letter to Federal Communications Commission. GN Dkt. No. 09-191. May 7. <http://apps.fcc.gov/ecfs/document/view?id=7020450131>
- Rewheel. 2014a. *EU28 & OECD mobile internet access competitiveness report Q4 2014*. [http://dfmonitor.eu/insights/2014\\_nov\\_premium\\_q4\\_update/](http://dfmonitor.eu/insights/2014_nov_premium_q4_update/)
- Rewheel. 2014b. *Mobile Internet usage price rankings & internet speeds EU 28 & OECD mobile operators - Q4 2014*. [http://dfmonitor.eu/insights/2014\\_nov\\_premium\\_q4\\_update/](http://dfmonitor.eu/insights/2014_nov_premium_q4_update/)
- Schmidt, Sarah. 2012. "Complaints About Online Traffic Delays Accelerating, Says CRTC." *Canada.com*. January 12. <http://www.canada.com/life/Complaints+about+online+traffic+delays+accelerating+says+CRTC/5986923/story.html>
- Skype. 2012. "Get Skype for Windows." February 21. <http://www.skype.com/intl/en-us/get-skype/on-your-computer/windows/>
- Telispire. 2014. "Internet Policy." *Telispire*,. <http://www.telispire.com/support/internet-policy/>
- van Schewick, Barbara. 2010a. *Background Paper for the Federal Communications Commission's Workshop on Approaches to Preserving the Open Internet in Seattle, WA on April 28, 2010*.
- van Schewick, Barbara. 2010b. *Internet Architecture and Innovation*. Cambridge, MA: MIT Press.
- van Schewick, Barbara. 2010c. *Opening Statement at the Federal Communications Commission's Workshop on Approaches to Preserving the Open Internet*. Federal Communications Commission. [http://www.law.stanford.edu/display/images/dynamic/publications\\_pdf/schewick-statement-20100428.pdf](http://www.law.stanford.edu/display/images/dynamic/publications_pdf/schewick-statement-20100428.pdf)
- van Schewick, Barbara. 2010d. *Opening Statement at the Federal Communications Commission's Workshop on Innovation, Investment and the Open Internet*. Federal Communications Commission. <http://fjallfoss.fcc.gov/ecfs/document/view?id=7020382126>
- van Schewick, Barbara. 2010e. *Opening Statement at the Federal Communications Commission's Workshop on Innovation, Investment and the Open Internet in Cambridge, MA on January 13, 2010*. Attachment to Barbara van Schewick's Ex Parte to Federal Communications Commission submitted on January 19, 2010 GN Dkt. No 09-191. <http://fjallfoss.fcc.gov/ecfs/document/view?id=7020382126>

- van Schewick, Barbara. 2014a. "The Case for Rebooting the Network-Neutrality Debate." *The Atlantic*. May 6. <http://www.theatlantic.com/technology/archive/2014/05/the-case-for-rebooting-the-network-neutrality-debate/361809/>
- van Schewick, Barbara. 2014b. "The FCC Changed Course on Network Neutrality. Here is Why You Should Care." *Stanford Center for Internet and Society Blog*. April 25. <http://cyberlaw.stanford.edu/blog/2014/04/fcc-changed-course-network-neutrality-here-why-you-should-care>
- van Schewick, Barbara. 2014c. *The FCC Changed Course on Network Neutrality. Here is Why You Should Care*. . Attachment to Barbara van Schewick's Notice of Ex Parte Conversation In the Matter of Protecting and Promoting the Open Internet submitted April 25, 2014 to the Federal Communications Commission GN Dkt. No. 14-28. <http://apps.fcc.gov/ecfs/document/view?id=7521099988>
- van Schewick, Barbara. 2014d. "Only Title II will ensure fairness among ISPs." *The Hill*. September 16. <http://thehill.com/special-reports/net-neutrality-september-16-2014/217864-only-title-ii-will-ensure-fairness-among>
- van Schewick, Barbara & Morgan Weiland. 2015. "New Republican Bill Is Network Neutrality in Name Only." *Stanford Law Review*. January 20. [http://www.stanfordlawreview.org/sites/default/files/online/articles/67 Stan L Rev Online 85 vanSchewick Weiland.pdf](http://www.stanfordlawreview.org/sites/default/files/online/articles/67%20Stan%20L%20Rev%20Online%2085%20vanSchewick%20Weiland.pdf)
- Verizon. 2015. Letter to Federal Communications Commission. GN Dkt. No. 14-28. February 11. <http://apps.fcc.gov/ecfs/document/view?id=60001028587>
- Wireless Hometown. 2011. "Open Internet Principles of Wireless Hometown." *Wireless Hometown*. <http://www.wirelesshometown.com/8.html>