Net neutrality

Net neutrality is the principle that Internet service providers and governments regulating the Internet should treat all data on the Internet the same, not discriminating or charging differentially by user, content, website, platform, application, type of attached equipment, or mode of communication. The term was coined by Columbia University media law professor Tim Wu in 2003, as an extension of the longstanding concept of a common carrier, which was used to describe the role of telephone systems.[1][2][3][4]

A widely cited example of a violation of net neutrality principles was when the Internet service provider Comcast was secretly slowing (colloquially called "throttling") uploads from peer-to-peer file sharing (P2P) applications using forged packets.[5] Research suggests that a combination of policy instruments will help realize the range of valued political and economic objectives central to the network neutrality debate.[6] Combined with strong public opinion, this has led some governments to regulate broadband Internet services as a public utility, similar to the way electricity, gas and water supply is regulated, along with limiting providers and regulating the options those providers can offer.[7]

Part of a series about

Net neutrality

Topics and issues

Bandwidth throttling
Data discrimination
Deep packet inspection
End-to-end principle
Internet Protocol (IP)
Net bias
Net neutrality law
Search neutrality
Tiered Internet

By country or region

Brazil
Canada
Chile
European Union
India
Netherlands
Philippines
Singapore
United States (FCC)

Internet portal

Definition and related principles

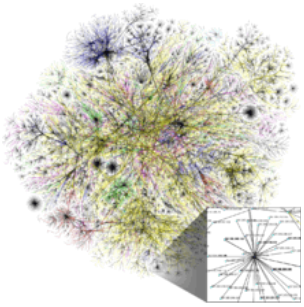
Internet neutrality

Network neutrality is the principle that all Internet traffic should be treated equally.[8] Internet traffic includes all of the different messages, files and data sent over the Internet, including, for example, emails, digital audio files, digital video files, etc. According to Columbia Law School professor Tim Wu, the best way to explain network neutrality is that a public information network will end up being most useful if all content, websites, and platforms (e.g., mobile devices, video game consoles, etc.) are treated equally.[9] A more detailed proposed definition of technical and service network neutrality suggests that service network neutrality is the adherence to the paradigm that operation of a service at a certain layer is not influenced by any data other than the data interpreted at that layer, and in accordance with the protocol specification for that layer.[10]

Open Internet

The idea of an "open Internet" is the idea that the full resources of the Internet and means to operate on it should be easily accessible to all individuals, companies and organizations. This often includes ideas such as net neutrality, open standards, transparency, lack of Internet censorship, and

Internet



An Opte Project visualization of routing paths through a portion of the Internet

General

Access · Censorship · Democracy · Digital divide · Digital rights · Freedom of information · History of the Internet · Internet phenomena · Net neutrality · Pioneers · Privacy · Sociology ·

low barriers to entry. The concept of the open Internet is sometimes expressed as an expectation of decentralized technological power, and is seen by some observers as closely related to open-source software, a type of software program where the maker allows users access to the code that runs the program, so that users can improve the software or fix "bugs".[11]

Proponents of net neutrality see this as an important component of an "open Internet", where policies such as equal treatment of data and open web standards allow those using the Internet to easily communicate and conduct business and activities without interference from a third party.[12] A "closed Internet" refers to the opposite situation, in which established persons, corporations or governments favor certain uses. A closed Internet may have restricted access to necessary web standards, artificially degrade some services, or explicitly filter out content. Some countries block certain websites or types of sites and monitor and/or censor Internet use using Internet police, a specialized type of law enforcement or secret police.

Usage

Governance

ICANN
Internet Engineering Task Force
Internet Governance Forum
Internet Society

Information infrastructure

Domain Name System
Hypertext Transfer Protocol
Internet exchange point
Internet Protocol
Internet protocol suite
Internet service provider
IP address
Internet Message Access Protocol
Simple Mail Transfer Protocol

Services

Blogs (Microblogging) · Email · Fax · File sharing · File transfer · Games · Instant messaging · Podcasts · Shopping · Television · Voice over IP · World Wide Web (search)

Guides

Book · **Index** · **Outline**

Internet portal

Dumb pipe

Main article: Dumb pipe

The concept of a "dumb network" made up of "dumb pipes" has been around since at least the early 1990s. The term "dumb network" refers to a network which is set up and then on which there is little or no control or management of the way users make use of the network. The term "dumb pipes" is an analogy to water pipes used in a city water supply system; in theory, these pipes provide a steady supply of water to all users, regardless of the identity of the user or the users' activities with the water. In a "dumb network", the endpoints of a network are thought to be where the intelligence lies, and as such, proponents argue that the network should leave the management and operation of communications and data transfer to the end users, not a government bureau or Internet company. In 2013 the software company MetroTech Net, Inc. (MTN) coined the term "dumb wave", which is the 2010s-era application of the "dumb pipe" concept to the ubiquitous wireless network.

End-to-end principle

Main article: End-to-end principle

The end-to-end principle is a principle of network design was first set out in the 1981 paper *End-to-end arguments in system design* by Jerome H. Saltzer, David P. Reed, and David D. Clark. The principle states that, whenever possible, communications protocol operations should be defined to occur at the end-points of a communications system, or as close as possible to the resources being controlled. According to the end-to-end principle, protocol features are only justified in the lower layers of a system if they are a performance optimization; hence, TCP retransmission for reliability is still justified, but efforts to improve TCP reliability

should stop after peak performance has been reached.

They argued that reliable systems tend to require end-to-end processing to operate correctly, in addition to any processing in the intermediate system. They pointed out that most features in the lowest level of a communications system have costs for all higher-layer clients, even if those clients do not need the features, and are redundant if the clients have to re-implement the features on an end-to-end basis. This leads to the model of a minimal dumb network with smart terminals, a completely different model from the previous paradigm of the smart network with dumb terminals. Because the end-to-end principle is one of the central design principles of the Internet, and because the practical means for implementing data discrimination violate the end-to-end principle, the principle often enters discussions about net neutrality. The end-to-end principle is closely related, and sometimes seen as a direct precursor to the principle of net neutrality.[13]

Traffic shaping

Main article: Traffic shaping

Traffic shaping is the control of computer network traffic to optimize or guarantee performance, improve latency (i.e., decrease Internet response times), and/or increase usable bandwidth by delaying "packets" that meet certain criteria.[14] In practice, traffic shaping is often accomplished by "throttling" certain types of data, such as streaming video or P2P file sharing. More specifically, traffic shaping is any action on a set of packets (often called a stream or a flow) which imposes additional delay on those packets such that they conform to some predetermined constraint (a contract or traffic profile).[15] Traffic shaping provides a means to control the volume of traffic being sent into a network in a specified period (bandwidth throttling), or the maximum rate at which the traffic is sent (rate limiting), or more complex criteria such as generic cell rate algorithm.

Over-provisioning

If the core of a network has more bandwidth than is permitted to enter at the edges, then good quality of service (QoS) can be obtained without policing or throttling. For example,landline telephone network employs admission control to limit user demand on the network core by refusing to create a circuit for the requested connection. During a natural disaster, for example, most users will get a busy signal if they pick up a landline phone, as the phone company prioritizes 9-1-1 and other emergency calls. Over-provisioning is a form of statistical multiplexing that makes liberal estimates of peak user demand. Over-provisioning is used in private networks such as WebEx and the Internet 2 Abilene Network, an American university network. David Isenberg believes that continued over-provisioning will always provide more capacity for less expense than QoS and deep packet inspection technologies.[16][17]

By issue

Discrimination by protocol

Discrimination by protocol is the favoring or blocking information based on aspects of the communications protocol that the computers are using to communicate.[18] In the US, a complaint was filed with the Federal Communications Commission against the cable provider, Comcast, alleging they had illegally inhibited users of its high-speed Internet service from using popular file-sharing software, Bit Torrent.[19] Comcast admitted no wrongdoing[20] in its proposed settlement of up to US$16 dollars per share in December 2009.[21] However, a U.S. appeals court ruled in April 2010 that the FCC exceeded its authority when it sanctioned Comcast in 2008

for deliberately preventing some subscribers from using peer-to-peer file-sharing services to download large files. However, the FCC spokeswoman Jen Howard responded, "the court in no way disagreed with the importance of preserving a free and open Internet, nor did it close the door to other methods for achieving this important end [goal]."[22] In spite of the ruling in favor of Comcast, a study by *Measurement Lab* in October 2011 verified that Comcast had virtually stopped its BitTorrent throttling practices.[23][24]

Discrimination by IP address

See also: IP address blocking and Deep packet inspection

During the 1990s, creating a non-neutral Internet was technically infeasible.[25] Originally developed to filter harmful malware, the Internet security company NetScreen Technologies released network firewalls in 2003 with so-called deep packet inspection capabilities. Deep packet inspection helped make real-time discrimination between different kinds of data possible,[26] and is often used for Internet censorship. In a practice called zero-rating, companies will reimburse data use from certain addresses, favoring use of those services. Examples include Facebook Zero[27] and Google Free Zone. These zero-rating practices are especially common in the developing world.[28]

Sometimes Internet Service Providers (ISPs) will charge some companies, but not others, for the traffic they cause on the ISP's network. French telecom operator Orange, complaining that traffic from YouTube and other Google sites consists of roughly 50% of total traffic on the Orange network, made a deal with Google, in which they charge Google for the traffic incurred on the Orange network.[29] Some also thought that Orange's rival ISP Free throttled YouTube traffic. However, an investigation done by the French telecommunications regulatory body revealed that the network was simply congested during peak hours.[30]

Favoring private networks

Proponents of net neutrality argue that without new regulations, Internet service providers would be able to favor their own private protocols over others. ISPs are able to encourage the use of specific services by utilizing private networks to discriminate what data is counted against bandwidth caps. For example, Comcast struck a deal with Microsoft that allowed users to stream television through the Xfinity app on their Xbox 360s without it affecting their bandwidth limit. However, utilizing other television streaming apps, such as Netflix, HBO Go, and Hulu, counted towards the limit. Comcast denied that this infringed on net neutrality principles since “it runs its Xfinity for Xbox service on its own, private Internet protocol network.”[31]

Peering discrimination

See also: Peering

There is some disagreement about whether "peering" is a net neutrality issue.[32] In the first quarter of 2014, streaming website Netflix reached an arrangement with ISP Comcast to improve the quality of its service to Netflix clients.[33] This arrangement was made in response to increasingly slow connection speeds through Comcast over the course of 2013, where average speeds dropped by over 25% of their values a year before to an all-time low. After the deal was struck in January 2014, the Netflix speed index recorded a 66% increase in connection. Netflix agreed to a similar deal with Verizon in 2014 after Verizon DSL customers connection speed dropped to less than 1 Mbit/s early in the year. Netflix spoke out against this deal with a controversial

statement delivered to all Verizon customers experiencing low connection speeds using the Netflix client.[34] This sparked an internal debate between the two companies that led to Verizon obtaining a cease and desist order on 5 June 2014 that forced Netflix to stop displaying this message.

Legal aspects

Main article: Net neutrality law

Legal enforcement of net neutrality principles takes a variety of forms, from provisions that outlaw anti-competitive blocking and "throttling" of Internet services, all the way to legal enforcement that prevents companies from subsidizing Internet use on particular sites.[35] Contrary to popular rhetoric and various individuals involved in the ongoing academic debate, research suggests that a single policy instrument (such as a no-blocking policy or a quality of service tiering policy) cannot achieve the range of valued political and economic objectives central to the debate.[6] As Bauer and Obar suggest, "safeguarding multiple goals requires a combination of instruments that will likely involve government and nongovernment measures. Furthermore, promoting goals such as the freedom of speech, political participation, investment, and innovation calls for complementary policies."[36]

By country

Further information: Net neutrality law § By geographic regions

Brazil

Main article: Brazilian Civil Rights Framework for the Internet

The Brazilian Civil Rights Framework for the Internet (in Portuguese: *Marco Civil da Internet*, officially Law No 12.965) became law on April 23, 2014 at the Global Multistakeholder Meeting on the Future of Internet Governance. It governs the use of the Internet in Brazil, through forecasting principles, guarantees, rights and duties to those who use the network as well as the determination of guidelines for state action. The legislation was used as basis to block the popular WhatsApp application in Brazilian territory, a decision lifted soon afterwards, experts claiming that it was, in actuality, against the Framework, which was misinterpreted by the judiciary.[37][38][39][40][41]

Canada

Main article: Net neutrality in Canada

In a January 25, 2011 decision, the Canadian Radio-Television and Telecommunications Commission (CRTC) ruled that usage-based billing could be introduced.[42] Prime Minister Harper signaled that the government may be looking into the ruling: "We're very concerned about CRTC's decision on usage-based billing and its impact on consumers. I've asked for a review of the decision".[43] Some have suggested that the ruling adversely affects net neutrality, since it discriminates against media that is larger in size, such as audio and video.[44]

Chile

Main article: Net neutrality in Chile

On 13 June 2010, the National Congress of Chile, amended its telecommunications law in order to preserve network neutrality, becoming the first country in the world to do so.[45][46][47] The law, published on 26 August 2010, added three articles to the General Law of Telecommunications, forbidding ISPs from arbitrarily blocking, interfering with, discriminating, hindering or restricting an Internet user's right to use, send, receive or offer any legal content, application, service or any other type of legal activity or use through the Internet. ISPs must offer Internet access in which content is not arbitrarily treated differently based on its source or ownership.[48]

India

Main article: Net neutrality in India

On 8th Feb 2016, Telecom Regulatory Authority of India (TRAI) banned differential pricing of data services.[49][50] As per TRAI's press release, the regulator had multiple responses soliciting different opinions with respect to its consultation paper. Considering all the responses, the regulator decided to have an ex ante regulation instead of a case by case tariff investigation regime. According to the TRAI this decision was reached in order to give the industry participants the much needed certainty and in view of the high costs of regulation in terms of time and resources that will be required for investigating each case of tariff discrimination. Ruling prohibits any service provider from offering or charging discriminatory tariffs for data services on the basis of content and also prohibits any agreement or contract which might have effect of discriminatory tariffs for data services or may assist the service provider in any manner to evade the regulation. It also specifies financial disincentives for contravention of regulation. However, the ruling does not prescribe a blanket ban on differential pricing and provides an exception in case of public emergency or for providing emergency services. Discriminatory tariffs are allowed in the case of an emergency. Lastly, according to TRAI this ruling shouldn't be considered the end of the net neutrality debate. The regulator has promised to keep a close view on the developments in the market and may undertake a review after two years or at an earlier date, as it may deem fit.[51]

In March 2015, the TRAI released a formal consultation paper on *Regulatory Framework for Over-the-top (OTT)* services, seeking comments from the public . The consultation paper was criticised for being one sided and having confusing statements. It was condemned by various politicians and internet users.[52][53][54] By 24 April 2015, over a million emails had been sent to TRAI demanding net neutrality.[54][55][56][57] The consultation period ended on January 7, 2016.

Violations of net neutrality have been common in India. Examples beyond Facebook's Internet.org include Aircel's Wikipedia Zero along with Aircel's free access to Facebook and WhatsApp, Airtel's free access to Google, and Reliance's free access to Twitter.[58][59]

Facebook's Free Basics program is seen by activists as a net neutrality violation, based on its provision of free-of-cost access to dozens of sites, in collaboration with telecom operators. There were protests online and on ground against the Free Basics program. The Free Software Movement of India also held a protest in Hyderabad and parts of Telangana and Andhra Pradesh.[60]

Netherlands

Main article: Net neutrality in the Netherlands

On June 4, 2012, the Netherlands became the first country in Europe and the second in the world, after Chile, to enact a network neutrality law.[61][62][63] The main provision of the law requires that "Providers of public electronic communication networks used to provide Internet access services as well as providers of Internet access services will not hinder or slow down services or applications on the Internet".[64]

Singapore

Main article: Net neutrality in Singapore

In 2014 and 2015, there were efforts to charge Over-the-top content (OTT) providers (companies that provide streaming video). Infocomm Development Authority (IDA) has a Policy Framework for Net Neutrality that did not allow a surcharge. Consumers also argued that they already pay for their service.

Slovenia

At the end of 2012 Slovenia legislated a Law of electronic communication.[65] The law implements strong principle of net neutrality. Slovenia became second country in Europe to enact net neutrality law. Government Agency for communications, networks and services (AKOS) is enforcing the law and executes inspections. In January 2015 it found zero-rating infringements at two largest mobile network providers Telekom and Simobil.[66] In February it found similar infringaments also at Amis[67] (now Simobil) and Tušmobil[68] (now Telemach). In July 2016 the Administrative court of the Republic of Slovenia annulled the decisions of AKOS.[69]

South Africa

As of 2016, there is no law on net neutrality in South Africa. A White Paper was to be published by the South African government in March, 2015,[70] but it has not been published yet. However, the telecommunications regulator ICASA, and the Department of Telecommunications and Postal Services has been engaged in this debate. In March 2014, ICASA invited comments to its “Notice of Public Inquiry into the State of Competition in the Information and Communications Technology Sector”,[71] in which net neutrality was brought up, and comments were invited on the stakeholders' views on enforcement of net neutrality in South Africa.

Simultaneously, DTPS was in the process of providing an integrated ICT policy review, to provide recommendations on various issues of ICT policy in South Africa. They published a Green Paper and invited comments to the same. The Green Paper did not venture into the debate of net neutrality in detail and simply stated that it is an issue that must be taken into consideration. Following the Green Paper, a Discussion Paper was published in November, 2014, which also invited comments. Lastly, a Final Report was published in June, 2015 by DTPS providing its policy recommendations. DTPS recommended that the broad tenets of net neutrality be adopted, with principles such as transparency, no blocking of lawful content, and no unreasonable discrimination in mind. They urged the government to set appropriate exceptions to the application of network neutrality principles, such as emergency services, blocking of unlawful content, etc.

United States

Main article: Net neutrality in the United States

There has been extensive debate about whether net neutrality should be required by law in the United States.

Advocates of net neutrality have raised concerns about the ability of broadband providers to use their "last mile" infrastructure to block Internet applications and content (e.g. websites, services, and protocols), and even to block out competitors.[72] Opponents claim net-neutrality regulations are unncessary and deter investment into improving broadband infrastructure.[73][74]

On 26 February 2015, the U.S. Federal Communications Commission (FCC) ruled in favor of net neutrality by reclassifying broadband access as a telecommunications service and thus applying Title II (common carrier) of the Communications Act of 1934 as well as section 706 of the Telecommunications act of 1996 [75] to Internet service providers.[76][77][78][79][80][81] On 12 March 2015, the FCC released the specific details of its new net neutrality rule.[82][83][84] And on 13 April 2015, the FCC published the final rule on its new regulations.[85][86] The rule took effect on June 12, 2015.[87]

In 2015, the United States Telecom Association (a trade association representing large telecom companies) filed a lawsuit against the FCC challenging the net neutrality rule.[88] The US Telecom industry argued that “the FCC reclassifying broadband carriers as ‘common carriers’ is an overreach on the part of the FCC”.[89] The challenge sparked "a huge legal battle as cable, telecom and wireless internet providers sued to overturn regulations that they said went far beyond the F.C.C.'s authority and would hurt their businesses."[90] In June 2016, in an 184-page ruling, the United States Court of Appeals for the District of Columbia Circuit upheld, by a 2-1 vote, the FCC's net neutrality rules and the FCC's determination that broadband access is a public utility, rather than a luxury. AT&T and the telecom industry said that they would seek to appeal the decision to the Supreme Court.[90]

United Kingdom

In 2007, Plusnet was using deep packet inspection to implement limits and differential charges for peer-to-peer, file transfer protocol, and online game traffic.[91] However, their network management philosophy was made clear for each package they sold, was consistent between different websites.[92]

EU and net neutrality

Article 3 of EU Regulation 2015/2120[93] sets the basic framework for ensuring net neutrality across the entire European Union. However, the regulation's text has been criticized as offering loopholes that can undermine the regulation's effectiveness.[94] Some EU member states, such as Slovenia and the Netherlands, have stronger net neutrality laws.

Arguments in favour

Proponents of net neutrality include consumer advocates, human rights organizations such as Article 19,[95] online companies and some technology companies.[96] Many major Internet application companies are advocates of neutrality. Yahoo!, Vonage,[97] eBay, Amazon,[98] IAC/InterActiveCorp. Microsoft, Twitter, Tumblr, Etsy, Daily Kos, Greenpeace, along with many other companies and organizations, have also taken a stance in support of net neutrality.[99][100] Cogent Communications, an international Internet service provider, has made an announcement in favor of certain net neutrality policies.[101] In 2008, Google published a statement speaking out against letting broadband providers abuse their market power to affect access to

competing applications or content. They further equated the situation to that of the telephony market, where telephone companies are not allowed to control who their customers call or what those customers are allowed to say.[4] However, Google's support of net neutrality was called into question in 2014.[102] Several civil rights groups, such as the ACLU, the Electronic Frontier Foundation, Free Press, and Fight for the Future support net neutrality.[103]

Individuals who support net neutrality include World Wide Web inventor Tim Berners-Lee,[104] Vinton Cerf,[105][106] Lawrence Lessig,[107] Robert W. McChesney, Steve Wozniak, Susan P. Crawford, Marvin Ammori, Ben Scott, David Reed,[108] and U.S. President Barack Obama.[109][110] On 10 November 2014, Obama recommended that the FCC reclassify broadband Internet service as a telecommunications service in order to preserve net neutrality.[111][112][113] On 12 November 2014, AT&T stopped build-out of their fiber network until it has "solid net neutrality rules to follow".[114] On 31 January 2015, AP News reported that the FCC will present the notion of applying ("with some caveats") Title II (common carrier) of the Communications Act of 1934 and section 706 of the Telecommunications act of 1996 [115] to the Internet in a vote expected on 26 February 2015.[116][117][118][119][120]

Control of data

Supporters of net neutrality want to designate cable companies as common carriers, which would require them to allow Internet service providers (ISPs) free access to cable lines, the same model used for dial-up Internet. They want to ensure that cable companies cannot screen, interrupt or filter Internet content without a court order.[121] Common carrier status would give the FCC the power to enforce net neutrality rules.[122] SaveTheInternet.com accuses cable and telecommunications companies of wanting the role of gatekeepers, being able to control which websites load quickly, load slowly, or don't load at all. According to SaveTheInternet.com these companies want to charge content providers who require guaranteed speedy data delivery – to create advantages for their own search engines, Internet phone services, and streaming video services – and slowing access or blocking access to those of competitors.[123] Vinton Cerf, a co-inventor of the Internet Protocol and current vice president of Google argues that the Internet was designed without any authorities controlling access to new content or new services.[124] He concludes that the principles responsible for making the Internet such a success would be fundamentally undermined were broadband carriers given the ability to affect what people see and do online.[105] Cerf has also written about the importance of looking at problems like Net Neutrality through the a combination of the Internet's layered system and the multistakeholder model that governs it.[125] He shows how challenges can arise that can implicate Net Neutrality in certain infrastructure-based cases, such as when ISPs to enter into exclusive arrangements with large building owners, leaving the residents unable to exercise any choice in broadband provider.[126]

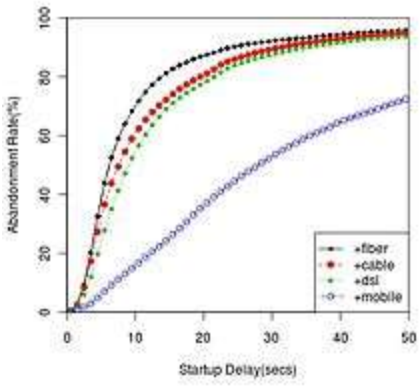
Digital rights and freedoms

Proponents of net neutrality argue that a neutral net will foster free speech and lead to further democratic participation on the internet. Senator Al Franken from Minnesota fears that without new regulations, the major Internet Service Providers will use their position of power to stifle people’s rights. He calls net neutrality the “First Amendment issue of our time.”[127] By ensuring that all people and websites have equal access to each other, regardless of their ability to pay, proponents of net neutrality wish to prevent the need to pay for speech and the further centralization of media power. Lawrence Lessig and Robert W. McChesney argue that net neutrality ensures that the Internet remains a free and open technology, fostering democratic communication.

Lessig and McChesney go on to argue that the monopolization of the Internet would stifle the diversity of independent news sources and the generation of innovative and novel web content.[107]

User intolerance for slow-loading sites

Proponents of net neutrality invoke the human psychological process of adaptation where when people get used to something better, they would not ever want to go back to something worse. In the context of the Internet, the proponents argue that a user who gets used to the "fast lane" on the Internet would find the "slow lane" intolerable in comparison, greatly disadvantaging any provider who is unable to pay for the "fast lane". Video providers Netflix[129] and Vimeo[130] in their comments to FCC in favor of net neutrality use the research[128] of S.S. Krishnan and Ramesh Sitaraman that provides the first quantitative evidence of adaptation to speed among online video users. Their research studied the patience level of millions of Internet video users who waited for a slow-loading video to start playing. Users who had a faster Internet connectivity, such as fiber-to-the-home, demonstrated less patience and abandoned their videos sooner than similar users with slower Internet connectivity. The results demonstrate how users can get used to faster Internet connectivity, leading to higher expectation of Internet speed, and lower tolerance for any delay that occurs. Author Nicholas Carr[131] and other social commentators[132][133] have written about the habituation phenomenon by stating that a faster flow of information on the Internet can make people less patient.



Users with faster Internet connectivity (e.g., fiber) abandon a slow-loading video at a faster rate than users with slower Internet connectivity (e.g., cable or mobile).[128] A "fast lane" in the Internet can irrevocably decrease the user's tolerance to the relative slowness of the "slow lane".

Competition and innovation

Net neutrality advocates argue that allowing cable companies the right to demand a toll to guarantee quality or premium delivery would create an exploitative business model based on the ISPs position as gatekeepers.[134] Advocates warn that by charging websites for access, network owners may be able to block competitor Web sites and services, as well as refuse access to those unable to pay.[107] According to Tim Wu, cable companies plan to reserve bandwidth for their own television services, and charge companies a toll for priority service.[135] Proponents of net neutrality argue that allowing for preferential treatment of Internet traffic, or tiered service, would put newer online companies at a disadvantage and slow innovation in online services.[96] Tim Wu argues that, without network neutrality, the Internet will undergo a transformation from a market ruled by innovation to one ruled by deal-making.[135] SaveTheInternet.com argues that net neutrality puts everyone on equal terms, which helps drive innovation. They claim it is a preservation of the way the internet has always operated, where the quality of websites and services determined whether they succeeded or failed, rather than deals with ISPs.[123] Lawrence Lessig and Robert W. McChesney argue that eliminating net neutrality would lead to the Internet resembling the world of cable TV, so that access to and distribution of content would be managed by a handful of massive, near monopolistic companies, though there are multiple service providers in each region. These companies would then control what is seen as well as how much it costs to see it. Speedy and secure Internet use for such industries as health care, finance, retailing, and gambling could be subject to large fees charged by these companies. They further explain that a majority of the great innovators in the history of the Internet started with little capital in their garages, inspired by great ideas. This was possible because the

protections of net neutrality ensured limited control by owners of the networks, maximal competition in this space, and permitted innovators from outside access to the network. Internet content was guaranteed a free and highly competitive space by the existence of net neutrality.[107]

Preserving Internet standards

Net neutrality advocates have sponsored legislation claiming that authorizing incumbent network providers to override transport and application layer separation on the Internet would signal the decline of fundamental Internet standards and international consensus authority. Further, the legislation asserts that bit-shaping the transport of application data will undermine the transport layer's designed flexibility.[136]

Preventing pseudo-services

Alok Bhardwaj, founder of Epic Privacy Browser, argues that any violations to network neutrality, realistically speaking, will not involve genuine investment but rather payoffs for unnecessary and dubious services. He believes that it is unlikely that new investment will be made to lay special networks for particular websites to reach end-users faster. Rather, he believes that non-net neutrality will involve leveraging quality of service to extract remuneration from websites that want to avoid being slowed down.[137][138]

End-to-end principle

Main article: End-to-end principle

Some advocates say network neutrality is needed in order to maintain the end-to-end principle. According to Lawrence Lessig and Robert W. McChesney, all content must be treated the same and must move at the same speed in order for net neutrality to be true. They say that it is this simple but brilliant end-to-end aspect that has allowed the Internet to act as a powerful force for economic and social good.[107] Under this principle, a neutral network is a dumb network, merely passing packets regardless of the applications they support. This point of view was expressed by David S. Isenberg in his paper, "The Rise of the Stupid Network". He states that the vision of an intelligent network is being replaced by a new network philosophy and architecture in which the network is designed for always-on use, not intermittence and scarcity. Rather than intelligence being designed into the network itself, the intelligence would be pushed out to the end-user's device; and the network would be designed simply to deliver bits without fancy network routing or smart number translation. The data would be in control, telling the network where it should be sent. End-user devices would then be allowed to behave flexibly, as bits would essentially be free and there would be no assumption that the data is of a single data rate or data type.[139]

Contrary to this idea, the research paper titled *End-to-end arguments in system design* by Saltzer, Reed, and Clark[140] argues that network intelligence doesn't relieve end systems of the requirement to check inbound data for errors and to rate-limit the sender, nor for a wholesale removal of intelligence from the network core.

Arguments against

Opponents of net neutrality regulations include civil rights groups, economists, internet providers and technologists. Among corporations, opponents include AT&T, Verizon, IBM, Intel, Cisco, Nokia, Qualcomm, Broadcom, Juniper, dLink, Wintel, Alcatel-Lucent, Corning, Panasonic, Ericsson, and others.[73][141][142] Notable technologists who oppose net neutrality include Marc Andreessen, Scott McNealy, Peter Thiel, David

Farber, Nicholas Negroponte, Rajeev Suri, Jeff Pulver, John Perry Barlow, and Bob Kahn.[143][144][145][146][147][148][149][150][151][152]

Nobel Prize-winning economist Gary Becker's paper titled, "Net Neutrality and Consumer Welfare", published by the *Journal of Competition Law & Economics*, alleges that claims by net neutrality proponents "do not provide a compelling rationale for regulation" because there is "significant and growing competition" among broadband access providers.[144][153] Google Chairman Eric Schmidt states that, while Google views that similar data types should not be discriminated against, it is okay to discriminate across different data types—a position that both Google and Verizon generally agree on, according to Schmidt.[154][155] According to the Journal, when President Barack Obama announced his support for strong net neutrality rules late in 2014, Schmidt told a top White House official the president was making a mistake.[155]

Several civil rights groups, such as the National Urban League, Jesse Jackson's Rainbow/PUSH, and League of United Latin American Citizens, also oppose Title II net neutrality regulations,[156] who said that the call to regulate broadband Internet service as a utility would harm minority communities by stifling investment in underserved areas.[157][158]

A number of other opponents created *Hands Off The Internet*,[159] a website created in 2006 to promote arguments against internet regulation. Principal financial support for the website came from AT&T, and members included BellSouth, Alcatel, Cingular, and Citizens Against Government Waste.[160][161][162][163][164]

Robert Pepper, a senior managing director, global advanced technology policy, at Cisco Systems, and former FCC chief of policy development, says: "The supporters of net neutrality regulation believe that more rules are necessary. In their view, without greater regulation, service providers might parcel out bandwidth or services, creating a bifurcated world in which the wealthy enjoy first-class Internet access, while everyone else is left with slow connections and degraded content. That scenario, however, is a false paradigm. Such an all-or-nothing world doesn't exist today, nor will it exist in the future. Without additional regulation, service providers are likely to continue doing what they are doing. They will continue to offer a variety of broadband service plans at a variety of price points to suit every type of consumer".[165] Computer scientist Bob Kahn [150] has said net neutrality is a slogan that would freeze innovation in the core of the Internet.[143]

Farber has written and spoken strongly in favor of continued research and development on core Internet protocols. He joined academic colleagues Michael Katz, Christopher Yoo, and Gerald Faulhaber in an op-ed for the *Washington Post* strongly critical of network neutrality, essentially stating that while the Internet is in need of remodeling, congressional action aimed at protecting the best parts of the current Internet could interfere with efforts to build a replacement.[166]

Reduction in innovation and investments

According to a letter to key Congressional and FCC leaders sent by 60 major ISP technology suppliers including IBM, Intel, Qualcomm, and Cisco, Title II regulation of the internet "means that instead of billions of broadband investment driving other sectors of the economy forward, any reduction in this spending will stifle growth across the entire economy. This is not idle speculation or fear mongering...Title II is going to lead to a slowdown, if not a hold, in broadband build out, because if you don't know that you can recover on your investment, you won't make it."[73][167][168][169] According to the *Wall Street Journal*, in one of Google's few lobbying sessions with FCC officials, the company urged the agency to craft rules that encourage investment in broadband Internet networks—a position that mirrors the argument made by opponents of strong net neutrality

rules, such as AT&T and Comcast.[155] Opponents of net neutrality argue that prioritization of bandwidth is necessary for future innovation on the Internet.[142] Telecommunications providers such as telephone and cable companies, and some technology companies that supply networking gear, argue telecom providers should have the ability to provide preferential treatment in the form of tiered services, for example by giving online companies willing to pay the ability to transfer their data packets faster than other Internet traffic.[170] The added revenue from such services could be used to pay for the building of increased broadband access to more consumers.[96]

Opponents say that net neutrality would make it more difficult for Internet service providers (ISPs) and other network operators to recoup their investments in broadband networks.[171] John Thorne, senior vice president and deputy general counsel of Verizon, a broadband and telecommunications company, has argued that they will have no incentive to make large investments to develop advanced fibre-optic networks if they are prohibited from charging higher preferred access fees to companies that wish to take advantage of the expanded capabilities of such networks. Thorne and other ISPs have accused Google and Skype of freeloading or free riding for using a network of lines and cables the phone company spent billions of dollars to build.[142][172][173] Marc Andreessen states that "a pure net neutrality view is difficult to sustain if you also want to have continued investment in broadband networks. If you're a large telco right now, you spend on the order of $20 billion a year on capex [capital expenditure]. You need to know how you're going to get a return on that investment. If you have these pure net neutrality rules where you can never charge a company like Netflix anything, you're not ever going to get a return on continued network investment — which means you'll stop investing in the network. And I would not want to be sitting here 10 or 20 years from now with the same broadband speeds we're getting today."[174]

Counterweight to server-side non-neutrality

Those in favor of forms of non-neutral tiered Internet access argue that the Internet is already not a level playing field: large companies achieve a performance advantage over smaller competitors by providing more and better-quality servers and buying high-bandwidth services. Should prices drop for lower levels of access, or access to only certain protocols, for instance, a change of this type would make Internet usage more neutral, with respect to the needs of those individuals and corporations specifically seeking differentiated tiers of service. Network expert[175] Richard Bennett has written, "A richly funded Web site, which delivers data faster than its competitors to the front porches of the Internet service providers, wants it delivered the rest of the way on an equal basis. This system, which Google calls broadband neutrality, actually preserves a more fundamental inequality."[176]

Broadband infrastructure

Proponents of net neutrality regulations say network operators have continued to under-invest in infrastructure.[177] However, according to Copenhagen Economics, US investment in telecom infrastructure is 50 percent higher that of the European Union. As a share of GDP, The US's broadband investment rate per GDP trails only the UK and South Korea slightly, but exceeds Japan, Canada, Italy, Germany, and France sizably.[178] On broadband speed, Akamai reported that the US trails only South Korea and Japan among its major trading partners, and trails only Japan in the G-7 in both average peak connection speed and percentage of the population connection at 10 Mbit/s or higher, but are substantially ahead of most of its other major trading partners.[178]

The White House reported in June 2013 that U.S. connection speeds are "the fastest compared to other countries with either a similar population or land mass."[179] Akamai's report on "The State of the Internet" in the 2nd quarter of 2014 says "a total of 39 states saw 4K readiness rate more than double over the past year." In other words, as ZDNet reports, those states saw a "major" increase in the availability of the 15Mbit/s speed needed for 4K video.[180] According to the Progressive Policy Institute and ITU data, the United States has the most affordable entry-level prices for fixed broadband in the OECD.[178][181]

In Indonesia, there is a very high number of Internet connections that are subjected to exclusive deals between the ISP and the building owner, and changing this dynamic could unlock much more consumer choice and higher speeds.[126] FCC Commissioner Ajit Pai and Federal Election Commission's Lee Goldman wrote in a Politico piece in February 2015, "Compare Europe, which has long had utility-style regulations, with the United States, which has embraced a light-touch regulatory model. Broadband speeds in the United States, both wired and wireless, are significantly faster than those in Europe. Broadband investment in the United States is several multiples that of Europe. And broadband's reach is much wider in the United States, despite its much lower population density." [182]

Significant and growing competition

A 2010 paper on net neutrality by Nobel Prize economist Gary Becker and his colleagues stated that "there is significant and growing competition among broadband access providers and that few significant competitive problems have been observed to date, suggesting that there is no compelling competitive rationale for such regulation."[153] Becker and fellow economists Dennis Carlton and Hal Sidler found that "Between mid-2002 and mid-2008, the number of high-speed broadband access lines in the United States grew from 16 million to nearly 133 million, and the number of residential broadband lines grew from 14 million to nearly 80 million. Internet traffic roughly tripled between 2007 and 2009. At the same time, prices for broadband Internet access services have fallen sharply."[153] The PPI reports that the profit margins of U.S. broadband providers are generally one-sixth to one-eighth of companies that use broadband (such as Apple or Google), contradicting the idea of monopolistic price-gouging by providers.[178]

Broadband choice

A report by the Progressive Policy Institute in June 2014 argues that nearly every American can choose from at least 5-6 broadband internet service providers, despite claims that there are only a 'small number' of broadband providers.[178] Citing research from the FCC, the Institute wrote that 90 percent of American households have access to at least one wired and one wireless broadband provider at speeds of at least 4 Mbit/s (500 kbyte/s) downstream and 1 Mbit/s (125 kbyte/s) upstream and that nearly 88 percent of Americans can choose from at least two wired providers of broadband disregarding speed (typically choosing between a cable and telco offering). Further, three of the four national wireless companies report that they offer 4G LTE to between 250-300 million Americans, with the fourth (T-Mobile) sitting at 209 million and counting.[178] Similarly, the FCC reported in June 2008 that 99.8 percent of zip codes in the United States had two or more providers of high speed Internet lines available, and 94.6 percent of zip codes had four or more providers, as reported by University of Chicago economists Gary Becker, Dennis Carlton, and Hal Sider in a 2010 paper.[153]

When FCC Chairman Tom Wheeler redefined broadband from 4 Mbit/s to 25 Mbit/s (3.125 MB/s) or greater in January 2015, FCC commissioners Ajit Pai and Mike O'Reilly believed the redefinition was to set up the agency's intent to settle the net neutrality fight with new regulations. The commissioners argued that the stricter speed guidelines painted the broadband industry as less competitive, justifying the FCC's moves with Title II

net neutrality regulations.[183]

Deterring competition

FCC commissioner Ajit Pai states that the FCC completely brushes away the concerns of smaller competitors who are going to be subject to various taxes, such as state property taxes and general receipts taxes.[184] As a result, according to Pai, that does nothing to create more competition within the market.[184] According to Pai, the FCC's ruling to impose Title II regulations is opposed by the country's smallest private competitors and many municipal broadband providers.[185] In his dissent, Pai noted that 142 wireless ISPs (WISPs) said that FCC's new "regulatory intrusion into our businesses...would likely force us to raise prices, delay deployment expansion, or both." He also noted that 24 of the country's smallest ISPs, each with fewer than 1,000 residential broadband customers, wrote to the FCC stating that Title II "will badly strain our limited resources" because they "have no in-house attorneys and no budget line items for outside counsel." Further, another 43 municipal broadband providers told the FCC that Title II "will trigger consequences beyond the Commission's control and risk serious harm to our ability to fund and deploy broadband without bringing any concrete benefit for consumers or edge providers that the market is not already proving today without the aid of any additional regulation."[141]

Potentially increased taxes

FCC commissioner Ajit Pai, who opposed the net neutrality ruling, claims that the ruling issued by the FCC to impose Title II regulations explicitly opens the door to billions of dollars in new fees and taxes on broadband by subjecting them to the telephone-style taxes under the Universal Service Fund. Net neutrality proponent Free Press argues that, "the average potential increase in taxes and fees per household would be far less" than the estimate given by net neutrality opponents, and that if there were to be additional taxes, the tax figure may be around $4 billion. Under favorable circumstances, "the increase would be exactly zero."[186] Meanwhile, the Progressive Policy Institute claims that Title II could trigger taxes and fees up to $11 billion a year.[187] Financial website *Nerd Wallet* did their own assessment and settled on a possible $6.25 billion tax impact, estimating that the average American household may see their tax bill increase $67 annually.[187]

FCC spokesperson Kim Hart said that the ruling "does not raise taxes or fees. Period."[187] However, the opposing commissioner, Ajit Pai, claims that "the plan explicitly opens the door to billions of dollars in new taxes on broadband...These new taxes will mean higher prices for consumers and more hidden fees that they have to pay." [188] Pai explained that, "One avenue for higher bills is the new taxes and fees that will be applied to broadband. Here's the background. If you look at your phone bill, you'll see a 'Universal Service Fee,' or something like it. These fees —- what most Americans would call taxes -- are paid by Americans on their telephone service. They funnel about $9 billion each year through the FCC. Consumers haven't had to pay these taxes on their broadband bills because broadband has never before been a Title II service. But now it is. And so the Order explicitly opens the door to billions of dollars in new taxes."[141]

Prevent overuse of bandwidth

Since the early 1990s, Internet traffic has increased steadily. The arrival of picture-rich websites and MP3s led to a sharp increase in the mid-1990s followed by a subsequent sharp increase since 2003 as video streaming and Peer-to-peer file sharing became more common.[189][190] In reaction to companies including YouTube, as well as smaller companies starting to offer free video content, using substantial amounts of bandwidth, at least one

Internet service provider (ISP), SBC Communications (now AT&T Inc.), has suggested that it should have the right to charge these companies for making their content available over the provider's network.[191]

Bret Swanson of the *Wall Street Journal* wrote in 2007 that the popular websites of that time, including YouTube, MySpace, and blogs, were put at risk by net neutrality. He noted that, at the time, YouTube streamed as much data in three months as the world's radio, cable and broadcast television channels did in one year, 75 petabytes. He argued that networks were not remotely prepared to handle the amount of data required to run these sites. He also argued that net neutrality would prevent broadband networks from being built, which would limit available bandwidth and thus endanger innovation.[192] One example of these concerns was the "series of tubes" analogy, which was presented by US senator Ted Stevens during a committee hearing in the US senate in 2006.

High costs to entry for cable broadband

According to a *Wired* magazine article by TechFreedom's Berin Szoka, Matthew Starr, and Jon Henke, local governments and public utilities impose the most significant barriers to entry for more cable broadband competition: "While popular arguments focus on supposed 'monopolists' such as big cable companies, it's government that's really to blame." The authors state that local governments and their public utilities charge ISPs far more than they actually cost and have the final say on whether an ISP can build a network. The public officials determine what requirements an ISP must meet to get approval for access to publicly owned "rights of way" (which lets them place their wires), thus reducing the number of potential competitors who can profitably deploy Internet service—such as AT&T's U-Verse, Google Fiber, and Verizon FiOS. Kickbacks may include municipal requirements for ISPs such as building out service where it isn't demanded, donating equipment, and delivering free broadband to government buildings.[193]

Unnecessary regulations

According to PayPal founder and Facebook investor Peter Thiel, "Net neutrality has not been necessary to date. I don't see any reason why it's suddenly become important, when the Internet has functioned quite well for the past 15 years without it.... Government attempts to regulate technology have been extraordinarily counterproductive in the past."[144] Max Levchin, the other co-founder of PayPal, echoed similar statements, telling CNBC, "The Internet is not broken, and it got here without government regulation and probably in part because of lack of government regulation."[194] Opponents of new federal net neutrality policies point to the success of the internet as a sign that new regulations are not necessary. They argue that the freedom which websites, ISPs and consumers have had to settle their own disputes and compete through innovation is the reason why the internet has been such a rapid success. One of Congress's most outspoken critics of net neutrality regulations is Senator Ted Cruz from Texas, who points out that "innovation [on the internet] is happening without having to go to government and say 'Mother, may I?' What happens when the government starts regulating a service as a public utility is it calcifies everything and freezes it in place."[195] In regulating how the internet is provided, opponents argue that the government will hinder innovation on the web.

FCC Commissioner Ajit Pai, who was one of the two commissioners who opposed the net neutrality proposal, criticized the FCC's ruling on internet neutrality, stating that the perceived threats from ISPs to deceive consumers, degrade content, or disfavor the content that they don't like are non-existent: "The evidence of these continuing threats? There is none; it's all anecdote, hypothesis, and hysteria. A small ISP in North Carolina allegedly blocked VoIP calls a decade ago. Comcast capped BitTorrent traffic to ease upload congestion eight years ago. Apple introduced Facetime over Wi-Fi first, cellular networks later. Examples this picayune and stale aren't enough to tell a coherent story about net neutrality. The bogeyman never had it so easy."[141] FCC

Commissioner Mike O'Reilly, the other opposing commissioner, also claims that the ruling is a solution to a hypothetical problem, "Even after enduring three weeks of spin, it is hard for me to believe that the Commission is establishing an entire Title II/net neutrality regime to protect against hypothetical harms. There is not a shred of evidence that any aspect of this structure is necessary. The D.C. Circuit called the prior, scaled-down version a 'prophylactic' approach. I call it guilt by imagination."[196] In a *Chicago Tribune* article, FCC Commissioner Pai and Joshua Wright of the Federal Trade Commission argue that "the Internet isn't broken, and we don't need the president's plan to 'fix' it. Quite the opposite. The Internet is an unparalleled success story. It is a free, open and thriving platform."[74]

Related issues

Data discrimination

Main article: Data discrimination

Tim Wu, though a proponent of network neutrality, claims that the current Internet is not neutral as its implementation of best effort generally favors file transfer and other non-time-sensitive traffic over real-time communications.[197] Generally, a network which blocks some nodes or services for the customers of the network would normally be expected to be less useful to the customers than one that did not. Therefore, for a network to remain significantly non-neutral requires either that the customers not be concerned about the particular non-neutralities or the customers not have any meaningful choice of providers, otherwise they would presumably switch to another provider with fewer restrictions.

While the network neutrality debate continues, network providers often enter into peering arrangements among themselves. These agreements often stipulate how certain information flows should be treated. In addition, network providers often implement various policies such as blocking of port 25 to prevent insecure systems from serving as spam relays, or other ports commonly used by decentralized music search applications implementing peer-to-peer networking models. They also present terms of service that often include rules about the use of certain applications as part of their contracts with users. Most consumer Internet providers implement policies like these. The MIT Mantid Port Blocking Measurement Project is a measurement effort to characterize Internet port blocking and potentially discriminatory practices. However, the effect of peering arrangements among network providers are only local to the peers that enter into the arrangements, and cannot affect traffic flow outside their scope.

Jon Peha from Carnegie Mellon University believes it is important to create policies that protect users from harmful traffic discrimination, while allowing beneficial discrimination. Peha discusses the technologies that enable traffic discrimination, examples of different types of discrimination, and potential impacts of regulation.[198] Google Chairman Eric Schmidt aligns Google's views on data discrimination with Verizon's: "I want to be clear what we mean by Net neutrality: What we mean is if you have one data type like video, you don't discriminate against one person's video in favor of another. But it's okay to discriminate across different types. So you could prioritize voice over video. And there is general agreement with Verizon and Google on that issue."[199] Echoing similar comments by Schmidt, Google's Chief Internet Evangelist and "father of the internet", Vint Cerf, says that "it's entirely possible that some applications needs far more latency, like games. Other applications need broadband streaming capability in order to deliver real-time video. Others don't really care as long as they can get the bits there, like e-mail or file transfers and things like that. But it should not be the case that the supplier of the access to the network mediates this on a competitive basis, but you may still have different kinds of service depending on what the requirements are for the different applications."[200]

Quality of service

Main article: Quality of service

Internet routers forward packets according to the diverse peering and transport agreements that exist between network operators. Many networks using Internet protocols now employ quality of service (QoS), and Network Service Providers frequently enter into Service Level Agreements with each other embracing some sort of QoS. There is no single, uniform method of interconnecting networks using IP, and not all networks that use IP are part of the Internet. IPTV networks are isolated from the Internet, and are therefore not covered by network neutrality agreements. The IP datagram includes a 3-bit wide Precedence field and a larger DiffServ Code Point (DSCP) that are used to request a level of service, consistent with the notion that protocols in a layered architecture offer services through Service Access Points. This field is sometimes ignored, especially if it requests a level of service outside the originating network's contract with the receiving network. It is commonly used in private networks, especially those including Wi-Fi networks where priority is enforced. While there are several ways of communicating service levels across Internet connections, such as SIP, RSVP, IEEE 802.11e, and MPLS, the most common scheme combines SIP and DSCP. Router manufacturers now sell routers that have logic enabling them to route traffic for various Classes of Service at "wire-speed".

With the emergence of multimedia, VoIP, IPTV, and other applications that benefit from low latency, various attempts to address the inability of some private networks to limit latency have arisen, including the proposition of offering tiered service levels that would shape Internet transmissions at the network layer based on application type. These efforts are ongoing, and are starting to yield results as wholesale Internet transport providers begin to amend service agreements to include service levels.[201]

Advocates of net neutrality have proposed several methods to implement a net neutral Internet that includes a notion of quality-of-service:

- An approach offered by Tim Berners-Lee allows discrimination between different tiers, while enforcing strict neutrality of data sent at each tier: "If I pay to connect to the Net with a given quality of service, and you pay to connect to the net with the same or higher quality of service, then you and I can communicate across the net, with that quality and quantity of service".[3] "[We] each pay to connect to the Net, but no one can pay for exclusive access to me."[202]
- United States lawmakers have introduced bills that would now allow quality of service discrimination for certain services as long as no special fee is charged for higher-quality service.[203]

Founder of Epic Privacy Browser, Alok Bhardwaj, has argued that net neutrality preservation through legislation is consistent with implementing quality of service protocols. He argues legislation should ban the charging of fees for any quality of service, which would both allow networks to implement quality of service as well as remove any incentive to abuse net neutrality ideas. He argues that since implementing quality of service doesn't require any additional costs versus a non-QoS network, there's no reason implementing quality of service should entail any additional fees.[137] However, the core network hardware needed (with large number of queues, etc.) and the cost of designing and maintaining a QoS network are both much higher than for a non-QoS network.

Pricing models

Broadband Internet access has most often been sold to users based on Excess Information Rate or maximum available bandwidth. If Internet service providers (ISPs) can provide varying levels of service to websites at

various prices, this may be a way to manage the costs of unused capacity by selling surplus bandwidth (or "leverage price discrimination to recoup costs of 'consumer surplus' "). However, purchasers of connectivity on the basis of Committed Information Rate or guaranteed bandwidth capacity must expect the capacity they purchase in order to meet their communications requirements. Various studies have sought to provide network providers the necessary formulas for adequately pricing such a tiered service for their customer base. But while network neutrality is primarily focused on protocol based provisioning, most of the pricing models are based on bandwidth restrictions.[204]

See also

- Concentration of media ownership
- Digital rights
- Economic rent
- Industrial information economy
- Killswitch (film)
- Municipal broadband
- Search neutrality
- Switzerland (software)
- Wikipedia Zero

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External links

- Technological Neutrality and Conceptual Singularity
- Why Consumers Should Be Worried About Net Neutrality
- The FCC on Net Neutrality: Be Careful What You Wish For
- Internet Policy: Who's Pulling the Strings
- Financial backers of pro neutrality groups
- *Killerswitch* - film advocating in favor of Net Neutrality
- Battle for the Net - website advocating net neutrality by Fight for the Future
- Don't Break The Net - website advocating against net neutrality by TechFreedom with monetary support

from telcos (see answer to corresponding question on website's "About TechFreedom" section)
- *La Quadrature du Net* – complex dossier and links about net neutrality
- *Net Neutrality – What it is and why you should care.* – comic explaining net neutrality.
- History of Deep Packet Inspection (DPI) PDF

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