

Agenda—10 years

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The net neutrality debate: the end of the world (wide web) as we know it?

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Back in the mid-2000s, policymakers on both sides of the Atlantic were considering whether all content and applications on the Internet should be treated equally. After almost a decade, the so-called 'net neutrality' debate is once again on the regulatory policy agenda in both Europe and the USA. Despite the common underlying technology and economics there seems to be a transatlantic divide, with Europe and the USA on track to adopt somewhat different net neutrality rules. Now is therefore a good time to revisit the economic arguments for and against the introduction of net neutrality as discussed in this 2006 article, to better understand the underlying economic incentives behind the arguments being made today.

Do regulators need to impose constraints on the pricing structure of Internet service providers to foster competition, investment and innovation? For content providers such as Yahoo! and Amazon, the answer is yes; for infrastructure and Internet service providers such as AT&T and Deutsche Telekom, the answer is no. This article reviews the economic underpinnings of both sides of the 'net neutrality' debate, and asks: does Europe need net neutrality regulation?

The net neutrality principle states that all content and applications should be treated equally on the Internet and therefore that Internet service providers (ISPs) should not be allowed to implement pricing schemes that discriminate by type of content or application. It has been one of the most contentious issues in the context of the reform of the US Telecoms Act 1996, with the House of Representatives and the Senate rejecting net neutrality regulations in their latest votes of 8 June and 28 June—although the debate is far from over.

On 26 February 2015 the FCC (the US communications regulator) adopted 'The Open Internet Rules and Order', which sets out three 'bright line rules':

- no blocking: broadband providers may not block access to legal content, applications, services or non-harmful devices;
- no throttling: broadband providers may not impair or degrade lawful Internet traffic on the basis of content, applications, services or non-harmful devices;

- no paid prioritisation: broadband providers may not favour some lawful Internet traffic over other lawful traffic in exchange for consideration of any kind—in other words, there can be no 'fast lanes'. This rule also bans ISPs from prioritising content and services of their affiliates.¹

This historic ruling (which is facing legal challenges)² means that the USA is likely to adopt strict net neutrality rules that prohibit any kind of 'fast' or 'priority' lanes—which is different from proposals being considered in Europe.

¹ Based on: <http://www.fcc.gov/openinternet>.

² USTelecom (2015), 'USTelecom Challenges FCC Open Internet Order', press release, 13 April, available at: <http://www.ustelecom.org/news/press-release/ustelecom-challenges-fcc-open-internet-order>.

The debate is gaining momentum in Europe, with Deutsche Telekom and Telecom Italia reportedly admitting that they have been lobbying the European Commission in the context of the 2006 review of the EU Electronic Communications regulatory framework.¹ In the UK, the debate has been led by ISPs such as Tiscali, which want to introduce new

technology to prioritise traffic and to charge content providers for offering guaranteed quality of service (QoS).²

The net neutrality rules currently being considered in Europe would explicitly give operators some leeway in differentiating their offers (for example, in terms of speed) and competing on enhanced quality of service, while setting out clear rules for traffic management (which must be non-discriminatory, proportionate and transparent). The rules would also allow network operators to strike deals with content providers to ensure a certain quality of service as well as offer 'specialised services', as long as this does not lead to the degradation of the 'normal'/best efforts Internet.¹

¹ European Commission (2015), 'Connected Continent legislative package', available at: <https://ec.europa.eu/digital-agenda/en/node/67489/#open-internet>.

Advocates of net neutrality—content providers such as Amazon and Yahoo!, and application developers such as Microsoft—claim that infrastructure operators should not be allowed to charge content providers different prices depending on the type of content that they pump into their networks. They also argue against any form of end-user price discrimination by type of content or application used—i.e. charging a customer more for downloading a movie than for 'surfing' the Internet. Doing so, the advocates claim, would both undermine the open architecture principle that has been at the heart of the Internet's rapid expansion and commercial innovation, and create Internet 'fast lanes' for those who can pay while leaving the rest behind.

In the other corner, infrastructure providers oppose net neutrality. They claim that, in order to support the increasing number of high bandwidth Internet services—e.g. IPTV (Internet protocol television), video on demand, online gaming, network-based backups, and telemedicine—significant network investment must be made, and that they should therefore be free to experiment with different pricing schemes to recover this investment, including charging end-users and content providers for the content and applications that consume the most network resources.

This article explores the economic rationale of both sides of the debate, and discusses whether explicit net neutrality regulation is needed in the context of the review of the Electronic Communications Services regulatory framework in Europe.

The economics of the debate

At the heart of the debate lies the classic regulatory problem in network industries—that of achieving the right balance between long-run dynamic efficiency (the right incentives to invest and innovate) and short-run allocative efficiency (achieving low prices and minimising the scope for firms to exercise market power). The traditional solution—regulating the prices (both retail and wholesale access) of the owner of the infrastructure—while still guaranteeing a reasonable

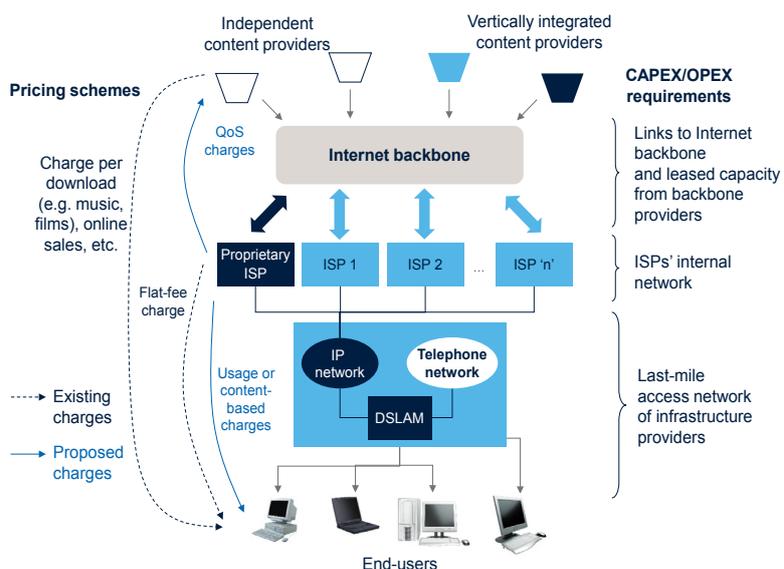
return on its investment, may no longer be effective in the broadband market.

- First, the wholesale regulated prices for access to the 'last-mile' network (the portion of the network linking the end-user and the network) allow the owner of the infrastructure to recover costs of the last-mile network only. These access prices are insufficient to recover all other costs associated with the provision of broadband Internet services. Moreover, since in most European countries the retail broadband market is competitive, infrastructure providers and ISPs are constrained in their ability to recover their costs through increases in the broadband retail price.
- Second, the source of innovation and investment no longer resides exclusively with the infrastructure provider, but often comes from independent content providers and application developers—e.g. successful online businesses such as Amazon, Google and Skype started as very small operations with limited capital investment.
- In addition, the broadband market exhibits two-sided network effects: broadband customers (end-users) benefit from a greater variety of content and applications, while content providers and application developers benefit from being able to deliver their services to large numbers of end-users. Both customers and content providers benefit, in turn, from the existence of a network capable of supporting the increasing number of services demanded.

To date, providers of Internet-based content, applications and devices have been able to take advantage of price/performance improvements in computing power to develop new services that are in high demand by end-users—e.g. IP telephony, peer-to-peer file sharing, and online gaming. To function adequately, however, these and other services will at some point require additional capital expenditure (CAPEX) by ISPs to increase their internal network capacity and/or additional operating expenditure (OPEX) to increase the leased capacity from Internet backbone providers, as well as upgrades in the last-mile access network (see right-hand side of Figure 1 overleaf).

This has given rise to the broadband incentive problem: network operators may be unwilling to invest further in infrastructure to support many of the high-bandwidth services developed by upstream content providers if they cannot make a return on this investment and, presumably, obtain a larger share of the growing market for Internet content and applications.³ The current flat-fee 'all-you-can-eat' pricing structure, coupled with the growth of bandwidth-intensive services, can lead to an exponential growth in bandwidth consumption, which directly affects the cost base of ISPs without a corresponding increase in revenues. The experience of the Korean market, where aggregate traffic has nearly doubled every year since 2001 while revenue growth has slowed considerably, provides an extreme example of this effect.

Figure 1 Basic architecture of broadband technology and the net neutrality debate



Notes: In the last-mile network, only digital subscriber line (DSL) technology is shown. Cable modem broadband technology is similar, the fundamental difference being in the use of cable modem termination systems (CMTSs) instead of digital subscriber line access multiplexers (DSLAMs) to split the data streams from the video or voice streams, respectively. Wireless access networks (e.g. 3G, WiFi, WiMax), while different in terms of the technology employed in the last-mile access, raise the same economic concerns with respect to the net neutrality debate.

Source: Oxera.

It is against this background that infrastructure providers and ISPs are exploring solutions that would allow them to align prices and costs more effectively, and manage the congestion generated by Internet traffic growth more efficiently. In essence, three types of solution can be adopted in response to the broadband incentive problem (see Figure 2 overleaf), ranging from pure cost management via network engineering to pure revenue-generating solutions such as entering into revenue-sharing agreements with content providers. In between lies the option of price discrimination to end-users and/or content providers (see also the proposed charges in Figure 1), which would achieve, if only in part, the dual objective of managing costs and generating additional revenues.

Why net neutrality regulation may be needed

The position in favour of government-imposed regulation of net neutrality can be summarised in the following three arguments.

1. **The current 'neutral' character of the Internet has fostered innovation and therefore needs to be preserved.** The 'neutral' character to which net neutrality advocates refer can be traced back to the original architectural design of the Internet, which made the core network as simple as possible, while most of the intelligence for the network was provided by equipment

Nuts and bolts of net neutrality

The debate over net neutrality regulation boils down to whether ISPs should be allowed to implement new pricing schemes to both end-users and content providers, which would discriminate between different types of content and applications. These pricing schemes are being proposed to create a clearer link between prices and costs, particularly as additional CAPEX and OPEX will be needed to support the growing traffic generated by users of bandwidth-intensive content and applications (right-hand side of Figure 1, excluding the last-mile access network investments, which are recovered through regulated access charges). These charges would also allow ISPs to obtain a larger share of the growing market for Internet content.

As the left-hand side of Figure 1 shows, ISPs currently charge end-users a monthly flat fee to access the Internet at a particular speed, and may impose a cap on the total monthly usage. The proposed charges include usage-sensitive prices (e.g. per megabyte downloaded) or content-specific charges (e.g. for using particular bandwidth-intensive applications such as online gaming), as well as QoS pricing schemes for content providers wanting to guarantee that their content and applications will reach end-users without delays.

Currently, neither the USA nor Europe prohibit ISPs from implementing the proposed pricing schemes, but concerns have been raised by the proponents of net neutrality.

and applications connected at the edges. This design has allowed the Internet to develop through multiple innovations that early infrastructure providers could not easily control.

In other words, net neutrality advocates claim that the existing network design has maximised the range of competitors that can innovate for the network. With very low entry barriers and unlimited growth potential for successful innovators, competition resembles what economists call 'Schumpeterian' innovation—an industry with 'gales of creative destructions', where new technologies and business models replace old ones in a constant process of industrial rebirth.⁴

2. **Consumers have certain basic rights and expectations about the Internet that would be at risk without net neutrality regulation.** This argument refers to the central role that the Internet plays in most developed countries. As Tim Wu, Professor at Columbia Law School, stated in his testimony to the US House of Representatives:

[the Internet] has become as essential to people and to the economy as the roads, the electric grid or the telephone. [For ISPs and infrastructure providers] to begin deciding what consumers want, by slowing down disfavoured companies, and speeding up favoured companies ... would be a shock.⁵

3. Infrastructure providers and ISPs have the incentives to engage in anticompetitive discrimination and, without net neutrality rules, they would also have the ability to do so. This argument highlights infrastructure providers' and ISPs' incentives and ability to engage in anticompetitive discrimination in the absence of net neutrality rules. For example, ISPs that are also active in the content and applications market could use QoS pricing schemes to raise rivals' costs and obtain an unfair competitive advantage for their own content. Similarly, content providers not paying for guaranteed QoS could experience significant reductions in the quality of their service. The case of Madison River Communications, which blocked the voice over Internet protocol (VoIP) service of Vonage and was later fined by the FCC (the US communications regulator), suggests that these anticompetitive practices are a real possibility.⁶

These three arguments are used by net neutrality advocates to oppose any form of discrimination (network- or price-based) against particular content or applications, as well as QoS schemes that might raise potential innovators' start-up costs, discriminate against potential competitors at the content/application level, or leave non-payers' services with unacceptably low levels of quality and hence unable to compete on an equal footing.

Why net neutrality regulation may generate inefficiencies

The position against net neutrality regulation can be summarised in the following three arguments.

1. The broadband incentive problem cannot be easily solved and infrastructure providers and ISPs should therefore have the freedom to experiment with different pricing policies. This argument refers to the unsuitability of any particular solution shown in Figure 2 to deal with the broadband incentive problem. Ideally, infrastructure providers and ISPs would be able to implement a usage-sensitive pricing scheme such that traffic that imposes additional costs is subject to higher fees. This may not be possible in practice, at least in the short run, since developing the metering and billing systems required would be costly,⁷ and end-users could find it difficult to understand how different Internet activities (accessing web pages, sending emails, downloading content, online gaming, VoIP calls, etc.) translate into additional costs.

Similarly, since the current pricing schemes (a combination of speed rates and monthly allowances) are imperfect approximations of the type of usage-sensitive pricing schemes that would solve the congestion problem, net neutrality opponents argue that they should be allowed to experiment with alternative pricing schemes that would align the incentives of users and providers more effectively. In this view, it would make perfect sense, for example, to charge higher prices to those who engage in bandwidth-intensive activities. In fact, this may lead to lower prices for low-volume end-users.

In addition, because of the two-sided network effects in the broadband market, net neutrality opponents argue that no particular pricing scheme, including charging content providers, should have an outright ban. In other words, they oppose the view that the existing pricing

Figure 2 Solutions to circumvent the broadband incentive problem

Type of solution	Description		
1 'Pure' cost management	Network engineering <ul style="list-style-type: none"> • traffic-shaping—i.e. prioritising particular data (packets) to manage congestion • investment in caches and 'mirroring' technology that places popular content closer to the end-user, reducing the consumption of leased capacity from Internet backbones 		
2 Cost management and revenue generation	<table border="1"> <tr> <td>End-user price discrimination <ul style="list-style-type: none"> • pricing tiered by peak rate i.e. speed measured in Mbps • pricing tiered by traffic volume e.g. monthly allowances in Gbps • pricing tiered by content/application </td> <td>Content provider price discrimination <ul style="list-style-type: none"> • payment for QoS guarantees, which could take the form of traffic-shaping (prioritisation of packets) </td> </tr> </table>	End-user price discrimination <ul style="list-style-type: none"> • pricing tiered by peak rate i.e. speed measured in Mbps • pricing tiered by traffic volume e.g. monthly allowances in Gbps • pricing tiered by content/application 	Content provider price discrimination <ul style="list-style-type: none"> • payment for QoS guarantees, which could take the form of traffic-shaping (prioritisation of packets)
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3 'Pure' revenue generation	Revenue-generating solutions <ul style="list-style-type: none"> • ISPs and infrastructure providers launching their own value-added non-access-based services: VoIP, video-on-demand, IPTV, etc. • this could include revenue-sharing agreements between content providers and ISPs/infrastructure providers 		

Many of these solutions to the 'broadband incentive problem' have already been widely adopted in the market. Traffic shaping, caching (the use of content delivery networks), and retail pricing by speed and capacity are widespread today. The adoption of these solutions is driven by the necessity for electronic communication networks to adapt to, and serve, the explosion in Internet data traffic since 2006. These innovations and investments in the access, transit and interconnection points of the physical 'pipes' of the Internet are based on commercial agreements between network operators, transit providers, and content and application providers (CAPs). The implementation of net neutrality rules by the FCC (in the USA) and the European Commission would need to ensure that such incentives to innovate and invest (by network operators and CAPs) are not an unintended casualty of the regulations. The underlying economic principles explored in this article remain relevant and serve as a good starting point for helping to shape these regulations.

Source: Oxera.

scheme that net neutrality advocates would like to preserve—charging zero (or a low price) to one group of customers (content and application providers) and recovering most fixed costs through the other group of customers (end-users)—is more efficient than other pricing schemes.⁸

2. Net neutrality regulation would equate to mandating product homogeneity, which can have significant adverse effects on static and dynamic efficiency.

This argument highlights a potential unintended consequence of net neutrality: weakening competition in the market. Because net neutrality would be limiting the dimensions over which networks and ISPs could compete (i.e. by banning differentiation on the basis of content or applications) entry by niche players and investment in alternative network platforms could be discouraged.⁹

3. There are many reasons to discriminate, some of which can actually be welfare-enhancing.

Some forms of network engineering, together with the price discrimination solutions shown in Figure 2, are often welfare-enhancing. For example, in order to manage congestion at peak times, ISPs must be able to cope with the traffic that flows through their equipment to minimise disruption and guarantee a minimum level of QoS for end-users. If net neutrality regulation that prohibits discrimination on the basis of bandwidth-intensive applications were implemented, this type of network engineering would be illegal and overall QoS could be reduced.

Does Europe need net neutrality rules?

Some incumbent operators in Europe have dismissed the net neutrality debate as a US issue. France Telecom, for example, has stated that:

in Europe, the regulatory and competitive environment is completely different, [hence] the situations are not comparable.¹⁰

Is this really the case, or is this a debate with worldwide relevance, and should Europe be doing something about it?

As this discussion has shown, the net neutrality issue is of fundamental importance wherever the broadband incentive problem is present. As the broadband market matures and penetration rates stabilise, the broadband incentive problem

is likely to arise. In these markets, regulators will probably be forced to take a position when ISPs and infrastructure providers begin to experiment with solutions to the problem (which they are currently not prevented from doing), and net neutrality advocates begin to make their voices heard. Many European broadband markets are likely to fit this description. So should European regulators be taking any action?

While the European Commission has not yet taken a definitive stance on the debate, in its working paper on the review of the Electronic Communications regulatory framework,¹¹ it has suggested that the current framework—which allows operators to offer different services to different customer groups, but does not allow those that are in a dominant position to discriminate between customers in similar circumstances—is equipped with the necessary regulatory tools to ensure an efficient outcome. The only additional provision that would be required is to set minimum-quality levels for network transmission in order to prevent service quality declining to unacceptably low levels.

The Commission's current position appears to be compatible with a light-touch regulatory approach that would not ban any particular operator's pricing scheme, provided that it is available to all customers (end-users and content providers) on non-discriminatory terms—in particular, provided it does not favour the content provider of vertically integrated ISPs.

This approach is likely to have several advantages over explicit net neutrality regulation. First, it would complement existing wholesale access regulation, which has been a catalyst for competition in the broadband market. Intense competition in this market is likely to provide incentives for ISPs to avoid engaging in anticompetitive practices. For example, an ISP would be unwilling to block a particular application that is highly valued by end-users if, as a result, a large proportion of its customers were to switch to a competing provider. In this context, a key policy objective for national regulators could be to improve end-user information such that it is easy to compare providers with multiple pricing schemes, as well as ensuring that the process of switching providers is as simple as possible.

Moreover, if competitive forces failed to discipline ISPs, national regulators or competition authorities in member states would still be in a position to detect and sanction overt anticompetitive practices as the FCC did in the case of Madison River Communications.

¹ *Financial Times* (2006), 'Why Network Operators are Flexing their Muscles', 28 March.

² 'ISPs Seek "Managed" Net, Raising Neutrality Fears', *New Media Markets*, 24:20, 2 June 2006.

³ Broadband Working Group MIT Communications Futures Programme (2005), 'The Broadband Incentive Problem: A White Paper', September.

⁴ Testimony of Tim Wu, House Committee on the Judiciary Telecom & Antitrust Task Force Hearing on 'Network Neutrality: Competition, Innovation and Nondiscriminatory Access', April 2006, p. 4.

⁵ Testimony of Tim Wu, House Committee on the Judiciary Telecom & Antitrust Task Force Hearing on 'Network Neutrality: Competition, Innovation and Nondiscriminatory Access', April 2006, p. 1.

⁶ 'Madison River Communications, LLC Order and Consent Decree', 3 March 2005, available at: <http://www.fcc.gov/voip/>.

⁷ Yoo, C. (2005), 'Net Neutrality and the Economics of Congestion', Vanderbilt University Law School, Working Paper 05-28, p. 28.

⁸ For more on this point see Hann, R. and Walsten, S. (2006), 'The Economics of Net Neutrality', AEI-Brookings Joint Center for Regulatory Studies, 06-13, April.

⁹ For more on this argument see Yoo, C. (2004), 'Would Mandating Network Broadband Network Neutrality Help or Hurt Competition? A Comment on the End-to-end Debate', Vanderbilt University Law School, Working Paper 04-04; and Ford, G., Koutsky, T. and Spiwak, L. (2006), 'Network Neutrality and Industry Structure', Phoenix Center Policy Paper 24, April.

¹⁰ *Financial Times* (2006), 'Why Network Operators are Flexing their Muscles', 28 March.

¹¹ European Commission (2006), 'Communication on the Review of the EU Regulatory Framework for Electronic Communications Networks and Services: Proposed Changes', SEC (2006) 816, p. 27.