Stanford Law School

Barbara van Schewick
Professor of Law and, by Courtesy, Electrical Engineering
Helen L. Faculty Scholar
Director, Center for Internet and Society

March 15, 2017

Comments on TRAI's Consultation Paper on Net Neutrality

I welcome the opportunity to comment on TRAI's Consultation Paper on Net Neutrality. I submit these comments as a professor of law and, by courtesy, electrical engineering at Stanford University whose research focuses on Internet architecture, innovation and regulation. My book "Internet Architecture and Innovation," which was published by MIT Press in 2010, is considered the seminal work on the science, economics and politics of network neutrality. My papers on network neutrality have influenced discussions on network neutrality all over the world.[1] I have testified on matters of Internet architecture, innovation and regulation before the US Federal Communications Commission (FCC), the Body of European Regulators for Electronic Communications (BEREC), and the Canadian Radio-television and Telecommunications Commission (CRTC).[2] The FCC's 2010 and 2014 Open Internet Orders relied heavily on my work. I have not been retained or paid by anybody to participate in this proceeding.

My comment is based on and draws heavily on my existing writings on net neutrality. The papers most relevant to this consultation are attached to this submission. The following text summarizes the key ideas and points to the parts of the papers that contain the relevant, more detailed analysis. I would welcome the opportunity to discuss these important issues further.

Proposal for Actual Network Neutrality Rules

In my comments to the Pre-Consultation Paper, I stated several general principles that should guide TRAI's analysis on net neutrality. However, as I explained in those comments, stating these general principles is not enough to provide meaningful net neutrality. To provide certainty to market participants and keep the costs of regulation low, more detailed rules are needed that address the various practices relevant to net neutrality.

As I explained in my earlier comments on the Pre-Consultation paper, I suggest that India should adopt the net neutrality rules described below. [3]

---

[1] See, e.g., van Schewick (2007); Frischmann & van Schewick (2007); van Schewick (2015d).

[2] See, e.g.,van Schewick (2008); van Schewick (2010c); van Schewick (2010b); Federal Communications Commission (2014).

[3] The following description of the rules is copied from or draws heavily on my comments on the Pre-Consultation Paper.

These recommendations for a regulatory framework for net neutrality are based on my work on network neutrality over the past 15 years and consider the relevant research, the broad record that was developed in various regulatory proceedings in Canada and the US, as well as the experience with and impact of the regulatory choices of countries like Europe, the United States, and Canada over the past decade.

The rules suggest here would apply to both technical and economic forms of ISP interference. TRAI already adopted rules governing zero-rating, so it could limit the rules to technical forms of blocking and discrimination.

Overview of Proposed Rules

No blocking

TRAI should adopt a rule that:

(1) prohibits providers of Internet access (ISPs) from blocking Internet applications, content, services or uses ("applications")

(2) subject to reasonable network management.

No application-specific discrimination

TRAI should adopt a bright-line rule nondiscrimination rule that:

(1) applies to any forms of differential treatment that falls short of blocking (including zero-rating and application-specific pricing), NOT just to technical forms of differential treatment and

(2) bans discrimination based on sender, receiver, application or class of application ("application-specific discrimination"), NOT just to discrimination based on application,

(3) subject to reasonable network management.

Reasonable network management

The exception for reasonable network management should require network management to be:

(1) appropriate and tailored (i.e. only used during times of congestion),

(2) as application-agnostic as possible (this requirement is key), and

(3) only apply to the rules against blocking and discrimination.

TRAI's consultation document seems to suggest that, due to the different characteristics and challenges of wireless Internet services, different standards might need to apply to network management of wireless as opposed to wireline Internet services. I disagree. Instead the same rules

should apply equally to mobile and fixed networks. That applies to the rules as such and to any exceptions.[4]

First, 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.

Second, 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.

Third, 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 (that's because the exception only requires network management problems to be as application-agnostic as possible. If an application-agnostic solution is not possible in light of the specific characteristics of mobile networks, ISPs would be allowed to choose a more application-specific solution, although they would have to choose the least restrictive one.) **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.**

Proactively applying a weaker standard to mobile or wireless technologies would provide the wrong incentives to ISPs and leave users without protection. As the experience in the US, Canada, and Europe has shown, ISPs are not interested in exploring application-agnostic ways of managing their networks unless they are required to do so by net neutrality rules. By contrast, the FCC's order requiring Comcast to adopt application-agnostic ways of managing congestion triggered a wave of interest and subsequent innovation in application-agnostic network management.

While ISPs routinely claim that mobile networks require application-specific traffic management, studies suggest that application-agnostic traffic management measure are sufficient

[4] The following analysis is adapted from {van Schewick, 2015 #8435}, pp. 23-35.

to manage mobile networks in a broader range of circumstances than is often assumed.[5] In light of the negative impact of application-specific network management practices on users and on the providers of applications, content, and services, such measures should not be allowed by default, but only as the last resort, if the problem cannot be solved in an application-agnostic way.

No access fees

TRAI should adopt:

(1) a bright-line ban (NOT a presumptive ban or, even worse, unstructured case-by-case analysis)

(2) on all forms of access fees, i.e. fees charged to edge providers for

- access to users,[6] and for
- any form of differential treatment (including prioritization, guaranteed bandwidth, differential pricing, and zero-rating) that gives an edge provider that pays an advantage over edge providers that don't pay, NOT just a ban that is restricted to fees for prioritization (as the Republican network neutrality discussion draft) or to technical forms of preferential treatment.

(3) This ban should not be subject to the exception for reasonable network management.

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 (and only 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 applications to use which class of service; and

[5] New America Foundation's Open Technology Institute (2014), "Re: Protecting and Promoting the Open Internet, GN Docket Nos. 14-28, 10-127," Ex Parte letter filed with the Federal Communications Commission, November 13 2014, https://www newamerica.org/downloads/ExParte_OTI_FilingCTCstudy_111314.pdf;
CTC Technology and Energy (2014), Mobile Networks Can Manage Congestion While Abiding by Open Internet Principles, November 2014, https://static newamerica.org/attachments/188-mobile-broadband-networks-can-manage-congestion-while-abiding-by-open-internet-principles/OTI_CTC_Wireless_Network_Neutrality_Engineering_Study_FINAL_111314.pdf

[6] The FCC's 2010 and 2015 Open Internet Orders treat this form of access fees as a form of blocking and explicitly state that it is prohibited.

(3) the network provider is allowed to charge only its own Internet service customers for the use of the different classes of service.

Equal protections for mobile and fixed networks

The rules should apply equally to mobile and fixed networks.

No access fees for interconnection with last-mile networks

Any meaningful network neutrality regime must include interconnection. TRAI should adopt a rule that prohibits providers of last-mile Internet access services from charging interconnecting networks, application providers and content delivery networks fees for access to their subscribers and clarifies that last-mile ISPs can't use practices related to interconnection to evade the FCC's network neutrality rules.

Specialized services

TRAI should:

(1) adopt a narrow definition of specialized services and

(2) ensure that specialized services

- cannot be used to circumvent the net neutrality rules,
- do not interfere with or retard the growth of the capacity available for Internet access, and
- are not offered in a way that distorts competition among applications or classes of applications or interferes with user choice.

My attached paper "The Case for Meaningful Net Neutrality Rules" provides the justification for each of these rules.[7] Instead of copying the relevant sections into this document, I submit it as an attachment and include it by reference.

I originally submitted that paper to the Federal Communications Commission during its recent Open Internet Proceeding, but the recommendations and arguments apply equally in India. As the paper explains, the proposal was strongly supported by the record in the Open Internet Proceeding. The paper has five appendices that collect relevant excerpts from submissions by a diverse group of stakeholders. The appendices are available from the author on request or can be found online at the following link: https://www.fcc.gov/ecfs/filing/60001018648.

I also include my paper "Network Neutrality and Quality of Service: What a Non-Discrimination Rule Should Look Like," which appeared in the Stanford Law Review in 2015. To make it easier to find the parts of the paper relevant to the consultation questions, I include an overview of the relevant discussions in the paper, with a reference to the page numbers:

[7] van Schewick (2015b).

The following parts of the paper are particularly relevant to this proceeding:

- "Introduction" (pp. 4-16):
  - Provides an overview of the paper's findings.
- "Ban Application-Specific Discrimination, But Allow Application-Agnostic Discrimination" (pp. 124-152) - describes my proposed non-discrimination rule, a rule that the FCC's Open Internet Rules adopted in part:
  - Defines the terms application-specific (pp. 124-126) and application-agnostic (p. 127; see also pp. 24-25, 128-130);
  - Explains the rationale for the rule (pp. 127-133; see also 99-102);
  - Describes my proposal for a reasonable network management exception requiring network management to be as application-agnostic as possible (pp. 137-140).
- "Ban discrimination among like applications or classes of applications" (pp. 102-124)
  - Explains why allowing ISPs to discriminate among classes of applications is socially harmful, even if the classes are not alike (pp. 107-124)
- "Quality of Service" (pp. 133-137) and "The proposed rule in practice: questions and answers" (pp. 143-152):
  - Describes the conditions under which TRAI should allow ISPs to offer certain forms of user-controlled Quality of Service paid by the user (pp. 133-135);
  - Explains why allowing these forms of user-controlled and user-paid Quality of Service is good policy (pp. 135-137);
  - Explains how this proposal would work in practice (pp. 143-152).
- "Summary: Network Neutrality and Quality of Service" (pp. 162-166)
  - Summarizes the paper's findings with regard to Quality of Service

- Discussions related to Quality of Service
    - Defines "Quality of Service" (pp. 7-8);
    - Analyzes whether there is a need for Quality of Service, and discusses the relationship between congestion and the need for Quality of Service and whether overprovisioning removes the need for Quality of Service (pp. 37-53);
    - Evaluates the social costs and benefits of the following forms of Quality of Service, and explains whether they should be allowed in a network neutrality regime:
        - Allowing network providers to offer Quality of Service exclusively to one or more applications within a class of "like" applications (should be prohibited) (pp. 105-107);
        - Allowing network providers to offer different types of service to different provider-defined classes of applications as long as the network provider treats like traffic alike (should be prohibited) (pp. 107-123);
        - Allowing ISPS to offer different types of service, if (1) network providers make different types of service available equally to all applications and classes of applications; (2) in which users choose whether, when, and for which applications to use which type of service; and (3) ISPs are allowed to charge only their end users for the use of the service (should be allowed) (pp. 133-137, 143-152).

"The Open Internet Order's Non-discrimination Rule" (pp. 152-161):

- Describes the 2010 Open Internet Order's non-discrimination rule (including the factors – application-agnostic and user choice – that the FCC said it would use to determine whether discrimination and network management are reasonable) (pp. 155-161);
- Describes the Open Internet Order's stance towards Quality of Service (pp. 157-158, 161).

- "A Framework for Evaluating Network Neutrality Rules" (pp. 16-27)
    - Explains how to best choose among different proposals for non-discrimination rules and network neutrality rules more generally;
    - Defines "user choice," "innovation without permission," "application-agnosticism," and "low cost of application innovation" and explains why they are important (pp. 21-23).

- "Problems with Case-by-Case Adjudication" (pp. 69-83):
    - Explains the social costs of using case-by-case approaches in the network neutrality context:
        - lack of certainty and predictability (pp. 70-73);
        - high costs of regulation (pp. 73-74);
        - limited ability to protect values and actors that network neutrality rules are designed to protect (pp. 74-81);
    - Explores the strategic incentives of policy makers and big stakeholders to adopt such approaches (pp. 81-83).

- "Formal Approaches: Ban Discrimination That Is Not Disclosed" (p. 83-99):

  - Explains why competition does not prevent ISPs from blocking or discriminating based on economic theory (pp. 83-96) and discusses the factors that provide ISPs with market power in the market for Internet services:
    - Consumers' incomplete knowledge, cognitive limitations, and cognitive biases (pp. 86-88);
    - Product differentiation and bundling (pp. 88-92);
    - Switching costs (pp. 92-96).
  - Highlights the empirical evidence supporting this view (pp. 96-98).

- "Ban Discrimination That Violates an Antitrust Framework" (pp. 54-64):
  - Sets out the differences between an antitrust framework and the broader theoretical framework used by network neutrality proponents and the FCC in its Open Internet Order (pp. 10, 16-19);
  - Explains why using an antitrust framework to distinguish good and bad discrimination does not capture all instances of discrimination that network neutrality proponents are concerned about (pp. 54-64).

The following sections are excerpts from my comments to TRAI's Pre-Consultation Paper. As they are directly relevant to the questions in the Consultation paper, I copy them again here.

The Role of Disclosure in a Net Neutrality Regime

Any net neutrality regime should include transparency and disclosure obligations. As TRAI's Pre-Consultation Paper rightly notes,[8] information about the terms and characteristics of the ISPs' offerings can help users make informed choices.[9] However, disclosure rules cannot replace substantive net neutrality rules.[10]

Participants on both sides of the debate often assume that net neutrality rules that ban discriminatory conduct that is not disclosed will be sufficient to prevent blocking and discrimination if there is competition in the market for Internet services. This assumption is not correct. The market for Internet services is characterized by a number of factors—incomplete customer information, product differentiation in the markets for Internet access and for wireline and wireless bundles, and switching costs—that limit the effectiveness of competition and reduce consumers' willingness to switch. Rules that require network providers to disclose whether and how they interfere with applications and content on their networks reduce the problem of incomplete customer information, but only to some degree. They do not remove any of the other problems. As a result, they leave network providers with a substantial degree of market power over their customers that enables them to restrict some applications and content on their network without losing too many Internet service customers. Disclosure rules also do not affect the cognitive biases, cognitive limitations, and externality problems that lead users to underestimate the benefits of switching providers compared to what would be in the public interest. Thus, disclosure rules are not a substitute for substantive rules against blocking or discrimination, even

[8] Telecom Regulatory Authority of India (2016), para 21.
[9] van Schewick (2015d), pp. 98-99 and Box 11: The Benefits of Disclosure Rules.
[10] The following text is adopted from van Schewick (2015d), pp. 29.

if there is competition in the market for Internet access services. The experience in Europe and Canada and in the market for mobile Internet services in the United States supports this view.[11]

While mandatory disclosure alone does not sufficiently protect against discriminatory conduct, it serves many other valuable functions. Thus, it is an important complement to substantive net neutrality rules.[12]

The attached article "Network Neutrality and Quality of Service: What a Nondiscrimination Rule Should Look Like" discusses this issue in detail.[13]

Due to a number of factors, these limitations apply even more strongly in the context of the reasonable network management, as Cooper and Brown show in an important paper based on a case study of the experience in the UK. The paper, entitled "Net Neutrality: Discrimination, Competition, and Innovation in the UK and US" is attached.[14]

The Importance of Brightline Rules

To avoid the considerable social costs associated with evaluating behavior case-by-case, behavior that is clearly harmful should be explicitly banned by bright-line rules.[15]

Bright-line rules provide certainty to the market, keep the costs of regulation low and make it feasible for users, start-ups and non-profits to bring complaints. By removing the regulator's discretion in specific cases, they also limit opportunities for regulatory overreach.[16]

By contrast, leaving the evaluation of specific practices to case-by-case adjudications creates considerable uncertainty, increases the costs of regulation and puts the burden on the public to bring complaints.[17] *First*, standards that are evaluated case-by-case make it difficult to determine how they would apply to specific practices. The resulting lack of certainty harms ISPs, entrepreneurs and investors alike, which, in turn, would reduce innovation and investment.[18] *Second*, case-by-case standards tilt the playing field in favor of large, established players that can afford long, costly proceedings at the regulatory agency and make it difficult for actors with few resources and little experience navigating the regulatory processes – users, start-ups, or non-profits – to bring successful complaints.[19] During the FCC's Open Internet proceeding, start-ups uniformly explained that such a standard would make it all but impossible for them to bring

11 van Schewick (2015d), pp. 96-98.
12 See van Schewick (2015d), pp. 98-99 and Box 11: The Benefits of Disclosure Rules.
13 van Schewick (2015d), pp. 84-99.
14 Cooper & Brown (2015), pp. 2:1-2:9.
15 This paragraph is adopted from van Schewick (2015a), pp. 5, 16-17.
16 van Schewick (2014a).
17 See generally van Schewick (2015d), pp. 69-83; van Schewick (2014a).
18 See generally van Schewick (2015d), pp. 70-73.
19 See generally van Schewick (2015d), pp. 74.

complaints.[20] *Third*, applying such a standard creates high costs of regulation.[21] *Finally*, vague case-by-case standards give the regulatory agency ample discretion to decide specific cases and so interfere with competitive markets for websites and services, providing opportunities for regulatory overreach.[22]

If a practice is yet unknown or cannot be evaluated without considering the specific facts of the case, the practice cannot be evaluated in advance, so these costs are unavoidable. *But if a practice is already known to be harmful*, it should be prohibited by bright-line rules in order to avoid the considerable social costs associated with case-by-case evaluations.

TRAI recognized the importance of brightline rules in its landmark decision on differential pricing, adopted in January 2016. The same consideration apply equally here.

Question 2: What are the reasonable traffic management practices that may need to be followed by TSPs while providing Internet access services and in what manner could these be misused? Are there any other current or potential practices in India that may give rise to concerns about net neutrality?

As indicated above, the exception for reasonable network management should require network management to be:

(1) appropriate and tailored (i.e. only used during times of congestion),

(2) as application-agnostic as possible (this requirement is key), and

(3) only apply to the rules against blocking and discrimination.

[20] See, e.g., Comments of Y Combinator, GN Docket No. 14-28, July 14, 2014, at 3, *available at* http://apps.fcc.gov/ecfs/document/view?id=7521383177 ("No startup has the funds and lawyers and economists to take on billion-dollar ISPs in an FCC action based on the vague legal standards in the proposal. Indeed, the startup ecosystem needs a bright-line, per se rule against discrimination."); Comments of Tumblr, GN Docket No. 14-28, Sept.9, at 10, available at http://apps.fcc.gov/ecfs/comment/view?id=6018347452, ("Notably, Tumblr has only two lawyers, and no telecommunications lawyers or lobbyists on staff. Tumblr cannot afford to engage in what would likely be multi-year challenges against the biggest broadband providers, with large legal teams experienced in telecommunications law, simply to secure access for its users equal to that of its current, and future, competitors with deeper resources."); Reddit at 8, http://apps fcc.gov/ecfs/document/view?id=7521679127, ("We have no lawyers on staff, and we devote our resources solely to meeting the needs of our 100 million visitors. We do not have the resources to engage ISPs in a legal fight, with only a vague standard as our weapon, without any firm ground on which to stand. We need clear, bright-line rules."). Comments of Meetup, GN Docket No. 14-28, July 14, 2014, at 8, *available at* http://apps.fcc.gov/ecfs/document/view?id=7521382127 ("It is simply unrealistic to think that a resource-constrained company such as Meetup would be able to avail itself of a vague and amorphous 'commercial reasonableness' standard that requires extensive and expensive adversarial proceedings."). For additional quotes, see Ammori (2014), footnote 1.

[21] See generally van Schewick (2015d), p. 73.

[22] van Schewick (2014b).

The rationale for this rule is explained in the attached papers "The Case for Meaningful Network Neutrality Rules" and "Network Neutrality and Quality of Service: What a Non-Discrimination Rule Should Look Like."[23]

Some participants in the debate assume that network management practices are only a problem from a net neutrality perspective if they are motivated by anticompetitive motivations.[24] However, the social costs of discriminatory conduct are created by the conduct as such; they do not change depending on the network provider's motivation.[25] If an application is being blocked, it cannot reach its customers. Users will be unable to use it, and the application developer and his investors will be unable to reap its benefits, whether the network provider is blocking the application to manage congestion or to exclude a competitor. Thus, the social harm—the reduction in application developers' incentives to innovate and in investors' willingness to invest, and users' inability to use the Internet in the way that is most valuable to them or participate in social, cultural, or democratic discourse related to blocked content—is caused by the blocking as such, not by the motivations that are driving it.

The reasonable network management exception proposed above gives network providers the tools they need to manage their networks and maintain the quality of the Internet experience for all users, while preserving the application-agnosticism of the network and the principle of user choice as much as possible.

Differentiation among classes of traffic based on technical requirements

Some participants in the debate assume that allowing ISPs to differentiate among classes of traffic to manage their network is not harmful if the classes are based on the objective characteristics of traffic. This assumption is not correct. Such traffic management practices still allow ISPs to distort competition, stifles innovation, harms users, and hurts providers who encrypt traffic by putting all encrypted traffic in the slow lane.

The following excerpt from one of my recent articles explains why.[26]

"The proposal allows ISPs to engage in class-based discrimination.

The proposal allows class-based discrimination: ISPs can make distinctions between different kinds of traffic and treat them differently to optimize overall transmission quality at any time, not just during times of congestion. The discrimination must be based on the technical requirements of the applications in question. Thus, ISPs could treat different kinds of applications differently if

[23] van Schewick (2015b), pp. 7-11 (discussing reasonable network management), 17-23 (discussing user-controlled Quality of Service and discrimination among classes of applications); van Schewick (2015d), pp. 137-140 (discussing reasonable network management), 124-133 (discussing application-agnostic discrimination), 133-137 (discussing user-controlled Quality of Service).

[24] See, e.g., the references cited in van Schewick (2015d), pp. 61-62.

[25] This paragraph is adopted from van Schewick (2015d), p. 63. For a longer, more detailed discussion, see ibd., pp. 62-64.

[26] van Schewick (2015c), section "Problem 3".

they have different technical requirements. For example, Internet telephony is sensitive to delay, but e-mail is not, so an ISP could give low delay to Internet telephony, but not to e-mail.

Whenever an ISP has the power to speed up certain applications or slow down others, it might use this power to give certain applications an advantage over others. The proposal tries to mitigate this danger by forcing ISPs to consider an application's technical requirements when making distinctions among traffic.

However, this kind of class-based discriminatory network management still allows ISPs to give some applications an advantage over others, whether intentionally or inadvertently. It distorts competition, slows all encrypted traffic, harms individual users, stifles innovation, and creates high costs of regulation.

Allowing ISPs to treat classes differently gives them power to deliberately distort competition.

When ISPs are free to define classes, they have a lot of discretion to discriminate against certain applications. ISPs could use this power to deliberately distort competition. For example, an ISP could offer low delay to online gaming to make it more attractive, but it could decide not to offer low delay to online telephony because that would allow Internet telephony to better compete with the ISP's own telephony offerings. Although both services are sensitive to delay, ISPs could argue that there are other, technical differences that justify distinguishing between them.

Class-based traffic management can inadvertently harm applications.

Traffic management that distinguishes among different kinds of applications often results in inadvertent discrimination that hurts users, distorts competition, and makes it harder for providers of affected applications to innovate. Traffic management technologies that distinguish among classes of applications often end up harming certain applications, even if that effect is not intended, because the ISPs or their technology misclassify certain applications.

For example, many ISPs in the UK limit the bandwidth available to peer-to-peer file sharing applications during times of congestion, arguing that these applications are not sensitive to delay. This creates huge problems for online gaming. ISPs use deep packet inspection technology to identify these applications, but the technology doesn't work very well: it has a hard time distinguishing between online gaming and peer-to-peer file sharing, so online games stop working or don't work as well as they could. In the end, UK ISPs and gaming providers established standing committees where ISPs, technology vendors, and gaming providers worked together to make sure the games would work on ISPs' networks in spite of the discriminatory network management.

In the UK, this class-based traffic management not only creates problems for online gamers and gaming providers, whose applications perform worse than other kinds of applications, but it also creates problems for innovation. If an online gaming provider wants to introduce a new feature for its game in the UK, it needs to work with the ISPs and their technology vendors to make sure that the feature won't be caught up in the traffic management measures directed at peer-to-peer file sharing. This is the opposite of innovation without permission.

Similarly, until 2010, many ISPs in Canada used deep packet inspection technology to single out all peer-to-peer file sharing applications and limit the amount of bandwidth available to them from 5pm to midnight. Again, ISPs assumed that it was alright to target peer-to-peer file sharing, because it's not sensitive to delay. But this assumption turned out to be wrong: there was an application called Vuze that used peer-to-peer file sharing protocols to stream video in real time. Real-time video is highly sensitive to delay, so the performance of Vuze suffered in the evening, when everybody wants to use the Internet.

Thus, the class-based traffic management might result in harmful discrimination by even the best-intentioned ISPs.

Class-based traffic management discriminates against encrypted traffic.

If traffic is encrypted, then the ISP cannot identify what kind of application—e-mail, telephony, web browsing—that a user is using, so it doesn't know what kind of treatment it needs. In the past, ISPs have addressed the problem by simply putting all encrypted traffic in the slow lane. That means that any time someone sends encrypted data, it will take longer to transmit. People encrypt their data for a variety of valid reasons, for example, to protect privacy, secure sensitive financial transactions, protect trade secrets, and guard against surveillance. If all encrypted data is automatically slowed down, it would discourage people from using encryption at all.

Class-based traffic management harms individual users.

Class-based traffic management takes the power to choose the right kind of service out of the hands of users and puts it into the hands of ISPs. However, people have different needs for speed on the Internet, and the same person has different needs at different times. As a result, a user's needs may differ from an application's technical requirements, so ISPs don't necessarily know what kind of service a user needs. For example, Internet telephony applications like Skype benefit from low delay, so ISPs may opt to give them low-delay service. That's great if you are doing a job interview, where you want the best quality possible. But if you are talking with a friend, you don't need crystal clear quality over Skype, so low-delay service might not be necessary. File uploads are generally considered not to be sensitive to delay. If you are uploading your hard disk to the cloud to do a backup, you will not mind that ISPs give file uploads lower priority. But if you are a student uploading homework right before it's due, or a lawyer filing a brief before the deadline, or an architect submitting a bid, then the speed of this upload is your highest priority. As long as ISPs, and not users, have the power to decide which classes of application get what kinds of service, users will never get exactly what they need. That's why class-based discrimination often harms users.

Class-based traffic management stifles innovation.

Imagine you develop a new application that would benefit from a specific kind of service. Entrepreneurs and start-ups typically do not have the resources or capacity to reach out to ISPs around the European Union to alert them that their particular application needs a certain kind of service. Even if a start-up manages to contact ISPs, they may not be interested in changing their systems for particular applications, which is a lot of work, especially when new apps don't have

any users yet. Entrepreneurs should be able to get the kind of Internet service their application needs without having to seek ISPs' permission.

Class-based traffic management leads to high costs of regulation.

If ISPs get to define classes of applications, the only way to challenge these definitions is to complain to regulatory agencies. The agency would need to determine whether kinds of traffic are similar enough to be treated in the same way, a messy and costly process that would involve lots of lawyers and expert witnesses. This not only creates high costs of regulation, but also tilts the playing field against anybody—users, start-ups, small businesses, low-cost speakers—who doesn't have the money to engage in long and costly proceedings before a regulator." (End of Excerpt)

The social costs of discrimination among classes of applications are discussed in more detail in the attached paper "Network Neutrality and Quality of Service: What a Non-Discrimination Rule Should Look Like."[27]

The attached article by Cooper and Brown provides vivid examples of how class-based traffic management in the UK harmed applications.[28]

Network Neutrality and Quality of Service

The network neutrality debate is often framed as a debate for or against Quality of Service.[29] 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.

For an in-depth analysis of the relationship between network neutrality and Quality of Service, see the attached paper "Network Neutrality and Quality of Service: What a Nondiscrimination Rule Should Look Like." For a shorter overview, see the attached paper "The Case for Meaningful Network Neutrality Rules."[30]

[27] van Schewick (2015d), pp. 105-124.
[28] Cooper & Brown (2015), pp. 2:9-2:17.
[29] For an in-depth analysis of the relationship between network neutrality and Quality of Service, see van Schewick (2015d). For a shorter discussion, see van Schewick (2015b), pp. 17-23 (discussing user-controlled Quality of Service and discrimination among classes of applications).
[30] For an in-depth analysis of the relationship between network neutrality and Quality of Service, see van Schewick (2015d). For a shorter discussion, see van Schewick (2015b), pp. 17-23 (discussing user-controlled Quality of Service and discrimination among classes of applications).

Ban provider-controlled Quality of Service to individual applications within a class of like applications[31]

Most network neutrality proponents agree that allowing network providers to offer Quality of Service exclusively to one or more applications within a class of like applications should be prohibited, and the paper shares that view. For example, a network provider should not be allowed to offer a low-delay service only to its own Internet video application, or only to selected unaffiliated video application

Ban Quality of Service to provider-defined classes of applications, even if the provider treats like traffic alike

By contrast, many network neutrality proponents see no problems with allowing network providers to offer different types of service to different provider-defined classes of applications, as long as the network provider treats like traffic alike. In other words, they would 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.") 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.[32] In the US, the *AT&T BellSouth Merger conditions* and *various draft bills in Congress* allowed this form of Quality of Service.

The positive stance towards forms of Quality of Service that provide like treatment is based on the assumption that discriminating among classes of applications that are not alike is socially harmless and should therefore be allowed. As this paper shows, this assumption is not correct. Contrary to what is commonly assumed, 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.

Allow certain forms of user-controlled, user-paid Quality of Service

By contrast, Quality of Service architectures where (1) network providers make different types of service available equally to all applications and classes of applications, (2) users choose whether and when to use which type of service, and (3) the network provider charges only its own Internet service customers for the use of the different classes of service do not raise similar concerns. As the paper shows, 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. With appropriate restrictions on charging and with provisions that protect the quality of the baseline service from dropping below unacceptable levels, this type of Quality of Service should be allowed under a network neutrality regime. Under the non-discrimination rule proposed above, these are the only forms of quality of Service that network providers would be able to offer.

Opponents of network neutrality regulation have created the impression that policy makers need to choose between protecting users and application innovators against interference from

[31] The following summary in this section is taken from van Schewick (2012).
[32] Internet telephony is sensitive to delay, but e-mail is not, so the two classes of applications are not alike.

network providers on the one hand and innovation in the network and the needs of network providers on the other hand. As the paper shows, it is possible to protect users and innovators while giving network providers the tools they need to manage their networks and allowing the network to evolve. Thus, regulators can have their cake and eat it, too.

Question 3: What should be India's policy and/or regulatory approach in dealing with issues relating to net neutrality? Please comment with justifications.

Network neutrality is based on a simple principle: The internet service providers that connect us to the Internet should not control what we do online. This principle has allowed the Internet to serve as a platform for 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.[33] In particular, internet service providers should have not have the power to block, slow down, or speed up Internet applications, content, and services, make some apps more attractive than others, or charge them a fee for preferential treatment. TRAI's 2016 Order on Network Neutrality and Differential Pricing adopted a complete set of rules for economic forms of discrimination. TRAI rightly recognized that differential pricing practices, including zerorating, allow ISPs to make some applications more attractive to users than others. Its rules ban harmful forms of differential pricing, but allow ISPs to use forms of differential pricing that do not raise network neutrality concerns. But the protections offered by these rules are fundamentally incomplete if internet service providers can reach the same results through technical forms of discrimination. If TRAI wants to protect competition, innovation, and free speech online, it needs to adopt rules that protect Indian Internet users, businesses and speakers against all forms of harmful discrimination.

I describe my proposed net neutrality regime in Question 1 above.

Attachments

van Schewick, Barbara. 2015. The Case for Meaningful Network Neutrality Rules. Report submitted as Attachment to Barbara van Schewick's Ex Parte in the Matter of Protecting and Promoting the Open Internet submitted February 20, 2015 to the Federal Communications Commission GN Dkt. No. 14-28.
Report: http://apps.fcc.gov/ecfs/document/view?id=60001031682
All documents filed with FCC, including cover letter, report and attachments to report: http://apps.fcc.gov/ecfs/comment/view?id=60001018648

van Schewick, Barbara. 2015. "Network Neutrality and Quality of Service: What a Nondiscrimination Rule Should Look Like." Stanford Law Review, 67(1): 1-166.
Article:
http://www.stanfordlawreview.org/sites/default/files/67_Stan_L_Rev_1_van_Schewick.pdf

[33] See, e.g., van Schewick (2010a); Benkler (2006). For a shorter summary of the arguments in the book, see van Schewick (2016).

van Schewick, Barbara. 2010. *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

van Schewick, Barbara. 2010. *Opening Statement at the Federal Communications Commission's Workshop on Innovation, Investment and the Open Internet.* Federal Communications Commission. Attachment to Barbara van Schewick's Notice of Ex Parte Meetings In the Matter of Preserving the Open Internet submitted January 19, 2010. GN Dkt. No 09-191. http://apps.fcc.gov/ecfs/document/view?id=7020382126

Cooper, Alissa & Ian Brown. 2015. "Net Neutrality: Discrimination, Competition, and Innovation in the UK and US." ACM Transactions on Internet Technology, 15(1): Article 2.

References

Ammori, Marvin. 2014. Ex Parte to Federal Communications Commission. GN. Dkt. No. 14-28. December 19. http://apps.fcc.gov/ecfs/document/view?id=60001010553

Benkler, Yochai. 2006. *The Wealth of Networks: How Social Production Transforms Markets and Freedom.* New Haven, CT: Yale University Press.

Cooper, Alissa & Ian Brown. 2015. "Net Neutrality: Discrimination, Competition, and Innovation in the UK and US." *ACM Transactions on Internet Technology*, 15(1): Article 2.

Federal Communications Commission. 2014. "Open Internet Roundtable - Policy Approaches." September 16. https://www.fcc.gov/news-events/events/2014/09/open-internet-roundtable-policy-approaches

Frischmann, Brett M. & Barbara van Schewick. 2007. "Network Neutrality and the Economics of an Information Superhighway: A Reply to Professor Yoo." *Jurimetrics Journal*, 47(4): 383–428.

Telecom Regulatory Authority of India. 2016. *Pre-Consultation Paper on Net Neutrality.* http://www.trai.gov.in/WriteReaddata/ConsultationPaper/Document/Net_Neutality_Preconsultation_30_may_2016.pdf

van Schewick, Barbara. 2007. "Towards an Economic Framework for Network Neutrality Regulation." *Journal on Telecommunications and High Technology Law*, 5(2): 329-391.

van Schewick, Barbara. 2010a. *Internet Architecture and Innovation.* Cambridge, MA: MIT Press.

van Schewick, Barbara. 2010b. *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

van Schewick, Barbara. 2010c. *Opening Statement at the Federal Communications Commission's Workshop on Innovation, Investment and the Open Internet.* Federal Communications Commission. Attachment to Barbara van Schewick's Notice of Ex Parte

Meetings In the Matter of Preserving the Open Internet submitted January 19, 2010. GN Dkt. No 09-191. http://apps.fcc.gov/ecfs/document/view?id=7020382126

van Schewick, Barbara. 2012. "Network Non-Discrimination and Quality of Service." *Internet Architecture and Innovation Blog.* June 13. http://netarchitecture.org/2012/06/network-non-discrimination-and-quality-of-service-2/

van Schewick, Barbara. 2014a. "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. 2014b. "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. 2015a. *Analysis of Proposed Network Neutrality Rules.* Attachment to Barbara van Schewick's Ex Parte In the Matter of Protecting and Preserving the Open Internet submitted February 18, 2015 to the Federal Communications Commission GN Dkt. No. 14-28. http://apps.fcc.gov/ecfs/document/view?id=60001030846

van Schewick, Barbara. 2015b. *The Case for Meaningful Network Neutrality Rules.* Attachment to Barbara van Schewick's Ex Parte in the Matter of Protecting and Promoting the Open Internet submitted February 20, 2015 to the Federal Communications Commission GN Dkt. No. 14-28. http://apps.fcc.gov/ecfs/document/view?id=60001031682

van Schewick, Barbara. 2015c. "Europe Is About to Adopt Bad Net Neutrality Rules. Here's How to Fix Them." *Medium.* October 22. https://medium.com/@schewick/europe-is-about-to-adopt-bad-net-neutrality-rules-here-s-how-to-fix-them-bbfa4d5df0c8#.xln6uf7oa

van Schewick, Barbara. 2015d. "Network Neutrality and Quality of Service: What a Nondiscrimination Rule Should Look Like." *Stanford Law Review*, 67(1): 1-166.

van Schewick, Barbara. 2016. "Internet Architecture and Innovation in Applications." In *Handbook on the Economics of the Internet*, eds. Johannes M. Bauer & Michael Latzer: Cheltenham, UK and Northampton, MA: Edward Elgar.