Title of peer-reviewed article: Network Neutrality’s Technical Troubles

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The purpose of this article is to explore the technical troubles involved with Network Neutrality and to deduce the best course of action to solve this problem. The initial technical hurdle associated with net neutrality is to get the internet to transport traffic that it wasn't ever meant to handle. The purpose of the creation of internet packet switching was to have a way to virtually transfer files between computers, and this technique was later adopted for e-mail and webpages. For this new technique, the virtual data doesn't need to be delivered at a specified rate or even in a specified order so it can be cut into packets that are routed over independent paths so they can be reconstructed when they arrive at their destinations.

In contrast, voice or video signals have to arrive quickly and in a specified sequence. The ability to converse with someone via a voice or video signal can become hard if any words or syllables become lost or are postponed beyond a few tenths of a second. Our eyes have a higher threshold when it comes to tolerating some variation in a video signal versus our ears, which don't have an upper limit when it comes to changes for a voice signal; in contrast, video signals need to have a ton of bandwidth.

Signals from a voice and video mediums can be changed into groups of coded packets to classify their contents as needing transmission at a constant rate. Regarding telephony, their packet priority codes were designed for the sole purpose of keeping any conversation flowing smoothly without the annoying static, which are variations in when packets are received. Similar codes help in keeping packets flowing at a proper rate in an application, and these flow controls aren't crucial in present-day fixed broadband networks, which in general possess ample capacity to send a signal from voice and video mediums. In contrast, mobile apps are a whole another tale.

One solution Jeff Hecht proposes to address and rectify this problem of network neutrality is to implement conventional telephony, which is a method that uses circuit switching. That will directly join two phones to each other with an audio bandwidth ranging from 300 to 3,400 hertz, which is sufficient enough for reasonable, intelligent speech. Present-day landline phone systems digitize audio signals into streams of 64,000 bps, which can combine with hordes of other calls that are on the same carrier, which is a technique called time-division multiplexing. Carriers with the support of the FCC have proposed to abandon old twisted-pair copper wire lines, which have become a pain to maintain. Instead of using landlines, the carriers want to change the 64-kilobit voice mediums into packets, which can be transmitted from a home or office internet connection via the internet's fiber-optic backbone along with wireless conversations which is more efficient than the existing backbone phone network. Even though this method doesn't supply a committed voice medium, it still can make the virtual voice services work just as well as a landline connection. Hecht conducted a study where he compared the quality of digital voice calls utilizing cable and skype. What Hecht discovered during his research is the following that calls that use Skype or VoIP services aren't very reliable because they surpass the carriers' broadband lines to the internet rather than to the backbone phone network. Traffic on the internet is more susceptible to bottlenecks, where packets could suffer from jitter, get delayed, or get lost. Next, he explains the hearing system humans have doesn't tolerate these flaws very well because of its acute sense of timing. Calls that were bounced around between geosynchronous satellites never made connections because people couldn't endure the quarter-to-half-second round-trip time. Still, he does say that these types of satellites operate well for data traffic. Hecht goes on to say that the internet disposes of packets that arrive after a maximum delay, and it can request retransmission of packets, which is excellent for webpages and downloads, but present conversations can't wait. The software could skip a lost packet or fill the space by redoing a packet that vowels can tolerate, which are lengthy balanced sounds, so if a packet is lost from the center of zoom, it will go unnoticed. Since consonants are short and sharp, so dropping a packet and the end of a word like "can't" would turn into "can." Severe congestion could cause whole sentences to disappear and would make having conversations nearly impossible. This type of blockage is more severe on wireless networks, and it has already affected fixed broadband and backbone networks. Consumers became frustrated by never-ending video-buffering delays, and they blamed cable companies purposely throttling streaming video from video-streaming services like Netflix. During 2014 the Measurement Lab consortium reported that the actual bottlenecks are located at the interconnections where the ISP's and backbone networks meet. This study measured data rates of broadband traffic in major urban centers, which included Dallas, NYC, and LA. during the majority of 2013 and 2014. it reported, "maintained performance degradation" when traffic from AT&T, Comcast, CenturyLink, Time Warner Cable, and Verizon went through interconnections with three crucial backbone transit carriers: Cogent Communications, Level 3, and XO Communications. This performance degradation repeated whenever traffic passed between the same pair of carriers. For almost a year, average download rates couldn't achieve a rate of 4 megabits per second for customers of Comcast, Time Warner, and Verizon, who were connected to the test system via Cogent in NYC.

The download rate changed every day; these download rates peaked in the minimal-traffic wee hours during the morning and were extremely slow during optimal usage times in the late afternoon and evening. In January of 2014, optimal-hour download rates for Comcast and Verizon customers dwindled below the 0.5 Mb/s that the FCC treats as the minimum rate usable for web browsing. Then in late February of 2014, the average download rate increased over 12 Mb/s. Those specific bottlenecks were low-capacity connections between Cogent and the carriers. But the core cause says Collin Anderson, who's a Measurement Lab researcher, is not one culprit, not one transit provider, not one ISP. He describes this predicament as a systemic issue it originates from business contracts that dictate traffic volume and payment for service in which its information is confidential. Third-party VoIP services like Skype are affected, but these bottlenecks which direct their traffic throughout the internet but not carrier digital voice services which connect to the backbone telephone network.

The differential treatment of packets worries advocates of Net Neutrality who are afraid that carriers may misuse these new Net Management tools to minimize customer access to sites and services. Hecht states that the central point of Net Neutrality is that carriers shouldn't discriminate the services they carry this way; cable companies, for example, won't be able to choke Netflix just because it competes with their video programming. Net neutrality has different meanings to different people. A few people want fair treatment for all bits; others want appropriate treatment for all information providers, which in turn would allow the information providers to assign priorities to their services. Others argue that carriers should have the ability to charge extra for exclusive services, but not to block or throttle access. Each approach has different implications for network management. Treating all bits equally has become a popular chant it states just what it means providing it a charming simplicity that leaves minimal wiggle room for companies to attempt to game the system. But philosophical clarity may come at the cost of telephone clarity. "LTE" utilizes accelerated forwarding services and packet priority to minimize jitter, which reduces voice quality. Says Fred Baker, a distinguished engineering fellow, a Cisco Systems and former chair of the Internet Engineering Task Force, which involves giving some bits preference over others. And all telephone traffic could be affected if the FCC pursued its plan to convert wire-line phone service to the internet.

A couple of viewers believe that network neutrality perfectionists don't mean what they say even though Jeremy Gillula says that people who operate networks shouldn't discriminate at all when it comes to managing their systems. The EFF's logic behind this is they advocate the encryption of the internet, and Gillula points out that data that's encrypted isn't able to be analyzed to determine whether or not it should be prioritized. Furthermore, he adds if we allow some packets to be treated better than others, we'd be shutting off a world of new methods of utilizing the internet that we haven't uncovered yet. Then we'd be reassigning ourselves to accept what already exists. Other advocate groups are taking a less restrictive approach; they know that networks need to be managed to provide a user's desired service. The key is to ensure network maintenance isn't a free pass to violate network neutrality; doing this would allow carriers to schedule conversational video packets differently from steaming video packets, which aren't as time-sensitive. Still, they won't permit carriers to distinguish between steaming video packets from two different companies. An important argument for using this approach is packet switching discriminates inherently against time-sensitive applications. Meaning if packet switching isn't coupled with network maintenance, it wouldn't be able to stop the deterioration of time-sensitive services on a busy network. In his November 2014 speech, President Obama advocated network neutrality. He didn't say that all bits should be treated the same, but he specified for rules; no blocking, no throttling, no special treatment for interconnections, and no paid prioritization to speed content transmission. The way the industry sees it net neutrality had another significant difference; it should permit companies to propose exclusively-priced services. A policy paper that was written by Nokia states that users should be allowed to talk with any other person or business and be able to access their content without any blocking or throttling. Except when the network is being managed, which is consistently applied to all network traffic. This paper annotates that fee-based differentiation should be permitted for specialized services as long as it's transparent. Carriers favor this method because annexing exclusive services would provide them a monetary incentive to improve their networks. Critics counter proposing a fast lane to elite customers could downgrade other users to the slow lane, especially in busy wireless networks. A critical issue yet to be resolved is who should pay for exclusive service.

The critical technology question regarding the discussion over net neutrality is which method to packet management would perform the best now and later on. Networks don't just work if you treat every packet the same way. Cisco's Baker phrased this more subtlety he said that equal treatment for all packets would set the industry back by a score; this is especially true of wireless networks where high demand and minimal bandwidth make network management essential. Remove priority, and you shatter VoLTE, which was the first technology to present key enhancements in cellular voice quality. If VoLTE didn't exist or a similar packet management system, there'd be no apparent method to recognize the FCC's unsettled plan to push wire-line telephony onto the internet without deteriorating voice quality to smartphone level. Other suggested services are contingent on priority coding. Telemedicine, teleoperation of remote devices, and everyday interaction among autonomous vehicles might cause problems if data packets become delayed during top congestion times. A couple of analysts argue that packet scheduling might choke other traffic by reducing the unscheduled bandwidth others disagree that this shouldn't be an issue in a properly-designed network that has ample capacity and interconnections. As unfair as packet scheduling is, it appears to be the best technology available for distributing a mix of time-sensitive and time-insensitive services. Few Net neutrality supporters are confident that any management will bring about bad results, but they aren't accepting that having control will also bring about bad results. To conclude, internet perfectionists take note managing traffic is as relevant on the internet as it is on streets and highways.

What I learned from the peer-reviewed article is what Network Neutrality is, and it's pros and cons. I also learned that the different approaches that were discussed in this article to address this issue would affect how packets are delivered and scheduled. There isn't only one way to solve network neutrality; there are multiple ways to try and solve this issue. Still, it will take a lot of debating and negotiations to decide on what is the most effective method to tackle network neutrality, just like it will take the same amount of discussion about how to converge the world from IPv4 to IPv6 addressing..

Reference

Hecht 2015. “Net Neutrality's Technical Troubles.” (February 2015) Retrieved February 12, 2020 from https://spectrum.ieee.org/telecom/internet/net-neutralitys-technical-troubles