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Network Neutrality: Implications for Europe

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Impressum

In den vom WIK herausgegebenen Diskussionsbeiträgen erscheinen in loser Folge Aufsätze und Vorträge von Mitarbeitern des Instituts sowie ausgewählte Zwischen- und Abschlussberichte von durchgeführten Forschungsprojekten. Mit der Herausgabe dieser Reihe bezweckt das WIK, über seine Tätigkeit zu informieren, Diskussionsanstöße zu geben, aber auch Anregungen von außen zu empfangen. Kritik und Kommentare sind deshalb jederzeit willkommen. Die in den verschiedenen Beiträgen zum Ausdruck kommenden Ansichten geben ausschließlich die Meinung der jeweiligen Autoren wieder.

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Zusammenfassung

Netzneutralität ist ein Schlagwort, welches in den Vereinigten Staaten in der vergangenen Dekade aufgekommen ist und sich auf eine Reihe von Verhaltensweisen bezieht, die von einigen als wettbewerbsfeindlich eingestuft werden. Netzneutralität impliziert, dass alle IP Pakete im Prinzip mehr oder weniger gleich behandelt werden sollten. Die Debatte spiegelt die Besorgnis wider, dass dies in Zukunft vielleicht nicht mehr der Fall sein könnte – Netzbetreiber könnten IP Pakete welche in Verbindung mit spezifischen Diensten, Anwendungen oder Endgeräten stehen oder aufgrund ihrer Herkunft oder ihrer Zieldestination unterschiedlich und diskriminierend behandeln.

Ziel dieser Studie ist es, zur Klärung einiger zentraler Fragen in diesem Komplex beizutragen:

- Was bedeutet der Begriff „Netzneutralität“ genau?
- Unter welchen Voraussetzungen könnte es wettbewerbsschädigend sein zwischen verschiedenen Arten von IP Verkehr zu diskriminieren?
- Warum ist das Thema gerade jetzt aufgekommen und warum in dieser besonderen Art und Weise?
- Warum erscheint die Debatte in den Vereinigten Staaten wesentlicher hitziger und intensiver zu sein als in Europa?
- Was sollte im Hinblick auf Netzneutralität in der Zukunft unternommen werden?

In unserer Studie werden die ökonomischen Theorien, welche für die Netzneutralitätsdebatte von Relevanz sind, vorgestellt. Dabei handelt es sich um Preisdiskriminierung, Netzwerkexternalitäten, Transaktionskosten, Wechselkosten, zweiseitige Märkte sowie insbesondere das Konzept der vertikalen Marktabschottung (vertical foreclosure). Technische Aspekte zur Qualitätsdifferenzierung von IP Verkehr (packet delay, jitter und loss) werden ebenfalls kurz behandelt. Die Studie liefert Hintergrundinformationen über eine Reihe von vermeintlichen Abweichungen vom Prinzip der Netzneutralität in den USA (bspw. *Madison River* und *Comcast)* und analysiert Fälle, welche in Europa zu Besorgnis im Hinblick auf das Thema geführt haben (bspw. der *iPlayer* von BBC). Das verwandte Thema *„Wireless Network Neutrality“* wird ebenfalls untersucht. Die eingeschränkten Handlungsmöglichkeiten, welche den Regulierern in den Vereinigten Staaten zur Verfügung stehen werden vorgestellt und mit der umfangreicheren Palette von Möglichkeiten, die der europäische Rechtsrahmen für elektronische Kommunikation und das europäische Wettbewerbsrecht bieten, verglichen. Schließlich geht die Studie auch der Frage nach, wie die im Rahmen des laufenden Review Verfahrens gemachten Änderungsvorschläge die Einflussmöglichkeiten der europäischen Regulierungsbehörden vergrößern und welche negativen Auswirkungen damit verbunden sein könnten.

Eine zentrale Schlussfolgerung ist, dass sich die Rahmenbedingungen in den Vereinigten Staaten signifikant von denen in Europa unterscheiden. Der Wettbewerb auf den europäischen Breitbandmärkten ist wesentlich stärker ausgeprägt, was hohe Relevanz für das Thema Netzneutralität hat. Der durchschnittliche Europäer kann zwischen einer wesentlich größeren Zahl von Anbietern wählen, weswegen problematische Abweichungen vom Prinzip der Netzneutralität wesentlich weniger wahrscheinlich als in den Vereinigten Staaten sind. Gleichzeitig haben europäische Regulierer eine größere Auswahl an Werkzeugen (sowohl *ex ante* als auch *ex post*) um wettbewerbsschädigenden Abweichungen vom Prinzip der Netzneutralität vorzubeugen oder um diese zu sanktionieren, falls sie bereits aufgetreten sind. Zusammengenommen stellt sich das Thema Netzneutralität somit in Europa ganz unterschiedlich und wesentlich unproblematischer als in den USA dar.

Angesichts des unterschiedlichen Charakters des Netzneutralitätsproblems in Europa, sollte es für Regulierer und Gesetzgeber oberste Priorität haben weiterhin mögliche Probleme durch die Aufrechterhaltung der Wettbewerbsfähigkeit der zugrunde liegenden Märkte zu vermeiden. Die Kommissionsvorschläge vom 13. November 2007 erweitern die bereits verfügbaren Mittel für europäische Regulierer in maßvoller Art und Weise in erster Linie durch die Realisierung von größerer Transparenz für Endkunden. Dies erscheint als ein maßvoller und geeigneter Schritt. Für radikalere Maßnahmen sehen wir in Europa keine Notwendigkeit.

Summary

Network Neutrality is a catch-all phrase that emerged in the United States over the past decade to reflect a number of potential behaviours that some consider to be anticompetitive. Network neutrality implies that all *Internet Protocol (IP)* packets should be treated more or less the same, and the debate reflects concerns that they might not be in the future – that a network operator might somehow apply different and anticompetitive treatment to IP packets (or *datagrams*) associated with specific services, applications, origins, destinations or devices.

This report seeks to provide clearer answers to several key questions:

- What exactly is meant by "Network Neutrality"?
- Under what circumstances might it be anticompetitive to discriminate among IP traffic to different services, applications, destinations or devices?
- Why has the issue emerged at this particular time, and in this particular way?
- Why does the debate seem to be so much more heated and intense in the US than in Europe?
- What should be done about Network Neutrality going forward?

The report reviews the economics that underlies the Network Neutrality debate, including price discrimination, network externalities, transaction costs, switching costs, two-sided markets, and especially the economics of vertical foreclosure. It also briefly reviews the technical aspects of quality differentiation for IP traffic (including packet delay, jitter and loss). It provides background on a number of alleged deviations in the U.S. (including *Madison River* and *Comcast*), and assesses the Network Neutrality concerns that have been raised in Europe (for example, by the BBC's iPlayer). It explores the related topic of *wireless Network Neutrality*. It reviews the limited options available to U.S. regulators, and compares them to the more expansive palette of options available under the European regulatory framework and under European competition law. The report also considers the ways in which the changes proposed to the European regulatory framework as part of the ongoing "2006 review" might strengthen the hand of European regulators, and at what cost.

A key conclusion is that circumstances in the United States are significantly different from those in Europe. Competition for broadband Internet access is richer in European markets in ways that are highly relevant to Network Neutrality – the average European has a far wider range of meaningful choice. As a result, problematic deviations from Network Neutrality are far less likely in Europe than in the U.S. At the same time, European regulators have far more tools (both *ex ante* and *ex post*) to prevent anticompetitive deviations from Network Neutrality, or to deal with deviations once they have oc-

curred. For all of these reasons, Network Neutrality manifests itself very differently, and much less problematically, in Europe than it does in the United States.

Given the very different character of the Network Neutrality problem in Europe, the first line of defence for European regulators and policymakers should continue to be to attempt to avoid the problem altogether by maintaining the competitiveness of the underlying markets. The Commission's proposals of 13 November 2007 expand modestly on the already considerable tools available to European regulators, primarily by fostering *informed consumer choice*. This seems to be a measured and appropriate positive step. We see no need for more radical measures in Europe.

1 Introduction

As communication networks evolve increasingly to the *Internet Protocol (IP),* an intensive debate has emerged as to whether IP-based network operators should be obliged to offer non-discriminatory access to providers of content, applications, and end devices. This debate has been referred to as 'Network Neutrality'. Network neutrality is a thorny issue.

While this debate has been raging in the United States for quite some time, it has only recently surfaced with force in Europe. The issue of Network Neutrality has, however, been a factor in the ongoing review of the European regulatory framework, and it could have far-reaching implications for the long-term development of ICTs in Europe. This is therefore an appropriate time to assess the current situation, to identify any shortcomings in European arrangements, and to explore future options.

In this report, and in this Introduction, we seek to address a number of issues:

- What do we mean by Network Neutrality?
- Is discrimination among IP packets necessarily harmful or anticompetitive? What are the potential harms associated with deviations from Network Neutrality? Under what circumstances are these harms likely to arise?
- Why has the issue emerged with force at this particular time, and why has it emerged so differently in the United States than it has in Europe?
- What regulatory responses have been attempted, and with what effect?
- What regulatory or public policy responses are likely to be most appropriate and most effective in Europe?

1.1 What do we mean by Network Neutrality?

There is no single, generally agreed on definition of Network Neutrality, nor of deviations from the principle. Network Neutrality is something of a catch-all phrase that has come to reflect a number of potential behaviours that some have considered to be anticompetitive.

The principle of Network Neutrality implies that all network traffic should be treated more-or-less the same, and the debate reflects concerns that IP-based network traffic might be subject to inappropriate discrimination in the future – that a network operator might somehow apply different treatment to network traffic (IP packets or *datagrams*) associated with different services, applications, destinations or devices. Emblematic of these concerns include the possibility that an Internet Service Provider (ISP) might:

- offer better performance to some Internet sites than to others;
- assess a surcharge where a customer wants to reach certain Internet sites with better-than-standard performance;
- permit access only to affiliated sites, and block access to unaffiliated sites;
- assess supracompetitive surcharges for the use of certain applications, or of certain devices;
- disallow outright the use of certain applications, or of certain devices, especially where those applications or devices compete with services that the integrated ISP itself offers and for which it charges; and
- erect “tollgates” in order to collect unwarranted charges from unaffiliated content providers who need to reach the integrated ISP’s customers.

1.2 Are deviations really a problem?

The reader might wonder – and with good reason – why some of these scenarios have been viewed as being problematic in the first place. As we explain in Chapter 2, economists do not necessarily consider service or price discrimination to be problematic *per se* in competitive markets. Service and quality differentiation in competitive markets – first class versus economy airplane tickets, regular mail versus overnight delivery, and so on – normally make a positive contribution to social welfare.

Why, then, is Network Neutrality viewed as a matter suitable for public policy concern?

There are a number of possible harms that could be identified, all of which are linked in some way to the possible market power of the network operator:

- Where a network operator has market power, e.g. over last mile fixed access, it might find it profitable to favour affiliated content or applications and to disfavour those of competitors (a form of *economic foreclosure*, as explained in Chapter 2). In other words, a network operator with market power might well find it profitable to act as a *gatekeeper*.
- A related concern is that this gatekeeper function effectively reduces the number of independent voices available to the consumer. This is in essence a *media pluralism* concern, and is linked to concerns over free speech and political expression.
- A distinct but still-related concern is that the gatekeeper effectively *hampers innovation* by barring meaningful access to applications and content that compete with those with which the network operator is affiliated.

All of these potential harms flow from price, quality or access discrimination; however, none of them are likely to be profitable, effective, or detrimental to consumers in the absence of market power. Market power serves as an essential enabler to those deviations from Network Neutrality that could cause concern. In other words, *market power is a unifying theme in problematic deviations from Network Neutrality.*

Conversely, effective competition (where consumers are well informed, and switching costs sufficiently low) can serve to mitigate or prevent problematic deviations.

1.3 Is this a U.S. problem, or a global concern?

The challenges presented by Network Neutrality will play out quite differently in Europe than in the U.S. because of differences in the structure of markets, as well as differences in the regulatory and competition law environment.

European markets for fixed broadband Internet access and for mobile services are profoundly different from their U.S. counterparts. In particular, the European broadband marketplace is far more robustly and diversely competitive than that of the U.S., which means that the issues are less contentious and more tractable here in Europe. It is fairly rare for an American to have more than two meaningful choices among broadband Internet service providers; the average European has far more meaningful options, and that makes for a world of difference.

European *National Regulatory Authorities (NRAs)* already have a substantial palette of tools to apply to any problems that might emerge. As noted in the previous section, the problematic instances of Network Neutrality are generally linked to the exercise of market power. The diagnosis and treatment of market power are central themes in the European regulatory framework for electronic communications.[1]

In Europe, competition law provides an *ex post* complement to the *ex ante* application of regulation. By contrast, the application of competition law (antitrust) is not a realistic option in the U.S. due to a number of legal precedents[2] that render competition law largely ineffective in areas subject to telecommunications regulation.

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1 Even so, there are challenges to the application of the European regulatory framework to Network Neutrality problems. See Valcke, Peggy/ Hou, Liyang/ Stevens, David/ Kosta, Eleni (2008): Guardian Knight or Hands Off: The European Response to Network Neutrality: Legal Considerations on the Electronic Communications Reform", in: Communications & Strategies, No. 72, 4th quarter 2008, pp. 89-112.

2 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). Conduct subject to the Telecommunications Act of 1934 as amended cannot serve as a separate cause of action under antitrust. We discuss this in more detail in Section 5.5.

1.4 A Historical perspective on Network Neutrality

The issues that underlie the Network Neutrality debate are not new. Telecommunications law and policy in the U.S. and in Europe have dealt in various ways with discrimination in network industries for more than a century. In the UK and the U.S., the historical response to these concerns had its roots in the law of *common carriage*, and in obligations for common carriers to serve all customers indifferently. It was recognised that many networks – including transportation networks, not just communication networks – include critically important segments that constitute bottlenecks, and that cannot readily be replicated by competitors. Unconstrained discrimination in the presence of such competitive bottlenecks could have been harmful.

Obligations of non-discrimination carried over from transportation into communications networks early on. For example, New York State (U.S.) mandated in 1848 that telegraph companies provide non-discriminatory service to individuals and to competing telegraph companies.[3] The Communications Act of 1934 (US) circumscribes the forms of price discrimination that telecommunications common carriers are permitted to practice.[4]

The migration to IP-based networks raises additional and novel challenges that are not present in traditional telephone networks. In a telephony network, if a connection (call) can be established, it is typically of adequate quality. Traditional telephone networks were engineered to block calls when capacity was limited, but once the call was completed, the quality would be fairly constant. In IP-based networks, however, quality can be highly variable, either due to random variability in traffic load, or else due to conscious (and possibly malicious) intent on the part of the network operator.

The convergence of communications networks further complicates matters. Networks were historically engineered, marketed, and legally permitted to perform a single function, such as the transmission of voice or video. The convergence into multipurpose, IP-based networks puts different types of users (with different traffic patterns) and different applications (with different application requirements) into competition for finite network resources. The network operator must inevitably make choices about how to manage network capacity in support of competing demands.

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3 Noam, Eli, *Interconnecting the Network of Networks* at pp. 213-14, MIT Press, Cambridge, MA (2001). Nearly a century later, a New York court ruled that, “a telephone company may not refuse to furnish service and facilities because of a mere suspicion or mere belief that they may be or are being used for an illegitimate end; more is required.” *Shillitani v. Valentine*, 53 N.Y.S.2d 127, 131 (1945).

4 See Sections 201 and 202 of the US Communications Act of 1934 as amended.

1.5 Network neutrality in the fixed and in the mobile environment

Network Neutrality concerns initially were focused on the fixed network. Network Neutrality has, however, in recent years come to be viewed as two debates, one related to fixed broadband Internet access, the other to mobile services and especially to mobile broadband Internet access.

A U.S. expert, Tim Wu, has explored the *wireless* dimension of the Network Neutrality issue.[5] He observed a number of U.S. trends had long been taken for granted: (1) that mobile operators support only a limited selection of devices on their networks; (2) that mobile operators cripple some handset features;[6] (3) that some features are not developed, even though potentially valuable to consumers, because the mobile operators do not want them; (4) that mobile operators tend to restrict broadband services both in terms of bandwidth available (e.g. for peer-to-peer applications [P2P]) and for competing applications (e.g. Voice over IP [VoIP]); and (5) that barriers to entry for mobile application developers are high due to restrictions imposed by the mobile operators.

Some, but not all, of these problems are relevant to Europe.

1.6 Structure of this paper

This paper proceeds as follows. Section 2 covers the technical parameters which apply to Network Neutrality and discusses underlying economics. Section 3 details experiences with network management practices and Network Neutrality around the world. In Section 4, we compare and contrast Network Neutrality in the U.S. and Europe. Section 5 contains an analysis of potential remedies. Finally, we offer our Conclusions and Recommendations in Sections 6.

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5 Wu, Tim (2007): Wireless Carterfone, in: *International Journal of Communication*, Vol. 1, pp. 389-426. See also Noam, Eli (2001): The Future of Telecommunications: Open Wireless Systems, Telecommunications Policy Research Conference, at http://www.citi.columbia.edu/elinoam/articles/tprc2001.htm; and Mossberg, Walt (2007): Free My Phone, *D: All Things Digital*, at http://mossblog.allthingsd.com/20071021/free-my-phone/.

6 This seems to be routine in the U.S., but not in Europe. There have been, however, concerns about the behaviour of European mobile operators as well, e.g. with regard to the blocking of certain number ranges such as those for voice chats or call through services. See Heise Online (2008): O2 und E-Plus sperren Festnetznummern, at http://www.heise.de/mobil/O2-und-E-Plus-sperren-Festnetznummern--/newsticker/meldung/115201

2 The Technology and Economics of Network Neutrality

The Network Neutrality debate is conditioned by a range of underlying technical and economic considerations. Section 2.1 reviews the technical implications of Quality of Service in IP-based networks, while Section 2.2 discusses the economics of quality and price discrimination as it relates to the Network Neutrality debate.

2.1 Application requirements and Quality of Service (QoS)

In order to make sense of the debate, it is necessary to understand how IP-based networks implement *Quality of Service (QoS)*, and the ways in which they differ from conventional circuit-switched telephony networks. Section 2.1.1 discusses the implementation of QoS. Section 2.1.2 explains the degree to which different applications (i.e. different uses of the network, such as web browsing versus real time bi-directional voice or video) have different application requirements.

2.1.1 Technical aspects of IP Quality of Service (QoS)

From an engineering standpoint, the performance of electronic communications networks to transmit information vary along a number of important dimensions. Notable among these are:

- The *bandwidth* of each communications channel (the number of bits [or e.g. megabits] per second that the channel is capable of carrying) within the network.
- The *link delay* that traffic experiences through each communications channel (data link) within the network.
- The *error characteristics* of each transmission medium. For modern fibre optic media, errors are quite infrequent.[7] By contrast, radio transmission might require more robust error correction.[8]
- The *end-to-end delay* that the traffic experiences in its entire journey from sender to receiver through the network, both in terms of average or expected delay and in terms of variance of delay (*jitter*).

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7 The risk of cuts in the fibre is, however, not negligible.

8 The error rate of a wireless link may be associated with the level of interference protection afforded the operator. When low interference protection is afforded the error rate in transmission generally increases as the spectral environment becomes more ‘crowded’.

- The likelihood of *end-to-end packet loss* from sender to receiver. Packet loss is more likely to be a function of queuing characteristics within the network than of errors within network links.

For the Network Neutrality debate, the end-to-end delay, jitter, and packet loss are particularly relevant.

End-to-end delay is comprised of (1) latency, (2) queuing delays waiting for access to each intermediate communications link, and (3) queuing delays waiting for processing resources in each intermediate node (router). The last of these is small enough to ignore in general.

Delay in an IP network can be compared to waiting times on a ski lift, as visualised in Figure 1. In the figure, skiers face a variable queuing delay when standing in line to get on the ski lift. The length of the variable delay is based on the number of skiers trying to get on the lift, and the number of skiers that can board per minute. Each skier faces a fixed delay (latency) once on the chair, based on the length of the lift cable and the constant speed at which it moves. In this analogy, overall delay is the total time that it takes to get up the lift from the moment that one enters the queue at the bottom of the ski slope to the time that one disembarks at the top of the mountain.

Figure 1: An Analogy for Latency and Queuing Delay in IP Networks

Source: WIK-Consult, photo courtesy of alexindigo, Flickr.com

The latency can be viewed as being roughly the time to get a packet through the network if there were no contention for resources whatsoever. For each communications link, it is a function of the speed of light through the transmission medium of which the link is comprised, and the length of the link. As long as the end-to-end communications path does not change, the latency of an end-to-end communication can be viewed as being a constant.

Queuing delays, however, are highly variable. For each transmission link in a packet's path, the packet can be viewed as having been placed on a waiting line (a *queue*) while it seeks to gain access to the transmission link. The mathematics of these waiting lines is well known, and can be analysed by means of *queuing theory*. Sometimes, the communications link is free and the packet gains immediate access to it; in other cases, the packet must wait.

The routers that forward packets have substantial *buffers* in which they maintain waiting lines of packets; however, these buffers are not unlimited. If the offered load is greater than the capacity of the link, the waiting line will get longer, and will eventually overrun the size of the buffer, no matter how large. Routers respond to this condition by simply discarding excess packets, which normally causes no harm for data applications such as email. In contrast to traditional telephony networks, networks based on the *Internet Protocol (IP)* are engineered to delay or drop packets as a part of normal operations. Packet loss does not represent a failure of the network, rather it is normal response to momentary loading above available capacity.

The IP network designer has a limited number of tools available to prioritize some messages ahead of others. Essentially, one can control the queuing discipline and the drop priority. It is possible to mark each packet with a Type of Service or Quality of Service.[9] There are two basic tools:

- Some packets can be given a higher queuing priority than others – this means that they go to the head of the waiting line, in preference to other packets.
- Some packets can be identified as being eligible for discard only as a last resort, after other packets.

Neither mechanism makes the network go faster. Rather, prioritised queuing determines *which* packets are delayed more (or dropped altogether) when the network is heavily loaded or overloaded. Under normal or light load, neither mechanism has much impact on network performance. (Consider again the analogy of the ski lift. When the waiting lines are long, we might wish to be favoured by a prioritised express line. When waiting lines are short, however, an express line makes little difference.)

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9 Many people think of this as a capability of IP version 6 (IPv6); however, it is just as much a capability of today's standard version of IP, albeit with a smaller number of QoS codepoints.

The impact on packets that are not prioritised depends on several factors, including how heavily the network is loaded, and what fraction of the traffic is prioritised.

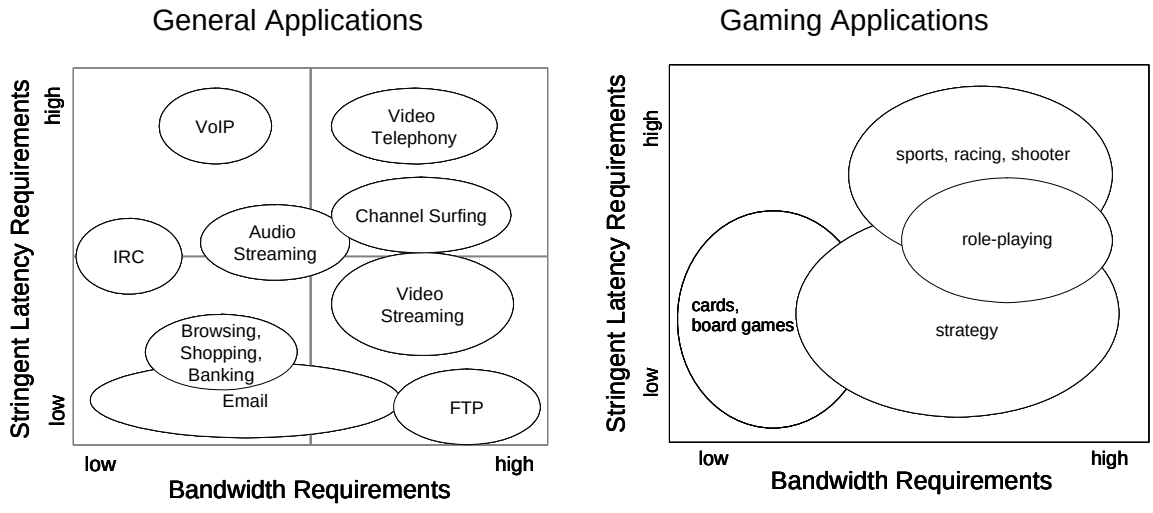
Many argue that Network Neutrality problems can be avoided by simply *over-engineering* with massive excess capacity in order to carry disparate applications. Underlying this presumption is the notion that is substantially less costly to build ultra-high capacity network than to implement differentiated QoS. *With or without differentiated QoS, a network needs to be properly dimensioned to carry the offered load, both delay-sensitive and non-delay-sensitive.* Routers routinely include all the capabilities needed to support QoS, and have for more than ten years; thus, QoS-capable routers do not add to the cost of the network. If the fraction of traffic that requires prioritised handling is small – as is likely to be the case – then support for differentiated QoS adds very little to requirements for transmission link capacity, and thus adds very little overall to the cost of the network.

With that in mind, we would suggest that the use of the term over-engineering can be misleading. The network needs to be properly dimensioned, whether differentiated QoS is used or not. The network needs to be *properly* engineered, not necessarily over-engineered.

2.1.2 Application service quality needs

If all network uses and users were same, there would be no need for differentiated QoS; however, users' demands for network resources vary along any number of dimensions, including the bandwidth required and their tolerance for delay and jitter (see Figure 2).

Figure 2: Application requirements for stringent QoS



Source: WIK-Consult

For example, email is insensitive to delay. If an email is delayed for a few seconds, or even a few minutes, users will not be greatly distressed. Further, the transmission of email generally only requires narrow band communications.

By contrast, real-time bidirectional voice is highly sensitive to delay. A real-time bidirectional voice call requires only 56 kbps (perhaps as little as 8 kbps if compressed), but cannot tolerate an end-to-end delay of much more than 150 milliseconds. If the end-to-end delay is too great, parties on both sides of the real time dialogue are like to start speaking at the same time, since neither knows that the other has already begun. This phenomenon is familiar to anyone who has held a telephone conversation over a circuit using a geosynchronous satellite (where the delay must necessarily be some 270 milliseconds).

Video services require more bandwidth than voice or email, but one way video services are not highly delay-sensitive. For one way (e.g. streaming) video, moderate delay and loss are not a problem *as long as the user is willing to wait a second or two for the program to begin*. The receiving system can establish a buffer of packets, and can use the buffer to “smooth out” minor variability in packet delay. One caveat is that the mean (average) and the standard deviation (a measure of variability) of delay must *both* be within reasonable bounds. If these conditions are met, even an occasional lost packet is not a catastrophe – the CODECs (encoding devices) are often smart enough to interpolate for the missing data, and the human ear and eye are good at compensating for minor gaps in the program.

Gaming applications present a wide variety of bandwidth needs and latency tolerance, depending on the nature of play.

2.2 Economic Background

This section of the report provides background on a range of economic phenomena that are relevant to Network Neutrality. Section 2.2.1 provides a basic introduction to market power, transaction costs and switching costs as they relate to the Network Neutrality debate. Section 2.2.2 discusses price and service discrimination in conventional markets. Section 2.2.3 addresses the economics of foreclosure. Section 2.2.4 extends the discussion to consider two-sided markets. Section 2.2.5 places the discussion in the context of contention, or lack of contention, for resources, and distinguishes between private goods, public goods, and common pool resources.

2.2.1 The basics: market power, network effects, transaction and switching costs

This section provides background on a number of basic concepts that underlie much of the following analysis. Sub-section 2.2.1.1 discusses market power; Sub-section 2.2.1.2 discusses network externalities and network effects; and Sub-section 2.2.1.3 explains transaction costs and switching costs.

2.2.1.1 Market power

Simply put, market power is the ability of a firm to influence prices in the market. Traditional economics holds that in perfectly competitive markets, firms are forced to accept the price that the market is willing to pay for their goods or services. Most markets face somewhat imperfect competition. These imperfections often enable firms to offer a smaller quantity of products or services than the market is capable of accepting, but to thus command a higher unit price (thanks to the normal working of supply and demand). Where a company that has market power chooses to produce less than it otherwise could, the company may earn a good profit, but consumers are short-changed to the extent that more goods and services could have been produced and consumed at a lower yet cost-covering price, but were not. This loss to consumers is a *deadweight social loss*.

The European regulatory framework is largely premised on an analysis of market power. For purposes of European regulation, 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."[10] The Guidelines[11] distinguish between determining market power *ex post* and *ex ante*. In an *ex ante* world, the only meaningful measure of market power is the ability "… of the undertaking concerned to raise prices by restricting output without incurring a significant loss of sales or revenues."[12]

2.2.1.2 Externalities

The value of a network increases as the number of parties who participate in the network increases. This characteristic is referred to as a *network externality*[13] or a *network*

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10 See Directive 2002/21/EC, Article 14(2).

11 *Commission Working Document on Proposed New Regulatory Framework for Electronic Communications Networks and Services, Draft Guidelines on market analysis and the calculation of significant market power*, Brussels, March, 3, 2001 (Guidelines).

12 Guidelines, at 65.

13 In economics, an externality arises when one market participant affects others without compensating other affected actors. Wikipedia contributors, 'Externality', Wikipedia, The Free Encyclopedia, 21 May 2007, 15:44 UTC, <http://en.wikipedia.org/w/index.php?title=Externality&oldid=132458322> [accessed 25 May 2007].

effect. This is not a mere question of economies of scale, where unit costs decline as the number of units produced and consumed increases; rather, it is linked to the number of parties with whom the subscriber could potentially interact. A new subscriber joins a network by engaging in a transaction with the service provider; however, the act of joining enhances the value of the network to *all* network users, even though the other network users were not parties to the transaction. Network effects are common in many contexts, not just in communication networks.

Introduction of new products and services can be particularly challenging where network externalities are present, inasmuch as consumers will tend to stay with the older, widely used service unless the advantages of the new services are compelling.[14]

The economics of market power in industries subject to network externalities has been extensively analysed over the years,[15] and implications for Internet interconnection were analysed more recently.[16] 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.

2.2.1.3 Transaction and switching costs

A *transaction cost* is any cost incurred in making an economic exchange. For every participant in the network, there is a transaction cost associated with either interconnecting two networks or with adding an additional user. Given that there are, by some measures, thousands of IP-based networks and millions of users. This could potentially represent daunting transaction costs.

Switching costs are those which impede a customer from changing suppliers. Switching costs can arise for several different reasons, including contract cancellation fees, the needed to inform others of new contact information (such as email addresses or telephone numbers), costs related to setting up and learning the new network, and equipment and installation costs. Switching costs affect competition in that they present a

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14 See Rohlfs, Jeffrey H. (2003): Bandwagon Effects in High Technology Industries, MIT Press; and Marcus, J. Scott (2004): Evolving Core Capabilities of the Internet, in: *Journal on Telecommunications and High Technology Law*, Vol. 3, pp. 123-163. Note that switching costs interact with these challenges (see Section 2.2.1.3).

15 See Katz, Michael L./ Shaprio, Carl (1985): Network Externalities, Competition, and Compatibility, in: *The American Economic Review*, Vol. 75, pp. 424-440 and Farrell, Joseph / Saloner, Garth (1985): Standardization, Compatibility, and Innovation, in: *the RAND Journal of Economics*, Vol. 16, pp. 70-83.

16 Crémer, Jacques/ Rey, Patrick/ Tirole, Jean (2000) : Connectivity in the Commercial Internet, in: *Journal of Industrial Economics*, Vol. 48, pp. 433-472.

barrier to reaping the benefits offered by another supplier. A consumer will typically not switch to a more cost-effective service provider if the switching costs are large in comparison to the benefits of being with the new provider. The consumer is to some extent locked in.

2.2.2 Price discrimination and market power in conventional markets

The basic economic theory that evolved in the Nineteenth Century described a world of perfect cut-throat competition, in which firms would compete away all of their profits and would price down to their marginal costs. It was subsequently recognized that real markets are not perfectly competitive; moreover, in utility markets like electronic communications, which are often characterized by high fixed costs and low marginal costs, such a model would tend to be ruinous for the operators. Pricing to pure marginal cost would leave the operators with no possibility of recovering their quite substantial fixed costs.

The solution to this quandary has been obvious to businessmen and to economists for more than a hundred years. By offering services at different levels of quality, the business can retain some pricing power, and can thus achieve profitability in a business that would otherwise price down to an unsustainable marginal cost.[17] We are all familiar with this principle in the context of airplane or railroad tickets: we do not consider it anti-competitive 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 their least expensive service without roofs in the Nineteenth Century not because of the cost of the roof, but rather in order to terrify passengers who could afford to pay more out of taking the less expensive service.[18]

More generally, optimal pricing would be based on *Ramsey-Boiteux principles*, where the highest mark-ups would be assessed to those whose demand is least *elastic*, that is, whose demand is least likely to be impacted by high prices.[19] Ideally, the firm would price to each individual's elasticity (*first order price discrimination*); however, this is generally impractical, so firms in practice price to reflect the willingness to pay on the part of large groups of prospective customers (*second order price discrimination*). When an airline offers a lower price to those who are willing to stay over on a Saturday night, it has nothing to do with the airline's costs, but everything to do with the willingness of prospective customers to pay. Business customers generally want to be home on the

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17 See especially Hotelling, Harold (1929): Stability in Competition, in: *The Economic Journal*, March 1929, pp. 41-57.

18 See Odlyzko, Andrew (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, at http://www.rnejournal.com/articles/odlyzko_RNE_sept_2004.pdf . He draws on earlier work.

19 For an introduction to Ramsey-Boiteux pricing, see Laffont, Jean-Jacques/ Tirole, Jean (2000) : Competition in Telecommunications, MIT Press.

weekend, and are relatively insensitive to price because the costs are borne by their firms rather than being carried personally by the traveller. Airlines charge them more because they are willing to pay more.

In competitive markets, this price discrimination is generally *welfare-enhancing*. Airline price discrimination makes it possible for budget-minded vacationers to get favourable packages, and generally expands the economic frontier in such a way that passengers may collectively fly more miles, and that planes have fewer empty seats, all effects that tend to enhance overall welfare.

The darker side of price and quality discrimination appears when the firm has market power. Price and quality discrimination then provides a means for the firm to extract more of the economic *surplus* (the perceived value to the customer, minus the cost) from the customer. Price discrimination benefits the firm, at the cost of harming consumer welfare. The real underlying problem here is not the price discrimination, but rather the lack of competition, which results in higher prices and in lower overall levels of consumption than would be the case in an effectively competitive market. The resultant loss of welfare can be referred to as a *deadweight social loss*.

2.2.3 Economic foreclosure

One aspect of the Network Neutrality debate is that network operators might affiliate with (or acquire) certain content or application providers, and might then disadvantage their competitors. This kind of behaviour smacks of economic *foreclosure* or tying, where a firm that possesses market power in one market segment attempts to project that market power into upstream or downstream market segments that would otherwise be competitive.

In the United States, as in Europe, the providers of content and applications (e.g. Google, Yahoo, Vonage, and YouTube) are in most cases not the same as the network operators (e.g. AT&T, Verizon, Comcast), although a few companies have a foot in both camps (e.g. America Online (AOL) / Time Warner). The Network Neutrality debate is complicated by the fact that these markets are largely distinct, but are upstream/downstream from one another.

To date, attempts to exercise this kind of foreclosure have often failed. AOL/Time Warner did not notably benefit from possessing both network and content. The merger of Excite and @Home also did not seem to generate advantage – in particular, @Home did not attempt to limit the Excite portal to its cable customers, nor did Excite attempt to treat @Home cable customers differently from other customers. On the other hand, a small local telephone company (Madison River) apparently attempted to block Vonage

Voice over IP access to its customers, which presumably would have been profitable for Madison River had the FCC not intervened.[20]

Once again, where underlying markets are sufficiently competitive, anticompetitive actions are usually unprofitable (foreclosure cannot exist in the absence of market power); however, where underlying markets are highly concentrated, problems could indeed emerge.

2.2.4 Two-sided markets

A recent development in economic theory is the ability to analyse *two-sided platforms*. A two-sided platform brings together the two distinct sides of a market in a way that benefits both. Common examples include (1) free-to-air television broadcasting, and (2) singles bars.

In a sense, every communication market is two-sided. In most cases, the more complex analysis necessary for a two-sided market does not provide a deeper understanding of the market. For certain markets, however, the *structure* of prices matters, not just the *level* of prices.[21] For example, end-users typically do not pay for free-to-air broadcasting – the costs are in effect carried by advertisers (see Figure 3). Television programming is distributed essentially free of charge to consumers in order to ensure an adequate audience for advertisers, who bear the full cost of the service. The free-to-air broadcaster serves as a market maker, bringing advertisers together with consumers. The broadcaster has a strong incentive to bring both sides of the market together. Too little content, or the wrong content, and there might be too few viewers to be of interest to advertisers.

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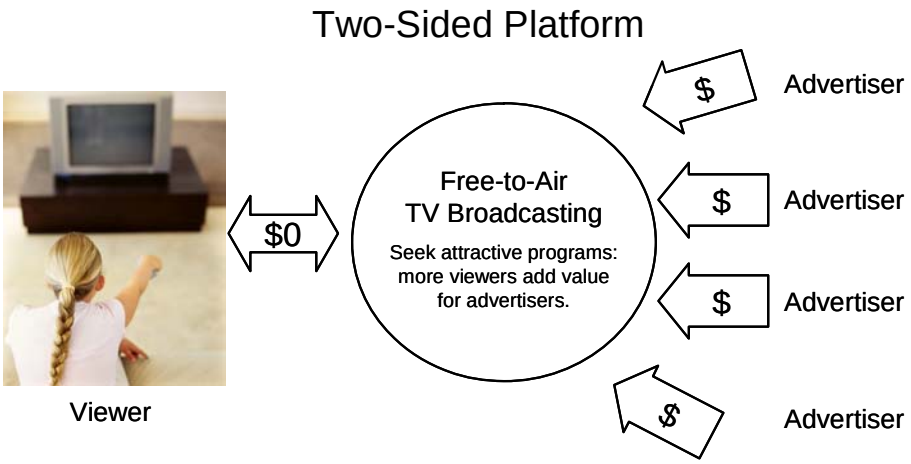
20 In March, 2005, the FCC investigated "… allegations that Madison River was blocking ports used for VoIP applications, thereby affecting customers' ability to use VoIP through one or more VoIP service providers." Madison River agreed to discontinue the practice, and to pay a small fine. Note that Madison River probably had substantial market power relative to its rural telephony customers.

21 Rochet, Jean-Charles/ Tirole, Jean (2004) : Two Sided Markets : An Overview, in : *Institut d'Economie Industrielle working paper*, Toulouse, 2004, at: http://faculty.haas.berkeley.edu/hermalin/rochet_tirole.pdf.

Figure 3: Two-sided markets



Source: WIK-Consult

As another example, a singles bar might find it profitable to offer free drinks to women (or for that matter to men) in order to ensure the right number of each are present. Pricing schemes that would be irrational in conventional markets can be appropriate in two-sided markets.

The Internet has some parallels to the free-to-air broadcasting case. Laffont et. al. analysed the Internet in terms of web sites and consumers, and found that access charges between Internet backbone networks (which today are often zero) would have a tendency to transfer relative welfare between content providers versus consumers.[22]

Again, nearly any communications market could be analysed as a two-side market; however, the two-sided analysis is likely to provide additional insights only for markets whose two-sidedness implies that the *structure* of prices matters, and not just the *level* of prices. In a conventional market, for an average incremental price to be less than the corresponding average incremental cost would normally indicate some market failure, possibly predation. In a two-sided market, however, such pricing could be perfectly normal and rational.

22 Laffont, Jean-Jacques/ Marcus, J. Scott/ Rey, Patrick/ Tirole, Jean (2003): Internet Interconnection and the Off-Net-Cost Pricing Principle, in: *RAND Journal of Economics*, Vol. 34, pp. 370-390, at http://www.rje.org/abstracts/abstracts/2003/rje.sum03.Laffont.pdf.

2.2.5 Common pool resources and the Tragedy of the Commons

Economists distinguish among goods and services based on the degree to which they exhibit *rivalrousness* and *excludability* (See Table 1).[23] Goods are rivalrous if consumption of the good by one individual reduces the amount available for other users. Goods are excludable if it is possible to prevent potential beneficiaries from consuming them.

Table 1: Externalities: Public and Private Goods

	Excludable	Non-excludable
Rivalrous	**Private goods** food, clothing, toys, furniture, cars	**Common goods / (Common-pool resources)** water, fish, hunting game
Non-rivalrous	**Club goods** cable television	**Public goods** national defence, over-the-air television

Source: http://en.wikipedia.org/wiki/Public_good

The benefits of common-pool resources are non-excludable, but they are rivalrous. It is impractical to prevent potential beneficiaries from consuming them, but consumption by one beneficiary means that there is less available for others. Due to the inherent free entry condition, network participants will not account for the negative effect of their consumption decisions on the value others receive from the good. Thus, participants are likely to "over consume" the resource from a collective standpoint. This is one of several welfare reducing outcomes frequently referred to as the "Tragedy of the Commons." Because of this excessive use, the welfare of individual users is not maximized and, further, society fails to obtain the most efficient use of its scarce resources.

By contrast, private goods are rivalrous and excludable. They do not present the same tragedy of the commons problems that common pool resources do.

Portions of IP-based networks exhibit characteristics of private goods, while other portions may exhibit characteristics of common pool resources. Many aspects of IP-based networks are excludable, but not necessarily all. For example, where multiple cable television broadband users share the same cable, there often are few or no controls on the bandwidth consumed by each user.

To the extent that network participants are in competition for common pool resources, a Tragedy of the Commons problem could arise. Where this is the case, it could be appropriate to ration network resources system in order to prevent over-consumption.

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23 See Olson, M., Jr. (1965): The logic of collective action—Public goods and the theory of groups. Cambridge, MA: Harvard University Press. and Musgrave, R. A. (1969): Provision for social goods, in J. Margolis, & H. Guitton (Eds.), Public economics (pp. 124–144). London: Macmillan.

2.3 Describing deviations from Network Neutrality

The emerging literature on Network Neutrality has struggled to characterise and categorise the many different aspects of the problem. This is not surprising, inasmuch as a single practice may give rise to several different economic, policy and technological issues, each involving several different classes of entities. In this section, we offer some classifications based on Competition law and economics in an effort to better describe Network Neutrality issues.

Network Neutrality could be viewed as generating three dimensions of conflicts for public policy: (1) vertical conflicts, (2) horizontal conflicts, and (3) “diagonal” conflicts.

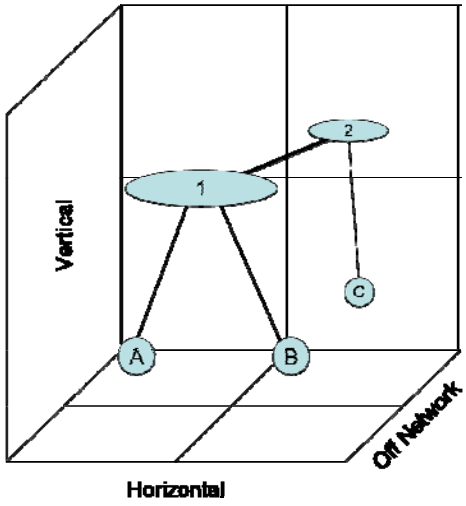
Vertical conflicts are those between players in the same value chain – content sources, network operators, and end-users. These are upstream/downstream issues. These vertical conflicts usually involve market power, and often contain an aspect of vertical foreclosure.

Horizontal conflicts are those between entities operating at the same level of the network value chain. Horizontal conflicts arise between, say, end-users competing for finite bandwidth in the access network. Horizontal issues often relate to competition for common pool resources, and might be linked to differences in bargaining power.

Diagonal conflicts arise between entities that are in *different, but interconnected, value chains*. Notably, a conflict between one network operator and a customer of a different network operator can be viewed as a diagonal conflict.

Consider the situation depicted in Figure 4, were entities 1 and 2 are access networks and A, B, and C are end-users. Further suppose that Networks 1 and 2 are interconnected, and end-users A and B are both customers of 1. C is a customer of Network 2. The vertical dimension denotes the network participant’s place in the value chain, i.e., network provider versus end-user.

Figure 4: Three Dimensions of Network Neutrality



Source: WIK-Consult

If Network 1 were to block or degrade the ability of its customers A and B to access non-affiliated content, that would represent a vertical conflict. If end-users A and B were competing for network resources, that would be an example of a horizontal issue. Similarly, deviations from Network Neutrality in terms of interconnection between Networks 1 and 2 would also reflect a horizontal dimension.

If Network 1 were to block or degrade the ability of end-user C (who is not its customer) to exchange messages with its customer, end-user B, that would represent a diagonal issue; however, end-user B might view the same issue as a vertical conflict.

3 Network neutrality – experience to date

Many of the concerns (but not all) that have been raised to date about deviations from Network Neutrality in the *fixed* IP-based network reflect *potential* conduct by network operators, not actions that they have actually taken. There have been relatively few clear-cut, problematic deviations to date from the principle of Network Neutrality.[24] On the other hand, many of the concerns that have been raised about wireless Network Neutrality represent conduct that is widespread and routine.

Section 3.1 describes a number of instances where the ability to connect devices to the network was blocked (or in some cases continues to be blocked). Section 3.2 discusses impediments to the access of applications of the end-user's choice. Section 3.3 reviews instances where network operators expressed the desire to impose charges on providers of third party content (a *diagonal* conflict in the terminology of Section 2.3).

3.1 Blockage of ability to use certain devices

In this section, we consider a range of behaviours where network operators have refused to permit the user to connect devices to the network. These cases can be viewed as vertical conflicts, and as examples of attempted economic foreclosure.

3.1.1 Hush-a-Phone, Carterfone, and Part 68

The policies enabling attachment of third party devices to the monopoly Bell System in the U.S. began in earnest with a DC Circuit Court of Appeals ruling in 1956.[25] The impetus to the case was a company called Hush-a-Phone Corporation which began in the 1920s to market a small plastic scoop which attached the mouthpiece of a telephone handset. The device was intended to provide a shield from background noise and to reduce the ability of others to eavesdrop on the conversation. In the late 1940s, an AT&T lawyer saw the Hush-a-Phone in a store window. AT&T brought an action before the FCC to try to prevent the sale of the Hush-a-Phone device. AT&T, through its tariffs, refused to allow anyone to attach anything to its network. AT&T argued that Communications Act of 1934 afforded it the right to forbid the attachment of any third party device. The FCC agreed that the device was a "foreign attachment", posing a risk of technical interference with the network and potentially negatively impacting the general quality of telephone service.

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24 Not all experts share this view. See, for instance, Wu, Tim / Lessig, Lawrence (2003): letter to the FCC: http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6514683885. There are also indications that deviations may be on the rise. At an informal level, see: http://thetyee.ca/Mediacheck/2007/12/27/NetNeutrality/print.html.

25 *Hush-a-Phone v. United States*, 238 F.2d 266 (D.C. Cir. 1956).

It may seem ludicrous to us today that a piece of plastic with no electrical interface to the telephone network could pose such a threat; more important, the District Court thought so, and reversed the FCC. The court found that AT&T's prohibition of the device was not "just, fair, and reasonable", as required under the Communications Act. The court found that the device did not "physically impair any of the facilities of the telephone companies", nor did it "affect more than the conversation of the user."[26]

Three years later in 1959, Thomas Carter[27] introduced a device which allowed a mobile radio system to be interconnected with the Bell System landline telephone network. Similar to the Hush-a-Phone device, Carter's device (see Figure 5) was in fact a mere acoustic coupler attached to the phone handset, and was not electrically connected to the network. The device enabled an operator at the radio base station to dial a telephone on the Bell System's network. The base station operator would then place the telephone handset on the Carterfone device's acoustic coupler. A voice circuit in the Carterfone controlled the transmission and reception of the radio equipment. A separate speaker allowed the operator to monitor the conversation, adjust the voice volume, and hang up the telephone when the conversation ended.

Figure 5: The Original Carterfone Equipment

Source: The Wireless Messaging Newsletter, <http://www.braddye.com> (used with permission).

AT&T advised its customers that use of the Carterfone would subject the end user to penalties pursuant to AT&T's FCC tariff. In response, Mr. Carter filed a private antitrust

26 *Ibid*.
27 No relation to Kenneth R. Carter, who is an author of this report.

suit against AT&T. The District Court referred the matter in 1966 to the FCC. The FCC concluded that AT&T's tariff was unreasonable and discriminatory because the tariff would require end-users to install AT&T-manufactured equipment with exactly the same functionality. It ordered the restrictive tariff provisions stricken.[28] This opened the telephone network to the attachment of non-Bell System equipment which would improve the functionality of the network, so long as that equipment did not harm the network. In response to the Carterfone decision, AT&T permitted attachment of foreign devices, but only through expensive connection equipment supplied by AT&T.

In 1975, the FCC established a certification program, relying on the National Academy of Sciences, to evaluate connection of foreign equipment. Based on this evaluation, the FCC allowed attachment of foreign devices through technical standards intended to prevent harm to the network, and using standardized plugs and jacks. This work culminated in the FCC's Part 68 Rules. Subsequent to the enactment of these rules, the number of vendors increased and equipment such as private branch exchanges became more widespread.

3.1.2 Device attachment in mobile, wireless networks

As noted earlier in Section 1.5, the U.S. expert Tim Wu and others have explored the wireless dimension of the Network Neutrality issue. Wu has been concerned that mobile operators support only a limited selection of devices on their networks, and that mobile operators cripple some handset features. Wu and others have proposed that the Carterphone principle, which applies only to fixed phones in the U.S., should be extended to mobile phones.

GSM handsets in the U.S. are routinely sold with locked SIMs, and U.S. mobile operators have historically not always been particularly obliging in assisting subscribers in unlocking them (even though handset subsidies are comparatively low in the U.S.). Meanwhile, a bit more than half of the U.S. mobile handset market comprises devices based on standard other than GSM; these devices are truly locked.

3.1.3 SIM Locks and the iPhone

Soon after the launch of the iPhone in the U.S. on June 29 2007 (where it is sold in conjunction with an AT&T contract), Apple and T-Mobile agreed on an exclusive partnership for Germany. T-Mobile started to sell iPhones in Germany in November 2007. The product launch of the iPhone in Germany drew much attention, not only due to the

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28 In the Matter of *Use of the Carterfone device in message toll telephone service*; In the Matter of *Thomas F. Carter and Carter Electronics Corp., v. American Telephone and Telegraph Co., et al*., Docket No. 16942; Docket No. 17073, 13 FCC2d 420 (1968); 13 Rad. Reg. 2d (P & F) 597 (June 26, 1968).

iPhone's design and technical capabilities, but also due to the fact that it was equipped with an electronic SIM-lock disabling the use of the phone with any SIM card except the one provided by T-Mobile at the time of sale.[29] Further, the SIM-lock also locked other functions that were not directly related to the use of the provider's network, such as the iPod (MP3 player), integrated camera, and Wi-Fi functions of the iPhone.

In the U.S. and in many European countries, it is common for operators to lock mobile devices at least for the duration of the initial contract. In Germany, for example, carriers have a similar practice for highly subsidised devices sold in combination with prepaid cards without a monthly fee; however, it had rarely been applied to devices sold in combination with a long-term contract.[30] Explicit rules prohibiting SIM-locks have been enacted in some Member States, but not in Germany.[31]

Vodafone, T-Mobile's largest competitor, went to court and obtained an injunction against the exclusive distribution of SIM-locked iPhones by T-Mobile from the *Landesgericht* Hamburg. Vodafone asked the court to clarify whether T-Mobile's practices were in accordance with existing German law. Shortly after the Vodafone complaint, Debitel, a mobile telephony service provider, brought a complaint to the German NRA, the *Bundesnetzagentur,* regarding the terms of T-Mobile's contract. As a reaction and to avoid a possible fine, T-Mobile started offering unlocked phones without a contract for € 999, compared to its standard price of € 399 for SIM-locked iPhones sold in combination with a 24 month contract. On 4 December 2007, the court lifted the injunction and T-Mobile immediately announced that it would stop selling unlocked iPhones.[32] Since no party involved appealed the decision, the verdict became a precedent for German law after one month.

3.2 Blockage of access, QoS degradation, or unreasonable surcharges to access certain sites or content

This section reviews a number of instances where network operators interfered in one way or another with the ability of end-users to access sites or content. Intentional degradation of the Quality of Service of access can be viewed in this context as a less extreme form of blockage. Analogously, discrimination can be either price-based or non-price-based.

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29 In general, it is necessary to distinguish between SIM-lock (which means that the particular end device can be used with one specific SIM card only) and Net-lock (which means that the particular end device can be used with any SIM card, but only in the mobile network of the specific operator).

30 According to forum and blog statements, SIM and Net-locking in connection with long-term contracts has increased in the last months. However, this topic did not draw wide attention in the public prior to the iPhone launch.

31 For example, Finland, Belgium and France prohibit SIM locks. On the other hand, Hungary prohibits unlocking of SIM locked end devices.

32 In December 2008, the French Competition Council also issued a temporary injunction barring France Télécom and Apple Inc. from an exclusive distribution agreement regarding the iPhone. ARCEP had recommended the injunction; however, the original complaint was filed by Bouygues Telecoms.

3.2.1 Madison River Communications

The U.S. FCC case, *In the Matter of Madison River Communications, LLC and affiliated companies*[33], is often cited as an example of Network Neutrality policy in action. Unfrotunately, not much is known about the facts of the case. The dearth of information on the facts is not due to a lack of diligence or scholarship, but rather to the case's procedural posture. Much of the information obtained during the case was treated as confidential. The matter was initiated as an investigation in the Enforcement Bureau of the FCC. Madison River Communications is a holding company which operates telephone and broadband Internet service providers in Alabama, North Carolina, Georgia, Mississippi, and Illinois. The FCC was investigating "allegations that Madison River was blocking ports used for VoIP applications, thereby affecting customers' ability to use VoIP through one or more VoIP service providers."[34] Presumably, Madison River's behaviour would have been profitable had the FCC not intervened.[35]

To conclude the case, Madison River and the FCC entered into a consent degree. In exchange for the FCC's dropping the matter and promising not to investigate further in the absence of new complaints, Madison River agreed "not block ports used for VoIP applications or otherwise prevent customers from using VoIP applications." In addition, adison River agreed to make a "voluntary" contribution of $15,000 to the U.S. Treasury.

The FCC's ruling does not provide any basis for FCC jurisdiction in the matter, nor does it indicate exactly what rules, if any, were violated. Given subsequent changes in FCC rules, it is quite likely that whatever basis for jurisdiction might have existed at the time is no longer operative. Consequently, the consent degree does not represent a helpful precedent, nor does it provide any useful guidance or concrete rules going forward.

3.2.2 Comcast's Treatment of Peer to Peer Traffic

The FCC recently ruled that Comcast must stop its practice of degrading BitTorrent peer-to-peer traffic (see Section 5.4). This section of the report describes the incident; Section 5.4 deals with the FCC's regulatory response.

According to a report by Peter Svensson of the Associated Press, Comcast had been preventing its subscribers from using peer-to-peer applications to legally share files online. Comcast was actively interfering by masquerading as its user's computer and resetting the connection that sought to upload a file from a Comcast subscriber to some

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33 Federal Communications Commission, In the Matter of Madison River Communications, LLC and affiliated companies, DA 05-543, File No. EB-05-IH-0110.

34 *Ibid.*

35 In March, 2005, the FCC investigated "… allegations that Madison River was blocking ports used for VoIP applications, thereby affecting customers' ability to use VoIP through one or more VoIP service providers." Madison River agreed to discontinue the practice, and to pay a small fine. Note that Madison River probably had substantial market power relative to its rural telephony customers.

other Internet user.[36] "It's like a telephone operator breaking into a conversation, telling each person in the voice of the other, 'sorry, I have to hang up, goodbye.'"[37] Comcast customers had not been notified of the practice.

In most peer-to-peer networks, such as BitTorrent, Gnutella, and Napster, content is exchanged directly among participants in the network. Participants inform a centralized server as to which files they have available to share. Often, more than one participant will have a version of the same file to be shared. Other participants can browse the entries on that server and decide not only which file to download, but also from which participant.

According to a spokesman, "Comcast does not block access to any applications, including BitTorrent."[38] While this statement might have been technically true, it was misleading. A more nuanced analysis is necessary to understand the implications for Network Neutrality. The technology that was employed does not technically block the application, but it might delay it sufficiently that the economic benefit to subscriber is *de minimis*, and thus it is effectively blocked. Furthermore, while Comcast subscribers could download files from other BitTorrent users, the Associated Press analysis showed that their uploads to other participants could indeed be blocked or significantly delayed.

This Comcast practice could potentially make more bandwidth to available to Comcast's subscribers' for other activities.

In any given transmission path, there is only finite capacity. On a cable television network, this capacity can be divided between upstream and downstream transmission to only a very limited degree (see Figure 6). Cable networks tend to have far more bandwidth available downstream than upstream.

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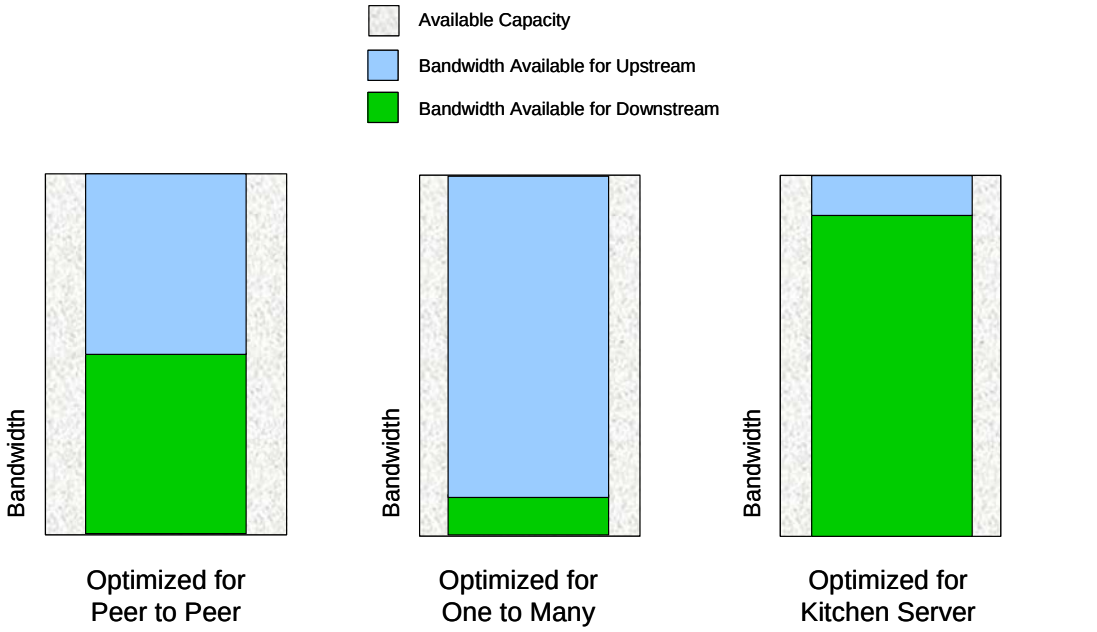
36 Svensson, Peter (2007): Comcast blocks some Internet traffic: Tests confirm data discrimination by number 2 U.S. service provider, *Associated Press*, at http://www.msnbc.msn.com/id/21376597/.
37 Gladstone, Brooke (2007): Please Don't Share, *On the Media*, WNYC, New York Public Radio.
38 *Ibid.*

Figure 6: Allocating Upstream and Downstream Bandwidth



Source: WIK-Consult

In Comcast's DOCSIS-based network, a single router (CMTS controller) at the cable headend controls transmission in the downstream direction. This enables some measure of traffic management; however, in the upstream direction, traffic management is significantly harder since there are a great many cable modems competing for upstream bandwidth, and these cable modems are not necessarily under Comcast's control. To the extent that Comcast's subscribers prefer downstream applications, such as web browsing or media streaming, then all is well; however, the network is not ideally suited to carry large volumes of upstream traffic.

Comcast's strategy took advantage of the fact that Comcast subscribers would tend not to care very much whether other anonymous peer-to-peer participants could access the files of Comcast subscribers for sharing. Other BitTorrent participants might be able to download the desired file from another BitTorrent user not on the Comcast network. Indeed, portions of a single file downloaded by an end-user could originate from different computers using different TCP connections in a BitTorrent "swarm". Thus, Comcast's actions had a greater effect on BitTorrent as a whole than it did on Comcast's own subscribers.

Even if this negative externality affected other BitTorrent participants, that would have been of little consequence to Comcast since there was no commercial relationship between Comcast and BitTorrent, or its users (see Table 2). Furthermore, as Comcast said, it was not literally blocking BitTorrent as an application. One commenter argued

that, "[r]eset spoofing merely rations the number of BitTorrent seeding sessions a user can offer to the internet at a given time."[39] Nonetheless, after resetting peer-to-peer connections a certain number of times, corresponding to approximately 10 minutes,[40] Comcast would allow the transfer.

Table 2: Relationship of the participants using BitTorrent and Comcast

First Party	Second Party	Relationship
Comcast Corp.	Comcast Subscriber	Vertical
Comcast Corp.	Other ISP Subscriber	Diagonal
Comcast Subscriber	Comcast Subscriber	Horizontal
Comcast Corp.	Other ISP	Horizontal

Source: WIK-Consult

Some content available on BitTorrent is fungible and some is not. Consider the Associated Press's example of trying to download the King James Bible. To the average BitTorrent user, it may matter little who seeds the copy which he or she downloads; however, if the content were baby pictures, and if the BitTorrent user were the baby's grandmother, she might have been willing to wait some minutes for the download to start. Moreover, if this grandmother were chronically unable to download those photos, the uploading subscriber might eventually change network providers.

This explains the significance of the 10 minute period that Comcast enforced. It enabled Comcast to identify which off-network end-users were strongly motivated to obtain BitTorrent content from Comcast's subscribers and which were not. Those off-network users who were strongly motivated to obtain content from Comcast's subscribers might have had an impact on the benefits derived by its own customers.

3.2.3 Comcast and AfterDowningStreet.org

The U.S. cable operator Comcast has also been embroiled in another Network Neutrality dispute. In 2004, Comcast was accused of blocking content for political purposes. Comcast, the second largest broadband provider in the U.S., was alleged to have systematically filtered all email messages to its subscribers containing the URL *afterdowningstreet.org*. This is the URL of *After Downing Street*, a coalition of activists who oppose the war in Iraq; they have no relationship to the government of the UK.

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39 Bennett, Richard (2007): Dismantling a Religion: The EFF's Faith-Based Internet An Expert View, *The Register,* at http://www.theregister.co.uk/2007/12/13/bennett_eff_neutrality_analysis/.

40 Gladstone, Brooke (2007): Please Don't Share, *On the Media*, WNYC, New York Public Radio.

What sets this case apart from other content blocking cases is not just the political dimension, but the way in which the filtering was implemented. The filtering technique examined the *content* of the email, not the sender's domain or originating IP address. In response to complaints from After Downing Street, Comcast stated that afterdowningstreet.org was on its list of spam sender's domains; however, this does not fully explain why emails containing the URL in content were being filtered.

It is common to scan the content of email to guard against the reception of malware and viruses. Comcast reported that its subcontractor Symantec's Bright Mail filter was blocking the email messages because Symantec had received some 46,000 complaints which warranted the blocking procedure. Comcast and Symantec refused requests to release any of the 46,000 purported complaints. Symantec eventually lifted the block, thus resolving the matter.

A troubling aspect of this case is the lack of transparency. Under certain circumstances, blocking content can be appropriate and welfare enhancing, such as spam and adult content filtering undertaken at customer request; however, it is difficult to see how this could be such a case. Comcast subscribers did not receive any indication that some of their email messages were being filtered due to the complaints of others, and Comcast's motivations remain unclear.

3.2.4 Competition in mobile data services in Japan

Japanese experience with competition for mobile data services provides an interesting example of competitive forces constraining the ability of a network operator to limit the ability of end-users' to directly access the content of their choice. NTT DoCoMo's success with i-mode, and their subsequent setback with FOMA, together represent a much overlooked case which may hold valuable lessons regarding the firm-level dynamics of Network Neutrality.

In 1999, NTT DoCoMo introduced i-mode, a wireless data service, in Japan. Almost immediately, it became a phenomenal success. NTT DoCoMo's i-mode offered mobile access to numerous online content sources and services and to the Internet from a cellular phone; however, the application access was controlled by DoCoMo (thus keeping end-users in a "walled garden"). When true 3G services hit the Japanese market in 2001, NTT DoCoMo rapidly lost market share to competitors, KDDI and Japan Telecom. Only recently, and only after DoCoMo opened access to general Internet applications, has its FOMA product become the leading 3G service.

When it initially launched i-mode, NTT DoCoMo had to achieve a delicate balance between open and proprietary access in order to achieve commercial success.[41] i-mode users had access to more than 40,000 i-mode-affiliated Internet sites, as well as e-mail, online shopping and banking, ticket reservations and restaurant reviews. The applications and content that rode on the network were controlled by NTT DoCoMo; however, that control was not completely rigid. Realizing that the company could never provide enough content to attract enough subscribers, NTT DoCoMo created the proprietary protocols c-HTML and i-HTML which enabled website owners to convert their content, making it accessible to i-mode users through NTT DoCoMo's Internet gateways. The protocols enabled third parties to convert existing Web sites to i-mode format, largely automatically, with only minor changes to the existing code. In addition, NTT DoCoMo served as a financial intermediary, billing i-mode users for transactions with these websites. NTT DoCoMo charged content providers a 9% commission for the billing system service. NTT DoCoMo enabled i-mode users to gain access to other i-mode-compatible content through the Internet, provided that the user could key the URL into his mobile phone. NTT DoCoMo-affilated sites were given preference in i-mode's menu-driven interface to ensure that these sites were easier to access, and hence more frequently visited.

Several reasons for FOMA's lackluster commercial performance when it was first launched have been suggested, including: (1) limitations in the number and nature of available services; (2) poor network experience; and (3) inadequate handset performance. By the time FOMA was launched, i-mode comprised an entire ecosystem of content and service providers; however, the i-mode system began to unravel as users increasingly visited "off-portal" services (accounting for some 60% of usage in 2004). Compared to i-mode, there were few additional services available for FOMA subscribers. In the absence of a compelling value proposition (i.e., a "killer-app"), i-mode users had little incentive to upgrade to FOMA, except for those heavy users who were attracted by the price. The FOMA handsets featured video telephony; however, that was of little value to most users.

One competitor, KDDI, fought back by launching viable music services. KDDI's Lismo service has had more full-track downloads than Apple's i-Tunes in Japan. A focus on music and on GPS navigation services, coupled with flat-rate bucket plans, helped to overcome user switching inertia and to contribute to KDDI's success.

The FOMA network also had performance problems. The FOMA network employed W-CDMA, which was not backwards compatible with the PDC-based i-mode network. This forced NTT DoCoMo to support two networks simultaneously. FOMA and i-mode users were thus in competition for network resources, particularly for radio spectrum. Moreover, the launch of FOMA service occurred only in a limited geographic area, cov-

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41 Carter Kenneth R./ Katz, Richard M./ Pitt, William/ Van Rossen, John, (2003): NTT DoCoMo, USA: Can It Bring the Wireless Internet to America?, *Chazen Web J. of Intl. Bus.*, Issue II.

ering only the Tokyo metropolitan area for several months when it was expanded to include Osaka.

NTT DoCoMo did not offer a dual-mode handset, so FOMA users could only connect in these limited areas. In addition to not being supported on the nationwide network, FOMA handsets were large, expensive, "uncool", and suffered from poor battery life. FOMA handsets had to be recharged after a typical day of use, while i-mode handsets could go as long as a week between charges.

By contrast, KDDI's launch of CDMA1x in 2003 relied on the same base stations that were already deployed, and required only software upgrades and new handsets.

NTT DoCoMo achieved a good balance with respect to i-mode's openness to content and applications, and initially enjoyed a commanding market share; however, it did not control any durable bottlenecks. Less-than-ideal choices as regards applications, network architecture, and handsets, in the presence of low switching costs, enabled competitors to challenge its initially seemingly unassailable position.

DoCoMo's original limitation of end-user access to applications affiliated with DoCoMo should be viewed as a vertical issue, a form of foreclosure. This Network Neutrality issue was solved not by regulation, but rather by competition constraining the firm's market power with respect to its customers.

3.3 Extraction/extortion of payments from third parties

In this section, we consider two instances (one in Europe, the other in the US) where network operators expressed the desire to charge third party providers of content for accessing the network operator's customers. This represents an example of a diagonal Network Neutrality issue, inasmuch as the content provider was not itself necessarily a customer of the network operator.

In neither case did the network operator actually attempt to interfere with content delivery.

3.3.1 BBC iPlayer

The case of BBC's iPlayer stands as an example of the trade-offs that ISPs face in terms of whether to expand existing capacity or to discriminate against certain types of traffic.[42] The case also raises both horizontal and diagonal issues.

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42 e.g. by prioritizing or blocking.

This case suggests that the market can resolve disputes suitably under appropriate conditions. In this case, it would likely have been unprofitable for network operators to have attempted to limit access to iPlayer content. Network operators in the UK probably lack the market power that they would have needed to make such a strategy effective. It is also likely that end-users value the BBC iPlayer content highly.

In 2007, BBC launched its online video streaming and download service iPlayer. Subscribers are able to view programmes from the past seven days free of charge by playing them directly on the BBC iPlayer website or by downloading them to their computer. This service offers high quality video, and is designed for watching programmes in their entirety rather than the consumption of small vignettes. The iPlayer uses peer-to-peer networking to avoid download bottlenecks at peak times. The service is limited to people in the UK, and is funded by the £135.50 annual licence fee that each television owner pays to support the majority of BBC activities.[43] Consequently, the iPlayer business model does not rely on advertising for support. Due to heavy promotion on its TV channels and zero incremental price, BBC's iPlayer rapidly became UK's most popular Internet player shortly after its introduction in December 2007.**44** Usage data from the ISP Plusnet quickly revealed changes in consumers' usage caused by the iPlayer.

> "In December 177,093 customers had usage in streaming, using a total of 31,859GB or a mean of 180MB per customer for the month. This was likely reduced from November because of Christmas. However, in January 181,108 customers had usage in streaming, with a total of 52,970GB or a mean of 292MB per customer for the month. That's a total increase of 66% in January against December, 60% against November. Per customer the increase is 62% up in January against December and 54% up against November."**45**

Moreover, Plusnet's data refer to large increases in streaming costs. According to their analysis, costs of carrying streaming traffic increased from £17,233 to £51,700 per month, or to 18,3 p/user (British pence per user) from 6,1 p/user in the first month after the service had been launched.**46**

In its market impact assessment**47**, Ofcom also tried to calculate additional costs for broadband capacity in connection with the iPlayer. Ofcom assumed that the average

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43 See Telco 2.0 (2008): BBC's iPlayer nukes "all you can eat" ISP business model, at http://www.telco2.net/blog/2008/02/bbcs_iplayer_nukes_all_you_can.html.

44 See Palmer, Maija (2007): ISPs warn BBC over new iPlayer service, *Financial Times,* at http://www.ft.com/cms/s/0/f3428cd4-48fb-11dc-b326-0000779fd2ac.html?nclick_check=1.

45 See Tomlinson, Dave (2008): iPlayer Usage Effect - A Bandwidth Explosion, *PlusNet,* at http://community.plus.net/blog/2008/02/08/iplayer-usage-effect-a-bandwidth-explosion/.

46 See Telco 2.0 (2008): BBC's iPlayer nukes "all you can eat" ISP business model, at http://www.telco2.net/blog/2008/02/bbcs_iplayer_nukes_all_you_can.html.

47 See Ofcom (2006): BBC's new on-demand proposals: Market impact assessment, London, 23 January 2006, electronically available under http://www.ofcom.org.uk/research/tv/bbcmias/ondemand/bbc_ondemand/bbc_ondemand.pdf.

broadband customer, using these services would involve downloading an additional 3GB of data per month. The costs of the broadband capacity required to support the services could in aggregate be between £399 million and £831 million over the next 5 years. However, Ofcom acknowledged that:

- broadband connection speeds and download caps are likely to continue rising in the years ahead;
- new technological solutions are likely to reduce the costs of incremental capacity over time; and
- to the extent that additional capacity would be available for use by a wide range of other services, it would not be appropriate to attribute the associated costs to the BBC services in isolation.[48]

Several ISPs including Tiscali, BT and Carphone Warehouse expressed concerns, that BBC's iPlayer application might put too much demand for capacity on their networks. Mary Turner, chief executive of Tiscali UK said to the Financial Times:

> "We have been improving our capacity, but the bandwidth we have is not infinite.(…) If the iPlayer really takes off, consumers accessing the internet will get very slow service and will call their ISPs to complain. (…)"[49]

UK's ISPs have not yet come to a common position on the iPlayer. Tiscali started a debate on charging content providers for the transport of their services, but other major ISPs seem less concerned with this issue.[50] In the same interview, Turner further stated that unless they could agree with the BBC to share network costs, Tiscali would restrict users' access to the iPlayer. In fact, Tiscali and some UK ISPs acknowledge the use of "traffic shaping"[51] techniques to manage network traffic by giving lower priority to users who download large music, video or games files at peak times.[52]

In December 2007, BBC presented a compromise under the codename *Project Cheetah*.[53] Anthony Rose, the BBC's head of digital media technologies said:

> We want to innovate in online distribution, as consumers increasingly get their video online. We are looking at a number of ways to get the

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48 *Ibid*, p. 6.
49 Palmer, Maija (2007): ISPs warn BBC over new iPlayer service, *Financial Times,* at http://www.ft.com/cms/s/0/f3428cd4-48fb-11dc-b326-0000779fd2ac.html?nclick_check=1.
50 See Ferguson, Tim (2008): Online TV blamed for choking broadband networks, *ZDNet,* at http://news.zdnet.co.uk/communications/0,1000000085,39292468,00.htm?r=4.
51 Traffic shaping slows access to services but does not interrupt them.
52 See *Ibid*.
53 See Garside, Juliette (2007): Broadband firms want BBC to share iPlayer costs, *The Telegraph*, at http://www.telegraph.co.uk/money/main.jhtml?xml=/money/2007/12/23/cnbbc123.xml.

> best experience possible for audiences, which work both for the ISPs and us, and are looking at a limited technical trial with some ISPs.[54]

BBC plans to place about 200 servers at various points in the BT network, including locations at local telephone exchanges. These servers, or caches, will store the most popular iPlayer programmes in a place physically close to the viewers. By building its own transmission network, the BBC can bypass existing network bottlenecks; however, some argue that in order to cover the cost of serving up video to 80% of the population, 2,000 caches would need to be installed in local exchanges.[55] Consequently, representatives of ISPs sound a little sceptical: "The fear is if we signed up to something like this, the BBC would say 'the deal has been done, everything has been sorted'. This doesn't address where the pain really is."[56]

3.3.2 AT&T's desire to extract payments in the US

Perhaps the most disquieting concern presented by the Network Neutrality along diagonal lines (using the taxonomy presented in Section 2.3) – in particular, the risk that a network operator might somehow attempt to extract rents from content or application providers with which it does not even have a direct commercial relationship.

Perhaps the best known example of such a threat is the now-famous quote given by the Chief Executive Officer (CEO) of SBC (now AT&T), Ed Whitacre:

> Now what [Google, MSN, Vonage, and others] would like to do is use my pipes free, but I ain't going to let them do that because we have spent this capital and we have to have a return on it. So there's going to have to be some mechanism for these people who use these pipes to pay for the portion they're using. Why should they be allowed to use my pipes?
>
> The Internet can't be free in that sense, because we and the cable companies have made an investment and for a Google or Yahoo! or Vonage or anybody to expect to use these pipes [for] free is nuts![57]

This statement has widely been interpreted as a thinly veiled threat to degrade quality of service for content and application providers who refuse to pay a supracompetitive premium to the network operator. Note that we are not necessarily talking about the content or application provider's network operator; rather, we are talking about a net-

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54 *Ibid*.
55 See *Ibid*.
56 *Ibid*.
57 O'Connell, Patricia (2005): At SBC, It's All About "Scale and Scope", BusinessWeek Online, at http://www.businessweek.com/@@n34h*IUQu7KtOwgA/magazine/content/05_45/b3958092.htm.

work operator serving the end-user – a network operator that does not necessarily even have a direct commercial relationship with the content or application provider.

It is true that a content provider does not pay AT&T directly to send traffic to an AT&T subscriber (or to receive traffic from an AT&T subscriber), unless the content provider is itself an AT&T customer; however, the notion that the content provider wants to use AT&T's "pipes" for free is dubious at best. If the content is available in the first place, then the content provider has presumably paid some Internet Service Provider (possibly but not necessarily AT&T) to make it available on the Internet. For a large company like Google or Yahoo, the fees to carry their traffic can run into quite substantial sums. If AT&T is carrying that traffic, it means that some AT&T customer, who is presumably paying for his or her connection, wanted to see it. The content provider is paying to have its traffic delivered, and the AT&T customer is paying to receive the traffic. It is nonsense to suggest that an additional cost is somehow being imposed on AT&T from outside.

Mr. Whitacre's comment could perhaps be read instead as a complaint that his network is being burdened by interconnection traffic that it must carry for free; however, an argument along these lines would also be dubious. IP-based networks interconnect to exchange traffic using a variety of arrangements, the most common of which are peering and transit. Peering is often, but not always, without charge – if there are traffic or cost asymmetries, networks can and do reach negotiated arrangements to compensate one another.[58] Once again, there is no reason to view this as a problem of free riding.

Would payments such as those that Mr. Whitacre proposes be good or bad for overall welfare? In an effectively competitive environment, they would probably be either harmless or welfare-enhancing. In a re-monopolised environment, however, the payments would probably harm overall welfare.[59]

If one views the Internet, and the applications and content that run over it, as a two-sided market, then the Whitacre argument takes on a different meaning. In free-to-air television broadcast, for instance, the payments come indirectly from advertisers, but not generally from television viewers. If Mr. Whitacre's remarks are interpreted as a call to shift more of the economic burden to the other side of the two-sided market, they become slightly more intelligible. Laffont et. al analysed the effects of possible access fees on Internet interconnection, and found that the level of access fees was generally neutral overall but that higher access fees would tend to place more burden on traffic

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58 See Marcus, J. Scott / Elixmann, Dieter / Carter, Kenneth R. (2008): The Future of IP Interconnection: Technical, Economic, and Public Policy Aspects, *European Commission*, at: http://ec.europa.eu/information_society/policy/ecomm/doc/library/ext_studies/future_ip_intercon/ip_intercon_study_final.pdf. See also Clark, Dave / Lehr, Bill / Bauer, Steve / Faratin, Peyman / Sami, Rahul / Wroclawski, John (2006): Overlay Networks and the Future of the Internet *Communications & Strategies,* No. 63, 3rd quarter 2006, pp. 109-129.

59 See Economides, Nicholas / Tåg, Joacim (November 2007): Net Neutrality on the Internet: A Two-sided Market Analysis.

generators ("websites") and less on consumers ("eyeballs").[60] Such a system could be rational; however, the system analysed in Laffont et al. would reflect payments between network operators based on the traffic carried, which seems to be quite different from what Mr. Whitacre suggested.

It is worth noting that this is not the first time that Internet providers have attempted to extract payments from third parties. It was occasionally attempted in the mid-nineties. In the past, content providers simply ignored such demands – they knew that end-users seeking to access their services would resent network operators that blocked access, and that enough end-users would change network operators to make such a strategy unprofitable for the network operator. That the issue is re-emerging today indicates, once again, that underlying broadband competition in the U.S. has eroded to the point where content providers and end-users are no longer convinced that competition is sufficient to inhibit anticompetitive conduct on the part of network operators. The real culprit is not the structure of payments, but rather the decline in effective competition for last mile fixed broadband Internet access in the United States.

The Whitacre comments have been viewed by many as a potential assault on media pluralism and free speech. Spurred by the fear that a broadband service provider might serve as an effective gatekeeper over what people can see and hear, partisan organisations have been driven into the arms of organisations to which they are normally opposed on other issues.[61]

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60 Laffont, Jean-Jacques/ Marcus, J. Scott/ Rey, Patrick/ Tirole, Jean (2003): Internet Interconnection and the Off-Net-Cost Pricing Principle, in: *RAND Journal of Economics*, Vol. 34, pp. 370-390, at http://www.rje.org/abstracts/abstracts/2003/rje.sum03.Laffont.pdf. An earlier version of the paper appeared as "Internet Peering", American Economics Review, Volume 91, Number 2, May 2001.

61 For example, the *Save the Internet* coalition has brought together the right wing organisations such as the Christian Coalition of America and the Gun Owners of America, with the left wing organisations such as MoveOn.org, U.S. PIRG (federation of public interest research groups), the Service Employees International Union and the Progressive Democrats of America. These organisations have wildly different policy goals, but they support Network Neutrality regulation because they are afraid of restrictions on their ability to express their respective views. See Babington, Charles (2007): Neutrality On the Net Gets High '08 Profile Tech Issue Gains Traction in Election, *Washington Post*, at http://www.washingtonpost.com/wp-dyn/content/article/2007/02/19/AR2007021900934.html. See also, http://www.savetheinternet.com/=coalition.

4 Differences between the U.S. and the European Union

In the context of Network Neutrality, the U.S is very different from the European Union in terms of both market conditions and of the regulatory (and competition law) environment. The following sections compare the markets, the regulatory environment, and the competition law environment, respectively.

4.1 Market conditions

The competitiveness of underlying markets, especially the marketplace for last mile fixed broadband Internet access, is critical to the Network Neutrality issue.

In the mid-nineties, Internet access in the U.S. and in the EU was primarily accomplished by means of dial-up and leased lines. Facilities-based network operators in the U.S. were required to make their facilities available to competitors on terms no less favourable than those on which they self-supplied the same capabilities, and competitors made extensive use of those facilities. At one point, there were more than 7,000 Internet Service Providers (ISPs) in the U.S.[62] The marketplace for Internet access in the U.S. was felt to be highly competitive, and there was little concern about deviations from Network Neutrality.

The growth of broadband Internet access, coupled with the collapse of the dot-com bubble and a series of deregulatory regulatory decisions, changed all of this.[63] The FCC withdrew obligations that had previously applied to telecommunications network operators to make their broadband facilities available to competitors at wholesale (with the notable exception of copper loops). This had the predictable effect of forcing most competitive operators to exit the market; alternatively, a few of the largest (including the former AT&T and WorldCom) were acquired by incumbents. Today, not more than 3.1% of all DSL lines are provided by competitive operators (CLECs), and this percentage continues to decline over time.[64]

This is not to say that there is no competition whatsoever. A majority of those U.S. consumers who subscribe to broadband services depend on cable television. Across the U.S., there are many cable companies. There are also many telephone companies, although a substantial majority of subscribers get their fixed telephony services from just three network operators. What this means in practice is that most Americans are

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62 *Boardwatch* magazine.

63 For a more extensive explanation of these changes, see Marcus, J. Scott (2005): Is the U.S. Dancing to a Different Drummer?, *Communications &Strategies,* No. 60, pp. 1-18 at: http://www.idate.fr/fic/revue_telech/132/CS60%20MARCUS.pdf. Also available in *intermedia* (the journal of the International Institute of Communications), vol. 34, no.3, July/August 2006.

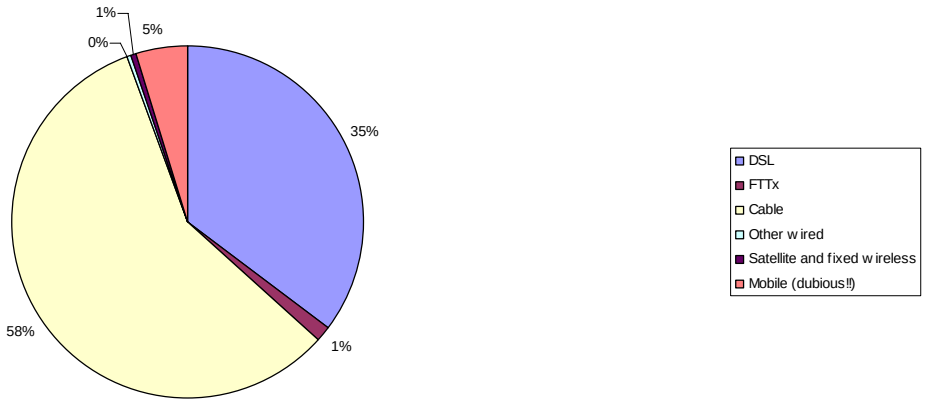
64 Based on the latest available FCC data, and corresponding to June 30, 2007. See http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-08-88A1.pdf.

effectively subject to a duopoly of broadband service provision – they can choose between one cable company and one telephone company, as shown in Figure 7 following.

There tends to be much debate about what is and is not reflected in these FCC statistics. A few facts are worth noting: (1) the FCC uses various definitions of broadband, some of which nobody other than the FCC would consider to be broadband (for example, services that are less than 200 Kbps in the slower direction); (2) high speed Internet access is available across the U.S. using a range of technologies such as satellite, but few people subscribe to them for reasons of cost and scalability; (3) the FCC data do not systematically track licence-exempt solutions such as Wi-Fi, but a hot spot (at, say, a Starbucks coffee shop) does not realistically replace a fixed broadband access at home; and (4) it is unclear what mobile broadband services the FCC is counting, but most of them are probably most appropriately viewed as economic *complements* to wired broadband rather than as economic *substitutes* – they do not *replace* a fixed broadband connection.

Figure 7: U.S. residential broadband (FCC data, December 2006)

US Residential Broadband
(at least 200Kbps both directions, December 2006)

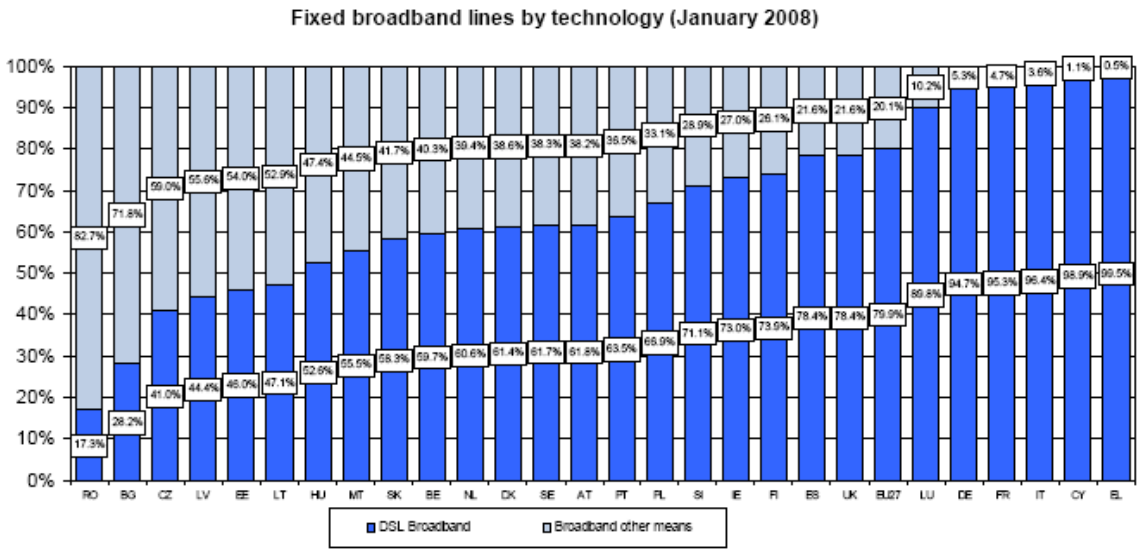


Taking all of this into account, it is appropriate to regard the U.S. broadband marketplace as a series of non-geographically-overlapping cable/telecoms duopolies. *Real* consumer choice is limited.

The European environment is strikingly different. First, there is far less presence of cable television across Europe as a whole; however, the situation is highly varied from one Member State to the next, as shown in Figure 8. Countries like the Netherlands,

Belgium, Denmark, Austria, Hungary, Romania and Switzerland have quite substantial cable television presence, and substantial broadband Internet access over cable. France has very little cable (but nonetheless gets good competitive results as a result of intensive regulation). Italy has no cable to speak of. Germany has very extensive cable television, and adoption of broadband access over cable is increasing rapidly; however, adoption to date is still quite limited in Germany.[65]

Figure 8: Total fixed broadband retail lines in Europe by technology, January 2008[66]



Much of Europe thus lacks a “second wire to the home”; nonetheless, overall competition is much more robust than in the United States. Averaged across Europe, more than 40% of DSL lines are provided at retail by third parties, although the results vary substantially from one Member State to the next, as is shown in Figure 9.

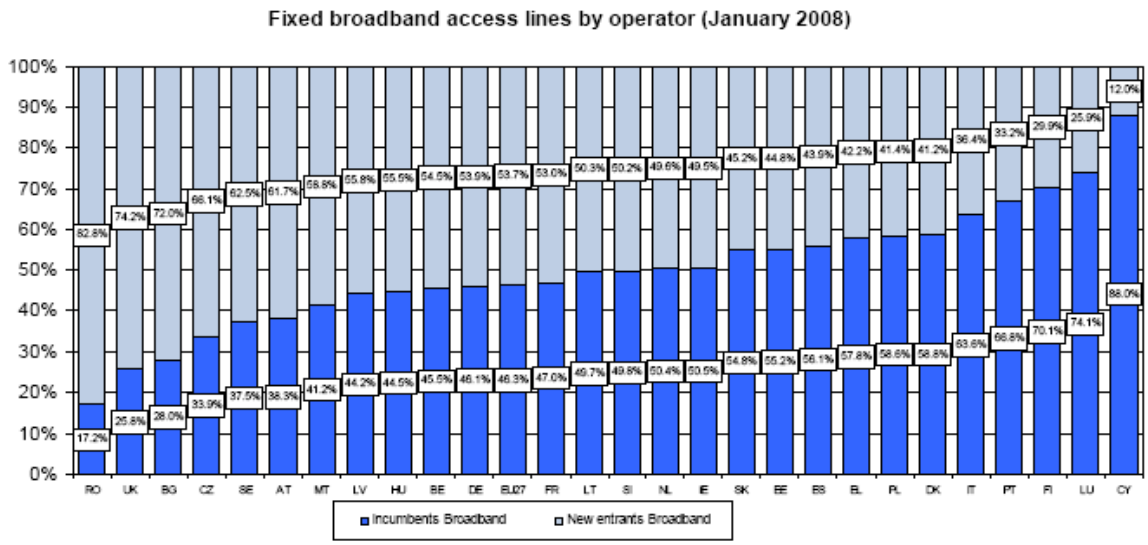
In terms of Network Neutrality, competitive broadband based on wholesale alternatives (bitstream access, shared access or LLU) represent meaningful competition as long as the incumbent is prevented (by technical, regulatory or contractual means) from adversely impacting the quality of the service that the competitor offers to its end-user.

65 See Marcus, J. Scott / Stamm, Peter (2006): Kabelinternet in Deutschland, at: http://www.deutscherkabelverband.de/web/cms/upload/pdf/06-12-14_Studie_Kabelinternet_in_Deutschland.pdf.

66 European Commission, *13th Implementation Report*, Annex 2, page 98. Note that “other means” includes cable television but is not limited to it.

As a practical matter, this means that *most Americans have at most two meaningful alternative providers of broadband Internet access; most Europeans have more than two viable alternative providers of broadband Internet access.*

Figure 9: European market share of fixed broadband access lines by operator (incumbent vs competitor) (January 2008)[67]



4.2 Mobile market

The mobile marketplace is also substantially different. The European 2G mobile market is overwhelmingly GSM; in the U.S., about 45% of the mobile market is GSM, with the rest being CDMA, iDEN, or other alternatives. This implies that the U.S. market has less economies of scale than the European (but still substantial economies of scale). It also means that a majority of U.S. handsets do not have SIMs, and thus are truly locked to a single service provider.[68]

At the same time, U.S. wholesale arrangements are more efficient than those in Europe, and result in retail prices that are much closer to cost than those in Europe. This means that handset subsidies are much lower in the U.S. than in Europe (service providers are not motivated to provide large initial incentives).[69]

67 *bid*.
68 Those that have SIMs are generally SIM-locked by default.
69 Littlechild, Stephen C. (2006) Mobile Termination Charges: Calling Party Pays versus Receiving Party Pays, in: *Telecommunications Policy*, Vol. 30, p. 242-277.

The higher subsidies in Europe, coupled with the presence of SIMs, collectively imply that European customers have more economic means but less technical means than their U.S. counterparts to restrict the options of their customers. A number of European mobile operators have suggested that their customers already have most if not all of the freedoms that are being sought as mobile Network Neutrality in the U.S.

4.3 The regulatory milieu

In both Europe and in the United States, a key regulatory philosophy has historically been to regulate only where necessary to address market power. In the EU, the adoption of economic tests based on competition law, coupled with the institutional separation of powers between the European Commission and the Member State National Regulatory Authorities (NRAs), have helped to enforce independent, objective decision-making.

The core of the European Framework for electronic communications is established in the Framework Directive 2002/21, Articles 14–16. As European regulatory philosophy in telecommunications is explicitly technologically neutral,[70] no distinction is drawn between different technology platforms. The aim is not to impose, nor to discriminate in favour of, the use of a particular type of technology; rather, it is to ensure that equivalent services are regulated in an equivalent manner (if regulation is required at all), irrespective of the means by which they are delivered.

Market regulation takes place in a three-stage process: (1) market definition, (2) market analysis, and (3) imposition (where needed) of remedies.[71] If a market is not effectively competitive, sector-specific regulatory obligations have to be imposed by NRAs, which have the discretion to choose between measures such as transparency, non-discrimination, accounting separation, access and access price control, cost accounting, and retail price regulation.[72]

If markets are found to be effectively competitive (based on the absence of *significant market power (SMP)*)[73], existing SMP remedies have to be removed. Articles 14–16 of the *Framework Directive* can be interpreted as representing a transition from traditional regulation to regime based on competition law.[74] Wholesale markets for broadband are

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70 Framework Directive 2002/21 EC, Consideration No. 18.

71 See, e.g., Picot, A./ Wernick, C. (2005): Wettbewerbsregulierung in der Telekommunikation gemäß EU-Richtlinien und TKG, in: Wirtschaftsinformatik, Vol. 47, S. 222-225 for a more detailed discussion.

72 See Cave, M. E. (2004): Economic aspects of the new regulatory regime for electronic communications services, i:n P.-A. Buigues, & P. Rey (Eds.): The economics of antitrust and regulation in telecommunications: Perspectives for the new European regulatory framework (pp. 27–44). Cheltenham, Northampton, MA: Edward Elgar.

73 Framework Directive 2002/21, Article 14.

74 See Klotz, R. (2003): Die neuen EU-Richtlinien über elektronische Kommunikation: Annäherung der sektorspezifischen Regulierung an das allgemeine Kartellrecht. Kommunikation & Recht (K&R)(Supplement 1/2003).

targeted by the Commission's recommendation on relevant markets[75] and therefore must be analysed by NRAs. In most Member States, incumbent operators have been found to possess SMP on the wholesale broadband market and are therefore subject to one or more of the aforementioned SMP remedies. [76]

These SMP-based regulatory prerogatives are complemented by a number of other regulatory powers. European NRAs also have substantial ability to protect the rights of consumers, for example by requiring network operators to disclose deviations from Network Neutrality either online or in their contracts with end-users.[77] These consumer protection powers are particularly important, in that they potentially enable NRAs to ensure *informed consumer choice*.

In the United States, by contrast, the FCC has effectively abandoned its historic pro-competitive regulatory philosophy in favour of a deregulatory stance that is in effect pro-incumbent.[78] U.S. regulators no longer have explicit power to regulate broadband Internet service, in general. The FCC rulings of the past few years have placed broadband Internet access into the category of an unregulated *information service*.

In the Comcast ruling (see Section 5.4), the FCC announced its intention to deal with violations of Network Neutrality through case-by-case adjudications. This process will likely prove to be problematic, inasmuch as it leaves the FCC adjudicating cases with no underlying rules (and in an environment where the composition of the FCC itself will be shifting over time).

The FCC could conceivably impose Network Neutrality regulation if it chose to by resorting to its raw jurisdictional authority over electronic communications, as expressed in Title I of the Communications Act, thus crafting entirely new rules "out of whole cloth", as it were; this cure, however, might well be worse than the current disease.

The incoming Obama administration has expressed its commitment to Network Neutrality.[79] It is not yet clear how this could be implemented. It is possible that the Congress would have to enact new law.

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75 See EU-Commission (2007b): Commission Recommendation of 17 December 2007 on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services, 2007/879/EC, L 344/65, Brussels, at http://eur-lex.europa.eu/LexUriServ/site/en/oj/2007/l_344/l_34420071228en00650069.pdf.

76 For an overview on notifications and decisions, see Community Consultation Procedures, at http://ec.europa.eu/information_society/policy/ecomm/implementation_enforcement/article_7/index_en.htm.

77 *Universal Service Directive*, Articles 20 and 22.

78 Marcus, J. Scott (2005): Is the U.S. Dancing to a Different Drummer? in: *Communications &Strategies,* Vol. 60, pp. 1-18, at: http://www.idate.fr/fic/revue_telech/132/CS60%20MARCUS.pdf. Also available in *intermedia* (the journal of the International Institute of Communications), vol. 34, no.3, July/August 2006.

79 Per the website of the Obama-Biden Transition Team, part of the Obama-Biden plan is: "Protect the Openness of the Internet: Support the principle of Network Neutrality to preserve the benefits of open competition on the Internet." See http://change.gov/agenda/technology_agenda/.

4.4 Competition law

In Europe, competition law is viewed as an after-the-fact (*ex post*) complement to the application of anticipatory (*ex ante*) application of electronic communications regulation. To the extent that competition law addresses market failures such as tying, it provides a sophisticated alternative to regulation.

Many U.S.-based colleagues harbour the assumption that European competition law is utterly different from that of the United States. This is partly true, and partly false. A comparison of horizontal merger guidelines between the U.S. and the EU demonstrates that the two systems are in principle nearly identical.[80] There are some differences in emphasis, but the largest overall difference is in the degree to which competition authorities adhere to their own nominal guidelines.

In the area of electronic communications, however, there are substantive practical differences. A series of court rulings in the U.S.[81] have taken the position that matters covered by the Communications Act[82] do not constitute a separate cause of action under antitrust (competition) law. In practice, the applicability (not just the application) of regulation in the U.S. is thus for the most part *mutually exclusive with the application of competition law*.

80 Compare U.S. Department of Justice and Federal Trade Commission, *Horizontal Merger Guidelines*, 57 Fed. Reg. 41557 (April 2, 1992, as revised April 8, 1997), available at http://www.ftc.gov/bc/docs/horizmer.htm, to European Commission (February 2004), *Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings* (2004/C 31/03).

81 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).

82 The US Communications Act of 1934, as amended.

5 Current and future remedies

This section addresses the regulatory approaches which may be applicable to solving issues of Network Neutrality. We discuss actions taken and measure available to regulators in the United States and in the European Union. This section is organized according to type of action, and not geographically.

5.1 Non-discrimination obligations

The 2002 framework contains no explicit mention of Network Neutrality. Rather, the framework relies on the benefits of competition with its self-correcting functions. It builds on the idea that any customer should have the choice of different operators. If one supplier seeks to restrict user rights, customers will be able to switch to an alternative provider. This is meant to represent a strong incentive for operators to satisfy the needs of consumers or to risk being penalized by the market.

The current framework explicitly allows operators to offer different services to different customer groups, since price discrimination is perceived as welfare enhancing. It does not allow those who are in a dominant position to *discriminate against others* in an anti-competitive manner; however, it does not provide NRAs with the means to intervene against operators which are not deemed to have SMP in the event that they discriminate against others.

Non-discrimination as a remedy is established in Article 10 of the Access Directive:

> "1. A national regulatory authority may, in accordance with the provisions of Article 8, impose obligations of non-discrimination, in relation to interconnection and/or access.
>
> 2. Obligations of non-discrimination shall ensure, in particular, that the operator applies equivalent conditions in equivalent circumstances to other undertakings providing equivalent services, and provides services and information to others under the same conditions and of the same quality as it provides for its own services, or those of it subsidiaries or partners."

Non-discrimination is primarily relevant to cases of an operator with SMP which is vertically integrated into a competitive market, and the obligation is said to be needed to prevent exclusionary behaviour by this firm, through the foreclosure of competition in the upstream and downstream market.[83]

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83 See See Cave, M. E. (2004): Economic aspects of the new regulatory regime for electronic communications services, in P.-A. Buigues, & P. Rey (Eds.): The economics of antitrust and regulation in telecommunications: Perspectives for the new European regulatory framework (pp. 27–44). Cheltenham, Northampton, MA: Edward Elgar.

Usually, non-discrimination is a matter that could also be adequately dealt with under competition law, on the basis that such behaviour would be a clear and foreseeable breach of Article 82 EC, for which significant case law exists. However, NRAs may be confronted with more subtle departures due to the specific characteristics of the communications industry, i.e. high fixed costs and economies of scale.

Consequently, NRAs have the ability to impose *ex ante* obligations on operators possessing SMP so as to avoid distortions to competition, in particular where there are vertically integrated undertakings that supply services to undertakings with whom they compete on downstream markets.

5.2 The FCC Computer Inquiries

In a series of proceedings during the 1960s, 1970s, and 1980s, the US FCC dealt with many of the issues presented in the Network Neutrality debate. The FCC initiated a proceeding, later known as *Computer I*, to address the question of whether and how to regulate access to computer-based networks. In *Computer I*, the FCC was concerned that the incumbent telephone monopoly might discriminate unfairly against other enhanced service providers, or might unfairly cross-subsidize their (presumably unregulated) enhanced services from their monopoly regulated services. The decision thus focused on whether the service in question was a communications service or a data processing service. Data processing services were left unregulated. Unfortunately, this approach created great confusion for services that contained both communications and data processing.

In its *Computer II* proceeding, the FCC sought to clarify the distinction between communications and data processing services. The Computer I decision had inadvertently created a deluge of case by case determinations as to whether a hybrid service was to be regulated or not. Thus, the FCC created the distinction between *basic services*, which involve pure transmission of data, versus *enhanced services* where information is transformed, processed and/or stored. Computer II also recognized that microcomputers were becoming widely available and were being connected to the ends of telephone lines. “The new technology may also have rendered meaningless any real distinction between ‘terminals’ and computers.”[84] In order to ensure fair access for these devices, the FCC required full separation between AT&T’s enhanced service operations and its local exchange operations. This required the establishment of separate subsidiaries with separate employees and accounts within the 7 Regional Bell Operation Companies (RBOCs), subsequent to the AT&T Divestiture in 1984. These subsidiaries could obtain transmission facilities from the RBOCs which owned them on the same terms which the RBOCs offered to non-affiliated providers.

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84 Amendments of Section 64.702 of the Commission’s Rules and Regs. (Computer Inquiry), Supplemental Notice of Inquiry and Enlargement of Proposed Rulemaking, 64 F.C.C.2d 771 (1977).

These separation requirements kept the RBOCs market power at bay, but did so at the cost of the loss of certain economic efficiencies afforded by vertical integration. The FCC felt the requirements limited "the ability of AT&T and the BOCS to make unfair use of their regulated operations for the benefit of their unregulated, enhanced services activities."[85] In *Computer III*, the FCC abandoned its structural separation requirements and instead allowed RBOCs the ability to adhere to non-structural requirements. The non-structrural requirements included:

1. Accounting rules to allocate cost between basic and enhanced services;
2. Rules to protect customer information;
3. Conditions for handling the information regarding technical changes to the basic network;
4. Implementation of Open Network Architecture arrangements (setting out unbundled pricing for basic network features of enhanced services); and
5. Mandatory filing of non-discrimination reports.

5.3 Broadband policy statement

In August of 2005, the US FCC adopted a Broadband Policy Statement.[86] This statement does not have the enforceable weight of a Commission rule, but the Commission committed to incorporating these principles into future policymaking. The policy principles in the Statement were intended to "ensure that broadband networks are widely deployed, open, affordable, and accessible to all consumers." The Statement further set out four entitlements for consumers which it felt necessary to further this goal:

- consumers are entitled to access the lawful Internet content of their choice;
- consumers are entitled to run applications and use services of their choice, subject to the needs of law enforcement;

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85 Amendment of Sections 64.702 of the Commission's Rules and Regs. (Third Computer Inquiry), Report and Order, CC Docket No 85-229, 104 F.C.C.2d 958, 60 Rad. Reg.2d 603 at ¶ 3 (1986).

86 Policy Statement, *In the Matters of: Appropriate Framework for Broadband Access to the Internet over Wireline Facilities; Review of Regulatory Requirements for Incumbent LEC Broadband Telecommunications Services; Computer III Further Remand Proceedings: Bell Operating Company Provision of Enhanced Services; 1998 Biennial Regulatory Review – Review of Computer III and ONA Safeguards and Requirements; Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities; Internet Over Cable Declaratory Ruling; and Appropriate Regulatory Treatment for Broadband Access to the Internet Over Cable Facilities*, CC Docket No. 02-33; CC Docket No. 01-337; CC Docket Nos. 95-20, 98-10; GN Docket No. 00-185; CS Docket No. 02-52 (adopted: August 5, 2005; released: September 23, 2005) 20 FCC Rcd at 14988.
http://fjallfoss.fcc.gov/edocs_public/attachmatch/FCC-05-151A1.pdf ("Broadband Policy Statement").

- consumers are entitled to connect their choice of legal devices that do not harm the network; and

- consumers are entitled to competition among network providers, application and service providers, and content providers.

In a footnote, the FCC offered the caveat that, "all of these principles are subject to reasonable network management." This caveat is important for the Network Neutrality debate, inasmuch as traffic shaping (for instance) could under suitably circumstances be viewed as a form or network management.[87]

The Comcast decision (see Section 5.4) can be viewed as an enforcement of the Broadband Policy Statement; nonetheless, the Comcast decision leaves many questions unanswered. Given the broad and sweeping nature of the principles expressed in the Broadband Policy Statement, in conjunction with the lack of specific detailed rules, it is by no means clear what exactly could be enforced under the Broadband Policy Statement.

5.4 FCC's Order Regarding Comcast's Treatment of Peer to Peer Traffic

On 1 November 2007, Free Press, a public-interest organization calling for media reform, filed a complaint with the US FCC[88] against Comcast. In this complaint, Free Press asked the FCC to declare "that an Internet service provider violates the FCC's Internet Policy Statement when it intentionally degrades a targeted Internet application."[89] According to the complaint, Comcast was actively interfering with its subscribers' use of the Internet when they attempted to transfer a file to another Internet user through the peer-to-peer file sharing applications BitTorrent. (See Section 3.2.2 for background on Comcast's alleged conduct.) Free Press also filed a petition for declaratory ruling asking the Commission to "clarify that an Internet service provider violates the FCC's Internet Policy Statement when it intentionally degrades a targeted Internet application."[90] Separately, Vuze, Inc. filed a petition for rulemaking asking the Commission "to adopt reasonable rules that would prevent the network operators from engaging

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87 The choice of the term "network management" was perhaps unfortunate. Network management has a well-defined meaning to engineers. It is not clear what the Commissioners had in mind with "network management".

88 Formal Complaint of Free Press and Public Knowledge against Comcast Corporation for Secretly Degrading Peer-to-Peer Applications, File No. EB-08-IH-1518 (Nov. 1, 2007) ("Free Press Complaint").

89 Federal Communications Commission, Memorandum Opinion and Order, In the Matters of Formal Complaint of Free Press and Public Knowledge Against Comcast Corporation for Secretly Degrading Peer-to-Peer Applications Broadband Industry Practices Petition of Free Press et al. for Declaratory Ruling that Degrading an Internet Application Violates the FCC's Internet Policy Statement and Does Not Meet an Exception for "Reasonable Network Management, WC Docket No. 07-52, (20 August 20, 2008).

90 Free Press Complaint.

in practices that discriminate against particular Internet applications, content or technologies."[91]

The FCC claimed jurisdiction to enforce "federal policy."[92] The FCC routinely implements Federal policy by means of rulemaking, pursuant to the Administrative Procedures Act (which establishes procedure for all Federal agencies). Originally, the Policy statement was intended to guide the formation of rules. Given an alleged violation of one of its rules, the FCC would have then sought an enforcement action against the perpetrator.

In the Comcast case, the FCC had not first created any rules to enforce. Critics of the FCC's actions in the Comcast Order assert that while the FCC may have jurisdiction to enforce matters relating to TCP/IP-based Internet connections, the basis for those matters must be actionable rules, not broad pronouncements of policy. Instead of drafting rules to implement the FCC's Broadband Policy Statement,[93] the FCC attempted to transform the Policy Statement policy into an enforceable standard through an adjudicatory process.

It is clear enough why the FCC chose this path. It would have been extremely difficult in the best of circumstances to draft a sound, bright-line rule that could distinguish between permissible, welfare-enhancing quality discrimination versus anticompetitive quality discrimination. Had a good rule been drafted, it probably would have nonetheless been impossible to muster a majority of commissioners to vote for it.

In the adjudicatory proceeding, the FCC sought to determine whether Comcast's action were violating consumers' right to "run applications and use services of their choice," and the degree to which Comcast's action might constitute "reasonable network management practices." In addressing the latter concern, the FCC inquired whether Comcast's network management practices were "carefully tailored to its interest in easing network congestion." The FCC found the manner in which Comcast was resetting TCP connection without regard to network traffic load to be unreasonable. The FCC suggested that bandwidth caps and/or charges for excess traffic might have been reasonable. The FCC declined to consider whether Comcast's failure to disclose its practices to subscribers was in violation of FCC policy.

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91 *Broadband Industry Practices*, WC Docket No. 07-52, Petition to Establish Rules Governing Network Management Practices by Broadband Network Operators of Vuze, Inc., at 7 (Nov. 14, 2007) (Vuze Petition).

92 Federal Communications Commission, Memorandum Opinion and Order, In the Matters of Formal Complaint of Free Press and Public Knowledge Against Comcast Corporation for Secretly Degrading Peer-to-Peer Applications Broadband Industry Practices Petition of Free Press et al. for Declaratory Ruling that Degrading an Internet Application Violates the FCC's Internet Policy Statement and Does Not Meet an Exception for "Reasonable Network Management, WC Docket No. 07-52, at para 15 (20 August 20, 2008).

93 See Section 5.3, and the *Broadband Policy Statement.*

Based on its analysis, the FCC found that Comcast was violating its policy and ordered Comcast to:

- precisely disclose to the Commission its network management practices;
- submit a compliance plan with interim benchmarks; and
- disclose to the Commission and to the public the details of its future network management practices.

Finally, the FCC encouraged Free Press as well as the rest of the public at large to help the FCC stay abreast of Comcast's network management practices. Presumably this admonishment applies to other US network operators.

The FCC's approach seems to the authors to have produced an appropriate result in this case, even though many legitimate procedural concerns have been raised. Perhaps this is because the Comcast violation was egregious.

We nonetheless remain unconvinced that an *ad hoc* approach to solving deviations from Network Neutrality is desirable or effective. Case by case adjudications by five politically appointed commissioners, without any underlying rules, are unlikely to result in a steady hand at the rudder. The decisions are too likely to represent the whims of individual commissioners, and to fluctuate as the composition of the five commissioners varies over time.

We do not feel that this procedure represents a useful precedent for Europe.

5.5 AT&T BellSouth merger obligations

In December 2006, after a long delay, the US FCC approved US $85 billion merger between AT&T and BellSouth.[94] The deal made AT&T the largest provider of landlines in the U.S. (and the second largest ISP), with roughly 70 million customers across 22 states. In order to win approval, AT&T consented to certain merger obligations which required it to reduce interconnection charges to competitive local exchange carriers (CLECs), cut prices for broadband service, offer stand alone DSL service, divest some of BellSouth's spectrum and adopt Network Neutrality. Due to the recusal of one of the three Republican Commissioners, the issue of Network Neutrality became a sticking point among the four remaining Commissioners, leading to a 2 to 2 impasse over the deal. The two Democratic Commissioners insisted on Network Neutrality obligations as a prerequisite to the merger. AT&T resisted the conditions, but agreed in the end, and committed to not prioritise Internet traffic in its residential broadband network.

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94 Federal Communications Commission, *In the Matter of AT&T Inc. and BellSouth Corporation Application for Transfer of Control*, Memorandum Opinion and Order, WC Docket No. 06-74 (26 March 2007).

Network Neutrality was one of the major issues holding up the FCC's approval. When the FCC's order approving the merger issued, it required AT&T/Bell South to commit for to, "conduct business in a manner that comports with the principles set forth in the Commission's Policy Statement."[95] Further, the FCC required:

> AT&T/BellSouth also commits that it will maintain a neutral network and neutral routing in its wireline broadband Internet access service. This commitment shall be satisfied by AT&T/BellSouth's agreement not to provide or to sell to Internet content, application, or service providers, including those affiliated with AT&T/BellSouth, any service that privileges, degrades or prioritizes any packet transmitted over AT&T/BellSouth's wireline broadband Internet access service based on its source, ownership or destination.[96]

The commitment does not apply to AT&T/BellSouth's enterprise managed IP services/ Further, fixed (i.e. wireline) broadband Internet access service was defined as being from the network side of the customer premise equipment up to and including the closest Internet Exchange Point where public or private Internet backbone networks freely exchange Internet packets.

The Network Neutrality provision would remain in effect for 30 months after the closing of the merger, or until Congress enacts legislation on the issue. The provision, however, does not apply to backbone network customers, to major enterprise customers, or to AT&T's plans to offer its own branded IPTV service.

In addition to the Network Neutrality principles, AT&T also agreed to offer "naked" broadband access to customers in select service areas at a monthly rate of $19.95. That means that those customers can opt for the broadband service without having to purchase other services bundled in. In other AT&T/BellSouth service areas, it offered a trial-service for as little as $10 a month.

5.6 700 MHz spectrum auction rules

On 20 March 2008, the US FCC concluded an auction for spectrum licenses in the 700 MHz band, which will redistribute the frequencies reclaimed in the transition to digital terrestrial Broadcast television. Full power TV stations are required to cease analogue broadcasting by 17 February 2009, at which point the spectrum will become available. The auction for these spectrum licenses generated 1090 provisionally winning bids for 1091 licenses, at total of US $19.59 billion.

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95 *Ibid* at p. 154.
96 *Ibid*.

What is notable about this auction, beyond the historic reallocation of TV spectrum, is the characteristics of the service rules that the FCC crafted for so-called C Block, one of the 5 blocks of spectrum auctioned. The FCC created special open access provisions in this block of spectrum, comprising 22 MHz in the upper 700 MHz band. Early on in the rulemaking, Google petitioned the FCC to mandate that any spectrum licensees in this block make their services available on a wholesale basis, and to prohibit licensees from using technological measures to block external devices and applications from their networks. The FCC adopted Google's open access request, but not the wholesale obligations. The FCC concluded that these rules were justified because it did not find "that competition in the [mobile] marketplace is ensuring that consumers drive handset and application choices, especially in the emerging wireless broadband market…. it is easy for consumers to differentiate among providers by price, most consumers are unaware when carriers block or degrade applications and of the implications of such actions, thus making it difficult for providers to differentiate themselves on this score."[97] Inherent in this assumption is that the band will evolve to resemble the next generation of the current mobile market in the US; however, the assignment is technology and service neutral, consistent with typical US practice.

Thus, licensees are required to provide a platform that is open to third party devices and applications. Specifically, licensees must allow customers, device manufacturers, third-party application developers, and others to use any device or application of their choice on their networks in this band, subject to certain limited conditions. Licensees may not "lock" handsets to prevent their transfer from one system to another, or to other services that compete with wireless service providers' own offerings. The limitations to these open access requirements still permit the licensee to adopt reasonable network management practices and their own certification standards and processes for devices and applications. Standards for third-party applications or devices may not be more stringent than those that the licensee would apply to its own services. Further, applications and devices cannot be prohibited solely because they are likely to increase demand for bandwidth; however, the licensee may charge for the corresponding increased bandwidth demand.

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97 Federal Communications Commission, *Second Report and Order* Service Rules for the 698-746, 747-762 and 777-792 MHz Bands (WT Docket No. 06-150); Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems (CC Docket No. 94-102); Section 68.4(a) of the Commission's Rules Governing Hearing Aid-Compatible Telephones (WT Docket No. 01-309); Biennial Regulatory Review – Amendment of Parts 1, 22, 24, 27, and 90 to Streamline and Harmonize Various Rules Affecting Wireless Radio Services (WT Docket No. 03-264); Former Nextel Communications, Inc. Upper 700 MHz Guard Band Licenses and Revisions to Part 27 of the Commission's Rules (WT Docket No. 06-169); Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band (PS Docket No. 06-229); Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Communications Requirements Through the Year 2010 (WT Docket No. 96-86); Declaratory Ruling on Reporting Requirement under Commission's Part 1 Anti-Collusion Rule (WT Docket No. 07-166), FCC 07-132 at ¶ 200 (31 July 2007). We observe that there is a finely tuned distinction here which may present legal questions of interpretation down the road. Implicit in the service rules is the assumption that the band will evolve to resemble the next generation of the current mobile market in the US. However, it is possible that some C-Block licensees would deploy fixed wireless broadband networks to compete with wireline incumbents xDSL and cable modem. It would then be unclear as to whether the open access provisions would apply to such networks which do not incorporate handset devices.

5.7 Competition law

As explained in Section 4.4, competition law could serve as an effective remedy to Network Neutrality problems in Europe, but not in the United States.

Competition law is a powerful instrument that operates across all sectors of the economy, not just electronic communications. A limitation, however, is that competition law normally comes into play only after a violation has occurred. Cases can then take years to resolve. Consequently, competition law can be relatively ineffective as a means of safeguarding competitive entry – few competitors have enough staying power to wait for the results.[98] On the other hand, if the fear of action under competition law serves to deter anticompetitive behaviour, that could be enough.

5.8 Technological constraints

The example of Apple's introduction on its iPhone in Germany (see Section 3.1.3) points to the differences throughout Europe with respect to SIM locking regulations and the sale of locked mobile devices when bundled with a long-term contract. These different rules have consequences on cross-border issues. Some customers may realise arbitrage advantages if they purchase un-locked devices in one country and bring them to another country where the same phones are offered SIM-locked only. At the same time, there are instances where customers who legally buy an unlocked mobile phone in a foreign country might face difficulties when they try to use the same mobile phone in their home country with their domestic SIM card. Moreover, the issue of unlocking SIM-locked mobile phones, which is actually a grey zone in many Member States, is difficult or impossible to resolve today in an international context.

From a consumers' point of view, SIM locking is associated with a limitation of end-users' property rights[99], in particular regarding *abusus* (changing the profile of the good). Moreover, the resale value of the good is reduced to the extent that its use is bundled for some period of time with a particular SIM card or network. Therefore it seems necessary to at least inform customers about these limitations. Moreover, it is worth considering whether operators should be obliged to unlock their phones after the contract has finished (which is already offered for free by some operators). Nonetheless, although typical current practices are obviously associated with some loss of consumer welfare, there may not actually be a case for regulation.

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98 Marcus, J. Scott / Haucap, Justus (2005): Why Regulate? Lessons from New Zealand, *IEEE Communications Magazine*, at http://www.comsoc.org/ci1/Public/2005/nov/ (click on "Regulatory and Policy").

99 See, e.g., Coase, Ronald H. (1960): The Problem of Social Costs. *Journal of Law and Economics Vol.* 3, Issue 1, pp. 1-44; Demsetz, Harold (1967): Towards a Theory of Property Rights. The American Economic Review. Vol. 57, Issue 2. May, 1967, 347-359; and Picot, Arnold/ Dietl, Helmut/ Franck, Egon (2005): *Organisation: Eine ökonomische Perspektive*. Stuttgart: Schäffer Poeschel.

From an operators' point of view, SIM locking represents a possibility to increase customer retention and to practice price discrimination. Moreover, as there are several operators in the market, consumers should be able to choose between different operators and therefore different offerings, which represents a significant difference in comparison to the discussions on the separation of network operations and the provision of end devices in the fixed network in the past.[100] Finally, there might be economic incentives for operators to change their practices such that not all of there offerings would be SIM-locked,[101] especially due to decreasing margins that call for new solutions and business models.

Consequently, from an economic point of view there is no compelling argument for additional regulation to prevent mobile operators from offering SIM-locked end devices as long as competitive market structures and transparency are maintained. Nevertheless, there seems to be a need for increasing harmonisation between the Member States as regards SIM-locking to facilitate the development of a common market and to ease cross-border issues.

5.9 European Commission November 2007 proposals

There was some discussion as to how to deal with the issue of Network Neutrality in the context of the framework review. Proponents of Network Neutrality rules worry that market power on wholesale or even on retail markets might not represent the appropriate criterion by which to identify violations of Network Neutrality.

The review process is continuing to move forward. For purposes of this section, we treat the Commission's November 2007 recommendations as a stable base for discussion, even though we realise that the discussion has to some degree moved on.

As an example of the concerns that were voiced, if Ofcom were to interpret Tiscali's behaviour as regards the BBC iPlayer in the UK as discrimination[102], SMP regulation would probably not be able to deal with this case. Instead, competition law might be the appropriate answer.[103]

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100 In fixed telecommunications the bundling of services and end devices had a long tradition. However, splitting up this bundling was among the first steps n regulation (both in the U.S. and in Europe) mainly due to the monopolistic market structure, as explained in Section 3.1.1.

101 See, e.g., Heise Online (2007): Verizon Wireless propagiert offenes Mobilfunknetz, at http://www.heise.de/newsticker/meldung/99715.

102 See chapter 3.3.1.

103 Valcke, Peggy/ Hou, Liyang/ Stevens, David/ Kosta, Eleni (2008): Guardian Knight or Hands Off: The European Response to Network Neutrality: Legal Considerations on the Electronic Communications Reform", in: Communications & Strategies, No. 72, 4th quarter 2008, pp. 89-112.

Concerns were also raised as to the adequacy of competitive constraints, inasmuch as switching from one operator to another might be difficult. Broadband access is often sold in conjunction with long term contracts, which represent serious switching barriers.

Therefore, in the context of the Framework Review, different alternatives to deal with Network Neutrality issues were considered: (1) to impose specific Network Neutrality rules; or (2) to make no changes to the existing regime; or (3) to maintain the existing regime, but to make appropriate improvements with regard to consumer rights.

The integration of additional regulation which aims to prevent violations against Network Neutrality seems challenging in the context of the European framework. As of yet, the European system of market regulation has proven to be successful, in particular due to the interaction of intra- and inter-platform competition and public policy measures.[104] One of its main features, the transition from regulation to competition law, could be impeded by additional rules.

There have been no precedents in Europe to date that would justify strong interventions in the current system. There have been few calls for additional obligations assuring Network Neutrality in the market, and no prominent cases of discriminatory behaviour against content operators. Moreover, incumbent operators and new entrants continue to invest in the roll-out of NGN and fibre infrastructure, which makes it likely that there will be even more infrastructure competition in the future.[105]

Altogether, this leads us to conclude that there is no urgent need for major changes to the EU framework with regard to Network Neutrality.

Nevertheless, there is some reason to believe that Network Neutrality could become an issue in Europe in the medium term as well, especially as new bandwidth-hungry services deploy. Consequently, it makes sense to further the self-healing functions of the market.

The 2007 Review proposals take this aspect into account, in particular with regard to the strengthening of consumer rights:

Article 8 paragraph 4g of the proposed amended Framework Directive would require NRAs to apply:

g)… the principle that end-users should be able to access and distribute any lawful content and run any lawful applications and/or services of their choice.“

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104 See Picot, A./ Wernick, C. (2007): The Role of Government in Broadband Access, in: Telecommunications Policy, Vol. 31, pp. 660-674.

105 See Wernick, C. (2007): Strategic Investment Decisions in Regulated Markets: The Relationship Between Infrastructure Investments and Regulation in European Broadband, Wiesbaden, Gabler.

In the draft proposal for amending the Universal Service Directive, a new Article 20 (5) would require that consumers must receive clear advance information in case a provider wants to limit access to certain content:

"Member States shall ensure that where contracts are concluded between users and undertakings providing electronic communications services and/or networks, subscribers are clearly informed in advance of the conclusion of a contract and regularly thereafter of any limitations imposed by the provider on their ability to access or distribute lawful content or run any lawful applications and services of their choice."

These changes represent both a strengthening of consumer protection and a commitment to unrestricted access to lawful content, applications, and services. They ensure that any relevant limitations are explicit. They introduce the possibility that deviations from Network Neutrality that are inconsistent with the terms of the contract could be addressed through contract law rather than through regulation.

In its accompanying impact assessment, the Commission provided information on its assessment on Network Neutrality.[106] In this document, the Commission summarised its concerns over Network Neutrality by noting that the potential of the Internet would be threatened if network or service providers rather than users were to decide which content, services, and applications could respectively be accessed, distributed and run.[107] The Commission emphasized the positive benefits associated with product differentiation so long as users have the choice to access the transmission capabilities and the services they want. The document says:

"Allowing broadband operators to differentiate their products may make market entry of content providers more likely, thereby leading to a less concentrated industry structure and more consumer choice."[108]

The Commission is convinced that sector-specific regulatory issues raised in the Network Neutrality debate can be effectively addressed by the NRAs under the regulatory framework.

Nonetheless, the problem remains that the current regulatory framework does not provide NRAs with the means to intervene if the quality of service for transmission in an IP-based communications environment is degraded to unacceptably low levels, unless the network operator in question is an SMP operator subject to a non-discrimination obligation. Consequently, the Commission proposes an enhancement of the Universal Service Directive. The proposed Article 22, No. 3 of the USD reads as follows:

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106 See EU-Commission (2007): *Commission Staff Working Document: Impact Assessment*, SEC(2007) 1472, Brussels.
107 See *Ibid*, p. 91.
108 *Ibid*.

"In order to prevent degradation of service and slowing of traffic over networks, the Commission may … adopt technical implementing measures concerning minimum quality of service requirements to be set by the national regulatory authority on undertakings providing public communications networks."

This amendment aims to grant to the national regulatory authorities the power to prevent degradation of quality of service by setting minimum quality levels for network transmission services for end-users. Moreover, the possibility for the Commission to take implementing measures should ensure an appropriate level of harmonisation in this area.

It is worth noting that these minimum quality standards need to be used cautiously – overly zealous use could actually *reduce* consumer choice by preventing competitors from bringing to market connectivity services of lower quality that might nonetheless be perfectly acceptable to some consumers.

6 Conclusions and Recommendations

Given that there is no systematic failure in Europe, it is unlikely that a single set of *ex ante* rules would affectively address all of the challenges presented by Network Neutrality without running the risk of over regulation.

The problem is far too complicated that even the most sophisticated regulator could craft one set of meaningful rules to enforce a Network Neutrality solution. A worst, a lack of sophistication on the part of decision makers would inevitably lead to subjective and imprudent decisions. Further it may prove impossible for those rules to distinguish between welfare-enhancing discrimination (such as advertising-supported content) versus anticompetitive discrimination. Thus, the market must be empowered to constrain behaviour in the most economically efficient way. To achieve this a clear statement of acceptable carrier and subscriber behaviour. However, where competition is imperfect, there will be the need for some regulatory intervention. European regulators already have a substantial palette of tools to apply to any problems that might emerge. Since Network Neutrality is a subset of competition problems, efforts to address Network Neutrality should focus on solving the underlying lack of competition, not the instant network traffic management issues.

The one area where preventive regulatory measures should be considered is in ensuring that consumers have the information they need to make informed choices. NRAs could mandate (pursuant to their authority under Articles 20 and 22 of the *Universal Service Directive*) that ECNPs and/or ECSPs provide consumers with a public statement as to the circumstances under which they would intentionally block access or degrade the quality of access to a site or a service (for example, to block denial-of-service attacks). In the absence of market power and high switching cost, the extent the deviations from Network Neutrality adversely consumer happiness, consumers would punish the offending network by switching to a different provider. To ensure this result, consumers need be adequately informed.

Should marketplace competition erode to the point where regulation is necessary, all of the choices tend to be unattractive. The objective of the regulator should be less about divvying up rents and more about how to make inciting competition. For these purposes, service-based competition may be sufficient. This has heretofore proved successful in Europe. On the average, more than half of all retail DSL lines in Europe are provided by competitive entrants, and most consumers have access to more than two providers. To date, the presence of competition has tended to deter deviations from Network Neutrality; however, NRAs and NCAs need to be prepared to address wilful deviations from Network Neutrality, especially where an element of economic foreclosure appears to be present.

If intervention should prove to be required, the existing remedies already available under the European regulatory framework for electronic communications probably pro-

vides adequate tools, and competition law provides additional mechanisms. In general, we do not see the need for new regulatory remedies. Non-discrimination obligations are already in place on most incumbents, and the NRA has the additional ability to apply Article 5(1) of the *Access and Interconnection Directive.*[109], The SMP remedies in the *Access and Interconnection Directive* (notably the Article 12 obligation to interconnect networks or network facilities) may be appropriate to force open interconnection in order to address Network Neutrality when network operators possess SMP.

Regulators should however be vigilant as regards possible anticompetitive discrimination, especially where there is a risk that network operator or service provider might leverage market power into an otherwise competitive upstream or downstream segment. Such harmful leveraging is potentially actionable by the National Competition Authority (NCA) *ex post* as a competition law violation. An ECNP might have market power by virtue of network externalities rather than according to standard tests of market power in one of the markets susceptible to *ex ante* regulation, and might be disinclined to offer fully effective interconnection in order to exploit its market power.[110] The European regulatory framework does not provide a comprehensive solution to interconnection problems in the absence of conventional SMP; however, Article 5(1) of the *Access and Interconnection Directive* provides NRAs with a sufficient tool to take necessary interim measures should this still somewhat hypothetical scenario emerge.

Aside from that, we see merit in the Commission's other proposals in this area, including the ability for NRAs to impose carefully crafted minimum quality standards on SMP operators.

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109 The NRA should bear in mind, however, that Article 5 needs to be used with caution and restraint, inasmuch as it is not linked to a finding of SMP. Further, it is not altogether clear what specific powers Article 5 confers on the NRA.

110 See Katz, Michael L./ Shaprio, Carl (1985): Network Externalities, Competition, and Compatibility, in: *The American Economic Review*, Vol. 75, pp. 424-440; Crémer, Jacques/ Rey, Patrick/ Tirole, Jean (2000) : Connectivity in the Commercial Internet, in: *Journal of Industrial Economics*, Vol. 48, pp. 433-472.

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Annex 1. Survey of recent published work on Network Neutrality

This annex summarizes key findings of articles and reports relevant to Network Neutrality.

Atkinson, R.D._Weiser,P.J.(2006) A Third Way on Network Neutrality	The report says that the current state of the Network Neutrality debate denies the reasonable concerns articulated by each side and obscures the contours of a sensible solution. Nonetheless, there is a reasonable concern that the changing nature of the Internet could threaten the development and deployment of new services and content offerings. Such changes, however, are not necessarily imminent and the adoption of overly aggressive prophylactic rules could limit the opportunity for broadband providers to capture revenues to support their continuing infrastructure investments as well as give rise to unintended consequences (such as interminable legal proceedings). Consequently, we recommend a more focused and carefully tailored regulatory response to ensure that the Internet remains an open platform for innovation and a dynamic medium.
Bauer, J. (2007): Dynamic Effects of Network Neutrality, in International Journal of Communications, Vol. 1, pp. 531-547	In this paper a stylized model is developed to figure out revenue streams between different parties involved (step 1) and to discuss interdependencies of innovations. This framework is used to discuss consequences of three scenarios, absence of regulation (i), non-discrimination rules (ii), and full platform regulation (iii). These scenarios are discussed and some considerations on the consequences of different forms of regulators' activities are given. It is argued that a credible threat to address abuses swiftly and if necessary to promulgate rules in case of prolonged abuse would appear to be the best immediate step forward.
Cave, M./ Crocioni (2007): Does Europe Need Network Neutrality Rules?, in: International Journal of Communication, Vol. 1, pp. 669-679.	Starting from the debate on Network Neutrality in the U.S., it is analyzed whether there is a need for European Network Neutrality rules. It is argued that the 2002 European framework is able to deal with the problems in a focused and targeted way, which does not involve restrictions on potentially welfare-improving pricing strategies adopted by firms.
Cherry, B. (2007): Analyzing the Network Neutrality Debate through Awareness of Agenda Denial, in: International Journal of Communication, Vol. 1, pp. 580-594.	The article views Network Neutrality as an example for an agenda conflict, characterized by proponents seeking to get the issue on the agenda and opponents seeking its denial. It therefore chooses a meta approach analyzing the arguments of proponents and opponents and highlights the debate as a clear example of agenda conflict
Clark, D.D. (2007): Network Neutrality: Words of Power and 800-Pound Gorillas, in: International Journal of Communications, Vol. 1, pp. 701-708.	The paper interpretes the current debate as the collision of different revenue models, each valid in its own context. Therefore, each intervention must be throughly planned and should be based on a realistic estimation of the options of the stakeholders involved.
Crowcroft, J. (2007): Net Neutrality: The technical Side of the Debate ~ A White Paper, in: International Journal of Communication, Vol. 1, pp. 567-579.	

Farrell, J./ Saloner, G. (1985): Standardization, Compatibility, and Innovation, in: Rand Journal of Economics, Vol. 16, No. 1, pp. 70-83.	The article examines whether standardization benefits can trap an industry in an inferior standard although there is a better alternative. In case of complete information this is not possible, but when information is incomplete, this can occur. In the following it is discussed, whether this problem can be overcome by communication between the different companies. Given this scenario, it depends on the preferences of the affected actors. If preferences of the firms coincide it eliminates inertia, but they increase, when the preferences differ.
Faulhaber, G. D. (2007): Network Neutrality: The Debate Evolves, in: International Journal of Communication, Vol. 1, pp. 680-700.	The paper discusses (the) three major components of the Network Neutrality debate: 1.) the “bit is a bit is a bit” Internet purist position. 2.) application providers should not have to pay broadband ISPs for delivering their services to the ISP’s customers. 3.) the market power of the current broadband ISP incumbents (telcos and cable) will result in anticompetitive and monopolistic actions that will damage customers, application providers, and innovators. Only the problem of vertical foreclosure is estimated as a serious problem (especially in regard to IP-TV), but currently it is supposed that there is no current problem and thus it is deduced that the government should not impose additional regulation.
Frieden, R. (2006) Network Neutrality or Bias– Handicapping the Odds for a Tiered and Branded Internet, Working Paper Nr. 1755	This paper applies a business perspective on the Network Neutrality debate. Internet and telecommunications business models rarely jibe, even though convergence and business transactions puts incumbent telecommunications firms in market leadership positions. Having such dominant market share now makes it likely that incumbent telecommunications firms will attempt to imprint their business models and their mindsets on Internet markets.
Frieden, R. (2007): Internet 3.0: Identifying Problems and Solutions to the Network Neutrality Debate, in: 18th ITS Conference, Istanbul, Turkey.	This paper draws on examining the Network Neutrality debate with an eye toward refuting and dismissing false and misleading claims and concentrating on the real problems occasioned by the Internet’s third evolution. Necessary and proper types of price and quality of service discrimination are accepted, while other types of hidden and harmful discrimination are identified. The paper concludes with an identification of best practices in “good” discrimination that should satisfy most Network Neutrality goals without creating disincentives for the upgrade of infrastructure.
FTC (2007) Broadband Connectivity Competition Policy, FTC Staff Report June 2007	Very detailed but useful report building on the results of a workshop with well known scholars and market experts. It therefore provides an in depth but balanced overview on the different positions within the Network Neutrality debate with a detailed bibliography (pp. 51-69). Guiding principles and conclusions can be found in part ten (pp. 155-162) which also summarizes the results of the expert panel
Hahn, R.W./ Litan, R. E. (2007): The Myth of Network Neutrality and What We Should Do About It, in: International Journal of Communication, Vol. 1, pp. 595-606.	Starting from the end-to-end argument, the authors argue that the ideal of a "dumb network" could be best achieved by preventing access providers from charging content providers for priority delivery or comparable services. It is argued that content providers are already protected from anticompetitive behavior of vertically integrated incumbents due to antitrust laws that deter access providers from abusing their position and due to the competitive environment in broadband

Hotteling, H. (1929): Stability in Competition, in: The Economic Journal, March 1929, pp. 41-57	In many markets it is rational for producers to make their products as similar as possible, which is also referred to as the principle of minimum differentiation. This phenomenon is present in many markets, particularly in those considered to be primarily commodities, and results in less variety for the consumer.
Katz, M. L./ Shapiro, C. (1985): Network Externalities, Competition, and Compatibility, in: American Economic Review, Vol. 75, No. 3, pp. 424-440.	A monopoly may benefit from entry, which follows from the fulfilled expectations condition: a monopolist will exploit its position with high prices and as consumers know this they are expecting a smaller network and are thus willing to pay less for the good. If the monopolist could commit himself to higher sales he would be better off, but his commitment is not credible so long as he is the sole producer. Therefore, the importance of consumers' expectations in markets with network externalities becomes obvious. In this respect firms' reputation plays a large role. Finally, private decisions depend whether firms can act unilaterally (or if consensus is required) and on the feasibility of side payments. Allowing firms to make side payments may influence the likelihood of compatibility being adopted as well (upwards when the technology is an industry standard, and either upwards or downwards when the compatibility technology is an adapter. Antitrust exemptions that allow industry groups to get together may lower the costs of achieving compatibility and make it more likely.
Kocsis, V._de Bijl, W.J. (2007) Network Neutrality and the Nature of Competition between Network Operators, in 18th IST Conference, Istanbul, Turkey.	Starting from a useful literature survey, the paper discusses discriminating practices known as port blocking or deliberate quality degradation, and access-tiering and their likelihood in combination with certain market structures in terms of welfare to identify potential needs for regulatory intervention. It is highlighted that sufficient platform competition reduces the risk of port blocking due to the fact that incumbents are disciplined by the threat that customers could change to competitors. In terms of welfare, access-tiering is difficult to assess. However, the paper concludes that a hands-off policy can be dangerous due to the potential welfare loss, while strong regulatory intervention may create heavy burden on market players, and since at this stage of the research the real welfare loss cannot be exactly assessed, the risk of regulatory failure may be large. An intermediary type of solution (minimal intervention), could be relying on interoperability requirements, in which, compared to the option of doing nothing, the operators face minimal obligations, while applications and services providers do not have to carry the burden of proof if things go wrong from their perspective. This solution includes little regulatory costs, does not require additional information, and bears little risk of regulatory failure or distorting market incentives
Lehr, W.H./ Gillet, Sharon E./ Sirbu, M.A./Peha, J.M. (2007): Scenarios for the Network Neutrality Arms Race, in: International Journal of Communication, Vol. 1, pp. 607-643.	This paper discusses possible consequences of withdrawing from regulatory or legislative efforts to protect Network Neutrality. 3 possible reactions of end-users in case of non neutral treatment are distinguished: 1.bypassing (cooperative access charing, broadband resale [fon], municipal open access) 2. technical and non-technical countermeasures (end-to-end encryption, onion routing, application port hopping) 3. living with differentiation (encompass strategies that end-users may adopt to mitigate the situation). These potential responses have to be taken into account in the political debate, although the authors highlight that none of it can be assessed being a "silver bullet".

Peha, J. M. (2007) The Benefits and Risks of Mandating Network Neutrality, and the Quest for a Balanced Policy, in: International Journal of Communication, Vol. 1, pp. 644-668.	Starting from a discussion of different kinds of discrimination (technical possibilities, benefits & disadvantages), the article pleads for a balanced policy, which limits harmful practices where there is insufficient competition, but doesn't interfere to beneficial discrimination or innovation. Estimated as being beneficial, policy should allow network operators to provide different measures (quality of service to different classes of traffic using explicit prioritization or other techniques; charge different prices for different classes of traffic; block traffic that poses a threat to security; charge the senders of information, recipients, or both; offer proprietary content or unique services to their customers; block traffic originating from an attached device that one might reasonably believe is harmful to the network; use any form of discrimination they wish, if the broadband market becomes truly competitive.) On the other hand, some things should be not allowed: (A network operator could not charge more for stream A than for stream B if stream B requires at least as many scarce resources as stream A; not charge one user more than another for a comparable information transfer; could not block traffic based on content or application alone; could not degrade quality of service for traffic based on content alone; could not block traffic from a properly functioning device; not offer lower quality of service or higher price for traffic that competes with a legacy circuit-switched service than it offers for comparable traffic that does not compete with a legacy service; not offer content or services directly or through an affiliate at a data rate or quality of service that is not available to competitors at a comparable price.)
Peha, J.M./ Lehr, W.H./ Wilkie, S. (2007): The State of the Debate on Network Neutrality, in: International Journal of Communication, Vol. 1, pp. 709-716	Overview of the content of the "Network Neutrality" volume of the international journal of communication
van Schewick, B. (2007): Towards an Economic Framework for Network Neutrality Regulation, in: The Journal on Telecommunications and High Technology Law, Vol. 5.	The paper develops an economic framework and identifies a justification for Network Neutrality regulation. It is argued that in the absence of Network Neutrality regulation, there is a real threat that network providers will discriminate against independent producers of applications, content or portals or exclude them from their network. This threat reduces the amount of innovation in the markets for applications, content and portals at significant costs to society. While Network Neutrality rules remove this threat, they are associated with the costs of regulation itself and reduce network providers' incentives to innovate at the network level and to deploy network infrastructure. Thus, regulators face a trade-off. However, due to the potentially enormous benefits of application-level innovation for economic growth, increasing the amount of application-level innovation through Network Neutrality regulation is more important than the costs associated with it.
Wallsten (2007) Wireless Net Neutrality_Progress Snapshot_Release 3.2 February 2007	This paper is a response on Wu (2007). The author disagrees with the estimations expressed in the aforementioned paper. The wireless industry is assessed to exhibit no evidence of a market failure, and regulations are therefore rejected assessed making it likely to impose significant costs on society and ultimately harm consumers.

Wilkie, S. (2007): Wholesale Access Licensing Promotes Competition and Could Increase Auction Revenue, Issue Brief #21.	This paper analyzes the competitive effects of a reservation of a small portion of the upcoming 700 MHz band auction for wholesale, open-access use. Using this license, a wholesale open-access licensee could build out the wireless network, own and operate the cell sites, towers, and radio equipment, and provide transport to the Internet backbone. Furthermore, a "no retail rule" for this field is under discussion. It is argued that an open access rule might enhance consumer welfare, whereas the FCC should prohibit vertically integrated incumbents from bidding for the license as well. Some suggestions for an appropriate auctioning design are provided
Wu, T. (2007): Wireless Net Neutrality: Cellular Carterfone on Mobile Networks, Working Paper # 17 ver. 2.1	Wu describes industry practice in the U.S. wireless market, which is estimated to harm consumer welfare and innovation due to their aggressive controlling of product design and innovation in the equipment and application markets, to the detriment of consumers. Wu discusses potential reasons for this (mis-)behaviour including price discriminiation, the protection of revenue sources, cultural reasons (telcos always tried to maximize their control and power over their networks). Different solutions are under discussion, including 1. Cellphone Carterfone 2. Basic Network Neutrality Rules 3. Disclosure 4. Standardized Application Platforms
Yoo, C.S. (2005) Beyond Network Neutrality, in: Harvard Journal of Law & Technology, Vol. 19, pp. 2-77.	The question is not whether Network Neutrality yields benefits, but rather whether the threat posed by a single network owner deviating from Network Neutrality is so great that regulators should prohibit it from exploring whether network diversity might make more sense. The analysis suggests that public policy might be better served if policymakers were to embrace network diversity. Doing so would permit end users to enjoy the benefits of product variety. Network diversity also has the potential to mitigate the supply-side and demand-side scale economies that concentrate telecommunications markets and to make it easier for multiple networks to coexist. This is not to say that policymakers should reject Network Neutrality once and for all. What is called for is a sense of balance and optimality that can adjust with the circum-stances. But in the face of technological uncertainty, the more appropriate and humble approach would appear to favor forbearance from mandating any particular architecture.
Sidak, G. (2006): A Consumer-Welfare Approach to Network Neutrality Regulation of the Internet, in Journal of Competition Law and Economics, Vol. 2, pp. 349-474.	This paper interprets the debate on Network Neutrality to reflect the clash of two cultures, the high-tech entrepreneurial Silicon Valley culture vs. The Washington regulatory culture. It can be classified to the group of papers opposing against Network Neutrality. The U.S. broadband market is assessed competitive due to declines in broadband prices and competition by cable modem. Furthermore, the argument of lacks of innovation in the telecommunications industry is denied and discriminations have become rare since 2002. In this respect it is argued that the danger of anticompetitive treatment by incumbents is less likely and Network Neutrality is rejected. Finally, some considerations on negative consequences of neutrality regulation are presented.

Sidak, G. (2007): What is Network Neutrality Debate Really About, in: International Journal of Communication, Vol. 1, pp. 377-388.	This paper is a short version of Sidak (2006).
Yoo, C.S. (2007) What Can Antitrust Contribute to the Network Neutrality Debate, in International Journal of Communication 1, pp. 493-530.	The article discusses, whether antitrust might be able to contribute to the current debate on Network Neutrality. Antitrust is estimated to play a constructive role in the Network Neutrality debate having developed a body of substantive law based on sound and widely accepted principles of competition policy. Furthermore, the commentary and doctrine on vertical exclusion sound useful cautionary notes about the dangers of adopting a reflexive hostility toward vertical integration. Instead, the Supreme Court's endorsement of the rule of reason over per se illegality provides powerful support for adopting a case-by-case approach that permits network owners to experiment with various practices until actual harm to competition can be shown. Although the substance of antitrust law can offer insights that can help guide the Network Neutrality debate, whether the institutional apparatus of antitrust has a similarly constructive role to play depends on how broadly subsequent courts read Trinko's sweeping indictment of antitrust courts' competency to supervise access mandates. The eventual resolution of this ambiguity is assessed not to affect the authority of agencies like the FTC to exercise their consumer protection mandate to ensure that consumers have complete information about the precise nature of their service plans.
Crawford (2007): The Radio and the Internet, Working Paper.	The article concentrates on spectrum policy and especially the 700 MHz auction and is looking for parallels to early radio regulation. In the first part it describes key events in early radio regulation. The second part presents the high-stakes 700 MHz auction from the perspectives of the major players and describes the changed technical landscape against which the auction rules functioned. The third part analyzes how the Commission responded to those interests during the summer of 2007, and compares its responses to early radio regulation. The fourth part takes on the inherently normative and highlycontested question of the "public interest" that the future Commission should serve. It is criticised that the Commission is strongly focussing on the interests of incumbents and law enforcement instead of concentrating on enabling unlicensed uses of the airwaves that can assist the nation with online access.
Felten (2007) Nuts and Bolts of Network Neutrality	

Annex 2. Glossary of Terms

Note to the reader: This Glossary of Terms is intended to be useful to the uninitiated or novice reader, by providing definitions and explanations of commonly used terms. Not every entry appears in the main body of the text; however, these terms will be helpful to the understanding of the subject matter. This Glossary may also be helpful to those with more experience in the field by providing consistent acronyms and abbreviations.

B

Bit (Binary Information Unit): The smallest unit of digital information. It is equivalent to a "yes" or a "no".

Bits per Second (bps): A unit used to express the number of bits passing a designated point per second.

Broadband: a descriptive term for evolving digital technologies that provide consumers a signal switched facility offering integrated access to voice, high-speed data service, video-demand services, and interactive delivery services.

Bundesnetzagentur (the German Federal Network Agency)

Byte: a set of bits that represent a single character. Eight bits comprise a Byte.

C

Client-server: an asymmetric technical implementation involving to 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 many clients.

CODEC (coder decoder): An encoding or decoding device that enables the digitization and digital transmission of analogue information (such as voice).

CPE (Customer Premises Equipment): A terminal device in a computer network, a telephone network or a telephone system which are at the end-user's premises.

D

DiffServ (Differentiated Services): a 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.

DNS (Domain Name System): the system of databases which associates various sorts of information with domain names in order to translate hostnames to IP addresses for Internet access. It also stores other information such as the list of mail exchange servers that accept

DOCSIS (Data Over Cable Service Interface Specification): the industry standard for cable-based Internet access service.

DRM (Digital Rights Management): see also TPM measures used by copyright owners and publishers to control access and use of their digital data (e.g. encryption or digital watermarks).

DSL (Digital Subscriber Line): technologies providing digital data transmission over the local telephone network.

E

ECNP (Electronic Communications Network Provider): a provider of an Electronic Communications Network (ECN). An ECN is a transmission system and, where applicable, switching or routing equipment and other resources which permit the conveyance of signals by wire, by radio, by optical or by other electromagnetic means, including satellite networks, fixed (circuit- and packet-switched, including Internet) and mobile terrestrial networks, electricity cable systems, to the extent that they are used for the purpose of transmitting signals, networks used for radio and television broadcasting, and cable television networks, irrespective of the type of information conveyed. (Framework Directive, Article 2).

ECSP (Electronic Communications Service Provider): a provider of electronic communications service (ECS). An ECS is a service normally provided for remuneration which consists wholly or mainly in the conveyance of signals on electronic communications networks, including telecommunications services and transmission services in networks used for broadcasting, but exclude services providing, or exercising editorial control over, content transmitted using electronic communications networks and services; it does not include information society services, as defined in Article 1 of Directive 98/34/EC, which do not consist wholly or mainly in the conveyance of signals on electronic communications networks. (Framework Directive, Article 2).

F

FCC (Federal Communications Commission): the U.S. regulatory authority for telecommunications.

G

Gbps (Gigabit per second): one billion (1,000,000,000) bits per second.

GSM (Global System for Mobile communications, originally from Groupe Spécial Mobile): an ETSI standard which employs TDMA to provide cellular mobile networks operating in the 900 MHz or 1800 MHz bands. GSM often refers to a set standards for second generation (2G) mobile communications.

H

Hotspot: a wireless data network access point. Service providers are beginning to offer portable internet hotspot access for laptops and handheld computers in airports, hotels, cafes and other public places.

Hz (Hertz): a frequency measurement unit which is equivalent to one cycle per second.

I

ICT (information and communication systems): technologies designed to support the exchange and management of information.

Interconnection: the physical, legal and logicial connection between two networks which enables an operator to establish and maintain communications with the customers of another operator.

IP (information packet or Internet Protocol): Internet Protocol, along with TCP, is a standard developed by the U.S. military, which allows computers to communicate with one another over long distance, digital networks. IP is responsible for moving packets of data between nodes. TCP/IP forms the basis of the Internet, and is built into every common modern operating system. For information packet, see packet switching.

IPTV (television over IP): IPTV is the distribution of video programming (one way) by means of the Internet Protocol.

IPv4 (Internet Protocol, version 4): IPv4 is the current protocol for transmitting Internet Protocol datagrams over the Internet, using a 32-bit address system.

IPv6 (Internet Protocol, version 6): IPv6 is the emerging protocol for transmitting Internet Protocol datagrams over the Internet, using a 128-bit address system.

ISP (Internet Service Provider): A firm which enables other organizations to connect to the global internet.

J

Jitter: Variability of delay.

K

Kbps (kilobit per second): One thousand bits per second.

L

LAN (Local Area Network): a local data network that is used to interconnect the computers and computer equipment.

Latency: Propagation delay.

LLU (Local Loop Unbundling): the regulatory requirement mandating certain telecommunications operators to wholesale to competitors the connections from their telephone exchange's central office to the customer's premises.

M

Mbps (Megabit per second): one million bits per second.

MPLS (Multi Protocol Label Switching): a data communications protocol developed by the Internet Engineering Task Force (IETF). It was originally designed to reduce the complexity and thus to improve the performance of routers in ISP backbones, and also to support traffic engineering.

N

NAP (Network Access Point): a public peering point.

Narrowband: a term commonly referring to analogue facilities and to digital facilities operating at low data transfer rates which are capable of carrying only voice, facsimile images, slow-scan video images, and slow data rate transmissions.

Net Neutrality or Network Neutrality: A proposed regulatory principle the seeks to limit anticompetitive discrimination by network operators and service providers.

Network Externality or Network Effect: Where network effects are present, the value of a network to its users is greater as the number of participants in the network increases.

Network Provider: the organization that provides the network connectivity to the Service Platforms.

NGN (Next Generation Network): the 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."

P

P2P (Peer to peer): a system where the users typically have a symmetric relationship with one another.

Packet switching: a communications paradigm in which packets (units of information carriage) are routed between nodes over data links shared with other traffic. In each network node, packets are queued or buffered, resulting in variable delay. This contrasts with the other principal paradigm, circuit switching, which sets up a constant bit rate and constant delay connection between the two nodes for their exclusive use for the duration of the communication.

PC (Personal Computer): an IBM standards based computing platform employing a DOS- or Microsoft-based operating system, cf. Linux, Macintosh OSX, or OS X86.

Peering: 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.

PoI (points of interconnection): A point at which networks meet for purpose of interconnection.

Privacy: the right of the individual to determine his own destiny without hindrance, especially from government.

Propagation delay: 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).

PSTN (Public Switched Telephone Network): the network of public circuit-switched telephone networks, originally fixed-line analogue telephone systems. The PSTN is now almost entirely digital.

Q

QoS (Quality of Service): in an IP-based environment, QoS often denotes measures of delay, variability of delay, and the probability of packet loss. It could also denote other measures of service quality.

Queuing: 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.

R

Ramsey-Boiteux pricing: a pricing principle whereby the service provider takes the highest price mark-ups on those services that have lowest demand elasticity, that is, where high prices will have least effect in diminishing demand.

RBOCs (Regional Bell Operating Companies): The former Bell System incumbents providing local telephone service in the U.S.

RSVP (Resource ReSerVation Protocol): a data communications protocol designed to reserve resources across the Internet so as to assure end-to-end QoS for applications that require such assurances. RSVP is the key component of the Integrated Services Architecture (ISA).

S

S/W (Software): The set of ordered instructions which enables a computer to perform specific tasks.

SIP (Session Initiation Protocol): an application-layer data communications control protocol for creating, modifying, and terminating sessions with one or more participants. It can be used to create two-party, multiparty, or multicast sessions that include Internet telephone calls, multimedia distribution, and multimedia conferences. SIP is designed to be independent of the underlying transport layer; it can run on TCP, UDP, or SCTP. It is widely used as a signalling protocol for Voice over IP, along with H.323 and others.

SLA (Service Level Agreement): a contract between a customers and his or her service provider, or between service providers, which reflects the common understanding about the level of service to be provided.

SMP (Significant Market Power): 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, Article 14(2).

spam (Single Post Addressed to Multiple lists): unsolicited email sent indiscriminately and in bulk.

T-U

TCP/IP Reference Model: the layered data communications protocol model used by the Internet.

Teledensity: the number of communications access (or other metrics) in a given population or geographic area.

Tier 1 ISP: a large, well-connected Internet Service Providers that has no significant need for a transit provider.1 Tier 1 ISPs are richly connected to one another by peering.

Transmission Control Protocol (TCP): A data communications protocol used to assure reliable delivery of data in an IP network.

Trust: the perceived security of the networked environment.

V

VoD (Video on Demand): a technology which enables end-users to select and watch video content over a network.

VoIP (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.

VPN (A virtual private network): a computer network in which some of the links between nodes are carried by open connections instead of by dedicated physical wires. The link-layer protocols of the virtual network are said to be tunneled through the larger network when this is the case. VPNs, for example, can be used to separate the traffic of different user communities over an underlying network with strong security features.

W-Z

WAN (Wide Area Network): a data network used to interconnect remote sites or widely-dispersed computer equipment.

Wi-Fi (Wireless Fidelity): the suite of IEEE 802.11 standards adopted starting in 1999, for short-range wireless digital connectivity. It is by far the most widely adopted WLAN standard and performance and speed these standards can provide rivals that of 10BaseT wired Ethernet networks. It now includes, inter alia, the 802.11a, 802.11b, 802.11e, 802.11g and 802.11n standards.

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