(Inter)net Neutrality: Your Voice Matters

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The growing use of the Internet coupled with the rapid growth in applications’ bandwidth requirements are pushing network owners (ISP) to a point where they can no longer treat all Internet content, sites, and platforms equally. This in turn is leading providers to start employing proprietary protocols or to enter into exclusivity agreements with content providers that may reduce the transparency and hence the neutrality of the Internet. Current network neutrality rules forbid network operators to discriminate against third-party applications, content or portals or to exclude them from their network. However, there is mounting evidence that providers are circumventing these rules. The debate has erupted for advocates of more network neutrality regulation to stop this from escalating and there are those opposed to new rules for net neutrality. Those supporting a strong net neutrality argue 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 then will reduce the amount of innovation in the markets for applications, content and portals at significant costs to society.

Those opposed to net neutrality argue that the regulatory tools needed to implement network neutrality are likely to prove ineffective in a world in which communications technologies are increasingly changing. Their most important argument though is that network neutrality threatens to make things worse by reinforcing the sources of market failure in the last mile and dampening incentives to invest in alternative network capacity.

The paper explores and advances the debate over network neutrality, highlighting important limitations of both arguments and showing other alternatives.

1. Introduction

Net neutrality as a principle or as a goal is a very controversial but interesting issue of discussion today. As a society, we are getting more and more included in the information revolution. Society, in varying degrees, is getting more and more dependant on computing systems and automated devices for day to day life tasks. Most of these devises and the information we get have all come to depend on the internet. The future, for those of you who care to think ahead, is going to depend more on the evolving internet of today. We are likely to success or fail based on the success or the failure of the internet. Yes we have a lot to think about the future of this internet. We should and indeed must care about who controls it, will be denied equal access, what privileges and rights will we have and what content of the internet will we be allowed to own and use? All these concerns and more make up what is net neutrality. Net neutrality has varying definitions depending on the person you ask based on their philosophy and expectations of the future internet. Many people involved enough today and understand the risks and involvement of society with the internet, tend to be advocates of net neutrality
and the definition they will give you will reflect their shade. There are two sides to the
debate. On one side of the net neutrality fence are the telcos and cable companies that
are investing big bucks to offer consumers access to their broadband networks. On
the other side are the application providers who are responsible for creating Internet
content – “the Google’s, Yahoo’s and eBay’s of the world. Based on these camps, three
definitions of net neutrality emerge according to Wikipedia [2009].

The first definition of network neutrality deals with the network design principle
based on the idea that the internet is a useful public information network, just like ports
and railways lines, whose content, sites, and platforms should be treated equally and
every user should have unrestricted access. It emphasizes that internet users should be in
control of what content they view and what applications they use while on the Internet.
The internet has operated according to this neutrality principle since its earliest days.
Fundamentally, net neutrality is about equal access to the Internet. No one, including
broadband carriers should have sole, even partial control of the internet and be in
position to detect terms of use of the internet.

The second definition focuses on the quality of service (QoS) of the internet.
Internet users and applications come in different categories. There are those who use a
lot of bandwidth and there are those with applications that are real time like streaming
data and video that require pre-reservation of the bandwidth. For all these to work
peacefully and successfully, when there is congestion in the network and network
capacity is insufficient, there is a need for limited discrimination of users and applications
based on their need. Quality of service in computer networking deals with resource
reservation control mechanisms under network conditions when there is congestion. It
is the ability to provide different priority to different applications, users, or data flows,
or to guarantee a certain level of performance to a data flow. For example, quality of
service guarantees are important if the network capacity is insufficient, especially for
real-time streaming multimedia applications such as voice over IP and online games
since these often require fixed bit rate and are delay sensitive, and in networks where the
capacity is a limited resource, for example in cellular data communication.

The third definition also involves quality of service but this time allowing for a
higher charge on those requiring a higher QoS as long as there is no exclusivity in
service contracts.

The rest of the paper is as follows. Section 2 we give the background to the net
neutrality debate, section 3 we define and explain net neutrality, section 4 we give
a detailed discussion and outline and analyze the issues in the net neutrality debate
including suggestions and useful alternative solutions to those advocated by the
opposing sides. Finally section 5 is the conclusion.

2. Background

The history of net neutrality is not long. In fact, the phrase “net neutrality” (or “network
neutrality”) did not come into use until somewhere in the early 2000s. There are those
who argue that although the phrase may not have been there but the idea and principle
of net neutrality where there. For example, the principle of public carrier neutrality
was bestowed by the U.S. Congress on all public carriers and infrastructure like roads, canals, electric grids, trains, and telecommunications. Since the 17th century, there has been regulations in U.S. that forbid discrimination on transport networks that serve the public interests because they catalyze entire industries. It was deemed that any type of discrimination on such networks would have ripple effects across the nation. The same logic now applies to the internet because it is a public carrier. For generations, these regulations have been ensuring fairness in the market place and protecting the consumer.

The internet was started by the United States Department of Defense through funded research and it was initially governed by an Acceptable Use Policy (AUP) prohibiting commercial activity. It was first privatized and the AUP lifted for commercial users in the early 1990s. The privatization of the internet and the rifting of AUP, immediately created an internet driven by market forces with limited to no central control. In its early years, the issue of QoS did not affect the Internet. The issues of QoS first appeared in the Internet2 project but did not receive that much attention until 2003 when Prof. Tim Wu of Harvard Law School, published a proposal for a net neutrality rule in which he considered network neutrality in terms of neutrality between applications, as well as neutrality between data and QoS-sensitive traffic, and proposed some legislation to potentially deal with these issues [Wu, 2003]. Based on the discussion generated by Wu’s paper, in 2005 the U.S. Federal Communications Commission (FCC) introduced and enforced the network neutrality principles in a documented case of abuse involving Madison River Communications, a small DSL (Digital Subscriber Line) provider that briefly blocked VoIP (Voice over Internet Protocol telephone) service Wikipedia [2009]. In the same year, the FCC further adopted a policy statement in which it adhered to the four principles of network neutrality. The four principles were [Federal Communication Commission]:

- To encourage broadband deployment and preserve and promote the open and interconnected nature of the public Internet, consumers are entitled to access the lawful Internet content of their choice.
- To encourage broadband deployment and preserve and promote the open and interconnected nature of the public Internet, consumers are entitled to run applications and use services of their choice, subject to the needs of law enforcement.
- To encourage broadband deployment and preserve and promote the open and interconnected nature of the public Internet, consumers are entitled to connect their choice of legal devices that do not harm the network.
- To encourage broadband deployment and preserve and promote the open and interconnected nature of the public Internet, consumers are entitled to competition among network providers, application and service providers, and content providers.

On the legislative side in U.S., there has been several bills in Congress with varying success. Many failed. Some of the attempted bills included:
• The Internet Freedom Preservation Act of 2008, contains no requirements for regulations on the Internet whatsoever. It does, however, suggest that the principles which have guided the Internet’s development and expansion are highly worthy of retention, and it seeks to enshrine such principles in the law as guide stars for U.S. broadband policy. This is pending.

• The Internet Freedom and Nondiscrimination Act of 2006 that would have made it a violation of the Clayton Antitrust Act for broadband providers to discriminate against any web traffic, refuse to connect to other providers, or block or impair specific (legal) content. It would also have prohibited the use of admission control to determine network traffic priority [Wikipedia, 2009]. This Act, however, failed to become law.

• The Communications Opportunity, Promotion and Enhancement Act of 2006, referencing the principles enunciated by the FCC and authorizing fines up to U.S. $750,000 for infractions, was passed by the full House of Representatives but failed to pass in the U.S. Senate [Wikipedia, 2009].

After many legislative failures in the U.S. Congress to pass legislation to protect net neutrality, its advocates took to courts. This led to several landmark court rulings on net neutrality including:

• The Comcast, a U.S. Cable Television and a major internet provider was sued and was found to be blocking or severely delaying BitTorrent (bitTorrent is a peer-to-peer (P2P) file sharing communications protocol) uploads on their network using a technique which involved the network creating ‘reset’ packets (TCP RST) that appeared to come from the other party [Cheng, 2007]. Comcast reached an out court settlement and agreed to adopt a protocol-neutral stance and explore ways to “more effectively manage traffic on its network at peak times.” [Wikipedia, 2009]. This case, and others, led the FCC to issue a ruling that Internet service providers (ISPs) cannot ration service to heavy users of the Internet, indicating that Comcast broke the law when it slowed the transfer of video files among a group of its customers to ensure that other customers had adequate bandwidth. This ruling and others following it has given net neutrality advocates hope that the net will remain free for some time, however long that is.

3. The Notion of Net Neutrality

The notion of net neutrality is comprised of three distinct issues, as defined by Information Technology and Innovation Foundation (ITIF): Transparency, Blocking and Tiering. Transparency deals with clarity of broadband provider usage policies, an issue that has yet to gain full public attention. Blocking relates to the practice of degrading or blocking consumer access to content and applications. Finally tiering addresses the question of whether broadband providers can charge content providers for access to their networks [Barry, 2006]. These issues are at the core of the net neutrality debate.
4. The Debate About Net Neutrality

There is no question that the explosive use of the internet has resulted in headaches for internet service providers (ISPs), usually big telecommunication companies. Together with the explosive use of the Internet, there is a growing, stochastically changing and unpredictable user needs in content and bandwidth use. This is creating serious and unpredictable congestion problems in the network. Thus the call for the way to manage this problem. This had led to the QoS issue in the debate for net neutrality. The question is how to create fairness in bandwidth use when there are varying interests and motives of users?

4.1 The Role of Net Quality of Service (QoS)

Recall from the introduction that quality of service within the computer networking communities as a set of internet resource reservation control mechanisms under network conditions when there is congestion. It can also be taken as the ability to provide different priorities to different applications, users, or data flows, or to guarantee a certain level of performance to a data flow.

In an ideal internet working environment, all users and applications would be able to request for services requiring any amount of bandwidth and they would get them with no questions asked. However, in the real world under which the current internet is operating, nothing like that exists. First bandwidth is limited. Second, the needs of users and applications are growing and the amount of bandwidth required for those applications is growing exponentially. In fact providers are currently faced with a growing list of applications that are bandwidth guzzlers including [Wikipedia, 2009]:

- streaming multimedia
- IPTV (Internet Protocol Television) - a system where a digital television service is delivered using Internet Protocol over a network infrastructure, which may include delivery by a broadband connection.
- IP telephony or Voice over IP (VOIP) which may require strict limits on jitter and delay
- Video Teleconferencing (VTC) which normally requires low jitter and latency
- Alarm signaling such as Burglar alarms
- Dedicated link emulation which requires both guaranteed throughput and imposes limits on maximum delay and jitter
- A safety-critical application, such as remote surgery which may require a guaranteed level of availability.
- Online gaming, such as fast paced real time simulations with multiple players.

All these types of service, called *inelastic* because they cannot scale to whatever bandwidth is available and run, require a certain minimum level of bandwidth and a certain maximum latency to function. In cases like these, the providers are faced with serious bandwidth management problems and a need for good QoS.
Delivering and maintaining good QoS to meet user needs outlined above, may require several approaches including [Wikipedia, 2009]:

- An advance contractual agreement called a service level agreement (SLA) between network users and providers which specifies guarantees for the ability of a network/protocol to give guaranteed performance/throughput/latency bounds based on mutually agreed measures, usually by prioritizing traffic.

- A process resource reserving system similar to the Resource ReSerVation Protocol (RSVP), described in RFC 2205, in TCP to reserve resources across a network for an integrated services internet.

- Traffic/packet shaping to control network traffic in order to optimize or guarantee performance, lower latency, and/or increase usable bandwidth by delaying packets that meet certain criteria.

- Scheduling algorithms like weighted fair queuing (WFQ), class based weighted fair queuing, weighted round robin (WRR), deficit weighted round robin (DWRR), and Hierarchical Fair Service Curve (HFSC) to provide access to threads, processes or data flow to system resources like processor time, communications bandwidth, and others.

- Congestion avoidance techniques like policing (marking/dropping the packet in excess of the committed traffic rate and burst size), explicit congestion notification (ECN) and buffer tuning.

4.2 Arguments for network neutrality

After understanding what is at stake in the net neutrality debate, let us now look at the current arguments in the debate. Those who advocate for network neutrality have several issues that they fear may mean the end of net neutrality according to William [2006]. These include:

4.2.1 Content Blocking

Proponents of net neutrality content that with it, ISPs would become Internet gatekeepers, deciding at will which application or user to go first and fast which may lead to unfairly discriminate and control which data they prioritize, such as data from their own sponsors or media interests. This is not an isolated or hyped fear; there have been cases in the U.S. where this has happened in including [Wikipedia, 2009]

- The Madison River Experience - In the Madison River experience, the Madison River Communications’ customer Doug Herring was traveling through Tennessee in November of 2004, Mr. Herring attempted to call his wife at their Alabama home but could not get through. Mr. Herring’s frustration turned to outrage when he discovered the reason behind his inability to call home Madison River Communications, his DSL provider, had instituted a policy of blocking rival Voice-Over-Internet Protocol (VoIP) Internet phone services [William, 2006].
• In April 2006, Time Warner’s AOL blocked all emails that mentioned www.dearaol.com, an advocacy campaign opposing the company’s pay-to-send e-mail scheme. An AOL spokesman called the issue an unintentional glitch [ZDNet News, 2006].

• In February 2006, some of Cox Cable’s customers were unable to access Craig’s List because of a confluence of a software bug in the Authentium personal firewall distributed by Cox Cable to improve customers’ security and the way that Craig’s List had their servers misconfigured. Save the Internet said this was an intentional act on the part of Cox Cable to protect classified ad services offered by its partners. The issue was resolved by correction of the software as well as a change in the network configuration used by Craig’s List [Matt, 2006].

• In September 2007, Verizon Wireless prevented a pro-choice organization from sending text messages to its members coordinating a public demonstration, despite the fact that the intended recipients had explicitly signed up to receive such messages [New York Times, 2007].

• In October 2007, Comcast was found to be preventing or at least severely delaying uploads on BitTorrent.

4.2.2 The Move toward a Two-Tiered Internet

There is also fear of the emergence of a “two-tiered” Internet or an Internet in which select content and applications would be offered at higher speeds. Although this concept is not new, however, it has been, of late, moved to the forefront of the debate. This is a result of DSL providers started to aggressively press for U.S. congressional approval of a two-tier scheme that will use one tier with a fee-based reserved pipe to provide faster platform for content and application companies. The other tier (slower) will be for the public [William, 2006].

4.3 Arguments against network neutrality regulations

As would be expected, net neutrality is mostly supported by intended user groups and in various locations around the globe is arguing for regulations that will continue to protect net neutrality. However, this is not the case with many providers. Many of them, especially telecommunication companies, are opposed to net neutrality regulations claiming that these regulations may indirectly prevent the expansion and improvement of Internet access for their customers, who are demanding an increasing amount of bandwidth. In fact there many valid reasons for a non-neutral network including [William, 2006]:

4.3.1 Blocking Content and A Two-Tiered Internet May not Solve All Problems

Both of these methods would definitely drop competition in the broadband Internet access market, posing the danger of limited market power resulting in losing customers. Losing customers results in long term profit losses and a low return on provider investments.

4.3.2 The Benefits of a Non-Neutral Internet
There are several customer benefits to a non-neutral network including [Matt, 2006]:

**Broadband Expansion**
 Many countries around the world are trying or planning to invest an unprecedented amount of money to bring about universal broadband to their citizens. There are huge national benefits for this. In U.S. it is estimated that this would bring in an estimated $300 billion a year [William, 2006]. The amount of investment into this venture may require billions of U.S. dollars. This money either must come from government or through private investments. Assuming private investment is the preferable, there must be enough investor incentives to be able to raise this amount of money to build the networks. Blocking and regulations are not these incentives.

**Other Benefits from a Non-Neutral Net**
 With a neutral network, there is likely to be additional competition in the application/content market. Such competition may lead to lower prices, increased variety, and a larger incentive for companies to innovate. This lack of incentives threatens to make things worse by reinforcing the sources of market failure in the last mile and dampening drive to invest in alternative network capacity.

4.3.3 **Inadequate Technology to Maintain a Neutral Network**
 There is a strong belief that the regulatory tools needed to implement network neutrality are likely to prove ineffective in a world in which communications technologies are increasingly changing.

4.4 **Alternatives to the net neutrality debate**
 Not everyone is in one of the last two opposing camps. For example many U.S. technology trade associations have remained noncommittal on the issue and a large chunk of U.S. internet users; either do not want to pay attention or are not aware of what is going on. Outside the U.S., there is little to no debate about net neutrality for a variety of reasons.

Among those who are following what is going on but are not interested in taking a side are proposing a variety of mid-of-the road alternatives to those proposed by the two opposing camps. For example, according to Wu [2003], total prohibition is bad. There is a need for some degree of discrimination but we need to have a grip on good and bad discrimination. Some of their proposals include:

4.4.1 **Eminent Domain Against ISPs**
 The thread of eminent domain against ISPs, according to Andy Kessler, is very effect and much better than new legislation [Kessler, 2006]. In eminent domain, the state possesses the power over all property within the state and it can appropriate property for a public use. In some jurisdictions, the state can delegates eminent domain power to certain public and private companies like utilities, such that they can bring eminent domain actions to run telephone, power, water, or gas lines. In most countries, however, the owner of any appropriated property is entitled to reasonable compensation based on the fair market value of the property.

4.4.2 **Creative Commons**
The concept of Creative Commons is to make web content free for all to use. This way, information can be shared anywhere in the world, at any time, by any one, with no worry of limitation. With Creative Commons we keep the Internet as an open democracy without placing regulations like both sides of the Net Neutrality debate want to do.

4.4.3 Government as “Net Nanny”

Another approach is to make the government be a “Net Nanny” and let it baby sit the internet arbitrating between the warring sides. This may require governments to pass some laws and let bodies like the U.S. FCC monitor and supervise the internet.

4.4.4 Managed Services

Under the managed services model, the ISPs must agree to offer a basic amount of open and non-discriminate data pipe access, then the provide would be allowed to charge for content that goes across their networks just like rail lines and ports do. The approach consists of a three-prong strategy that includes: effective consumer protection measures, sound competition policy oversight, and conditioned tax incentives [Barry, 2006].

1 For consumer protection, the government requires ISPs to state their broadband access usage policies in clear terms that specify level of bandwidth, amount of latency and limitations consumers may face in accessing content or services. The government regulatory body like the FCC would monitor these policies and take action against companies that fail to comply.

2 The competition model policy calls on governments or government agencies like the U.S. FCC to address competition policy issues after-the-fact and require the Commission to manage relevant proceedings on an expedited basis.

Offer financial incentives to companies that invest in broadband networks, as long as those companies offer consumers an open Internet pipe with speeds at least as fast as the evolving regulatory agency definition.

4.4.5 Structural Separation.

Structural Separation is a law that requires that no ISP may have any financial interest in any of the content carried by that network and that any network operator’s network management is for the sole purpose of running the network. This may keep regulating bodies out.

4.4.6 Use of Antitrust Laws

Where competition breaks down or does not exist at all like in a neutral network, antitrust laws can be used to provide consumers the necessary protection. For example in U.S., in markets where a broadband provider may enjoy monopoly power, the Sherman Act will provide a remedy for anti-competitive behavior and an incentive for the monopolist not to engage in harmful business practices. Also in markets where competition breaks down due to collusion among broadband providers, the Sherman Act again provides a remedy and steep punishment for the guilty parties. The presence of this legal mechanism to address potential harms in the absence of competition makes additional regulation
unnecessary [William, 2006].

4. Conclusion

We have introduced the debate of net neutrality. We surveyed the many valid reasons given by both the advocating and opposing sides of net neutrality. So far the debate seems to be pitting first the webes, large bandwidth intensive web companies and a few individual consumers against correspondingly wealthy telcos, large telecommunication companies, who are watering for a hand in the webes money pot. We propose that governments should come in and try to bring fairness to the playing field by introducing some regulations that wont make the telcos, the omniscient gatekeepers of the global internet upon which all of us have come to depend and will not make the webes haggle the limited bandwidth for their high paying customers.

5. References


WIKIPEDIA. http://en.wikipedia.org/wiki/Network_neutrality
