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**Network Neutrality:  
Challenges and responses  
in the EU and  
in the U.S.**

**IMCO**





**DIRECTORATE GENERAL FOR INTERNAL POLICIES**  
**POLICY DEPARTMENT A: ECONOMIC AND SCIENTIFIC POLICY**  
**INTERNAL MARKET AND CONSUMER PROTECTION**

# **Network Neutrality: Challenges and responses in the EU and in the U.S.**

## **STUDY**

### **Abstract**

This analytical study provides background on the debate over network neutrality, including (1) its technological and economic underpinnings, (2) the implications for business models going forward, and (3) the legal, regulatory, policy and business responses that have been attempted and that are currently in play. It includes a comparison between the US, where these issues have been debated intensely, and the EU.

This document was requested by the European Parliament's Committee on the Internal Market and Consumer Protection.

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## CONTENTS

<b>Contents</b>	<b>3</b>
<b>LIST OF ABBREVIATIONS AND GLOSSARY</b>	<b>5</b>
<b>LIST OF INTERVIEWEES</b>	<b>9</b>
<b>LIST OF TABLES</b>	<b>10</b>
<b>LIST OF “FOOD FOR THOUGHT” TEXT BOXES</b>	<b>10</b>
<b>LIST OF FIGURES</b>	<b>11</b>
<b>Executive Summary</b>	<b>13</b>
<b>1. Introduction</b>	<b>17</b>
1.1. The definition of net neutrality	17
1.2. The many faces of net neutrality	18
1.3. Structure of this report	19
<b>2. The technology of quality differentiation in the internet</b>	<b>20</b>
2.1. The Internet Protocol (IP) suite	20
2.2. Quality of Service (QoS) in an IP-based packet network	21
2.3. Relationship between network Quality of Service (QoS) and end user Quality of Experience (QoE)	22
2.4. The interconnection of IP-based networks	25
2.5. The IP network chain in the delivery of broadband services	26
2.6. Traffic prioritisation and the end-to-end principle	28
<b>3. The economics of quality differentiation</b>	<b>30</b>
3.1. Quality differentiation	30
3.2. Economic foreclosure	32
3.3. Two-sided markets	34
3.4. Network effects	35
<b>4. QUALITY DIFFERENTIATION and evolving business models</b>	<b>36</b>
4.1. Emergence of the two-lane model	36
4.2. Openness in the public Internet lane	40
4.3. Quality guarantees in the managed services lane	41
4.4. Future business models combining quality guarantees and openness	42
4.4.1. Relative likelihood	43
4.4.2. Competition	44

4.4.3.	Innovation	45
4.4.4.	Freedom of expression	45
4.4.5.	Consumer awareness	45
4.4.6.	Privacy	46
4.4.7.	Comparative assessment	46
5.	Differences between the US and the EU	47
5.1.	Broadband markets	48
5.1.1.	Broadband markets in the United States	48
5.1.2.	Broadband markets in Europe	49
5.2.	Relevant Regulation	51
5.2.1.	Relevant regulation in the United States	51
5.2.2.	Relevant regulation in the European Union	54
5.3.	Competition law	59
5.4.	Comparison	60
6.	FINDINGS AND RECOMMENDATIONS	62
6.1.	Key findings	62
6.2.	Recommendations	63
	REFERENCES	65

## LIST OF ABBREVIATIONS AND GLOSSARY

<b>Access</b>	Access enables an operator to utilize the facilities of another operator in the furtherance of its own business and in the service of its own customers.
<b>ADSL</b>	(Asymmetric Digital Subscriber Line) The most common technology for providing consumer broadband services over copper telephone lines.
<b>Bandwidth</b>	The capacity of a channel to carry information, typically expressed in bits per second.
<b>BEREC</b>	(Body of European Regulators for Electronic Communications)
<b>Bitstream access</b>	The incumbent installs a high-speed access link to the customer premises, and makes this access link available to third parties (new entrants) over a shared access facility to enable them to provide high-speed services to customers.
<b>Client-server</b>	An asymmetric technical implementation involving two computers whose functions are not the same. The software running on the customer's Personal Computer (PC) (often just a web browser) might be the client of software running on a server platform of the service provider. A single server can support a great number of clients.
<b>Deep packet inspection</b>	(DPI) A set of techniques for examining and categorising packets for any of a number of purposes. Unlike most other IP-based tools, DPI can be used to inspect not only the headers of IP datagrams, but also their application content (which also raises possible privacy concerns). DPI has been used to suppress peer-to-peer traffic.
<b>Demand elasticity</b>	The response of demand to price. An increase in prices generally leads to lower demand, other things being equal.
<b>DiffServ</b>	(Differentiated Services) An IP-based data communications protocol which enables hop-by-hop traffic management, whereby selected packets can be marked as having application requirements other than best efforts. It can be used as part of an implementation of Quality of Service (QoS).
<b>Economic foreclosure</b>	Foreclosure occurs when a firm that has market power in one segment attempts to project that market power into vertically related market segments where competition would otherwise lead to efficient outcomes.
<b>FCC</b>	(Federal Communications Commission)The national regulatory authority for the United States.
<b>FTTH</b>	Fiber-To-The-Home.
<b>Gbps</b>	(Gigabit per second) One billion bits per second.

<b>Interconnection</b>	Interconnection enables the customers of one network operator to establish and maintain communications with the customers of another network operator.
<b>IP</b>	(Internet Protocol) The Internet Protocol is a data communications standard that allows computers to communicate with one another over digital networks. Together with the Transmission Control Protocol (TCP), IP forms the basis of the Internet.
<b>IPTV</b>	(Television over IP) IPTV is the distribution of video programming (one way) by means of the Internet Protocol.
<b>IPv4</b>	(Internet Protocol, version 4) IPv4 is the current protocol for transmitting Internet Protocol datagrams over the Internet, using a 32-bit address system.
<b>IPv6</b>	(Internet Protocol, version 6) IPv6 is the emerging protocol for transmitting Internet Protocol datagrams over the Internet, using a 128-bit address system.
<b>ISP</b>	(Internet Service Provider) An ISP is a firm that enables other organizations to connect to the global Internet.
<b>Jitter</b>	Variability of delay.
<b>Kbps</b>	(kilobit per second) One thousand bits per second.
<b>Latency</b>	Delay.
<b>LLU</b>	(Local Loop Unbundling) A copper pair (or equivalent) is rented to a third party for its exclusive use.
<b>Mbps</b>	(Megabit per second) One million bits per second.
<b>MNO</b>	(Mobile Network Operator)
<b>MPLS</b>	(Multi Protocol Label Switching) A data communications protocol developed by the Internet Engineering Task Force (IETF). MPLS seeks to reduce the complexity of IP-based networks, and thus to improve the performance of routers in ISP backbones. It can be used to support traffic engineering as part of an implementation of Quality of Service (QoS).
<b>Net Neutrality or Network Neutrality</b>	A proposed regulatory principle that seeks to limit harmful or anticompetitive discrimination on the part of network operators and service providers.
<b>Network Externality or Network Effect</b>	Where network effects are present, the value of a network to its end users can be greater as the number of participants in the network increases. These effects go beyond pure economies of scale.
<b>Network Provider</b>	Network operator.
<b>NGN</b>	(Next Generation Network) The International Telecommunication Union (ITU) defines a Next Generation Network as "... a packet-based network able to provide services including Telecommunication Services and able to make use of multiple

broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies. It offers unrestricted access by users to different service providers. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users.”

<b>NRA</b>	(National Regulatory Authority)
<b>NRIC</b>	(the Network Reliability and Interoperability Council) The NRIC is an industry advisory council to the U.S. regulatory authority, the FCC.
<b>OECD</b>	(Organisation for Economic Cooperation and Development)
<b>OSI</b>	(Open Systems Interconnection) Reference Model: A layered data communications protocol model.
<b>Packet drop discipline</b>	The order in which a router drops packets if the number of packets exceeds the memory available for a queue. Note that dropping packets is a normal event for an IP network under load, not necessarily a failure mode.
<b>Packet filtering</b>	A technique for dropping packets (i.e. not allowing them through) or otherwise applying special handling based on defined criteria, which could be quite complex. It is often used to block harmful content.
<b>Packet loss</b>	The probability that a packet never reaches its destination. This could be due to transmission errors, but errors are quite rare in modern fibre-based fixed networks. More often, packets are lost because the number of packets waiting for transmission is greater than the available storage capacity (buffers).
<b>Peer to peer</b>	(P2P) A system where the end users typically have a symmetric relationship with one another.
<b>Peering</b>	The arrangement whereby ISPs exchange traffic for their respective customers (and for customers of their respective customers), but not for third parties. Peering is a substantially symmetric form of network interconnection.
<b>Propagation delay</b>	The time that it takes for light or electricity to reach its destination in a network. This is a function of the distance that the signal must travel, and the speed of light in the medium employed (typically wire or fibre).
<b>QoE</b>	(Quality of Experience) Quality of service as perceived by the end-user, in light of the task that the end user is seeking to perform.
<b>QoS</b>	(Quality of Service) In an IP-based environment, QoS often denotes measures of delay, variability of delay, and the probability of packet loss.
<b>Queuing</b>	The need for one packet of data to wait for another in order to gain access to a shared facility. These delays can be analysed using a branch of mathematics known as queuing theory.

<b>Queuing delay</b>	The time that a packet waits before being transmitted. Both the average delay and variability of delay (jitter) matter, since the two together establish a confidence interval for the time within which a packet can be expected to arrive at its destination.
<b>Queuing theory</b>	A branch of mathematics that studies waiting lines.
<b>Ramsey-Boiteux pricing</b>	A pricing principle whereby the service provider takes the highest price mark-ups on those services that have lowest demand elasticity, that is, where the tendency of high prices to diminish demand is least.
<b>Shared access</b>	Enables the incumbent to continue to provide telephony service while the new entrant delivers high-speed data services over that same local loop.
<b>Simple resale</b>	A new entrant receives and sells to its end users a product that is commercially similar to the DSL product provided by the incumbent to its own retail customers.
<b>SMP Significant Market Power</b>	A firm is "... deemed to have significant market power if, either individually or jointly with others, it enjoys a position equivalent to dominance, that is to say a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers and ultimately consumers." (Framework Directive)
<b>TCP/IP Reference Model</b>	The layered data communications protocol model used by the Internet.
<b>Traffic prioritisation</b>	In the context of an IP network, the process of determining the order in which each packet (IP datagram) is transmitted from a router's outbound queue for a particular transmission link.
<b>Transit</b>	The arrangement whereby an ISP carries traffic for a customer (and, if the customer is an ISP rather than an end-user, for customers of its customer). Transit generally includes carriage of traffic destined for third parties, not just for the ISPs own customers. Transit is a substantially asymmetric form of network interconnection.
<b>Transmission Control Protocol</b>	(TCP) A data communications protocol used to assure reliable delivery of data in an IP network.
<b>Two-sided market</b>	In a two-sided market, a two-sided platform provider seeks to serve both sides of the market. The structure of prices matters, not just their levels. (See Tirole and Rochet (2004).)
<b>VoD</b>	(Video on Demand) Video on Demand enables end-users to select and watch video content over a network.
<b>VoIP</b>	(Voice over IP) A set of data communications protocols and technologies to enable voice to be sent over individual IP-based networks or over the Internet.
<b>VPN</b>	A virtual private network.

## LIST OF INTERVIEWEES

In light of the recent Commission consultation, we conducted only a limited number of interviews as a cross check. The parties whom we formally or informally interviewed include:

Deutsche Telekom / T-Mobile	Network operator
Telecom Italia	Network operator
European Competitive Telecoms Association (ECTA)	Trade group for competitive operators
UPC / Liberty Global	Cable operator
Skype	VoIP service provider
Electronic Frontier Foundation (EFF)	Privacy advocate
BEUC	Consumer advocate

## LIST OF TABLES

<b>Table 1:</b>	
Characteristics of the public Internet lane and the managed services lane	<b>39</b>
<b>Table 2:</b>	
Relative merits of different Internet evolutionary scenarios	<b>46</b>
<b>Table 3:</b>	
Broadband connections in the US	<b>48</b>
<b>Table 4:</b>	
Comparison between the European Union and the United States	<b>61</b>

## LIST OF “FOOD FOR THOUGHT” TEXT BOXES

<b>Food for thought 1:</b>	
Visualising delay in an IP network	<b>22</b>
<b>Food for thought 2:</b>	
The Madison River case	<b>33</b>
<b>Food for thought 3:</b>	
The Comcast - BitTorrent case	<b>33</b>
<b>Food for thought 4:</b>	
The BBC iPlayer dispute	<b>34</b>
<b>Food for thought 5:</b>	
The ISP's traffic management tool box	<b>37</b>
<b>Food for thought 6:</b>	
The French ARCEP's approach to network neutrality	<b>57</b>
<b>Food for thought 7:</b>	
The approach of the Swedish PTS to network neutrality	<b>59</b>

## LIST OF FIGURES

<b>Figure 1:</b> The Internet protocol architecture	<b>21</b>
<b>Figure 2:</b> Cisco VNI global consumer Internet traffic forecast	<b>24</b>
<b>Figure 3:</b> End to end path through the Internet from the application to a fixed end user	<b>26</b>
<b>Figure 4:</b> End to end path through the Internet from the application to a mobile end user	<b>28</b>
<b>Figure 5:</b> Application services, ISPs, and end-users	<b>32</b>
<b>Figure 6:</b> Two Lane model over a single broadband access	<b>38</b>
<b>Figure 7:</b> The role of access and interconnection in the public Internet lane	<b>40</b>
<b>Figure 8:</b> Cisco VNI global overall Internet traffic forecast	<b>43</b>
<b>Figure 9:</b> OECD Fixed (wired) broadband subscriptions per 100 inhabitants, by technology, June 2010	<b>49</b>
<b>Figure 10:</b> Incumbent versus new entrant DSL access lines in the EU	<b>50</b>



## EXECUTIVE SUMMARY

As the Internet has come to play an increasingly important role in the European and global economy, concerns have been expressed about the potential risk that firms (especially vertically integrated broadband network operators with market power) might exploit their control over the network to inappropriately discriminate among different kinds of traffic. This discrimination, it is argued, could enable the firms to thwart consumer choice and to unfairly expropriate the benefits that should otherwise flow to consumers. These concerns have led to a debate, in Europe and elsewhere, over network neutrality.

### Background

There are many different definitions of network neutrality. Price and quality differentiation can have both positive and negative consequences; thus, any concerns should in our view focus on *unreasonable, anticompetitive or socially damaging discrimination*.

The European Commission conducted a public consultation on network neutrality between June and September 2010.<sup>1</sup> The Commission found a consensus among "...network operators, internet service providers (ISPs) and infrastructure manufacturers that there are currently no problems with the openness of the internet and net neutrality in the EU ... They maintain that there is no evidence that operators are engaging in unfair discrimination in a way that harms consumers or competition. This general view is supported by a number of Member States."<sup>2</sup>

There have been scattered complaints, some of them credible, of (1) mobile network operators (MNOs) blocking or charging excessive prices for VoIP, and of (2) blocking or throttling of traffic such as file sharing.<sup>3</sup> In its response to the Commission's public consultation,<sup>4</sup> the *Body of European Regulators for Electronic Communications (BEREC)* noted that the incidents to date are relevant but "may not necessarily represent breaches of network neutrality"; moreover, many were finally resolved "without any formal proceedings", and the incidents "have not led to a significant number of investigations by National Regulatory Authorities (NRAs)". There appear on balance to be few if any documented, clearly problematic incidents in Europe to date, and no demonstrated, sustained pattern of systematic and abusive discrimination.<sup>5</sup> Despite all of this, possible concerns for the future remain.

Network neutrality in the Internet poses complex questions, both at the technical and at the economic level.

<sup>1</sup> Questionnaire for the public consultation on the open internet and net neutrality in Europe, European Commission, Information Society and Media Directorate-General, Electronic Communications Policy, 30 June 2010, [http://ec.europa.eu/information\\_society/policy/ecomm/doc/library/public\\_consult/net\\_neutrality/nn\\_questionnaire.pdf](http://ec.europa.eu/information_society/policy/ecomm/doc/library/public_consult/net_neutrality/nn_questionnaire.pdf)

<sup>2</sup> Ibid., page 2.

<sup>3</sup> In its response, BEREC reported cases of i) blocking, or charging extra for, Voice over Internet Protocol (VoIP) services in mobile networks by certain mobile operators; and ii) throttling of peer-to-peer (P2P) file-sharing or video streaming. VoIP providers and BEUC (a consumer advocacy organisation) have also expressed concerns, both in their comments and in our interviews.

<sup>4</sup> See [http://ec.europa.eu/information\\_society/policy/ecomm/doc/library/public\\_consult/net\\_neutrality/comments/04eu\\_national\\_regional\\_ministries\\_authorities\\_incl\\_berec/berec\\_x.pdf](http://ec.europa.eu/information_society/policy/ecomm/doc/library/public_consult/net_neutrality/comments/04eu_national_regional_ministries_authorities_incl_berec/berec_x.pdf)

<sup>5</sup> The Commission took a somewhat more nuanced position of the incidents identified by BEREC and others in "The open internet and net neutrality in Europe", COM(2011)222 final. "The Commission does not have evidence to conclude that these concerns are justified at this stage but this should be borne in mind in a more exhaustive fact-finding exercise."

## A technological view of network neutrality

Network performance plays a complex role in the Internet. Some uses of the Internet<sup>6</sup> are far more sensitive to network performance (delay, variability of delay, and probability of loss of packets) than others. These technical aspects, often collectively termed *Quality of Service (QoS)*, strongly influence the user's *Quality of Experience (QoE)*. Network operators may have sound technical and business reasons for prioritising traffic for delay-sensitive uses (such as real time Voice over IP [VoIP] or streaming video) over less-sensitive traffic (e.g. email or file sharing).

The technology of prioritisation has been reasonably well established for ten to fifteen years, and has been fairly common within individual networks; however, the maintenance of QoS *between* interconnected networks has been very rare.

## An economic view of network neutrality

There are different economic views of network neutrality.

Some quality and price differentiation is benign or even essential; however, other forms are harmful. *Quality differentiation* and *price differentiation* are well understood practices that, in the absence of anticompetitive discrimination, generally benefit both producers and consumers; however, differentiation can be used in harmful ways where market power is present. A producer with *significant market power (SMP)* in one segment may attempt to project that market power into upstream or downstream segments that would otherwise be competitive (a practice known as *economic foreclosure*). Economic foreclosure harms consumers and can impose an overall socio-economic deadweight loss on society.

In an alternative and equally relevant view, the Internet can be thought of as a *two-sided market*, where network operators collectively function as a *platform* connecting providers of content (e.g. web sites) with end-users (who function primarily as consumers of content).<sup>7</sup> Under this view, some disputes are simply about the division of revenue and profits between the platform provider (i.e. the network operators) and the two sides of the market.

## Quality and price differentiation and evolving business models

At a technical and business level, evolution towards a Two Lane model (public Internet coexisting with Managed Services) is conceivable, and is likely to benefit many network operators and end-users (but perhaps not all). Individual broadband ISPs already provide examples of the Two Lane Model. What is not yet visible is a global Two Lane model that spans networks and/or providers. As previously noted, QoS-aware interconnection is technically feasible, but hardly ever implemented.

Alternative scenarios for the evolution of the Internet include:

- **Little change from today:** A Two Lane Internet has been technically feasible for at least ten years. That it has appeared to only a very limited extent may mean that consumers do not want it, or at least that commercial incentives are not strong enough to drive the necessary business model and competitive evolution. The managed services lane already exists, but is used mainly for the QoS-sensitive TV and telephony components of triple play.

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<sup>6</sup> This is equally true of other networks that are based on the *Internet Protocol (IP)* family, which constitutes the technological foundation of the Internet.

<sup>7</sup> This is arguably an over-simplification of a marketplace that is truly *multi-sided*.

- **Continuation and further expansion of two-lane model:** If traffic over the managed services lane were substantially to increase, due to new applications or increased use of the managed services lane for forms of video that today are in the public lane, what effect might they have on services in the public Internet lane? This scenario assumes that access remedies preserve the openness of traditional services, but that the managed services lane is used exclusively by the facilities-based ISP for its own “walled garden” of services.
- **ISPs open up the managed services lane to other providers:** In this scenario, not only does the managed services lane expand, but it is made available to competitors of facilities-based network operators. Capacity planning potentially becomes more complex than it is today.
- **End-to-end service guarantees become possible in the public Internet:** If it were possible to surmount the quite substantial practical obstacles to QoS-aware interconnection, new uses of the Internet might be enabled.

The relative likelihood of these scenarios is difficult to assess. Based on current traffic trends, some growth of managed services and associated capacity expansion should be expected, but whether this will suffice to significantly expand the Two Lane model remains to be seen.

These scenarios have somewhat different implications for competition, innovation, freedom of expression, consumer awareness, and privacy.

## Markets and regulation in the US and in the EU

As part of the review of the regulatory framework enacted in 2009, the European Union put in place measures (1) to ensure that consumers are informed of the relevant practices of their network operators, and can switch network operators without direct penalty if they are dissatisfied with a change in those practices; (2) to empower national regulators to impose minimum QoS standards on network operators that possess SMP should it prove necessary; and (3) to establish the right of end-users to access content, applications or services of their choice as an explicit goal of European policy.

There is little experience to date with how these provisions will work in practice. Member States are required to transpose these requirements in national law by 25 May 2011; thus, they are not even in effect yet in many Member States.

Effective regulation of last mile fixed access in Europe has ensured that a great many European end-users have a meaningful choice of broadband network operators. This competition has likely reduced the incentives of network operators to deviate from network neutrality in harmful ways. Given that there have been few if any network neutrality problems in Europe that required formal action by the NRA, there is a real possibility that the provisions already enacted will prove to be sufficient.

The United States, by contrast, recently imposed explicit network neutrality obligations; however, we would caution that Europe should not blindly follow the US example. The US differs greatly from Europe in relevant aspects of market structure, regulatory framework, and competition law. US fixed broadband markets constitute a series of *de facto* duopolies, with no effective competition based on granting competitors access to end-users via Local Loop Unbundling (LLU), shared access or bitstream access; thus, consumer choice is severely limited. In the absence of the recently imposed rules, US regulators would have no ability at all to prevent or remedy network neutrality harms. Moreover, US competition law has been ruled to be ineffective in cases that are also relevant to telecommunications law, as is the case here.

## Recommendations

In light of the current state of play, we think that it is important to avoid inappropriate, disproportionate, or premature action. There is a good likelihood that the evolving regulated competition will facilitate innovation and the evolution of helpful forms of differentiation, while minimising the dangers of anticompetitive abuse.

The Commission's April 2011 Communication noted that the 2009 amendments to the regulatory framework have not yet been transposed, and remarked that "...it is important to allow sufficient time for these provisions to be implemented and to see how they will operate in practice." We concur. We think that imposition of significant further obligations at this time would be ill-advised.

With that in mind, our key recommendations are:

- Do not impose any further network neutrality obligations until there is sufficient experience with the obligations already imposed through the 2009 amendments to the regulatory framework to make a reasoned judgment about their effectiveness;
- Support both technical and policy research to enhance the effectiveness of the consumer transparency obligations, and to ensure that the minimum QoS obligations can be effectively imposed should they prove to be needed;
- Continue to study the aspects of network neutrality where complaints may have some basis, including (1) charges and conditions that mobile operators impose on providers of Voice over IP (VoIP), and (2) impairment of peer-to-peer traffic; and
- Reserve judgment on any further obligations until there is a clearer vision of what harms to societal and/or consumer welfare, if any, are visible once the 2009 provisions are fully implemented.

# 1. INTRODUCTION

## KEY ISSUES

- There are many different definitions of network neutrality. Should the concern be with *discrimination*, or only with *unreasonable* or *anticompetitive* discrimination?
- Net neutrality represents a wide range of potential threats to consumer welfare. Which are more likely? Which might potentially be more harmful?
- Given that there have been no clearly problematic incidents to date, where (if anywhere) should European institutions focus their attention?

The European Parliament's Committee on the Internal Market and Consumer Protection (IMCO) has requested a study on net neutrality with the aim to seek the opinion of independent experts on the challenges related to net neutrality having regard to the most recent developments and in particular the following questions:

"I. New internet business models:

- Explore options for the future development of business models based on "best efforts" and/or "managed services". How can these options affect competition at different levels of the value chain and influence consumers' on-line behaviour?

II. EU and US, same principle, different approaches:

- Update, assessment and possible evolution of the US situation on net neutrality, taking into account the most recent developments (including the expected court case)."

This analytical study seeks to provide background on the debate over network neutrality: its technological and economic underpinnings, the implications for business models going forward, and the legal, regulatory, policy and business responses that have been attempted and that are currently in play.

This brief introduction discusses the definition of network neutrality, the many areas of public policy with which it intersects, and presents the overall structure of the report.

## 1.1. The definition of net neutrality

What constitutes network neutrality? Several definitions are in current use:

- The ability of all Internet users to access the content or applications of their choice.
- Assurance that all traffic on the Internet is treated equally, whatever its source, content or destination.
- Absence of *unreasonable discrimination* on the part of network operators in transmitting Internet traffic.<sup>8</sup>

<sup>8</sup> See, for instance, paragraph 1 of the U.S. FCC, "Preserving the Open Internet (GN Docket No. 09-191) / Broadband Industry Practices (WC Docket No. 07-52)", FCC 10-201, released 23 December 2010, which we will refer to from now on as the FCC's Network Neutrality Order. See also the European Commission's "Report on the public consultation on 'The open internet and net neutrality in Europe'", which considers the degree to which there might be a problem with "... unfair discrimination in a way that harms consumers or competition."

These definitional differences are not a mere matter of semantics. They differ in (1) the degree of focus on access, versus the *quality* of access, versus the *price* of access to content and applications; and (2) whether one should be concerned with all forms of differentiation, or only with those that are anticompetitive, discriminatory, or otherwise unreasonable.<sup>9</sup>

It is worth noting at this point that the concern here is not only with traditional text and audiovisual content, but also with services such as search engines (such as Yahoo, Google, and Bing) and voice over IP (such as Skype and Viber).

The use of various forms of *quality differentiation* for Internet traffic has been routine for decades. As we explain later in this report, this differentiation serves in most cases (but not necessarily in all) to benefit consumers.

A key question, then, is whether European policymakers should concern themselves with all forms of quality discrimination, or whether they should instead focus on possible *unfair* or *unreasonable* quality differentiation. For both technological and economic reasons (see Section 2 and 3, respectively), we think that the latter approach is the more appropriate.<sup>10</sup>

## 1.2. The many faces of net neutrality

Departures from network neutrality (i.e. unreasonable discrimination) could raise a number of quite distinct potential issues of societal welfare, among them:

- **Anticompetitive behaviour:** Is there a risk that a network operator with significant market power (SMP) might project its market power into upstream or downstream market segments that would otherwise be competitive?
- **Innovation:** Might a network operator (especially a vertically integrated network operator that possesses some form of market power) act as a gatekeeper, inhibiting the ability of content providers or application service providers with which it competes from offering new, innovative products or services?
- **Freedom of expression:** Might a network operator interfere with the ability of its customers to express views with which the network operator disagrees?<sup>11</sup>
- **Consumer awareness:** Do consumers understand the service that is being offered to them, and are they receiving the service that has been committed?<sup>12</sup>
- **Privacy:** To the extent that a network operator treats some Internet traffic differently from other traffic, does this necessarily imply that the network operator is delving more deeply than it should into the user's personal affairs (e.g. by means of *Deep Packet Inspection [DPI]*)?

<sup>9</sup> Distinguishing reasonable from unreasonable discrimination is, of course, a huge challenge in its own right.

<sup>10</sup> Our interviewees for this study generally also took this view. This is also consistent with the view that BEREC expressed in the Commission's public consultation: "There have been and will continue to be deviations from [the strict principle that all traffic must be treated equally.] Some of these deviations may well be justified and in the end users' interest but other forms [cause] concerns for competition and society."

<sup>11</sup> As a possible example, a large US broadband provider was alleged in 2004 to have systematically filtered all email messages to its subscribers whose content contained the URL of a coalition of activists who oppose the war in Iraq. The details and possible motivation of the incident remain unclear.

<sup>12</sup> Search by informed consumers is often a more effective way of ensuring efficient outcomes and competition for consumers, and protects their interests better, than static regulation; however, it is not always helpful for consumers to understand the full technical details of the service, since this can lead to inefficient and exploitative feature competition that may not result in higher consumer welfare or utility. This is borne out by the marketing literature: When offered two goods or services that are functionally equivalent in terms of actual use, consumers will generally have higher willingness to pay for the one with more or newer features.

These issues are more subtle and complex than one might initially assume. The answers to some of these questions might seem at first blush to be black and white, but in practice all are in varying degrees rather grey.

The network by its very nature is used for a host of applications and interactions among a wide variety of players. Problematic discrimination could damage the potential for others to deliver value, but the same could be said of simplistic one-size-fits-all rules based on only a subset of these interactions or traffic flows.

### **1.3. Structure of this report**

Section 2 provides technical background on network neutrality, while section 3 provides economic background. Section 4 discusses evolving current and future business models. Section 5 provides a detailed comparison between the market, the regulatory environment, and the competition law environment in Europe and in the United States (where the debate over these issues has been more intense than in Europe). It includes a detailed discussion of public policy responses to network neutrality that have been attempted or are being attempted. Section 6 provides conclusions and recommendations.

## 2. THE TECHNOLOGY OF QUALITY DIFFERENTIATION IN THE INTERNET

### KEY FINDINGS

- Quality discrimination was not a major issue for traditional voice networks, but it is very much an issue for IP-based networks.
- Quality of Service (QoS) in an IP-based network reflects many variables, notably including the average and variance of queuing delay; propagation delay; and the probability of packet loss.
- The user's Quality of Experience (QoE) is largely a function of these same parameters, but is heavily dependent on the particular application that the user is making of the network. Some applications are much more sensitive to delay or loss than others.
- The Internet is a complex interconnected system of networks. Most of these interconnections take place by means of variants of *peering* and *transit*.
- QoS within ISP networks is commonplace, and has been for years, but QoS-aware peering continues to be extremely rare.
- QoS has somewhat different implications for fixed versus mobile networks because of their different bandwidth demands and capacities.
- It is sometimes claimed that the differentiated QoS somehow violates core principles of the Internet (such as the end to end principle). In fact, differentiated QoS was always a design consideration for the Internet (although not fully implemented). Its rich history goes back decades, to the earliest days of the Internet and its predecessor networks.

In the traditional voice telephone network, there was little concern about network neutrality; either a call completed (with better quality or worse), or it did not. Network operators and their customers typically had a common interest in achieving the best possible voice quality at a given cost and price. For an incumbent with Significant Market Power (SMP) to wilfully block a call to a competitor's service or customer would in any case typically have been actionable by the national regulatory authority (NRA).

In the world of the Internet, many forms of wilful interference are possible, ranging from subtle degradation to outright blockage. Some are obvious, but others are difficult to detect.

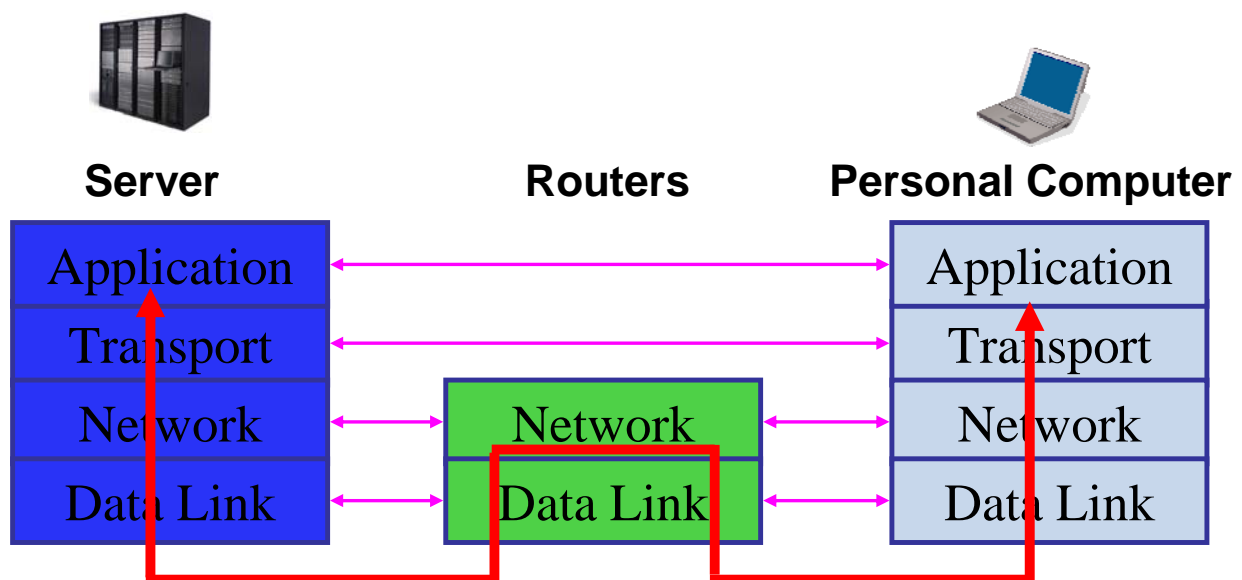
### 2.1. The Internet Protocol (IP) suite

The Internet is based on a suite of technical standards collectively known as the *Internet Protocol (IP) family* or *protocol suite*. Traditional communications networks use *circuit switching*, where a (virtual) circuit remained in place from the time that a call was initiated (dialed) until the call was completed. The circuit delivers information as a steady and (ideally) reliable sequenced stream. The Internet Protocol instead uses *packet switching*, where large streams of data are broken up into small *packets* of data, and each packet (or *IP datagram*) is independently directed (*routed*) to its end destination. An IP network does not inherently guarantee that all packets are delivered, nor that they are delivered in order; however, reliable in-sequence delivery services can easily be layered on top (notably by the *Transmission Control Protocol [TCP]*) for those applications that require it. IP-based packet switching has shown itself to be more flexible and more efficient than traditional circuit switching for a very wide range of uses.

The IP protocol suite is constructed as a *layered network architecture*, such that different layers of the network communicate with their peer layers in other devices, but need not know the details of layers above or below.

The application – which might represent browsing the web, or Voice over IP, or IPTV (television over the Internet) – *uses* the layers below, but need not concern itself with how those layers work. The *Data Link Layer* manages the underlying transmission device – which could just as well be a wireless service such as UMTS, or a wired Ethernet or ADSL or fibre-based GPON service. The Internet Protocol itself comprises the *Network Layer*, which is responsible for forwarding traffic from one end of the connection to the other, usually through multiple *routers* (IP packet forwarding devices). It is the Transport Layer (notably, the Transmission Control Protocol) that is responsible for building reliable communications (if needed) out of the more primitive packet-based services available to it.

**Figure 1: The Internet protocol architecture**



Source: WIK

## 2.2. Quality of Service (QoS) in an IP-based packet network

Quality of Service (QoS) in an IP-based packet network is more complex than in traditional networks. IP networks are not designed to be able to carry all of every IP packet (or *datagram*) that every user might attempt to send or receive; rather, they are designed so that excess packets must wait until capacity is available. If more packets are waiting than can be stored, some must be discarded – this usually causes no harm, because the network protocols (notably *TCP*) typically ensure that missing packets are retransmitted.

This approach works extremely well for applications such as e-mail or file sharing, where small delays are perfectly acceptable. It is less well suited to real-time applications such as Voice over IP (VoIP), as we explain shortly.

In an IP network, every IP packet (datagram) goes through many point-to-point “hops” from its start to its destination. Each hop contributes to the total time (delay) that it takes

to traverse the network. Key performance parameters for each hop of an IP-based network include:

- **Bandwidth:** the maximum number of bits that a transmission path can carry.
- **Propagation delay:** The time that a packet requires, as a function of the length of all transmission path and the speed of light through that particular transmission path.
- **Queuing delay:** The time that a packet *waits* before being transmitted. Both the *average delay* and *variability of delay (jitter)* matter, since the two together establish a confidence interval for the time within which a packet can be expected to arrive at its destination.
- **Packet loss:** The probability that a packet never reaches its destination. This could be due to transmission errors, but errors are quite rare in modern fibre-based fixed networks. More often, packets are lost because the number of packets waiting for transmission is greater than the available storage capacity (*buffers*).

Not every application is heavily dependent on the QoS. E-mail is, as previously noted, tolerant of high delay or loss, since users do not expect instant delivery. Real-time Voice over IP (VoIP) is not. We return to this point in Section 2.3.

Queuing delay and packet loss are dependent on the amount of traffic that attempts to enter one hop of the network, in comparison to the amount of traffic that it can accommodate. *Queuing theory*, a branch of mathematics that deals with waiting lines, can be used to analyse these characteristics.

#### Food for thought 1: Visualising delay in an IP network

From the perspective of the mathematics of queuing theory, a waiting line for an IP “hop” is not very different from a waiting line for a ski lift. The waiting time is a function of the average number of skiers who show up per unit time, and the degree to which their arrivals occur in bursts, in comparison with the carrying capacity (think of *bandwidth*) of the lift. This delay is highly variable.

Once a skier has boarded the chair lift, the time to get to the top (think of *propagation delay*) is a function of speed of the lift, and of the distance to be traversed, but is independent of the number of skiers.

### 2.3. Relationship between network Quality of Service (QoS) and end user Quality of Experience (QoE)

The QoS parameters and mechanisms outlined in section 2.2 relate to the transport of packets at the Network (IP) Layer in the protocol stack (see Figure 1). These parameters and mechanisms are important to enable network operators to design, build and manage their networks; however, they are not directly visible to most consumer end-users. What counts for end-users is the quality that they personally experience during their use of services and applications. The relationship between QoS at the IP network level and the end user Quality of Experience (QoE) is strongly dependent on the application.<sup>13, 14</sup>

<sup>13</sup> The QoE for the end user can also depend on factors other than the network QoS, such as the codecs used to code and decode voice and video at the application layer.

Some important examples are:

- E-mail is, as previously noted, tolerant of high delay or loss, since users do not expect instant delivery.
- The QoE of voice conversations, such as in IP telephony, is dependent on packet delay, delay variation and packet loss. A well-known criterion is that for a proper experience, the one-way delay through the network should not exceed 150 milliseconds.<sup>15</sup> Longer delays may cause users on both sides of the connection to begin speaking at once (as is also typical with satellite phones, where round trip delay is at least 270 milliseconds).
- For interactive gaming, delay and delay variation are also important, but in a slightly different way. For example, for Quake IV, a so-called first person shooter game, it was found that the QoE is determined mainly by the ping time and variations in the ping time.<sup>16</sup> Here, the ping time is a so-called two-way delay: the time required to send an IP packet from the end users' computer to the central game server and back.
- The parameters that determine the QoE for streaming video include not only those for voice conversation (i.e., delay, delay variation (jitter), and packet loss), but other parameters as well.<sup>17</sup> For users watching video content in a classical TV environment with a defined set of channels to choose from through a remote control, the so-called *zapping time* is important. This is the time that elapses between the selection of a new channel on the remote control and the actual appearance of the new channel on the screen.

For an IP network to deliver the QoE required by the most demanding applications all the time would be prohibitively expensive; however, it is possible for service providers and network operators to increase the QoE of specific applications by applying technical measures tailored to these applications. An example of this is the distribution of streaming video through Content Delivery Networks (CDNs).<sup>18, 19</sup> In CDNs, copies of popular videos are placed on video servers at many locations with good Internet connectivity and close to the interested audience, for example at selected Internet Exchanges. By playing out the video from a server closer to the end users, the IP transport chain is shortened, potentially resulting in better IP QoS characteristics and hence a better QoE. Another effect is that the IP traffic load on the Internet core is reduced. The video servers can also be placed inside the IP network of a particular Internet Service Provider (ISP), further shortening the IP transport chain and introducing additional possibilities to improve the QoE.

<sup>14</sup> Techniques for Measuring Quality of Experience, Kuipers, F.A., R.E. Kooij, D. De Vleeschouwer, and K. Brunnstrom, , Proc. of the 8th International Conference on Wired/Wireless Internet Communications (WWIC 2010), Lulea, Sweden, June 1-3, 2010, LCNS 6074, pp. 216-227, 2010.

<sup>15</sup> ITU-T G.114 General Recommendations on the transmission quality for an entire international telephone connection (05/2003).

<sup>16</sup> Predicting the perceived quality of a first person shooter: the Quake IV G-model, A. F. Wattimena, R. E. Kooij, J. M. van Vugt, O. K. Ahmed, Proceedings of 5th ACM SIGCOMM workshop on Network and system support for games, Singapore, 2006 , ISBN:1-59593-589-4.

<sup>17</sup> Takahashi, A.; Hands, D.; Barriac, V.; , "Standardization activities in the ITU for a QoE assessment of IPTV," *Communications Magazine, IEEE* , vol.46, no.2, pp.78-84, February 2008 doi: 10.1109/MCOM.2008.4473087.

<sup>18</sup> Vakali, A.; Pallis, G.; , "Content delivery networks: status and trends," *Internet Computing, IEEE* , vol.7, no.6, pp. 68- 74, Nov.-Dec. 2003, doi: 10.1109/MIC.2003.1250586

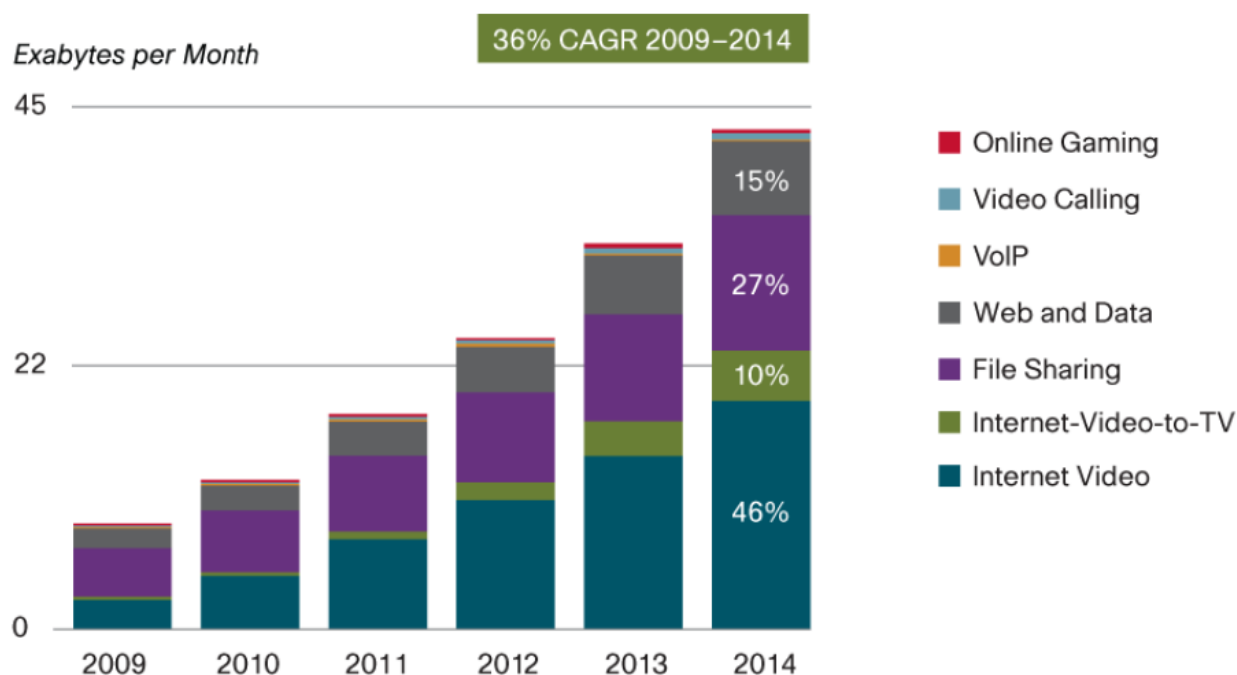
<sup>19</sup> Pathan, M., Buyya, R., Vakali, A, Content Delivery Networks: State of the Art, Insights, and Imperatives, Lecture Notes in Electrical Engineering, Springer , 2008, Volume 9, Part I, 3-32.

Another example of applying specific methods to improve the quality of specific applications is the introduction of a managed service lane in ISP networks. As discussed in more detail in section 4.1, the IP QoS characteristics in the managed service lane can be carefully selected and managed to optimize the QoE for the services that the ISP delivers through this lane. The technical feasibility of CDNs and the managed service lane concept is clear from many operational implementations.

Some have expressed concerns that the provision of different QoS to different applications may not accord with the end-to-end principle. We return to this point in Section **Error! Reference source not found.**

A key question relative to the network neutrality debate relates to the fraction of Internet traffic that requires explicit QoE management. A plausible forecast by Cisco systems (see Figure 2) shows that VoIP represents, and will continue to represent, a negligible fraction of total Internet traffic.<sup>20</sup> Video over the Internet represents a large and increasing fraction of all Internet traffic. VoIP is an inherently low bandwidth service, while video is an inherently high bandwidth service. At the same time, a fairly small fraction of all video requires explicit QoE management.<sup>21</sup> Taking into account VoIP, video, and a range of other applications, Cisco estimates that 17% of all Internet traffic in 2014 will represent managed consumer Internet IP traffic, and 4% will represent managed business Internet IP traffic (see Figure 8).

**Figure 2: Cisco VNI global consumer Internet traffic forecast**



Source: Cisco VNI, 2010.<sup>22</sup>

<sup>20</sup> Cisco VNI, "Hyperconnectivity and the Approaching Zettabyte Era", 2 June 2010.

<sup>21</sup> For that matter, for streamed video (such as YouTube) where the user can tolerate a second or two of delay at the outset (i.e. where the permissible zapping time is large), the *receiving end system* can do a great deal to provide a suitable QoE by means of a *jitter buffer*. This is not purely a matter of the underlying *network*.

<sup>22</sup> Ibid.

## 2.4. The interconnection of IP-based networks

The Internet is the collection of network operators, or Internet Service Providers (ISPs), that comprise it. Many would define the Internet to also include every IP-based end user system that is attached to it, thus including laptop computers, smart phones, and a wide range of intelligent devices that primarily communicate with other devices.

For an end to end communication in the Internet to proceed entirely within a single ISP's network is the exception rather than the rule. More often, communication takes place between networks – often, between a great many networks.

Interconnection among ISPs is complex and continues to evolve, but the great majority of interconnections take place using one of two mechanisms: peering and transit. The clearest definition of these forms of interconnection comes from the NRIC, an advisory panel to the US FCC:

*Peering* is an agreement between ISPs to carry traffic for each other and for their respective customers. Peering does not include the obligation to carry traffic to third parties. Peering is usually a bilateral business and technical arrangement, where two providers agree to accept traffic from one another, and from one another's customers (and thus from their customers' customers). ...

*Transit* is usually a bilateral business and technical arrangement, where one provider (the transit provider) agrees to carry traffic to third parties on behalf of another provider or an end user (the customer). In most cases, the transit provider carries traffic ... to and from every destination on the Internet, as part of the transit arrangement.

Peering thus offers a provider access only to a single provider's customers. Transit, by contrast, usually provides access at a predictable price to the entire Internet. Historically, peering has often been done on a bill-and-keep basis, without cash payments.<sup>23</sup>

Peering represents traffic exchange between an ISP's customers, and customers of their customers (who could also be ISPs), with the customers of another ISP. This implies that Internet traffic generally traverses at most one peering connection on its journey from source to destination. There must then be a complete chain of transit relationships between the eventual source and destination end user systems and the two peering systems.

With these two basic building blocks, the Internet can provide connectivity to the entire IP-based world.

In a transit relationship, the transit provider maybe offer QoS assurance to its customers – at least, it may offer guarantees up to the edge of its own network. The transit customer, however, normally provides no assurance to the transit provider.

<sup>23</sup> NRIC V, Focus Group 4; Interoperability: "Service Provider Interconnection for Internet Protocol Best Effort Service". Note that these definitions incorporate both paid and unpaid peering, and partial and global transit; however, they omit a few exotic forms of interconnection such as reciprocal transit.

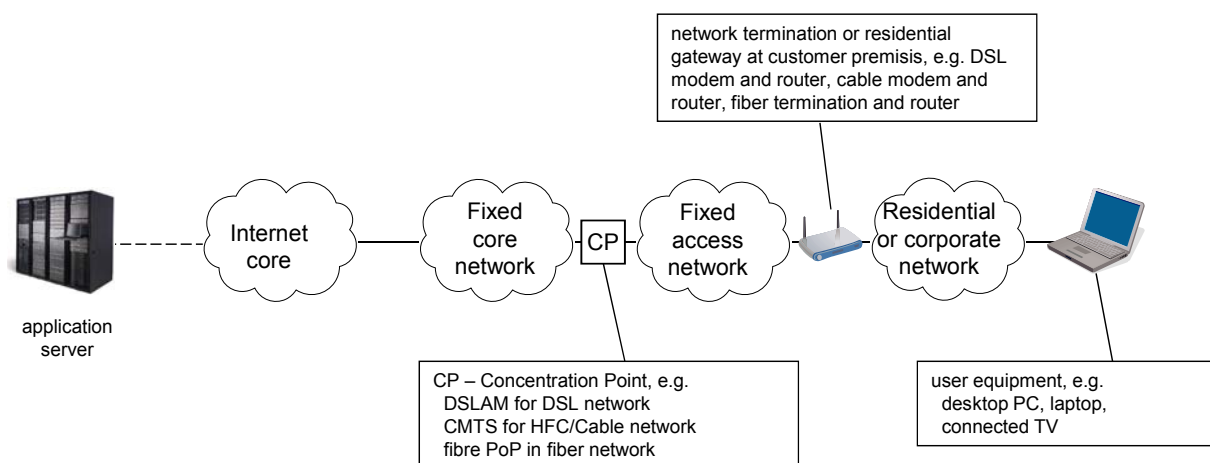
In peering relationships, there have been efforts for years to provide quality guarantees between the peers. There are numerous practical impediments – for instance, two networks who compete head to head for the same end user customers are unlikely to be happy about sharing information about how well their respective networks are performing, and yet this is exactly what is required to make QoS guarantees enforceable. Further, QoS assurances would be of little value until and unless a group of providers who collectively represented a substantial fraction of the total Internet were fully on board. The economic transaction costs of gaining such a large consensus have so far proven insurmountable.

Thus, QoS controls are readily implementable within an ISP network, but there are few examples of QoS being offered on an end to end basis across multiple ISP networks.<sup>24</sup>

## 2.5. The IP network chain in the delivery of broadband services

In today's Internet, a chain of IP networks is responsible for the delivery of fixed and mobile broadband services to end-users. Figure 3 outlines the chain for fixed broadband services, providing IP connectivity between an end user (right-hand side) and an application server (left-hand side). The application server could be a web server, an applications store, a VoIP server, or a streaming video server, depending on the application that is provided. The end user could have any of a number of devices and terminals, such as a desktop PC, laptop or a web pad.

**Figure 3: End to end path through the Internet from the application to a fixed end user**



Source: TNO

<sup>24</sup> See J. Scott Marcus, Dieter Elixmann, Kenneth R. Carter, and senior experts Scott Bradner, Klaus Hackbarth, Bruno Jullien, Gabriele Kulenkampff, Karl-Heinz Neumann, Antonio Portilla, Patrick Rey, and Ingo Vogelsang, *The Future of IP Interconnection: Technical, Economic, and Public Policy Aspects*, March 2008, a study prepared for the European Commission, available at: [http://ec.europa.eu/information\\_society/policy/ecomm/doc/library/ext\\_studies/future\\_ip\\_intercon/ip\\_intercon\\_stu\\_dy\\_final.pdf](http://ec.europa.eu/information_society/policy/ecomm/doc/library/ext_studies/future_ip_intercon/ip_intercon_stu_dy_final.pdf)

The chain of IP networks between the application server and a fixed end user enables the transport of IP packets in both directions. It can be viewed as comprising three components: the Internet core, a fixed core network, and a fixed access network. A fourth component, often ignored, is the private network within the end-user's home or business.

- The Internet core is comprised of multiple interconnected global and regional ISP networks that provide connectivity among one another by means of some form of (usually bilateral) IP peering and IP transit agreements (see Section 2.4).
- An ISP's network can be thought of as being comprised of fixed core and fixed access components.<sup>25</sup> They tend to use different technologies and different topologies. The fixed core network carries and concentrates traffic over the geographic area served by the ISP.<sup>26</sup>
- An ISP's fixed access network might be comprised of any or all of several different access technologies, including:
  - Traditional copper twisted-pair telephony networks using Digital Subscriber Line (DSL) technologies such as ADSL<sup>27</sup>, ADSL2+<sup>28</sup> and VDSL2.<sup>29</sup>
  - Hybrid Fibre-Coax (HFC) cable television networks with DOCSIS<sup>30</sup> technology.
  - Optical Fibre in combination with Point-to-Point Ethernet<sup>31</sup> or Gigabit-capable passive optical networks (GPON)<sup>32</sup> technologies.
- At home, an end-user might have his own network providing the connectivity between his devices and the ISP's network by means of a DSL or cable modem and router. Figure 4 depicts an analogous typical chain of IP networks responsible for the delivery of broadband services over a mobile access. The obvious difference with the fixed chain from Figure 3 is the Radio Access Network and the user equipment, commonly based on UMTS<sup>33</sup> and HSPA technologies<sup>34</sup> today.

<sup>25</sup> The core and access networks are linked at a so-called Concentration Point (CP). Depending on the fixed access technology, the CP might be a DSLAM (DSL Access Multiplexer, for DSL) or a CMTS (Cable Modem Termination System, for DOCSIS).

<sup>26</sup> These networks are increasingly based on Optical Ethernet technology. See the Metro Ethernet Forum specifications, available at [www.metroethernetforum.org](http://www.metroethernetforum.org).

<sup>27</sup> ITU-T G.992.1 (06/99) Asymmetric digital subscriber line (ADSL) Transceivers

<sup>28</sup> ITU-T G.992.5 (01/2009) Asymmetric digital subscriber line transceivers 2 (ADSL2) – Extended bandwidth (ADSL2plus)

<sup>29</sup> ITU-T G.993.2 (02/2006) Very high speed digital subscriber line transceivers 2 (VDSL2)

<sup>30</sup> DOCSIS Specifications - DOCSIS 3.0 Interface, CableLabs, available via <http://www.cablelabs.com/specifications/doc30.html>

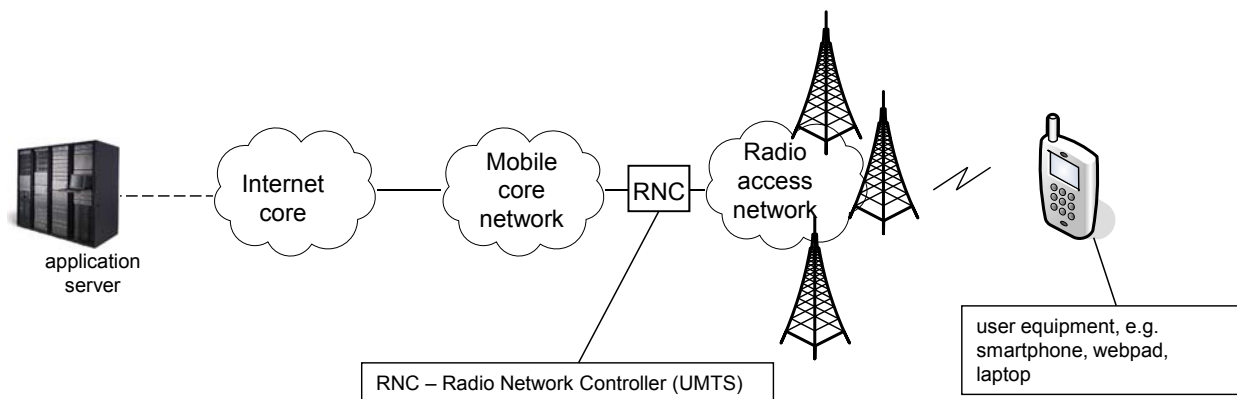
<sup>31</sup> G.985 (03/03) 100 Mbit/s point-to-point Ethernet based optical access system

<sup>32</sup> G.984.1 (03/08) Gigabit-capable passive optical networks (GPON): General characteristics

<sup>33</sup> 3GPP Release 99 and beyond, available via [www.3gpp.org](http://www.3gpp.org)

<sup>34</sup> 3GPP Release 7 and beyond, available via [www.3gpp.org](http://www.3gpp.org)

**Figure 4: End to end path through the Internet from the application to a mobile end user**



Source: TNO

At the same time, a substantial part of the end-to-end IP connectivity chain is the same or similar for fixed and mobile. Both use the same Internet core. Moreover, the IP networking functions in the mobile core network are similar to those in the fixed core network. The differences between fixed and mobile technologies generally relate only to the edge of the network, and primarily to layers of the network below the IP layer (see Section 2.1).

Each individual IP network in the chains in Figure 3 and Figure 4 influences the end-to-end IP QoS characteristics, such as bandwidth, delay and jitter (see Section 2.2). Therefore, every part of the chain is a potential bottleneck limiting the overall IP QoS characteristics. The IP QoS characteristics of the individual networks in the chain vary from network to network because of differences in underlying technology, network topology, network capacity and traffic management. As previously noted, the largest differences in the physical media and technologies are found in the access networks. There are many large and small differences between access networks that affect the IP QoS characteristics and, as a result, have the potential to limit the end user Quality of Experience.

## 2.6. Traffic prioritisation and the end-to-end principle

The Internet Protocol family was optimised from the first for applications that do not require special handling in terms of preference or prioritisation, and there are practical challenges in implementing prioritisation; however, prioritisation should not be viewed as violating the basic architecture of the Internet.

In the Internet, applications communicate conceptually with one another on an end to end basis. (The path from one router to another router, or from a router to an end point such as the server or personal computer shown in the figure, are *point to point* rather than *end to end*.) It was recognised from the first that many functions are best accomplished by the applications themselves on an *end to end* basis.<sup>35</sup> Some have interpreted this *end to end principle* as a core tenet of the Internet<sup>36</sup> and have argued that an extreme form of network neutrality with no prioritisation at all is required in order to adhere to it; however, this is

<sup>35</sup> Saltzer, J., Reed, D., and Clark, D.D. End-to-End Arguments in System Design. Second International Conference on Distributed Computing Systems, pages 509-512, April 1981. ACM Transactions on Computer Systems, 2(4), pages 277-288, 1984.

<sup>36</sup> Cf. Isenberg, David (1 August 1996). "The Rise of the Stupid Network", available at <http://www.rageboy.com/stupidnet.html> (viewed 10 April 2011).

probably giving the principle much too much weight. In reality, the end to end principle was intended to merely reflect pragmatic engineering trade-offs that were relevant at the time.

Notably, some have argued that the Internet protocol suite intended from the first to treat all traffic alike, without preference or prioritisation. This is simply incorrect; prioritised delivery was always envisioned as part of the Internet Protocol (although details were not fully specified at the outset).<sup>37</sup> Work on prioritised traffic delivery over Internet Protocol has a rich tradition with roots going back to the earliest days of the Internet and its precursor networks in the seventies, eighties and nineties.<sup>38</sup>

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<sup>37</sup> See RFC 791, September 1981, which defines the Internet Protocol (IPv4): "The Type of Service provides an indication of the abstract parameters of the quality of service desired. These parameters are to be used to guide the selection of the actual service parameters when transmitting a datagram through a particular network. Several networks offer service precedence, which somehow treats high precedence traffic as more important than other traffic (generally by accepting only traffic above a certain precedence at time of high load). The major choice is a three way tradeoff between low-delay, high-reliability, and high-throughput."

<sup>38</sup> See for instance C. Topolcic, RFC 1190, Experimental Internet Stream Protocol, Version 2 (ST-II), 1990; and L. Delgrossi and L. Berger, RFC 1819, Internet Stream Protocol Version 2 (ST2), 1995.

### 3. THE ECONOMICS OF QUALITY DIFFERENTIATION

#### KEY FINDINGS

- There are different economic views of network neutrality. Differences in quality and price in most circumstances are benign; however, some forms are harmful.
- Quality differentiation is a well understood practice that, in the absence of anticompetitive discrimination, general benefits both producers and consumers.
- When a producer with market power in one market segment attempts to project that market power into upstream or downstream segments that would otherwise be competitive, that constitutes economic foreclosure. Foreclosure harms consumers, and imposes an overall socio-economic deadweight loss on society.
- The Internet can be thought of as a two-sided market, with network operators serving as a platform connecting providers of content (e.g. web sites) with consumers. Under this view, some disputes are simply about how costs and profits should be divided between the network operators and the two (or more) sides of the market.
- The number of viewers/customers that one has can provide a special form of market power associated with network effects. Network effects interact with other economic aspects in complicated ways.

There are many different economic tools that can provide insights in the network neutrality debate. In this section, we discuss quality discrimination in general (Section 3.1), economic foreclosure (Section 3.2), two-sided markets (Section 3.3), and network effects (Section 3.4).

#### 3.1. Quality differentiation

Over the past twenty years, networks have been privatised and opened to competition. In a fully competitive environment, competitors might be tempted to lower prices in order to win business, the only lower limit to this process being the short run marginal cost of running the network; however, at that price level, there would be no way for the network operator to recoup the initial investment in the network, nor would there be incentive to maintain or improve the network.

Network operators could address this challenge in various ways, most notably by means of:

- **Ramsey-Boiteux pricing**, where the network operator takes a higher mark-up on services where the volume that the end-user purchases is not much dependent on the price (i.e. services that are relatively *inelastic*), and a lower mark-up on price-sensitive services;<sup>39</sup> and
- **Quality differentiation**, where the network operator offers different qualities of service at different prices. Quality differentiation can enable the network operator to maintain some pricing power.<sup>40</sup>

<sup>39</sup> For an introduction to Ramsey-Boiteux pricing, see Laffont and Tirole (2001), *Competition in Telecommunications*. They note that a corporate monopolist and a benevolent social planner have similar incentives to reflect demand elasticity in pricing, and that doing so is efficient.

<sup>40</sup> See especially Harold Hotelling, "Stability in Competition", *The Economic Journal*, March 1929, pages 41-57

Both represent a departure from pure cost-oriented prices. Both can, under suitable conditions, enhance social welfare.

Network operators (like other firms) seek to differentiate their offerings in order to weaken the force of price competition. This differentiation may be accompanied by differentiated or non-linear pricing arrangements. Indeed, where customer preferences are heterogeneous, differentiated prices may be necessary for efficient outcomes.

Depending on the extent to which different users have distinct preferences for one aspect of service over another, this may have beneficial effects: covering the fixed costs of network infrastructures, increasing overall capacity (and thus reducing deadweight loss), and, where the quality differences align with differences in user preferences, achieving a better match between user needs and service levels. At the same time, they can also have negative impacts, including: spurious differentiation; excessive monopoly rents; distorted innovation (e.g. feature-based competition that does not deliver enhanced functionality); and collusive market-sharing arrangements.

We are all familiar with this principle in the context of airplane or railroad tickets: we do not consider it anticompetitive for airlines to offer economy, business and first class tickets. Moreover, we recognize instinctively that the differences in *price* are only weakly linked to differences in *cost*. French railroads ran the passenger cars for third class (their least expensive service) with wooden benches and without roofs in the Nineteenth Century “not because of the few thousand francs which would have to be spent to put a roof over the third-class carriage or to upholster the third-class seats, [but rather to] prevent the passengers who can pay the second-class fare from travelling third class”.<sup>41</sup>

In competitive markets, this quality and price discrimination is generally welfare-enhancing.

Internet Service Providers (ISPs) can or could use quality and price differentiation in many different ways<sup>42</sup> and for many different purposes. Some of these are probably positive or neutral to societal welfare on balance, while others are not. Possible reasons to differentiate include:

- extracting more money from existing customers;
- attempting to extract money from content providers on the other side of the two-sided market (see Section 3.3);
- locking-in existing customers through personalised service;
- attracting rivals’ customers;
- shifting high cost customers to rivals;
- getting customers to implicitly reveal private information/demand characteristics through their choice of plan or through changes in their service utilisation patterns;
- changing customer preferences;
- modifying consumer behaviour to reduce congestion and other negative spillovers (e.g. by congestion charging).

<sup>41</sup> “Having refused the poor that which is necessary, they give the rich that which is superfluous.” Emile Dupuit, quoted in Andrew Odlyzko (2004): The evolution of price discrimination in transportation and its implications for the Internet, Review of Network Economics, vol. 3, no. 3, September 2004, pp. 323-346.

<sup>42</sup> Quality as experienced by Internet end-users could include not only capacity and delay, but also price, security, reliability, or ubiquity, while the ISPs and others along the value chain may not think of quality in the same way.

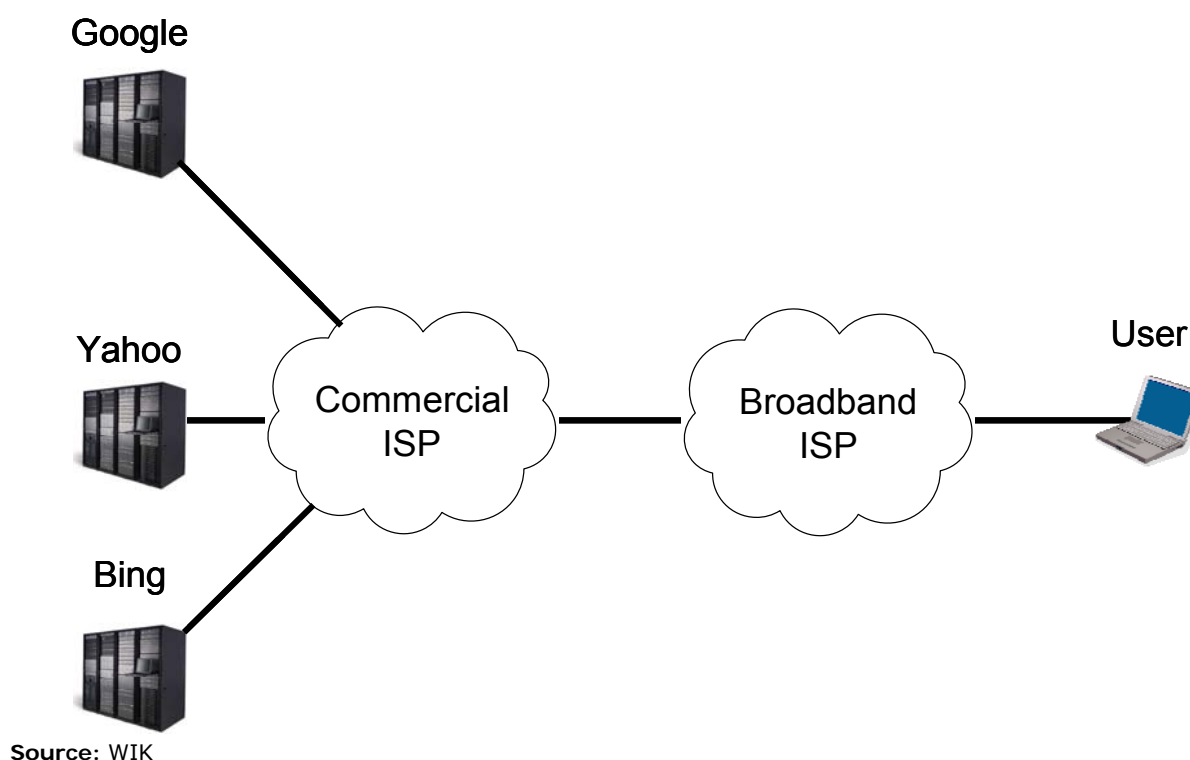
### 3.2. Economic foreclosure

A key concern regarding network neutrality has been with *economic foreclosure*. Foreclosure occurs when a firm that has market power in one segment attempts to project that market power into vertically related market segments where competition would otherwise lead to efficient outcomes.

It is perhaps useful to work through an example involving end-user access to search engines such as Google, Yahoo, or Bing. The search engine does not charge the end-user; instead, it monetises end-user attention by selling advertisements and preferential list placement to merchants. Each end-user can be assumed to choose his or her ISP (the "Broadband ISP" in Figure 5) independently, and to pay for that ISP to convey traffic throughout the Internet. Each Internet service or application provider (in this example, each search engine) also chooses one or more ISPs (the "Commercial ISP" in Figure 5) independently, and pays those ISPs to convey traffic throughout the Internet. There is no assurance that a given end-user's Broadband ISP will be the same firm as any of the Commercial ISPs employed by the end-user's preferred applications; nonetheless, the system works, and the traffic is conveyed between the service and the end-user.

The end-user has, in the normal course of events, a free choice among Internet search engines such as Google, Yahoo, and Bing (see Figure 5). Suppose, however, that the user's broadband ISP were acquired by (to pick an example) Google, or otherwise were to form some affiliation with Google. Might the broadband ISP then favour Google, to the detriment of competitors (Yahoo and Bing in this example), and to the detriment of consumer choice?

**Figure 5: Application services, ISPs, and end-users**



Whether this would be profitable for the broadband ISP depends on many factors. How strong is the desire of the end-user to access search engines other than Google? Could the end-user choose among other broadband ISPs, some of whom would not impose restrictions on access to Yahoo or Bing? Would the switching costs be prohibitive?

## Food for thought 2: The Madison River case

In March 2005, the US FCC announced that it had reached a settlement with a small local telephone company called Madison River over allegations that Madison River was blocking end-user access to VoIP applications. The FCC has never explained exactly what rules, if any, had been violated. Madison River nonetheless agreed to end the practice, and made a “voluntary” contribution of \$15,000 to the U.S. Treasury.

Madison River presumably felt that VoIP competed with its own traditional voice services. They had both the incentive and the ability to block VoIP, and apparently did so. This would appear to represent a clear cut instance of economic foreclosure.

If the user’s desire to access other search engines is strong, and if competitive broadband providers are available, and if switching costs are low, then restricting access to Yahoo and Bing is likely to be unprofitable for the broadband ISP. Too many users would switch to competitors. The broadband ISP is unlikely to attempt an unprofitable strategy.

Conversely, if consumer choice among broadband ISPs is poor, or switching costs are high, or consumer preferences are not strong enough to promote switching, then the broadband ISP might be tempted to block or impair access to unaffiliated services.

Economic foreclosure generally *reduces societal welfare*. It not only transfers welfare from consumers to suppliers (in this case, the broadband ISP, and possibly also the affiliated search engine); to the extent that it results in increased prices and reduced consumer choice, it also results in services that would have been consumed in a competitive market, but are not in this foreclosed market. This lost consumption represents a *deadweight loss* to society as a whole.<sup>43</sup>

## Food for thought 3: The Comcast - BitTorrent case

In November 2007, the US FCC received a complaint on behalf of Rob Topolski, a network engineer, amateur musician and broadband subscriber of Comcast (the largest US broadband ISP). Topolski had discovered to his surprise that no one was able to download his uncopyrighted music from BitTorrent.

According to the complaint, Comcast was actively interfering with Topolski’s use of BitTorrent by masquerading as another computer and using reset packets to stop the transmission of files in various peer-to-peer networks, notably BitTorrent. The reset packets did not technically block the application, but delayed it sufficiently that it was effectively blocked.

The FCC ordered Comcast to precisely disclose its current and future network management practices, and to submit a compliance plan.

Was Comcast’s behaviour inspired by the belief that use of peer to peer applications by its customers was interfering with its own ability to sell content? Or were other considerations paramount?

The subsequent litigation is discussed in Section 5.2.

<sup>43</sup> These relationships are often expressed in the form of *Harberger’s Triangle*.

### 3.3. Two-sided markets

A relatively new branch of economics deals with two-sided markets.<sup>44</sup> In a two-sided market, a platform provider somehow benefits by bringing the sides of the market together. Payment could come from either side of the market; thus, relationships between price and cost that would be irrational in a conventional market might be reasonable in a two-sided market.

Broadcast television is a common and pertinent example. Payment comes from programmers/broadcasters, and ultimately from advertisers; the consumer typically pays little or nothing. In a conventional market, it would be strange for consumers to pay less than the cost of the service, but in a two-sided market it can be rational.

Cable television provides a more complex demonstration of the dynamics of two-sided (or multi-sided) markets. High value content providers such as premium sports can typically demand high payments from the cable operator, i.e. the provider of the two-sided platform; providers of content that is valued less, or that is valued by fewer end-users, may not be able to command high payments, or for that matter may need to pay the cable operator to have their content transmitted. The results of the negotiation are heavily dependent on the relative bargaining power of the parties. Payment may flow in some cases from the end-user to the content provider, typically through the cable operator. From an economic perspective, the fact that a bargaining game is involved is not necessarily a problem, nor is the relevance of bargaining power. The negotiated outcomes can be economically rational and efficient.

The two-sided (or multi-sided) cable television marketplace differs from that depicted in Figure 5 chiefly in that, instead of a single cable television platform, there are two or more ISPs involved (shown in the figure as "Commercial ISP" and "Broadband ISP"), and they are usually distinct firms.<sup>45</sup>

#### Food for thought 4: The BBC iPlayer dispute

In December 2007, the BBC launched the *iPlayer*. The iPlayer is a peer-to-peer (P2P) application that allows subscribers to view recent programmes free of charge by streaming or downloading them to their computer. The success of the iPlayer drove significant demand for bandwidth, thus imposing significant cost on access ISP networks. Several ISPs expressed concerns, and some acknowledged engaging in traffic shaping techniques to manage network traffic by giving lower priority to users who download large files at peak times.

<sup>44</sup> Rochet, Jean-Charles/ Tirole, Jean (2004): Two Sided Markets: An Overview, March 2004, available at: [http://faculty.haas.berkeley.edu/hermalin/rochet\\_tirole.pdf](http://faculty.haas.berkeley.edu/hermalin/rochet_tirole.pdf).

<sup>45</sup> A comprehensive analysis of the situation, with web sites and consumers served by different ISPs, appears in Laffont, J.-J., Marcus, J.S., Rey, P., and Tirole, J., "Internet interconnection and the off-net-cost pricing principle", *RAND Journal of Economics*, Vol. 34, No. 2, Summer 2003. The paper concludes that "... the access charge determines the allocation of communication costs between senders (mainly websites) and receivers (mainly consumers) and thus affects the level of traffic. The socially optimal access charge takes into account [not only] the demand elasticities on the two segments, but also the magnitude of the externality that each segment generates on the other segment." It also notes that if ISPs have market power, their interests are in general no longer aligned with social welfare.

This is at its heart a two-sided market dispute. BBC actions led to the dispute, but the dispute could just as well be said to have originated with the end-user ISP customers who wished to view BBC content. Inevitably, the question was which side of the market should bear the substantial costs.

The BBC ultimately defused the dispute by content servers at various points in the BT network. The BBC is also developing a simple system to help make iPlayer users aware of the bandwidth that they are consuming.

Network operators have often argued in recent years that they need to exploit the other side of the two sided market in order to cover exploding costs for bandwidth. It is perhaps worth noting that exploding bandwidth requirements are by no means a new phenomenon. Traffic growth rates in the fixed network today are far less in percentage terms than they were in the late nineties (although that percentage growth is on an immensely larger base, as can be readily seen in

Figure 2). A key question has always been whether technology-driven improvements in unit costs would work more quickly than the increase in traffic. With the decline in percentage traffic growth per year, one might hope that it is becoming easier, not harder, for fixed network operators to keep up with traffic growth.

### 3.4. Network effects

In many industries, there are advantages to having large number of customers that go far beyond pure economies of scale.<sup>46</sup> The postal system is worth more to you because it is possible to send a letter to practically anyone. In the same way, each time another user joins the Internet, the value to all users could be said to have increased.<sup>47</sup>

These same network effects can confer a form of market power on firms that control access to a large number of users. The economics of market power in industries subject to network externalities has been extensively analysed over the years,<sup>48</sup> especially in connection with standards compliance. More recently, the work was extended to consider the implications for interconnection, including Internet interconnection.<sup>49</sup> In general, where no player has a dominant market share (in overall percentage terms, and also relative to the next largest players) in terms of controlling access to customers, all players will be motivated to have good interoperability and interconnection. Where one player has a sufficiently large share, however, that player will be motivated to have less-than-perfect interoperability and/or interconnection, because perfect interconnection would prevent it from exploiting its market power.<sup>50</sup>

<sup>46</sup> Rohlfs, Jeffrey H. (2003): *Bandwagon Effects in High Technology Industries*, MIT Press, 2003.

<sup>47</sup> This is, of course, not true for all potential users. Spammers, for instance, impose negative externalities that decrease the value of the Internet to other users.

<sup>48</sup> See M. Katz and C. Shapiro (1985), "Network externalities, competition, and compatibility", *American Economic Review* 75, 424-440.; and J. Farrell and G. Saloner (1985), "Standardization, compatibility and innovation", *RAND Journal of Economics* 16, 70-83.

<sup>49</sup> Jacques Cremer, Patrick Rey, and Jean Tirole, "Connectivity in the Commercial Internet", May 1999.

<sup>50</sup> Ibid.

## 4. QUALITY DIFFERENTIATION AND EVOLVING BUSINESS MODELS

### KEY FINDINGS

- At a technical and business level, an evolution to a two lane model (public Internet versus Managed Services) is conceivable and apparently desirable.
- At the level of the broadband ISP, we can already see examples of the Two Lane Model.
- What is not yet visible is a Two Lane model between network operators at global level. QoS-aware interconnection is technically feasible, but hardly ever implemented.
- Different scenarios are possible as regards the evolution of QoS in the Internet, with different implications for public policy.

### 4.1. Emergence of the two-lane model

Initially, the net neutrality discussions focused on the different treatment of traffic flows in the public Internet. As explained in Section 2, the public Internet is a global system of interconnected networks that use the IP protocol to transport data between the connected end points. The adjective “public” in public internet emphasis that end users can access all information and applications on the global Internet from their own end point. This information and the applications are offered, either for free or in exchange for payment, by content providers that are connected to an Internet end point themselves as well. The role of the public Internet is essentially that of a transport network that connects users and applications providers across the globe (see also the discussion of two-sided platforms in Section 3.3). In principle, the Internet can support all IP-based services and applications by transporting IP traffic between application or content providers and users worldwide. Broadband ISPs play an important role in the public Internet, as they provide the Internet Access Service: the part of the Internet transport chain between the home network or mobile terminal of the user and the larger ISPs that collectively comprise the Internet core (see Section 2).

In general, the Internet access service is a best-effort service, e.g., there are no guarantees that IP packets sent over the network reach their destination end point within a certain time. This type of best-effort Internet access services matches the best-effort characteristics of the Internet core.

Providers of Internet Access Services increasingly provide other IP-based services in parallel with the Internet access service over same infrastructure. Two well-known examples here are IPTV and IP telephony services provided by a range of European ISPs over their DSL, cable and fibre access networks. Although these services are delivered over the same network infrastructure as the Internet Access Service, they can in a number of respects be distinct from the Internet Access Service. Often, they are offered

as “managed services”.<sup>51</sup> Other terms that are used are “managed or specialized services”<sup>52</sup> or “additional, differentiated online services”.<sup>53</sup> The adjective “managed” can be slightly misleading here, as it does not provide a clear demarcation between these newer forms and the traditional public Internet access service.

Although the Internet access service and the Internet core are both characterized as best effort, they are both subject to various types of management to ensure their efficient and reliable operation. Apart from this, application and service providers on the Internet actively monitor and manage their web servers, application stores and other resources. Nonetheless, the degree of management and guarantees for managed services is typically higher than that for the best-effort public Internet.

### Food for thought 5: The ISP's traffic management tool box

ISPs can use a number of distinct but interrelated tools and techniques to manage their traffic. Each of these tools has many useful, positive applications.

- *Traffic prioritisation* determines the order in which each packet (IP datagram) is transmitted from a router's outbound queue for a particular transmission link.
- The *packet drop discipline* determines which packets a router drops if the number of packets exceeds the memory available for a queue. Note that dropping packets is a normal event for an IP network under load, not necessarily a failure mode.
- *Packet filtering* is used to drop packets (i.e. not allow them through) or otherwise apply special handling based on defined criteria, which could be quite complex. It is often used to block harmful content.
- *Routing* is the means by which an IP network determines where each packet (IP datagram) should be directed next. Internet routing *does not* routinely consider the congestion of each link; however, some delay-sensitive applications and services may use any of a number of techniques to try to intelligently pick an uncongested path, or may send data more than once to increase the likelihood that it gets through quickly.
- *Deep packet inspection (DPI)* is a set of techniques for examining and categorising packets for any of a number of purposes. Unlike most other IP-based tools, DPI can be used to inspect not only the *headers* of IP datagrams, but also their application *content* (which also raises possible privacy concerns). DPI has been used to suppress peer-to-peer traffic (see Food for thought 3).

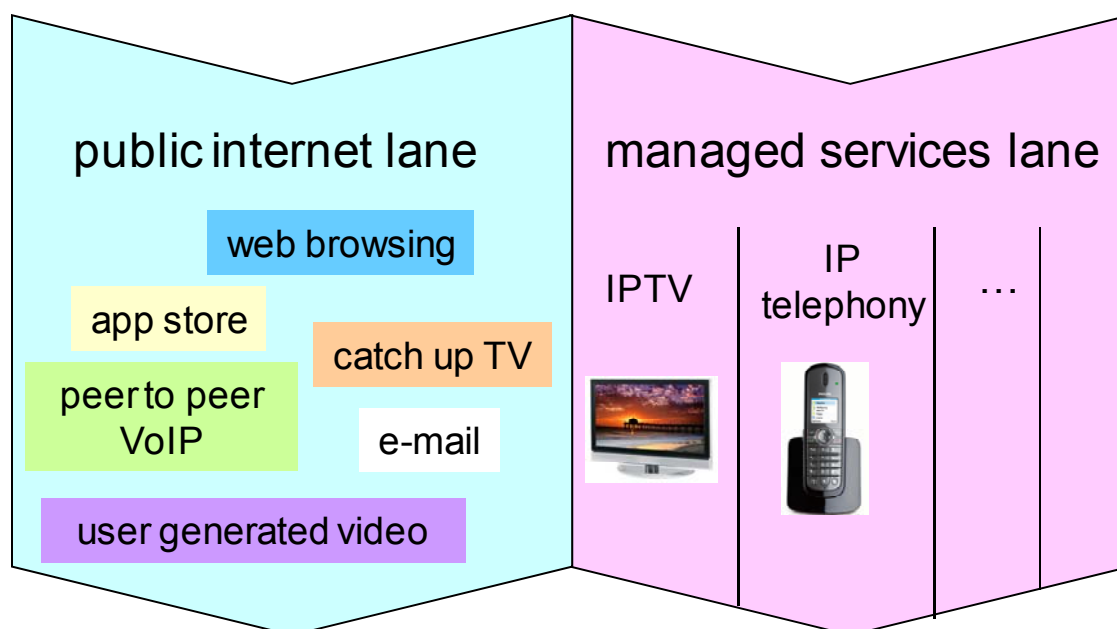
<sup>51</sup> Questionnaire for the public consultation on the open internet and net neutrality in Europe, European Commission, Information Society and Media Directorate-General, Electronic Communications Policy, 30 June 2010, [http://ec.europa.eu/information\\_society/policy/ecomm/doc/library/public\\_consult/net\\_neutrality/nn\\_questionnaire.pdf](http://ec.europa.eu/information_society/policy/ecomm/doc/library/public_consult/net_neutrality/nn_questionnaire.pdf)

<sup>52</sup> FCC, In the Matter of Preserving the Open Internet, Broadband Industry Practices, GN Docket No. 09-191, WC Docket No. 07-52, October 22, 2009, [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/FCC-09-93A1.doc](http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-09-93A1.doc)

<sup>53</sup> Verizon-Google Legislative Framework Proposal, August 9, 2010, via <http://googlepublicpolicy.blogspot.com/2010/08/joint-policy-proposal-for-open-internet.html>

The co-existence of (services and applications) over the public Internet and managed services leads to emergence of the so-called two-lane model.<sup>54</sup> In the two-lane model, the broadband access connection of an end user is used to provide him both with the Internet Access Service and a number of managed services.

**Figure 6: Two Lane model over a single broadband access**



Source: TNO

In the public Internet lane, the ISP provides an Internet Access Service to the end user. Through this access service, the user gains access to the information and applications on the public Internet. Thus, the user has access to a very large variety of information and applications on the Internet, while he only buys the Internet Access Service from his ISP. In a number of cases, the end user is likely to enter into an agreement or contract with a content provider on the public Internet. These agreements do not involve the ISP and also do not require any action from the ISP. In the managed services lane, the ISP has an agreement with the end user to provide him specific services. There can be a single agreement, made directly between the ISP and the end user. There can also be multiple, interrelated agreements, e.g. one agreement between the end user and a content provider, in combination with a second, related agreement between the content provider and the ISP. Each specific service that an end user buys in the managed services lane requires, in principle, an action by the ISP. Typically, part of this action consists of taking measures to guarantee the quality of the service, for example through the reservation of dedicated bandwidth. In the public Internet lane, no measures are taken to guarantee the quality of specific services.

<sup>54</sup> BEREC Response to the European Commission's consultation on the open Internet and net neutrality in Europe, BoR (10) 42, 30 September 2010, [http://www.erg.eu.int/doc/berec/bor\\_10\\_42.pdf](http://www.erg.eu.int/doc/berec/bor_10_42.pdf)

**Table 1: Characteristics of the public Internet lane and the managed services lane**

	<b>Public Internet lane</b>	<b>Managed Services lane</b>
<b>Services provided by ISP</b>	Single service: access to the global public Internet	Specific services, e.g. IPTV, IP telephony, etc.
<b>Services provided by other providers</b>	All services on the public Internet ("Over the Top" services)	Specific services, subject to agreement between other provider and ISP
<b>Agreements between ISP and end user</b>	Single agreement covering Internet access service	Individual agreements per service
<b>Quality</b>	Best effort (good but no guarantees)	Typically with statistically guaranteed quality for each service

Source: TNO

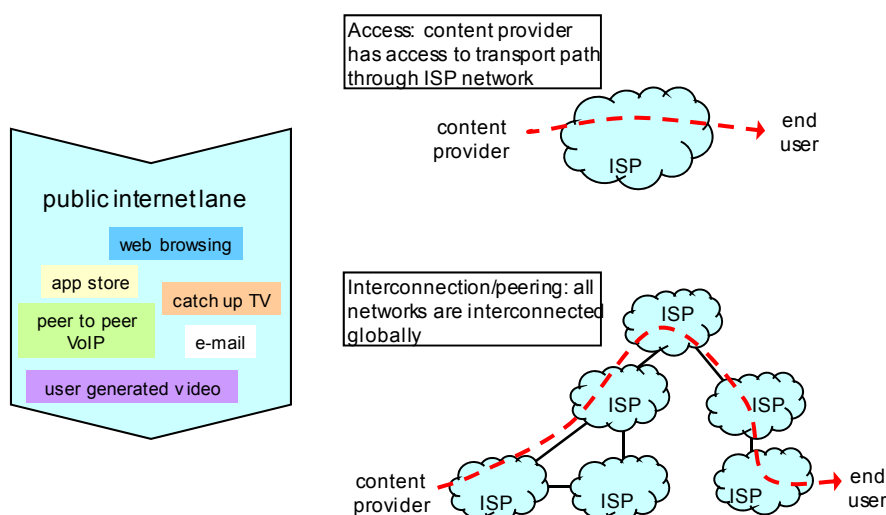
Table 1 summarizes the characteristics of the public Internet lane and the managed services lane. It is seen that there are substantial differences between the two lanes in two areas that are crucial to net neutrality discussion: openness and quality guarantees.

- *Public Internet lane offers more openness.* As discussed earlier, an end user can access all information and buy services from all content providers on the global public Internet via a single Internet access service. In addition to this openness from the end user perspective, there is also openness from the content provider perspective: a content provider connected to the public Internet can reach and provide services to all end users on the global public Internet. As explained in the Section 4.3, the openness in the public Internet lane is obtained through a combination of access and interconnection. The managed service lane, in contrast, has a limited openness. Typically, an end user can only choose among the managed services offered by his own ISP. Also, from the content provider perspective, the openness can be limited: the content provider is heavily dependent on the end user's ISP to provide the service to a particular end user over the managed services lane.
- *The managed services lane offers more quality guarantees.* In the managed services lane, ISPs can, for example, guarantee the availability of bandwidth for specific services or guarantee a small delay of the IP packets (see section 4.3). In the public Internet lane, ISPs cannot in general guarantee the quality for specific services, because they handle all traffic using the same best-effort approach. They typically aim to achieve a good quality for the total of the best-effort traffic they transport, within the technical and economic constraints they have, but the performance cannot be guaranteed.

## 4.2. Openness in the public Internet lane

One of the attractive and much valued properties of the public Internet lane is its openness. This section analyses the combination of access and interconnection through which this openness is achieved.

**Figure 7: The role of access and interconnection in the public Internet lane**



Source: TNO

- Through the availability of access at the IP layer (see Figure 7, top right), a content provider can benefit from the IP routing and transport capabilities of the ISP. In essence, the access provides the content provider with a path or connection to the end user he wants to reach. With the access to one ISP network, a content provider can reach all customers of the particular ISP that he is connected to himself.
- Because ISP networks are all typically directly or indirectly interconnected through IP peering and IP transit agreements, a content provider can not only reach end users connected to his own ISP's network, but also end users connected to other ISP networks (Figure 7, bottom right). Because of the extensive interconnection of today's ISP networks, a content provider can in principle reach every end user over the global public Internet.

Thus, the current degree of openness in the public Internet lane requires both access and interconnection. With access only, a content provider can reach only a limited group of end users. If the content provider's end users are distributed over multiple ISP networks, which is a typical situation, it would need to connect its service and application platforms to each of these networks, which is difficult and expensive in practice. It is only with interconnection of networks that a large group of customers can be reached, without the need to know the specific IP connectivity arrangements of individual end users.

### 4.3. Quality guarantees in the managed services lane

An attractive feature of the managed services lane is the ability to guarantee the quality of the service and applications that are delivered. Since the ISP has detailed knowledge of the services that it has agreed to deliver to the end users, it can apply traffic management measures tailored to the specific services involved. This is typically done by combining the IP QoS mechanisms from section 2.2 with bandwidth reservations at the layers below the IP layer (see Section 2.1).

The technology to provide QoS assurance on an end to end basis through the entire Internet has been reasonably implementable for perhaps a dozen years, yet there is hardly any actual implementation *between* ISPs, even though QoS is commonly implemented within an ISP. There are technical challenges, to be sure, notably including a lack of standardisation of QoS levels;<sup>55</sup> however, the absence of QoS aware interconnection has much more to do with economic and business factors than with technical ones.<sup>56</sup> Among the practical challenges are:

- Limited demonstrated consumer willingness to pay for QoS, presumably because performance in the absence of guarantees is nonetheless sufficient for most purposes.
- Network effects and the initial adoption hump: QoS-aware interconnection has little value until and unless a critical mass of ISPs implement it.
- Challenges in verifying that the other network has in fact delivered the service that it has committed: This difficulty is compounded by the understandable reluctance of network operators to make the internal performance of their networks visible to their competitors.
- Challenges with the business model: A basic model for assessing different wholesale charges based on (1) the volume of traffic in conjunction with (2) the class of service requested and delivered has been fairly clear for some time.<sup>57</sup> Actual implementation would have to address not only the measurement issues noted previously, but also possible financial penalties for failing to meet performance level commitments (Service Level Agreements).

If bandwidth reservations in the access network are used to obtain quality guarantees in the managed services layer, then this can also affect the quality of the services delivered through the public Internet lane. Since both lanes are typically provided over a single broadband access connection, they share the network capacity in this part of the transport chain. As a result, bandwidth reservations that are beneficial for service delivery in the managed services lane can lead to a lower quality for services delivered through the public Internet lane.

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<sup>55</sup> Perhaps the most promising work in this vein was conducted by an industry Quality of Service (QoS) Working Group hosted at MIT in the US. The MIT White Paper establishes targets for delay, jitter and packet loss for a service capable of supporting high quality IP voice, and also puts forward an overall methodology for measuring adherence to the targets. See MIT QoS WG, "Inter-provider Quality of Service", White paper draft 1.1, 17 November 2006, available at: [http://cfp.mit.edu/publications/CFP\\_Papers/Interprovider%20QoS%20MIT\\_CFP\\_WP\\_9\\_14\\_06.pdf](http://cfp.mit.edu/publications/CFP_Papers/Interprovider%20QoS%20MIT_CFP_WP_9_14_06.pdf).

<sup>56</sup> See J. Scott Marcus, "Framework for Interconnection of IP-Based Networks – Accounting Systems and Interconnection Regimes in the USA and the UK", a background paper prepared for the German Federal Network Agency's study group on a Framework for Interconnection of IP-Based Networks, 27 March 2006, available at: <http://www.bundesnetzagentur.de/media/archive/6201.pdf>.

<sup>57</sup> See for instance Jean-Jacques Laffont, J. Scott Marcus, Patrick Rey, and Jean Tirole, IDE-I, Toulouse, "Internet interconnection and the off-net-cost pricing principle", *RAND Journal of Economics*, Vol. 34, No. 2, Summer 2003, available at <http://www.rje.org/abstracts/abstracts/2003/rje.sum03.Laffont.pdf>

#### 4.4. Future business models combining quality guarantees and openness

There is, of course, no certainty as to how business models will evolve in the future. In order to clarify possible directions for future evolution, and their relative impact on consumers, we have attempted to identify a number of possible outcomes or scenarios, each based on considerations of a two lane (or multiple lane) Internet. They differ chiefly among three dimensions:

- The quality and bandwidth available to the public lane, in comparison to that available to the managed services lane. Will the public lane offer sufficient bandwidth for over-the-top (OTT) providers? How is the relative balance of bandwidth likely to evolve over time?
- What new services and applications are likely to emerge that might function better with better-than-best-efforts quality? Might the evolution of other sectors (health, energy, transport) drive such applications?
- What market players will have access to the best-efforts lane, and to the managed services lane?

Possible scenarios for the future evolution of the sector include:

- **Little change from today:** A two lane Internet has been technically feasible for at least ten years. That it has appeared to only a very limited extent may mean that consumers do not want it, or at least that commercial incentives are not strong enough to drive the evolution. This is a rather likely option. The managed services lane already exists, but it is used mainly for the TV and telephony components of triple play. These two components compete to only a limited degree with services delivered over the public Internet lane.
- **Continuation and further expansion of two-lane model:** If traffic over the managed services lane were to substantially increase, either due to new applications or due to increased use of the managed services lane for forms of video that today are in the public lane, might they tend to crowd out services in the public Internet lane? This scenario assumes that access remedies remain relative to traditional service, but that the managed services lane is used exclusively by the facilities-based ISP for its own “walled garden” of services.
- **ISPs open up the managed services lane to other providers:** In this scenario, not only does the managed services lane expand, but it is made available to competitors of the facilities-based network operators.<sup>58</sup> Capacity planning potentially becomes more complex than it is today.
- **End-to-end service guarantees become possible in the public Internet:** QoS-aware interconnection has been technically feasible for many years, but is hardly ever implemented. If it were possible to surmount the quite substantial practical obstacles, new uses of the Internet might be enabled.<sup>59</sup>

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<sup>58</sup> This is technically possible for DSL, HFC, fibre networks, and also in a way that makes these different networks look the same for the (external) service provider that wants to connect to them; however, further commercial, standardization and wholesale service development would be needed to make this work in practice.

<sup>59</sup> Interviewees for this study were skeptical. They felt that it was extremely difficult to implement managed services across the boundaries of autonomous networks. One noted that the IPX interconnection model developed by the GSMA could in principle achieve this.

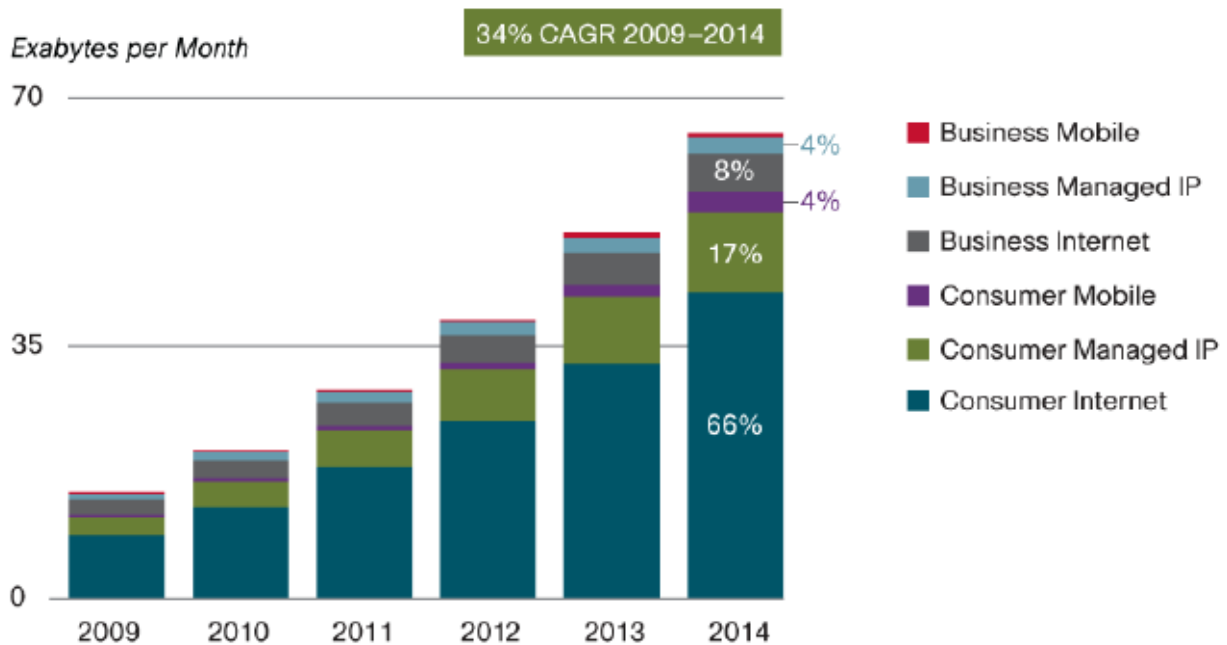
In the remainder of this section, we assess these four scenarios in terms of their relative likelihood, and in terms of their implications for competition, innovation, freedom of expression, consumer awareness, and privacy (the factors put forward in Section 0).

#### 4.4.1. Relative likelihood

Given the relative slow pace of change over the past ten to fifteen years in regard to implementation of QoS, it would seem that the most likely scenario reflects only gradual change to the status quo. On the other hand, increasing traffic volumes might drive a more rapid evolution.

As part of Cisco Systems' annual review of likely trends in Internet traffic (based largely on a review of likely take-up of VoIP, video, and sectoral applications), they project a gradual but substantial increase in the scope of the managed services lane for both consumer and business traffic.<sup>60</sup> We find their projections plausible.

**Figure 8: Cisco VNI global overall Internet traffic forecast**



Source: Cisco VNI, 2010.<sup>61</sup>

This would seem to suggest a steady growth in the importance of the managed services lane, but not necessarily to the point of crowding out services based on the public lane – at least, not for quite some time. We would also caution against simply extrapolating the growth in managed services beyond the period that they have projected – often, there are natural limits to the growth of new services, resulting in S-shaped growth curves that “top out” rather than growing exponentially without limit.

The idea that ISPs might open their managed service lane to competitors is perhaps not as far-fetched as it might seem at first blush, even though we are aware of no instance of commercial application today. Several NRAs have considered imposing QoS constraints, with different price levels for different mixes of average delay, jitter, and packet loss.<sup>62</sup>

<sup>60</sup> Cisco VNI, “Hyperconnectivity and the Approaching Zettabyte Era”, 2 June 2010.

<sup>61</sup> Ibid.

<sup>62</sup> AGCOM and Telecom Italia invested considerable effort in 2007-2008 in adapting bitstream to IPTV.

One of our interviewees also indicated that they have a QoS-aware wholesale offer, but no actual take-up.

End-to-end guarantees and QoS-aware interconnection pose perhaps the greatest challenges. It is notoriously difficult to bring services over the initial adoption hump<sup>63</sup> in a case like this, which is characterised by strong network effects, long value chains, and high transaction costs (many ISPs that have to somehow find agreement).<sup>64</sup>

For either the “opening the managed services lane” of the “end-to-end guarantees” scenarios, it would be important to arrive at agreed standards on how to interpret QoS. Promising work has been done in this area,<sup>65</sup> but much remains to be done.

#### 4.4.2. Competition<sup>66</sup>

In terms of competition, “little or no change” is familiar and would appear to be acceptable.

Further expansion of a two-lane model as a series of broadband ISP-specific “walled gardens” would seem to be a somewhat less attractive model, to the extent that it implies that the broadband ISP’s own services become increasingly important, and that third parties might not be able to offer competitive alternatives that depend on special QoS capabilities. This would effectively confer a certain degree of market power on the broadband ISP, even in cases where competitors using LLU, shared access and/or bitstream access were effective. This is already the case today, but it might take on increasing significance if QoS-sensitive applications were to gain in importance.

This form of market power would appear likely to enhance the ability of a facilities-based ISP to extract payments from the other side of the market, to the extent that there are applications that depend on better-than-best-efforts service. This is arguably a negative consequence.

There might also be some risk in that scenario of the broadband ISP choosing to permit the public Internet lane to be crowded out in order to make its own managed services lane more attractive in comparison to the offers of competitors; however, NRAs in the EU seem to have adequate tools to deal with this in the form of the minimum QoS authority provided by the 2009 amendments to the regulatory framework (see section 5.2.2.1).

If facilities-based operators were to open their QoS-aware managed service lane to third parties, and if the opening (and other elements of existing regulation) were effective, then one could expect competition to be in good shape.

The effect that QoS-aware interconnection would have on competition is heavily dependent on how it is implemented, and by which market players.

<sup>63</sup> Cf. Rohlfs, *Bandwagon Effects*, op. cit.

<sup>64</sup> See J. Scott Marcus, “Evolving Core Capabilities of the Internet”, *Journal on Telecommunications and High Technology Law*, 2004, available at: [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=921903](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=921903).

<sup>65</sup> See for instance MIT QoS WG, “Inter-provider Quality of Service”, White paper draft 1.1, 17 November 2006, available at: [http://cfp.mit.edu/publications/CFP\\_Papers/Interprovider%20QoS%20MIT\\_CFP\\_WP\\_9\\_14\\_06.pdf](http://cfp.mit.edu/publications/CFP_Papers/Interprovider%20QoS%20MIT_CFP_WP_9_14_06.pdf).

<sup>66</sup> Article 8 of the Framework Directive recognises the value of competition. It is perhaps worth noting that, from a broader economic perspective, competition is a means to an end (GDP growth, jobs, innovation) rather than an end in and of itself.

#### 4.4.3. Innovation

Innovation is not just a matter of physical network access. In the complicated and potentially multi-sided market of the Internet, gateways of bottlenecks could serve to inhibit the creation of applications. For example, it is impossible to determine which applications might have been developed, but were not, due to the lack of QoS guarantees in the Internet. It is also possible for the *threat* of gate keeping activity to inhibit innovation.

From the perspective of innovation, scenarios where there is no gatekeeper will tend to be preferable to those where there are bottlenecks, other things being equal.

Some have argued that, in the absence of additional payments from content providers to broadband ISPs, the latter will not be motivated to build or maintain their networks. We find this argument unpersuasive; however, from a two-sided market perspective, such payments are not necessarily objectionable.

In general, differentiation can help bring to market new goods and services whose QoS requirements exceed or differ from the market's least common denominator.

#### 4.4.4. Freedom of expression

The scenarios that entail a gatekeeper will also tend to be less attractive from the perspective of maintaining freedom of expression; however, European and national policymakers are unlikely to tolerate limits to freedom of expression, and will find tools to deal with it should problems arise.

Examples of network neutrality deviations as a means of interference with freedom of expression have been rare in any case. As a possible example, consider the case of a large US broadband provider that was alleged in 2004 to have systematically filtered all email messages to its subscribers whose content contained the URL of a coalition of activists who opposed the war in Iraq.<sup>67</sup>

With the entry into force of the Lisbon Treaty in 2009, the Charter of Fundamental Rights of the EU has full legal effect. Article 11, which ensures the "right to freedom of expression" and respect for the "freedom and pluralism of the media", would appear to be directly applicable.<sup>68</sup>

#### 4.4.5. Consumer awareness

In the communications from the Commission and from BEREC, the need for clear and transparent communication of QoS parameters and network management practices has been a recurrent theme. We think that there may be scope for continued technical and policy research on better (more meaningful, more easily grasped, more repeatable) Internet performance metrics. This is independent of scenario that the sector ultimately follows.

The scenarios that entail end-to-end QoS assurance, or where the managed lane becomes available to competitors, might be slightly superior from this perspective. They tend to depend on a degree of standardisation of QoS, which is likely to be more readily grasped by consumers.

<sup>67</sup> For a description of the incident, see Marcus et al., *Network Neutrality: Implications for Europe*, WIK, January 2009. The details and possible motivation of the incident remain unclear.

<sup>68</sup> The degree to which these provisions would be effective in practice in addressing network neutrality concerns related to freedom of expression is largely untested, and one should also bear in mind the protocol to the Lisbon Treaty that limits the applicability of the Charter of Fundamental Rights of the EU in the case of Poland, the United Kingdom, and the Czech Republic.

#### 4.4.6. Privacy

The intersection between network neutrality and privacy is rather limited. The primary concern is that managed services could be implemented by means of Deep Packet Inspection, and that DPI potentially makes a great deal of individual data available to the ISP.

The key questions still relate to how the data is used, and how and for how long it is retained. These are still addressed by the e-Privacy Directive.

Given that DPI can be used in any of the scenarios (including the “little or no change” scenario), this is not a reason to prefer one scenario over another.

#### 4.4.7. Comparative assessment

Table 2 provides a rough assessment of the relative merits of the alternative evolutionary scenarios. As with any table of this type, it should be interpreted with some care. QoS-aware interconnection is in some ways the most promising of the scenarios, but it is also the least likely to emerge (see Section 4.4.1).

**Table 2: Relative merits of different Internet evolutionary scenarios.**

	Little or no change	Increasing significance of the two-lane model	Open up managed services lane to other providers	QoS-aware inter-connection in the public Internet
<b>Competition</b>	0	-	+	?
<b>Innovation</b>	0	-	+	++
<b>Freedom of expression</b>	0	-	0	0
<b>Consumer awareness</b>	0	0	+	++
<b>Privacy</b>	0	0	0	0

0 = no change; + = better; ++ = still better; - = worse; -- = still worse

Source: WIK

## 5. DIFFERENCES BETWEEN THE US AND THE EU

### KEY FINDINGS

- Most US homes could receive broadband from either a cable television provider or a telecommunications provider.
- Competitive providers (using LLU, shared access, or bitstream) have largely disappeared in the US, resulting in a market environment that is essentially duopolistic.
- Regulatory measures taken in the US in the period 2002-2005 have limited the ability of the FCC to regulate broadband. The Open Internet order adopted in December of 2010 seeks to re-establish the FCC's authority to deal with deviations from network neutrality. The Open Internet order is subject to court challenges and political opposition and obstruction (see Section 5.2.1).
- Many European homes are served by only a single fixed telecommunications network operator; however, many Europeans nonetheless have the opportunity to be served by any of a number of broadband providers.
- The regulatory framework for last mile fixed network access in Europe (based on LLU, shared access and bitstream) is generally effective. It has enabled competitive entry in many Member States; however, not all Member States enjoy a high level of consumer choice among fixed broadband providers (see Section 5.1.2).
- Competition law in the US could not be effective in dealing with deviations from network neutrality; in Europe, by contrast, it might potentially be effective (but is as yet unproven as a remedy for network neutrality problems).
- The richer competitive market structure in Europe, together with a more robust regulatory and competition law environment, has likely contributed to the apparently low level of network neutrality incidents that have been observed in Europe to date.
- In light of these differences, it is not surprising that Europe is taking a different approach to network neutrality than that of the United States.

Network neutrality issues have been far more visible in the United States than in Europe, and the remedies recently imposed by the US FCC are more stringent than those in place in Europe. Is the US right? Is the European Union right? Or are both responding to different market and regulatory realities, in the context of different underlying institutional structures?

Section 5.1 summarises the US marketplace, and compares it with that of Europe; Section 5.2 discusses regulation of broadband generally, and network neutrality specifically, again comparing the US to the EU; Section 5.2.2 compares competition law in the US to that of the EU; and finally Section 5.4 provides an overall comparison. We spend somewhat more time explaining US arrangements, and present them first, because we believe that European readers (our audience) will be less familiar with them.

## 5.1. Broadband markets

Unlike Europe, cable is the majority fixed broadband medium in the United States. Broadband markets differ in this respect and in many others.

### 5.1.1. Broadband markets in the United States

Broadband markets in the US are dramatically different from those in the EU. In the US, broadband access is potentially available to most households by means of both cable television and telecommunications; however, wholesale remedies were effectively eliminated a few years ago (see Section 5.2), so most Americans in practice confront a duopoly.<sup>69</sup> They can choose between one cable-based broadband provider and one telecommunications-based broadband provider. Other forms of broadband may be physically available, but they do not serve as meaningful economic substitutes for these two forms of fixed broadband access.

According to statistics of the US FCC, in June 2010 there were the following numbers of broadband connections.

**Table 3: Broadband connections in the US**

	Number	Percent of Households
<b>Fixed connections</b>	81,744,000	71.2%
<b>ADSL</b>	30,739,000	26.8%
<b>FTTH</b>	4,436,000	3.9%
<b>Cable</b>	43,924,000	38.3%
<b>Fixed wireless</b>	546,000	0.5%
<b>Other fixed</b>	2,099,000	1.8%
<b>Mobile wireless</b>	71,177,000 <sup>70</sup>	62.0%

**Source:** WIK-Consult based on US FCC data.<sup>71</sup>

US FCC statistics report huge numbers of mobile wireless users; however, these statistics do not distinguish between consumer mobile telephone usage versus laptop usage (e.g. via a dongle). Survey data suggest that 15% of Americans use their laptop with a mobile wireless service; however, the service should be primarily viewed as an *economic complement* to fixed access rather than a substitute, in that the vast majority (92 percent) of wireless broadband users have fixed broadband access at home.<sup>72</sup>

<sup>69</sup> Unlike most of Europe, the US is characterized by multiple incumbents. The territorial division of the fixed telephone network continues to largely follow the lines established with the breakup of the former Bell System in 1982. AT&T, Verizon and US West cover the majority of the US population with non-overlapping territories, while rural areas are served by a large number of tiny incumbent operators. Broadband competition among these network operators is negligible (see Section 5.2.1), largely due to gaps in the regulatory system. Cable operators also choose non-overlapping territories in almost all cases.

<sup>70</sup> As we explain later in this section, very little of this usage substitutes for residential broadband to a computer.

<sup>71</sup> US FCC: Internet Access Services: Status as of June 30, 2010. Note that the FCC reports reflect connections that are over 200 kbps in at least one direction. For households in 2010, we assume 114,825,000 based on US Census Bureau estimates (Projections of the Number of Households and Families in the United States: 1995 to 2010, P25-1129).

<sup>72</sup> John B. Horrigan, US FCC, Broadband Adoption and Use in America, OBI Working Paper Series Number 1. It is clear (see pages 14-15 of this report) that the FCC struggled in interpreting the survey responses due in part to the presence of more than one form of broadband in a household. US Census Bureau surveys shed no further light on the matter (see US NTIA, Digital Nation: Expanding Internet Usage, February 2011).

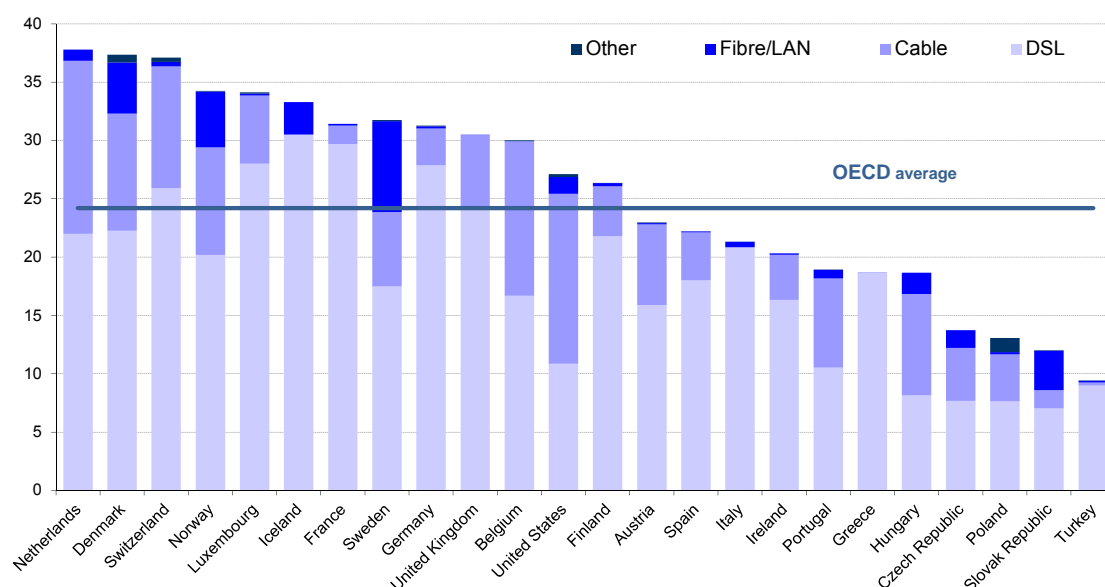
Procompetitive remedies such as local loop unbundling (LLU), shared access and bitstream access were largely phased out during the George W. Bush years. Their use peaked in 2002 at a bit more than 5% of all DSL access lines. Today, they are an insignificant factor in the marketplace. In effect, all DSL lines are provided by the local incumbent.

### 5.1.2. Broadband markets in Europe

These figures stand in stark contrast to equivalent European values. Overall, there is a richer and more complex competitive environment in Europe; however, the availability of cable television in Europe is uneven, meaning that there is typically only one fixed network connection to each home.

The OECD has been reporting broadband statistics for years. Their assessment of broadband subscriptions per 100 inhabitants provides the best cross-comparable international data for international comparisons; however, one should take care with EU-US comparisons, because the average number of individuals per household is higher in the US than in the EU.

**Figure 9: OECD Fixed (wired) broadband subscriptions per 100 inhabitants, by technology, June 2010**



Source: OECD<sup>73</sup>

The OECD data also shed light on the fraction of fixed broadband subscriptions over cable in comparison to DSL or fibre.

Survey data can serve as a useful cross check on OECD data, because (1) they can capture per-household characteristics rather than being limited to per-individual, and (2) they can correct for the case where a household has more than one subscription. Eurobarometer survey data show that 62% of those EU-27 households that have Internet at home get their broadband by ADSL or similar, only 15% by cable, 12% by dial-up, and 5% by mobile

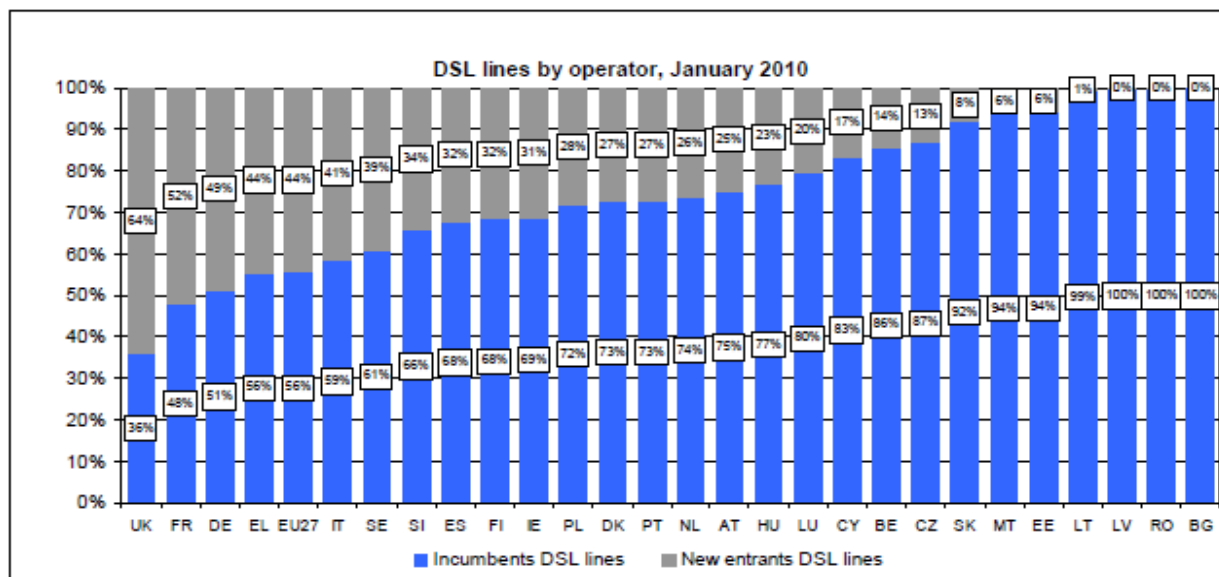
<sup>73</sup> Based on table 1d from the OECD's Broadband Portal, viewed on 1 May 2011 at [http://www.oecd.org/document/54/0,3746,en\\_2649\\_33703\\_38690102\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/54/0,3746,en_2649_33703_38690102_1_1_1_1,00.html). Note that as of December 2010, OECD separately reports fixed and wireless broadband data; thus, these data are not precisely cross-comparable to previous summaries. Note, too, that in the interest of readability we have omitted data for OECD members that are not EU/EEA members or candidates; however, the US is included for comparison.

broadband.<sup>74</sup> The role of cable television is, however, extremely uneven among the Member States – in Belgium, Bulgaria, Denmark, Estonia, Hungary, Latvia, Lithuania, Malta, the Netherlands, Portugal, Poland, and Romania, 30% or more of household that have access to Internet at home use cable.<sup>75</sup>

Use of the mobile phone network<sup>76</sup> (via an Internet card or USB modem that is plugged into the computer or a computer connected to the Internet via a mobile phone or directly via the mobile phone itself) to connect to the Internet at home stands at only 5% in the EU-27, and has not increased significantly in the past year (+1%); however, there are once again significant differences among the Member States. Usage is greatest in Austria (15%), Ireland (15%), Poland (14%) and Slovakia (14%). Again, our belief is that mobile subscriptions often serve as an economic complement to fixed broadband, not necessarily as an economic substitute.

Procompetitive remedies (LLU, shared access and bitstream) are effective in many European countries. 44% of DSL lines in the EU-27 are provided by new entrants rather than by the incumbent.<sup>77</sup> At the same time, it is clear a few of the Member States do not (yet) enjoy significant take-up of competitive DSL services.<sup>78</sup>

**Figure 10: Incumbent versus new entrant DSL access lines in the EU**



Source: European Commission<sup>79</sup>

<sup>74</sup> European Commission, E-Communications Household Survey, Fieldwork: November - December 2009; Publication: October 2010; Eurobarometer 335, pages 94-96.

<sup>75</sup> Note that Eurobarometer per-household figures are not directly comparable to the US figures because each Member State has a different number of households with access to the Internet at home, i.e. a different denominator for the percentages. The average number of individuals per household is much higher in the US than in the EU.

<sup>76</sup> The OECD published wireless broadband statistics for the first time in December 2010 (see table 1d from the OECD's Broadband Portal, viewed on 1 May 2011 at [http://www.oecd.org/document/54/0,3746,en\\_2649\\_33703\\_38690102\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/54/0,3746,en_2649_33703_38690102_1_1_1_1,00.html)). In time, they will likely prove to be an excellent source for these data. We chose not to show them here because there is as yet little experience with them.

<sup>77</sup> European Commission, 15<sup>th</sup> Implementation Report, 25.8.2010, SEC(2010)630 final/2, page 90.

<sup>78</sup> Reasons for this vary from one Member State to the next. In some of the newer Member States, the fixed network is not fully built out, but cable plays a relatively large role.

<sup>79</sup> Ibid.

## 5.2. Relevant Regulation

The different market characteristics of the US, in comparison to those of Europe, are partly a cause and partly a consequence of differences in the overall approach to regulation.

### 5.2.1. Relevant regulation in the United States

The regulation of network neutrality needs to be understood in the context of the overall regulation (or lack of regulation) of the Internet and of broadband Internet access in general.

Regulation of electronic communications in the United States reflects a sharp dichotomy between two legal (not economic) classifications: *telecommunication services* and *information services*. Telecommunication services are subject to numerous regulatory obligations; information services were historically subject to few if any explicit obligations.

Core Internet services were always treated as information services, and thus largely unregulated; physical access to the Internet was, however, historically treated as a regulated telecommunication service. As long as this was the case, the US regulatory system worked more or less similarly to that which Europe adopted in 2002 -2003.<sup>80</sup>

Through a series of regulatory decisions taken in the years of the George W. Bush administration, the FCC classified Internet access when sold bundled with Internet service to be an information service, thus generally exempting it from regulation. No serious analysis of possible market power on the last mile was undertaken.<sup>81</sup>

This *laissez faire* evolution had two important consequences relative to the evolution of the network neutrality debate in the U.S. First, it reversed any tendency of the US broadband market toward competition over incumbent ADSL lines and similar; second, it made it nearly impossible for the FCC to impose penalties on firms that violate network neutrality.

As noted in Section 5.1, ADSL lines provided by competitors peaked at just over 5% in 2003, and subsequently declined. Shared access was eliminated in 2003, together with LLU for fibre-based broadband Internet access.<sup>82</sup> LLU for copper-based access nominally remains, but it alone appears to be insufficient – it is a single rung on the “ladder of investment”.

Various forms of anticompetitive discrimination are prohibited under US law, notably in Sections 201 and 202 of the Communications Act of 1934 as amended; however, these sections are applicable to telecommunication service providers. When the FCC reclassified broadband Internet access as an information service, they rendered these obligations ineffective. At the same time, the FCC eliminated other non-discrimination obligations that had existed under a series of FCC rulings known collectively as the Computer Inquiries. Collectively, these actions meant that there was no longer a clear legal or regulatory basis for the FCC to take action against anticompetitive discrimination.

<sup>80</sup> J. Scott Marcus, Federal Communications Commission (FCC) Office of Strategic Planning and Policy Analysis (OSP) Working Paper 36, “The Potential Relevance to the United States of the European Union’s Newly Adopted Regulatory Framework for Telecommunications,” July 2002, available at [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/DOC-224213A2.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-224213A2.pdf).

<sup>81</sup> See for instance J. Scott Marcus, “Is the U.S. Dancing to a Different Drummer?”, Communications & Strategies, no. 60, 4th quarter 2005. Available at: [http://www.idate.fr/fic/revue\\_telech/132/CS60%20MARCUS.pdf](http://www.idate.fr/fic/revue_telech/132/CS60%20MARCUS.pdf).

<sup>82</sup> US FCC, In the Matter of Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers; Implementation of the Local Competition Provisions of the Telecommunications Act of 1996; Deployment of Wireline Services Offering Advanced Telecommunications Capability (better known as the Triennial Review Order, or TRO), adopted 20 February 2003, released 21 August 2003.

In 2005, the FCC issued an *Internet Policy Statement* that argued that "... consumers are entitled to access the lawful Internet content of their choice ... [and] to run applications and use services of their choice ..."; however, the FCC had never formalized this statement of principles into explicit rules. An FCC policy statement has no legal force – it is simply a statement indicating how the five current FCC Commissioners might view particular matters that might come before them. It does not even do anything to bind future Commissioners.

After a lengthy investigation, the FCC found that Comcast (a large cable television company, and the largest provider of home broadband Internet access in the US) had interfered with the ability of their broadband customers to access peer-to-peer applications such as BitTorrent. Comcast agreed to end the practice; however, they challenged the legal basis on which the FCC had ordered them to do so. Comcast argued that the FCC had acted improperly, first by enforcing a "rule" that was not in fact a rule, and where the FCC had circumvented the normal bureaucratic safeguards; and second, that the FCC lacked authority to issue such a rule in the first place for an information service.

The court indeed found that the FCC had failed to demonstrate its authority, and therefore vacated (lifted) the FCC's order.<sup>83</sup> As a regulatory authority, the FCC is supposed to implement provisions of US law. It also has *ancillary authority* that enables it to craft new rules in support of explicit legal mandates, or to ensure that its actions in support of a legal mandate are not circumvented or made meaningless. In this case, the court found that the FCC had failed to tie its assertion of ancillary authority to any "statutorily mandated responsibility." The court thus found that the FCC's purported grounds were nowhere near sufficient.

The FCC spent the subsequent eighteen months looking for ways to reassert its authority over possible deviations from network neutrality.<sup>84</sup> The FCC finally issued an Open Internet ruling in December<sup>85</sup> that can be viewed as an attempt to formally implement an expanded version of the Internet Policy Statement:

- **Rule 1: Transparency:** A provider of broadband Internet access service must publicly disclose accurate information regarding the network management practices, performance, and commercial terms of its broadband Internet access services sufficient for consumers to make informed choices regarding use of such services and for content, application, service, and device providers to develop, market, and maintain Internet offerings.
- **Rule 2: No Blocking:** A provider of *fixed* broadband Internet access service, insofar as such person is so engaged, shall not block lawful content, applications, services, or non-harmful devices, subject to reasonable network management. A provider of *mobile* broadband Internet access service shall not block consumers from accessing lawful websites, subject to reasonable network management; nor shall such person block applications that compete with the provider's voice or video telephony services, subject to reasonable network management.

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<sup>83</sup> See *Comcast vs FCC*, United States Court of Appeals for the District of Columbia Circuit, argued 8 January 2010, decided 6 April 2010, No. 08-1291.

<sup>84</sup> See, for instance, J. Scott Marcus, "New Directions for U.S. Telecommunications Regulation? The Comcast decision and the 'Third Way'", presented at ITS Europe, Copenhagen, September 2010, available at: <http://ssrn.com/abstract=1656570>.

<sup>85</sup> US FCC, Report and Order, In the Matter of Preserving the Open Internet; Broadband Industry Practices; GN Docket No. 09-191, WC Docket No. 07-52, 23 December 2010.

- **Rule 3: No Unreasonable Discrimination:** A provider of *fixed* broadband Internet access service, insofar as such person is so engaged, shall not unreasonably discriminate in transmitting lawful network traffic over a consumer's broadband Internet access service. Reasonable network management shall not constitute unreasonable discrimination.

A few observations are in order. First, we note that the Open Internet ruling attempts to rigorously define what constitutes "reasonable network management"; nonetheless, our prediction is that the FCC will be entangled in complex adjudications for the next several years at least, assuming that the order stands, as to what constitutes reasonable network management.

Second, we note that the order takes a significantly milder approach toward the mobile network, arguing that the mobile broadband environment is at an earlier stage of its development than fixed, and is also more competitive than fixed (in the US).<sup>86</sup> The European reader should bear three things in mind: (1) there is no over-arching principle of technological neutrality in US telecommunications law; (2) market power implicitly plays a role in US telecommunications law, but means of tailoring remedies in response to presence or absence of market power are largely lacking;<sup>87</sup> and (3) the US fixed broadband market is basically a series of duopolies, while the mobile market has four nationwide players (possibly about to merge down to three if the AT&T T-Mobile USA merger completes). Joint telco-cable dominance is arguably a nearly universal issue for the fixed network, but not for the mobile network.

Third, the FCC signals a negative view toward Internet access arrangements that include tiered pricing for different services – they say that they are unlikely to satisfy restrictions on unreasonable discrimination in the fixed network. In nearly the same breath, they then speak about "specialised services" that might include facilities-based IP voice or video services, presumably at a different price. As noted in Sections 2 and 3, there are sound technical and economic reasons for offering different levels of QoS at different price points; these could, however, be problematic in the presence of sufficient market power. The tacit implication once again is that joint market power is a general problem for the fixed network, but not necessarily for the mobile.

Verizon has already attempted to challenge the Open Internet order in court. The complaint alleged that the order (1) exceeded the FCC's authority; (2) was "arbitrary and capricious" (the standard phrasing that would be used in seeking to overturn a regulatory decision); and (3) that it violated the US constitution and other laws.<sup>88</sup>

<sup>86</sup> One could also argue that mobile networks face significantly different capacity constraints than fixed networks.

<sup>87</sup> See J. Scott Marcus, Federal Communications Commission (FCC) Office of Strategic Planning and Policy Analysis (OSP) Working Paper 36, "The Potential Relevance to the United States of the European Union's Newly Adopted Regulatory Framework for Telecommunications," July 2002, available at [http://hraunfoss.fcc.gov/edocs\\_public/attachmatch/DOC-224213A2.pdf](http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-224213A2.pdf). The article and derivative works also appear in: *Rethinking Rights and Regulations: Institutional Responses to New Communications Technologies*, Ed. Lorrie Faith Cranor and Steven S. Wildman, MIT Press, 2003; in the *Journal on Telecommunications and High Technology Law* 111 (2003); and in the 2004 *Annual Review* of the European Competitive Telecommunications Association (ECTA).

<sup>88</sup> See Verizon's Notice of Appeal in the case, page 4.

Some experts were surprised that Verizon chose to oppose the order, given that they had previously made a joint proposal with Google that seemed in most respects similar to the order that the FCC ultimately adopted.<sup>89</sup> The apparent explanation is that Verizon was less concerned with the substance of the order than with the breadth of authority that the FCC was asserting.<sup>90</sup>

A court found that the time for Verizon's suit was not yet ripe,<sup>91</sup> but the suit will presumably be reintroduced shortly. In the context of the US legal system, serious legal challenges to the Open Internet ruling should be anticipated.

There has also been substantial agitation against the Open Internet order in the Congress. The Republican-controlled House of Representatives passed an amendment to a funding bill that would prevent the FCC from spending money to implement the Open Internet order.<sup>92</sup> The House of Representatives has also passed a resolution of disapproval that would, if enacted, nullify the order. The actions would appear to have been primarily of symbolic significance, since neither could take effect without (1) passage by the Democratic-controlled Senate, and (2) signature by President Obama, which the administration has clearly signalled will not be forthcoming. Nonetheless, the actions provide useful clues as to how events might evolve if the political landscape were to change in the next US elections.

### 5.2.2. Relevant regulation in the European Union

The response in Europe has reflected the introduction in 2003 of obligations imposed on network operators who have Significant Market Power (SMP) to make access to their networks available to competitors at regulated prices, terms and conditions.

The regulatory framework for electronic communications<sup>93</sup> entails a carefully crafted division of responsibilities between the European Commission, the Member State National Regulatory Authorities (NRAs), and (since 2009) BEREC. The European Commission has delineated seven communications markets that are "susceptible to ex ante regulation". (Two of these are directly relevant to broadband.) Each NRA must evaluate these market

<sup>89</sup> Verizon and Google jointly called for creation of a regime based on (1) support for the principles of the FCC's *Internet Policy Statement*; (2) addition of a new principle prohibiting discrimination or prioritisation impacting lawful Internet content, applications or services in a way that causes harm to users or competition; (3) transparent disclosure of capabilities and network management practices to consumers; (4) case by case ex post enforcement; (5) enabling network operators to offer new, prioritised services; and (6) applying only the transparency obligations to mobile data.

<sup>90</sup> See the statement of Tom Taukey, "Verizon Files Appeal in Federal Court Regarding FCC Net Neutrality Order", 20 January 2011. "We are deeply concerned by the FCC's assertion of broad authority for sweeping new regulation of broadband networks and the Internet itself. We believe this assertion of authority goes well beyond any authority provided by Congress, and creates uncertainty for the communications industry, innovators, investors and consumers."

<sup>91</sup> The Hill, "Court chucks Verizon's net-neutrality appeal; company will refile", 4 April 2011.

<sup>92</sup> Washington Post, "House votes to stop FCC funding for net neutrality", 17 February 2011.

<sup>93</sup> The regulatory framework for electronic communications, as revised in 2009, consists of one general and four specific directives, namely:

- Directive 2002/21/EC on a common regulatory framework for electronic communications networks and services (Framework Directive) as amended by Directive 2009/140/EC (Better Regulation Directive);
- Directive 2002/20/EC on the authorisation of electronic communications networks and services (Authorisation Directive) as amended by Directive 2009/140/EC;
- Directive 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities (Access Directive) as amended by Directive 2009/140/EC;
- Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services (Universal Service Directive) as amended by Directive 2009/136/EC (Citizens' Rights Directive);
- Directive 2002/58/EC concerning the processing of personal data and the protection of privacy in the electronic communications sector (e-Privacy Directive) as amended by Directive 2009/136/EC.

definitions relative to its national circumstances, determine whether any undertakings possess significant market power on one of the markets, and (if SMP has been found) impose proportionate remedies. These NRA findings are subject to review by the Commission under a well-defined process.

The four remedies that have been widely used in Europe<sup>94</sup> are:

- **Local Loop Unbundling (LLU):** a copper pair (or equivalent) is rented to a third party for its exclusive use.
- **Shared access:** enables the incumbent to continue to provide telephony service while the new entrant delivers high-speed data services over that same local loop.
- **Bistream access:** the incumbent installs a high-speed access link to the customer premises, and makes this access link available to third parties (new entrants) over a shared access facility to enable them to provide high-speed services to customers.
- **Simple resale:** a new entrant receives and sells to its end users a product that is commercially similar to the DSL product provided by the incumbent to its own retail customers.

These provisions are important to an understanding of the European response to network neutrality to the extent that they help to ensure retail competition for broadband services (see Section 5.1.2). As noted previously, effective retail competition for broadband makes harmful network neutrality problems less likely.

The non-discrimination obligation could also be relevant, but it is primarily conceptualised in terms of ensuring that a network operator that possesses SMP offers the same wholesale service to competitors that it supplies to itself; thus, it deals with a somewhat different issue than network neutrality.

Many other aspects of European regulation touch on the network neutrality issue, but these (together with the changes implemented in 2009 that are discussed in the next section) would appear to be the most relevant.

#### 5.2.2.1. Revisions to the regulatory framework in 2009

The European framework as adopted in 2002-2003 did not specifically address network neutrality, but network neutrality became a significant issue in the "2006" revisions to the regulatory framework, which were enacted late in 2009, and a number of changes to the regulatory framework were introduced as a result:

- Amendment of Article 8 of the Framework Directive to establish the ability of end users to access content, applications or services of their choice as an explicit goal of European policy.<sup>95</sup>
- Amendment of Article 20 of the Universal Service Directive to oblige providers of electronic communication services to inform their end users of their practices in regard to traffic management, and providing end users with the right to change providers without penalty if they are dissatisfied with a change in these practices.
- Empowerment of NRAs through Article 22(3) of the Universal Service Directive<sup>96</sup> to impose, if necessary, minimum QoS obligations on an SMP operator.

<sup>94</sup> There are many formulations of these services. This form is based on the Commission's 15<sup>th</sup> Implementation Report, Annex 2.

<sup>95</sup> "The national regulatory authorities shall promote the interests of the citizens of the European Union by inter alia: ... promoting the ability of end-users to access and distribute information or run applications and services of their choice; ..."

There is little experience to date with how these provisions will work in practice. Member States are required to transpose these requirements in national law by 25 May 2011; thus, they are not even in effect yet in many Member States. The Article 8 amendment establishes a principle, but is not linked to specific obligations.

The minimum QoS obligations have not been imposed, and are not very likely to be imposed any time soon. Thus, it is the transparency obligations that constitute the real, substantive change, but it is too soon to say how well they are working in practice.

Given that Europe has for the most part not experienced major problems with network neutrality, these relatively “soft” obligations may prove adequate. Europeans have a meaningful choice among network operators. The transparency obligations enacted in 2009, coupled with lower switching costs, may be sufficient to deter network operators from anticompetitive deviations from network neutrality.

#### 5.2.2.2. The Commission’s online consultation and Communication

Between June and September 2010, the European Commission held a public consultation<sup>97</sup> on “The open internet and net neutrality in Europe.” The Commission asked 15 consultation questions and garnered responses from 318 different stakeholders. The questions dealt both with current and with anticipated future circumstances.

A key finding is that there appears to be a consensus among “...network operators, internet service providers (ISPs) and infrastructure manufacturers that there are currently no problems with the openness of the internet and net neutrality in the EU (question 1). In their view, traffic management exists to support the efficient operation of today's internet and does not have a negative impact on the consumer; indeed, some contend that traffic management actually enables the development of services at lower cost. They maintain that there is no evidence that operators are engaging in unfair discrimination in a way that harms consumers or competition. This general view is supported by a number of Member States.”<sup>98</sup>

There have been scattered complaints, some of them credible, of (1) mobile network operators (MNOs) blocking or charging excessive prices for VoIP by certain mobile operators in Austria, Croatia, Germany, Italy, the Netherlands, Portugal and Romania, and of (2) blocking or throttling of traffic such as file sharing in France, Greece, Hungary, Lithuania, Poland and the United Kingdom.<sup>99</sup> In its response to the Commission’s public consultation,<sup>100</sup> the *Body of European Regulators for Electronic Communications (BEREC)* noted that the incidents to date are relevant but “may not necessarily represent breaches

<sup>96</sup> “In order to prevent the degradation of service and the hindering or slowing down of traffic over networks, Member States shall ensure that national regulatory authorities are able to set minimum quality of service requirements on an undertaking or undertakings providing public communications networks.” The text goes on to establish coordination mechanisms between the Member States and the Commission.

<sup>97</sup> Questionnaire for the public consultation on the open internet and net neutrality in Europe, European Commission, Information Society and Media Directorate-General, Electronic Communications Policy, 30 June 2010, [http://ec.europa.eu/information\\_society/policy/ecomm/doc/library/public\\_consult/net\\_neutrality/nn\\_questionnaire.pdf](http://ec.europa.eu/information_society/policy/ecomm/doc/library/public_consult/net_neutrality/nn_questionnaire.pdf)

<sup>98</sup> Ibid., page 2.

<sup>99</sup> In its response, BEREC reported cases of i) blocking, or charging extra for, Voice over Internet Protocol (VoIP) services in mobile networks by certain mobile operators; and ii) throttling of peer-to-peer (P2P) file-sharing or video streaming. VoIP providers and BEUC (a consumer advocacy organisation) have also expressed concerns, both in their comments and in our interviews.

<sup>100</sup> See [http://ec.europa.eu/information\\_society/policy/ecomm/doc/library/public\\_consult/net\\_neutrality/comments/04eu\\_national\\_regional\\_ministries\\_authorities\\_incl\\_berec/berec\\_x.pdf](http://ec.europa.eu/information_society/policy/ecomm/doc/library/public_consult/net_neutrality/comments/04eu_national_regional_ministries_authorities_incl_berec/berec_x.pdf)

of network neutrality”; moreover, many were finally resolved “without any formal proceedings”, and the incidents “have not led to a significant number of investigations by NRAs”. There appear on balance to be few if any documented, clearly problematic incidents in Europe to date, and no demonstrated, sustained pattern of systematic and abusive discrimination.<sup>101</sup> Despite all of this, possible concerns for the future remain.

There are clear instances of mobile network operators (MNOs) charging a premium to enable their subscribers to use VoIP services over their respective networks;<sup>102</sup> however, it is not clear that these should be viewed as problematic in Member States where subscribers have substantial choice among MNOs. It is arguably a normal and permissible business practice. Moreover, it is not clear what level of charging, if any, should be viewed as being excessive or inappropriate. BEUC maintains, however, that there are a number of Member States where all MNOs appear to impose restrictions on VoIP; for those Member States, further analysis would appear to be warranted.

### Food for thought 6: The French ARCEP's approach to network neutrality

In September 2010, the *autorité de régulation des communications électroniques et des postes (ARCEP)* published a series of ten proposals on network neutrality.<sup>103</sup> The proposals culminated from work beginning in the previous September, including some 50 hearings held by ARCEP. Central to this undertaking were the objectives: guaranteeing transparent and non-discriminatory; sufficient bandwidth to meet demands; and reconciling the desire for an open internet with the need for networks to recoup the massive investments required. ARCEP stated that its approach was one of prevention, avoiding threats to network neutrality before they arise.

- Freedom and quality of Internet access: end users may send and receive the content of their choice; use the services and run the applications of their choice; connect the hardware and use the programmes of their choice, provided they do not harm the network; a sufficiently high and transparent quality of service.<sup>104</sup>
- Non-discrimination between Internet traffic streams according to the type of content, the service, application, device or the address of the stream's origin or destination.
- Supervising Internet traffic management mechanisms ISPs do employ traffic management mechanisms for ensuring access to the Internet, that they comply with the general principles of relevance, proportionality, efficiency, non-discrimination between parties and transparency.
- Managed services: ISPs may offer managed services in addition to Internet access, so long as the managed service does not degrade the quality of Internet access below a certain satisfactory level.

<sup>101</sup> The Commission took a somewhat more nuanced position of the incidents identified by BEREC and others in “The open internet and net neutrality in Europe”, COM(2011)222 final. “The Commission does not have evidence to conclude that these concerns are justified at this stage but this should be borne in mind in a more exhaustive fact-finding exercise.”

<sup>102</sup> In the past, at least, there appear to have been instances of outright blockage.

<sup>103</sup> ARCEP, *Internet and network neutrality: Proposals and recommendations*. (September 2010), available at: [http://www.arcep.fr/uploads/tx\\_gspublication/net-neutralite-orientations-sept2010-eng.pdf](http://www.arcep.fr/uploads/tx_gspublication/net-neutralite-orientations-sept2010-eng.pdf)

<sup>104</sup> These track closely the US FCC's proposal of August 2005.

- Increased transparency with respect to end users in sales material and the contractual terms and conditions for their electronic communications services, and in the information that is available to the customers of these offers for the duration of their service contract – with clear, precise and relevant information.
- Monitoring traffic management practices: ARCEP that industry participants identify and qualify the different types of traffic management practices, including “fair use” limitations.
- Monitoring the quality of the Internet access service: to ensure that the quality of the Internet access service is both sufficiently high and transparent.
- Monitoring the data interconnection market.
- Taking account of the ISV’s role in Net neutrality: users have the ability to exercise their freedom to choose between offers (services/applications/content) made available by ISVs over the Internet.
- Increasing the neutrality of devices.

ARCEP noted that its approach involved issuing these recommendations and monitoring. It could in future issue prescriptive measures aimed at achieving these results. ARCEP noted that this type of approach requires a state of healthy competition.

Looking forward, some pointed to potential problems with IPTV, while some content providers “... voiced concerns that network operators could favour certain services over others, to the detriment of competition and innovation.” This concern clearly relates to economic foreclosure (see Section 3.2).

Most respondents to the questionnaire felt that the European regulatory framework for electronic communications is capable of handling network neutrality issues, and only a few advocated additional regulation at this stage.<sup>105</sup> Many felt that the need for additional regulation could not be properly assessed until the 2009 changes to the regulatory framework had been transposed into national regulation at the Member State level, and until there was experience with them.

There was consensus among respondents traffic management is a necessary and essential part of the operation of an efficient Internet. There was also general agreement on the need for transparency in relation to traffic management. At the same time, some expressed concerns that traffic management could be used for anticompetitive ends, and a number expressed concerns about the use of *Deep Packet Inspection (DPI)* and its impact on confidentiality and privacy.

Some respondents were not convinced that that transparency measures alone would be sufficient.<sup>106</sup> Some felt that measures should be technologically neutral in principle, but recognized that some differences between fixed and mobile networks may be required in practice due to the very different capacity constraints to which those networks are subject.

<sup>105</sup> BEUC is noteworthy among organisations that called for regulatory action, partly as a means of ensuring a consistent response across Europe.

<sup>106</sup> Notably, BEUC has argued that transparency measures will be of limited effectiveness, largely due to high switching costs.

There was general agreement that the commercial arrangements that currently govern the provision of internet access, such as peering arrangements and paid transit, have worked well until now; however, opinion was divided on future approaches.

### **Food for thought 7: The approach of the Swedish PTS to network neutrality**

Beginning in January 2009, the Swedish Post and Telecom Agency (PTS) undertook a review of potential network neutrality issues in Sweden. In November 2010, the PTS published a comprehensive report on network neutrality in Sweden.<sup>107</sup> The findings were based on input from numerous stakeholders, supporting several findings. The PTS found that access to passive infrastructure was a critical input to broadband services and as such can function as a barrier to market entry. Shared access to infrastructure can lead to efficiency gains. Further, lock-ins which increase switching costs and mitigate the power of consumers to have access to the communications services of their choice. Another limiting factor is availability of spectrum necessary to provide broadband coverage. The PTS identified network neutrality as a queuing problem. Finally, the Telecom Reform Package will give increased leverage to address network neutrality in terms of transparency and informing consumers.

The PTS articulated a dozen main existing and potential challenges relating to openness that could be addressed by the Agency. It further proposed a number of measures to ensure openness, while protecting other interests. These proposals will help safeguard consumers and achieve social goals, but will not necessarily solve all problems. PTS should monitor further developments in Sweden. Within this role, one important area for the PTS to address is the extent to which prioritisation tools may be used when there is a lack of capacity in the networks, instead of the operators' expanding network capacity or building separate networks.

On 19 April 2011, the Commission published a short Communication in regard to network neutrality.<sup>108</sup> The Communication largely reiterates the Commission's interpretation of the public consultation. The Commission considers action at this time to be premature: "Given that Member States are still transposing the revised EU electronic communications framework into national law, it is important to allow sufficient time for these provisions to be implemented and to see how they will operate in practice." The Commission will wait until the end of the year to see if BEREC identifies and unambiguously documents any significant and persistent problems in regard to network neutrality. For now, the Commission is keeping its options open – it might issue additional guidance, or it might call for more stringent measures if there were clear indications that the Transparency obligations and other mechanisms already in place were not sufficient to prevent serious problems.

### **5.3. Competition law**

In Europe, competition law is largely seen as an *ex post* complement to *ex ante* sector-specific regulation. Competition law could potentially deal with some network neutrality violations; however, it might be too slow and ponderous to provide the relief needed in order to achieve market entry. Whether competition law would represent an effective remedy in practice is unproven, but no incident in Europe has risen to the level where competition law could be seriously tested.

<sup>107</sup> Swedish Post and Telecom Agency, Open networks and services, Report Number: PTS-ER-2009:32 (30 November 2009) <http://www.pts.se/upload/Rapporter/Internet/2009/2009-32-open-networks-services.pdf>

<sup>108</sup> The open internet and net neutrality in Europe, COM(2011)222 final.

Competition law (antitrust) cannot play the same role in the United States. Pursuant to a number of court cases,<sup>109</sup> competition law is largely pre-empted by sector-specific regulation. More specifically, the provisions of the Communications Act of 1934 as amended cannot constitute a separate cause of action under competition law.

It is also worth noting that competition law in the United States differs in many ways from that of Europe – for example, if a firm has achieved market power through legal means, the firm is not prohibited from charging a monopoly price.

## 5.4. Comparison

Differences between the EU and the US in terms of markets, regulation, and competition law are substantial.

The US is blessed with two independent wires to nearly all homes – both telecommunications and cable television. Cable coverage in Europe is, by contrast, very uneven – a number of regions in Europe have substantial coverage, but very few Member States have more-or-less universal cable availability across the entire national territory. At the same time, thanks to effective last mile regulation, a great European consumers can choose from among several providers of broadband network access, which is from the perspective of network neutrality greatly preferable to the *de facto* duopolisation of the US broadband market. For both conventional telecommunications (e.g. via ADSL) and cable, the situation varies significantly from one Member State to the next.

The US regulatory environment stands in sharp contrast to European practice. As previously noted, the European framework as adopted in 2002-2003 did not specifically address network neutrality, but network neutrality became a significant issue in the “2006” revisions to the regulatory framework, which were enacted late in 2009. The 2009 amendments include (1) transparency provisions, (2) a backup power for the NRA to impose a minimum level of QoS on an SMP network operator, and (3) new language in Article 8 that establishes the right of users to access content, services or applications of their choice as a basic goal of the regulatory framework.

The transparency provisions in the FCC’s Open Internet ruling are similar to the enhancements to the Universal Service Directive that serve to ensure that consumers understand the traffic management practices of their network service providers, and that gives them a right to switch without contractual penalty if they are dissatisfied with a change in those policies. This, then, is a point of commonality; however, the effectiveness of transparency is likely to be far greater in Europe than in the US, because most European consumers have more alternative providers to which they could potentially switch. That the FCC felt it necessary to add rules to explicitly prevent blocking an unreasonable discrimination suggests that there was no confidence that a transparency rule alone would suffice.

In Europe, there *is* an additional back-up power: The authority for the NRA to impose a minimum level of QoS on a network operator that has SMP. But it has not yet been invoked, and it is entirely possible that the transparency measures alone will suffice for Europe.

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<sup>109</sup> Notably *Goldwasser v. Ameritech Corp.* 222 F.3d 390 (7th Cir. 2000) and *Law Offices of Curtis V. Trinko, L.L.P. v. Bell Atlantic Corp.*, 294 F.3d 307 (2nd Cir. 2002).

It is also worth noting that many of the Internet Policy Statement principles – that consumers should have the right to access content and use applications or devices of their choice – is reflected in Article 8 of the Framework Directive as revised in 2009, even if these changes did not lead to explicit operative language.

Competition law as a remedy to deviations to network neutrality might be effective in the European Union; in the US, by contrast, it cannot be effective.

**Table 4: Comparison between the European Union and the United States**

	<b>European Union</b>	<b>United States</b>
Number of fixed connections available to most homes	1	2
Majority of fixed broadband lines	DSL	Cable
Number of alternative operators available on most fixed telco lines	Many	None
Mobile broadband provides the primary home computer connection	About 5%	Unknown
LLU obligations on access network (SMP) operators	Yes	Copper only
Shared access obligations on access network (SMP) operators	Yes	No
Bitstream obligations on access network (SMP) operators	Yes	No
Nondiscrimination obligations on broadband network (SMP) operators	Yes	No
Transparency obligations for net neutrality	Yes	Yes
Prohibition on blockage of websites	Implicit in Article 8?	Yes
Prohibition on blockage of applications or devices	Implicit in Article 8?	Fixed only
Prohibition on unreasonable net neutrality discrimination	Implicit in Article 8?	Fixed only
Competition law as a net neutrality remedy	Possibly effective	Ineffective

## 6. FINDINGS AND RECOMMENDATIONS

Each chapter of this report begins with a summary of Findings. In this chapter, we bring together only the most critical of these.

### 6.1. Key findings

BEREC and the Commission continue to study the issue, but to date there have been few if any clear-cut, well documented, problematic instances of network neutrality.

The European Commission conducted a public consultation on network neutrality between June and September 2010.<sup>110</sup> The Commission found a consensus among "...network operators, internet service providers (ISPs) and infrastructure manufacturers that there are currently no problems with the openness of the internet and net neutrality in the EU ... They maintain that there is no evidence that operators are engaging in unfair discrimination in a way that harms consumers or competition. This general view is supported by a number of Member States."<sup>111</sup>

There have been scattered complaints, some of them credible, of (1) mobile network operators (MNOs) blocking or charging excessive prices for VoIP, and of (2) blocking or throttling of traffic such as file sharing.<sup>112</sup> In its response to the Commission's public consultation,<sup>113</sup> the *Body of European Regulators for Electronic Communications (BEREC)* noted that the incidents to date are relevant but "may not necessarily represent breaches of network neutrality"; moreover, many were finally resolved "without any formal proceedings", and the incidents "have not led to a significant number of investigations by NRAs". There appear on balance to be few if any documented, clearly problematic incidents in Europe to date, and no demonstrated, sustained pattern of systematic and abusive discrimination.<sup>114</sup> Despite all of this, possible concerns for the future remain.

Finally, we observe that the changes to the regulatory framework that were enacted in 2009 are scheduled for transposition into national law in May of 2011. There is thus little or no experience with their effectiveness in practice. Given that there were no clear-cut violations even prior to their enactment, there may be little basis for judging their effectiveness until and unless problems were to emerge.

<sup>110</sup> Questionnaire for the public consultation on the open internet and net neutrality in Europe, European Commission, Information Society and Media Directorate-General, Electronic Communications Policy, 30 June 2010, [http://ec.europa.eu/information\\_society/policy/ecomm/doc/library/public\\_consult/net\\_neutrality/nn\\_questionnaire.pdf](http://ec.europa.eu/information_society/policy/ecomm/doc/library/public_consult/net_neutrality/nn_questionnaire.pdf)

<sup>111</sup> Ibid., page 2.

<sup>112</sup> In its response, BEREC reported cases of i) blocking, or charging extra for, Voice over Internet Protocol (VoIP) services in mobile networks by certain mobile operators; and ii) throttling of peer-to-peer (P2P) file-sharing or video streaming. VoIP providers and BEUC (a consumer advocacy organisation) have also expressed concerns, both in their comments and in our interviews.

<sup>113</sup> See [http://ec.europa.eu/information\\_society/policy/ecomm/doc/library/public\\_consult/net\\_neutrality/comments/04eu\\_national\\_regional\\_ministries\\_authorities\\_incl\\_berec/berec\\_x.pdf](http://ec.europa.eu/information_society/policy/ecomm/doc/library/public_consult/net_neutrality/comments/04eu_national_regional_ministries_authorities_incl_berec/berec_x.pdf)

<sup>114</sup> The Commission took a somewhat more nuanced position of the incidents identified by BEREC and others in "The open internet and net neutrality in Europe", COM(2011)222 final. "The Commission does not have evidence to conclude that these concerns are justified at this stage but this should be borne in mind in a more exhaustive fact-finding exercise."

## 6.2. Recommendations

In light of the current state of play, we think that it is important to avoid inappropriate, disproportionate, or premature action.

Based on the findings noted in the previous section, our key recommendations are:

- Do not impose any further network neutrality obligations until there is sufficient experience with the obligations already imposed through the 2009 amendments to the regulatory framework to make a reasoned judgment about their effectiveness;
- Support both technical and policy research to enhance the effectiveness of the consumer transparency obligations, and to ensure that the minimum QoS obligations can be effectively imposed should they prove to be needed;
- Continue to study the aspects of network neutrality where complaints may have some basis, including (1) charges and conditions that mobile operators impose on providers of Voice over IP (VoIP), and (2) impairment of peer-to-peer traffic; and
- Reserve judgment on any further obligations until there is a clearer vision of what harms to societal and/or consumer welfare, if any, are visible once the 2009 provisions are fully implemented.

In its April 2011 Communication, the Commission noted that the 2009 amendments have not yet been transposed, and remarked that "...it is important to allow sufficient time for these provisions to be implemented and to see how they will operate in practice." We concur. We think that imposition of significant further obligations at this time would be ill-advised.<sup>115</sup>

In its public consultation, the Commission found broad consensus that traffic management is appropriate and necessary, but different views as to what constitutes appropriate traffic management. This may be an appropriate topic for further study as a background activity.

The Commission and BEREC have noted that "the majority of NRAs received complaints from consumers concerning the discrepancy between advertised and actual delivery speeds for an internet connection." Challenges in understanding or measuring network performance may not specifically be a network neutrality issue (the Universal Service Directive addressed this long before network neutrality became an issue), but it is relevant. Internet performance is extraordinarily difficult for the average consumer to understand. Existing performance metrics leave much to be desired in terms of comprehensibility, reliability, relevance, and repeatability; at the same time, we caution that this is an intrinsically difficult problem. As Einstein is said to have remarked, "Make things as simple as possible, but no simpler." In any case, continuing research efforts to ensure that there is a clear understanding of Internet performance, and that consumers are clearly and properly informed, would appear to be appropriate.

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<sup>115</sup> In its submission to the Commission's public consultation, BEUC argued for immediate imposition of additional explicit network neutrality obligations in order to mitigate the risk of disparate transposition and implementation on the part of the Member States. The concern may have been legitimate at the time, but it seems clear at this point in time that the process of transposition should be allowed to proceed without interference.

In creating the possibility of imposing minimum QoS standards on SMP operators, the 2009 amendments to the regulatory framework provided NRAs with a powerful tool; however, it is a tool that should be used with care and restraint. There is considerable opportunity to think through what such standards might entail, and this work is potentially linked to the notion and need for intelligible, repeatable Internet performance metrics noted previously. Thus, there is room for further research in order to ensure that this backup power can really be used should it ever be needed.

It is conceivable that one or more of the problems that have been warned of, but not observed, might emerge in time; however, our view is that no public policy response should be undertaken until such a problem has been observed and understood. Preventative measures for threats that may or may not appear risk doing more harm than good.

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