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The BEREC Office

Desk Research on the demand- side of Internet use

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1 Executive Summary

For several years, the BEREC Office has been conducting various studies on Net Neutrality. Today, as part of its work programme 2015, the BEREC Office aims to gain insights on the **Internet ecosystem dynamics** and demand-side forces in Net Neutrality developments from an end-user perspective. This study is intended to ultimately provide the National Regulatory Authorities (NRAs) with an understanding of market dynamics between consumers, Internet Service Providers (ISPs) and Content and Application Providers (CAPs).

Within this context, this research involves the investigation of two overarching questions, covering the demand side of Internet, on: how consumers are using and valuing the Internet and how the ecosystem responds to these characteristics. The response to these questions has been achieved through an in-depth research and analysis of information available in existing literature - such as earlier reports of the European Commission and OECD covering this subject – as well as expert analysis and reports, public debate, press information and any other relevant source of data available through desk research. This study has a **global scope** but with a special emphasis and **focus on developments in Europe**, reinforced with examples and trends from North America.

This approach has led to several findings regarding the evolution of Internet, which has changed rapidly in recent years. So has the **number of Internet users reached nearly 3 billion in 2014**, adding more than 2 billion users in less than a decade. The percentage of people that have never used the Internet is strongly declining, nearly meeting EU targets of 15% in 2015. Globally, there is a clear **trend towards broadband networks**, with more than 97% of European households having a fixed broadband subscription. Next to the increase in fixed connections, it is expected that **Internet traffic will grow four-fold between 2013 and 2018**, with e.g. an estimated 38.3 gigabytes of usage per month per user in Western Europe. The majority of this traffic will originate from **rich and data-heavy media such as video and audio streaming**. On the other hand, **mobile broadband** is rapidly gaining ground, today even serving people that do not have fixed broadband access. As part of the mobile revolution, **consumers have changed their behaviour and the way they access the Internet**. The **Internet of Things** will certainly add another dimension to this development. Increasingly, consumers are using mobile for every aspect of their daily lives and they continue to demand more from mobile networks and devices.

Mobile traffic per user in Europe expected to grow at more than 500% in Western Europe and 1223% in Central and Eastern Europe between 2014 and 2019. **1% of consumers are responsible for the heaviest consumption**, with video streaming applications such as Youtube, Netflix and BBC iPlayer being increasingly popular. Other activities consumers value and use the Internet for are general search, e-mail exchange and social networking. Overall, when accessing the Internet, consumers value the availability of devices as they have different device preferences for a variety of activities. **Consumers further demand high-speed broadband performance, continuous availability, value for money and rich online user interactivity and experience.**

The large amounts of traffic generated by consumers, especially due to video and audio streaming services, puts pressure on CAPs and ISPs. These organisations have found it necessary to respond to **rapidly evolving consumer trends and behaviour**. CAPs on the one hand are trying to get closer to consumers to **deliver quality of service and seamless end-user experience**. They generate more and more **data-heavy content** (for data-hungry consumers) that causes **congestion on the networks of operators**. There have been instances of “**network discriminations**” whereby ISPs have slowed down or blocked CAPs’ services as ISPs claim to have a limited bandwidth capacity (based on user averages) that they have to share amongst all users. They therefore **justify the need to slow down and block services** that “jam up” the Internet, especially due to services of large CAPs such as YouTube, Amazon and Netflix. In order to ensure to smooth delivery of their services, **CAPs are paying terminating ISPs to get closer to end-users** and ensure that their services are not disrupted. There have been questions surrounding these practices, but CAPs see this as a “**strategic necessity**” to ensure customer satisfaction. ISPs on the other hand are investing more in network-based content delivery platforms for internal purposes and as a service to CAPs. **ISPs increasingly see the urgency of defending their profitability** and search for **new revenue streams** to compensate for **their declining distribution revenues**. They have been offering **specialised services** at a fee for prioritising one CAP over another on the same Internet Access Network, creating “**two lanes**” of Internet. With the domination of CAPs, which have very attractive and lucrative **business models**, ISPs are also

partnering up with them to work against their dropping revenues and gain a fair market share of the value generated in the Internet ecosystem. Through this way **ISPs try to reposition themselves in the market and re-establish their faltering business models**. As mentioned - and in the current heated context of net neutrality debates - CAPs claim to have no other choice than working together in order to ensure the promised quality of service required by consumers.

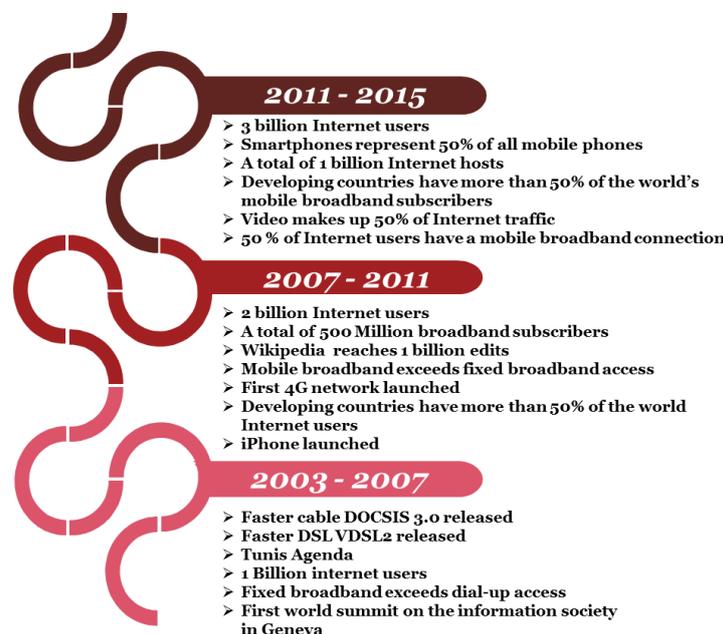
Throughout this report, we show examples of **incidents** of “network discrimination” and of instances where the neutrality of the Internet has been disputed. It has become apparent that the Internet, as most consumers know it, has changed drastically from a nice-to-have platform to become a **mission-critical new media platform**. The ecosystem dynamics have changed so fast that any change in this context will certainly affect consumers, ISPs and CAPs alike. Especially, with the FCC (in the United States) bringing out a critical vote on net neutrality in February 2015, **will further change the relationships** between these stakeholders.

2 Background and context

2.1 Introduction

The Internet has changed in ways that was unimaginable a decade ago. Only in 2004/2005, at a time when there were about 1 billion Internet users, fixed broadband exceeded dial up access. Most recently, in 2010 mobile broadband exceeded fixed access, kindled with the launch of the first 4G network technology. Thanks to this development a colossal mobile Internet usage trend started all over the world, including developing countries, which previously had – to a certain extent - limited access to broadband Internet. In 2015, it is expected that there will be **3 billion Internet users**, with more than 50 per cent of Internet users having a mobile broadband connection. Developing countries will account to more than 50 per cent of broadband subscriptions, surpassing developed countries. Today more than 50 per cent of world Internet traffic is in the format of videos.¹

Figure 1: Evolution of Internet



Consequently, with the rise in global Internet traffic, online content and the ISP/CAP offerings, **Net Neutrality** - i.e. preventing any prioritisation of Internet - has become a hot topic of debate. Net Neutrality is about the idea that cellular, cable, or phone Internet connections should treat all websites and services the same. Within this context, the BEREC Office seeks to commission desk research on the demand side of Internet use.

The BEREC Office already conducted an initial study in 2010 to have a general view on this subject. This study was followed by several publications in 2011 and 2012. Further work has included a BEREC Report on **ecosystem dynamics** and **demand-side forces** in Net Neutrality developments from an end-user perspective, to be published in June 2015. This study has been commissioned as part of that work on ecosystem dynamics and demand-side forces.

This study is intended to provide BEREC and its member National Regulatory Authorities (NRAs) with an understanding of market dynamics between consumers, Internet Service Providers (ISPs) and Content and Application Providers (CAPs). The research will involve the investigation of two overarching questions, covering the demand side of Internet, on: how consumers are using and valuing the Internet and how the ecosystem responds to these characteristics of consumer demand. Additionally, we will look at providing a

¹ http://www.internetsociety.org/sites/default/files/Global_Internet_Report_2014_0.pdf

brief overview of the current market situation with regard to certain trends e.g. in data-caps and the diversity of national markets.

The response to these questions will be achieved through an in-depth research and analysis of the information available in existing literature, expert analysis and reports, public debate, press information and any other source of data available through secondary desk research.

As a result, BEREC will be provided with a report, answering the several underlying questions regarding consumer Internet use, the ecosystem characteristics and dynamics, responses to demand and global drivers and trends on consumer Internet.

The aim of this study is to generate insights to further the discussions around the developments and opinions on Net Neutrality, but especially with findings that are derived from the demand-side/end-user perspective.

This report presents two key components of the debate, each of which includes the following components: market developments, consumer perspective, the Internet ecosystem, interactions between key stakeholders and the impact on end-users.

3 Demand-side - How are consumers using the Internet: a global overview

3.1 General overview

Against a backdrop of relentless growth, the Internet continues to change and evolve. In the past ten years, the number of Internet users surpassed one billion and is nearing **three billion users**. People all over the world are abandoning their fixed – mostly dial-up - Internet access and increasingly opt for **high-speed broadband**. As part of this trend, consumer Internet usage shifted from text-based activities to mostly (real-time) **video traffic**.² Globally, a few trends can be noticed: the number of users is higher in developing countries than those in developed countries; there are more mobile broadband subscribers than fixed; and mobile access has shifted to smartphones.

Figure 2: Internet Users 2004-2014³

Year	Internet Users	Users Growth
2014*	2,925,249,355	7.9%
2013	2,712,239,573	8.0%
2012	2,511,615,523	10.5%
[...]	[...]	[...]
2006	1,157,500,065	12.4%
2005	1,029,717,906	13.1%
2004	910,060,180	16.9%

Most recent data suggests that **18% of people have never used the Internet**, just 3% above the EU target of reducing this figure to 15% by 2015.⁴

Figure 3: Individuals who have never used the Internet (% of individuals aged 16 to 74) – EU 28⁵

	2009	2010	2011	2012	2013	2014
EU-28 countries	30	27	24	23	20	18

While the Internet is constantly changing, the ultimate nature of the Internet has remained the same. The Internet is a unique and universal platform that uses the same standards in every country, so that every user can interact with every other user in ways that were not possible a decade ago.

Also, the number of people using the Internet has risen globally at a compound annual growth rate of 12% in the period between 2008 and 2012, reaching a level of nearly 40% of the global population in 2013. Strong growth rates are especially visible in regions that had lower levels of Internet usage in the past 5 years.⁶

Internet access rates grow at noteworthy rates, as more and more users are switching to broadband connections. Internet access can take many forms, from shared dial-up access in an Internet café to ultra-fast fibre-to-the-home broadband connections. Nonetheless, **all forms are important** to those users who rely on them to access the Internet. Globally, there is a clear trend towards both fixed and mobile broadband

² <http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture-Video-Over-Internet-Consumer-Survey-2013.pdf>

³ <http://www.internetlivestats.com/internet-users/>

⁴ Digital Agenda Scoreboard 2012

⁵ <http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tin00093>

⁶ http://www.internetsociety.org/sites/default/files/Global_Internet_Report_2014_0.pdf

access. This is mainly due to the advantages of broadband providing always-on access against massively increasing amounts of bandwidth. While **Internet adoption is growing globally, so is Internet traffic per connection**, due to the increasing move to higher-bandwidth broadband access connections, the corresponding adoption of relatively data-heavy Internet applications (such as audio and video streaming) and increased adoption of devices, such as smartphones, that are optimized to access these applications. It is projected that in Western, Central and Eastern Europe (see Annex 7.1 for region covered); the total number of Internet users will continue to grow.

Figure 4: Forecast of population vs number of users in Europe⁷

Western Europe	Population	Number of Users	Total Devices
2013	417 million	323 million	1,622 million
2018	423 million	346 million	2,758 million

Central and Eastern Europe	Population	Number of Users	Total Devices
2013	482 million	224 million	1,011 million
2018	486 million	339 million	1,648 million

As we will present in the next sections, both fixed and mobile broadband connections are expected to grow with these above mentioned numbers, with mobile connections already outnumbering fixed broadband connections. A noteworthy development is the **strong growth in mobile broadband connections** in the emerging regions that have low Internet penetration today.

3.1.1 Fixed Broadband Internet Access

Fixed Internet subscriptions are increasingly dominated by broadband access. **Broadband subscriptions** reached 93% of total global fixed Internet subscriptions in 2012.⁸ Europe-wide, basic broadband is today largely available to everyone through all major technologies such as (cable, fibre, LTE, satellite etc.) and 97.2% of EU homes are connected through fixed and fixed-wireless technologies.⁹

Figure 5: Fixed broadband Internet subscribers (per 100 people)¹⁰



⁷ http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html

⁸ http://www.internetsociety.org/sites/default/files/Global_Internet_Report_2014_0.pdf

⁹ <https://ec.europa.eu/digital-agenda/en/news/scoreboard-2014-trends-european-broadband-markets-2014>

¹⁰ <http://data.worldbank.org/indicator/IT.NET.BBND.P2/countries/1W?display=map>

Next to the increase in fixed broadband connections, total fixed broadband Internet traffic is also expected to see strong growth. Globally, it is expected that **Internet traffic will grow four-fold between 2013 and 2018**. Internet traffic in Europe will grow at fast rates with a compound annual growth rate of 20% for Western Europe and 24% for Central and Eastern Europe.¹¹

Whereas the amount of Internet connections will rise at 5% per year between 2013 and 2018, Internet traffic is expected to rise at 35% for the same period. This can be related to the increasing traffic per connection, which will reach nearly 10GB per month per connection by 2018. In the same year it is expected that the average European in Western Europe will generate about **38.8 gigabytes of Internet traffic per month**. This is an increase of 110% from 2013.¹² In Central and Eastern Europe the average user will generate 27.4 gigabytes of Internet traffic per month in 2018 (95% growth from 2013).

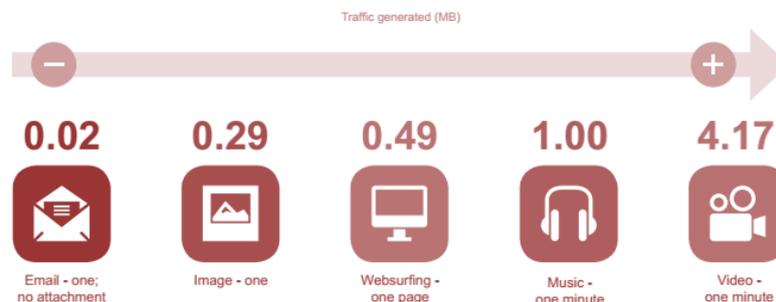
Figure 6: Internet traffic per user 2013 – 2018 in Europe

	<u>Western Europe</u>	<i>Growth</i>	Central and Eastern Europe	<i>Growth</i>
2013	18.2 gigabytes/per month per user		14 gigabytes/per month per user	
2018	38.3 gigabytes/per month per user	110%	27.4 gigabytes/per month per user	95%

Together with the growth in Internet applications that use rich and data-heavy media such as video, the increase in traffic per connection is also associated with the rise and move towards higher bandwidth connections.

As shown in the figure below, watching a minute of video online generates 200 times more data than sending a basic email.

Figure 7: Traffic generated by different applications¹³



In addition, **Internet traffic as a result of video applications** is expected to further rise from 48% to 67% of total Internet traffic between the years of 2012 and 2017.¹⁴ This is today and will still be a major challenge for operators as especially video traffic is causing massive congestions on networks, which leads to operators implementing traffic management policies on broadband packages, as we will elaborate in the following sections of this report (see *Relationship between ISP and CAP*).

3.1.2 Mobile Broadband Internet Access

In recent years, **mobile broadband growth has even exceeded growth rates of fixed broadband access**. As shown in the figure below, mobile broadband access has grown rapidly in the period between 2008 and 2012.

¹¹ http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html

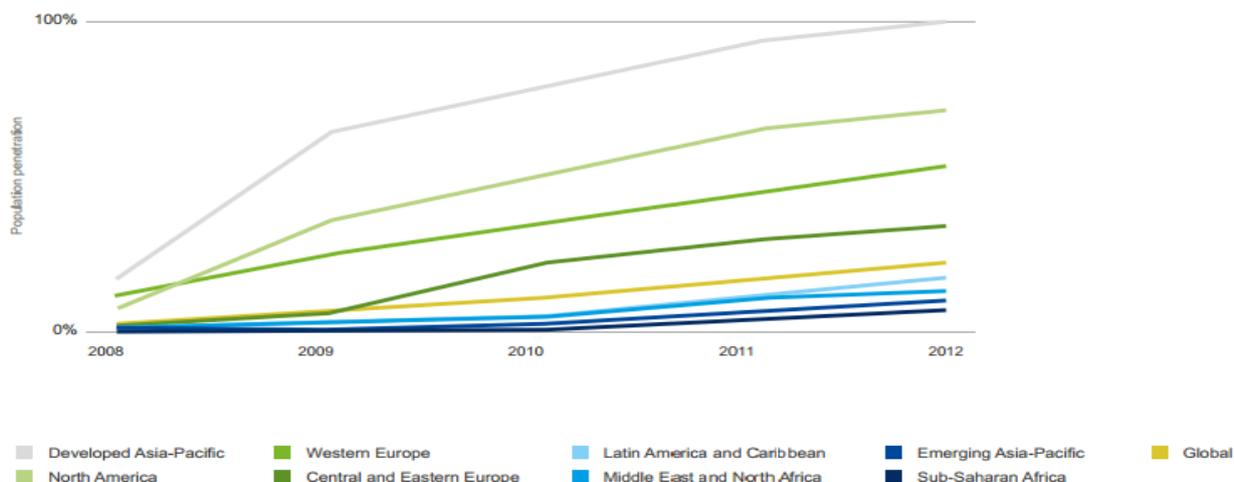
¹² http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html

¹³ <http://shop.sprint.com/content/datacalculator/index2.html>

¹⁴ http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html

Mobile broadband penetration rates are the highest in developed Asia-Pacific, such as South Korea and Japan, but are also very high in Western, Central and Eastern Europe.

Figure 8: Mobile broadband population penetration



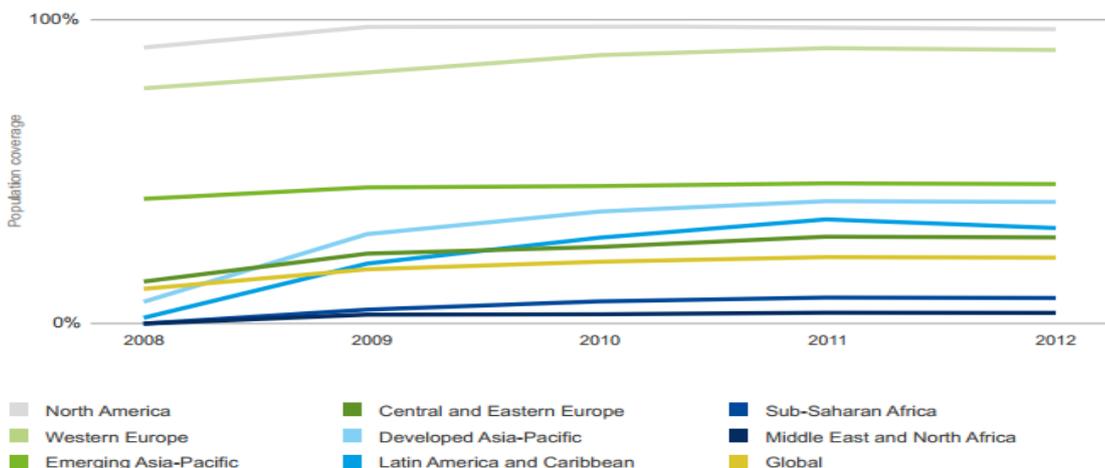
In Western Europe, there were 367.0 million mobile users in 2014 and there will be a total of 382.6 million mobile users in 2019.¹⁵ In Central and Eastern Europe the population of mobile users will reach 407.2 million in 2019 whereas there were 381.9 million mobile users in 2014.

Figure 9: Mobile Users 2014 and 2019¹⁶

<u>Year</u>	Western Europe Users	Central and Eastern Europe Users	Total Europe
2014	367.0 million	381.8 million	748.8 million
2019	382.6 million	407.2 million	789.8 million

An interesting development is how **mobile broadband access is especially growing in areas where fixed broadband coverage is limited**. As illustrated below, the proportion of people using at least 3G services for mobile broadband has risen by nearly 10% between 2008 and 2012.

Figure 10: Proportion of population covered by at least 3G



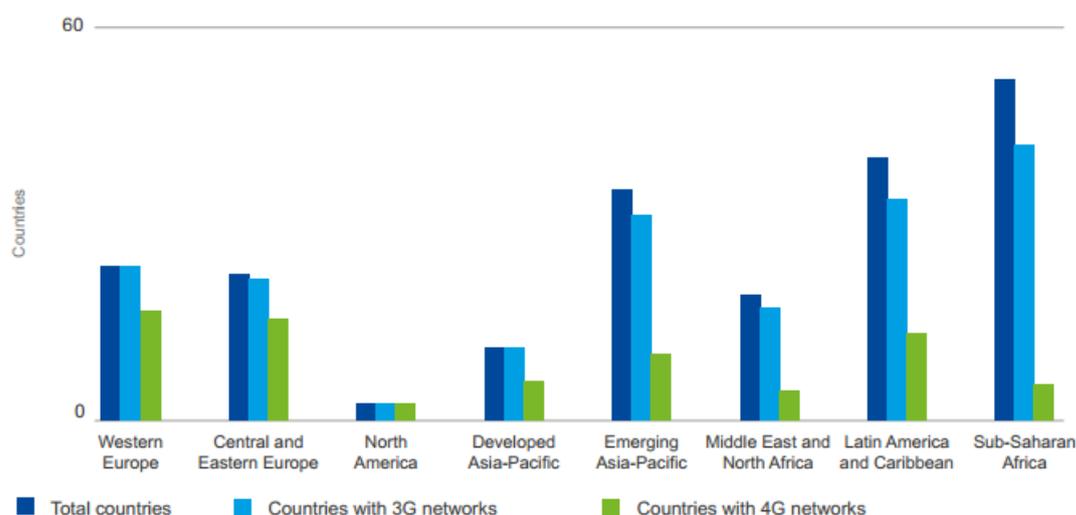
¹⁵ http://www.cisco.com/c/dam/assets/sol/sp/vni/forecast_highlights_mobile/index.html

¹⁶ http://www.cisco.com/c/dam/assets/sol/sp/vni/forecast_highlights_mobile/index.html

In Europe, for instance, 3G mobile broadband coverage is still higher than 4G coverage. While 3G coverage is extremely high (near at 100% levels), as of Q4 2013 only 60% of mobile network operators offered 4G services. In developing 4G (LTE) speeds, Sweden, Portugal and the Netherlands have been particularly rapid, while Central and Eastern European countries were a bit slower in making the leap.

As illustrated in the figure below, by the end of 2012 3G networks were active in 181 countries. Meanwhile, 4G networks had been deployed in 63 countries.

Figure 11: 3G and 4G network deployments by region in 2012¹⁷



As a result of the deployment of 3G and 4G technologies, all regions have faced a rise in penetration rates for mobile broadband compatible devices. Consequently, in 2012 mobile broadband subscriptions reached 60% of global Internet users.

This figure shows **how important mobile broadband access is compared to all other forms of Internet access**. In some developed countries, already the number of mobile subscriptions is overtaking fixed subscriptions, proving its popularity and also the trend of some users having multiple subscriptions.

Mobile broadband connections are expected to grow to reach 5.3 billion subscriptions in 2018, **six times more than fixed broadband connections** for the same period.

Investment in networks and more efficient standards have increased network capacity and enabled access to ever more **data-intensive usage**, which is increasingly demanded by users. We expect this trend to continue with more advanced generations such as 5G. The increased coverage of these mobile network technologies with faster Internet speeds is not simply arising from expanding coverage of existing networks, but also from the deployment of new, or upgraded, network across a larger number of countries.

In Western Europe, mobile consumption share was 4% of total Internet traffic as of 2013, and will be 12.1% in 2018.¹⁸ It is expected that mobile traffic will grow with a compound annual growth rate of 50% until 2018. Western European mobile data is also expected to grow 3 times faster than fixed IP traffic in the same region from 2014 to 2019. In addition, mobile traffic per mobile connection per month in Western Europe will reach 2,048 megabytes in 2019. Whereas mobile traffic per user will reach 5,808 megabytes per month in 2019.

¹⁷ http://www.internetsociety.org/sites/default/files/Global_Internet_Report_2014_0.pdf

¹⁸ http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html

Figure 12: European Mobile Data Traffic Forecasts – 2019¹⁹

	Western Europe 2014	Western Europe 2019	Growth	Central and Eastern Europe 2014	Central and Eastern Europe 2019	Growth
Mobile traffic per mobile-connected end-user device	645 megabytes per month	3,923 megabytes per month	508%	373 megabytes	4,737 megabytes per month	1170%
Mobile traffic per mobile connection	558 megabytes per month	2,048 megabytes per month	267%	351 megabytes	3,412 megabytes per month	872%
Mobile traffic per user	916 megabytes per month	5,808 megabytes per month	534%	627 megabytes	8,299 megabytes per month	1223%

The increasing rates per device are also related to users switching from feature phones to devices that are more suitable for mobile data, such as tablets and smartphones. Analysys Mason forecasts that post-2013 the majority of mobile handsets shipped will be smartphones at nearly 1.6 billion in 2017. Other non-smartphone handsets that will be shipped will be relatively low with 0.6 billion in 2017.²⁰ The increase in the shipment of “smart” devices can be associated to the sharp drop in prices, which have fallen from around an average price of USD 305 in 2011 to USD 220 in 2014.

Evidently, **smartphones have changed the way consumers use their handsets**. Compared to other handsets, smartphones enable Internet access via web browsers and email clients, but also the most recent mobile apps and Internet services including video calling, games and location-based services. In combination with high-speed mobile networks, the mobile broadband Internet services available via handsets can eventually be seen as a substitute to fixed broadband access services.

As mentioned earlier for fixed broadband access, a key challenge for mobile network operators will be to address the increasing demand in mobile Internet traffic volumes. Mobile operators are given a limited amount of capacity which must be shared among all users in the environment of the cell towers. As more and more users are sending and receiving more Internet traffic this also leads to **more congestion**. To address this issue, it is already common that on the demand side usage charges or caps are deployed. This also applies during peak usage times and areas.

In the following section we will describe and illustrate what types of online activities are leading to increased Internet traffic in Europe.

3.2 Consumer Internet Traffic and Consumption

3.2.1 Internet Traffic: Fixed network access (Europe)

As Europe presents a mix of developed and emerging markets, with various cultural, economic and linguistic differences, it is a challenge to assess the available applications and usage given the differences in penetration and availability. However, with limited information available at hand we have attempted to give an accurate estimation of Internet traffic and consumption rates in Europe.

For instance, compared to North America, Europe’s **mean monthly usage of 20.4GB** and median monthly usage of 8.2GB is significantly lower. Whereas these numbers in North America reach levels of 51.4 GB (mean) and 19.4 GB (median) respectively.

¹⁹ http://www.cisco.com/c/dam/assets/sol/sp/vni/forecast_highlights_mobile/index.html

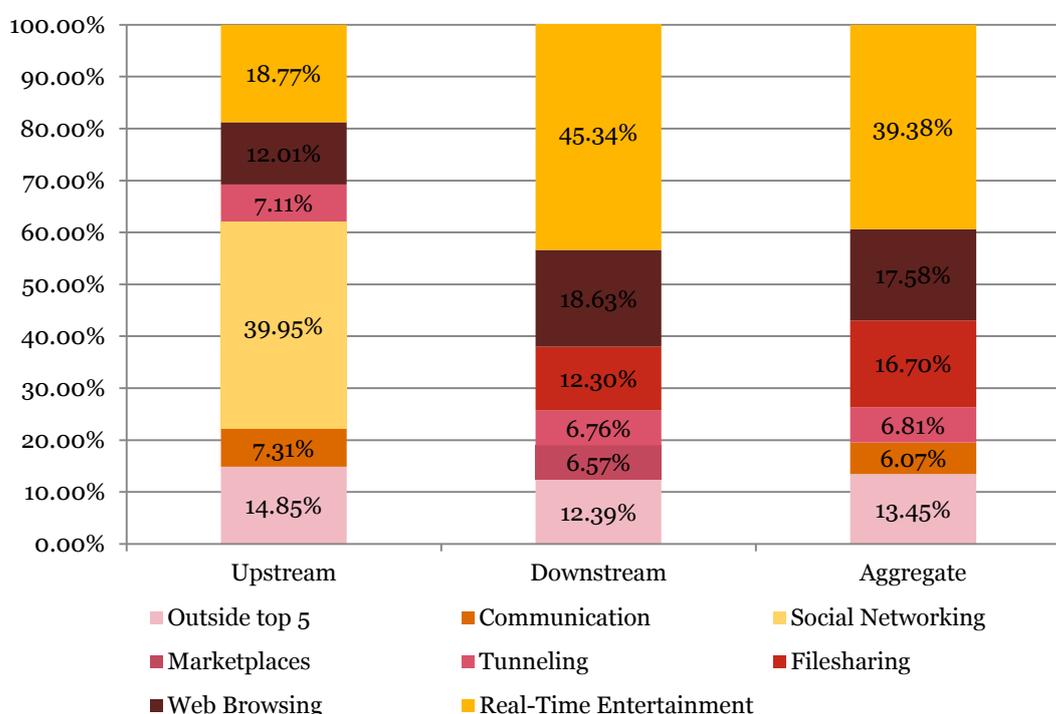
²⁰ <http://www.statista.com/statistics/263441/global-smartphone-shipments-forecast/>

Figure 13: Monthly consumption over fixed networks – Europe 2014

Monthly Consumption – Europe, Fixed Network Access ²¹ (2014)		
	Median	Mean
Upstream	984 MB	3.6 GB
Downstream	6.9 GB	16.8 GB
Aggregate	8.2 GB	20.4 GB

As part of this traffic, real-time entertainment continues to top the table with a total of 43.3% of peak downstream traffic. As mentioned, depending on the country, this percentage varies between 20% and 65%. This can mainly be related to the over-the-top (OTT) video services in different countries. For instance, countries with access to paid services such as Netflix or BBC iPlayer usually have a higher share of Real-Time Entertainment²² streaming traffic on the networks.

Figure 14: Peak Period Traffic Composition (Europe, Fixed Access)²³



Overall, about 70% to 75% of traffic originates from a small set of popular bandwidth consuming activities (such as YouTube, Skype and Facebook) that are available in most countries due to e.g. their global availability. The rest of the traffic originates from activities that are country-restricted and are only locally available (such as Netflix).

²¹ <https://www.sandvine.com/downloads/general/global-internet-phenomena/2014/1h-2014-global-internet-phenomena-report.pdf>

²² Real-Time Entertainment i.e. video and audio streaming

²³ <https://www.sandvine.com/downloads/general/global-internet-phenomena/2014/1h-2014-global-internet-phenomena-report.pdf>

Below is the overview of the top 10 activities for the region, all of which have availability in multiple countries.

Top 10 Bandwidth Consumption Activities in Europe over 2014 ²⁴						
	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	Bit Torrent	33.20%	YouTube	19.27%	YouTube	17.38%
2	HTTP	10.07%	HTTP	17.46%	HTTP	16.26%
3	YouTube	7.67%	Bit Torrent	11.10%	Bit Torrent	14.71%
4	SSL	5.63%	SSL	6.19%	SSL	6.10%
5	Skype	4.54%	Facebook	3.88%	Facebook	3.95%
6	Facebook	4.29%	RTMP	3.66%	RTMP	3.27%
7	eDonkey	3.64%	MPEG	3.54%	MPEG	3.21%
8	Dropbox	2.11%	Netflix	3.23%	Netflix	2.98%
9	MPEG	1.51%	Flash Video	2.37%	Flash Video	2.17%
10	iTunes	1.30%	iTunes	2.23%	iTunes	2.08%
<i>Total top 10</i>		72.66%		70.69%	k	70.01%

Of noteworthy importance is Netflix's dominance on networks in the United Kingdom and Ireland. Combined, the traffic from these two countries puts Netflix as the second largest source of downstream traffic during the peak evening hours accounting for 17.8% of traffic. Netflix now only has YouTube ahead with 19.9% and based on current growth rates, it is expected that Netflix will be the leading source of network traffic within the next year or so. Other video streaming services from providers such as the BBC and Amazon account for 1-3% individually, well behind Netflix and YouTube.²⁵ Furthermore, **1% of subscribers in Europe are the heaviest users** accounting for 44% of upstream traffic and 19% of downstream traffic. Increasingly, consumers are expecting the Internet to function rapidly, putting almost everything on speed. They expect things to load rapidly; their emails to be sent instantly and their music to be downloaded within seconds.²⁶

3.2.2 Internet Traffic: Mobile Network Access (Europe)

Examining mobile networks in Europe provides the same set of challenges for regional analysis as fixed networks due to the diversity in each country's culture, economy, languages, and deployed network technologies. One thing that remains unaffected and similar is the monthly subscriber consumption. Usage rates remained relatively static across many of the European countries. Mean monthly usage over mobile networks for Europe was observed to be **397.4 MB**, an increase of over 11% from 358 MB observed six months ago. Interestingly, over that same time period, median usage saw higher gains increasing 15% from 16.9 MB to 19.4 MB. The below provided data covers network consumption irrespective of the access technology used i.e. data consumed over mobile networks irrespective of the handset or technology used.

Figure 15: Monthly consumption over mobile networks – Europe 2014

Monthly Consumption – Europe, Mobile Network Access ²⁷ (2014)		
	Median	Mean
Upstream	3.1 MB	60.8 MB
Downstream	16.8 MB	333.6 MB
Aggregate	19.4 MB	394.4 MB

²⁴ <https://www.sandvine.com/downloads/general/global-internet-phenomena/2014/1h-2014-global-internet-phenomena-report.pdf>

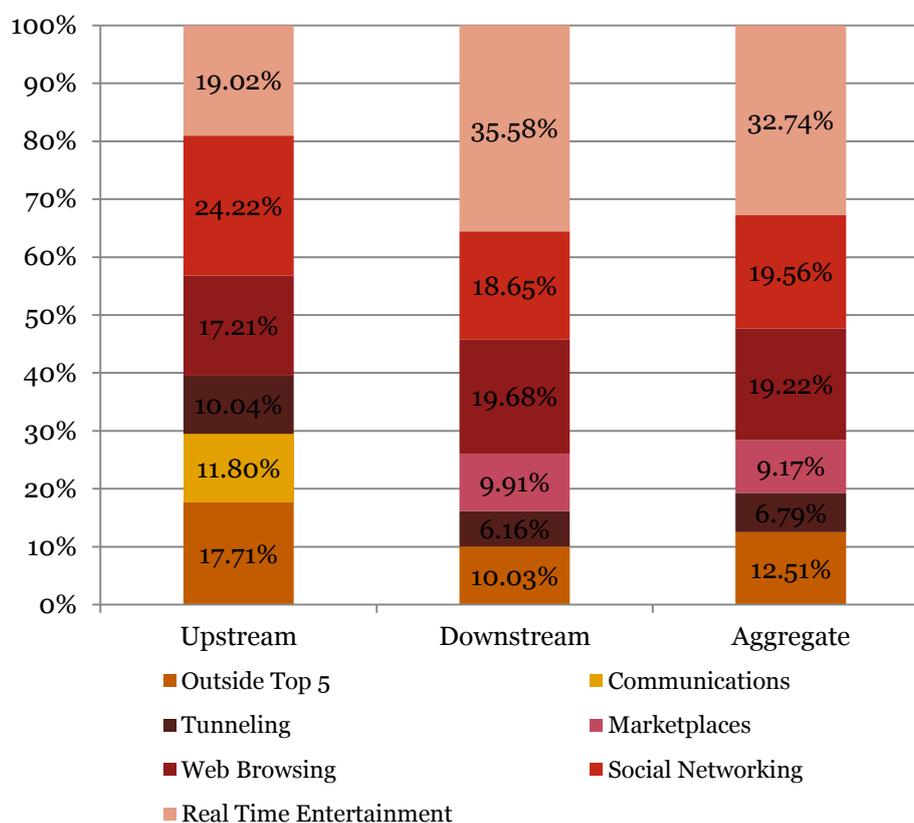
²⁵ <https://www.sandvine.com/downloads/general/global-internet-phenomena/2014/1h-2014-global-internet-phenomena-report.pdf>

²⁶ <http://thenextweb.com/dd/2014/07/28/internet-things-startups-need-shift-speed-gears-survive-era-net-neutrality/>

²⁷ <https://www.sandvine.com/downloads/general/global-internet-phenomena/2014/1h-2014-global-internet-phenomena-report.pdf>

As with most mobile networks, **real-time entertainment is the leading category**. Web Browsing and Social Networking are the second and third most popular categories. What is most noticeable in Europe is the higher share of Tunneling²⁸, which accounts for 10.0% of upstream traffic and 6.2% of downstream traffic during peak period. The exact reason behind the increase is unknown, but it is believed to be related to subscribers with dongles using VPNs to access regionally restricted content. This could also be related to increased privacy concerns online.

Figure 16: Peak Period Traffic Composition (Europe, Mobile Access)²⁹



In the communications category, Skype is the leading and dominant force accounting for about one-thirds of the traffic in that category.

The remaining top activities vary from country to country, but there is a huge surge in the usage of over-the-top (OTT) messaging services in many European countries, with WhatsApp - and now Snapchat - continuing to be the dominant players.

Top 10 Applications in Europe over 2014 ³⁰						
Rank	Upstream		Downstream		Aggregate	
	Application	Share	Application	Share	Application	Share
1	Facebook	17.93%	HTTP	17.65%	HTTP	16.92%
2	HTTP	13.45%	YouTube	16.54%	YouTube	15.15%
3	SSL	8.63%	Facebook	12.85%	Facebook	13.72%

²⁸ <http://searchenterprisewan.techtarget.com/definition/tunneling> (Protocols and services that allow remote access to network resources or mask application identity – such as Remote Desktop, VNC, PC Anywhere, SSL, SSH).

²⁹ <https://www.sandvine.com/downloads/general/global-internet-phenomena/2014/1h-2014-global-internet-phenomena-report.pdf>

³⁰ <https://www.sandvine.com/downloads/general/global-internet-phenomena/2014/1h-2014-global-internet-phenomena-report.pdf>

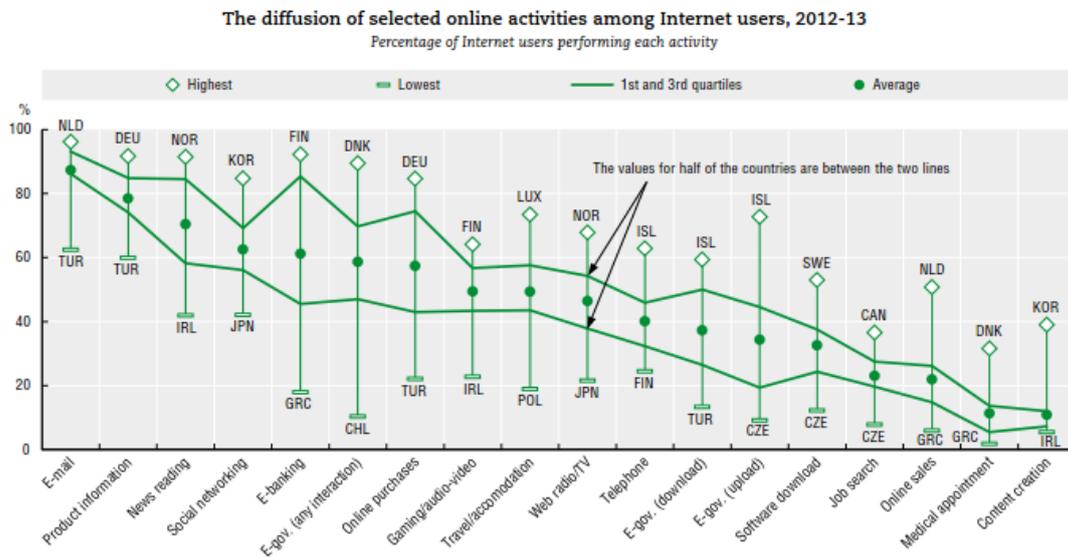
4	YouTube	8.25%	SSL	5.68%	SSL	6.17%
5	Bit Torrent	5.00%	MPEG	4.23%	MPEG	3.85%
6	Skype	4.60%	Netflix	3.89%	Netflix	3.53%
7	iTunes	3.01%	iTunes	3.48%	iTunes	3.40%
8	Instagram	2.07%	Google Market	2.66%	Bit Torrent	3.02%
9	MPEG	2.05%	Bit Torrent	2.60%	Google Market	2.43%
10	Snapchat	1.86%	Instagram	1.92%	Skype	1.93%
<i>Total top 10</i>		<i>64.99%</i>		<i>69.59%</i>		<i>70.13%</i>

Interestingly, HTTP is the category that generates the most bandwidth both in peak period and the entire day, just ahead of YouTube which is often top ranked on mobile networks. The presence of Bit Torrent means that there is a rising popularity in the use of aircards or dongles in Europe. Strong growth in the European mobile network Internet traffic can be related to the rise in the usage of data-heavy activities. Estimates point that video traffic will make up most of the traffic, with Cisco estimates indicating levels near 56% in 2017.

The top 1% of subscribers account for 42% of upstream traffic, and 31% of all traffic. On the other hand, the network's lightest 50% of users account for only 0.84% of total traffic, caused by the continuing usage of feature phones.

In broader terms and further to the online activities of users, we have found that the type of activity varies across countries. Most recent data from 2014 indicates that on average almost 90% of Internet users sent emails, 80% uses the Internet to obtain information on goods and products, and 70% used the Internet for reading online news.³¹ In addition, 57% of users bought products online while only 22% of users sold something over the Internet.

Figure 17: Dispersion of selected online activities among Internet users, 2012-2013³²

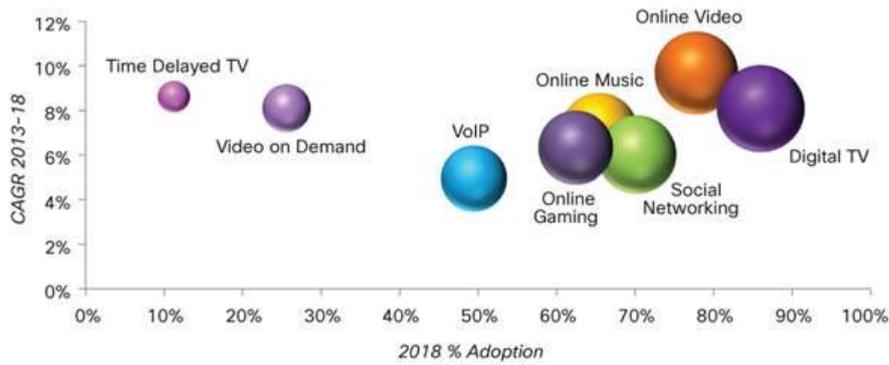


By 2018, online video and digital TV will be the most highly penetrated services for fixed networks, with social networking, online music and online gambling following these two activities closely, with compound aggregate growth rates of about 8%.

³¹ http://www.keepeek.com/Digital-Asset-Management/occd/science-and-technology/measuring-the-digital-economy_9789264221796-en

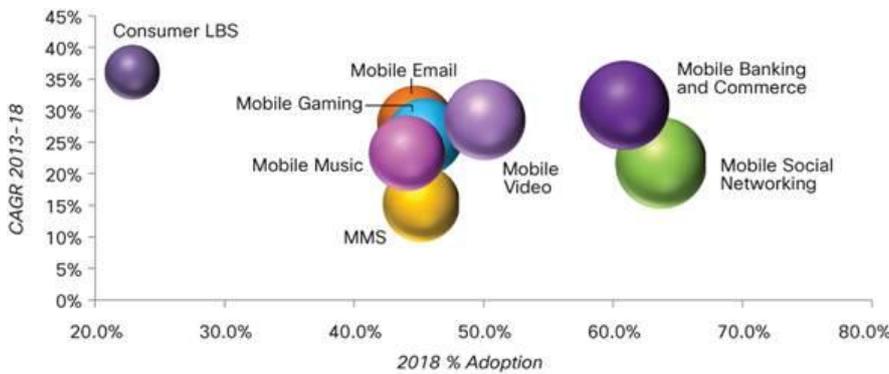
³² http://www.keepeek.com/Digital-Asset-Management/occd/science-and-technology/measuring-the-digital-economy_9789264221796-en

Figure 18: Fixed services adoption and growth 2013 - 2018³³



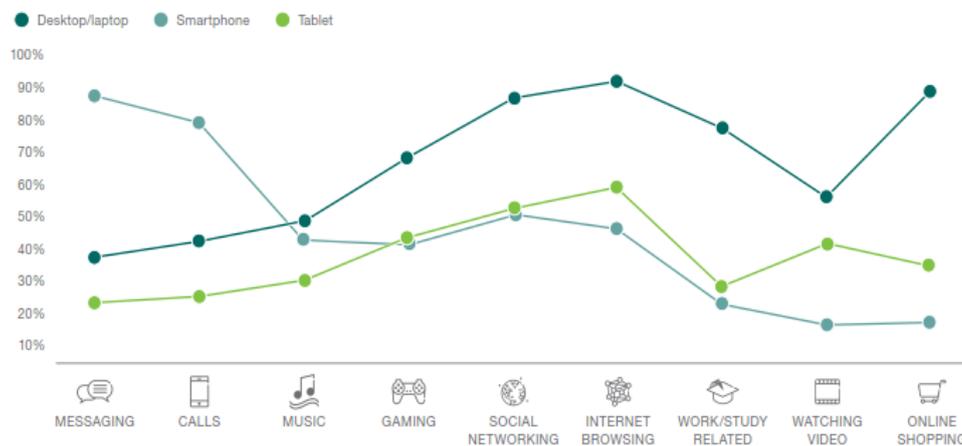
For mobile services there will be a much more different scenario with mobile banking & commerce, and mobile social networking being the most popular services.

Figure 19: Mobile services adoption and growth 2013 - 2018³⁴



The difference in these trends can be associated to the **device preferences of users for various activities**. Also with the increased availability of multiple connected devices, it is clear that the usage profile of activities performed via apps or telecom services is affected by the device type. As it can be seen below, based on the activities online (incl. other activities) people prefer to use different devices, especially where mobility is a key requirement such as messaging and voice calls.

Figure 20: Device usage preferences Europe 2014³⁵



³³ http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/VNI_Hyperconnectivity_WP.html

³⁴ http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/VNI_Hyperconnectivity_WP.html

³⁵ <http://www.ericsson.com/res/docs/2014/emr-november2014-regional-appendices-europe.pdf>

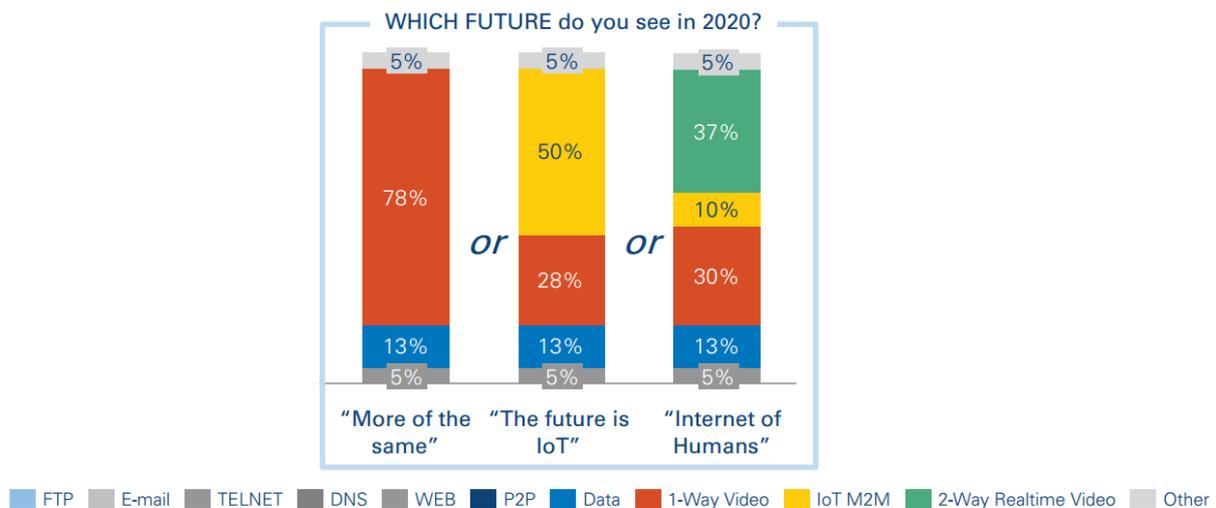
3.3 Future drivers of Internet demand

Compared to previous years, the Internet traffic has increasingly changed from static data & text file transfer to streaming interactive media content, in the forms of online video, image and audio, as presented earlier. Through this evolution the nature of **Internet has been transformed into a new media platform.** ³⁶

The Internet is continuously changing while new content and applications are emerging in unexpected ways. Although, the future of Internet and consumer demand cannot be predicted accurately today, we can draw a few assumptions based on three scenarios: *More of the same*, *The Internet of Things (IoT)*, and *The Internet of Humans*.

- **More of the same:** In the coming years, video traffic might continue to remain the main dominant source of Internet traffic. Most of the content would be generic reducing the need for real-time connection. Traffic volumes will consequently continue to increase together with the growing number of end-users, increased usage levels per end-user and increased high-definition standards.
- **The Internet of Things (IoT):** Another scenario is the massive adoption of machine-to-machine (M2M) applications consuming up to 50% of Internet traffic. For instance, we could think of examples such as remote health monitoring & care, smart homes, driverless connected vehicles, smart grid and smart traffic control. Next to this, public institutions might also make a move towards efficient public administration with e-Administration and e-Government services and applications.
- **The Internet of Humans:** Finally, we could also see online human interactions growing through e.g. mass adoption of two-way, real-time high-definition video applications. This would enable remote human interactions in the context of telemedicine or online crowd-working.

Figure 21: Internet traffic split by applications: today and tomorrow³⁷



³⁶ The future of the Internet – Innovation and Investment in IP Interconnection (Arthur D Little – Liberty Global, May 2014)

³⁷ The future of the Internet – Innovation and Investment in IP Interconnection (Arthur D Little – Liberty Global, May 2014)

4 Consumer value

As presented in the previous sections, consumer behaviour is changing with the increased use of various Internet services. In addition, the availability of different bundles, new devices and broadband technologies make consumers demand more than ever and their online activities have changed accordingly. The rapid acceptance of smartphones and other connected devices has transformed the telecom landscape – shaping and broadening the way users work, play and communicate. Especially, as smartphones are becoming mainstream in Europe, it is of utmost importance to identify what consumers want for content and services. However, at the base of every online activity lies the initial decision of choosing an ISP. Consumers select ISPs based on a number of key factors including performance, the network deployed and the value for money they receive. This is also sometimes related to CAPs as not all Internet users understand the Internet ecosystem and the various players involved.

Today, ISPs promote other areas than pricing, since this is an aspect users can easily compare between operators. However, comparing important areas such as network performance is a more challenging task. Today, for Internet consumers, price is not the only differentiator in their decision making processes. Highlighting the importance of this, and making those other areas a part of the initial purchase decision is vital to building lasting relationships with consumers and reducing churn.

Consumers select operators based on a number of key factors – ranging from performance of the network, to value for money. Consumers place emphasis on specific areas of Internet which are influencing how they value the Internet, considering one or more of the following aspects:

- ✦ **Performance:** Today, the **quality of network performance** is one of the most important factors affecting customer loyalty to the operator. As more and more Internet traffic is covered by online video and audio streaming, consumers attach great value to **high-quality and high-speed performances**. Therefore, ensuring network speed and reliability is fundamental to a trusting, long-term relationship between consumers, CAPs and ISPs. Any manipulation of such aspects in the context of traffic management, might lead to different decisions as well as complaints from consumers.
- ✦ **Price: Value for money** is a deciding factor for most when considering a broadband package. Being contractually obliged to stick with an unattractive and unsuitable **price-plan** can have a negative impact on the relationship between consumers and operators, but also leads to churn. But a transparent and fair plan that is flexible can positively impact the way consumers value the way they access Internet and their Internet experience.
- ✦ **Interactivity: The relationship between operator and consumer** is currently distant and somehow unfamiliar. Most users do not experience an overly negative relationship, but the personal touch is somewhat lacking, and the relationship is often peripheral rather than focal. The relationship could be vastly improved through offering **customised and targeted offerings**, which could effectively re-engage the consumer and ensure improved satisfaction and valuation of their **Internet experience**.
- ✦ **Device:** The devices that operators offer can be extremely important for certain consumers. In particular, it is important that for consumers to own the latest and sought-after models, as **devices have become an indispensable part of consumers' lives**.

4.1 Performance

The growing availability of high-speed mobile and fixed broadband has raised user expectations of network quality. Especially when we look at the increasingly popular use of mobile networks and devices, mobility has become an integral element to our everyday lives. To provide coverage, sufficient quality and speed to run apps anywhere and anytime is now a prerequisite for an ISP. Also, given that today CAPs increasingly develop richer and data consuming services, performance in terms of speed, continuous connectivity and quality are essential. Already, with Apple announcing that apps in the App Store can now have a size of up to 4GB (from 2GB previously) is going to add another dimension to this with CAPs being able to provide even richer end-user services and experiences³⁸. As mentioned in this report, consumers increasingly become frustrated with the advertised speeds of broadband and the real speeds of broadband they have. These expectations have also increased with **the use of smart devices** that have triggered new user behaviour. Users across the world have similar expectations of their broadband experiences, with having coverage being the most important factor in achieving a positive user experience for all types of users. Coverage and speed form the most important network quality satisfaction determinants for users. Our smartphone is always within arm's reach, allowing us instant access to information, entertainment and social interaction. In fact, using social media – watching online video on mobile devices has become an activity which consumers highly value and continuously engage in throughout the whole day.

The amount of time spent using mobile devices is increasing. A large proportion of the video and TV consumption on these mobile devices is still conducted at home. The smartphone is an exception as nearly half of the time spent watching TV and video is done outside the home, where mobile broadband connections are facilitating the increase.

The price and the speed of an Internet connection appear to be the primary reasons influencing consumer choice of their current Internet service provider and consequently how they value and experience the Internet.

4.2 Price and Ease of Access

Consumers do not always have to choice of all broadband options. They are **restricted in what operators they can choose from** based on geographical availability. Also, the limited packages available based on these locations influence what type of Internet access consumers have and at what price. Already, as shown previously, there are **large discrepancies across nations in terms of Internet packages and prices**.

Value for money is a deciding factor for most users when considering a broadband package. Being “trapped” in an unsuitable price plan can have a negative impact on consumer value and behaviour, but a transparent, fair plan that is flexible can positively impact the user experience.

Today when subscribing to a new data plan, users usually have the choice to benefit from a new phone or tablet for a really affordable price (subsidised phone). The downside of these offers is the lock-in period; consumers cannot change providers for a defined period (12-24 month contracts) or they have to pay for the residual value of the package and an exit fee which typically represents a significant amount. These types of contracts make it difficult for consumers to switch providers.

- Switching

The **ability to switch providers** easily is essential in order for consumers to take advantage of new offers, and to stimulate competition between providers. Increasingly, consumers are buying ‘bundles’ of media and telecommunications services from a single provider, for example, triple-play bundles of phone, broadband and pay-tv, or even quad bundles, which include mobile phones. This has brought clear benefits to consumers in terms of price and convenience, but it can also make switching providers more difficult. Bundles bring

³⁸ <http://thenextweb.com/insider/2015/02/12/apple-doubles-the-maximum-app-size-on-ios-to-4gb/>

together services which are subject to different regulatory regimes, and have inconsistent switching processes – so to switch a triple-play bundle a householder may need to follow three separate processes. It is therefore unsurprising that people switching triple-play bundles of telephone, broadband and pay-tv report higher levels of major problems with the switching process than double-play customers.

- Switching behaviour

A recent study on European consumers regarding switching from ISPs concluded that across the European Union, only about 10% of households have changed their Internet service provider, according to Eurobarometer data; the highest switching rate is seen in Finland, while the lowest reported rate is in Hungary.

The very same survey results also showed that the proportion of switchers is higher in metropolitan areas than in rural zones or villages and that age also appears to have an effect on switching, with more people over the age of 55 identifying themselves as ‘non-switchers’ than in the three other age categories.

Consumers who switch are more likely to have had standalone Internet access with their previous connection than with their current connection. Nearly half of the respondents have switched tariff or package with the same provider; and it appears the threat of **switching is being used to negotiate a better price**, which is considered to be the main driver for switching by consumers, followed by connection speed. Also the principal barriers for those respondents who considered switching but did not switch were the attached direct costs of switching, such as in particular a penalty for leaving their current supplier or additional fees for switching; reluctance to leave a ‘known’ company; and lack of time/ difficulty in comparing offers.

The two main reasons why survey respondents did not even consider switching are satisfaction with their current provider and a belief that their provider offers them the best value for money.

4.3 Interactivity / Online Experience

The value of services is not homogenous among users. The market splits into 40 percent of Internet users who gain relatively high surplus against 60 percent who gain more limited (but still material) value from the use of Internet services.

The 40 percent of Internet users who generate the greatest value can be further divided into five clusters, among which are three niche “domain premium” segments:

- Premium entertainment

This is a niche segment (1 percent of total market) of users assigning a much higher value to consuming **entertainment services** (approximately 65 percent of their total surplus versus approximately 20 percent market average). This niche segment is focused on TV/videos and music and is characterized by a higher percentage of single urban Internet users (73 percent live in urban areas versus 59 percent for the full-sample average; 45 percent versus 31 percent are single).

- Premium information Web services

This niche segment (2 percent of total market) assigns more value to **information Web services** (approximately 65 percent of their total surplus), especially search and map-direction services. In general, this segment is characterized by more highly educated couples (68 percent versus 58 percent on average have college degrees, and 65 percent versus 59 percent live as a couple).

- Premium communication services

This niche segment (4 percent of total market) assigns a strong value to **communications**, particularly e-mail, social networks, and instant messaging (approximately 70 percent of the total surplus value). This

segment is characterized by a propensity toward young, urban, female Internet users (67 percent versus 53 percent are less than 35 years old; 40 percent versus 29 percent live in large cities; and 59 percent versus 50 percent are female).

- Complete Internet offer

This segment represents 7 percent of the market, and generates value equally from using intensively **all types of services** (entertainment, information and communication). This segment is slightly more female and single.

- Traditionalists

This sizeable segment of 26 percent of Internet users represents the average profile and preferences of the rest of the market.

In general, socio-demographics are such that younger, wealthier users tend to derive more value from using the Web. This is already well known and is usually referred to as the “digital divide.” This divide is not linked to disturbance risk but more to lower value (and lower usage) of all types (entertainment, information and communications) of advertising-based Web services.

Consumers claim that it is important the companies they interact with are technology leaders³⁹. Also, the offline/online interaction is still very important to consumers. E.g. some consumers value to find information online to buy it offline, but also vice-versa some consumers value to buy things online which they have seen offline. However, it is believed that consumers are confused by the online telecommunications services’ complexity and that especially for broadband services to access the Internet they still consult a local store to make their decisions⁴⁰.

4.4 Device

As mentioned in the previous chapter, the way consumers use the Internet is also influenced by the devices they are using. With increased device intelligence and interconnected simultaneously operating devices, consumers have drastically changed the way they use Internet services. This poses a key challenge for operators and CAPs alike, but there is already service offerings enabling users to have similar experiences across all devices, on fixed networks or mobile networks. Consumers want their content available anytime and anywhere, and the devices they use play an important role in this. A new wave of technologies including the IoT is expected to increase consumer satisfaction and how they value the use of Internet services. Connected devices will play an important role in the future on how consumers perceive value from the services of providers and operators.

Mobile devices play an important role in the future of the Internet since it will act as a bridge to the gap between disconnected parts of consumers’ lives or locations and it will help build a greater context for their environments. Consumers value richer experiences e.g. through wearable gadgets, or home appliances that ease our lives by sending us a signal when a task is completed. Consumers believe that devices are essential part of their lives and that **there is a strong link between the device in their hands and the connected freedom it brings**⁴¹. Consumers who own both smartphones and tablets do not spend less time using their smartphones, which indicates that tablets complement smartphones, increasing time spent on tech devices and not taking away from it. Email (69%) and searching for info online (70%) are the most popular activities to perform on tablets at least once a day; for smartphones, it is email (91%) and text messaging (90%). Tablets are used more frequently than smartphones for passive activities like watching videos or movies (40% tablet vs 30% smartphone) and reading (57% tablet – 43% smartphone). While the tablet is not always fully mobile, it is trending toward becoming tablet owners’ preferred method for accessing content.

³⁹ <http://www.exacttarget.com/sites/exacttarget/files/deliverables/etmc-2014mobilebehaviorreport.pdf>

⁴⁰ http://retail-revolution.interone.de/en/buying_habits_online_offline_interaction.html

⁴¹ <http://www.exacttarget.com/sites/exacttarget/files/deliverables/etmc-2014mobilebehaviorreport.pdf>

Additionally, for the majority of consumers access to content however they want it is very important. Equally, the vast majority of consumers value a seamless experience across all devices. Also, multi-device users perform a greater variety of activities than single device owners. Therefore, mobile optimised websites play an important role on how consumers value their content access and Internet experience⁴².

4.5 Consumer Surplus

Connected consumers place a considerable value on the Internet. The perceived value that consumers themselves believe they receive, over and above what they pay for devices, applications, services and access makes up the ‘**consumer surplus**’. Consumer surplus varies vastly across nations depending on the drivers stimulation their Internet economy. It is interesting to note that in countries such as France and Germany, which have low levels of Internet GDP, consumers’ perceived value of the Internet is very high. As mentioned, key drivers of consumer surplus are quality of the online content, the number of devices in use, the ease and frequency of access, and the number of people online.

All services contribute to consumer surplus. The greatest contributors to date are search (information-based services), e-mail and social networks (communication-based services). Three services generate the largest consumer surplus: e-mail, search, and social networks contribute on average 45 percent of the Internet user surplus.

For instance, in France consumers value access to **E-mail** at €522.97⁴³, which they consider as the most valuable online activity followed by **General Search** at €499.25, and **Online Banking and Investing** at €367.86. In other countries such as Germany and the UK, these rates are similar and in the same order. ⁴⁴

The willing-to-pay level for Internet services per month per household is estimated to be approximately €38 per month. This is above what a household spends for television services. This is also roughly 40 percent of the bill a household pays for mobile and fixed telecommunications services.

Consumer service surplus shape is similar by country

The pattern of consumer-surplus distribution is a traditional long-tail distribution, with a lot of users willing to pay little for services and a minority willing to pay quite extensively. In fact, the bottom 50 percent of users make up only 20 percent of the total consumer surplus. However, this consumer surplus still amounts to €10 per month per household, or equivalent to what people in Europe pay for financing the public service broadcaster or for their basic analogue cable tier in Northern Europe.

Consumer service surplus will continue to grow at a fast pace, fuelled, among others drivers, by the fact that Internet use is morphing to multi-screen.

The consumer surplus will continue to grow at about 13 percent annually, reaching about €190 billion by 2015 in Europe and the US.

⁴² <http://www.exacttarget.com/sites/exacttarget/files/deliverables/etmc-2014mobilebehaviorreport.pdf>

⁴³ Converted from 1 USD = 0.875878 EUR – 13/02/2015

⁴⁴ BCG – The Internet Economy in the G-20 The \$4.2 Trillion Growth Opportunity - 2012

5 The Internet ecosystem

5.1 General overview

5.1.1 The Internet ecosystem

Internet can be defined as a set of interconnected networks using the Internet Protocol (IP), which allows them to work as a single large virtual network thanks to the use of a single public IP addressing field common to all users.

The “**Internet ecosystem**” is the term employed to define the organizations and communities that make the Internet work and evolve. These different organizations share common values for the open development of the Internet. The continuous and rapid development of the Internet as well as its adoption can be attributed to the involvement of a large range of actors (See Annex: Figure 7.4).

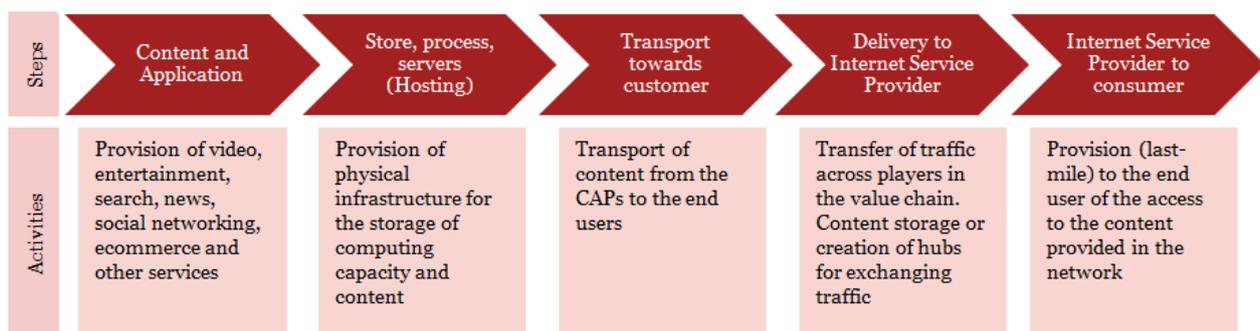
Internet has changed the way people acquire and exchange information. This has affected us in several ways; from social relationships to the way people work. Furthermore, the speed of Internet connectivity has also increased considerably with the rise of broadband connections. As users adopted to higher-speed and always-on connections, the habits of these people also evolved. Consequently, they spend more time connected (e.g. via email or social networks), perform more activities (e.g. with wearables and fitness trackers), watch more videos (e.g. on YouTube, Dailymotion and Netflix), listen to larger sets of music (through Spotify, Pandora and Deezer) and themselves become content creators (through blogs and social networks).

ITU (International Telecommunication Union) and the OECD (Organisation for Economic Co-operation and Development) have defined broadband as a connection with a capacity of at least 256 kbps in the uplink or downlink speed. In terms of speed, steady growth continues in both theoretical and actual access speeds or data throughput capacity. One common belief from experts is that data transmission speeds will continue to increase globally. In 2014, the Technical University of Denmark reached a speed of 43 terabits (Tbps) per second⁴⁵ while the global average web speed was only at 3.9 Mbps at the beginning of 2014⁴⁶. That is an important gap between what is presently and theoretically possible and what is commercially available. Though, every year, the cost of producing high speed networks is decreasing. Soon, consumers will be able to download a high-definition movie in less than a second.

5.1.2 Major players

The major players of this industry are **Content and Application Providers**, **Internet Service Providers** and the **end-users**. These three major players are the key stakeholders heavily influencing and reshaping the associated industries.

Figure 22: Key activities involved at each stage of the Internet Value Chain



⁴⁵ <http://www.gizmag.com/dtu-world-record-data-transmission-43tbps/33214/>

⁴⁶ <http://www.gizmag.com/dtu-world-record-data-transmission-43tbps/33214/>

5.1.2.1 Internet Service Providers

An Internet Service Provider (ISP) - sometimes called an Internet Access Provider - is a telecommunications company that offers its customers access to the Internet. An ISP can provide its customers with services such as **Internet access**, Internet transit, domain name registration, web hosting and the provision of a mailbox. Examples of such companies are AT&T, Verizon and Comcast in the United States and Telefonica, Orange and Vodafone in Europe.

It is important to distinguish between the various types of Internet Service Providers that exist today, as listed below:

- **Access ISPs:** Employ a variety of technologies to facilitate consumer connection to their network. These technologies may include broadband or dialup. Always-on types of broadband connections comprise cable, fibre optic service (FiOS), Digital Subscriber Line (DSL) and satellite. A number of access providers also provide email and hosting services;
- **Mailbox ISPs:** Offer email mailbox hosting services and email servers to send, receive and store email. Many mailbox ISPs are also access providers;
- **Hosting ISPs:** Offer email, File Transfer Protocol (FTP), web-hosting services, virtual machines, clouds and physical servers;
- **Transit ISPs:** Provide large amounts of bandwidth needed to connect hosting ISPs and access ISPs together;
- **Virtual ISPs (VISP):** Purchase services from other ISPs to allow customers Internet access;
- **Free ISPs (freenets):** Provide service free of charge and often display advertisements while users are connected;
- **Wireless ISP:** Provide services with a network based on wireless technology.

5.1.2.2 Content and Application Providers

A Content and Application Provider (CAP) is a company focusing on information and media **services, content, entertainment and applications services on the Internet**. Major examples of such organisations are Facebook, the BBC, Yahoo and MasterCard.

A Content and Application Provider's core business purpose – and hence the main cost of doing business - is related to the acquisition and management of intellectual property (the content and applications) that drives consumers to use the Internet. Content and Application Providers invest billions of euros in developing video content, news articles, games, platforms and software that make the Internet more attractive, interesting and useful to end-users.

There are five main types of categories through which content and application providers deliver their offerings:

1. Inter search engines and portals: **aid in navigation on the Internet;**
Examples: Google, Yahoo and Bing
2. E-commerce intermediaries: **enable buying or selling;**
Examples: Amazon and eBay
3. Payment systems: **process Internet payments;**
Examples: MasterCard and Visa
4. News services platforms: **provide information;**
Examples: BBC News and Le Monde
5. Participative networked platforms: **Participative networked platforms.**
Examples: Facebook and Google Plus

Content and Application Providers are in the business of delivering content and applications to end users. Depending on the nature and volume of the traffic and their available resources, Content and Application providers can consider several routes for bringing their services to end-users.

CAPs can:

Route 1: Connect to a local ISP. The most popular option for smaller CAPs;

Route 2: Directly connect to an independent CDN. Mainly used for applications with stricter delivery requirements;

Route 3: Directly connect to a Transit Provider or peer with a Tier-1 or Tier-2 ISP. Mainly used by larger CAPs to ensure better connectivity service;

Route 4: Connect directly to the terminating ISP. Large CAPs have the opportunity to connect directly to terminating ISPs.

They have an incentive to ensure that their offerings are delivered with a high quality of experience: high level of service reliability, quick response speeds, high resolution and with little or no degradation of the content. To do this, Content and Application Providers must invest in a range of systems, software and networks.

✚ **Hosting**

Content and Application Providers need a place to store their content. This is typically a storage device located in a large data centre. In addition, when a Content and Application Provider receives a request for content from an end user, it needs to process the request. For certain activities (e.g. searching/browsing on the Internet), this requires a large amount of computing power, provided by servers also located in a data centre. Moreover, these data centres house and run a large amount of networking and transport equipment such as routers, switches and cable termination points. In itself, they form the nodes of the Internet and are an integral part of the network.

✚ **Transport**

Once the Content and Application Provider has decided what content to send, it must be transported, often over long distances, from the hosting location to the ISP network to which the customer is connected. This typically involves the use of high capacity fibre optic cables, typically owned and built by Internet backbone providers, who sell capacity to other companies, including CAP.

✚ **Delivery**

Once the content has been carried to the edge of the Internet Service Provider's network, it needs to be handed over to the ISP, who then delivers it to the end user. This involves physical connections between the networks of a transit backbone provider (if used) and the ISP, or in some cases directly between the CAP and the ISP.

Case study

Facebook is one of the world's largest content and application providers. It has 1.35 billion monthly active users (as of September 30, 2014) worldwide. It invests around 1 billion \$ yearly in networks, facilities and equipment. Examples are:

- **Hosting: 2011-2013: Investment in a new data centre in Lulea – Sweden**
- **Transport: 2012-2014: Asia Pacific Gateway submarine cable**
- **Delivery: 2014: 38 private peering points**

5.1.2.3 Contribution to the Internet Network

For the majority of Internet users, Internet is intangible or virtual. Nevertheless, it relies on networks, facilities and equipment connected by millions of kilometres of cabling and many other devices⁴⁷.

Investment in these networks, facilities and equipment is done by a widespread range of actors: Internet backbone providers, Internet Service Provider (ISP), Content and Application Providers (CAP) and a variety of other service providers (CDN, IAP, etc.). All of these working together and investing in the networks have come together and formed the Internet.

A CAPs main business is the creation and delivery of content and applications to Internet end-users. In order to create value, it must be able to both create a demand for its services and be able to actually supply these services to end-users. The content and services that users access, consult and consume over Internet could not exist without infrastructure, which is enabled and supported through significant investment in networks,

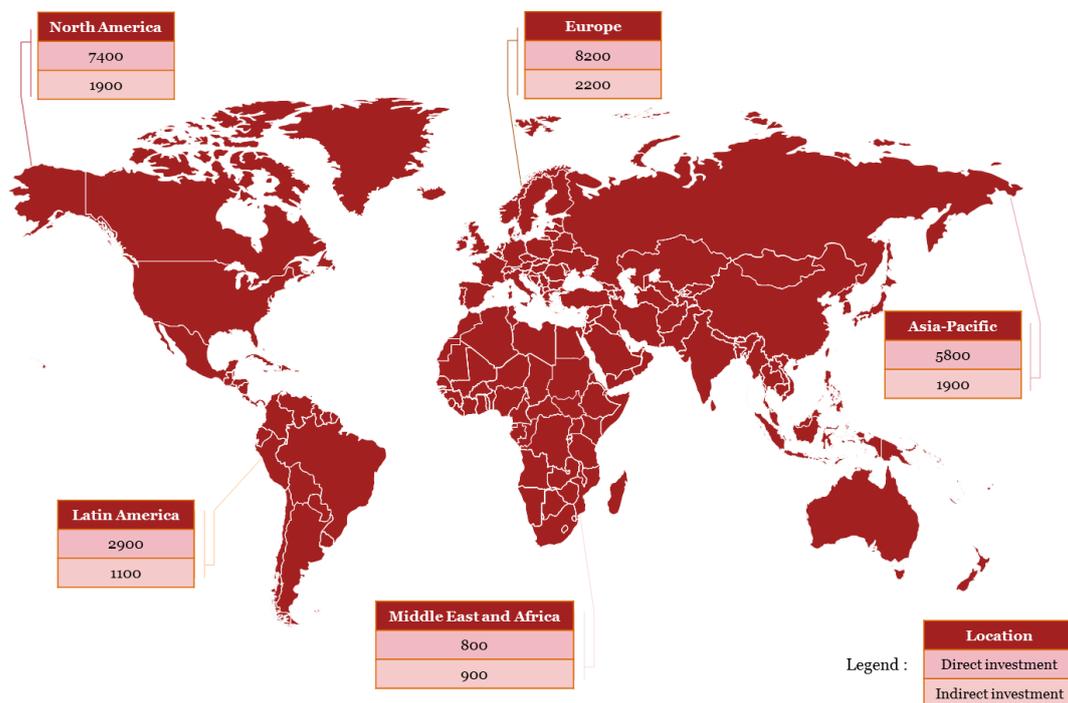
⁴⁷ *Investment in Networks, Facilities, and Equipment by Content and Application Providers (Analysys Mason, 2014)*

facilities and equipment. With the rapidly increasing interest in Internet services by end-users and CAPs - together with the rise of fast-growing demand for and supply of high-quality content (such as video – YouTube and Netflix) - demands on networks have increased significantly.

CAPs have to invest billions of euros annually in a combination of facilities, fibre networks, servers and routers. This investment is usually less visible to end-users than other investments in R&D, content development, software development and engineering, but it forms a critical part of the Internet. Some software may be accessible anywhere at any time, however it has to be hosted and transported by physical networks, facilities, and equipment.

The level of investment by CAP in the networks, facilities, and equipment of the Internet, is significant. For example, in 2011 and 2013 between approximately \$28 billion and \$36 billion was spent annually, with an average of \$33 billion per year⁵⁰.

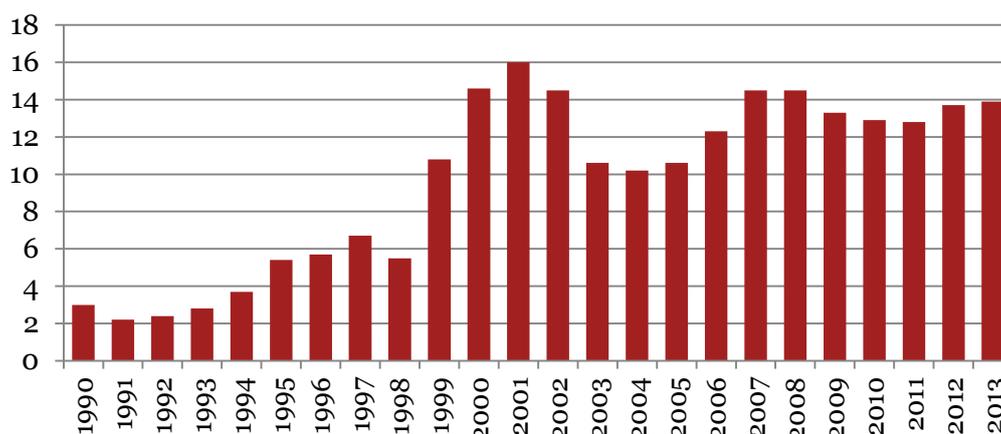
Figure 23: Regional split of direct and indirect investment by CAP in 2013 (in million \$)



From this figure, it can be seen that North America, Europe and Asia are all significant contributors to Internet investment, while Latin America, the Middle East and Africa are contributing less. This is expected as the current concentration of Internet infrastructure is in North America and Europe, and the growth in Internet usage in Asia. **Europe seems to be the largest destination for CAPs investment.** Europe is at the centre for Internet traffic as it is the meeting point of many international cables and has a large population of end users. This is attracting investment by US companies, especially in data centre facilities (example of Facebook in Sweden), as well as by local CAP providers such as the BCC and Spotify. E.g. Spotify invested in massive data centres in Sweden in order to ensure that customers received improved quality of service, increase overall reliability and also to generate capacity for future growth and expansion of their services⁴⁸.

⁴⁸ <http://www.telecitygroup.com/our-company/news/2009/spotify-chooses-telecitygroup-to-host-music-streaming-service.htm>

Figure 24: Cable Industry Infrastructure Expenditures (in billion \$) ⁴⁹



5.2 Consumer value proposition

5.2.1 ISPs and CAPs value proposition

5.2.1.1 Internet Service Providers

In order to be granted access to services and content provided or sold by CAPs, end-users purchase connectivity services from Internet Service Providers. Traditionally, fixed and/or mobile telecom operators and cable operators act as local access providers or terminating ISPs. Terminating ISPs ensure the access to the global Internet by paying a transit provider and/or investing in Peering capacity. In addition, CAPs also need Internet connection to deliver services and consequently have to pay access or transit fees to the local-access network operators to the global ISPs specialised in Internet transit services. As we will present in the following sections, in some cases, CAPs might even consider delivering their services via independent CDN providers or even directly via their own Content Delivery Networks, completely bypassing these previously mentioned types of ISPs.

Overall, in terms of products offering, Internet Service Providers all over the world are equal. It seems that almost all of them offer the exact same thing; Internet access and telephony (fixed and mobile frequently with subsidised mobile phone), often combined with television and some generic services such as e-mail address (domain name) and cloud services (bundled offers). Nevertheless, with these different services ISPs can offer hundreds of different combinations by varying speeds, amount of data (data cap), prices and content packages. The most common offering is the “triple play” which combines Internet, phone and television⁵⁰. The European Commission defined a bundled offer as “a product where operators offer a variety of services for single overall price, provided through different platforms for the benefit of consumers”⁵¹.

Bundles generally fall into one of the following two categories⁵²:

- **Pure bundles:** Consumers are only given the chance of buying the bundle (or nothing or all)

Example: In terms of broadband tiers of service for pay television channel bundling, consumers can either go with broadcast basic, basic or expanded basic i.e. for these bundles, consumers are only given the option of buying the bundle or nothing at all, which obliges for them to pay for these services whether they want it or not. Another example from another product bundling is e.g. how Windows computers come with Internet Explorer, whether at the end you are a Chrome, Firefox, Safari or an Opera user, you still get Internet Explorer installed by default.

⁴⁹ <http://www.vox.com/2014/5/13/5714294/new-ncta-data-confirms-that-broadband-investment-has-fallen>

⁵⁰ *The Cost of Connectivity* (Hussain, 2013)

⁵¹ *Broadband Internet Access Cost* (Van Dijk, 2012)

⁵² *The Dynamic Effects of Triple Play Bundling in Telecommunication*(Prince, 2012)

- **Mixed bundles:** Consumers have the option on buying the bundle or any subset of bundle components

Example: In a telecom shop, a consumer can buy a bundle consisting of Internet services, television services, phone services, etc. or simply decide to buy a subset such as a stand-alone Internet subscription.

As described in the example, the Internet Service Providers industry falls into the mixed bundle category. Buying a bundle of service is often cheaper (discount) or easier for a consumer (record-keeping, payment scheduling, and customer service) than to buy all the services separately. Although it comes at a risk ISPs include service contract commitment which prevents customers from switching operators.

Figure 25: Switching barriers in broadband

Barrier	Standalone broadband	Additional for bundled broadband
Search costs	<ul style="list-style-type: none"> • Complex product information • Diverse information formats • Challenging to compare 	<ul style="list-style-type: none"> • Issue listed on the << standalone broadband column>> apply even more strongly for more complex bundled products
Uncertainty costs	<ul style="list-style-type: none"> • Individual line performance often unknown until after installation • Performance metrics (packet loss) are obscure to consumers 	<ul style="list-style-type: none"> • Features such as quality of PVR/DVR user interface are very difficult to assess without direct experience
Compatibility costs	<ul style="list-style-type: none"> • Modem may be rendered obsolete if switching to a new type of provider 	<ul style="list-style-type: none"> • TV content may only be available from one provider • SIM-lock impacts bundles with mobile
Contractual cost	<ul style="list-style-type: none"> • Contracts (12-24 months) and exit fees are very common 	<ul style="list-style-type: none"> • Discounts for multiple product purchase make it expensive to switch one product
Shopping cost	<ul style="list-style-type: none"> • N/A 	<ul style="list-style-type: none"> • Bundles offer purchase simplicity
Transaction costs	<ul style="list-style-type: none"> • Ordering process • Service interruption • Overlapping contracts • Being home for an install • Disruptive install • Wi-Fi reconfiguration • Troubleshooting 	<ul style="list-style-type: none"> • More complex ordering • More complex installation • Loss of stored program on incumbent PVR/DVR

In order to differentiate their bundles ISPs typically impose data caps on fixed internet services and mobile networks (also called bandwidth cap). Internet data caps are monthly limits on the amount of data a user can use over his Internet connection. When the user hits the limit, ISPs engage in different actions such as slowing down data speeds, charge extra fees, and disconnect the subscriber. Data caps allow ISPs to offer different types of bundles (e.g. 2 gigabytes / 5 gigabytes / 10 gigabytes of mobile connectivity per month). Data caps are mostly seen on mobile networks but are also visible on fixed networks with a much larger amount of data (see example of Voo below).

Another way to differentiate the bundle is the speed of the network (download and upload) and to include a line of different services (usually for free) such as an email address, Wi-Fi hotspot, cloud services, anti-virus, etc. For the telecom aspect (telephony), the provider can also provide “free” services, such as free/unlimited calls to national landlines during weekend/evening/public holidays, free calls to international number across a certain amount of countries during a specific period. The television package is usually a fixed amount of channels (standard) for a certain price plus some options such as sport channels, recent movies, catalogue of

movies to stream, etc. Recently, ISPs have also started to issue “gifts” to their new customers such as a new laptop, a tablet or a mobile phone.

Let us take the example of the ISP “Voo” in Belgium which offers 5 different types of triple play – Internet & Television & Fixed telephony (ranging from 50€ to 100€):

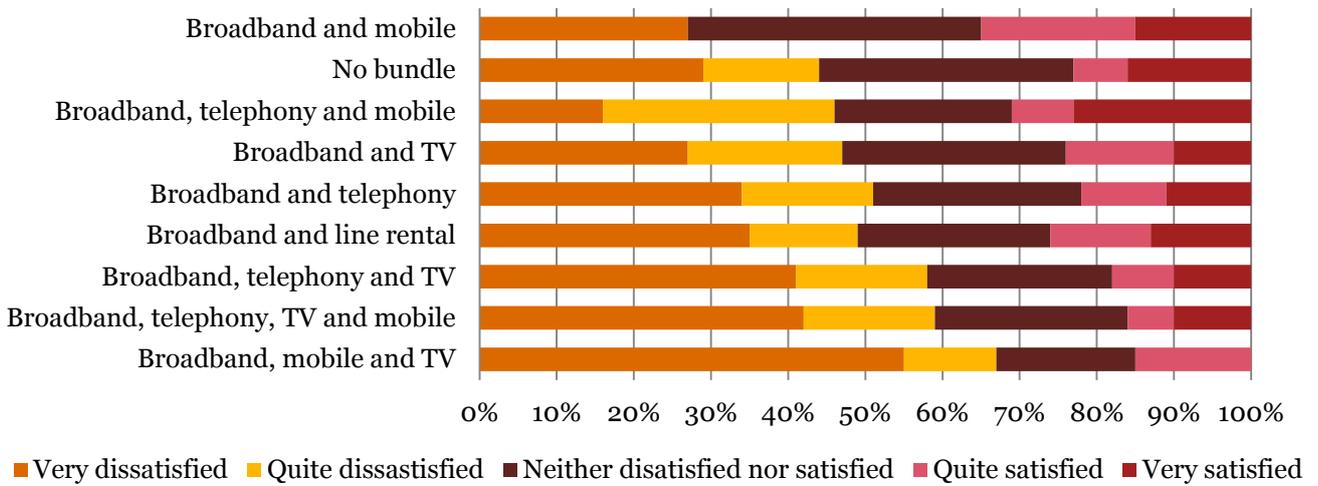
	Bundle 1	Bundle 2	Bundle 3	Bundle 4	Bundle 5
Internet	35Mbps download (max 100 gigabytes)	45Mbps download (no data cap)	55Mbps download (no data cap)	100Mbps download (no data cap)	120Mbps download (no data cap)
Television	Digital television	Digital television	Digital television	Digital television	Digital television
Fixed telephony	Free calls to national landline numbers in the evenings, weekends and public holidays	Free calls to national landline numbers in the evenings, weekends and public holidays	Telephone subscription including unlimited calls to national landline numbers 24/7	Telephone subscription including unlimited calls to national landline numbers 24/7	Telephone subscription including unlimited calls to national landline numbers 24/7
Extra (free)	Wi-Fi hotspot + Acer Tablet PC	Wi-Fi hotspot + Acer Tablet PC	Wi-Fi hotspot + Acer Tablet PC	Wi-Fi hotspot + Acer Tablet PC	Wi-Fi hotspot + Acer Tablet PC
Option	<i>Internet security</i>	<i>Internet security</i>	<i>Internet security</i>	<i>Internet security</i>	<i>Internet security</i>
Option	<i>Football channel</i>	<i>Football channel</i>	<i>Football channel</i>	<i>Football channel</i>	<i>Football channel</i>
Option	<i>Movies channel</i>	<i>Movies channel</i>	<i>Movies channel</i>	<i>Movies channel</i>	<i>Movies channel</i>
Option	<i>2000 minutes International call</i>	<i>2000 minutes International call</i>	<i>2000 minutes International call</i>	<i>2000 minutes International call</i>	<i>2000 minutes International call</i>
Option	<i>1000 minutes mobile call</i>	<i>1000 minutes mobile call</i>	<i>1000 minutes mobile call</i>	<i>1000 minutes mobile call</i>	<i>1000 minutes mobile call</i>

From this example, the differences in services are the speed of Internet, the data caps for the cheapest bundle and a small difference in the phone subscription. But the prices double for the most expensive bundle.

A report from the European Commission⁵³ comparing the access costs and of Internet in the 27 EU concludes that more than the majority of Internet Service Providers offer bundled services. Some ISPs have even decided to propose only bundled offers (e.g. Orange and Free in France, Vodafone and O2 in Germany, Vodafone and Orange in Spain). Internet and Television service is the least available package while Internet and Fixed Telephony is the most available. The main trend was to offer mobile services (mobile telephony and mobile broadband) in the bundle. It is expected that this trend is ongoing with the important growth of mobile devices. In another study, EY (2013) found that **bundles generate higher customer satisfaction rates** which in turn reduced churn. They also found that the higher the number of services, the greater the loyalty of these customers.

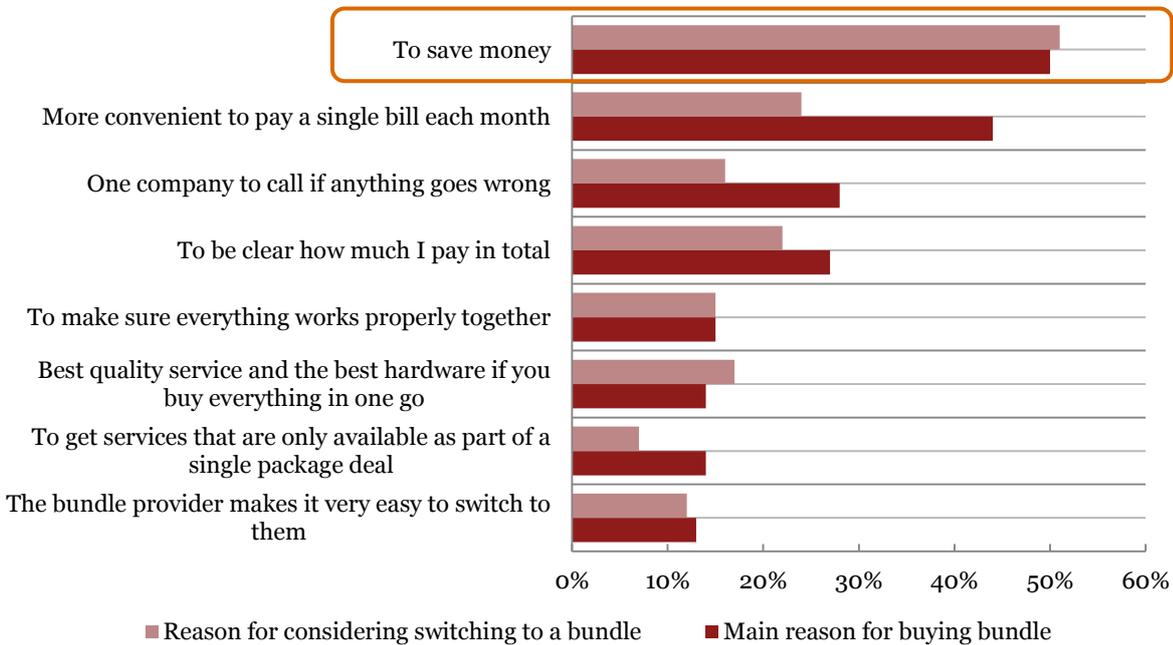
⁵³ *Broadband Internet Access Cost (Van Dijk, 2012)*

Figure 26: Future switching propensity by type of bundle



Interestingly, bundles in Europe are provided at various price levels and with various broadband speeds. Europe-wide, there are large discrepancies between bundles and advertised prices, which are a serious concern for consumers (see Annex 7.3). This is very confusing for consumers in Europe also at EU policy-maker level, since the main reason consumers buy bundled services is to save money.

Figure 27: Main reasons customers buy bundled services from a single provider⁵⁴



⁵⁴ Accenture Digital Consumer Survey 2014: Insights from Consumers on Price and Perceived Value (Accenture, 2014)

5.2.1.2 Content and Application Providers

As mentioned earlier, similar to end-users **CAPs also have to pay for access to the Internet** as CAPs deliver their content and applications mostly over ISPs. However, there have already been various cases with large CAPs choosing to bypass ISPs. Below we list these cases and the underlying motivation for CAPs to choose this path:

- Netflix Open Connect: Netflix claims that ISPs who use Netflix's Open Connect caching appliances having fewer slow-downs during prime time;
- Google Global Caches: Leverages Google's extensive global network infrastructure, which interconnects Google's data centres and backbone to their edge points of presence across the globe. Through this way, Google is able to deliver its content and services as close to users as possible in order to provide the best possible performance.
- Amazon CloudFront: is a content delivery web service which integrates with other Amazon Web Services products to give developers and businesses an easy way to distribute content to end users with low latency, high data transfer speeds, and no minimum usage commitments.

Traditionally, most Content and Application Providers were not linked to expectations of remuneration or profits. Some of the motivating factors were connecting with peers, self-expression, notoriety or prestige. Today, these CAPs are becoming increasingly attractive and interesting for investors and other businesses. The best recent example of such a case is e.g. the recent acquisition of WhatsApp by Facebook for \$21.8 billion⁵⁵. A few reasons for this deal were that WhatsApp is the fastest growing company in history (in terms of users) with remarkably ongoing growth and usage rates. In addition, WhatsApp already operates at low costs with a powerful revenue model. Overtaking such a business model could be a very profitable deal for Facebook despite the staggering cost of this acquisition.

As **online businesses strive to remain competitive and to gain market share**, growing Internet uptake in all markets is pressurising companies to search for new frontiers and to adapt to **changing consumer preferences and environments**. For instance, traditional telecom companies or even previously existing applications such as Viber are following suit after the WhatsApp revolution, which has significantly affected how consumers communicate today.

Furthermore, as CAPs generate revenues from distributing content to end-users over the Internet they have **different types of business models** for doing so, including:

- Advertisers paying to reach end-users also known as 'eyeball monetisation';
- Directing end-users' subscriptions or pay-per-use for content or services (e.g. subscriptions to video services);
- Intermediation of transactions between online merchants and final customers through an online marketplace (e.g. Amazon and iTunes);

Alternatively, CAPs can also choose to go for a mix of all of the above as their business models since they are selling services and/or content driven by any proxy of traffic volumes (i.e. web clicks, page/video views, unique visitors, downloads, transactions, paid events or subscriptions).

5.2.1.3 Relationship between ISP and CAP

In recent years, the largest CAPs and ISPs have been reshaping the industry by determining the nature of Internet traffic innovation through vertical integration. Today, many CAPs are seeking end-user proximity and are increasingly investing in exclusive or third-party CDNs. This also enables them to have higher control over the **Quality of Experience and creates economies of scale**. In addition, the quality aspect of the whole business model has become a critical point since it can be a potential differentiator between other CAPs and thus be a source of competitive advantage. This is related to the fact that the popularity of streaming video grows resulting in increased pressure on CAPs to ensure the quality of experience. Since this is becoming so critical and a matter of competitive advantage, **CAPs are making a move towards having an increased control over how end-users experience their services** and especially with regard to the quality of this experience. Also, with the emergence of ultra-giant CAPs such as Netflix, Google and Amazon, the whole

⁵⁵ <http://www.pcworld.com/article/2692252/facebooks-purchase-of-whatsapp-a-done-deal-at-22-billion.html>

traffic balance of the Internet has been turned upside down. While in the past the share of Internet traffic was rather equally shared among various CAPs, today with the emergence of these large parties, they collectively have disrupted these balances, especially given that due to the nature of the traffic (e.g. video streaming) the traffic is actually one-way to end-users, causing massive imbalances.

ISPs, on the other hand, **are investing more and more in network-based content delivery platforms for internal purposes and as a service to third-party CAPs**. In addition, ISPs provide and sell connectivity for access at local or international level i.e. their business models are currently driven by capacity extent (i.e. gigabit per second). Terminating ISPs try to enlarge their wholesale service offerings by providing services directly to CAPs. ISPs increasingly see the **urgency of defending their profitability** and search for new revenue streams to compensate for their declining distribution revenues. Consequently, ISPs are both enabling content and applications from CAPs but also try to provide their own content and applications in order to survive.

As a result, CAPs and ISPs increasingly work directly, removing - to a certain extent - the need for intermediary and pure Internet connectivity providers. The main motivation in such movements from CAPs and ISPs is to **improve control on the quality of delivery over the Internet**. Contrary to the first days of IP transit, today both ISPs and CAPs have various IP interconnection models at their availability, which are the result of three major developments:

- Decentralisation of the Internet – (e.g. through the emergence of private peering arrangements by ISPs’ access networks);
- Commodisation of IP Interconnect prices – (e.g. related to the falling IP transit, CDN or router costs);
- Proliferation of Content Delivery Networks – (e.g. CAPs build on the increased value of their Internet content and using commercial CDN services to be located closer to the ISPs’ access networks).

The main challenge at hand for these two parties – which they commonly understand and share – is ensuring Quality of Service. Increasingly, since the Internet has become overloaded with mission-critical services rather than nice-to-have services, ISPs and CAPs have to ensure that next-generation and content-rich services and applications are supported and delivered in the best way. Additional pressure is coming from other sectors such as Financial Services and from Government bodies, since these parties demand more “serious” requirements for their new Electronic Payment methods or e.g. police, military and emergency services. Any disruption in their activities can have significantly negative consequences on a national level both to the society and the economy. ISPs and CAPs are therefore faced with ever increasing pressure both from the traditional consumer/end-user, but today also from other parties that require features relevant for e.g. streaming high-definition video and audio.

Further to this topic, certain large CAPs such as Netflix and Google have started their own initiatives for tracking the delivery capabilities of ISPs especially related to this particular subject of Quality of Experience/Service.

In recent years, the Internet ecosystem has already been evolving with the **creation of new business partnerships**, of which we have listed some below:

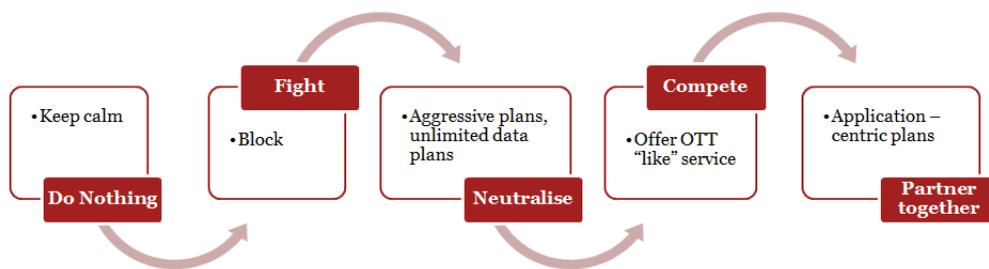
Figure 28: Publicly known new business partnerships

Year	Case
2012	Orange and Akamai entered into a global content delivery alliance
2013	Google and Orange signed a special transit deal in France
2014	Telefonica and Akamai entered into a global content delivery alliance
2014	Comcast signed an IP Interconnection deal with Netflix
2014	Orange agreed to host and serve Netflix in its network in preparation for Netflix’s service launch in France
2014	Verizon signed an IP Interconnection deal with Netflix

✦ Evolution of the ecosystem relationship between ISPs and CAPs

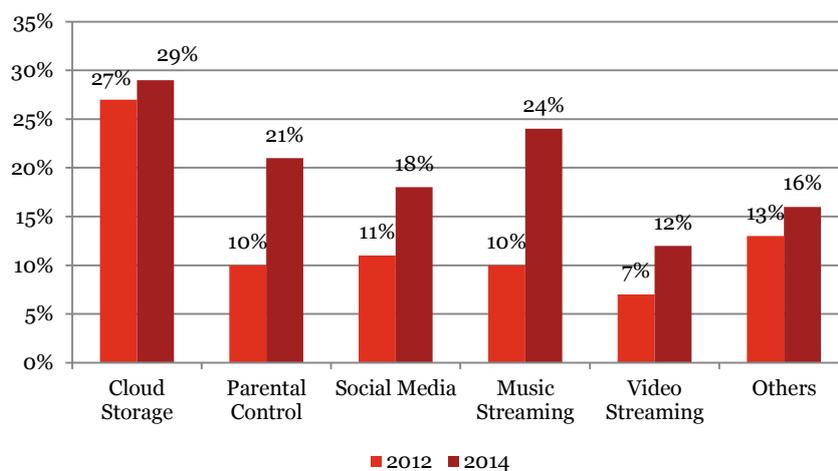
It is clear how and why CAPs have changed their position and are now important players in the telecommunication ecosystem. ISPs are now seeing them as important partners to differentiate their offers and increase customer satisfaction whilst reducing churn. On the other hand, CAPs realised that if they want to keep customers interested and engaged, they must focus on the content and on how well their content is delivered to the consumer. Since they have realised that they are more or less **strategically obliged to work together with ISPs** - instead of fighting to deliver quality content services to customers - we have seen an **increase in the relationship between ISPs and CAPs**.

Figure 29: Evolution of the ecosystem relationship between ISP and CAP



Competition from bundled service propositions, by telecommunication operators has decreased the number of standalone ISPs. Today, consumers usually buy their telephony, television and internet services from a single provider. It is therefore not surprising that, in order to compete, they must try to differentiate themselves by exploring ways to enhance their customer appeal, especially on advertised prices and service enhancements (i.e. faster network, providing more content, stability of their applications). The latest trend to distinguish themselves is to offer new services by partnering with CAPs. ISPs have an established customer base; have existing charging/billing relationships, the appropriate branding and brand awareness together with the mechanism to collect data on consumer usage and behaviour⁵⁶. Thanks to these characteristics, ISPs and CAPs have been gaining market share by cross-selling and bundling offerings. **Partnerships between ISPs and CAPs are becoming recurrently more common**⁵⁷. ISPs offering services such as video, music, cloud storage, location based services etc. grew from 35% in 2011 to 59% in 2012. As of 2014, this 85% of ISPs were offering these services⁵⁸.

Figure 30: Operators Offering Value-based Services



⁵⁶ <http://www.openet.com/blog/otts-content-providers-and-operators>

⁵⁷ Content and OTT Partnership: The Key to Unlocking New Business Models (Openet, 2014)

⁵⁸ App-Centric Operators on the Rise - Allot Mobile Trends 2014(Allot, 2014)

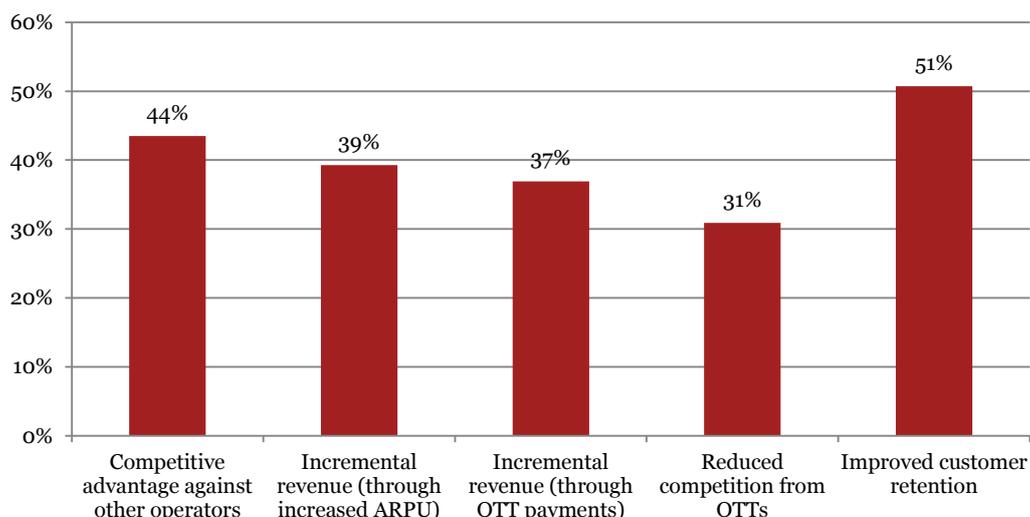
Progressively, we also see operators offering subscribers a choice between different levels of access to different applications such as unlimited social media or OTT VoIP minutes (application centric plans). In 2012, only 27% of operators were offering these types of plans. In 2014, around 55% of the ISP offered these types of services globally - 63% for Europe.

The recent drive by music streaming companies to work with operators is a clear indicator of the opportunities operators can present to CAPs. Music streaming companies such as Spotify, Beats, Deezer and Napster are all signing agreements with mobile operators (example: Deezer with Orange in France). Amongst them, these four major companies serve around 19 million paying customers, compared to the 3.6 billion mobile subscribers worldwide. Using mobile as a delivery channel offers instantaneous access to an enormous market that is already accustomed to paying monthly subscription fees.

TV and movie companies are also looking at generating content and revenues for mobile. The recent deals in the US with the main operators and Netflix may be seen as an indicator that content providers are willing to discuss paying for a better delivery of services. In the UK, Vodafone launched their 4G service promoting free Netflix, Sky Sports TV or Spotify Premium. One of the issues at hand is that **video streaming services are network hungry**. As more and more people watch TV content on tablets and operators are looking to sell more (cellular) data-enabled devices, there might be potential for a lot more creativity in data pricing in terms of speed, data caps and shared data plans. Additional options could include having video traffic sponsored / subsidized by the content partner or even advertisers.

With the development of these new partnerships - instead of the subscribers paying for the data associated with a certain application, website or device - a third-party does so. In this model, data usage does not count against existing usage-based billing quotas, so subscribers with a subscription plan get free usage. Furthermore, subscribers who lack even a basic subscription can gain completely free access if they purchase a sponsored device.

Figure 31: Benefits of partnerships for operators ⁵⁹



Further to this topic, partnership between ISPs and CAPs can take several forms. Below we present the most commonly used cases:

Bundling content: In these particular situations ISPs and CAPs offer several services as one combined product

- *Example: Verizon Wireless and Skype (the application is pre-loaded on some devices), Xiaomi mobile phones with preinstalled Google apps, Spotify and Sprint (free premium account on Spotify).*

This creates a win-win situation, as the ISPs can differentiate their offer at no costs while CAPs can reach a larger customer base.

⁵⁹ <http://telecoms.com/228392/ott-partnerships-boost-customer-retention-says-survey/>

Zero-rating (“sponsored data”): ISPs do not charge end-customers for data for the use of specific applications or Internet services. It allows customers to use data services such as video streaming, which otherwise might result in important charges depending on their data plans and data caps.

- Examples: Spotify and Orange Switzerland (streaming of Spotify music does not count in the data cap), Spark with Twitter, WhatsApp and Mobily (unlimited data usage with roaming included in 50 countries), Facebook Zero (providers do not charge data for accessing Facebook on a stripped-down version of the site), Wikipedia Zero (free of charge on mobile phones in developing markets), Twitter Zero – or Twitter Access (free of charge in emerging markets),*
- According to Mobile Trends Charging Report (2014), around 49% of mobile operators worldwide now offer at least one zero-rated application (and it is Facebook in 65% of the case);
 - 40% of application centric plans are zero-rating (Allot, 2014)

This creates a win-win situation as the ISPs can differentiate their offer by providing a free service to their customer, while CAPs can reach a larger customer base.

Zero-rating apps have the potential to create a win-win scenario for subscribers, operators, and content providers alike because of the following reasons:

- Subscribers benefit from free data access;
- Mobile operators still get paid for the bandwidth they deliver;
- The sponsor (app or device developer) gets increased traffic, impressions and end-users.

Nevertheless, zero-rating challenges the fundamental principles of net neutrality and may present particular development concerns by giving dominant web services an advantage over local competition. Further, the hypothesis that zero-rating will lead to widespread access to a free, open, and neutral Internet is unproven. Furthermore, it may:

- Lower innovation from smaller market players;
- Lead to a lock-in of customers.

IP Transit: Connect ISPs to the rest of the world through interconnection of several networks (e.g. undersea cables, regional networks, satellite links etc.)

Example: Level 3 Communications is the largest IP transit player in Europe followed by Sprint. E.g. KPN has partnerships with Telefonica and Sprint in the USA. With the increased partnerships between ISPs and ISP transit firms, IP transit firms get their fair share as they get paid per Mbps for transit sold to large ISPs. They are particularly in a favourable position since IP transit prices vary per region and ISPs are challenged to deliver the same QoS everywhere.

This creates a win-win situation as ISPs can get closer to consumers to deliver excellent quality experiences by paying for favourable geographic locations. In return, this results in increased profitability for the IP transit firms.

Example: The largest CDN is Akamai. It offers services to firms such as Hulu, the BBC, the White House, Sony, Nintendo, Airbnb and Apple. Recently, Apple has invested a large amount into building its own CDN to improve the delivery of content to their consumers.

This creates a win-win situation as the customers receive a better service from the CAPs while ISPs are paid to host the servers of the CDN.

Overall, we can conclude that the underlying reasons for these CAPs to work in these ways are to benefit from the secure quality of service for own applications and search for economies of scale. ISPs, on the other hand, look to defend profitability and look for new revenue streams and monetise eyeballs.

5.2.2 Traffic Management

Internet service providers do not actually buy enough capacity for every customer to hit their maximum speed at once. If they did, broadband connections would be very expensive. As mentioned earlier in this report as well, ISPs have to share their capacity over the number of users. Also, it can be assumed that it is highly unlikely that everyone will be online all at once and in need of maximum connection speeds. Consequently, based on averages, **ISPs just buy the “will-do” amount of bandwidth** for the number of consumer they have⁶⁰. Of course, there are peak times such as evenings and weekends through which there is increased online activities. At these moments, ISPs turn things in their favour by restricting end-user online activities, especially for bandwidth heavy broadband activities such as P2P downloads, Skype or online gaming. ISPs are able to detect these various types of traffic and “throttle” them to lower speeds so there is enough bandwidth to share across all users ensuring that the regular email sender and news reader is able to do so without any interruptions or slow-down of speeds. While European Union officials, request a “full” and unrestricted Internet option⁶¹.

Although, the suggestions of the EU officials are comprehensible, it is also important to understand why ISPs actually do this.

Given that the online consumption of bandwidth today is dramatically different than that of previous years (as presented in the beginning of this report) this is also leading to more **congestion**. Internet in its early days consisted just of users sending plain text emails and reading news articles. With the growth in its popularity, the Internet became a “place” from which people demanded more and more. Consequently, already in the recent past the old dial-up phone could not cope with the increased demand and broadband was the solution. As broadband provided greater opportunities, it also led to the increase in online activities such as streaming films, downloading files, playing games and making video calls – all at faster speeds and for longer periods of time.

Logically, a lot of these activities require a lot of bandwidth and so again the Internet has become a congested place. And given that ISPs buy their bandwidth just to meet the average usage rates they have to find ways to “keep the Internet running” without slowing everything down for everyone.

If we look at a major company, such as British Telecom (BT) we can see that they offer Unlimited bundles where users have unrestricted access to the Internet at high speeds. However, since some of their bundles offer restricted usage allowance, BT clearly warns their users about the consequences and even **helps consumers understand what activity uses how much data** etc. in order for them to choose the most appropriate services for their needs. For instance, BT estimates the following levels of data usage activities:

Figure 32: Type of activities and related usage rates

Activity type	Typical usage
Online catch-up TV service (1 hour)	644 MB
Video streaming: for example, YouTube (1 hour)	429 MB
Online gaming (1 hour)	43 MB
Standard definition movie (2 hours)	1,974 MB
High definition movie (2 hours)	4,292 MB
Music (1 album, 10 tracks)	80 MB
Photo (1 photo)	5 MB

Below we provide two cases of possible ways of how ISPs manage traffic through service tier policies:

Case 1: A user uploads more data than the threshold for their service package and is consequently traffic managed by an ISP for the following hour or so. When an ISP notices that the user’s upload speeds has dropped and conclude that they have reduced their activity, they “release” the user and ensure the return to normal speeds for their activities. The user then exits traffic management at the end of this time period.

⁶⁰ <http://consumers.ofcom.org.uk/internet/internet-traffic-management/>

⁶¹ http://europa.eu/rapid/press-release_IP-14-354_en.htm

Case 2: For instance, the same user continues to upload more traffic than the threshold in their tier of service and is traffic managed, but their upstream connection is so heavy that their total usage leads to the triggering of the next policy of the ISP. This could e.g. last for more than two hours until the upload speeds return to normal levels.

Overall, we can conclude that the reason **behind traffic management is deemed to be necessary by ISPs as they believe that reasonable network traffic management practices are essential**, especially for various services such as premium or managed services⁶². As the Internet transformed itself from a data and file transfer platform (e.g. sending emails with delayed delivery times) into a new-media platform (especially due to massive increases in rich media such as video, which flows mainly one way from content providers to end-users) access networks experienced significant imbalances in traffic. This shift led to an increased demand for a higher bit rate and delivery quality. In addition, heavy data consuming activities such as IPTV, voice and video streaming also require the necessary level of quality to be available and worthwhile. However, the debate continues about whether ISPs should be able to continue activities such as blocking, throttling (both where the treatment of specific applications are differentiated), degrading (e.g. resulting from specialized services becoming widespread) and prioritizing certain applications, content and services over others.

5.2.3 *Traffic Management or Network Discrimination? An overview of trends and disputes*

Given that in the previous section we have explained why traffic management policies are deployed, it is also important to remember that as part of the whole net neutrality debate these actions are considered to be discriminatory. Whether or not this is the case, we present some instances of “network discrimination” accidents which can take various forms.

- **Blocking of applications and services**

ISPs in the UK have introduced new filters which could lead to some online gambling sites being blocked to customers. Users will be required to actively ask their ISP for permission to unblock such websites, which are also offered e.g. through smartphone and tablet applications⁶³. In January 2015, the Spanish government ordered ISP Vodafone to block access to The Pirate Bay, a popular file-sharing website⁶⁴.

- **Slowing Internet speeds/Throttling**

A single and major example is how major US ISPs have been intentionally allowing traffic congestions among rival companies⁶⁵. A recent study claims that major ISPs such as AT&T, Comcast, CenturyLink, Time Warner Cable and Verizon have been purposefully restricting data from competing video streaming sites such as Netflix. There are also instances where ISPs detect anomalies, but by not doing anything about it they allow speeds to slow down while “technically” not slowing down Internet speeds.

- **Blocking websites**

In 2014 - Cartier, Montblanc and Richemont ordered BskyB, BT, TalkTalk, EE and Virgin (all major UK ISPs) to block access to websites selling counterfeit products. This decision was one of the largest ever taken that has an impact on the Internet and a case that is first of its kind in Europe within this domain⁶⁶. Also, most recently the French government has given itself the right to force ISPs to block websites that it considers to be “unsuitable” or “inappropriate”⁶⁷.

⁶² *Modern Economic Regulation: An Introduction to Theory and Practice*, Christopher Decker – 2014

⁶³ <http://www.igamingbusiness.com/news/new-isp-filters-could-block-access-gambling-websites-uk>

⁶⁴ <http://au.ibtimes.com/pirate-bay-blockade-spain-spanish-government-orders-isp-vodafone-block-tpb-1415511>

⁶⁵ http://esq.h-cdn.co/assets/cm/15/06/54d45c4a1418b_-_M-Lab_Interconnection_Study_US.pdf

⁶⁶ <http://www.herbertsmithfreehills.com/-/media/Files/ebulletins/2014/20141023%20-%20Internet%20Service%20Providers%20ordered%20to%20block%20sites%20selling%20counterfeits.htm>

⁶⁷ <http://venturebeat.com/2015/02/09/france-issues-new-rules-requiring-isps-to-block-child-porn-and-terrorism-websites/>

- **Direct interconnection**

Netflix and Comcast agreed on a deal where Netflix pays for peering. Enhanced interconnection capacities significantly improved Netflix' data transport in Comcast's network⁶⁸.

- **Conflicts and Disputes between ISPs and CAPs**

Consequently, these developments also have led to certain conflicts between ISPs and CAPs. Without concluding whether one or the other is right, we are presenting an example of one particular case directly related to the above example: Netflix and Comcast. Following their major partnership announcement it became apparent that despite its advantages, Netflix CEO and founder Reed Hastings mentioned that the deal with Comcast was a necessity since it needs a good bandwidth to deliver its services to millions of users worldwide. However, with the need for such a strategy – considering that many users of Netflix are “binge watchers” and that every video watched are very large files being transmitted over broadband networks – ISPs and CAPs are ending up in disputes over the fact that CAPs have to pay premium prices for the fast connections needed to deliver their services. Mr Hastings said: “... big ISPs can demand potentially escalating fees for the interconnection required to deliver high quality service. The big ISPs can make these demands – driving up costs and prices for everyone else – because of their market position.⁶⁹” CAPs further claim that no matter the situation, when an ISP sells to a consumer e.g. a 50 or 100 Mbps Internet service package, the consumer should get that rate, no matter where the data is originating from. ISPs on the other hand claim that some CAPs such as Netflix are “dumping” as much data and volume as they can on their networks.

5.2.4 *Recent trends - New services development*

Nowadays, consumers are spending more on devices than on content, but CAPs now have an unprecedented opportunity to grab a larger share of the revenues that are available. From a study conducted by Accenture ⁷⁰ 12 percent of the respondents said they were planning to increase their spending on video content over the next 12 months. To do so, they must be equipped to adapt the content experience and value proposition to each individual device, creating multiple different offerings at different price points. CAPs ability to harness and analyse consumer data will be the critical differentiator.

In order to do so, **CAPs have to work closely with ISPs to deliver these expected levels of quality of service.** Through this way, **they can get closer to the end-user** and can ensure that they deliver this expected content experience and value proposition through each individual device.

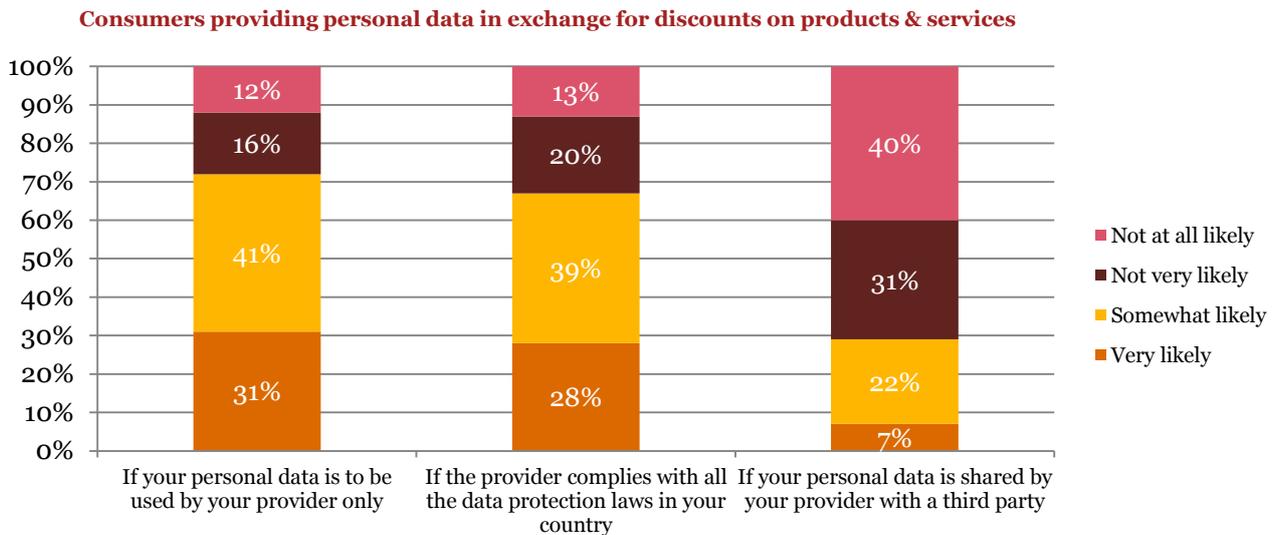
In the same study, Accenture (2014) found that sixty-seven percent of digital consumers are willing to share more personal data in return for additional services or discounts, provided local data protection laws are followed. As broadcasters move to offer new services and products based on consumer data, they must be ready to overcome current consumer scepticism by demonstrating the value in sharing that information. They must also gain and keep the consumers' trust if they are to keep this data exchange going (for example, by providing improved recommendations based on preferences or greater relevance, as with location-based services). **ISPs and CAPs have now increased insights on how consumers use the Internet.** A beneficial aspect for both parties, but especially for CAPs is that they can have a deeper understanding of consumer behaviours and preferences, so that they can develop new and targeted services for their customers. Additionally, e.g. if a CAP serves only 3 million consumers, it can only collect user data on consumer from these people. While a partnership with an ISP can provide them with data on e.g. a whole population that an ISP serves.

⁶⁸ <http://qz.com/256586/the-inside-story-of-how-netflix-came-to-pay-comcast-for-internet-traffic/>

⁶⁹ <http://blog.netflix.com/2014/03/internet-tolls-and-case-for-strong-net.html>

⁷⁰ Accenture Digital Consumer Survey 2014: Insights from Consumers on Price and Perceived Value (2014)

Figure 33: Consumers are willing to provide additional personal information under trusted conditions (Accenture, 2014)



5.3 Reorganisation of market players

5.3.1 Platformisation and integration

With the introduction of Internet Protocol (IP) and broadband networks, voice, data and video services can now be offered on the same platform. This convergence has enabled inter-platform competition for a wide variety of services and applications that were previously not possible. As a result, “traditional” telephony providers now offer video and data (Internet) services, and cable companies offer Internet access and voice services. **Wireless networks that previously provided mainly voice services have now become the primary means of Internet access in many countries.** Convergence has had the following impact on services, networks, devices and companies:

- **Services:** Voice, data and video services and applications can all be provided over a single infrastructure platform;
- **Networks:** Different types of transmission systems (wired, wireless, satellite) can be linked together through IP to deliver converged services anywhere and at any time;
- **Devices:** A single device can allow access to telephone services, video streaming or broadcasting and Internet access;
- **Companies:** Firms are combining in many different ways through mergers and acquisitions and vertical integration in order to respond to consumers’ demand for advanced services.

Connected televisions or devices with screens such as tablets, laptops and smartphones, for watching video content transmitted over the Internet, are one of the key elements of convergence between telecommunication and content providers.

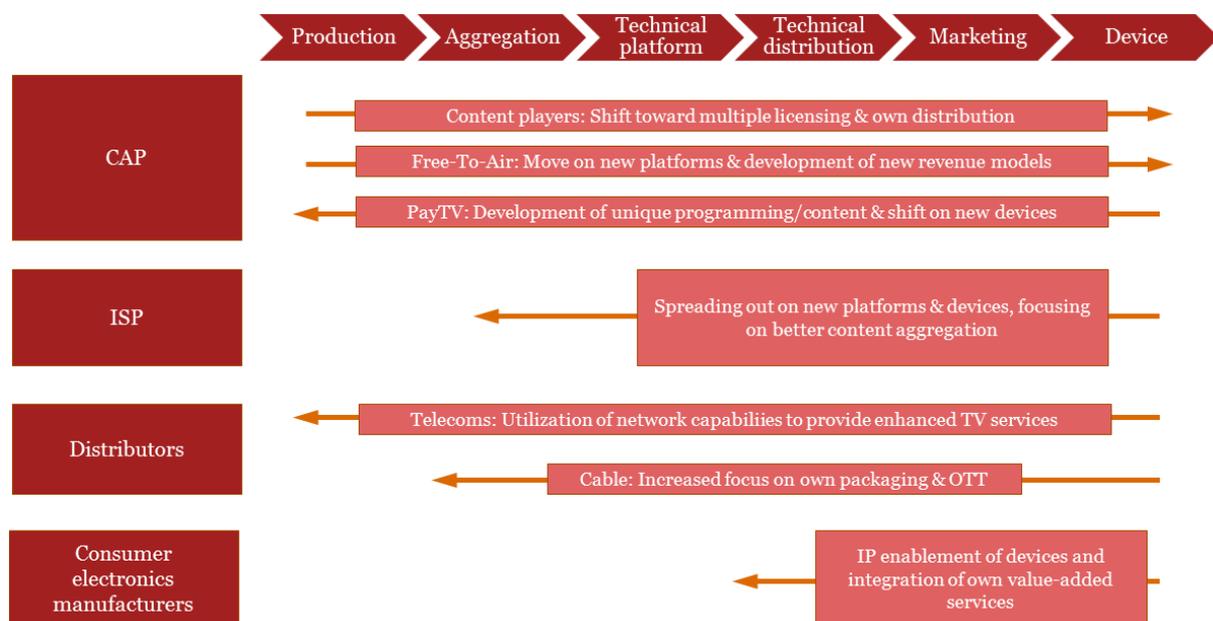
Some see new online video content providers as a major threat to their business models. Policy and regulatory frameworks can also be tested by such developments, and, in some cases, not be meeting the original objectives. In addition, next to bringing increased choice and more competition - as well as innovative services - the increase of online video providers represents an opportunity to advance regulatory reform towards the Internet era.

Recently, more **traditional ISPs have started to provide voice and video services.** Increasingly, new consumer-centric business models are appearing in the media and entertainment industry and increasing numbers of developers, device manufacturers, security and digital rights management companies, aggregation platforms and delivery networks are entering the market. For example, CAPs such as Netflix and Amazon, are aggressively getting into the content development game. Netflix is expanding its reach continuously and rapidly. The company recently announced that, from 2016, it will be the exclusive carrier of first-run movies

distributed by the Weinstein Company. In addition, it has the ambition of operating in 200 countries by 2016 – currently the company operates in 50 countries⁷¹. Meanwhile, Amazon recently announced that it would be shipping a streaming device to compete with Google Chromecast and Roku. Others are following: Apple, Google and Samsung are continuously expanding the reach of their products and services, seeking further vertical integration and exploiting TV metadata to unlock new experiences. In a digital environment, agile disruptors can and do appear without warning. Looking ahead, the combination of wearables, cloud-based TV apps and mobile services could result in a whole new range of personalised experiences. To thrive in this complex new ecosystem, broadcasters must adapt fast to changing consumer needs, as well as reimagining how they operate. Legacy capabilities built around silos will not provide the strategic agility broadcasters need to move rapidly to meet consumer demands for content. Nor will they provide the capabilities needed to compete with most recent businesses (such as Netflix) that have, from the outset, built their organizations around new technology and data-driven insight.

During the last years, we have seen an increase in mergers between ISPs and television production companies (such as NBC Universal and Comcast). When companies merge, there will inevitably be benefits and costs to the industries and consumers affected by the mergers, which consequently reshape the industry.

Figure 34: Value Chain Movements⁷²



Vertical integration is simply a method for ISPs and CAPs to survive and a method for them to evolve over time. The effects on end-users are high because these actions have both static and dynamic effects. The decrease in competition as a result of these collaborations can lead to higher prices. It could also consequently influence the demand in CAP services.

As they have the resources to develop the Internet networks, they are able to fit into the market. And because they can purchase content from others using those revenues, it is likely that the companies will either change their business models or they will lose their production sides.

5.3.2 Integration and substitution of services

Services such as email, instant messaging and social networking sites, all of which offer alternatives to voice calls originating on fixed and mobile networks, have proved popular as take-up of mobiles, smartphones and fixed broadband has become common. As these services are providing mostly the same services, we are seeing a substitution of services of traditional networks to services provided over the top. All of this makes it imperative for operators to leverage their core strengths and drive the wave of OTT-Telco partnerships, which can lead to powerful services that can be monetized.

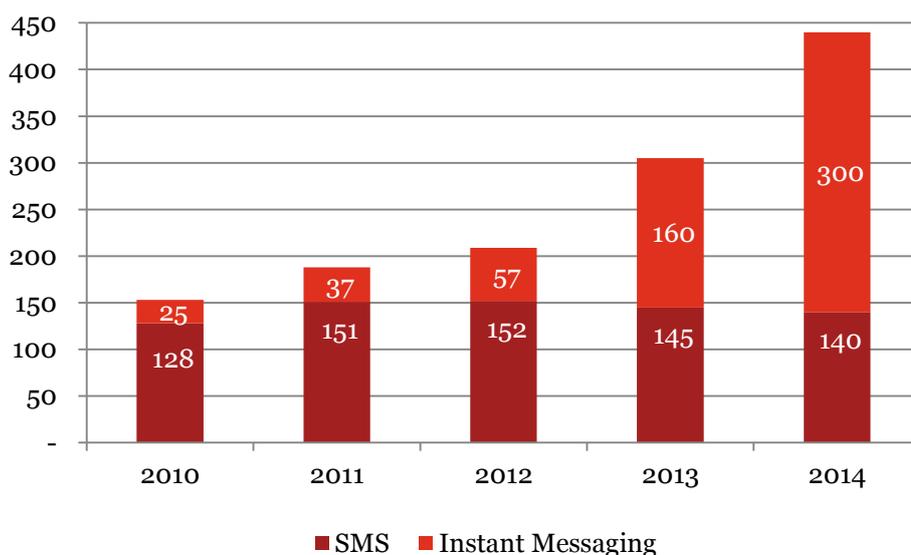
⁷¹ http://www.nytimes.com/2015/01/21/business/media/netflix-earnings.html?_r=0

⁷² *Over-the-Top Video- "First to Scale Wins"* (Taga, et al., 2012)

A new tendency in the industry is “**Cord-Cutting**”. This refers to the principle of “cutting” extensive TV cable to switch to free broadcast through antenna or over-the-top broadcast on Internet (e.g. Netflix and Apple TV). In North America, Subscribers who exhibit “cord-cutting” behaviour consume on average 212GB a month. These “cord cutters” consume an average of 100 hours of video a month and account for 54% of total traffic consumed each month⁷³. This trend is recent and has mostly been seen in the US (by people 25 to 34 years old) where many different alternatives are available⁷⁴. Recently, it has also been observed in Europe with a decline in overall pay TV uptake, while previously Europe has had fewer issues with this trend because of its generally lower pay TV uptake. The regions where the problem was most present were the Benelux and the Scandinavian markets⁷⁵. Some even claim that cord-cutting is also a reality in Europe now, with pay TV subscribers declining rapidly in a dozen countries. Cord-cutting in Europe is believed to be gaining ground due to the massive economic downturn as well as due to the impact of new technologies. However, the direct impact is believed to be originating from the entrance of OTT players such as Amazon and Netflix in the European markets⁷⁶.

An important trend is the decrease in text messages which are slowly replaced by OTT messaging apps. Consumers' options for text-based communications are growing rapidly, and a number of low-cost and even free **alternatives** to SMS services are experiencing increased usage rates. Two different OTT alternatives have emerged: OS-specific communication systems such as iMessage and BlackBerry Messenger (which are also slowly becoming cross-platform through applications), and third-party applications such as WhatsApp and Kakao Talk, which are cross-platform services. Generally speaking, both sets of applications promise a **richer user experience** (text, picture, video, location sharing, translation services, etc.) at a price substantially lower than traditional SMS messaging (especially for roaming – international text).

Figure 35: UK Messaging Volumes and Forecasts to End 2014⁷⁷



In a study of McKinsey⁷⁸, they found that the drivers for consumers to switch from SMS to OTT are: technology readiness, cost incentive to adopt OTT, social propensity to adopt OTT, strength of OTT alternative:

⁷³ *The State of Broadband 2014: Broadband for all (The Broadband Commission, 2014)*

⁷⁴ <http://www.cnet.com/news/cord-cutter-wannabes-are-still-a-small-group-but-growing>

⁷⁵ http://www.broadbandtvnews.com/2014/08/19/cord-cutting-has-arrived-in-12-euro-markets/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+broadbandtvnews+%28Broadband+TV+News%29

⁷⁶ <http://www.digitaltveurope.net/219052/cord-cutting-takes-hold-in-europe/>

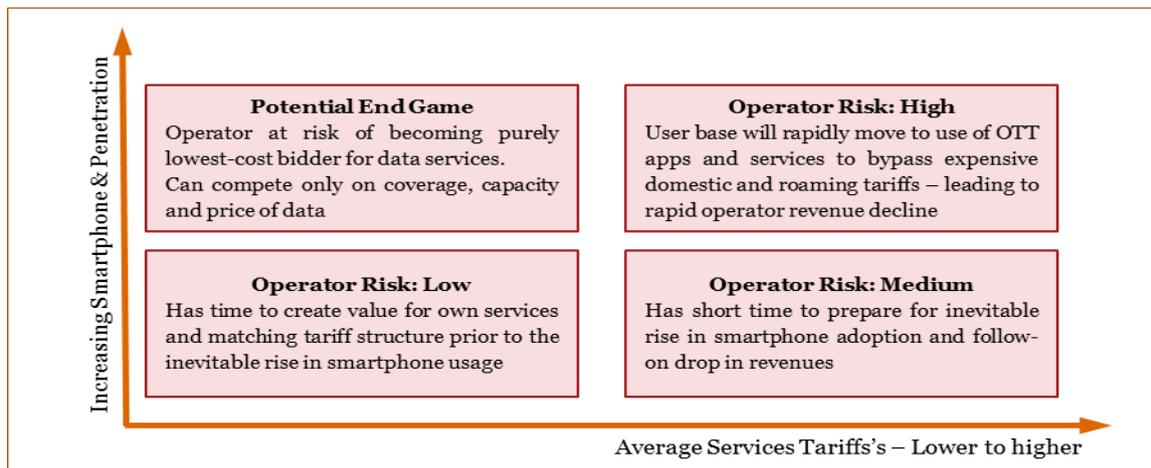
⁷⁷ *Technology, Media & Telecommunications Predictions (Deloitte, 2014)*

⁷⁸ *The future of mobile messaging: Over-the-top competitors threaten SMS (McKinsey, 2014)*

Figure 36: Drivers of the shifts from SMS to OTT messaging ⁷⁹

Driver Group	Leading indicators or rapid SMS decline
Technology readiness	<ul style="list-style-type: none"> • 3G or better network which enables accessibility and speed of OTT communications • Smartphone penetration at a high enough level to enable wide distribution of OTT apps
Cost incentive to adopt OTT	<ul style="list-style-type: none"> • Consumers given the opportunity to arbitrage data and SMS costs • High cost of SMS incentivizes the switch to inexpensive OTT
Social propensity to adopt OTT	<ul style="list-style-type: none"> • Strength of carrier handset control, indicating the influence carriers possess over applications • Relative mix of smartphones in youth aged 13-24 years
Strength of OTT alternative	<ul style="list-style-type: none"> • Significant market penetration by a given OTT app • Concentration of a single OS platform with integrated IM (e.g. iPhone or Blackberry)

Figure 37: Risk of SMS replacement by OTT services



5.3.3 Specialised services

Some providers of electronic communication services offer **specialised services**, which differ from (public and best effort) Internet access services in that they provide a generally guaranteed quality of service and strict admission control. These are services provided in parallel with, but separated from, the Internet access service. There are quite different national situations, varying from none to all operators offering specialised services in parallel to offering Internet best-effort access services.

When we talk about specialised services, it is important to distinguish between OTT services produced by independent CAPs and provided over the Internet and accessed by end-user via their Internet Access Services (IAS), versus specialised services produced by the ISP and accessed by end-users in parallel with, but separated from, IAS. This is also referred to as “**the two lanes**”. There is increased debate about the degrading of quality of service of the classical OTTs over IAS due to specialised services being prioritised for traffic capacity and enhanced quality. Consequently, there are disputes about the degradation of services and the hindering or slowing down of traffic over networks.

Specialised services already exist today through VoIP and IPTV. However, they can also be used to provide new services.

⁷⁹ The Future of Mobile Messaging: Over-the-Top competitors threaten SMS (2012)

✦ Specialised services produced by the ISPs

Recently, there has been a huge debate about Internet providers allowing **offering certain specialised services at a higher price** – e.g. video on demand and data-intensive cloud applications for businesses – as long as these are not supplied to the disadvantage of others. Reports claim that ISPs have been blocking or slowing down services of Skype and Netflix with an estimated 100 million users being affected as a consequence of these actions.

The underlying reason **operators are offering such services is to compete with CAPs** and offer OTT traffic through specialised services such as video on demand and business-critical data-intensive cloud applications. They do this by clocking content that compete with their own (that also occupy a lot of traffic on their networks e.g. BBC iPlayer or Netflix, without paying for the end-user's ISP), so they can begin to market a 'specialised service' unblocked lane to companies such as Skype that might pay for the extra service. Operators increasingly provide their own services as a response to lucrative CAP offerings in order to gain some ground and market share in services offered to end-users. This is broadly considered to be a strategically "necessary" move by operators in order to survive.

✦ Cases of operators' responses

OTT communications services are those that offer competing or substitutive products to users of telecom operators reducing profit and involvement of the operator while using their infrastructure.

Next generation over-the-top (OTT) services have generated significant media attention given the recent spate of acquisitions and venture capital funding. WhatsApp, Snapchat, Kakao and Line are a few of the specialized OTT IP messengers that have disrupted the market. In some cases, these OTT services have shown strong adoption curves and higher user engagement than default voice and data services provided by operators. For example, WhatsApp has an average daily usage of 18.3 minutes, compared to Facebook's 18.1.

With large internet companies like Google, Facebook and Microsoft also trying to drive user adoption, it is no wonder that an estimated 55% of smartphone users worldwide were active users of IP messaging services at the end of 2013.

Worldwide, operators are responding to OTT in a variety of ways. The paths that operators are choosing to take are:

1. Blocking OTT services: Preventing OTT from becoming mainstream by either banning services completely (Viber, for example, is illegal in Saudi Arabia) or selectively blocking it. This might mean throttling or permitting access for an additional fee. Our experience has shown that blocking is typically counterproductive to operators because it alienates customers and drives them to use workarounds. It might also lead to regulatory intervention because of net neutrality violations.

2. Partnering with OTT players: Partnerships are becoming increasingly common. 3 in HK has a partnership with WhatsApp, DiGi in Malaysia offers unlimited Skype on some tariff plan. Newer operators with less to lose in legacy services find it easier to partner to gain market share among the young, data-centric user base. Recently, Bharti Airtel was reported to have inked a deal with WhatsApp to provide 200 MB of WhatsApp data in various circles between the price of Rs 36 and Rs 49.

3. Stimulating legacy services: Strong usage levels of legacy services offer a cushion against substitution, so operators stimulate the use of voice and text by offering better pricing or bundling them with other products. Some operators in France see little threat of substitution from the likes of WhatsApp price reductions, supported by high availability of unlimited bundles reduce consumer motivation for adopting OTT alternatives.

4. Creating default substitutes to OTT services: RCS (Rich Communication Services) is a set of specifications produced by the GSMA that provides chat features and file sharing while integrating with the users address book. It is intended to be a default IP messaging communications service and aims to remove

the need for downloading and installing apps. Claro in Latin America, T-Mobile in Germany and Telefonica in Spain are a few of the operators that offer RCS VoLTE is a part of the RCS suite, and aims to make a meaningful impact on the market. With RCS, operators can combat increasingly popular OTT services such as Skype and Facebook Messenger.

5. Launching Telco OTT services: Proprietary Telco OTT services could range from Voice over Wi-Fi to IP messaging apps. TU Go by Telefonica is a Voice over Wi-Fi app. MBuddy was launched recently by Sistema Shyam in India to take on WhatsApp on feature phones, with plans to introduce audio and file sharing soon to cater to smartphone users. These services have the advantage of being backed by the operator and help retain their relevance as a provider of communication services

Figure 38: Operators are responding by offering IP-based messaging services and are adopting three main approaches⁸⁰ (Sandvine, 2014)

RCS	Telco-OTT	Partnerships
<ul style="list-style-type: none"> • RCS is the industry's official response. It is specified by the GSMA • The feature set currently comprises: <ul style="list-style-type: none"> • Messaging and group chat • Address book integration • Capability discovery • In-session file sharing, including video • RCS is intended to be offered as a native capability on handsets, but is also offered as a downloadable app • The service is typically rolled out as a coordinated operator response with interoperability as a marketable feature • This approach is gaining momentum in markets where SMS is under strong pressure and the argument for self cannibalisation is easier to make. 	<ul style="list-style-type: none"> • Telco-OTT services are proprietary services offered by operators following an OTT model • Services are either developed in-house or offered using a white label service. They may or may not use the IMS core • Many operators are using Telco-OTT to address specific market niches that are seen as vulnerable to substitution • The service is typically offered separately from the core operator proposition • Some of the major players are experimenting with both RCS and Telco-OTT approaches 	<ul style="list-style-type: none"> • While not widespread in Western Europe, some operators are forming partnerships with providers of alternative messaging services • The standard approach is to zero rate traffic associated with specific applications in some bundles • The brand strength of the partner is chiefly used to support the operator's data proposition than bolster the existing messaging service • The partnership approach particularly appeals to smaller, disruptive players with less exposure in legacy voice and messaging revenue

⁸⁰ Global Internet Phenomena Report (Sandvine, 2014)

6 Conclusion

Based on our findings throughout this report, we can conclude that the net neutrality debate is indeed a very complex one. Due to the various complicated characteristics and elements of the Internet ecosystem, it is important to understand the motivations and underlying reasons behind the behaviour of various players.

So have we discovered that consumers want more freedom on the Internet, accessing any content, any time and anywhere they want, putting a particular emphasis on mobility. At the same time, they want the highest possible quality and speeds available. Consumers use increasingly more (and multiple) devices for their online activities, with online video and audio streaming dominating as their most traffic generating activity. Additionally, with the mega-trend of IoT consumers will demand even more from ISPs and CAPs. Their online behaviour will continue to evolve and pose challenges to both CAPs and ISPs to meet these demands, in terms of content and connectivity.

Detecting these trends, CAPs try to move closer to end-users for better quality of services and improved/rich experiences, as these are the elements consumers most value. However, there have been some incidents where CAPs believe they have been disadvantaged by operators by slowing down or blocking their services. This caused a global debate on net neutrality, but especially in the US and Europe.

The massive amounts of traffic generated by consumers together with the data rich content and services CAPs supply, poses challenges for operators since they have a limited capacity and bandwidth to serve everyone all the time at the highest possible speeds. Considering their profitability in the sector, operators try to re-establish their role in the ecosystem by partnering with CAPs and charge them for priority treatments and assurance on quality delivery of their contents and services. Operators allege they need a fair share of the pie⁸¹. They also manage their infrastructure and bandwidth capacities. ISPs see this as a strategic necessity in order to survive. Consequently, the industry has seen increased responses from CAPs and ISPs

Whether the Internet as we know it will remain the same and true to its early-day nature is a big question that will have to be answered. Already, our findings show that Internet use, the ecosystem characteristics and dynamics, responses to demand and global drivers and trends on consumer Internet have changed dramatically. The Internet moved from being a nice-to-have place to become a mission-critical platform, hence the high stakes at play and importance of this subject to various parties. Given that the United States is at the core of most developments, the FCC vote on net neutrality rules in February 2015 will further influence how the true nature and ecosystem of the Internet will further evolve, with consequences spreading across the globe.

⁸¹ BEREC had critically assessed these claims its comments in BoR (12) 120 rev.1,
http://berec.europa.eu/files/document_register_store/2012/11/BoR_%2812%29_120_BEREC_on_ITR.pdf

7 Annex

7.1 Regions covered Western, Central and Eastern Europe⁸²

➤ Western Europe



➤ Central and Eastern Europe



⁸² http://www.cisco.com/web/solutions/sp/vni/vni_forecast_highlights/index.html

7.2 Mobile Internet Speeds

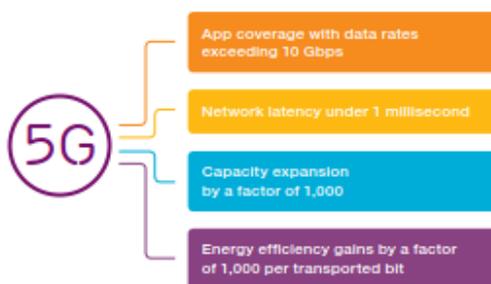
5G – EMBRACING A NETWORKED SOCIETY

Wireless networks will soon be used across industry and society in many ways beyond voice and mobile broadband.

5G will bring together the evolved versions of existing radio-access, cloud and core technologies with some

new complementary ones. It will be able to cater for thousands of new use cases, as well as more traffic, more devices and more types of devices – even those with different operating requirements. The emergence of 5G will bring much more than performance enhancements.

Wireless networks were originally built to provide voice and messaging, and offered limited data connectivity. With the introduction of 3G services and smart devices mobile broadband became more widely available, allowing people to stream music and video, surf the web and engage in social media. 4G has been about scaling up and enhancing the mobile broadband experience. 5G will need to meet new performance levels. Current plans envision:



While these improvements are truly impressive, they do not begin to convey the full impact of 5G. To a large extent, the evolution of mobile technology has been driven by requirements for faster and better mobile broadband services – e.g. data rates have increased from 10 Kbps to 1 Gbps, a factor of 100,000. Improved mobile broadband is still part of the impetus behind 5G; however it is by no means the only driver.

Much of the focus will be on enhancing wireless systems with functionality that allows them to address the new and interesting use-cases that will emerge by 2020 and beyond. Examples include:

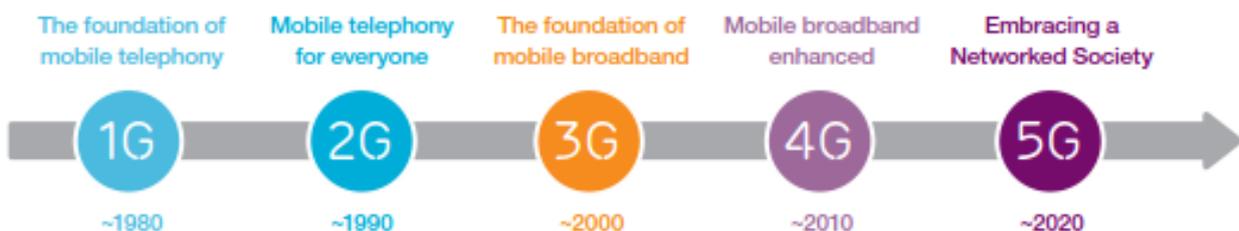
-  Advanced enterprise applications
-  Critical machine-type communication: Remotely controlling machinery in hazardous environments
-  Media: Mass-market personalized TV
-  Massive machine-type communication: Connecting massive numbers of sensors and other embedded devices, designed so that batteries can last 10 years or more

Separate systems cannot be built for each of the potential use cases for wireless connectivity. Instead, a very flexible 5G system should be built which could be configured to provide connectivity simultaneously to a wide range of application types, each with a different set of characteristics and requirements. Thus, in the 5G era an operator will need only one physical network infrastructure to support many separate network slices (virtual networks), catering for multiple disparate applications running in parallel.

Taking advantage of these opportunities will require new functionality. For example, many machine-to-machine applications will require enhancements:

- > In the air interface to enable very long battery life for connected devices

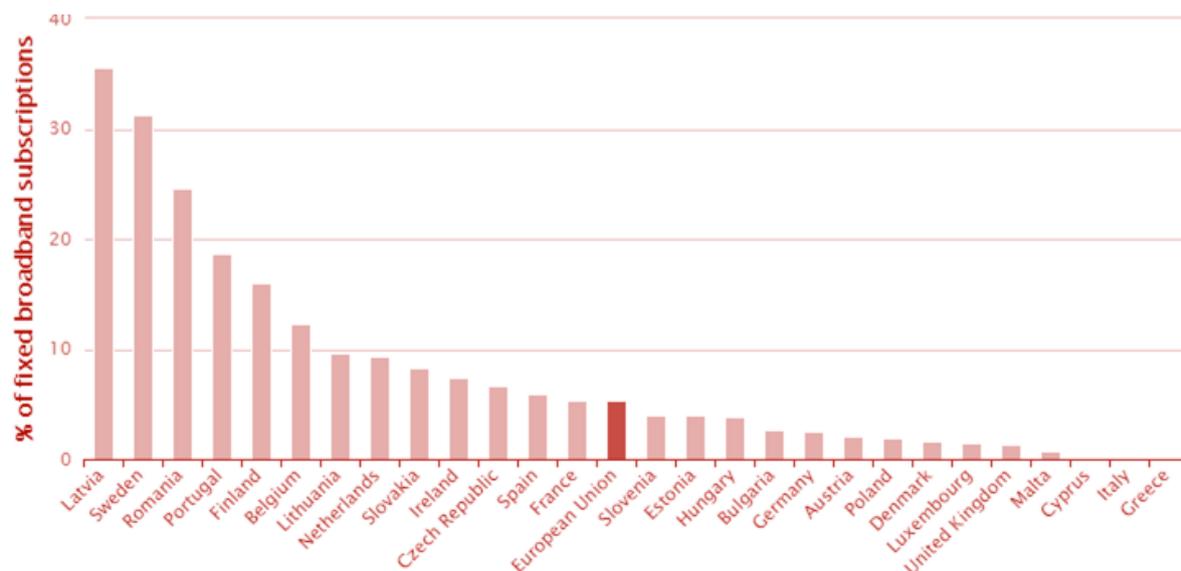
Wireless access generations



7.3 Broadband speeds and prices

When we look at broadband speeds and prices in Europe, we can see massive discrepancies between Member States. Fixed broadband subscriptions at >2Mbps (at advertised download speed) are above 97% in the EU (on average). When we look at speeds >= 10 Mbps, we can already see that the EU-average is at lower levels: 66.4% share of fixed broadband subscriptions. While countries such as Cyprus and Italy score low (below 25%), Member States such as Bulgaria, France and Portugal score very high with especially Bulgaria having near 95% rates. In the category of >= 30 Mbps the European Union average is at 20% levels, with Belgium standing out with the only nation having a share of fixed broadband subscriptions above 60%. Finally, the share of fixed broadband subscriptions >= 100 Mbps are at 5.3%, with Latvia and Sweden being the only countries surpassing the 30% level.⁸³

Figure 39: Share of fixed broadband subscriptions >= 100 Mbps – Advertised Download Speed (Dec 2013) EU



Based on the above speed categories, the price breakdowns (minimum price in euro) also show large differences in various categories as presented below:

Figure 40: Monthly price differences in standalone and bundled Internet access - 2014⁸⁴

	Monthly price of standalone Internet access			Monthly price of Internet + Telephony + TV		
	Price Per Month (EU Average)	Highest	Lowest	Price Per Month (EU Average)	Highest	Lowest
Advertised Speed						
Above 8 and up to 12 Mbps	€23.7	€47.2 (Luxembourg)	€10.9 (Lithuania)	€50.4	€91.3 (Latvia)	€25.8 (Estonia)
Above 12 and up to 30 Mbps	€22.6	€47.4 (Cyprus)	€12 (Lithuania)	€44.3	€87.6 (Norway)	€23.8 (France)
Above 30 and up to 100 Mbps	€29	€64.7 (Cyprus)	€11.5 (Lithuania)	€47.2	€86.2 (Norway)	€23.8 (France)
Above 100 Mbps	€54.9	€138.4 (Austria)	€19.5 (Latvia)	€76.5	€129.5 (Portugal)	€29.8 (Latvia)

⁸³ EU Digital Agenda Scoreboard 2014

⁸⁴ EU Digital Agenda Scoreboard 2014

As it can be seen from the above table, there are enormous price differences between nations at various speed levels. Especially, the average prices and the difference in prices across nations are higher in countries offering broadband speeds above 100Mbps. In comparison, prices for advertised speeds between 8 and 100 Mbps are relatively similar.

Furthermore, when we take a look at actual fixed broadband download speeds we can see that based on the technology deployed, there are some noteworthy differences. Looking at xDSL technology, cable modem, and fibre to the x, we can notice that especially with xDSL technology the actual download speeds are lower than advertised speeds.

Figure 41: Actual download speed of fixed broadband subscriptions 2013 – xDSL Technology

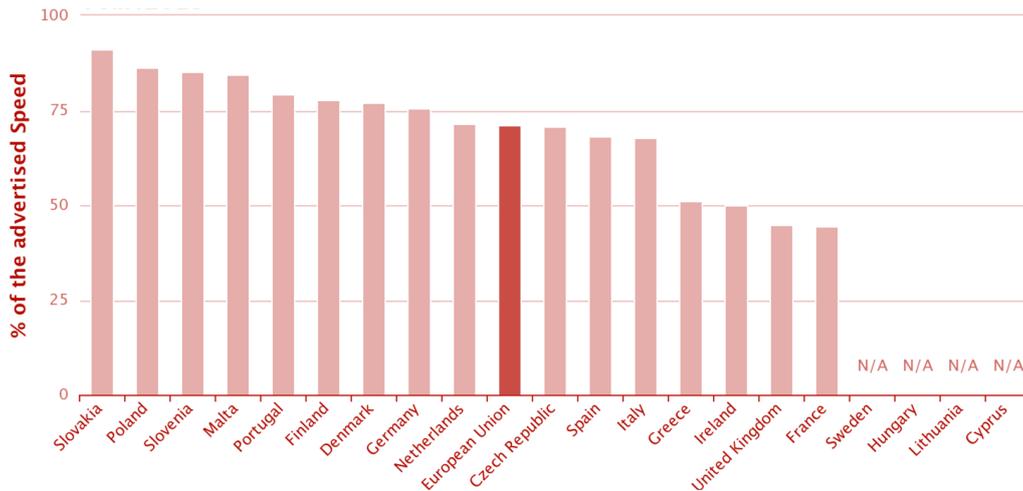
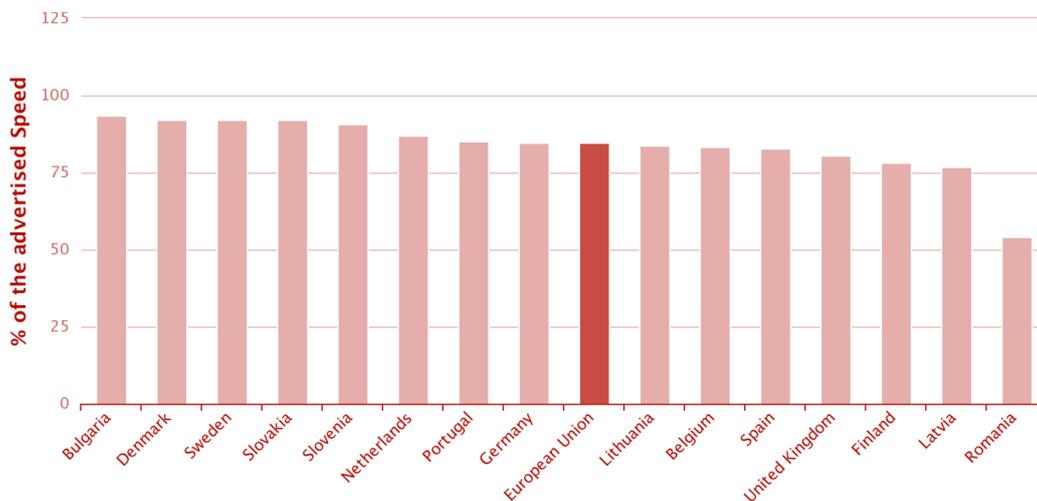


Figure 42: Actual download speed of fixed broadband subscriptions 2013 - Fibre to the x



7.4 Internet Ecosystem Actors⁸⁵

- ✓ **Technologists, engineers, architects, organizations** such as the Internet Engineering Task Force (IETF) and the World Wide Web Consortium (W3C) who help coordinate and implement open standards;
- ✓ **Global and local Organizations** that manage resources for global addressing capabilities such as the Internet Corporation for Assigned Names and Numbers (ICANN), including its operation of the Internet Assigned Numbers Authority (IANA) function, Regional Internet Registries (RIR), and Domain Name Registries and Registrars;
- ✓ **Operators, engineers, and vendors** that provide network infrastructure services such as Domain Name Service (DNS) providers, network operators, and Internet Exchange Points (IXPs);
- ✓ **Internet Users** who use the Internet to communicate with each other and offer services;
- ✓ **Educators** that teach others and build capacity for developing and using Internet technologies, such as multilateral organizations, educational institutions, and governmental agencies;
- ✓ **Policy and Decision Makers** that provide local and global policy development and governance.

⁸⁵ <http://www.internetsociety.org/internet/who-makes-it-work>