LAST-MILE DILEMMA: HOW NETWORK NEUTRALITY LEGISLATION COULD CREATE BARRIERS TO INNOVATION

Nicholas R Brown
Last-Mile Dilemma: How Network Neutrality Legislation Could Create Barriers to Innovation

Nicholas Ryan Brown*

*M.P.A., The Florida State University, Askew School of Public Administration. Mr. Brown is a private consultant in high technology industries. He can be reached at nick.r.brown@gmail.com.
In the last two decades the way we work, communicate, shop, entertain ourselves, and interact with others has greatly changed. This is in part due to how the Internet has reshaped many of our lives. A simple means of transferring data, created in an experiment by ARPA\(^1\), was transformed with the introduction of the World Wide Web\(^2\) into one of the most versatile and useful pieces of technology in history. Thought by some to be a toy or gimmick bound for eventual failure, the doubters now must take notice of the 100 billion dollar plus a year retail business that the Internet has become.\(^3\) This is not to mention the monumental resource for information, instant connectivity with anyone anywhere in the world, and centerpiece as a tool in daily business that is the Internet. Nevertheless some foresee the end of internet growth. The current state of the Internet has been compared to the “golden age of radio,” eventually faltering under the weight of big business tricks, copyright, and government involvement.\(^4\) While the development and current success of the Internet are no longer in question, the continuation of its success may indeed be in peril. That peril may be “Network Neutrality.”

Network neutrality, a term made popular by Tim Wu\(^5\), a professor of law at Columbia University, is used to describe not one, but several problems\(^6\) that the Internet

---


\(^6\) Tim Wu focuses on “Blocking,” “Favored Network violations”, “Termination Monopoly Pricing,” and “Transparency Failures” to be the main issues of concern.
may face in the coming years. Due to potential challenges, think tanks\(^7\) have formed to determine whether legislation is the best way to prevent problems from developing. Some groups are used for consultation, while others are action oriented. The general focus of concern has been how net neutrality legislation might affect a user at the consumer level, also called the “end user.” The concern is primarily that actions by Internet Service Providers (ISP)\(^8\) may increase charges to the end user or limit or bar the freedom of connectivity that is present in the Internet. While connectivity is an issue, negative effects on innovation at the corporate level may be an even greater concern.\(^9\)

Legislation may be used as a tool for good to promote change. It may also be used as a preventative measure which benefits society. In the fast and ever changing environment of the Internet, net neutrality legislation may be neither good, nor effective. Rather it may restrict the creativity which could enhance or improve upon the design of the Internet.

**Content**

Network neutrality is one of those terms that is at its root self-defining. There are various definitions of what exactly net neutrality is, and while those may differ slightly, most agree that network neutrality allows the transfer of content across a network without degradation due to speed or the type of communication and which has the ability to communicate with various types of attached devices without any restriction.\(^10\) Not all

---

\(^7\) Several think tanks looking into the Net Neutrality issue include, but are not limited to: Cato Institute, Center for Democracy and Technology, Electronic Frontier Foundation, Internet Education Foundation, Media Access Project, and New American Foundation.


networks are neutral or even have the opportunity to be neutral. Moreover not all networks should be neutral, as some networks would fall apart if they did not have a hierarchical structure or if parts of the network were not stronger than others. For example a business network may be more horizontal and neutral and would work better in this form, whereas a military network needs the hierarchical vertical structure of the chain of command to be more effective. \(^{11}\) The Internet delivery system is not neutral, and probably never will be neutral. It would be almost impossible to force a static service level on the entire U.S. population, much less the world. For instance, if an individual receives an 8 megabit downstream from his ISP, and his next door neighbor surfs the web on the exact same sites but uses a 56Kbps dial-up modem, their content delivery systems are not neutral.

Neutrality of the Internet is rather the idea that individuals on differing systems of connectivity and differing speeds of delivery should still have the ability to communicate with each other without applications or locations on the Internet being blocked or the traffic purposefully slowed. This is what Tim Berners-Lee was describing when he said, “If I pay to connect to the Net with a certain quality of service, and you pay to connect with that or greater quality of service, then we can communicate at that level.”\(^{12}\) This ability to communicate at any speed of content delivery with any person or Internet site and without restriction to application or content is network neutrality. This is a network that has a particular aspect that must stay neutral in order to work in a particular manner.\(^{13}\)

---


\(^{13}\) Wu, supra note 5.
If net neutrality has nothing to do with the speed of content delivery, and if content delivery will always be non-neutral, what would prohibit a neutral Internet? First and foremost is the possibility of preventing access to certain Internet sites. Blocking access could occur because one ISP did not allow a second ISP’s customers to access content that they provided or that was provided by customers on its servers. Blocking of sites outside of an ISP’s servers might occur for several reasons, the predominant one however is the opportunity for increased profits. The concept would work similarly to long distance telephone service. A basic broadband Internet connection would have a set price that a customer would pay. Content beyond the representation of the ISP would be blocked. However access to that content might be granted for a fee. The fee would be charged to the ISP, and the customer would be billed for the “long distance” fees on top of the standard monthly rate. In the same manner that banks and cell phone companies add up transaction charges, fees could be levied for surfing sites not included by an ISP. ISPs would in effect charge the equivalent of a cell phone roaming fee.

One major concern involving blocking by various political organizations is the possibility of an ISP board that opposes certain philosophies blocking all content to sites with the opposing view point. Such a scenario could introduce First Amendment violations. For instance, the Christian Coalition of America is concerned that tiered Internet service could cause independent news sites and blogs to be on the slower tier of service because they could not afford the fees to upgrade their sites to “fast lane” tiers.

14 Wu, Supra note 5. Also see: savetheinternet.com lobby FAQ, Isn’t the threat to net neutrality just hypothetical?, http://www.savetheinternet.com/=faq#threat.
15 savetheinternet.com lobby FAQ, Isn’t the threat to net neutrality just hypothetical?, http://www.savetheinternet.com/=faq#threat.
The result could cause these sites to be avoided by current users. In addition, there is a concern that the administration at an ISP may support different political ideology and block email newsletters to membership from the group. If it could be proven that an ISP was purposely slowing or blocking traffic to a site because of an opposing ideological stance, that situation would be a violation of free speech rights. Another concern is that an ISP may block sites or create a purposefully slow connection speed to a site because the ISP has a contractual obligation to a similar application or site. For example, if fictional SuperISP company contracted with Google to receive compensation from Google in exchange for directing their customer base to the Google search engine, it would be in SuperISP’s interest to block or purposefully slow Internet traffic trying to access Yahoo, Alta Vista, Ask, and other popular search engines. Another option would be for an ISP to block certain sites unless a fee was paid by a business so that the ISP’s customers could surf those businesses’ sites. This is one of the primary concerns for keeping the Internet neutral. Blocking a site no longer allows the user and the website owner to freely connect. The user is directed to where the ISP wants him to go, and companies trying to win the user’s business are no longer working within a neutral network. This is not simply a possibility, it is happening now. In November 2007, a San Francisco Comcast customer filed suit claiming that the company was “throttling” or outright blocking peer-to-peer file sharing services like BitTorrent. The suit also claims that the company is knowingly advertising speeds of service, and charging fees based on

17 Id.
those speeds, that the company cannot actually deliver to its customers.\textsuperscript{19} This action falls into a category of net neutrality discussion known as Quality of Service (QoS).

QoS deals with the way bandwidth is given priority, and is a way to guarantee a certain level of performance.\textsuperscript{20} In addition it assures the customer that they are getting what they are paying for in broadband speed, and that the provider is transparent in their explanation of what can be expected or what type of QoS might be expected. In other words, the speed of content sent to a customer’s computer, “downstream speed”, the speed of content sent from a computer, “upstream speed”, and delays or gaps in transmission, “latency”, that a customer or business might experience with the ISP’s broadband service would be made known to the customer or made available by request.\textsuperscript{21} For example, if a company offered 10 megabit downstream service but during high traffic times the customer was actually receiving a 7 megabit downstream connection, the provider should be transparent and honest with the customer that at certain times they may experience latency, often referred to as “lag”, in their connection. Many people do not receive the connection they are actually paying for and business ethics should dictate that companies are upfront with the customer if their service speed may not be as advertised. One proposed solution to this is the “two-tiered” or “multi-tiered” Internet.

A two-tiered or multi-tiered Internet is a central target of concern by network neutrality advocates.\textsuperscript{22} Currently the Internet is working on what would be considered a single tier because all information is treated equally. This is achieved through non-preferential treatment within the packet exchange system known as Transfer Control

\textsuperscript{19} Supra note 18.
\textsuperscript{21} Wu, supra note 5.
\textsuperscript{22} Supra note 15.
Protocol (TCP).\textsuperscript{23} The Internet breaks communications into packets which are sent across the Net with essentially a picture or map that allows the computer on the opposite end to recreate the information in the correct order. TCP transfers content in a first come, first serve manner. A multi-tiered Internet structure would allow certain applications or content the ability to travel with priority. The TCP system is a neutral system. For this reason, applications or content that are graphically or video intensive, large content delivery like streaming high definition movies, and future developing applications may struggle in an environment in which that content is not prioritized. The tiered Internet will be discussed in more detail further into this work. It is referenced here as one of the main points of the network neutrality issue.

Seeing these issues laid out begs the question, “Why are these issues?” It is becoming clearer that it may be because of the final provider in the chain of service. These are known as last-mile providers,\textsuperscript{24} and for broadband subscribers they act as the customers’ ISP. The last-mile provider changed drastically in the move to broadband. If not for those changes, the dialog into the net neutrality issue may not have been necessary, or at least it may have been very different.

In the early years of the new millennium, a surge of users migrating toward the broadband connection began to take shape. In 1997, almost 57 million Americans were using the internet.\textsuperscript{25} This usage was primarily in the form of narrowband access, often called dial-up. Today, ten years later, there are over 205 million internet users in the

\textsuperscript{24} “last-mile” is slang terminology used by the telecommunications industry to indicate the final leg of connectivity between a communications provider and a customer.
United States.\textsuperscript{26} The Nielsen ratings estimate that nearly 78% of all active online homes connect via a broadband connection.\textsuperscript{27} The resulting shift would change the way the Internet was controlled.

The progression to broadband caused incredible growth and innovation. Broadband captured over 50% of the Internet user market in 2004.\textsuperscript{28} From 2004-2007 the growth of the broadband Internet grew to 78% of the market.\textsuperscript{29} This coincided with a rapid increase in domains acquired, from 30,000 in 2004 to 439 million by late 2006.\textsuperscript{30} While the switch to broadband ignited a firestorm of innovation, new ways of thinking, social networking, broadband multiplayer gaming, types of media content, and various methods of accessing that content via the increased bandwidth that it provided, the result was that major telecommunications corporations in the country quietly took control over internet provision. Currently, there is a monopoly on internet provision by telecommunications companies.\textsuperscript{31} This occurred because very few ISP’s were setup to distribute broadband service. The telecommunications companies already had the infrastructure in place.\textsuperscript{32} This allowed last-mile providers exclusivity to the burgeoning broadband market place.

The last-mile is the last leg of the wiring, usually copper or wireless technology, that directly connects a cable or telephone company or other ISP to the end users’ home.

\textsuperscript{29} Id.
\textsuperscript{31} Mark Cooper, Cable Mergers and Monopolies, 1 (2002), Economic Policy Institute.
\textsuperscript{32} Supra note 31.
or office. Last-mile does not necessarily mean explicitly one unit mile from the end user. Rather, it is the last section of connectivity between the telecommunications provider and the end user. In reality, an individual’s last-mile provider could be several miles from the end user. The actual distance would be the length between the end user and the cable, telephone, or wireless company. For example, a satellite Internet provider would be tens of thousands of miles away in the Earth’s lower orbit. That distance between the satellite and the end users’ satellite dish would be considered the last-mile section even though it is quite a distance further than a literal mile.

When looking at the basic design of the narrowband network, the last-mile provider is the same provider of the end user’s telephone service. The last-mile provider connects a customer’s telephone call to their switchboard just like any other call. This call is then routed to the ISP which connects the customer to the backbone of the Internet. Because of this design an end user can choose any ISP they desire. An end user is surrounded with choices and has opportunities more closely resembling today’s cell phone market. They may purchase minutes per month, best connection, most connection lines, or other options because the last-mile provider has no control over the end users’ Internet connection and cannot directly influence their choice. With dial-up access, the last-mile provider sees an Internet connection the same way they see a phone call. If a customer dials their ISP, it looks the same as if they dialed up their neighbor. The last-mile provider simply carries the call like any other, and the call is connected to the ISP of choice.

35 Id.
In the late 90’s, the telecommunications companies realized two important things. First, they controlled the last-mile of service which allowed them to become an ISP; second, they already had networks in place capable of broadband connections. Telecommunication companies were already offering the last-mile connection while current ISPs were simply offering Internet features like email and web browsers. It became apparent to the telecommunications companies that a more attractive package could be offered. The companies could offer both the actual connection and the services the current ISPs were offering and make more money than simply charging a toll. At that point, a monopoly by a handful of telecommunications companies began to weed out consumer choice in the ISP marketplace. The reason for this was because with narrowband connection, the last-mile provider simply routed a call, while the ISP of choice handled packet switching duties. Whereas, the design for a broadband architecture required that the last-mile provider handle packet-switching duties as they were going to directly connect individuals to the Internet. What is probably obvious to the reader then is that if a last-mile provider is already handling packet-switching/ISP duties, there is no reason to connect to a secondary ISP for the end user to be connected to the Internet backbone. With that began the slow disappearance of a large number of ISPs along with consumer choice.

This is exactly what occurred in the first few years of the new millennium. Last-mile providers realized that they could handle the ISP duties, provide the customer with

37 Yoo, supra note 34, at 33.
38 Id. at 34.
the same perks dial-up ISPs provided, like email access and Internet storage, and they could monopolize entire regions of broadband subscribers. For instance, America Online lost almost 2 million subscribers between the years of 2002-2003, followed by another 2 million in 2004.

This monopolization is further evidenced by the fact that phone companies, and even more so, cable companies, control entire regions of states. There is one provider and one choice. Due to the deregulation of the telecommunications industry with the Telecommunications Act of 1996, the use of a price ceiling put in place by the Cable Television Consumer Protection and Competition Act of 1992 was withdrawn. In 2003, the Consumers Union, publisher of the popular Consumer Reports magazine, reported that, “95% of American homes have only one cable company…” In essence, this means that approximately 95% of American homes have one choice for cable modem service or possibly one choice for DSL service. Thus one company may completely control the market, or two companies may play off each other with clever marketing strategies to gain customers while keeping prices high at the same time.

The problem is that there is no large market with multiple consumer options. There are no start ups with bright ideas and strategies to challenge large telecommunication corporations. There is no stable of medium sized ISPs with prices or services just good enough to pull business away from the giants, forcing them to be more

---

43 Cooper, supra note 39.
45 Cooper, supra note 39.
competitive. There are only the top holders of the market share who continually buy or force small or mid-size ISPs out of business.\(^{46}\) This market power is creating the outcry for a net neutrality law.

Moving to broadband decreased the competitive market.\(^{47}\) Although the main focus in the net neutrality debate rests upon the issues of blocking, QoS, and a two tiered Internet structure, it is possible that the fear of these potential hazards to Internet neutrality is simply due to the monopolization of the ISP market by the major telecommunications giants. This is not the first time this sort of thing has occurred. In the 1800’s, when Western Union controlled all of the telegraph wires,\(^{48}\) they provided certain companies, like the Associated Press, reductions in rates, while charging others higher rates. The control was used to favor politicians, and other companies could not compete because they did not have access to the wires or the ability to create their own telegraph network to provide the end user an alternative.\(^{49}\) “Eventually the government intervened with something called ‘common carriage.’ (…) The telegraph is no different than an inn keeper, no different than a port, no different than a train, it has to carry everybody’s stuff equally,” says Wu.\(^{50}\) Net neutrality is the Internet’s version of common carriage.\(^{51}\) Without the monopoly, with other agents to keep everyone in check, there would be no need for regulation because the end user would simply choose the ISP that was not tampering with their connection.


\(^{47}\) Cooper, supra note 39.

\(^{48}\) Supra note 36, Rick Karr, Timothy Wu, Bill Moyers.

\(^{49}\) Id.

\(^{50}\) Supra note 36, Wu.

\(^{51}\) Supra note 36, Karr.
Consider the plausibility of blocking in a diverse market. If access to a consumers favorite sites, search engines, e-commerce, social networking devices, or sites dedicated to political, social, or moral issues were blocked by their ISP, the worst possible scenario would be that the customer switched ISPs. If a diverse market existed where telecommunications or cable companies did not have complete control over the last-mile and a large body of ISPs were available in a broadband marketplace, blocking would be likely a non-existent strategy because the customer has other options, and could not be forced to use a current ISP’s products, services, or contracted websites.

Some ISPs have stated that they will not block content. Can a verbal promise be relied upon by the consumer? It is highly unlikely that a business would not try to make money by blocking an ISP to either contract websites for access or exclusive availability, or charging toll fees to its customers when they wander off the pre-approved site list.

QoS is a similar issue. While blocking may be more logical for Internet applications, it may be more likely that there should be concern over QoS when it comes to basic Internet use. Because the last-mile provider is the ISP and the customer has little choice in which provider carries their service, it is likely that ISPs will begin to act much in the same way that cable companies do with television service. Cable television is sold in combo meal type packages with the choices of channels already made for the subscriber. Imagine, instead of having access to any Internet site a customer instead has to purchase the “Gold Package” or “Platinum Package” from an ISP, with

each package containing a pre-approved list of major e-commerce, entertainment, news, and research sites for a set monthly rate. Every other site the customer attempts to access would have purposefully slowed speeds or even be blocked. ISPs may also set up service similar to cell phone companies, so that any time a user browsed the Internet outside of the list of options in their package, they would be charged roaming fees. Again, if the last-mile provider choice was extensive, companies that operated in this manner would soon lose customers.

A two-tiered Internet is one of the most common concepts referred to in the Net Neutrality debate. Would this approach be desirable? Many voices have lobbied its undesirability without much evidence, and with a lot of self-interest in their advocacy. The two-tiered Internet structure that is of concern to net neutrality is solely at the ISP last-mile level. Packet prioritization and a multi-tiered Internet structure at the “backbone” level is a completely different construct. In other words once requested or sent data packets are off of an ISP’s network, the ISP no longer has control over how they are handled.

The two-tiered concept is a concern that is often first on the list of notables that would hurt the end user. It is possible the end user would never be able to tell the difference. The trouble with the ISP created two-tiered Internet structure is that it could be used to charge dense content or media based companies at the supply side, not the end user side. In other words, it is possible that a company like YouTube.com that moves massive amounts of media content would have to pay for their connection to their ISP as

---

normal. In addition, the site would be charged a toll fee from every ISP in which information was requested from YouTube.com and traveled across to the end user’s ISP. Therefore, the end user’s ISP would collect funds from the end user, and would collect funds from YouTube.com for sending information across the end user’s ISP. The reason this is involved with a two-tiered Internet is because the ISP is responsible for packet switching. With the current Internet model, all packets are treated equally on a first come, first serve basis. However, in a two-tiered model, media content, especially streaming media, gaming, VoIP, and emergency services would be given priority because these are extremely time sensitive applications. Because the current method does not give these applications priority, there is a slow down that can cause latency or complete inoperability. A two-tiered Internet at the ISP level would allow the ISP to determine what it was about to send to the end user, and prioritize the content. At the same time, this approach could easily be used for blocking or slowing QoS. A two-tiered Internet structure at the ISP level could be used to filter packets to find out what content was being called up by the end user. The content could then be passed on, blocked, or slowed depending on what level or package the end user subscribed to or what deals the ISP had with other companies. In addition to this, AT&T, a backbone provider that at some point probably carries the traffic of many end users daily surfing data, has announced that it is considering filtering all traffic that passes through its network to check for U.S. intellectual property law violations. “No one knows exactly what AT&T is proposing to build. But if the company means what it says, we’re looking at the beginnings of a private police state. That may sound like hyperbole, but what else do you call a system

---

designed to monitor millions of people’s Internet consumption? That’s not just Orwellian; that’s Orwell,” says Wu.60

It should be clear at this point that the main concerns of the net neutrality proponents are real. However, it should also be clear that one concern crafts the ability for an ISP to either fall victim to or create the second concern; the second concern creates another, and eventually affects the ability to enact the original concern. It is a downward spiral that once one option is enacted, all the fears of net neutrality proponents may be realized as it starts its domino affect. It has been suggested that the solution lies in new telecommunications legislation,61 or in specifically designed net neutrality legislation.62

Current legislation does not focus on the last-mile provider. It can at some points be vague at who it is directed. These last-mile providers are considered by some to be “net neutrality’s central concern” because of their control over the last leg of reception of content and applications to the home or business.63 This is a problem in itself which may cause the legislative solution to the net neutrality problem to become the nightmare of Internet innovation and the future of the World Wide Web.

In 2006, the U.S. Congress saw the first real push towards network neutrality legislation. One of the first attempts was Representative Joe Barton’s “Advanced Telecommunications and Opportunities Reform Act,” also known as the “Communications Opportunity, Promotion and Enhancement Act of 2006,” or more commonly as the “Telecommunications Act of 2006”.64

60 Id.
of 1996 is the first major overhaul of telecommunications law in almost 62 years.⁶⁵ Arguably good or bad, depending which side of the fence one stands, the fact that Congress is taking less time, though it could hardly be called quick, to deal with technology issues is a good step forward. While the 2006 variant of the act dealt with many issues needing reform, net neutrality was not one of them even though it was advertised as net neutrality legislation. To solve this problem, Senators Olympia Snowe and Byron Dorgan stepped in with an amendment to the act in 2006, S.2917. It would attempt to enforce the basic arguments of network neutrality. This action died at the end of session, but was resubmitted as amendment S.215 on January 9, 2007.⁶⁶ S.215 is word for word the same amendment as S.2917.

S.215 covers the basic elements about which net neutrality proponents are concerned. Initial wording prevents obstruction of an end user attaching devices to his connection.⁶⁷ This prevents ISPs from saying no to VoIP phones among other devices. A further section deals with QoS issues.⁶⁸ Specifically, the connection speed, limitations, and any other information about the connection are to be made public to the end user at their request. The points of concern by net neutrality proponents would be taken care of with these subsections. However, it is the first and last subsections in section “a” that could be troubling to futurists and advocates of the precautionary principle alike.⁶⁹

---

⁶⁷ Id. § 12(a)(2).
⁶⁸ Supra note 66 at § 12(a)(3).
⁶⁹ Internet Freedom Preservation Act, supra note § 12(a)(1) & 12(a )(4)
Some in the tech community have called for a complete overhaul of the TCP/IP system. Others simply realize the need for packet prioritization in data transmission as the Internet grows as an entertainment and media platform, and in uses such as telemedicine surgeries using robotics and broadband connections where packet prioritization could be the difference between life and death. TCP/IP structure is nondiscriminatory. Data packets are sent and received on a first come, first serve basis. This structure is arguably making it impossible for certain applications to be used correctly on the Internet. In summer of 2006 Senator Ted Stevens was quoted as saying,

They want to deliver vast amounts of information over the internet. And again, the internet is not something you just dump something on. It’s not a truck. It’s a series of tubes. And if you don't understand those tubes can be filled and if they are filled, when you put your message in, it gets in line and its going to be delayed by anyone that puts into that tube enormous amounts of material, enormous amounts of material. Now we have a separate Department of Defense internet now, did you know that? Do you know why? Because they have to have theirs delivered immediately. They can't afford getting delayed by other people.

The comments gave some in the tech community a good laugh. They also created a buzz on The Daily Show and additionally have even made appearances in other media like the Xbox 360 game, Gears of War. An attainable achievement for hosting 50 online matches was titled, “A Series of Tubes”. When you start to dissect Senator Stevens off the cuff comments, however, he may not have been off base by much. The term

---

“latency” or “lag” is used to describe a slow network connection with the result being lack of seamless integration or execution of an application or item of media content on the output side. Latency, however, can also be caused by data packets arriving too quickly. Network routers use a queuing structure in combination with TCP/IP.\(^{75}\) If data packets arrive too quickly, they begin to stack up. This is what Stevens was referring to with his “congested tubes” comment. A congested router, sending packets in a first come, first serve data transmission standard that cannot prioritize its multimedia, VoIP, or gaming traffic, then gets bogged down and latency occurs for those end users requesting the broadband content. The reason for this queuing structure is because of what is known as the “end-to-end principle”.\(^{76}\)

The end-to-end principle is essentially the idea that when transferring information, any changes to that information should occur at the beginning and end, but no change should occur in between.\(^{77}\) The original paper on the subject argued systems should be end-to-end to be reliable. It also allowed users to innovate.\(^{78}\) In the TCP/IP structure, the IP agent is essentially like a cart that carries data from one place to another without altering it. The TCP is the end agent that either prepared things that were placed on the cart or took them off and organized them. TCP as a transmissions protocol will break down the data, handle error detection, congestion control, and finally reorganization. IP simply takes the data unaltered from one place to the next. The end-to-end principle worked well in the initial stages of the Internet. This is because this type of architecture is very good for applications that need accuracy and can handle delays,


\(^{77}\) Id.

\(^{78}\) Supra note 31.
like file transfer. But this type of structure is not designed to handle VoIP, media streaming like movies and music, gaming, or other applications where accuracy is less important than maintaining an extremely low latency. As Yoo puts it, “While adherence to the end-to-end argument may make sense in most cases, circumstances do exist in which mandating network neutrality would actually harm competition”. 79 The point is that the system itself is a structure that already hampers the content that a broadband connection affords the end user. There are ways to improve the structure, but legislation may impede that effort.

Two sections of S.215 would prevent broadband service providers from “discriminating against” or to “impair” reception of “any lawful content, application, or service made available via the Internet”. 80 In addition a “broadband service provider shall enable any content, application, or service made available via the Internet to be offered, provided, or posted on a basis that…is reasonable and nondiscriminatory”. 81 Many aspects of S.215 and other legislation that has been submitted in the last year regarding net neutrality will for the most part have a positive outcome in preserving network neutrality. It is thoughtful of current problems, and it has obviously been designed along side people who are knowledgeable of basic network design and ISP duties. The problem is that casting this legislation or any legislation requires extremely careful wording, or the lack there of. Legislation could quickly paint society and the tech industry into a corner and strip its ability to innovate. After legislation is passed several things happen. Innovation is no longer working unbound by dictums, and updating

79 Yoo, supra note 34, at 26.
80 Internet Freedom Preservation Act, supra note § 12(a)(1).
81 Internet Freedom Preservation Act, supra note § 12(a)(4).
legislation at the same speed of Internet progression is almost absurd to mention in the same sentence.

When dealing with moral or political issues, the “precautionary principle” holds that one in society should essentially think twice when considering your options, and then think some more. The burden of proof is on those that desire action when something may cause irreversible damage to a societal construct, way of thinking, or even in regards to net neutrality and the future of the Internet. It is interesting to note then the sides of the debate. On one hand are the proponents pushing for legislation, on the other are individuals like Berners-Lee, creator of the World Wide Web, whose tone implies that many of these proponents don’t even understand the construct they are supporting, much less how to properly create legislation for that construct.

The Internet is only at a point in its history that in the long run will still be considered its developmental stages, and there is already a desire to create legislation that will mandate the use of protocols used to manage data packet transfer that were developed by ARPA in the 1970s. Yoo points out that, “consumer demand for more time-sensitive applications, such as Internet telephony and streaming media, may be providing much of the impetus away from standardization. Forbidding network owners to introduce routers that can assign different priority levels to packets based on the nature of the application would have the effect of precluding consumers from enjoying the benefits of certain types of applications. The current ubiquity of TCP/IP makes it seem like an appropriate default rule and appears to justify placing the burden on those who would

---

83 Berners-Lee, supra note 12.
deviate from it. A moment’s reflection makes clear how adherence to the Internet’s nonproprietary structure may actually impede innovation”. 85

TCP/IP works, but it is not the most efficient protocol for many current applications or applications that are time-sensitive (real-time applications). 86 The Internet sees explosive new ideas every year, and no one can predict what the future holds. Net neutrality proponents consider proprietary data exchange systems deviating away from TCP/IP as a means to increased fees or toll roads for certain applications. They are not necessarily wrong anymore than they may be right. This fear is certainly capable of coming true. It is also just as plausible to think that ISPs could be designing packet exchange systems that would work extremely well for their specific duties to improve service for the end user. We could also reach a time in which ISPs began designing their own networks. 87 This might “undermine network neutrality” 88, but it opens up the market to solving several of the current problems we face with emerging technologies and TCP/IP protocols. Customized networks could still connect the end user to every site he could browse today, or they could be tailored like today’s cable television. The real advantage though is that custom built networks by ISPs could be created specifically for the Internet gamer or for those who wanted to stream high definition movies to their Internet Protocol Television (IPTV) set top boxes. In an age where commercial items like vehicles are marketed to the customer to define his image, it is not impossible to imagine a world in which the end user selects from several different

85 Yoo, supra note 34, at 58.
86 Comer, supra note 84, at 600-601.
87 Viktoria Kocsis and Paul W.J. de Bijl, Network neutrality and the nature of competition between network operators, TILEC 22-23 (2006).
88 Id. at 23.
ISP for a custom built network that best suits their needs. In the 2006 network neutrality debate between Tim Wu and Christopher Yoo, Yoo had this to say:

In recent weeks, the House and the Senate have been debating “network neutrality” legislation, which would prohibit network owners from discriminating against particular applications and content providers. I am not convinced that deviations from network neutrality will necessarily harm consumers and innovation. On the contrary, competition and innovation might be better served if policy makers embraced a ‘network diversity’ principle that allows different network owners to pursue different approaches to routing traffic.\(^89\)

However, prior to any such invention, some change would have to occur to open up more last-mile ISPs to customers, and legislation prohibiting alteration to the TCP/IP structure of the last-mile ISP would need to be prevented.

Current legislation does not specifically mention backbone systems managers like Qwest, Verizon, or AT&T. But innovation in data exchange is only as good as the sum of its parts. Innovation at the backbone level will still be impeded if they are dealing with legislated road blocks at the ISP level. As mentioned previously, TCP/IP disassembles or assembles at the start or finish of its journey, in the middle, it is in a queue line. If innovation at the backbone level were to take place to increase the speed of packet transfer, as soon as it hit the ISP level, it would encounter TCP/IP transfer and revert back into a queue style structure. Imagine a 12 lane 100MPH freeway from Atlanta to Miami with a one lane 3MPH off and on ramp at either city. The speed of travel in the middle of the journey will not matter if the exits remain as Senator Stevens clogged tubes.

Looking toward the future concerning the issue of network neutrality, companies may attempt to find ways in which to work around future policy’s limitations on

\(^{89}\) Tim Wu and Christopher S. Yoo, *Keeping the Internet Neutral?: Tim Wu and Christopher Yoo Debate*, No. 06-27 Vanderbilt PLLT 1 (2006).
innovation on the network side. As has already been pointed out, the Internet has advanced in ways that its original pioneers never dreamed would be possible. The ever developing “Web 2.0” model, based in social networking and incorporating more and more time sensitive and bandwidth heavy applications is a sign that stagnation in Internet delivery technology is not an option. At some point, if policy is an issue resulting in damages to progress for a corporation that hurts its financial bottom line, other methods of delivery or fixes may be the only option.

Because the focus of this work is on the potential damaging effects of network neutrality policy on innovation, it is only fair to also point out possible ways for corporations to work around that potential problem as well. In the proceeding paragraphs, two major examples will be analyzed: one that focuses on a work around a particular content delivery corporation may employ to free themselves from a toll type scenario for its customers, and one that focuses on the supplier side, a solution from an ISP.

A major concern from content delivery corporations is that particular policies employed by ISPs would require the end user to pay their monthly connection fee, and at the same time the ISP would charge a content delivery company for the traffic it received as well. To reiterate the example, a customer, paying his monthly fee would access the fictional shoesforsale.com website. This customer’s ISP would charge him to connect to their network, and to direct his traffic to shoesforsale.com. In addition to charging the customer, the ISP would also charge shoesforsale.com for the traffic it received. It is the same traffic, but the ISP would take advantage of the situation and essentially charge

---

twice for the same traffic. It is akin to a football stadium charging fans to attend a
sporting event, and then charging the football players a fee to play the game for the fans.
In a scenario that is still developing, it appears that Google is preparing to take steps to
possibly create a back up plan for this potential problem.

In the Spring of 2007, the FCC officially announced that it would be auctioning
off the 700MHz frequency band. The 700MHz frequency band is currently used by
UHF channels 52-69. However, they will no longer be in use when those channels are
vacated in 2009. In February of that year, an FCC mandate forcing the switch from
analog television to digital television will take place, and that spectrum will no longer be
in use for television signals. The 700MHz frequency is extremely valuable, especially if
it is open access.

Open access would allow the company with the winning bid to develop a network
that they could lease out to major players like AT&T or start-ups around the country.
Google is in favor of open access, as are other companies that may see potential in
creating a network that they can lease out. Current ISPs like Verizon are against open
access as a requirement calling it an “imposition of regulatory judgments and intervention
in the markets.” This is not much of a surprise. A network built on the 700MHz
frequency essentially would create another broadband pipe to the Internet, the first two
being cable and DSL. Sole ownership of such a pipe, especially by a current market
provider of one of the other connection types, would give a current ISP an additional
stranglehold on the marketplace.

91 Eric Bangeman, FCC readies “for sale” sign on beachfront 700MHz property, Ars Technica, April 25,
property.html.
Google announced in July of 2007 their intent to bid on the spectrum, which carries a $10 billion reserve price\textsuperscript{92}, and will take place in January of 2008.\textsuperscript{93} While there are several options Google would have with ownership of the frequency, such as a cell phone network, leasing parts of the spectrum as an Internet gateway is entirely plausible. A successful winning bid could result in several possible scenarios as a safety net to the toll problem content delivery companies may face. A network built on this frequency would of course be wireless, far reaching, provide on the go access, and potentially be inexpensive. In the first of such scenarios, Google would develop their own “Google Network”. It would be a pipeline to the Internet, and if open access is not a requirement, they would have sole control over it. Having sole control would mean that if Google was ever threatened by an ISP trying to implement a toll system, Google could simply respond that they were removing their search engine from that ISP’s network. Millions of individuals would potentially be without access to Google, but not just the search engine. Consider the millions of individuals that would then be without access to their Gmail account or other much needed Google applications. It would be a nightmare scenario for an ISP, and one that would cause them to lose massive amounts of customers and potentially millions, if not billions of dollars.

In another scenario, Google indicated early on in negotiations with the FCC that it would bid on the frequency if it is indeed open access.\textsuperscript{94} It is possible Google plans to build an open network and lease out sections of the frequency to current ISP companies.

\textsuperscript{94} Supra note 92.
and upstarts to provide a third broadband pipeline. This would do several things. It would benefit Google because they would now have a new revenue stream through leasing their network that would help them recoup the money spent on their bid, and eventually be a money maker. It also would provide the end user an additional option for broadband access. Additionally, bear in mind that this would not mean one single additional option. Because a company could lease any part of the 700MHz frequency band, this would allow multiple current ISPs and upstart ISPs in the same area to offer wireless broadband services. Most importantly, it would provide Google a wildcard in the toll scenario. If threatened by an ISP, they could counter by terminating the company’s lease contract or pull their services and applications off the ISP’s network. Furthermore, it would put Google in a union type position where other content delivery companies that are threatened by the toll scenario could ask for Google’s support and possibly counter a threatening ISP by going “Google Network” exclusive. Imagine for instance a company like Amazon going “Google Network” exclusive. This would potentially scare an ISP out of the toll attempt because they might lose a large user base to a competing “Google Network” leasing agent.

It must be reiterated, that these are potential scenarios. The trend looks to be moving in that direction, especially as Google has made it clear that it will bid on the spectrum. But many things must play out for the end result to allow any of these things to work, particularly the winning bid from Google.

The second example of a solution to hampered innovation by potential network neutrality policy could come from the supply side. Currently copper wiring, that customers receive through coaxial able can not handle larger amounts of bandwidth to
individual end users in the current state of standards in use. These standards are known as Data Over Cable Service Interface Specifications or DOCSIS for short.\textsuperscript{95} DOCSIS 2.0 is currently in use.

In May of 2007, Comcast CEO Brian Roberts announced and demonstrated a new type of modem currently in the works, and expected to be rolled out in 2008 that would utilize DOCSIS 3.0 standards in combination with “channel bonding”.\textsuperscript{96} Channel bonding is a type of computer networking that is an arrangement of two or more network interfaces. A network interface is the “point of interconnection between a user terminal and a private or public network”.\textsuperscript{97} Essentially, DOCSIS 3.0 will use Internet Protocol version 6 and channel bonding to allow downstream and upstream bandwidth to be used simultaneously by the same end user. In the May demonstration by Roberts, Comcast’s new modem, in combination with these new standards was able to reach speeds of 150Mbps, or in lay terms, able to download “a 30-second, 300-megabyte television commercial in a few seconds at speeds up to 150Mbps”.\textsuperscript{98}

Comcast’s plan is to bombard their network with increased speed in an effort that will almost force time sensitive data to its destination at record speeds even though it is operating in a first-come, first-serve queue type packet structure. This may be similar to taking a small underpowered automobile, and swapping in a V8 motor. Suddenly the vehicle is overpowered and forces the little car to carry its passengers extremely fast.

The potential benefits may be currently unimaginable. In reality, as we enter the high

\textsuperscript{98} Supra note 96.
definition age, it would only take around 16Mbps to stream HD media to a television. However, 150Mbps would begin to allow many other opportunities simultaneously. Homes could begin to network not only their computers, but Internet telephony devices, televisions, gaming systems, home security systems, and even appliances. Imagine a situation where multiple HD movies are streaming to multiple locations throughout the home. At the same time a central media hub is transferring large time sensitive files across the same network, and high bandwidth interactive social networking sites are being accessed. Meanwhile your networked refrigerator sends an updated grocery list across the network to your wireless broadband connected cell phone, which is sending a signal to your alarm system to let it know that you are just arrived home and to unlock the front door. The possibilities are endless. A slight boost in speed may allow for one or two new applications to start taking place at a single time. But this massive increase in speed would allow for multiple processes in the high def, integrated and highly connected age to begin taking shape.

If an Internet wide improvement to archaic protocols cannot occur for whatever reason, the improvement of the protocols and delivery systems on the particular ISP’s network may be the next best thing. As has been already said, the transfer of data packets from one individual to another can only operate with QoS and speeds that are the sum of all the parts. Once a packet is off a speedy network, it will hit roadblocks once again. However, if networks can improve connection speeds at the front and back end, even if the middle of the journey is still slow, the bottom line is that there would arguably be a massive benefit, even if it is seen as a “band-aid” solution.
Other companies are doing similar things. While Comcast is finding software protocol solutions to turn up speeds, other companies are looking into building new high speed specific networks. Verizon introduced FiOS a few years ago. FiOS is a fiber to the premises service, or FTTP, which runs fiber optic wiring directly to the end user’s premises without junctioning off into a different type of wiring, like copper, for instance.99 FiOS still operates on the same protocols as other networks, but fiber optic cable has a much greater bandwidth, which allows them to turn up the speed much like Comcast’s upcoming system. Again though, once off Verizon’s personal network, and standard issue first come, first serve problems come back into play.

Considering these examples, and also using history as a guide, there is probably no way to ultimately stop innovation. Even with restrictions from policy in place, eventually if demand is high enough, and the cultural and societal norm demands something, the policy will change. It is without question though, that policy can hamper innovation, often making it more difficult to create or implement new technology. Even more so is the fact that ISPs exist for one sole reason: not to provide us with an Internet connection, but to make money. If providing Internet access became a non-viable business tomorrow, you could be sure they would be packing their bags. In that sense, if innovation is not cost efficient, does not look like it will recoup R&D costs, or to implement will require huge political strides to reverse laws, then innovation arguably will not take place. For these reasons, I believe the precautionary principle in relation to Internet policy again comes into play.

Innovation will never completely be stopped but it can be hampered. Being cautious so that innovation is not even hampered is the ideal solution however. These are

simply examples of ways to circumvent drawbacks to innovation that network neutrality policy may cause. Some scenarios are more likely than others, and some will occur whether network neutrality policy passes or not.

In the spring of 2007, the FCC held a comments period that allowed consumers to weigh in on the issue. This is a feature usually only taken advantage of by lobbyists dropping off their talking points. However, the FCC received 11,000 comments on the issue, signifying a growing interest in the topic at hand. Google, one of the notable corporations continually active in the discussion, is very concerned about competition in the ISP market place stating, “It is entirely reasonable for a broadband provider to utilize legitimate application and content-neutral practices – such as halting harmful denial of service (DOS) attacks, or prioritizing all packets of a certain application type, such as streaming video,” Google wrote. “If, on the other hand, network management is used to promulgate discriminatory practices — such as blocking, degrading or prioritizing certain applications or content, based on an intention to impair the offerings of competitors – such practices should be prohibited as unreasonable.”

Google is a company that proponents of legislation often bring up as part of their ammunition toward legislating network neutrality. However, it seems that it is becoming clearer that Google’s intent is not so much the desire to simply see Internet regulation but responsible regulation. There is an obvious understanding that certain types of regulation could defer future types of Internet technologies and consumer invention and progress. At the same time however, they see the importance of protecting themselves and other Internet companies from the stranglehold the current ISP conglomerate has over the industry.


101 Supra note 100.
A recent study from the University of Florida School of Business Administration reports that, “While the monopolist internet service provider gains from the [absence of network neutrality], the content providers are definitely worse off by the arrangement… It is therefore no wonder why the content providers and the internet service providers have been on the opposite sides of the net neutrality debate.”  The report implies that it is possible the whole debate is actually about the transfer of corporate profits. If net neutrality legislation passes, and ISPs are prevented from charging extra fees to prioritize certain companies traffic over other companies, then those content delivery corporations retain more revenue. It is really unrealistic to nail down the entire issue unto this argument. But as the saying goes, “Follow the money,” isn’t a bad idea, and is always something of which to take note.

It seems unlikely that legislation is going to be passed in its current state. The issue is still in the forefront, but it seems the right people are now being put in place to execute a precautionary principle mentality on the issue. At a round table discussion, Net Neutrality: Still on the Front Burner, Jim Cicconi, senior VP at AT&T was quoted as saying, “The public sees the dangers, the risks of regulating, and this is making industry work harder to keep the public trust…And if someone does engage in abuse, sue them—don’t demand Congressional intervention. Cicconi went on to say that legislation was impractical, “The absence of legislation gives us certainty…Technology is not static—the fundamental problem with legislation is that it is.”

---

103 The round table event was held at the Broadband Policy Summit III in June of 2007.
Considering the positions of the major players, compromise may not be possible. If that is the case, then there is certainly the possibility that the issue will simply die. From legislators points of view, the issue may become too frustrating, and they will eventually need to move on to other pressing issues, and eventually be concentrating on a future election cycle. From a policy perspective, the issue may have anywhere from 6-12 months before it may be shelved for quite some time. The death of the net neutrality issue in Congress may be exactly what certain groups are hoping will happen.

**Conclusion**

It is not clear whether current net neutrality legislation will be the answer to the problem. Although it has good facets, members of the legal communities and technology circles have concerns for the future of innovation. The desire for caution is probably the best approach in a still emerging technology. In addition, more consideration of how the “digital divide” can be closed may be needed. Generally, this terminology is used for a divide in computer or Internet access or resources. It is also now being applied to the divide between those who understand certain technology and how it works and those that do not.\(^{105}\) It is apparent that net neutrality is a complex issue that has a noticeable divide between the haves and the have-nots. An even more pressing issue, though, may be the need for the technology and scholarly communities to work harder toward a concurrence on how to define network neutrality. Once this is accomplished, it may make an explanation to the lay individual easier and encourage the closing of the gap.

There is definitely a need for appropriate action involving aspects of network neutrality. The prevention of blocking of content, and for companies to be up front in

---

QoS issues is, on one hand, simply an ethical business approach, and on the other, could result in something more serious if the more dangerous far end of the spectrum played out. As Wu puts it:

At an extreme, blocking can keep a better or cheaper product (VoIP) from coming to market at all, and often it can prevent such products from being offered in an effective form. That’s a problem, in turn, because if you believe that market entry and innovation are linked to economic growth, we’re ultimately talking about such policies hindering the growth rate of the country.106

However to prevent the possibility of innovation and improving an already amazing tool is not appropriate. It seems a weak argument that we should take steps to prevent corporate innovation and even innovation at lower levels based on the mere chance that corporate greed may raise its head. However, a cautious attitude amongst policy opponents and futurists may begin to shift with the outcomes of the Comcast net neutrality case107 and AT&T’s announcement to consider filtering traffic.108 It may be best at this time to only take the legislative steps that are unquestionably necessary, while leaving items of uncertainty to play out. It is likely much better to deal with problems as they arise instead of preventing improvement to Internet technology via legislation only to find ourselves wrapped up in legal battles and amendments to that legislation to reinstitute the ability to innovate in the future. With the current speed of progress in the digital age, it would be like stuffing ourselves in a jar and forever trying to bust the lid off. We would never get ahead in an era where we may arguably already be behind.

106 Wu, supra note 89, at 2.
107 Supra note 18.
108 Supra note 59.