Net neutrality
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This article is about the general principle of net neutrality. For its specific application to Canada, see Net neutrality in Canada. For its application to the U.S., see Net neutrality in the United States.

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Net neutrality (also network neutrality or Internet neutrality) is the principle that Internet service providers and governments should treat all data on the Internet equally, not discriminating or charging differentially by user, content, site, platform, application, type of attached equipment, and modes of communication. The term was coined by Columbia media law professor Tim Wu in 2003 as an extension of the longstanding concept of a common carrier.[1][2][3][4] Proponents often see net neutrality as an important component of an open internet, where policies such as equal treatment of data and open web standards allow those on the internet to easily communicate and conduct business without interference from a third party.[5] A "closed internet" refers to the opposite situation, in which established 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.

There has been extensive debate about whether net neutrality should be required by law, particularly in the United States. Debate over the issue of net neutrality predates the coining of the term. Advocates of net neutrality such as Lawrence Lessig 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.

Neutrality proponents claim that telecom companies seek to impose a tiered service model in order to control the pipeline and thereby remove competition, create artificial scarcity, and oblige subscribers to buy their otherwise uncompetitive services. Many believe net neutrality to be primarily important as a preservation of current freedoms.[6] Vinton Cerf, co-inventor of the Internet Protocol and considered a "father of the Internet," as well as Tim Berners-Lee, creator of the Web, and many others have spoken out in favor of net neutrality.[7][8]

Opponents of net neutrality claim that broadband service providers have no plans to block content or degrade network performance.[9] Despite this claim, there has been a single case where an Internet service provider, Comcast, intentionally slowed peer-to-peer (P2P) communications.[10] Still other companies have begun to use deep packet inspection to discriminate against P2P, FTP, and online games, instituting a cell-phone style billing system of overages, free-to-telecom "value added" services, and bundling.[11] Critics of net neutrality also argue that data discrimination of some kinds, particularly to guarantee quality of service, is not problematic, but is actually highly desirable. Bob Kahn, co-inventor of the Internet Protocol, has called the term net neutrality a "slogan" and states that he opposes establishing it, but he admits that he is against the fragmentation of the net whenever this becomes excluding to other participants.[12][dead link] Opponents of net neutrality regulation also argue that the best solution to discrimination by broadband providers is to encourage greater competition among such providers, which is currently limited in many areas.[13]

On 23 April 2014, the Federal Communications Commission (FCC) is reported to be considering a new rule that will permit Internet service providers to offer content providers a faster track to send content, thus reversing their earlier position on net neutrality.[14][15][16] A possible solution to net neutrality concerns may be municipal broadband, according to Dr. Susan Crawford, a legal and technology expert and a Visiting Professor at Harvard Law School.[17] On 15 May 2014, the FCC decided to consider two options regarding internet services: first, permit fast and slow broadband lanes, thereby compromising net neutrality; and second, reclassify broadband as a telecommunication service, thereby preserving net neutrality.[18][19]

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Definition and related principles[edit]
Net neutrality[edit]
At its simplest, network neutrality is the principle that all Internet traffic should be treated equally.[20] According to Columbia Law School professor Tim Wu: "Network neutrality is best defined as a network design principle. The idea is that a maximally useful public information network aspires to treat all content, sites, and platforms equally".[21]

Open Internet[edit]
The idea of an open internet is the idea that the full resources of the internet and means to operate on it are easily accessible to all individuals and companies. This often includes ideas such as net neutrality, open standards, transparency, lack of internet censorship, and low barriers to entry.

Common carrier[edit]
Main article: Common carrier
In common law countries, common carrier is a legal classification for a person or company which transports goods and is legally prohibited from discriminating or refusing service based on the customer or nature of the goods. The common carrier framework is often used to classify public utilities, such as electricity or water, and public transport. In the United States, there has been intense debate between some advocates of net neutrality, who believe internet providers should be legally designated common carriers,[22] and some internet service providers, who believe the common carrier designation would be a heavy regulatory burden.[23]

Dumb pipe[edit]
See also: Dumb pipe
The concept of a "dumb network" made up of "dumb pipes", has been around since at least the early 1990's. The idea of a dumb network is that the endpoints of a network are generally where the intelligence lies, and that the network itself generally leaves the management and operation of communication to the end users.

End-to-end principle[edit]

Main article: End-to-end principle
The end-to-end principle is a principle of network design, first laid out explicitly in the 1981 conference 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 resource 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 "dumb, minimal 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.[24]

History[edit]
Before the Internet[edit]
The concept of network neutrality predates the current Internet-focused debate, existing since the age of the telegraph.[25] In 1860 a U.S. federal law (Pacific Telegraph Act of 1860) was passed to subsidize a telegraph line, stating that:

messages received from any individual, company, or corporation, or from any telegraph lines connecting with this line at either of its termini, shall be impartially transmitted in the order of their reception, excepting that the dispatches of the government shall have priority ...

?An act to facilitate communication between the Atlantic and Pacific states by electric telegraph, June 16, 1860.[26]
In 1888 Almon Brown Strowger invented an automatic telephone exchange to bypass the non-neutral telephone operators who redirected his business calls to a competitor for their profit.[25]

Deployment of deep packet inspection[edit]
During the early decades of the internet, creating a non-neutral internet was technically infeasible.[27] Originally developed to filter malware, the internet security company NetScreen Technologies released network firewalls in 2003 with so called deep packet inspection. The deep inspection helped make real-time discrimination between different kinds of data possible.[28]

Positions[edit]
Proponents[edit]
Proponents of net neutrality include consumer advocates, human rights organizations,[29] online companies and some technology companies.[30] Many major Internet application companies are advocates of neutrality. Yahoo!, Vonage,[31] eBay, Amazon,[32] IAC/InterActiveCorp. Microsoft, along with many other companies, have also taken a stance in support of neutrality regulation.[33] Cogent Communications, an international Internet service provider, has made an announcement in favor of certain net neutrality policies.[34] 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 has recently been called into question.[35]

Individuals who support net neutrality include Tim Berners-Lee,[36] Vinton Cerf,[37][38] Lawrence Lessig, Robert W. McChesney,[6] Steve Wozniak, Susan P. Crawford, Ben Scott, David Reed,[39] and U.S. President Barack Obama.[40][41] However, President Obama has been accused of abandoning his net neutrality promises.[42]

Author Andy Kessler argued in The Weekly Standard that, though network neutrality is desirable, the threat of eminent domain against the telecommunication companies, instead of new legislation, is the best approach.[43]

A number of net neutrality interest groups have emerged, including SaveTheInternet.com which frames net neutrality as an absence of discrimination, saying it ensures Internet providers cannot block, speed up, or slow down content on the basis of who owns it, where it came from, or where it's going. It helps create the situation where any site on the Internet could potentially reach an audience as large as that of a TV or radio station, and its loss would mean the end for this level of freedom of expression.[44]

Envision Seattle and the Community Environmental Legal Defense Fund offer a model legal ordinance for communities and cities to enforce a free and open Internet.

Advocates of net neutrality have proposed several methods to implement a net neutral internet:

One of the simplest methods for implementation comes from Cardozo Law School professor Susan P. Crawford, who "believes that a neutral Internet must forward packets on a first-come, first served basis, without regard for quality-of-service considerations."[45]
Another 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."[46]
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.[47]
Opponents[edit]
Opposition includes the Cato Institute, the Competitive Enterprise Institute, the Goldwater Institute, Americans for Tax Reform, and the Ayn Rand Institute. Opponents of net neutrality include hardware companies and members of the cable and telecommunications industries, including major telecommunications providers.[9]

A number of these opponents created a website called Hands Off The Internet[48] (which no longer exists) to promote their arguments against net neutrality. Principal financial support for the website came from AT&T, and members included technology firms and pro-market advocacy group Citizens Against Government Waste.[49][50][51][52]

Network neutrality regulations are opposed by some Internet engineers, such as professor David Farber and TCP inventor Bob Kahn.[12][53] Robert Pepper is senior managing director, global advanced technology policy, at Cisco Systems, and is the former FCC chief of policy development. He 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".[54] Bob Kahn, another computer scientist, has said net neutrality is a slogan that would freeze innovation in the core of the Internet.[12]

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, stating, "The Internet needs a makeover. Unfortunately, congressional initiatives aimed at preserving the best of the old Internet threaten to stifle the emergence of the new one".[55]

Mixed and other views[edit]
Columbia University Law School professor Tim Wu observed the Internet is not neutral in terms of its impact on applications having different requirements. It is more beneficial for data applications than for applications that require low latency and low jitter, such as voice and real-time video: "In a universe of applications, including both latency-sensitive and insensitive applications, it is difficult to regard the IP suite as truly neutral." He has proposed regulations on Internet access networks that define net neutrality as equal treatment among similar applications, rather than neutral transmissions regardless of applications. He proposes allowing broadband operators to make reasonable trade-offs between the requirements of different applications, while regulators carefully scrutinize network operator behavior where local networks interconnect.[56] However, it is important to ensure that these trade-offs among different applications be done in a transparent manner so that the general public will have input on important policy decisions.[57] This is especially important as the broadband operators often provide competing services?e.g., cable TV, telephony?that might differentially benefit when the need to manage applications could be invoked to disadvantage other competitors.

? 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. ?
?Google CEO Eric Schmidt (August 4, 2010)[58]

Eric Schmidt
Former Washington Post columnist, and Fox News commentator, Jeffrey Birnbaum, who currently works for the BGR Group (a lobbying firm which is employed by Comcast[59]) has called the debate "vague and misleading."[60]

Arguments for net neutrality[edit]
Control of data[edit]
Supporters of network 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 model used for dial-up Internet. They want to ensure that cable companies cannot screen, interrupt or filter Internet content without court order.[61]

SaveTheInternet.com accuses cable and telecommunications companies of wanting "to be Internet gatekeepers, deciding which Web sites go fast or slow and which won't load at all". According to SaveTheInternet.com these companies want to "tax content providers to guarantee speedy delivery of their data...to discriminate in favor of their own search engines, Internet phone services, and streaming video ? while slowing down or blocking their competitors".[44] Vinton Cerf, a co-inventor of the Internet Protocol and current vice president of Google argues that "the Internet was designed with no gatekeepers over new content or services."[62] Concluding that "allowing broadband carriers to control what people see and do online would fundamentally undermine the principles that have made the Internet such a success."[37]

Digital rights and freedoms[edit]

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.[6]

Competition and innovation[edit]
Net neutrality advocates argue that allowing cable companies, often termed "content gatekeepers", the right to demand a toll to guarantee quality or premium delivery would create what Tim Wu calls an "unfair business model."[63] Advocates warn that by charging "every Web site, from the smallest blogger to Google", network owners may be able to block competitor Web sites and services, as well as refuse access to those unable to pay.[6] According to Tim Wu, cable companies plan to "carve off bandwidth" for their own television services and charge companies a toll for "priority" service.[64]

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.[30] Tim Wu argues that, without network neutrality, the Internet will undergo a transformation from a market "where innovation rules to one where deal-making rules".[64] SaveTheInternet.com argues that net neutrality creates an "even playing field" and that "the Internet has always been driven by innovation. Web sites and services succeeded or failed on their own merit".[44] 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 companies. 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.[6]

Preserving Internet standards[edit]
Network 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.[65]

Preventing pseudo-services[edit]
Alok Bhardwaj 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.[66]

End-to-end principle[edit]
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.[6] 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".[67]

A new network "philosophy and architecture", is replacing the vision of an Intelligent Network. The vision is one in which the public communications network would be engineered for "always-on" use, not intermittence and scarcity. It would be engineered for intelligence at the end-user's device, not in the network. And the network would be engineered simply to "Deliver the Bits, Stupid", not for fancy network routing or "smart" number translation...In the "Stupid Network", the data would tell the network where it needs to go. (In contrast, in a circuit network, the network tells the data where to go.) In a "Stupid Network", the data on it would be the boss...End user devices would be free to behave flexibly because, in the Stupid Network the data is boss, bits are essentially free, and there is no assumption that the data is of a single data rate or data type.

?David S. Isenberg The Rise of the Stupid Network.[67]
Contrary to this idea, the research paper titled End-to-end arguments in system design by Saltzer, Reed, and Clark[68] 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 net neutrality[edit]
Innovation and investment[edit]
Some opponents of net neutrality argue that prioritization of bandwidth is necessary for future innovation on the Internet.[9] 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. The added revenue from such services could be used to pay for the building of increased broadband access to more consumers.[30] Opponents to net neutrality have also argued that net neutrality regulation would have adverse consequences for innovation and competition in the market for broadband access by making it more difficult for Internet service providers (ISPs) and other network operators to recoup their investments in broadband networks.[69] 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.[9][70][71]

User welfare[edit]
Question book-new.svg
This section relies largely or entirely upon a single source. Relevant discussion may be found on the talk page. Please help improve this article by introducing citations to additional sources. (June 2014)
Both the proponents and opponents implicitly or explicitly claim that their approach is beneficial for Internet users. Some opponents of net neutrality argue that under the ISP market competition, paid-prioritization of bandwidth can induce optimal user welfare.[72] Although net neutrality might protect user welfare when the market lacks competition, they argue that a better alternative could be to introduce a neutral public option to incentivize competition, rather than enforcing existing ISPs to be neutral.

Counterweight to server-side non-neutrality[edit]
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 replicating 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 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."[73]

Tim Wu, though a proponent of network neutrality, claims that the current Internet is not neutral as, "among all applications", its implementation of best effort generally favors file transfer and other non-time sensitive traffic over real-time communications.[74]

Bandwidth availability[edit]
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.[75][76] 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.[77] 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 what he called the "exaflood" (see exabytes). He also argued that net neutrality would prevent broadband networks from being built, which would limit available bandwidth and thus endanger innovation.[78]

Opposition to legislation[edit]
Poorly conceived legislation could make it difficult for Internet Service Providers to legally perform necessary and generally useful packet filtering such as combating denial of service attacks, filtering E-Mail spam, and preventing the spread of computer viruses. Quoting Bram Cohen, the creator of BitTorrent, "I most definitely do not want the Internet to become like television where there's actual censorship...however it is very difficult to actually create network neutrality laws which don't result in an absurdity like making it so that ISPs can't drop spam or stop...attacks".[79]

Recent pieces of legislation, like The Internet Freedom Preservation Act of 2009, attempt to mitigate these concerns by excluding reasonable network management from regulation.[80]

The Wall Street Journal has written that: "Government's role here, properly understood, is not to tell Comcast how to manage its network. Rather, it is to make sure consumers have alternatives to Comcast if they are unhappy with their Internet service".[81]

George Mason University fellow Adam Thierer has argued that "any government agency or process big enough to control a major sector of our economy will be prone to influence by those most affected by it", and that consequently "for all the talk we hear about how the FCC's move to impose Net Neutrality regulation is about 'putting consumers first' or 'preserving Net freedom and openness,' it's difficult to ignore the small armies of special interests who stand ready to exploit this new regulatory regime the same way they did telecom and broadcast industry regulation during decades past."[82]

In her recently published research, Aparna Watal, Legal Officer at Attomic Labs, puts forward three reasons for resisting any urge "to react legislatively to the apparent regulatory crisis".[83] Firstly, she explains, "contrary to the general opinion, the Comcast decision does not uproot the Commission's authority to regulate ISPs. Section 201(b) of the Act, which was cited as an argument by the Commission but not addressed by the Court on procedural grounds, could grant the Commission authority to regulate broadband Internet services where they render 'charges,

practices and regulations for, and in connection with' common carrier services unjust and unreasonable".[83] Secondly, she suggests, it is "undesirable and premature to legislatively mandate network neutrality or for the Commission to adopt a paternalistic approach on the issue...[as] there have been few overt incidents to date, and the costs of those incidents to consumers have been limited".[83] She cites "prompt media attention and public backlash" as effective policing tools to prevent ISPs from throttling traffic. She suggests that it "would be more prudent to consider introducing modest consumer protection rules, such as requiring ISPs to disclose their network management practices and to allow for consumers to switch ISPs inexpensively, rather than introducing network neutrality laws".[83] Finally, she explains that while "by regulating broadband services the commission is not directly regulating content and applications on the Internet; however, to say that content will remain unaffected by the reclassification is inaccurate. The different layers of the Internet work in tandem with each other such that there is no possibility of throttling or improving one layer's performance without impacting the other layers. If that was the case, then network neutrality would be maintained regardless of what happened at the transmission layer. To let the Commission regulate broadband pipelines connecting to the Internet and disregard that it indirectly involves regulating the data that runs through them will lead to a complex, overlapping, and fractured regulatory landscape in the years to come".[83]

Legal situation[edit]
European Union[edit]
EU parliament[edit]
The 2002 regulatory framework for electronic communications networks and services in the European Union consisted of five directives, which are referred to as "the Framework Directive and the Specific Directives":[citation needed]

Access Directive (Directive 2002/19/EC)
Authorization Directive (Directive 2002/20/EC)
Framework Directive(Directive 2002/21/EC)
Universal Service Directive (Directive 2002/22/EC)
Directive on privacy and electronic communications (Directive 2002/58/EC)
When the European Commission consulted on the updating of the Framework Directive and the Specific Directives in November 2007, it examined the possible need for legislation to mandate network neutrality, countering the potential damage, if any, caused by non-neutral broadband access. The European Commission stated that prioritisation "is generally considered to be beneficial for the market so long as users have choice to access the transmission capabilities and the services they want" and "consequently, the current EU rules allow operators to offer different services to different customers groups, but not allow those who are in a dominant position to discriminate in an anti-competitive manner between customers in similar circumstances".[84] However, the European Commission highlighted that Europe's current legal framework cannot effectively prevent network operators from degrading their customers' services. Therefore the European Commission proposed that it should be empowered to impose a minimum quality of services requirements.[85] In addition, an obligation of transparency was proposed to limit network operators' ability to set up restrictions on end-users' choice of lawful content and applications.[86]

On 19 December 2009, the so-called "Telecoms Package" came into force and EU member states were required to implement the Directive by May 2011.[87][88] According to the European Commission the new transparency requirements in the Telecoms Package would mean that "consumers will be informed?even before signing a contract?about the nature of the service to which they are subscribing, including traffic management techniques and their impact on service quality, as well as any other limitations (such as bandwidth caps or available connection speed)".[88] Regulation (EC) No 1211/2009 of the European Parliament and of the Council of 25 November 2009 established the Body of European Regulators for Electronic Communications (BEREC) and the Office[89] Body of European Regulators of Electronic Communications. BEREC's main purpose is to promote cooperation between national regulatory authorities so as to contribute to the development and better functioning of the internal market for electronic communications networks and services by ensuring a consistent application of the EU regulatory framework for electronic communications.[90]

By individual country[edit]
See also: Net neutrality in the Netherlands
Since March 2009 in Italy, there is a bill called: Proposta di legge dei senatori Vincenzo VITA (PD) e Luigi Vimercati (PD) "Neutralita' Delle Reti, Free Software E Societa' Dell'informazione".[91] Senator Vimercati in an interview said that he wants "to do something for the network neutrality" and that he was inspired by Lawrence Lessig, Professor at the Stanford Law School. Vimercati said that the topic is very hard, but in the article 3 there is a reference to the concept of neutrality regard the contents. It is also a problem of transparency and for the mobile connections: we need the minimum bandwidth to guarantee the service. We need some principle to defend the consumers. It's important that the consumer has been informed if he could not access all the Internet. The bill refuses all the discrimination: related by the content, the service and the device. The bill is generally about Internet ("a statute for the Internet") and treat different topics like network neutrality, free software, giving an Internet access to everyone.

In June 2011, the majority of the Dutch lower house voted for new net neutrality laws which prohibits the blocking of Internet services, usage of deep packet inspection to track customer behaviour and otherwise filtering or manipulating network traffic.[92] The legislation applies to any telecommunications provider and was formally ratified by the Dutch senate on 8 May 2012.[93][94]

In Belgium, net neutrality was discussed in the parliament in June 2011. Three parties (CD&V, N-VA & PS) jointly proposed a text to introduce the concept of net neutrality in the telecom law.[95]

In France, on 12 April 2011, the Commission for economic affairs of the French parliament approved the report of MP Laure de La Raudière (UMP). The report contains[96] 9 proposals. Proposition n°1 & 2 act on net neutrality.

In Slovenia, with 1 January 2013 there is a new telecommunication law in effect which explicitly defines and requires net neutrality from telecommunication operators. Net neutrality is defined as a principle that every Internet traffic on a public communication network is dealt with equally, independent of content, applications, services, devices, source and destination of the communication.[97]

Israel[edit]
In 2011, Israel's parliament passed a law requiring net neutrality in mobile broadband. These requirements were extended to wireline providers in an amendment to the law passed on February 10, 2014. The law contains an exception for reasonable network management, and is vague on a number of issues such as data caps, tiered pricing, paid prioritization and paid peering.[98]

North America[edit]
Main articles: Network neutrality in the United States and Net neutrality in Canada

The following text needs to be harmonized with text in Network neutrality in the United States.
There is ongoing legal and political wrangling in the U.S. regarding net neutrality. The United States Federal Communications Commission is in charge of regulating internet service providers' conduct in the US, though the extent of its jurisdiction is subject to ongoing legal disputes.[99]

US FCC policy (2005-2010)[edit]
In 2005, the FCC made its first move to directly address net neutrality issues by issuing a Broadband Policy Statement (also known as the Internet Policy Statement), which lists four principles of open Internet,[100] "To encourage broadband deployment and preserve and promote the open and interconnected nature of the public Internet, consumers are entitled to:"

Access the lawful Internet content of their choice
Run applications and use services of their choice, subject to the needs of law

enforcement
Connect their choice of legal devices that do not harm the network
Competition among network providers, application and service providers, and content providers
These points are often summarized as "any lawful content, any lawful application, any lawful device, and any provider". President Barack Obama's American Recovery and Reinvestment Act of 2009 called for an investment of $7.2 billion in broadband infrastructure and included an openness stipulation. During the FCC's hearing, the National Cable & Telecommunications Association urged the FCC to adopt the four criteria laid out in its 2005 Internet Policy Statement as the requisite openness.

In September 2009, FCC Chairman Julius Genachowski proposed to add two additional rules on top of its 2005 policy statement, viz., the nondiscrimination principle that ISPs must not discriminate against any content or applications, and the transparency principle, which requires that ISPs disclose all their policies to customers. He also argued that wireless should be subject to the same network neutrality as wireline providers.[101]

In October 2009, the FCC took the next step by approving a notice of proposed rule making on the subject of net neutrality.[102]

On April 6, 2010, the United States Court of Appeals for the District of Columbia Circuit in Comcast Corp. v. FCC ruled that the FCC lacks the authority to force Internet service providers to keep their networks open to all forms of content.[103]

US FCC policy (2010-present)[edit]
Under commission chairman Julius Genachowski, the FCC proposed reclassifying broadband Internet access providers under the provisions of Title 2 of the Communications Act in an effort to force the providers to adhere to the same rules as telephone networks. This adjustment was meant to prevent, "unjust or unreasonable discrimination in charges, practices, classifications, regulations, facilities or services".[104] On December 21, 2010, these changes were put into effect by the FCC Open Internet Order 2010, which banned cable television and telephone service providers from preventing access to competitors or certain web sites such as Netflix. The rules also include a more limited set of obligations for wireless providers. The rules would not keep ISPs from charging more for faster access. Republicans in Congress threatened to reverse the rules through legislation.[105]

On September 23, 2011, the FCC released its final rules for Preserving a Free and Open Internet. These rules state that providers must have transparency of network management practices, not block lawful content, nor unreasonably discriminate in transmitting lawful network traffic.[106] These rules are effective 20 November 2011.

On January 14, 2014, the DC Circuit Court determined in Verizon Communications Inc. v. Federal Communications Commission (2014) that the FCC has no authority to enforce Network Neutrality rules, as service providers are not identified as "common carriers".[107] Since the January 14th ruling, AT&T has submitted several patents [108] that account for specific ways to take advantage of the FCC's limited authority. Verizon is also under a mountain of allegations that they have been slowing access to both Netflix and to the Amazon Cloud services, although the company denies these allegations. Multiple independent sources have performed network speed analysis and do find slower connection times to these sites, although there is currently no proof that Verizon is purposefully causing these slowdowns.

Proposed 2014 US FCC policy[edit]
On February 19, 2014 the FCC announced plans to formulate new rules to enforce net neutrality while complying with the court rulings.[109] On April 23, 2014, in a press statement, the Federal Communications Commission announced their new proposed rules which would allow Broadband Internet service providers, such as Comcast and Verizon, the "right to build special lanes" with faster connection speeds for companies, such as Netflix, Disney or Google, willing to pay a higher price. Their customers would have preferential access.[14][15][110][111] On May 15 the FCC

launched a rulemaking seeking public comment on how best to protect and promote an open Internet. [112]

Russian Federation[edit]
Since September 2007, the Russian government's Resolution No 575 introduces new regulation rules of telematics services. Network operators (ISPs) can now legally limit individual actions of the subscriber's network activity, if such actions threaten the normal functioning of the network. ISPs are obliged to exclude the possibility of access to information systems, network addresses, or uniform pointers which a subscriber informs the operator of communication in the form specified in the contract. The subscriber is obliged to take actions to protect the subscriber terminal from the impact of malicious software and to prevent the spread of spam and malicious software to its subscriber terminal. In reality, most Russian ISPs shape the traffic of P2P protocols (like BitTorrent) with lower priority (P2P is about of 80% of traffic there). Also, there is popular method, called retracker,[113][114] for redirecting some of the BitTorrent traffic to the ISP's cache servers and other subscribers inside of a metropolitan area network (MAN). Access to MANs is usually with greater speed (2x?1000x or more, specified in the contract) and better quality than the rest of the Internet.

South America[edit]
In 2014, the Brazilian government passed a law which expressly upholds net neutrality, "guaranteeing equal access to the Internet and protecting the privacy of its users in the wake of U.S. spying revelations".[115]

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.[116][117] This came after an intensive campaign on blogs, Twitter, and other social networks.[118] 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. To that effect ISPs must offer Internet access in which content is not arbitrarily treated differently based on its source or ownership.[119]

East Asia[edit]
Net neutrality in the common carrier sense has been instantiated into law in many countries, including Japan.[120] In Japan, the nation's largest phone company, Nippon Telegraph and Telephone, operates a service called Flet's Square over their FTTH high speed Internet connections. In South Korea, VoIP is blocked on high-speed FTTH networks except where the network operator is the service provider.[121]

According to Thomas Lum, a specialist in Asian Affairs: "Since its founding in 1949, the People's Republic of China (PRC) has exerted great effort in manipulating the flow of information and prohibiting the dissemination of viewpoints that criticize the government or stray from the official Communist party view. The introduction of Internet technology in the mid-1990s presented a challenge to government control over news sources, and by extension, over public opinion. While the Internet has developed rapidly, broadened access to news, and facilitated mass communications in China, many forms of expression online, as in other mass media, are still significantly stifled. Empirical studies have found that China has one of the most sophisticated content-filtering Internet regimes in the world. The Chinese government employs increasingly sophisticated methods to limit content online, including a combination of legal regulation, surveillance, and punishment to promote self-censorship, as well as technical controls."[122]

Controversies[edit]
Protocol discrimination[edit]
On 1 August 2008, the FCC formally voted 3-to-2 to uphold a complaint against Comcast, the largest cable company in the US, ruling that it had illegally inhibited users of its high-speed Internet service from using file-sharing software. FCC chairman Kevin J. Martin said that the order was meant to set a precedent that

Internet providers, and indeed all communications companies, could not prevent customers from using their networks the way they see fit unless there is a good reason. In an interview, Martin said, "We are preserving the open character of the Internet". The legal complaint against Comcast related to BitTorrent, a transfer protocol that is especially apt at distributing large files such as video, music, and software on the Internet.[123] Comcast admitted no wrongdoing[124] in its proposed settlement of up to US$16 dollars per share in December 2009.[125]

ISPs charging content providers[edit]
French telecoms operator Orange, complaining that traffic from YouTube and other Google sites consists of roughly 50% of total traffic on the Orange network, reached a deal with Google, in which they charge Google for the traffic incurred on the Orange network.[126] 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.[127] A better approach would be to make users aware of which consumption and at what time is responsible for congestion and have a proportional price, as in the User-in-the-loop paradigm.

Related issues[edit]
Data discrimination[edit]
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.[56] 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.[citation needed]

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.[citation needed]

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.[citation needed]

Jon Peha from Carnegie Mellon University in his paper "The Benefits and Risks of Mandating Network Neutrality, and the Quest for a Balanced Policy" presents a challenge for policy makers 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.[128]

Quality of service[edit]
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 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.[129]

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.[66] 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.[citation needed]

Xipeng Xiao covers the relationship between QoS and Network Neutrality in the book Technical, Commercial and Regulatory Challenges of QoS: An Internet Service Model Perspective.

Traffic shaping[edit]
Main article: Traffic shaping
Traffic shaping is the control of computer network traffic in order to optimize or guarantee performance, improve latency, and/or increase usable bandwidth by delaying packets that meet certain criteria.[130] 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).[131] 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 GCRA.

Over-provisioning[edit]
If the core of a network has more bandwidth than is permitted to enter at the edges, then good QoS can be obtained without policing. For example the telephone network employs admission control to limit user demand on the network core by refusing to create a circuit for the requested connection. 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.[132][133]

Pricing models[edit]

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.[134]

Privacy concerns[edit]
Some opponents of net neutrality legislation point to concerns of privacy rights that could come about as a result, how those infringements of privacy can be exploited. While some believe it is hyperbole to suggest that ISPs will just transparently monitor transmitted content, or that ISPs will have to alter their content, there is the concern that ISPs may have profit motives to analyze what their subscribers are viewing, and be able to use such information to their financial advantage. For example, an ISP may be able to essentially replicate the "targeting" that has already been employed by companies like Google. To critics such as David Clark, a senior research scientist at Massachusetts Institute of Technology, the proper question is "who has the right to observe everything you do"?[135]

See also[edit]
Competition law
Concentration of media ownership
Economic rent
Industrial information economy
Municipal broadband
Portal icon Freedom of speech portal
National Cable & Telecommunications Association v. Brand X Internet Services
Search neutrality
Switzerland (software)
Wikipedia Zero
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