The open internet – a platform for growth

A report for **the BBC, Blinkbox, Channel 4, Skype** and **Yahoo!**

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About Plum

Plum Consulting offer strategy, policy and regulatory advice in the telecoms, media and online sectors; and on radio spectrum as a key sector input. We draw on economics, our knowledge of the sector and our clients understanding and perspective to shape and respond to convergence.

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Foreword

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Access to internet-based content, applications and services has risen up the policy agenda because such applications are recognised to be of growing importance to citizens, consumers, public services, the economy and society; and because some network access providers have engaged in harmful blocking and discrimination against such applications. It has also been argued by some European network operators that demand and associated traffic growth is a problem rather than an opportunity and that policy makers should support the introduction of new charges in relation to content and application providers.

The question of how the open internet is governed is one of central economic and social importance. For this reason a group of content, application and service providers commissioned Plum to consider the question of how value is created and distributed along the value chain and what form of governance should apply in order to sustain innovation and investment along the value chain, to the benefit of all.

Our aim in producing this report has been to bring clarity to the issues - to make them as simple as possible but no simpler - and to provide a clear sense of direction for those charged with policy making and policy implementation, without being overly prescriptive given the pace of change and innovation which characterises the market.

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Executive Summary

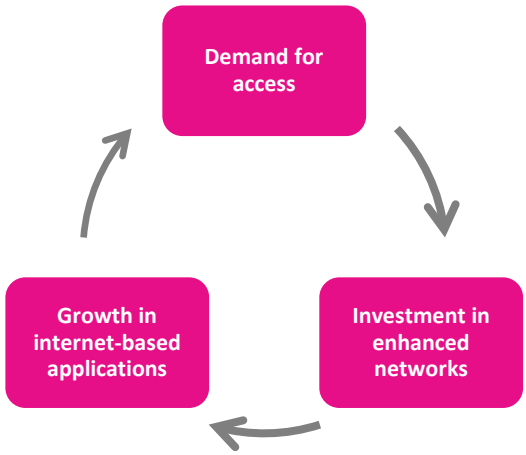
The open internet has been a platform for innovation and growth

The principles governing the open internet were established as norms early on and include:

- The ability of end-users to discover and access lawful internet-based content or applications of their choice.
- The ability of content and application providers to access end-users "without permission" from network operators and no requirement to pay for access to end-users.

We do not include in our definition of the open internet a requirement that all data are necessarily given equal priority, an additional concept that is often included in definitions of "net neutrality". There are circumstances in which traffic management for legal or technical reasons is beneficial, provided the approach is not discriminatory.

The open internet model has delivered a range of benefits for consumers, businesses and the economy. It has enabled a wave of innovation and allowed companies to develop new business models and services. As a result, consumers have access to a wide range of rich content and applications driving demand for faster broadband, for wider mobile data coverage and increased take-up of broadband and smart devices.



The estimated consumer benefits, in excess of what consumers already pay for network access, of access to internet-based applications and content are around €100 billion per annum for Europe. Further development of rich content and applications will drive demand for improved connectivity with benefits for access providers, and in terms of digital inclusion, economic growth and public service delivery. The open internet also supports trade in services in Europe, thereby contributing to the single market.

The open internet has allowed start-ups such as Skype, Yahoo!, Spotify, YouTube, Google and Facebook to scale globally. It has also allowed established content companies to provide content in new and innovative ways. For example:

- Voice over Internet Protocol (VoIP) applications such as Skype have benefited consumers through free and low cost voice calling and have progressively been enhanced with higher quality voice, 'presence', two-way and group video calling, integration across devices and further integration into business and social platforms.
- Content applications such as the BBC iPlayer and Channel 4's 4oD provide viewers in the UK with thousands of hours of on-demand content, and are extending their geographical reach with

the July 2011 launch of the iPlayer app in 11 European countries and 4oD making selected programmes available internationally from March 2011.

The ability of consumers to access internet content, applications and services is the reason consumers are willing to pay internet access providers. Access providers are dependent on this demand to monetise their substantial investments. Network operators have benefited from growth in traffic and growth in bandwidth-intensive applications. Fixed broadband access and mobile data revenues, which are dependent on demand for internet-based content and applications, amounted to approximately €155 billion in Europe in 2010.

Rich internet content and applications and data growth should therefore provide profitable opportunities for network operators, a conclusion borne out by the recent quarterly results of well-run operators. Furthermore, innovation and growth in rich content and applications, supported by the open internet, should improve, rather than harm, the business case for next generation access investment. Consumers have been upgrading to higher speed connections and larger data bundles precisely because they are making heavier use of the internet. Mobile data growth will also lower unit costs by improving overall network utilisation, thereby increasing the scope for low user data tariffs that may improve digital inclusion.

Challenges to the open internet are supported by a number of myths

Some network access providers have claimed that the open internet model should now be changed. They argue that growing demand for content and applications is a problem - rather than an economic opportunity. This myth and others have tended to cloud the European policy debate and need to be addressed and put to one side – as indicated on the right hand side below.

Myth 1: Demand is bad	• Demand is good since it reflects end-user value and supports revenue growth and network investment.
Myth 2: Costs are ballooning because of data growth	• Costs are not ballooning because of data growth. For fixed access they are low and declining on a unit cost basis, whilst for mobile access they are higher but nevertheless declining on a unit cost basis.
Myth 3: Application providers "cause" traffic	• End users cause traffic via requests for and generation of content.
Myth 4: Application providers free ride	• Application providers do not free ride but invest in infrastructure, purchase network services and have developed bandwidth efficient applications.
Myth 5: Charging application providers would promote broadband investment	• Any revenues raised would not necessarily be invested and would discourage applications innovation which would reduce demand for advanced network access.

Having addressed the above myths we examined the economic literature, the existing value chain and efficiency and practicality of alternative models. We conclude that there is no reason to believe that a departure from the open internet norm would be economically efficient – rather, we find a departure from this model would risk irreversible harm.

Policy measures are required to reinforce the open internet

The norms of openness that underpin the success of the internet value chain are fragile. Individual enterprises may have incentives to depart from them, even if harm to the overall ecosystem of applications, content and networks would be the outcome. Applications and content providers and network operators need more certainty to support their investment decisions.

We observe that discrimination against internet-based applications persists in markets deemed competitive by regulatory authorities. For example, a number of mobile operators in Europe have terms and conditions that either prohibit, or require payment of a premium for access to, certain internet-based applications, especially those seen to rival their businesses. As internet-based content and applications become increasingly important the stakes involved are rising.

The challenge is to prevent harmful discrimination and assure all stakeholders that they can continue to innovate and invest without having to negotiate a maze of private contracts, and without fear of discrimination and/or foreclosure. Measures to build greater confidence in the open internet are required to preserve existing benefits and support further innovation and investment. Care is however needed, if we are not to rule out possibilities including differentiation of access prices focussed on the consumer side of the market that would support broadband investment and improved outcomes.

The challenge of allowing such initiatives whilst also constraining abuse in relation to the open internet is in our view achievable. We propose, in addition to efforts to improve competition (including customer switching) and transparency in communications markets generally, an approach which combines a clear signal of commitment to the open internet by policy makers, limitations on the use of the term internet access to provide clarity to consumers and an industry code of conduct including dispute resolution procedures as outlined below.

Proposed measures to support the open internet

- A clear signal of commitment to the open internet by EU institutions, national governments and regulators.
- Internet access should be clearly defined and the use of the term in marketing restricted to those who provide open access to the internet. This measure could be implemented nationally under consumer protection powers.
- The application of an industry code of conduct and dispute resolution procedures, through “self-regulation with oversight”, should be promoted. The code should require:
  - Open access to and distribution of internet-based, lawful content and applications for consumers; no blocking of legal services and discrimination on the basis of commercial rivalry.
  - Protection against unilateral and opportunistic requests for payment i.e. holding players to ransom.
  - A principle of parity of access if and where prioritisation is provided on voluntary commercial terms for any content or applications i.e. the same opportunity on the same terms should be available to all (analogous to the principle of equivalence applied at the network access layer).
- Policy-makers and national regulators (e.g. Ofcom) should closely monitor market developments given the risks to innovation. If the suggested measures prove insufficient, then intervention by national regulators utilising their powers to protect the open internet under the revised EU Electronic Communications Framework, or the introduction by policy makers of a new legally binding open internet requirement, should be considered.

1 The open internet in context

The principles governing the open internet were established as norms early on. These principles include:

- The ability of end-users to discover and access lawful internet-based content or applications of their choice.
- The ability of content and application providers to access end-users "without permission" from network operators.[1]

We do not include in our definition of the open internet a requirement that all data are necessarily given equal priority, an additional concept that is often included in definitions of "net neutrality". There may be circumstances in which traffic management for legal or technical reasons would be beneficial, provided the approach was not discriminatory nor consumers or content and application providers are held to ransom for priority.

Throughout this paper, we place primary emphasis on the open internet – as defined above – on the grounds that these principles are clearly understood. In our view, these principles are at the heart of the innovation and significant benefits that have come from the internet. Further, we focus on innovation and economic consumer benefits in our analysis.

In this section we introduce the following:

- The benefits of the open internet principles in driving the development of internet-based content and applications, and demand for more advanced and robust communications networks.
- The distribution of commercial benefits along the value chain and beyond to the wider economy and society.
- The policy challenge in terms of the EU's "Digital Agenda" goals, UK and other European government policy priorities, and commercial pressures to erode the open internet.

In subsequent sections we go into greater detail. In Section 2 we consider a set of interrelated myths that have tended to cloud public policy discussions across Europe; in Section 3 we discuss the economics of the open internet; and finally in Section 4 we consider the policy question of what measures can be taken to safeguard the open internet.

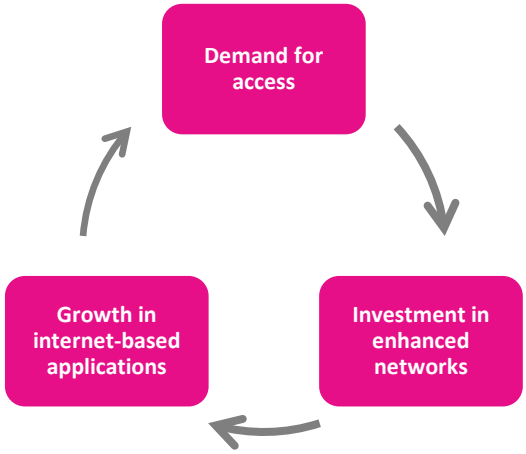
1.1 Benefits of the open internet

The open internet has had profound benefits. Further innovation is expected to continue at a rapid pace. This is reflected in consumers' willingness to pay for internet access (considered later), and demand for faster, better broadband packages to seamlessly access content, services and applications. The stimulus for broadband investment has been the availability of a critical mass of internet-based applications and content, in other words, the more end-users are attracted to rich

[1] Also without a requirement to pay a fee to access end-users – sometimes referred to as the zero price rule: Lee, Robin S., and Tim Wu. 2009. "Subsidizing Creativity through Network Design: Zero-Pricing and Net Neutrality." *Journal of Economic Perspectives*, 23(3). http://www.aeaweb.org/articles.php?doi=10.1257/jep.23.3.61

content and applications, the more value is generated for access providers, and the stronger incentive for investment in enhanced networks. This virtuous circle is illustrated in Figure 1-1. [2]

Figure 1-1: Virtuous circle between content & applications, demand and networks



The internet has contributed to innovation in terms of new content and applications across a wide range of economic and social activity. Those that are successful are able to scale rapidly and globally – a key benefit of innovation without permission. There are a wide range of examples which serve to illustrate such innovation, and its on-going nature as discussed in Figure 1-2.

Figure 1-2: Illustrative examples of internet-based innovation

Internet based communications

A wide range of internet based communications applications including VoIP, video chat and collaboration and instant messaging (IM) are now available to consumers and businesses including SMEs. These services were an early catalyst for broadband adoption. Application providers, who can innovate without permission from network operators utilising Internet Protocol and web standards, offer services with capabilities beyond those of conventional voice and text offerings and, often at zero or low cost. Examples of innovations include mass market two-way video and group video collaboration, higher quality voice, presence, notice of message receipt and extension of applications to non-telephony devices including PCs, hand held devices, games consoles and TVs.

An illustrative example is Skype who, founded in 2003 and headquartered in Luxembourg, initially offered free internet-based voice calling and Instant Messaging capability operating on PCs. A range of voice, video and business collaboration tools are now available on a wide range of devices. Skype users made 207 billion minutes of voice and video calls in 2010, approximately 42% of which was video.[3] In terms of international calls Skype is equivalent to almost 25% of total global voice calls – supporting both personal communication and business collaboration and trade.[4]

[2] Internet-based content and applications and network access may be "strategic complements" whereby an increase in one increases the incremental return to an increase in the other. Roberts. 2004. "The modern firm". Oxford University Press.

[3] At 21 September 2011. http://about.skype.com/

[4] http://blogs.skype.com/en/2011/01/international_calling.html

Internet based on-demand & catch-up TV

Internet based on-demand and catch-up TV services have proved popular as they offer wider choice and flexibility for consumers. These applications have driven demand for higher quality broadband and for customer migration to higher service tiers – thereby benefiting internet access providers. Internet based TV services have been extended to a range of devices including, for example, smartphones and tablets, and beyond their country of origin.

Examples of internet based video services include:

- The launch by Channel 4 of 4oD in December 2006 and, as part of its 4oD syndication strategy, a pioneering deal in 2009 with Google which allowed YouTube access to Channel 4's originally commissioned programmes in the UK
- The launch BBC iPlayer in 2007 and of an iPlayer iPad app in 11 European countries by BBC Worldwide in July 2011, with more territories planned. Extension of these services to include high definition content will help drive demand for next generation broadband.
- Yahoo! investment in content and distribution includes a range of premium locally-commissioned and advertiser-funded video, along with content licensed from third parties – in particular, the partnership with the Barclays Premier League that delivers video highlight packages to millions of football fans via the Yahoo! Eurosport site.
- YouTube launched in 2005, allowing users to upload, share and view videos. Since then a range of international media organisations have deals to offer their content via YouTube.

Music streaming

Streaming music services allow consumers to access large libraries of legal music on demand, with both advertising and subscription funded models, across a broad range of devices and platforms. For example, Spotify was launched in Sweden in 2008 and is available in Finland, France, the Netherlands, Norway, Spain, Sweden, the United Kingdom, the United States and soon Denmark. In September 2011 Spotify was integrated into Facebook.

Alongside the development of the open internet, networks moved from dial up access to broadband and from 2G to 3G wireless access over the past decade. The business case for these network transformations was made possible by continued end-user demand for internet-based content and applications.

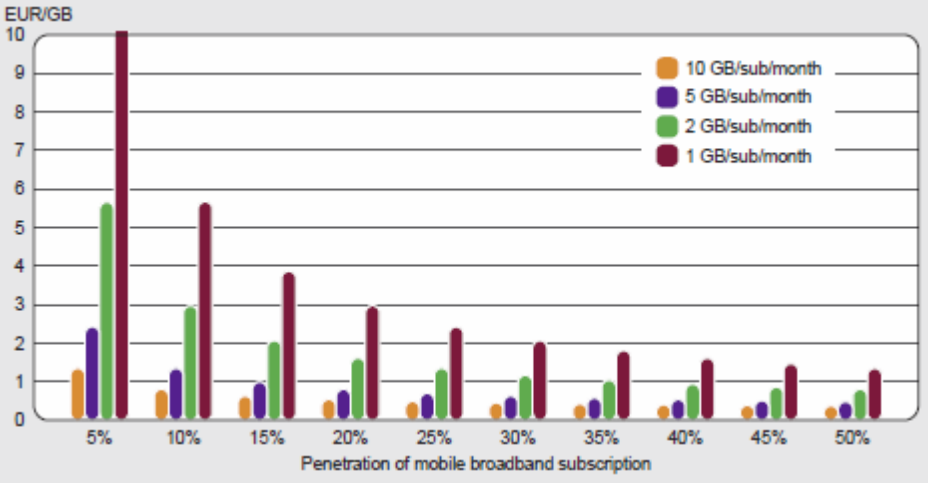
The next phase of network innovation involves extending fibre closer to the end-user and enhanced mobile (in particular Long Term Evolution or LTE). Rich applications and content will help support the business case for such investment by promoting wider internet use, demand for higher quality access and revenue growth. Revenue will accrue both from incremental payment for higher speed service and higher mobile data tiers. Examples which illustrate the opportunity include tiered pricing by mobile operators and higher speed cable packages offered at higher prices by Virgin in the UK.

In terms of overall economic benefits, our own estimates point to a "consumer surplus" (willingness to pay less cost) in Europe of around €100 billion. This estimate is based on a number of indicators (see Appendix A) including willingness to pay for broadband access, time spent online, and analysis by McKinsey for the eG8 meeting in Paris based on consumers' willingness to pay to reach specific applications online.

There have also been benefits to the whole economy with the internet a key part of the ICT ecosystem[5] and evidence of a substantial contribution of the internet to productivity and GDP growth. A US estimate of the contribution to growth of the internet and connectivity found a contribution of 0.468% pa compared with real US GDP growth of 2.3% pa over the period 2000-2007, a contribution of 20% of growth.[6] To put this number into perspective, in Europe 20% of the growth in GDP over the same period would be equivalent to around €100 billion per annum.

Growth in adoption of mobile broadband and growth in data use can also be expected to lower the average cost to network operators per gigabyte (GB) of traffic carried as shown in Figure 1-3.[7] An implication of this is that mobile data traffic growth may be expected, through economies of scale, to lower costs to network providers which should result in lower retail tariffs, thereby facilitating greater digital inclusion. Costs to providers are shown potentially falling well below €1 per GB[8] (excluding customer acquisition and marketing costs).

Figure 1-3: Mobile traffic and subscriber growth is anticipated to reduce unit data costs



The internet is also supporting innovation across the entire UK audio visual sector. A recent study identified the new service opportunities that are dependent on quality broadband and the open internet as follows:[9]

> *"• Digital media and the internet offer new ways of distributing and charging for content.*

[5] McKinsey Global Institute. May 2011. "Internet matters: The Net's sweeping impact on growth, jobs and prosperity." http://www.mckinsey.com/mgi/publications/Internet_matters/pdfs/MGI_Internet_matters_full_report.pdf

For the UK see Boston Consulting Group (commissioned by Google). October 2010. "The connected Kingdom – how the Internet is transforming the UK economy." http://www.bcg.com/documents/file62983.pdf

[6] Corrado. May 2010. "Communication capital, Metcalfe's law and US productivity growth." http://www.crei.cat/conferences/cornucopia/confpapers/CREI%20paper_Corrado_15May10_V2.pdf

[7] Nokia Siemens Networks. May 2010. "Mobile broadband with HSPA and LTE – capacity and cost aspects". White Paper. http://www.nokiasiemensnetworks.com/sites/default/files/document/Mobile_broadband_A4_26041.pdf

[8] To put a GB into perspective 300 minutes of voice corresponds to around 36 MB or 3.6% of a GB, whilst an hour of TV might be around 1 GB – depending on the quality.

[9] Robin Foster and Tom Broughton. April 2011. "Creative UK: the audiovisual sector and economic success." http://www.commcham.com/publications/creative-uk

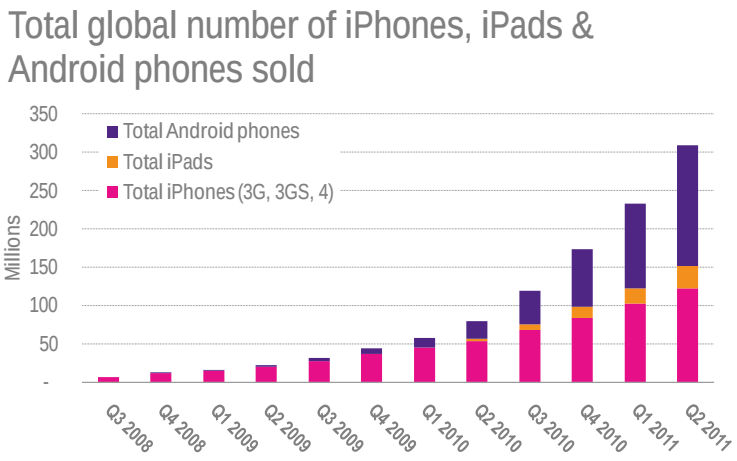
• Last year over 5bn videos were downloaded over the internet in the UK, and developments like YouView – a hybrid broadcast and online platform – offer scope for radical new ways of delivering content to consumers.

• Alongside broadcast release, content is being reformatted, diced and spliced for release on demand, via YouTube and in the form of new iPhone and Android apps."

This pattern, of a virtuous circle between innovations in relation to network enhancement and internet-based content and applications can be expected to continue. Recent development and adoption of smart personal devices, apps stores, and enhancements to mobile connectivity including greater coverage, speed and capacity, are expected to produce a further wave of innovation. That is, provided network operators do not undermine the underlying dynamic through discrimination to protect their own integrated voice, text and video services.

Mobile access to the internet took-off when the iPhone 3G and Android devices - and their content applications stores - were launched in the period June-October 2008. Figure 1-4 illustrates the phenomenal growth in cumulative advanced device sales since that time.

Figure 1-4



Source: Plum Consulting, Apple quarterly financial results, Gartner

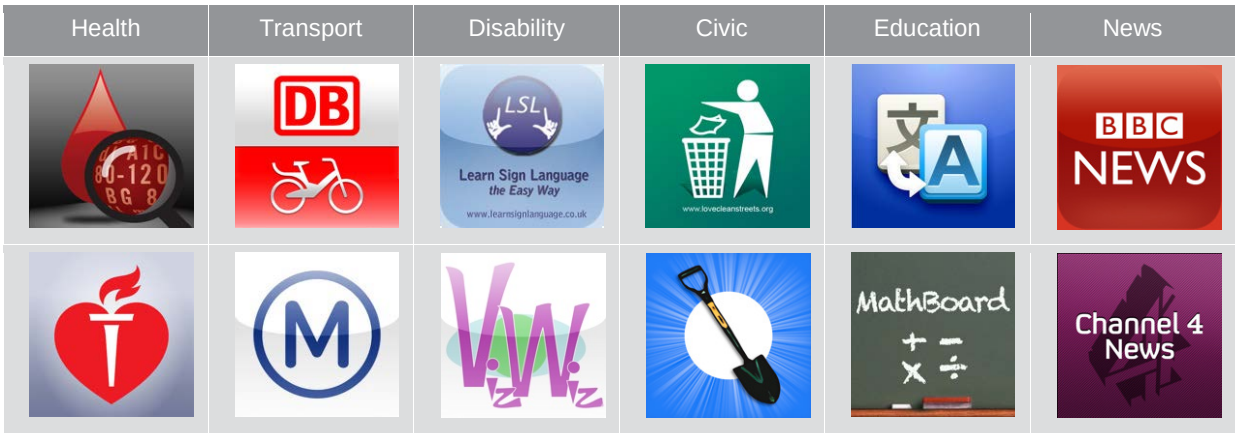
This acceleration indicates substantial willingness to pay for these devices (for which consumers pay a premium over a basic device) and for the advanced applications they enable – almost all of which are internet-based.

What is also implied is that– analogous to the early days of broadband – there may be direct network externalities as advanced mobile devices proliferate. As more people adopt smart device applications that depend on others adopting them, they will become more valuable, such as mobile social tools, location sharing, video calling and other services.

Besides devices, also important is the growth in mobile applications. From their launch respectively in July and October 2008 the Apple App store and Android Market achieved overall revenues of around $2 billion by 2010. Further, with 500,000 and 250,000 available apps, downloads had exceeded 15 billion and 4.5 billion respectively by July 2011. Many of these apps have private value to the user, but a growing number also deliver wider social benefits including health monitoring and first aid, public

and social transport, aids for the disabled, civic and community applications and news – as illustrated in Figure 1-5.

Figure 1-5: Mobile applications delivering citizen benefits



One reason that many mobile applications deliver wider social benefits is that the device can be with you all the time. Another is that location awareness and integration of sensors such as a microphone and camera increase the capability and lower the cost to the user of available services and of doing something socially valuable. The opening up of government data will also expand the opportunity to offer applications that improve democratic participation and community life.[10]

1.2 Distribution of commercial benefits along the value chain

We have considered the overall economic benefits related to the open internet, most of which will be captured by end-users.[11] However we are also interested in how commercial value is distributed and redistributed along the extended internet value chain. In less than 10 years, revenues from broadband connectivity have grown from nearly zero to £2.6 billion in the UK alone (for 2009).[12] Looking to Europe, Eurostat data indicate that the total turnover from the provision of internet services (a proxy for the access connectivity revenue) in the European Union is around €60 billion annually. This estimate excludes line charges and mobile data so the effective figure is substantially higher at €155 billion – as illustrated in Figure 1-6.[13]

[10] For example, in the UK http://data.gov.uk/

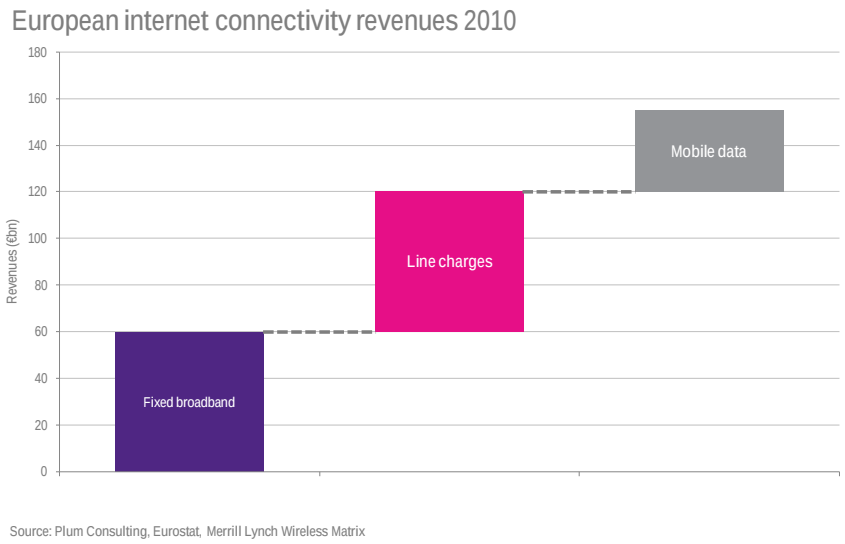
[11] William D Nordhaus. April 2004. "Schumpeterian Profits In The American Economy: Theory and Measurement." NBER Working Paper 10433. http://www.nber.org/papers/w10433

[12] Ofcom, The Communications Market 2010, http://stakeholders.ofcom.org.uk/binaries/research/cmr/753567/UK-telecoms.pdf

[13] Eurostat data indicate that the total turnover from the provision of internet services (a proxy for the access connectivity revenue) in the European Union is around €60 billion annually. Data is only available for a selection of EU countries so is extrapolated based on fixed telecoms revenue. Source: http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes

This estimate excludes line charges so the effective figure is substantially higher. Evidence from the UK and an OECD bundling report, http://www.oecd.org/document/33/0,3746,en_2649_34223_47179169_1_1_1_1,00.html suggest the line charge is around 50% of total broadband charges. Mobile data revenues are estimated to be 28.9% of total mobile revenues, which were $170 billion in 2010. Source: Merrill Lynch Global Wireless Matrix Q3 2010.

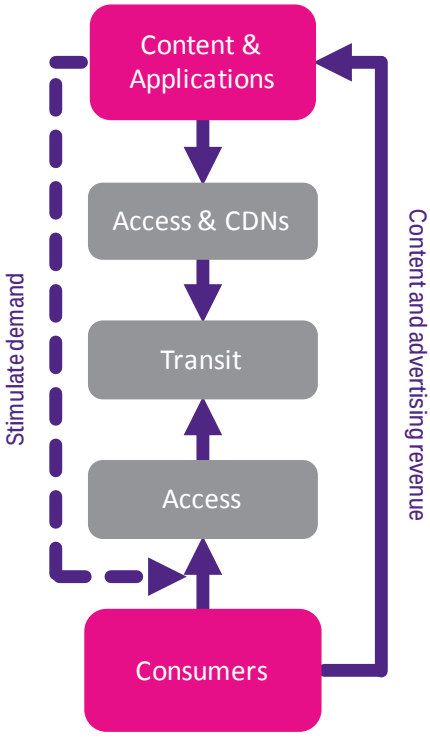
Figure 1-6



Source: Plum Consulting, Eurostat, Merrill Lynch Wireless Matrix

Demand for connectivity, and the corresponding revenues flowing to network operators, is a direct result of the availability of a vast amount of predominantly internet-based content and applications. There is therefore a relationship between the source of such demand – rich internet-based content and applications – and the distribution of value along the value chain. Figure 1-7 shows a simplified version of the internet value chain.

Figure 1-7: The content and applications networks value chain



Data flows from content providers to transit and access providers to consumers. Consumers pay internet access providers for access connectivity, and content and application providers pay for local access to the internet in order to distribute content and applications. The transit and access provider stage is in reality composed of a number of separate levels and players, which are not displayed in this simplified diagram. These players range from internet access providers, to incumbents who have infrastructure at all levels, to transit providers and content delivery networks (CDNs).

There is also a flow of money from consumers and advertisers to content and application providers; this may be directly in paying for over-the-top services and content, or indirectly through a range of other channels including advertising. Consumers' ability to access content and applications and distribute content is the reason consumers are willing to pay for access.

European data on the total revenues from the internet value chain are not available. However AT Kearney figures suggest that global fixed connectivity revenues alone account for over 50% of the

global revenues attributed to the internet value chain (excluding end-user devices).[14]

In conclusion, demand along the value chain determines how the benefits of the open internet are distributed. It is important to remember that the reason people are willing to pay for internet access is so they can access internet content and applications. For consumers, internet access is a means to an end. Network providers are dependent on this demand to monetize their substantial investments.

1.3 The policy challenge

Europe 2020 is the growth strategy for the EU to become a smart, sustainable and inclusive economy. The Digital Agenda for Europe is one of the seven flagship initiatives of the Europe 2020 Strategy and includes goals in relation to both content and applications, and networks. The goals of the Digital Agenda recognise the complementarity between content and applications and networks:[15]

> *"...the creation of attractive online content and services and its free circulation inside the EU and across its borders are fundamental to stimulate the virtuous cycle of demand."*
>
> *"We need very fast Internet for the economy to grow strongly and to create jobs and prosperity, and to ensure citizens can access the content and services they want."*

The EU Electronic Communications legislation requires transparency of communication with end-users about restrictions and traffic management practices, and gives regulatory authorities the power to set minimum quality of service requirements and introduce obligations in cases where network operator practices are discriminatory or anti-competitive.[16] In May 2011 the European Commission agreed a communication regarding the open internet.[17] The communication noted, as part of the 2009 EU telecoms reform package, a commitment to:

> *"preserving the open and neutral character of the internet, taking full account of the will of the co-legislators now to enshrine net neutrality as a policy objective and regulatory principle to be promoted by national regulatory authorities."*

The communication focussed on monitoring, transparency and back-stop powers in relation to minimum quality of service requirements to protect the open internet. In May 2011 Neelie Kroes, European Commission Vice-President for the Digital Agenda, sent a signal in relation to net neutrality:[18]

> *"...if measures to enhance competition are not enough to bring internet providers to offer real consumer choice, I am ready to prohibit the blocking of lawful services or applications. It's not OK for Skype and other such services to be throttled. That is anti-competitive."*

At the national level, member states are pursuing individual initiatives and have targets in relation to high speed broadband, promotion of the digital economy and net neutrality. Following the transposition of the 2009 EU telecoms reform package into UK law in May 2011, Communications and

[14] AT Kearney. April 2010. "Internet value chain economics." http://www.atkearney.com/index.php/Publications/internet-value-chain-economics.html

[15] EC. August 2010. A Digital Agenda for Europe. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0245:FIN:EN:PDF

[16] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:337:0011:0036:En:PDF

[17] EC. May 2011. "The open internet and net neutrality in Europe." http://ec.europa.eu/information_society/policy/ecomm/doc/library/communications_reports/netneutrality/comm-19042011.pdf

[18] May 2011. "The internet belongs to all of us." http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/11/285

Creative Industries Minister Ed Vaizey set out a set of open internet principles at the OECD in June 2011:[19]

> *"Users should be able to access any legal content or service at the speed at which they have contracted with their ISP. Content providers and applications should be able to reach any consumer. ISPs should not be able to discriminate unfairly against services or users."*

However there is emerging evidence of risks to the basic principles of openness on which the internet was founded – as illustrated in Figure 1-8.

Figure 1-8: Illustrative examples of discrimination and service degradation in Europe

Between late 2009 and 2010 the BBC iPlayer suffered a reduction in service bit rate and quality for many end-users which the BBC, but not end-users (at least initially), detected.[20] This resulted from the introduction of a BT policy in relation to video streaming that their Option 1 broadband users would be restricted to a maximum video streaming rate of 896 kbps between 5 pm and midnight. In practice implementation of this policy also impacted on the medium quality iPlayer 800 kbps stream with many users reduced to the low quality 480 kbps stream.

In the UK Vodafone charge a premium of £15 per month if users of mobile devices wish to use VoIP applications such as Skype.[21]

Orange explicitly restrict the use of certain non-Orange services in their terms and conditions which state that "The Offer is not to be used for other activities such as non-Orange internet-based streaming services, voice or video over the internet, peer to peer file sharing, non-Orange internet-based video."[22]

In the Netherlands KPN announced its intention in April 2011 to charge a premium for access to specific applications including VoIP, instant messaging and streaming video.[23] The Dutch Parliament responded by passing a bill to implement net neutrality principles in June 2011 (to become law it must also pass the Senate).[24]

There are also reasons to expect that discrimination may persist or grow without policy action. Some network operators have also signalled their desire to charge content and application providers (including a proposed data termination charge). Rivalry between internet-based and network integrated services can also be expected to increase as both develop.

In this report we assess these challenges and consider whether the protection of the open internet should be reinforced based on analysis of end-user benefits and incentives for investment and innovation in relation to networks and applications. We conclude that a clear commitment to the open internet – both nationally and at a European level – is desirable, in the interest of all.

[19] 18 June 2011. "Internet speech at OECD conference." http://www.culture.gov.uk/news/ministers_speeches/8265.aspx

[20] BBC. 2010. BBC response to Ofcom's discussion document on traffic management and 'net neutrality'. http://stakeholders.ofcom.org.uk/binaries/consultations/net-neutrality/responses/BBC.pdf

[21] Checked 21 September 2011. Premium applied to plans of £36 per month or less for 12 month plan. Contained in plan details under price plans.

[22] Checked 21 September 2011. http://www1.orange.co.uk/entertainment/OrangeWorld/terms.php

[23] http://tweakers.net/nieuws/74017/kpn-chatheffing-voor-mobiel-Internet-komt-deze-zomer-update.html

[24] http://arstechnica.com/tech-policy/news/2011/06/dutch-parliament-passes-europes-first-net-neutrality-law.ars

1.4 Conclusion

The open internet has and continues to generate substantial benefits. Yet the principles of the open internet face challenges with evidence of discrimination against internet-based applications in Europe particularly on mobile. We also conclude that the policy challenge of maintaining the open internet and promoting demand for advanced applications and networks is recognised, but has yet to be resolved. We offer potential options in terms of policy in Section 4.

2 Myths regarding the internet value chain

During the course of the 'net neutrality' debate, a number of myths have been promulgated regarding the internet value chain. Chief amongst these is the idea that demand for content and applications and the data growth associated with this is a problem for network operators. In fact, demand is an opportunity. Further related myths include the idea that applications and content providers "cause" traffic, that they free ride on networks and that were network operators to charge providers of content and applications, investment in enhanced networks would significantly increase.

Variants of these myths, in particular in relation to the cost implications of traffic growth and the need for a new structure in the internet value chain, were set out in various reports in 2010 and 2011 for network operators,[25] and have been expressed by a number of network operators.[26]

These myths have become embedded in the policy discussion without sufficient scrutiny[27] and as a result some of these arguments tend to cloud policy discussion at present. It is therefore helpful to address them before exploring the economics of alternative approaches and policy options in sections 3 and 4 respectively. Figure 2-1 sets out these interrelated myths with our conclusions based on the analysis in this section to the right of each of them.

Figure 2-1

Myth 1: Demand is bad	• Demand is good since it reflects end-user value and supports revenue growth and network investment.
Myth 2: Costs are ballooning because of data growth	• Costs are not ballooning because of data growth. For fixed access they are low and declining on a unit cost basis, whilst for mobile access they are higher but nevertheless declining on a unit cost basis.
Myth 3: Application providers "cause" traffic	• End users cause traffic via requests for and generation of content.
Myth 4: Application providers free ride	• Application providers do not free ride but invest in infrastructure, purchase network services and have developed bandwidth efficient applications.
Myth 5: Charging application providers would promote broadband investment	• Any revenues raised would not necessarily be invested and would discourage applications innovation which would reduce demand for advanced network access.

[25] AT Kearney. 2010. "A viable future model for the Internet." Commissioned by Deutsche Telekom, France Telecom, Telecom Italia and Telefónica. http://www.atkearney.com/index.php/Publications/a-viable-future-model-for-the-Internet.html

AT Kearney. April 2010. "Internet value chain economics." Op. cit.

[26] For example, "*[Google and Yahoo!!] "use Telefonica's networks for free, which is good news for them and a tragedy for us."* Cesar Alierta, CEO, Telefonica, 2010. http://www.bloomberg.com/news/2010-12-07/apple-google-asked-to-pay-up-as-europeean-operators-inundated-by-data.html

[27] A review of the AT Kearney reports was published in August 2011. Robert Kenny. August 2011. "Are traffic charges needed to avert a coming capex catastrophe?" A review of the AT Kearney paper *A Viable Future Model for the Internet*. http://www.commcham.com/traffic-charges

2.1 Myth One: Demand is bad

A number of network operators have argued that demand growth is a problem, particularly in relation to mobile networks. This claim is surprising given that businesses typically welcome demand for their services.

Growth in bandwidth intensive (Mbps) and capacity intensive (GB per month) applications is driving growth in the number of subscribers, first on fixed and now on mobile data networks. This growth is the basis for user willingness to pay for internet access and for increasing numbers of people upgrading to higher speed and/or higher data tier broadband packages. In terms of the underlying economics, increased demand results in an outward shift in the demand curve – increasing (not decreasing) the opportunity to profitably monetise network access (see Figure 2-2).

Figure 2-2

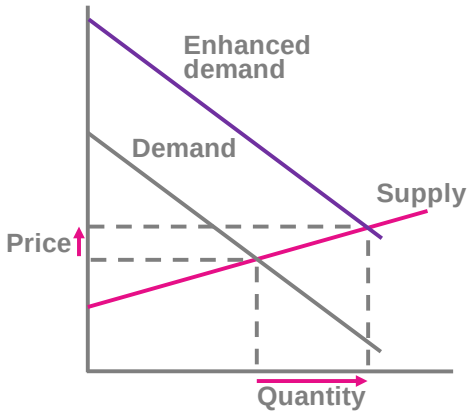


Figure 2-2 illustrates an important fact about value chains, namely that a flow of money is not necessary for benefits to be redistributed along the value chain. Content and application providers offer services, which increase consumer or end-user demand for internet access, which in turn is monetised by network operators without the need for any monetary payment to flow from content and application providers to network operators (increased demand is illustrated above by an outward shift in the demand curve which allows network operators to sell more at higher prices). In other markets it is not unusual for money to flow the other way – to those who stimulate demand for a service, such as payments to online referral sites.

For fixed networks, broadband has created a new revenue opportunity, and data traffic growth has helped sustain fixed residential connections that might otherwise be substituted by mobile only. Looking ahead, fixed residential access networks will increasingly owe their existence to broadband and data growth to remain competitive with potential wireless substitutes. Mobile would have made far greater inroads in terms of fixed substitution were it not for the advent of DSL and bandwidth- and capacity-intensive applications. With additional spectrum and LTE, wireless substitution for DSL may intensify unless traffic levels increase to the point where wireless is not an economically feasible substitute (perhaps >10-20 GB/month per household).

For mobile networks, traffic growth coupled with tiered pricing creates a revenue opportunity. Rich content and applications also create opportunities for revenue growth to the extent that they increase demand for higher priced / higher speed connections. Indeed, only comparatively recently, supported by mobile data growth, have investments in 3G and accompanying spectrum begun to make sense.

For mobile broadband, subscriber growth also provides a significant future revenue opportunity. In practice this conclusion has been borne out for efficient and forward looking network operators who have seen acceleration in growth of mobile data revenues.[28] As the Chairman of Vodafone Sir John Bond commented:[29]

> *"Data has been the key driver of growth over the last year. Our customers around the world are increasingly drawn to the experience of the mobile internet and related services. Organic data revenue growth was 26.4% achieved through combining increasingly disciplined pricing structures with a broad range of devices and a network with a deserved reputation for market-leading speed and reliability."*

Verizon explain the relationship between revenue growth and data growth as follows:

> *"...with our 4G launch and the speeds that 4G give and the proliferation of video and content consumption through mobile handset, we see usage starting to be on an escalating scale...then ARPU will start to accrete because people will start to use more, they will start to buy the higher tiers..."* [30]

This view – that data growth is a revenue opportunity - contrasts with that set out by AT Kearney who, for example, estimate that very little revenue is associated with the vast majority of internet traffic, as illustrated by the two columns to the left of Figure 2-3 (PB refers to a Petabyte = 10^{15} Bytes).[31]

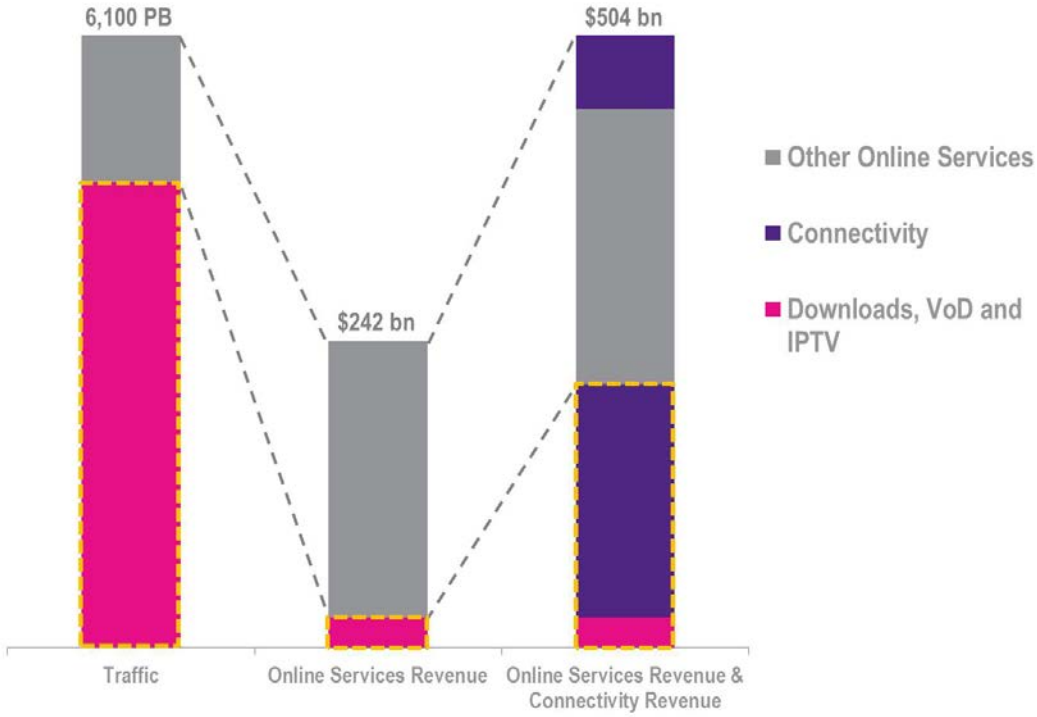
[28] A number of mobile operators have had stable/rising EBITDA margins. Bank of America Merrill Lynch Global Wireless Matrix 3Q10.

[29] http://www.vodafone.com/content/annualreport/annual_report11/business-review/chairmans-statement.html

[30] Verizon. 10 August 2011. Oppenheimer & Co. Technology & Communications Conference. Final transcript. Page 3. http://www22.verizon.com/investor/investor-consump/groups/events/documents/investorrelation/event_ucm_5_trans.pdf

[31] AT Kearney. April 2010. "Internet value chain economics." In the Vodafone Policy Paper Series, Number 11. http://www.vodafone.com/content/dam/vodafone/about/public_policy/policy_papers/public_policy_series_11.pdf

Figure 2-3: Global internet traffic and associated revenue – accounting for access



Source: Plum figure extending the original AT Kearney figure (shown as the two left hand bars).

Online service revenues of $242 billion relate to a minority of overall data traffic with digital downloads and video accounting for 76% of traffic but only generating 10% of online services revenue. According to AT Kearney this constitutes an imbalance. However, this analysis fails to account for access revenues which according to AT Kearney amounted to $262 billion in 2008 (for fixed alone). The right hand bar in Figure 2-3 shows revenue with access revenues attributed to services on the basis of relative data traffic levels (on grounds that payment for more advanced connectivity is driven by traffic levels and rich content and applications). A much more balanced picture then emerges.

Conclusion in relation to Myth One: Demand is good

Demand growth, reflecting the value of internet-based content and applications, support revenue growth and investment for network operators.

2.2 Myth Two: Costs are ballooning because of data growth

Some operators argue that increasing internet traffic means their network costs are ballooning. We conclude this is not the case. The analysis differs however for fixed and mobile access networks. (Appendix B sets out our complete analysis). For fixed networks the costs of carrying traffic are low relative to overall connectivity costs. Further technological innovation has kept pace with traffic growth in the past (when traffic growth was higher than it is today) and may outstrip traffic growth in future, thereby holding traffic related costs at or below current levels.

Figure 2-4 illustrates fixed traffic growth of 44% pa.[32] Figure 2-5 shows the estimated traffic-related cost for a base year of 2010 as a percentage of total connectivity revenue (as a proxy for overall cost).[33]

Figure 2-4

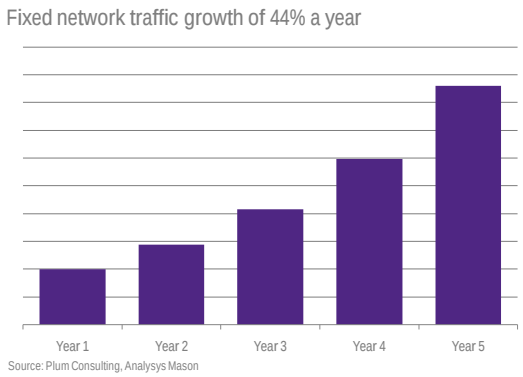
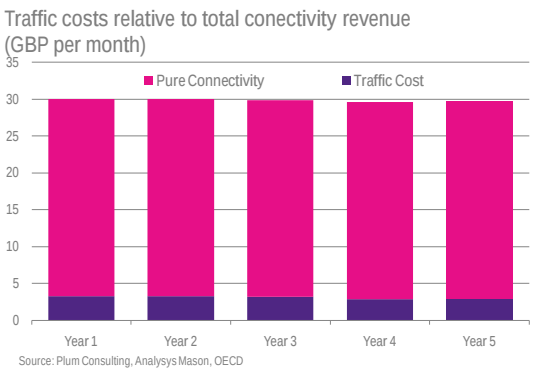


Figure 2-5



Traffic related costs are a small percentage of the total connectivity revenue and, despite traffic growth, this percentage is expected to stay constant or decline. Fixed access DSL networks have a single line per household between the exchange or street cabinet and the premises – so traffic growth over this segment involves no additional costs. Further back in the network, traffic is aggregated and carried by fibre which is seeing steady increases in capacity and reductions in cost per gigabyte carried. Studies in Canada and in the UK referenced in Appendix B put the incremental cost of fixed network traffic at around €0.01-0.03 per GB.

These costs are so low that Analysys-Mason, in estimates for Ofcom of the costs of accommodating video traffic growth, concluded that:[34]

> *"Video traffic could be accommodated by increasing the total bandwidth available, and it is not essential to deploy advanced technologies to prioritise video traffic over other types of traffic in order to ensure a high QoS for video services."*

Mobile networks differ from fixed networks in that the radio access network is shared by users and the costs of adding capacity are significantly higher than they are for fixed networks.[35] However, mobile network technology – the progress from 2G to 3G to 4G (with intermediate enhancements along the way) has seen significant improvements in spectrum efficiency and reductions in the cost of carrying

[32] Scenario 2 of Analysys-Mason, which is above the Cisco projection for fixed traffic growth of 32%. Analysys-Mason for Ofcom. 2008. "Delivering high quality video services online." http://stakeholders.ofcom.org.uk/market-data-research/technology-research/research/emerging-tech/hqvs/

[33] Estimated for the median price of broadband including line charges for the UK in 2010. OECD. February 2011. "Broadband bundling – trends and policy implications". http://www.oecd-ilibrary.org/science-and-technology/broadband-bundling_5kghtc8znnbx-en

We include the line charge on grounds that households primarily purchase a fixed line for broadband rather than voice where mobile offers a close substitute.

[34] Analysys-Mason for Ofcom. 2008. "Delivering high quality video services online." http://stakeholders.ofcom.org.uk/market-data-research/technology-research/research/emerging-tech/hqvs/

[35] In a mobile network, capacity is limited by the amount of spectrum and density of base stations (for a given radio technology) which makes meeting traffic growth inherently more costly.

traffic. Further, across Europe the release of 800 MHz and 2.6 GHz spectrum should increase capacity and reduce the costs of carrying traffic further.

Ericsson, Nokia Siemens Networks and "3" in the UK have published estimates of the costs of carrying additional traffic on mobile networks (considered in Appendix B). Forward-looking estimates which take account of the transition to LTE, additional spectrum and traffic and subscriber growth (which improves overall network utilisation) put the cost to the mobile network operators at under €1 per GB. WiFi and femtocells may also offer low cost options in terms of traffic offload.

Mobile network incremental data traffic costs are therefore substantially greater than those for fixed networks, but well below existing smartphone data tariffs of around €10 per GB.[36] Data traffic growth not only appears profitable, but may contribute to lower average costs per GB carried.

In other words if the rate of traffic growth falls below the rate of technical progress in terms of improvements of the price-performance of network equipment, the commercial value of the market will shrink. Further, if traffic volumes do not rise, fixed operators will forego a greater share of the connectivity market to mobile-only end-users as the price-performance of wireless improves. In conclusion, as Dr Odlyzko, Professor in the School of Mathematics at the University of Minnesota is reported in the Economist as saying:[37]

"Too little internet traffic could prove to be more dangerous to the industry than too much."

Conclusion in relation to Myth Two: Costs are ballooning Costs are not ballooning. For fixed networks traffic related costs are low, falling on a unit basis and likely to fall overall given declines in traffic growth and on-going cost-reducing technical progress. Whilst for mobile access they are higher but nevertheless declining on a unit cost basis.

2.3 Myth Three: Application providers cause traffic

Network operators have argued in the past that content and application providers congest their networks by causing internet traffic. This is misleading. Content and application providers offer content and applications; consumers or end-users "cause" demand by requesting a service from a server, for example, by clicking on a link to a YouTube video.[38] End-users also generate traffic "directly", for example, via content uploads. Therefore it is not application and content providers, but end-users, who "cause" individual flows of traffic.

This distinction is important since, to the extent that it is important to signal the costs associated with incremental network traffic, such signals need to be sent to end-users – as is the case today, for example, with tiered pricing structures.

The distinction is also important because, as discussed in Section 4, the application of two-sided market models to the internet has to date not taken account of the incremental cost of network traffic

[36] For example, in the UK O2 charge a contract price of £10.21 per GB per month on a dongle and £10 per month for data on a smart phone (as of 21 September 2011).

[37] The Economist. December 2008. Surviving the exaflood. http://www.economist.com/node/12673221

[38] Machine-to-machine traffic differs since it may not be requested by an end-user, but is modest.

and therefore the efficiency benefits (in terms of "allocative efficiency") of charging end-users.[39] Such models have been developed assuming that data transport and connectivity costs are recovered via a lump sum payment from users. Such models therefore ignore the possible role of consumption-based pricing or tiered pricing/caps in incentivising efficient behaviour by end-users where data costs are material.

Conclusion in relation to Myth Three: End-users cause most traffic

Content and application providers do not cause traffic – consumers do. To the extent that it is important to signal the cost of incremental network traffic, such signals should be sent to end-users. .This does not necessarily mean rising prices for end-users since the costs of carrying traffic are falling, and, in the case of mobile data, new users bring with them additional revenue.

2.4 Myth Four: Application providers 'free ride'

It has been argued in debates about the open internet that application and content providers 'free ride' on network investment made by others. In reality content and applications providers:

- Do not free ride, but rather stimulate demand for internet access which enables network operators to profitably monetise their investment in network access.
- Buy services from infrastructure providers and are major investors in infrastructure in their own right.
- Invest extensively in technical innovations (including data compression) that reduce the amount of data required to support a given service.

We do not discuss the first point above further, focussing here on the second and third points. Content and application providers both invest in and purchase data storage, service capacity, network access, CDN services and data transport services. The costs involved provide them with strong incentives to minimise the amount of data required to deliver a specific service. For example, Google was the third largest internet backbone operator in the US in 2009[40] and has invested in undersea fibre links, Apple recently invested £1 billion in a data centre[41] and global expenditure on CDN services was $1.6 billion in 2009.[42]

More generally, investment in communications infrastructure by content and application providers and other non-telco businesses is reflected in a declining share of investment by telecommunications companies. In the US spending by the telecommunications industry now accounts for only 40 percent

[39] If such incremental costs were charged back to content and application providers then, particularly given that many internet-based services are free to end-users, it is unlikely that appropriate price signals in relation to network related traffic costs would be signalled to end consumers.

[40] Labovitz *et al*. "ATLAS Internet Observatory 2009 Annual Report."
http://www.nanog.org/meetings/nanog47/presentations/Monday/Labovitz_ObserveReport_N47_Mon.pdf

[41] http://www.theregister.co.uk/2011/06/09/apple_maiden_data_center/

[42] IDATE. 2009. "Evolution of the CDN market." http://www.ict-ocean.eu/public-folders/dissemination-1/cdnworldsummit-2010-cdnmarketevolution/at_download/file

of total private investment in communications equipment, whereas 30 years ago it accounted for nearly 90 percent.[43]

Further, in addition to a desire to minimise direct expenditure and investment costs, application providers face strong incentives to minimise the data traffic associated with their services since:

- Doing so enables new applications to be launched and to be accessed by more end-users, particularly the growing number of users accessing the internet globally via mobile.[44]
- The end-user experience is what drives success and overly bandwidth- or capacity-hungry services are less likely to be successful for some end-users.

There are numerous examples of applications that only became feasible when bandwidth and capacity demands were reduced, most clearly via advances in compression with MP3 such as iTunes, MPEG-4 enabling YouTube, and improved compression and up-loader tools enabling Flickr to accommodate higher resolution images, etc. Figure 2-6 illustrates innovations that help manage data demand.

Figure 2-6

"iTunes match" will allow music held locally to be matched in the cloud with no need for upload.

"Newsstand" will allow subscription publications to be downloaded in the background overnight.

Improved H264 compression was introduced in August 2008 for BBC iPlayer. Improvements to compression implemented over time. BBC R&D also developed and open sourced the Dirac video compression code.[45] CDN services are also utilised for streaming. The BBC is also exploring opportunities for multicasting.

Skype developed SILK for audio compression and utilises VP8, developed by On2 and released as an open codec by Google, for video communication. Better compression results in a better user experience for real-time online communications.

In response to relatively low data caps for residential broadband in Canada, Netflix reduced the bitrate by two-thirds.[46] This illustrates sensitivity to end-user interests, but also a potential form of entry barrier/discrimination – low data caps.

[43] Corrado. May 2010. "Communication capital, Metcalfe's law and US productivity growth." Page 11. http://www.crei.cat/conferences/cornucopia/confpapers/CREI%20paper_Corrado_15May10_V2.pdf

[44] The Boston Consulting Group. September 2010. The Internet's New Billion will come from BRIC countries with many connecting via mobile. http://www.google.co.uk/url?sa=t&source=web&cd=1&ved=0CBsQFjAA&url=http%3A%2F%2Fwww.bcg.com%2Fdocuments%2Ffile58645.pdf&rct=j&q=the%20Internet%20billion%20boston&ei=ZZwRTsr5Cc21hAeO15zSDQ&usg=AFQjCNHpJxkrlcNaJvdpQ_-8oZdn6uftxg

[45] http://www.bbc.co.uk/rd/projects/dirac/index.shtml

[46] http://blog.netflix.com/2011/03/netflix-lowers-data-usage-by-23-for.html

Conclusion in relation to Myth Four: Application providers do not free ride, they have substantial incentives to manage their traffic volumes since they invest extensively in and purchase network services

Content and application providers invest directly in infrastructure including internet access and (leased and owned and operated) backbone infrastructure, purchase services from content distribution networks (CDNs) and invest in software innovations that reduce data traffic required to support services and stimulate demand for network access.

2.5 Myth Five: Charging application providers would promote broadband investment

Some network operators have publicly called for a move towards charging content and application providers in addition to access charges paid by end-users, arguing this will help investment in next generation access. There are a number of problems with the assertion that charging content and application providers would increase network investment, in particular:

- Charging content and application providers may reduce innovation and investment in such applications, which are the driver of demand for enhanced network access. Take-up – as opposed to availability – of superfast broadband remains low and service innovations are likely to provide the 'tipping-point' (see analysis of Myth One: demand is bad).
- Investment to meet traffic growth differs fundamentally from investment to facilitate higher speed access, and the cases of mobile and fixed networks should be distinguished:
  - In relation to mobile, traffic related costs are low relative to existing smartphone tariffs and expected to fall with traffic growth, additional spectrum and new technology – traffic growth therefore appears profitable. Investment in higher speed access including LTE not only raises access speeds but also lowers the cost of carrying traffic and can therefore be expected to proceed once spectrum is made available nationally.
  - In relation to fixed, incremental data costs are very low (negligible). Further, were data charges to content and applications applied, the services of competing internet access providers rather than those of the network operator may capture additional revenues.[47] Even if revenues from premium data services reach the network operator, the impact on investment incentives is ambiguous since they may have an incentive not to upgrade basic performance or invest in capacity, in order to increase revenues from 'having' to prioritise traffic:[48]

    "Contrary to ISPs' claims that net neutrality regulations would have a chilling effect on their incentive to invest, we cannot dismiss the possibility of the opposite."

    In other words, the development of premium data services could incentivise network operators to ensure capacity remains scarce, which may in turn reduce network investment rather than stimulate it.

[47] Internet access providers would receive any revenue from charges to content and application providers are separate entities or have a regulated arms length relationship with access network providers, and charges paid by internet access providers for access are determined by regulators on a cost oriented basis. This means that any increase in internet access provider revenue is unlikely to result in increased funding for next generation access investment.

[48] Choi and Kim. September 2008. Net neutrality and investment incentives." CESIFO Working Paper No. 2390.

- In relation to higher speed broadband (as distinct from investment to meet traffic growth *per se*) the investment required to upgrade fixed networks may be substantial (depending on the technology choice and extent of coverage), whilst for mobile networks the investment required to upgrade to LTE is much more modest and both raises speeds and lowers unit costs.

In conclusion the open internet is likely to help rather than hinder network investment, as the FCC concluded:[49]

> *"Some commenters contend that open Internet rules are likely to reduce investment in broadband deployment. We disagree. There is no evidence that prior open Internet obligations have discouraged investment; and numerous commenters explain that, by preserving the virtuous circle of innovation, open Internet rules will increase incentives to invest in broadband infrastructure."*

Conclusion in relation to Myth Five: Charging application providers may reduce rather than increase network investment

Charging content and application providers may decrease innovation in relation to such applications, which in turn may reduce demand for advanced network access. Charging may also not result in additional improved service for content and application providers – rather charging may be implemented as a means of transferring value. In addition, it is not clear that any revenue gained would go to network operators or, if it did, that it would result in increased investment: in some models they could result in less investment since lower quality basic internet service may encourage adoption of prioritised services. Finally, a data charge or bit tax would not be expected to incentivise investment in higher speed broadband since it would not generate incremental revenues directly related to next generation access investment.

2.6 Conclusion

The 'net neutrality' policy debate has been clouded by a number of misconceptions about the internet value chain, the incentives of the various players, and the costs involved. There can be no doubt that demand for internet content and applications is good, not bad. Demand incentivises investment in advanced network access, contributing to the realisation of EU Digital Agenda goals and the UK and other national Government's broadband ambitions.

[49] FCC. 23 September 2011. "Preserving the open Internet." Federal Register, Vol. 76, No. 185. http://www.gpo.gov/fdsys/pkg/FR-2011-09-23/pdf/2011-24259.pdf

3 The economics of the open internet

The previous two sections set out an assessment of value of the internet and rebutted a number of interrelated arguments associated with the claim that the current model for the internet must change. This chapter considers whether the current model is appropriate, in particular whether the open character of the internet is the socially and economically efficient approach. We now evaluate this question in terms of the economic welfare implications of alternatives.[50] In our evaluation we consider:

- The implications of the two-sided markets literature.
- Discrimination by vertically integrated providers against internet-based applications.
- Constraints on efficient relationships between content and access providers and the benefits of an open internet norm.
- The characteristics of the open internet and innovation.

3.1 The internet and the two-sided markets literature

Most markets can be thought of as two-sided in that they need to bring together buyers and sellers to the benefit of both, therefore a stricter definition is needed. Rochet and Tirole (2005) define a two-sided market as one where the platform can affect the volume of transactions by charging one side of the market more and reduce the charges facing the other side of the market.[51] There are many examples of two-sided markets, for example, music festivals charge festival goers and pay bands that attract festival-goers. In many two-sided markets, only one side pays. It is important to consider the specific features of each market to determine the most efficient allocation of costs.

There is a relatively large and growing literature on two-sided markets; but a much more limited and recent literature which focuses on the application of two-sided market theory to the internet. We find that the literature related to the internet value chain fails to take account of the following key considerations:

- There are multiple participants in the internet value chain. Consequently internet access providers typically cannot guarantee a quality of service to content and application providers. The value chain may not therefore be most appropriately analysed as a two-sided market. Further, many internet access providers who have proposed charging content and application providers, are not proposing to offer any additional, value-added service (other than best efforts internet access)[52] in return.
- The potentially beneficial effect of end-user charges in signalling the costs of carrying traffic to end-users (where incremental data-related costs are material).
- Whether charging content and application providers is a practical solution given the transaction costs involved.

[50] We do not assess the merits of the open internet from a rights based perspective.

[51] Rochet and Tirole. November 2005. "Two-Sided Markets: A Progress Report." http://idei.fr/doc/wp/2005/2sided_markets.pdf

[52] By best efforts we mean the open internet with access to all legal content and applications, where best effort delivery means that there is no guarantee of data delivery or of service levels, but best efforts are made.

The literature therefore does not address key considerations which point to the efficiency of not charging content and application providers.

3.1.1 Is the internet value chain a two-sided market?

Internet access providers typically do not offer end-to-end connectivity and typically cannot guarantee levels of service to content and application providers or end-users in relation to applications and content. Further, the services they offer are highly heterogeneous with some offering transit whilst others may only offer local access, in some cases acquired wholesale from the network operator. Peer-to-peer services also involve different relationships with end-users both originating and consuming products and services (and data).

There is therefore no simple two-sided market with a single intermediate player offering a full service in return for a fee, as in, for example, the credit card market. The internet value chain has many players and intermediaries between the end-user and online content and service providers. Further, in instances where a fee has been proposed by backbone and access providers in relation to content and applications providers, it has not necessarily been in return for a well-defined service offering, rather only a transfer of value was proposed (leaving to one side voluntary relationships regarding services such as CDNs etc.).

It is not therefore clear that two-sided market analysis is appropriate or informative in relation to the internet value chain. However, we consider both the theoretical literature and the possible implications of a departure from existing open internet norms.

3.1.2 What does the two-sided market literature tell us?

We examined the two-sided market literature, in particular as it relates to the internet, and conclude that:

- The formal literature is ambiguous[53]
  - Static models of efficient pricing indicate that charging content and applications providers can, but does not necessarily, result in a reduction of overall economic welfare.[54]
  - Dynamic models that consider network investment indicate that charging applications providers can, but would not necessarily, reduce incentives for network investment.[55]
- The formal literature we cite above relies on a number of simplifying assumptions, including not addressing an issue at the heart of the current debate, namely who should pay the incremental costs associated with data traffic. Transport costs are either neglected or treated as a lump sum

[53] Economides and Hermalin. December 2010. "The economics of network neutrality." http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1723945

Shuett. 2010. "Net neutrality: A survey of the economic literature." *Review of Network Economics*: Vol. 9: Iss. 2, Article 1. http://www.bepress.com/rne/vol9/iss2/1/

[54] Economedies and Tag. 2009. "Net Neutrality on the Internet: A Two-sided Market Analysis." http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1019121

A subsequent paper by Caves. April 2010. "Modelling the welfare effects of net neutrality regulation: a comment on Economides and Tag.

[55] Cho and Kim. September 2008. "Net Neutrality and Investment Incentives." http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1285639

payment by end-users. However, how costs related to incremental traffic are recovered is a key consideration in terms of economic (allocative) efficiency. We argued earlier, in relation to Myth Three, that in relation to incremental traffic costs it is efficient for end-users to pay, as is currently the case. Given the lack of consideration of this aspect, the two-sided market literature is incomplete (in relation to the internet value chain) and the conclusions of the literature may be biased away from a conclusion that end-user payment for access – including incremental traffic related fees where appropriate – is efficient.

3.1.3 Is two-sided pricing feasible (or desirable)?

A further element which is absent from two-sided modelling applied to the internet is the transaction costs of alternative multiple charging arrangements. Charging content and application providers in an efficient way (assuming charging application and content providers is considered efficient in principle) may not be feasible.[56]

In particular, the transaction costs of alternative pricing approaches could be significant given the large number of internet-based content and application providers and internet access providers globally. There are over 100 million active websites[57] and around 10,000 internet access providers[58] worldwide, and many application and content providers do not have a billing relationship with end-users (whereas network and internet access providers do).

The potential complexity involved in moving away from a model where content and application providers do not pay is therefore considerable. Further, some potentially efficient mechanisms for charging for access – for example tiered data pricing – would not be feasible if individual content and application providers recharged end-users since none would have an aggregate view of individual end-user data consumption.

Substantial investment in traffic metering and billing systems would be required. Further, it is not clear that the underlying basis for innovation in relation to applications and content – "innovation without permission" – would be preserved since content and application providers would need a billing relationship with multiple access service providers globally. Moving away from innovation without permission would reduce market entry, innovation and competition thereby harming consumers and network operators (who would see reduced demand for access and higher quality access relative to an open internet scenario enabling continued innovation without permission).

A report by AT Kearney raises another possibility, namely that countervailing market power on the application and content side of the market may limit the ability to implement an across the board charge and would, in effect, require a cartel:[59]

> *"The most effective method, but also the toughest to achieve in practice, would be a universal structure agreed by all Connectivity Providers at the national or regional level..."*

We do not consider this a desirable, practical or legal proposition. It is clearly inconsistent with proposals for differential charges in relation to content and application providers founded, in our view on false grounds, on the premise that such charging would be economically efficient.

[56] Kenny (August 2011) Op. Cit. discusses a range of practical difficulties in implementing charges for application and content providers.

[57] http://www.domaintools.com/internet-statistics/

[58] Baker. June 2011. "Views of IPv6 Site Multihoming." http://www.ipjforum.org/?p=528

[59] AT Kearney. 2010. "A viable model for the Internet." Page 30. Op. cit.

Reinforcing the open internet norm may be desirable from the perspective of access providers as well – not only because this would stimulate innovation and demand for access; but also because a departure from the open internet norm could see payment from network operators to content and application providers who may be considered a key element of their access package by consumers . The open internet represents a two-way implicit contract between access providers and content and application providers (the zero price rule) which we explore further in section 3.3. Greater predictability regarding open internet protections is in the interests of both content and application providers and network access providers.

3.2 Vertical integration and discrimination

Vertically integrated access and service/application/content providers may have both the incentive and the opportunity to discriminate against third party content and applications. This concern underpins a range of interventions in Europe at the access network level (where significant market power is found) designed to support non-discrimination and competition in access including, for example, the introduction of equivalence and creation of Openreach in the UK.

New service offerings such as video, electronic store payment systems on mobile devices are also offered by network operators and internet-based providers. The incentive to discriminate by vertically integrated providers may therefore increase. We also note that public policy concerns may also arise even where affiliated and non-affiliated services are not in direct competition (as discussed in Sections 3.4 and 3.5).

Rivalry between integrated applications and over-the-top internet-based content and applications may intensify in the near term due to the growth in smartphones and apps such as BlackBerry Messenger and iMessage in Apple iOS 5, alongside growth in video services provided by network operators which compete with over-the-top video services. Whilst networks and internet-based applications and content are complements, over-the-top and network-integrated applications compete. Incentives to discriminate may therefore intensify, though a desire to grow demand for next generation access may counter-balance this as network operators seek to maximise demand – and therefore their return on investment.

Discrimination might also arise without vertically integrated services if an internet access provider signed deals with existing content and application incumbents to charge higher prices or engage in non-price discrimination in relation to competing and new services. Preferential terms or exclusive contracts would distort competition, hinder innovation and reduce consumer choice.

In practice, we do observe vertical discrimination in mobile markets that are deemed competitive by national regulatory authorities, including blocking and surcharges for non-integrated services. We also see it in fixed markets subject to intervention designed to prevent discrimination at the internet access provider layer – via the exemption of vertically integrated services from data caps/tiers. Reality is not therefore consistent with a view that competition supported by regulation is sufficient to prevent discrimination.

3.3 Constraints on efficient contracting and the benefits of an open internet norm

The 'open internet model' is a form of implicit contract between content and application providers, network access providers and end-users. In addition to discrimination against unaffiliated services, two further problems potentially arise if there is a move away from open internet norms:

- Complexity in relation to multi-party contracting, which could lead to costly and protracted negotiations and disputes, and potentially to a failure to agree acceptable terms of trade.
- *'Ex post* opportunism' whereby a party on one side of the market attempts to hold a party on the other side of the market to ransom.

3.3.1 The complexity of multi-party contracting

The internet has developed on the basis of a norm of openness, whereby any party can reach another party free from undue constraints. The potential stakes of a move from this status quo may be both large and uncertain, and parties have asymmetric information regarding the value others attach to access to their network or application/content.[60] These circumstances could lead to costly and protracted negotiation and disputes, and potentially to a failure to agree acceptable terms of trade. As Weiser (2009) puts it: [61]

> *"A central rationale for developing a regulatory framework to govern network management and other Internet policy issues is that it can assure all stakeholders that they can employ business strategies without negotiating a maze of private contracts with the affected parties. Viewed in this light, a principal goal of Internet regulation – whether public or self-regulation – is to lower transaction costs, provide a principled structure to facilitate negotiations, and provide some measure of predictability and reliability. In doing so the regulatory structure can channel multiparty contracting problems into a framework that avoids the escalation and policitization of disputes and misunderstandings."*

Greenstein (2009) also considers the internet value chain and the complexity of negotiated solutions rather than reliance on norms, or as he puts it, "routines" in relation to business processes and activities. In relation to an efficient so-called Coasian bargaining solution (i.e. market participants can readily arrive at an efficient outcome) he concludes that:

> *"The very thing that makes the Internet economically successful – the accumulation of innovation that supports a wide set of applications for many participants, including entrepreneurs – gives rise to conditions that make it harder for Coasian solutions to arise."*[62]

The manner in which such negotiations can involve real costs, including costs in terms of services foregone, are illustrated by the cable and content industries in the US (see Figure 3-1).

[60] Myerson, R.B. and Satterthwaite, M.A. 1983. Efficient mechanisms for bilateral trading. *Journal of Economic Theory* 29(2).

[61] Weiser. 2009. The future of Internet regulation. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1344757 Page 7.

[62] Greenstein. August 2009. "Glimmers and signs of innovative health in the commercial internet." http://www.kellogg.northwestern.edu/faculty/greenstein/images/htm/Research/WP/Greenstein%20-%20Glimmers%20and%20Signs.pdf

Figure 3-1: Bargaining costs in the US content-cable market

In the US, the issue has hit the headlines after disputes involving the likes of Fox, Disney and Time Warner Cable (TWC)[63] over retransmission fees had threatened to leave cable viewers without access to popular channels like Fox, ABC and ESPN. A few of these highly contested negotiations and brinksmanship by both broadcasters and distributors even led to channels going off the air[64]. In response to the increasing number of negotiation impasses the FCC is currently reviewing retransmission consent rules which were enacted under the 1992 Cable Act. Specifically the FCC is considering whether amendments are needed to provide more guidance under good faith negotiation requirements and to improve notice to consumers in advance of possible service disruptions[65].

The bargaining costs involved in a realignment of who captures value along the network-internet value chain could be much greater given the significantly greater number of players potentially involved. A default position or "focal point" may be efficient, and the open internet and zero price rule provides such a focal point. It may also protect against opportunism in the absence of explicit contracts, as discussed below.

3.3.2 *Ex post* opportunism and the hold-up problem

Where investments are specific and co-dependent, for example in relation to a power station and a coal mine,[66] a hold-up problem can arise if part of the return from one party's relationship-specific investments is *ex post* appropriable by another party. The solution to this problem may involve a long-term contract or common ownership.

In relation to access network and content and applications, an access service provider with market power could *ex post* expropriate investments made by content providers (irrespective of whether the network operator offers its own vertically integrated service). Choi and Kim (2009) consider the hold-up problem and conclude that internet access providers may have an incentive to engage in *ex post* opportunism (holding content and application providers to ransom), thereby reducing content and application provider's incentives to innovate.[67]

They also consider the possibility that the internet access provider might have an incentive to commit to net neutrality in order to maintain incentives to invest. However, with multiple parties in a global market it is not clear how such a commitment would work (without some form of agreed norm and/or governance) since there might be an incentive for an individual internet access provider to defect from net neutrality. As Weiser notes:[68]

[63] http://www.bloomberg.com/news/2010-09-02/disney-keeps-channels-on-time-warner-cable-as-talks-extend-past-deadline.html; http://today.msnbc.msn.com/id/34632823/ns/today-entertainment/t/fox-time-warner-reach-programming-deal/

[64] http://latimesblogs.latimes.com/entertainmentnewsbuzz/2011/05/broadcasters-and-distributors-debate-retransmission-consent-rules-at-fcc.html

[65] http://transition.fcc.gov/Daily_Releases/Daily_Business/2011/db0303/FCC-11-31A1.pdf

[66] Joskow. 1987. "Contract duration and relationship-specific investments – evidenced from the coal industry." *American Economic Review*.

[67] Choi and Kim (2008) op cit.

[68] Weiser. 2009. "The future of Internet regulation". Page 6. Op. Cit.

"...a different form of market failure - high transaction costs and strategic behaviour by firms in an industry where cooperation is necessary to facilitate competition – is not merely a theoretical problem, but a practical one that the FCC's traditional regulatory institutions are ill equipped to handle."

Content and application providers might also engage in *ex post* opportunism in relation to network access providers if there is a move away from the conventions of net neutrality. This might be relatively more likely if network operators – through discriminatory practices of their own – had discouraged entry at the application and content level, thereby consolidating the position of existing internet players. *Ex post* opportunism is therefore a risk for both network operators and content and application providers. It can be managed through a clear and unambiguous commitment to the open internet.

3.4 The characteristics of the open internet and innovation

The benefits associated with the internet are significant, as discussed in Section 1 and Appendix A. However, to what extent do they relate to its open character? Intuitively, openness and 'innovation without permission' is central to the innovation, entry and growth of internet-based content and application providers over the past 15 years or so.

For example Amazon, Google, Facebook, Skype, Yahoo! were all entrants at some point, and low entry barriers helped them to establish themselves. Further, the opportunity to be accessible by end-users globally without permission from individual internet access providers enabled them to scale their businesses fast.

The fact that myriad companies, many of them small, can collaborate via web standards and the internet not only lowers entry barriers and the costs of developing new products and services for users,[69] but also enhances incentives to innovate since those starting a new business stand to capture a substantial share of the gains if successful

The open character of the internet, innovation without permission and the ability to coordinate via web standards is at the heart of the success of internet-based innovation and market entry to date. As Joaquin Almunia, Vice President of the European Commission responsible for competition policy put it in July 2010:[70]

"I consider that open models and interoperability do favour entry by a greater number of players. Open and interoperable environments drive down the cost of innovation. The lower the costs of entry, the lower the risk to innovators, and the more innovators you get. A time such as this one characterized by a very dynamic environment and a high rate of innovation might not be the best time to close the door to experimentation and private initiative.

For instance, it is a combination of competitive markets in infrastructure and open standards that fostered the development of cloud services. And the internet would not be the success it is today, had it not been built on open, interoperable standards and protocols. These brought the freedom to innovate to everyone, from the largest multinational to the self employed mom in her garage. It was impossible to predict the many ways internet services would develop and

[69] Hal Varan. October 2010. "Computer mediated transactions." http://people.ischool.berkeley.edu/~hal/Papers/2010/cmt.pdf

[70] July 2010. "Competition in Digital Media and the Internet." UCL Jevons Lecture London. http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/10/365

it took an open environment to have the very successful – and unexpected - services that we have today. Not any one company could have dreamt them all. There are many ways society might seek to lower the cost of innovation. An internet based on open standards has proved to be a very effective platform for innovation."

3.5 Conclusion

We conclude that the benefits of the open internet are likely to outweigh the benefits of alternative models and that there are significant risks associated with a departure from an open internet approach in terms of arbitrary discrimination, opportunism and high transaction costs. Such a departure would deter innovation and potentially prevent access to existing content and applications. It is unhelpful to signal that reliance on competition alone is sufficient when discrimination and opportunism persist. Rather, the open internet norm must be safeguarded and should be explicitly reinforced.

4 Safeguarding the open internet

In this section we consider what should be done to safeguard the open internet and therefore to provide greater assurance to market participants and potential entrants that they will not be subject to harmful discrimination or opportunism. We concluded earlier that this is an essential factor in order to deliver on the public policy goals of innovation and economic growth.

4.1 The norm of the open internet is fragile

As discussed in Section 1, evidence of discrimination against content and applications exists. Further, the growth in internet-based applications and content may expand both the economic cost of discrimination and opportunism, and increase the likelihood of such harmful discrimination arising in the future.

However, it has been argued that competition, competition law and the pro-competitive regulatory framework in Europe should be sufficient to address such problems and should be given time to work. The statement by Ofcom, in their discussion document on traffic management in June 2010, exemplifies this sentiment:[71]

> *"Generally speaking, our initial position is that discriminatory behaviour is only a potential issue where firms have substantial 'market power' and could discriminate in favour of their own services."*

Yet what we observe is instances of discrimination against internet-based content and applications and a concerted lobbying effort on the part of some network operators in Europe to move away from the open internet – indeed to seek policy support and regulatory protection for a data termination charge. There is a clear risk that terms and conditions that restrict consumers' use of rival internet-based applications and content will grow. In practice it has proved the case that "net neutrality" is as much an issue for the EU as it is for the US.[72] In practice internet access providers do exercise gatekeeper power in relation to access to customers for content and application providers i.e. in specific instances they restrict access or charge a premium for access to specific content and applications.

4.2 Competition has not proved sufficient to protect the open internet

There are a number of possible reasons why competition alone may not prove sufficient in practice to protect the open internet. One is that it may be less effective in disciplining behaviour in an area that is relatively opaque to consumers, compared to more transparent areas such as pricing. In the UK some access providers have published their network management principles.[73] While this represents an important first step to improving transparency, further work is required to ensure this information is

[71] Ofcom. June 2010. "Traffic management and net neutrality – a discussion document." http://stakeholders.ofcom.org.uk/binaries/consultations/net-neutrality/summary/netneutrality.pdf

[72] Brian Williamson. July 2011. "Convergence policy and outcomes: a transatlantic divide?" http://www.plumconsulting.co.uk/pdfs/Plum_July2011_Convergence_and_outcomes_-_a_transatlantic_divide.pdf

[73] http://www.broadbanduk.org/content/view/479/7/

meaningful to the consumer, verifiable, comparable and easily accessible. Consumers also need to be able to act on the information available to them, i.e. readily switching providers. Further transparency measures are likely to be necessary both to inform policy-makers and consumers regarding potentially harmful conduct. However competition (including switching) and transparency are unlikely to be sufficient.

Reliance on conventional tests of significant market power may not pay sufficient regard to the possibility that firms may not be able to profitably raise prices above cost even where they may be able to exercise market power by excluding rivals. Salop (2000) discusses this possibility in relation to dynamic markets.[74] An analysis by Charles River Associates (CRA)[75] of the application of competition policy within markets characterised by large-scale product and service innovation concluded that it is important to focus on evidence of exclusionary behaviour and harm rather than market power *per se*:

> *"The proof of exclusionary power is often to demonstrate that a firm has undertaken exclusionary anti-competitive conduct that has been successful and has caused competitive harm. In such instances no separate screening process to test for market power is needed or appropriate*."

In addressing departures from open internet principles, reliance on competition law may be too slow and costly, particularly where market entry may be discouraged through discrimination or the threat of discrimination. In the market for content and applications, particularly where time to market, the ability to scale fast and where network effects are important to success (for example, Facebook and Google+), early discrimination could harm new entrants and therefore incentives to innovate whilst providing network operators with an opportunity to seek to dominate the market. However, the alternative of reliance on conventional regulatory remedies may prove overly prescriptive in a fast moving market.

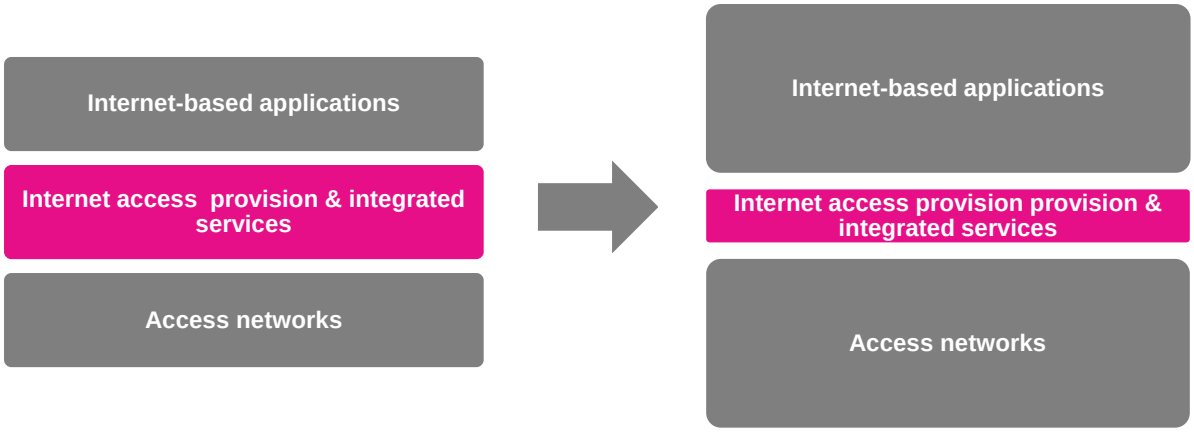
An intermediate approach, nudging the market in the direction of a good outcome, is instead proposed. Greenstein (2009) argues that a conceptual framework and benchmark for quickly recognising when a market event does or does not contribute to a healthy outcome is required and that policy guidance, rather than detailed prescription, may be necessary to promote good outcomes.[76] We also note that greater focus on the internet-based content and applications layer may be appropriate given the growing importance of the latter in terms of innovation, entry and competition (Figure 4-1).

[74] Salop. 2000. "The First Principles Approach to Antitrust, Kodak, and Antitrust at the Millenium." http://scholarship.law.georgetown.edu/facpub/208/

[75] CRA. March 2002. "Innovation and competition policy." A report commissioned by the Office of Fair Trading (OFT), Department of Trade and Industry (DTI) and Office of Telecommunications (OFTEL). http://www.oft.gov.uk/shared_oft/reports/comp_policy/oft377part1.pdf

[76] Greenstein. August 2009. "Glimmers and signs of innovative health in the commercial internet." http://www.kellogg.northwestern.edu/faculty/greenstein/images/htm/Research/WP/Greenstein%20-%20Glimmers%20and%20Signs.pdf

Figure 4-1: Shift in relative value over time



A presumption that competition and transparency measures alone are sufficient in the face of discrimination is counterproductive, and may encourage further discrimination and opportunistic behaviour. Given this, the conclusion of the FCC appears equally relevant for Europe:[77]

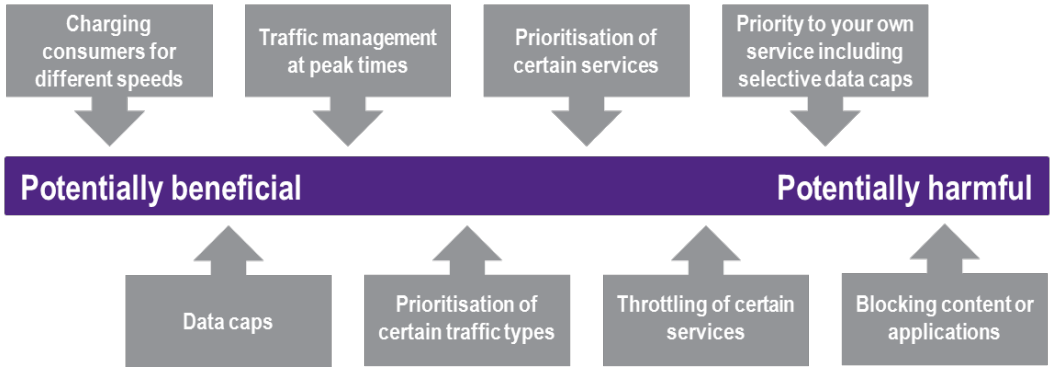
> *"We conclude that the benefits of ensuring Internet openness through enforceable, high-level, prophylactic rules outweigh the costs. The harms that could result from threats to openness are significant and likely to be irreversible, while the costs of compliance with our rules should be small, in large because the rules appear to preserve the benefits of the open Internet and increase certainty for all Internet stakeholders, with minimal burden on broadband providers."*

4.3 Potential practices cover a spectrum from beneficial to harmful

There is a range of possible conduct, ranging from potentially beneficial to potentially harmful, illustrated in Figure 4-2 (which is a simplification in terms of the range of practices that occur now or might occur in future, and might involve a different ordering for a specific practice). In developing policy, it is clearly important not to constrain the development of innovative models that can add value for content providers and end-users, and also support next generation access investment. In our view, the challenge of allowing such developments whilst also constraining harmful discrimination is achievable.

[77] FCC. 23 September 2011. "Preserving the open Internet." Federal Register, Vol. 76, No. 185. http://www.gpo.gov/fdsys/pkg/FR-2011-09-23/pdf/2011-24259.pdf

Figure 4-2: Taxonomy of conduct



On the left hand side of Figure 4-2 are practices relating to the consumer side of the market which are potentially beneficial:

- Price differentiation based on access service characteristics such as access speed. Such differentiation could improve the business case for next generation access investment, for example. It may also support digital inclusion by allowing, for example, lower tariffs for lower speed broadband alongside higher tariffs for higher speed broadband (supporting, for example, video collaboration).
- Data caps and tiered pricing which are relevant to mobile access in particular given the higher traffic related costs of mobile. One might expect any caps or tiers for fixed access to be at high levels given the low incremental cost of around 1 Euro cent per GB. In practice there are examples of low data caps for fixed broadband which may have been put in place for discriminatory purposes, for example, in Canada.[78]

On the right hand side of Figure 4-2 are practices which are potentially harmful:

- Blocking of specific legal content or application providers or services.
- A retail price premium for using certain classes of applications (e.g. instant messaging, VoIP and video), in particular a price premium for using applications that are seen as competing with integrated services provided by the network operator.
- Throttling specific services, applications or providers may be harmful - even where the network operator is not discriminating to support their own vertically integrated service. For example, if throttling of a certain service or application was used to extract payment.

Other behaviour may be harder to characterise:

- A data cap with an exemption for an integrated service appears discriminatory against third party applications.[79]
- Mobile network operators can be expected to prioritise traffic in some way at specific times and locations when demand at an individual cell site exceeds capacity (in fixed networks the last mile is un-contended and costs of adding capacity deeper in the network are very low so the same issues are less likely to arise). Approaches which are application and provider agnostic, and/or

[78] http://arstechnica.com/tech-policy/news/2011/07/very-bold-or-very-dumb-data-caps-dont-apply-to-isps-own-movie-service.ars

[79] July 2011. "Very bold or very dumb – caps don't apply to ISP's own movie service." http://arstechnica.com/tech-policy/news/2011/07/very-bold-or-very-dumb-data-caps-dont-apply-to-isps-own-movie-service.ars

are driven by end-user needs and willingness to pay, may be beneficial; whilst approaches involving throttling of specific applications or providers may be harmful.

Alongside the development of any managed services, a robust best efforts internet - whereby everyone has access to content and services of their choice - needs to be safeguarded. The European Commission's 2011 Communication on net neutrality commits to this objective. We note that differentiated managed services could lead to an incentive to reduce the quality of the best efforts internet – in order to increase revenues associated with managed or enhanced quality services. In the first instance internet access provider competition and improved consumer transparency and reduced switching costs should provide a check against this as degradation of the best efforts internet might be expected to show up in league tables of simple measures of service quality such as speed. Nevertheless national regulators – in line with their 'backstop' powers under the EU framework - should monitor the market to ensure that an open and robust best endeavours internet is delivered.

4.4 Policy options to support the open internet

We consider a range of options, falling short of detailed and prescriptive new regulation, for addressing the problems of harmful discrimination and opportunism in relation to internet-based content and applications. These are summarised in the spectrum illustrated in Figure 4-3.

Figure 4-3: Spectrum of possible measures

In what follows we focus on the options towards the middle of 4-3. However, should these prove insufficient to safeguard the open internet it may be helpful to briefly consider what form more explicit regulatory options might take. One option, already open to national regulators under new powers under the EU Electronic Communications Framework, would be to define quality of service in relation to the best efforts internet. Another option would be to have a binding set of rules enforced by the regulatory authority. For example, the Infocomm Development Authority in Singapore, following consultation, have published a decision on net neutrality, which in particular includes the following principle: [80]

> *"ISPs and telecom network operators are prohibited from blocking legitimate Internet content."*
>
> *"ISPs and telecom network operators cannot impose discriminatory practices, restrictions, charges or other measures which, while not outright blocking, will render any legitimate Internet content effectively inaccessible or unusable."*

[80] IDA. June 2011. "Decision on net neutrality." http://www.ida.gov.sg/doc/Policies%20and%20Regulation/Policies_and_Regulation_Level2/20070612111424/NetNeutralityExplanatoryMemo.pdf

4.4.1 Signals regarding acceptable conduct

What is said by policy makers at the national and European level and by national regulators will either reinforce or undermine the norms of the open internet. A signal that existing competition is sufficient as a safeguard may embolden some network operators to undermine the open internet, whilst a signal that discrimination is unacceptable will serve to reinforce the open internet. Signals to date have been mixed but clear concerted signals in support of the open internet may help forestall harmful conduct.

The US adopted this approach from 2005, with the FCC publishing a set of principles focussed on open access by consumers to lawful content and applications on the internet. This may be a factor which has shaped different attitudes and conduct in relation to the open internet in the US and Europe. More recently signals in support of the open internet have also been sent in Europe. For example, the UK Communications, Culture and Creative Industries Minister Ed Vaizey MP has set out open internet principles as input to developing an industry agreement to cover managing and maintaining the open internet:[81]

> *"The first is users should be able to access all legal content. Second, there should be no discrimination against content providers on the basis of commercial rivalry and finally traffic management policies should be clear and transparent." March 2011*

We propose that consistent signals along the above lines are sent both nationally and at the European level to reinforce the open internet norm.

4.4.2 Clarifying the use of the term "internet access"

Alongside signals supporting the open internet, consumers need information to help them make informed decisions when purchasing network access. Already required under the EU Electronic Communications Framework, transparency by internet access providers about traffic management practices could go further. In particular, we propose that the term "internet access" be defined consistent with open internet norms and that use of the term in marketing be allowed only for those network access providers who abide by the stipulated set of open internet principles (rather than consumers having to assess potentially complex and opaque information regarding network management and blocking). This approach has been proposed by ARCEP (French regulator) who recommended that:[82]

> *"…to provide "Internet access," an ISP must be obligated, in accordance with the legal provisions in effect, to furnish end users with the ability to:*
>
> - *send and receive the content of their choice;*
> - *use the services and run the applications of their choice;*
> - *connect the hardware and use the programmes of their choice, provided they do not harm the network." 1st direction*
>
> *"In the case of offers of partial access to the services available on the Internet, due to the blocking (outside the scope of regulatory obligations) of certain services, websites or protocols, which is generally the case on mobile networks today, operators cannot qualify*

[81] 16 March 2011. "Open Internet Roundtable statement." http://www.dcms.gov.uk/news/news_stories/7958.aspx

[82] ARCEP. May 2010. "Discussion points and initial policy guidelines on Internet and network neutrality." http://www.arcep.fr/uploads/tx_gspublication/consult-net-neutralite-200510-ENG.pdf

these offers as "Internet access" so as not to mislead end users. Only an offer that has all the characteristics of "Internet access" (see above) may employ this terminology." 6th direction (2nd element)

This proposal is analogous to other initiatives including clarifying the use of the term "free" with respect to broadband access in the UK and initiatives to bring clarity of meaning in relation to advertised broadband speeds. It may be that the approach can be implemented using existing consumer protection powers. Network operators would be free to offer other services, but could not claim that they constitute "internet access", and should make it clear this is not the case.

4.4.3 Self-regulation with oversight

In addition to the defined ex ante powers of national regulators under the EU Communications Framework, and ex post competition law, an additional self-regulatory regime would provide further guidance and certainty for all players in the value chain. Self-regulation provides an opportunity for industry to agree norms and resolve problems without formal recourse to a regulatory authority in the first instance, Weiser (2009) discusses this approach and argues that:[83]

> *"A central rationale for developing a regulatory framework to govern network management and other Internet policy issues is that it can assure all stakeholders that they can employ business strategies without negotiating a maze of private contracts with the affected parties."*

However, given the high stakes – particularly the risk of consumer harm – it is important that any self-regulatory approach has some form of oversight from the national regulator. The national regulator (e.g. Ofcom) may be a participant in the self-regulatory process, for example, if participants considered that independent auditing of information on traffic management was valuable.

We envisage that self-regulation with oversight might comprise a number of elements:

- A statement of principle regarding the open internet that self-regulation is designed to protect. We would expect this to be informed by the signals already sent by both the UK government and EU policy-makers.
- A code of conduct setting out specific conduct that is unacceptable.
- A dispute resolution mechanism for both end-users and website owners who may be discriminated against.

The code of conduct could require:

- Open access to lawful content and applications for consumers (including an explicit prohibition against blocking).
- No discrimination on the basis of commercial rivalry.
- Protection against unilateral and opportunistic efforts to hold content and application providers or internet access providers to ransom and demand payment.
- A principle of parity of access if and where prioritisation is provided on voluntary commercial terms for any content or applications i.e. the same opportunity on the same terms should be available to all (analogous to the principle of equivalence applied at the network access layer).

[83] Weiser. 2009. The future of Internet regulation. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1344757

Given changing technology and the dynamic nature of the market we do not consider that it will be possible or advisable to attempt to cover all eventualities in a code. Rather a mechanism for resolving potential disputes consistent with the principles and code will be required, which will require a formal process for reverting to the national regulator (or a delegated adjudicator) for adjudication.

4.5 Conclusion

We propose that additional measures are adopted to support the open internet. Care is however needed, if we are not to rule out possibilities including differentiation of access prices focussed on the consumer side of the market that would support broadband investment and improved outcomes. The challenge of allowing such initiatives whilst also constraining abuse in relation to the open internet is in our view achievable.

We propose, in addition to efforts to improve competition (including customer switching) and transparency in communications markets generally, an approach which combines a clear signal of commitment to the open internet by policy makers, limitations on the use of the term internet access to provide clarity to consumers and an industry code of conduct including dispute resolution procedures as outlined below.

Proposed measures to support the open internet

- A clear signal of commitment to the open internet by EU institutions, national governments and regulators.
- Internet access should be clearly defined and the use of the term in marketing restricted to those who provide open access to the internet. This measure could be implemented nationally under consumer protection powers.
- The application of an industry code of conduct and dispute resolution procedures, through "self-regulation with oversight", should be promoted. The code should require:
  - Open access to and distribution of internet-based, lawful content and applications for consumers; no blocking of legal services and discrimination on the basis of commercial rivalry.
  - Protection against unilateral and opportunistic requests for payment i.e. holding players to ransom.
  - A principle of parity of access if and where prioritisation is provided on voluntary commercial terms for any content or applications i.e. the same opportunity on the same terms should be available to all (analogous to the principle of equivalence applied at the network access layer).
- Policy-makers and national regulators (e.g. Ofcom) should closely monitor market developments given the risks to innovation. If the suggested measures prove insufficient, then intervention by national regulators utilising their powers to protect the open internet under the revised EU Electronic Communications Framework, or the introduction by policy makers of a new legally binding open internet requirement, should be considered.

Appendix A: Economic benefits of the open internet

The internet is clearly important in terms of the transformation of the economy, and end-users and citizens interests. Getting a clear quantitative picture of the impact and value of the internet is however not straightforward. We consider a range of indicators of value:

- People's willingness to pay to connect to internet-based applications.
- The value of time people spent online.
- Evidence that the internet is contributing to productivity and GDP growth.

A.1 Willingness to pay to connect to internet-based applications

People pay for access to the internet not because they value access *per se* but because they value internet-based applications and content.[84] Willingness to pay for broadband access, as opposed to what is paid for broadband access, therefore provides an indication of the value of internet-based applications and content.

A US study found willingness to pay for ranged from $59 for a fast (ADSL) but unreliable service or $79 for a fast and reliable service.[85] This range exceeds what people actually pay for DSL, typically $30-$40 per month for a major US broadband provider we considered.[86] This leaves a margin or surplus of $19-$49 per month. Assuming willingness to pay in Europe is similar and scaling for the population (around 500 million) and allowing for the exchange rate and internet use of around 65%, one obtains an estimate for Europe of consumer surplus (willingness to pay less the cost of access) for internet access of around €53-€135 billion per annum. We note that this excludes the consumer surplus associated with mobile data access.

In a report for the 2011 G8 meeting in Paris, McKinsey also cite direct evidence in relation to willingness to pay for internet-based applications.[87] McKinsey estimate that the surplus is up to €20 per internet user per month, or around €80 billion per annum across Europe.

A.2 The value of time spent online

An alternative approach to valuing internet access is not to ask people how much they value such access directly, but to consider the value of time they spend online. In a US study Goolsbee and Klenow (2006) used time spent online to estimate the value of the internet to consumers (excluding business use benefits).[88] They estimated that, with internet users averaging 7.7 hours per week online, the value of the internet is around 2% of income (with a number of caveats noted by the authors). For comparison, in May 2011 the average time spent online in Europe was 26.8 hours per

[84] They may also value integrated services such as IPTV, though this is separable from the value of broadband access.

[85] Rosston, Savage and Waldman. February 2010. "Household demand for broadband Internet service." http://siepr.stanford.edu/system/files/shared/Household_demand_for_broadband.pdf

[86] Based on Verizon DSL tariffs. http://www22.verizon.com/Residential/Internet/

[87] McKinsey Global Institute. May 2011. "Internet matters: The Net's sweeping impact on growth, jobs and prosperity." http://www.mckinsey.com/mgi/publications/Internet_matters/pdfs/MGI_Internet_matters_full_report.pdf

[88] Goolsbee and Klenow. January 2006. "Valuing consumer products by the time spent using them: an application to the Internet." http://faculty.chicagobooth.edu/austan.goolsbee/research/timeuse.pdf

individual per month, similar to the US estimate.[89] Based on a value of time figure of €6.10[90] and scaling for the population of Europe we obtain an estimate for the value of time spent online of €245 billion.

A.3 The internet's contribution to productivity and GDP growth

We note that one can consider a level question – how much of GDP is currently accounted for by the internet – or consider the contribution to growth. We focus on growth.

In a paper on the contribution of the communications sector to productivity growth Corrado (2010) notes that:[91]

> "*The Internet, a network of networks...is the primary story in this paper*".

The paper seeks to identify the separate contribution of network investment and spillover benefits associated with network services including internet services. Qualitatively the paper concludes that:

> *"The Internet and mobile telephony are two of the 20th century's greatest developments yet are stepchildren in discussions to date on the role of information technology in the productivity acceleration in the United States."*
>
> *"...this paper attributes a good deal of the boom in real ICT investments in the second half of the 1990s to the demand for networked computers—a demand derived from their possibilities for competitive advantage that was in turn created by the emergence of the Internet in more or less its current form by 1994."*

The paper estimates that:

> *"...the contribution of network effects could have been very large—0.468 percentage points annually from 2000 to 2007, or 32 percent of overall MFP [multifactor productivity] growth."*

A growth contribution of 0.468% pa compares with real US GDP growth of 2.3% pa over the same period, in other words a contribution of 20%. To put this number into perspective, in Europe 20% of the growth in GDP over the same period was equivalent to around €100 billion per annum.

[89] ComScore. http://www.comscore.com/Press_Events/Press_Releases/2011/7/comScore_Releases_Overview_of_European_Internet_Usage_for_May_2011

[90] National Roads Authority (March 2008), Project Appraisal Guidelines, Appendix 6 – National Parameters Value Sheet, page 5.

[91] Corrado. May 2010. "Communication capital, Metcalfe's law and US productivity growth." http://www.crei.cat/conferences/cornucopia/confpapers/CREI%20paper_Corrado_15May10_V2.pdf

Appendix B: The costs and sustainability of traffic growth

We find, based on indepedent studies, that the incremental cost of data traffic is low and falling for fixed nextworks. Capital investment requirements to meet traffic growth are more likely to fall than rise due to technical progress outstripping lower anticipated rates of traffic growth. The incremental costs of carrying traffic on mobile networks are higher than on fixed networks, but are expected to fall below €1 per GB (given traffic and subscriber growth), signficiantly below typical smart phone data tariffs today.

B.1 Traffic related costs for fixed network access

It is self evident that the incremental costs of carrying traffic on fixed networks has been falling rapidly given that data growth rates of 100% per annum have been sustained in the past without apparent problem (either in terms of congestion, industry profitability or end-user prices).

Estimates of the rate of traffic growth suggest it has been decelerating, with a brief period of "internet traffic doubling every 100 days" back in 1995-96, but already by 1997 growth subsided towards an approximate doubling every year, and more recently even that growth rate has declined towards 50-60% per year.[92] The most recent Cisco projection is for average annual traffic growth of 32% per annum, well below historical rates.[93]

Analysys-Mason estimated that the overall costs for average traffic levels are around £2 per month with the incremental costs per GB expected to fall roughly 8-fold between 2008 and 2012 (see their Figure 6.16) offsetting the impact of traffic growth.[94] The cost per GB (converting 1 Mbps per month to 324 GB per month[95]) in 2012 is around 3 pence, potentially falling below 1 pence per GB by around 2014. Further, Analysys-Mason concluded that:

> *"Video traffic could be accommodated by increasing the total bandwidth available, and it is not essential to deploy advanced technologies to prioritise video traffic over other types of traffic in order to ensure a high QoS for video services."*

Another estimate, by Lemay Yates Associates, estimates the fixed network wholesale incremental cost for delivery of internet traffic, for average "heavy users", ranges from below 1 to at most 1.4 cents (Canadian) per GB.[96]

Progress in terms of falling costs of carrying data can be expected to continue, with potential to increase capacity utilising advances in laser and encoding technology. 40 GB ethernet has been deployed (replacing 10 GB ethernet in some circumstances). A survey of the Ethernet charts the evolution from 3 Mbps to 100 Gbps and notes that undersea fibre already transport multi-terabit

[92] http://www.dtc.umn.edu/mints/

[93] Cisco. June 2011. "Cisco Visual Networking Index: Forecast and Methodology, 2010-2015." http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-481360_ns827_Networking_Solutions_White_Paper.html

[94] Analysys-Mason report for Ofcom. 2009. Delivering high quality video services online. Page 16 and Figure 6.9. http://stakeholders.ofcom.org.uk/market-data-research/technology-research/research/emerging-tech/hqvs/

[95] Allowing for the fact that there are 8 bits in a byte and allowing for the number of seconds in 30 days.

[96] March 2011. The Cost of Incremental Internet Transit Bandwidth in the Local Access Cloud. Report presented to Netflix, Inc. http://fjallfoss.fcc.gov/ecfs/comment/view?id=6016484809

aggregate bandwidths over single fibre.[97] In the laboratory a data rate of 26 Tb/s was announced in May 2011.[98] Whilst by no means a commercial technological this points to the fact that the fibre may in future support data rates far higher than those available today.

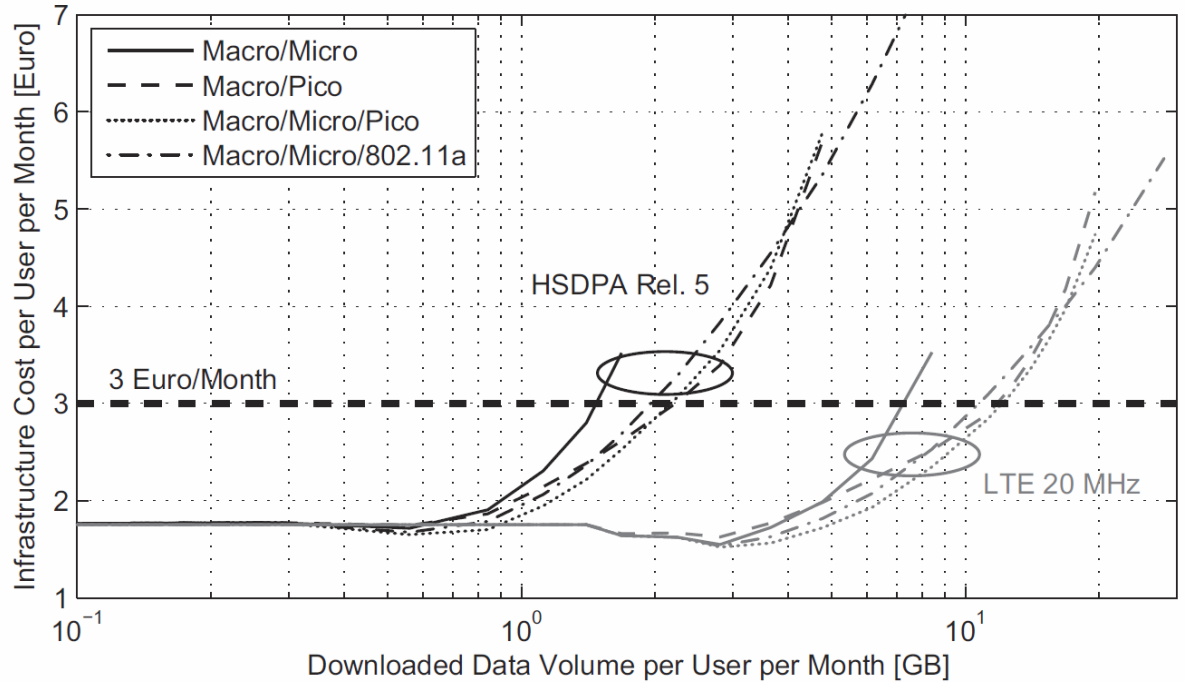
B.2 Traffic related costs for mobile network access

The radio access element of mobile networks is inherently contended and traffic growth must be accomdated via improvements in spectrum efficiency (which are subject to physical limits), additional transmitters (allowing re-use of spectrum across smaller cells) and additional spectrum (which can substitute for additoanal base stations). The introduction of LTE will enable improvements in spectrum efficiency and reduce capital investment requriements in relation to traffic growth. As Verizon, who are deploying LTE nationally in the US, noted in March 2011:[99]

> *"the reason we like LTE so much is because...it really delivers an almost fivefold benefit to the bottom line for us from an efficiency standpoint."*

One study compares the monthly infrastructure cost per subscriber for HSDPA and LTE.[100] This shows the significantly lower infrastructure cost for LTE versus HSDPA Rev 5, as shown in Figure B-1.

Figure B-1: Infrastructure cost of mobile networks as a function of download data volume



[97] http://arstechnica.com/gadgets/news/2011/07/ethernet-how-does-it-work.ars

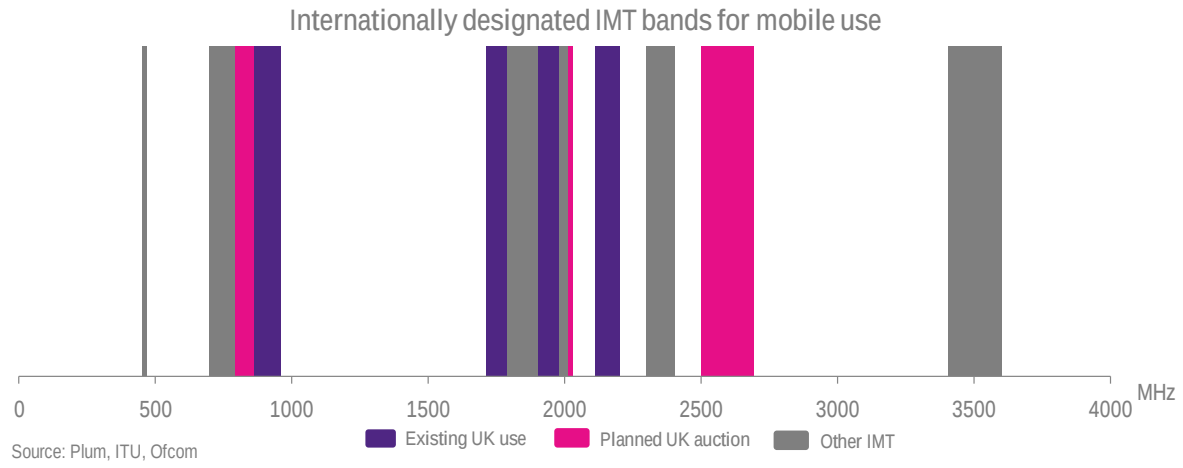
[98] Iljitsch van Beijnum. July 2011. "Speed matters: how Ethernet went from 3Mbps to 100Gbps... and beyond." Ars Technica. http://www.nature.com/nphoton/journal/v5/n6/full/nphoton.2011.74.html

[99] March 2011. "Verizon at Morgan Stanley Technology, Media & Telecom Conference." Final Transcript, Page 8. http://www22.verizon.com/investor/investor-consump/groups/events/documents/investorrelation/event_1036_trans.pdf

[100] Johansson, Zander and Furuskar. 2007. "Modelling the cost of heterogeneous wireless access networks." *International Journal of Mobile Network Design and Innovation.* Volume 2(1). http://www.inderscience.com/storage/f962711085114312.pdf

Further, the release of additional spectrum at 800 MHz and 2.6 GHz which is planned across Europe will increase capacity, reduce the need for additional base stations and lower the cost per GB carried. Beyond these near term releases attention is also now focussed on releasing spectrum held by the public sector for mobile broadband use with targets for release adopted in Denmark, the UK and Sweden. A European target of making available a total of 1200 MHz for mobile use by 2015 has been proposed.[101] Figure B-2 illustrates the position for the UK in terms of spectrum available, available for imminent release and which would in principle be allocated for mobile broadband (IMT bands). Spectrum available for WiFi can also be used to offload mobile and nomadic traffic at low cost, whilst Femtocells can also provide efficient traffic offload.

Figure B-2: Planned and potential spectrum for mobile



A number of estimates of the incremental costs of carrying additional mobile traffic are available. "3" provided estimates to Ofcom prepared by LECG for them based on the Ofcom/Analysys model and showing the falling cost of 3G over time (Figure B-3).[102]

Figure B-3: LECG analysis for 3 of incremental mobile data costs (LRIC for HSPA)

Year	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13
£/Gbyte	187.81	150.94	105.31	80.99	65.46	6.30	4.08	3.70	3.53
Year	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22
£/Gbyte	3.37	3.21	3.06	2.92	2.78	2.65	2.52	2.44	2.40

Source: LECG analysis of Ofcom/Analysys model

These estimates show how much mobile data costs have fallen. However, they indicate that mobile data consumption per subscriber considerably above the levels today should be affordable for end-users and profitable for operators (mobile data growth will also be driven by new data customers who

[101] http://www.europarl.europa.eu/meetdocs/2009_2014/documents/itre/pr/852/852716/852716en.pdf

[102] "3". June 2010. "Three response to Ofcom Wholesale mobile voice call termination Market Review Consultation." http://stakeholders.ofcom.org.uk/binaries/consultations/wmctr/responses/H3G.pdf

of course bring data additional revenue). We note that these estimates do not allow for efficiency gains and unit cost reductions from LTE and additional spectrum.

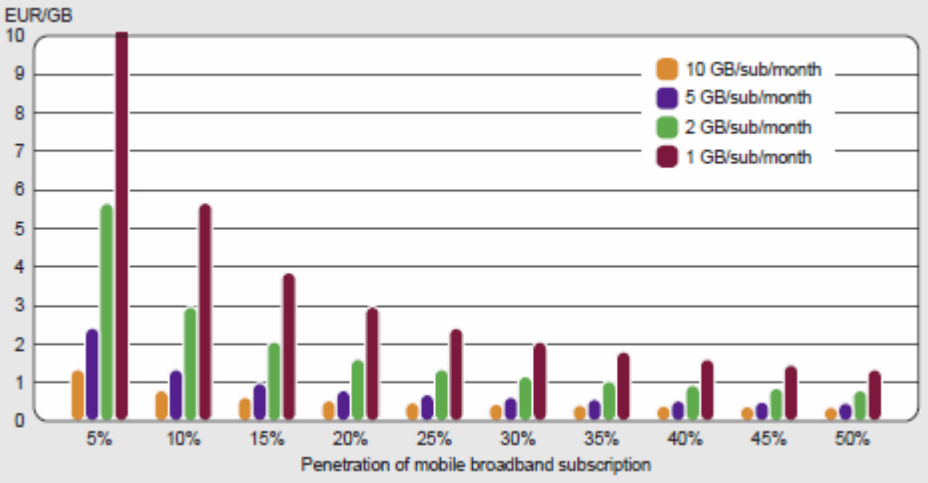
Ericsson have also published estimates of the incremental costs of mobile data are less than €1 per GB with 15 percent average network utilisation, whilst the incremental costs associated with adding a sector at a congested cell site are estimated to be around €0.1-€0.2 per GB.[103]

Nokia Siemens Networks consider the impact of subscriber numbers and traffic levels on incremental costs.[104] They find that incremental costs fall as penetration and traffic per subscriber increase:

> *"If the traffic per subscriber grows ten-fold, the cost will increase only two- to three-fold."*

As shown in Figure B-4 for high penetration and high usage scenarios incremental costs are estimated to be less than €1 per GB (excluding customer acquisition and marketing costs).

Figure B-4: Falling mobile data costs driven by take-up and utilisation



The above cost estimates for mobile do not take into account new base station technologies announced by Nokia Siemens Networks "Liquid Radio"[105], Alcatel-Lucent "LightRadio"[106] and Ericsson "Air"[107] which they claim will reduce costs further.

[103] Ericsson. 2010. "Mobile broadband – busting the myth of the scissor effect." http://www.ericsson.com/ericsson/corpinfo/publications/ericsson_business_review/pdf/210/210_strategy_mobile_broadband.pdf

See also an earlier report. Ericsson. 2009. "Don't worry – mobile broadband is profitable." http://www.ericsson.com/ericsson/corpinfo/publications/ericsson_business_review/pdf/209/209_BUSINESS_CASE_mobile_broadband.pdf

[104] Nokia Siemens Networks. May 2010. "Mobile broadband with HSPA and LTE – capacity and cost aspects". White Paper. http://www.nokiasiemensnetworks.com/sites/default/files/document/Mobile_broadband_A4_26041.pdf

[105] http://www.nokiasiemensnetworks.com/sites/default/files/document/Nokia_Siemens_Networks_Liquid_Radio_Executive_Summary_lore_17-03-11.pdf

[106] http://www.alcatel-lucent.com/features/light_radio/index.html

[107] http://www.ericsson.com/thecompany/press/releases/2011/02/1486615