ERICSSON

ERICSSON MOBILITY REPORT

ON THE PULSE OF THE NETWORKED SOCIETY

NOVEMBER 2014

KEY FIGURES

*Using active VLR subscriptions for India
**Monthly data traffic volumes by year end
***Active devices

Mobile subscription essentials	2013	2014	2020 forecast	CAGR 2014–2020	Unit
Worldwide mobile subscriptions*	6,700	7,100	9,500	5%	million
> Smartphone subscriptions	1,900	2,700	6,100	15%	million
> Mobile PC, tablet and mobile router subscriptions	250	300	650	15%	million
> Mobile broadband subscriptions	2,200	2,900	8,400	20%	million
> Mobile subscriptions, GSM/EDGE-only	4,200	4,000	1,100	-20%	million
> Mobile subscriptions, WCDMA/HSPA	1,600	2,000	4,400	15%	million
> Mobile subscriptions, LTE	200	400	3,500	45%	million

Traffic essentials**	2013	2014	2020 forecast	CAGR 2014–2020	Unit
> Monthly data traffic per smartphone***	700	900	3,500	25%	MB/month
> Monthly data traffic per mobile PC***	3,300	4,300	15,000	25%	MB/month
> Monthly data traffic per tablet***	1,400	1,900	7,600	25%	MB/month
Total monthly mobile data traffic	2	3.2	25	40%	EB/month
Total monthly fixed data traffic	40	50	140	20%	EB/month

Mobile traffic growth forecast	Multiplier 2014–2020	CAGR 2014–2020
All mobile data	8	40%
> Smartphones	8	40%
> Mobile PC	3	20%
> Tablets	15	60%

Traffic exploration tool and regional appendices
Create your own graphs, tables and data using the Ericsson Traffic Exploration Tool. The information available here can be filtered by region, subscription, technology, traffic and device type. You may use generated charts in your publication as long as Ericsson is stated as the source.

To find out more, scan the QR code, or visit www.ericsson.com/ericsson-mobility-report

There, you will be able to access regional appendices for North America, Latin America, Europe, North East Asia and South East Asia and Oceania.

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ERICSSON MOBILITY REPORT

The number of mobile subscriptions worldwide grew approximately 6 percent year-on-year during Q3 2014.

The number of mobile broadband subscriptions grew even faster – at a rate of 30 percent year-on-year, reaching 2.5 billion and data usage per subscription also continued to grow steadily. 65–70 percent of all mobile phones sold in Q3 2014 were smartphones. Together, these factors have contributed to a 60 percent growth in mobile data traffic during the 12 months following Q3 2013.

Our forecasts on subscriptions, subscribers and traffic up to 2020 show continued strong growth. By 2020, 90 percent of the world's population over 6 years old will have a mobile phone. Furthermore, 5G is expected to be commercially deployed in 2020. 5G will combine evolved versions of existing radio access, cloud and core with new complementary technologies, enhancing performance and supporting thousands of new use cases.

Video continues to dominate mobile networks. In 4G-dominated networks it typically constitutes 45–55 percent of mobile traffic. This is driven by increased usage of video streaming and mobile video experience improvements.

Ericsson ConsumerLab research shows that consumers expect instant internet access whether they are indoors or outdoors. There is a willingness among users to pay for improved connectivity in both cases.

Our article on the signatures of city life examines similarities and differences in device usage in mobile traffic patterns in different areas of three cities. It shows that census-based analysis of a city's structure can be complemented with traffic-based land use detection.

We hope you find this report engaging and valuable.

Publisher: Rima Qureshi
Senior Vice President,
Chief Strategy Officer

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MOBILE SUBSCRIPTIONS Q3 2014

The total number of mobile subscriptions in Q3 2014 was around 6.9 billion. This included the addition of 110 million new subscriptions during Q3.

Global mobile subscriptions are growing by 1.6 percent quarter-on-quarter and 6 percent year-on-year. Global mobile penetration reached 95 percent in Q3 2014.

Around the world, smartphone uptake has continued at a strong pace. These devices accounted for 65–70 percent of all mobile phones sold in Q3 2014, compared to around 55 percent during Q3 2013. And it doesn't show any sign of slowing down. Of all mobile phone subscriptions today, around 37 percent are associated with smartphones, leaving considerable room for further uptake.

Global mobile broadband subscriptions are growing by around 30 percent year-on-year and reached 2.5 billion in Q3 2014.

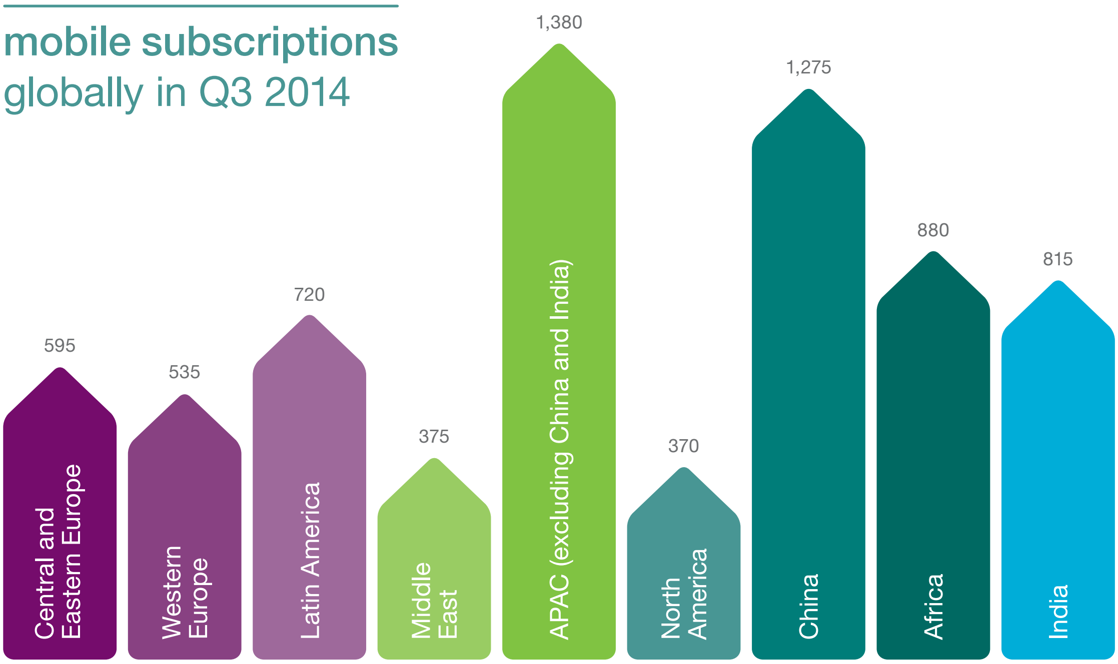
LTE continues to grow strongly and has reached 350 million subscriptions, with around 50 million additions in Q3 2014. WCDMA/HSPA had the highest net additions during the quarter at around 85 million. Almost all of these 3G/4G subscriptions have access to GSM/EDGE as a fallback. The number of GSM/EDGE-only subscriptions declined by 10 million (0.2 percent).

2.5 BILLION

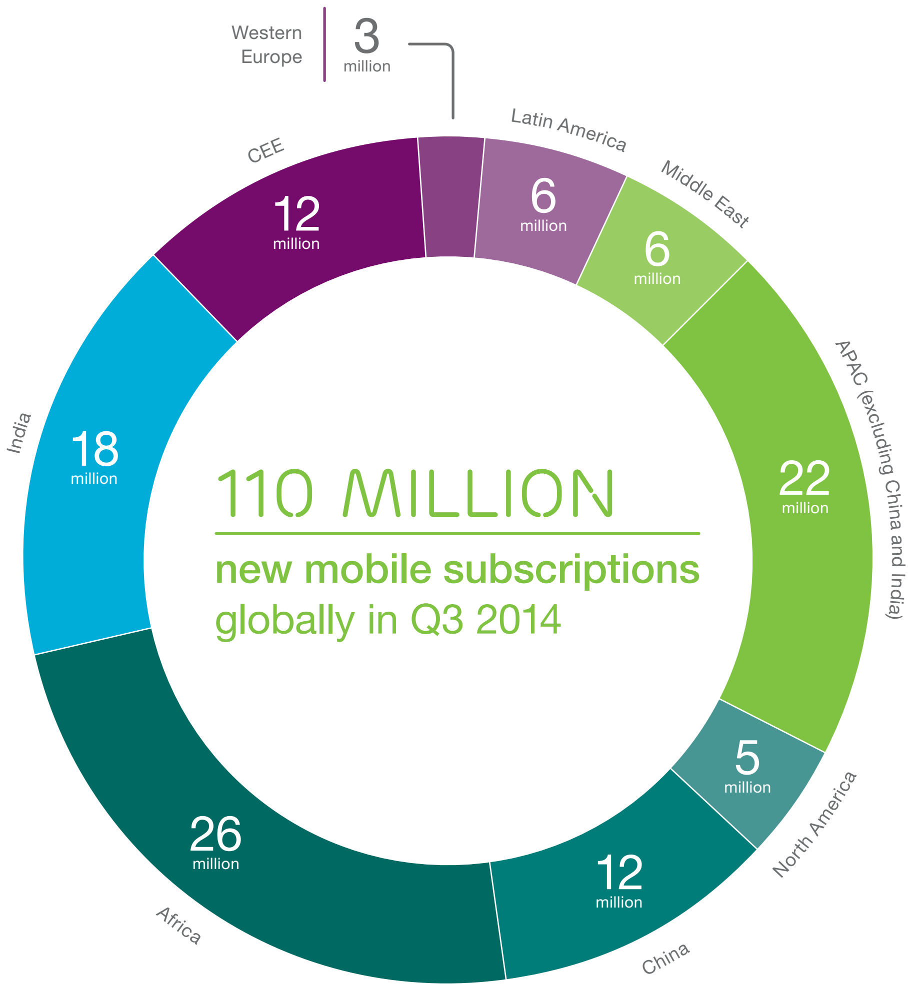
mobile broadband subscriptions globally in Q3 2014

6.9 BILLION

mobile subscriptions globally in Q3 2014

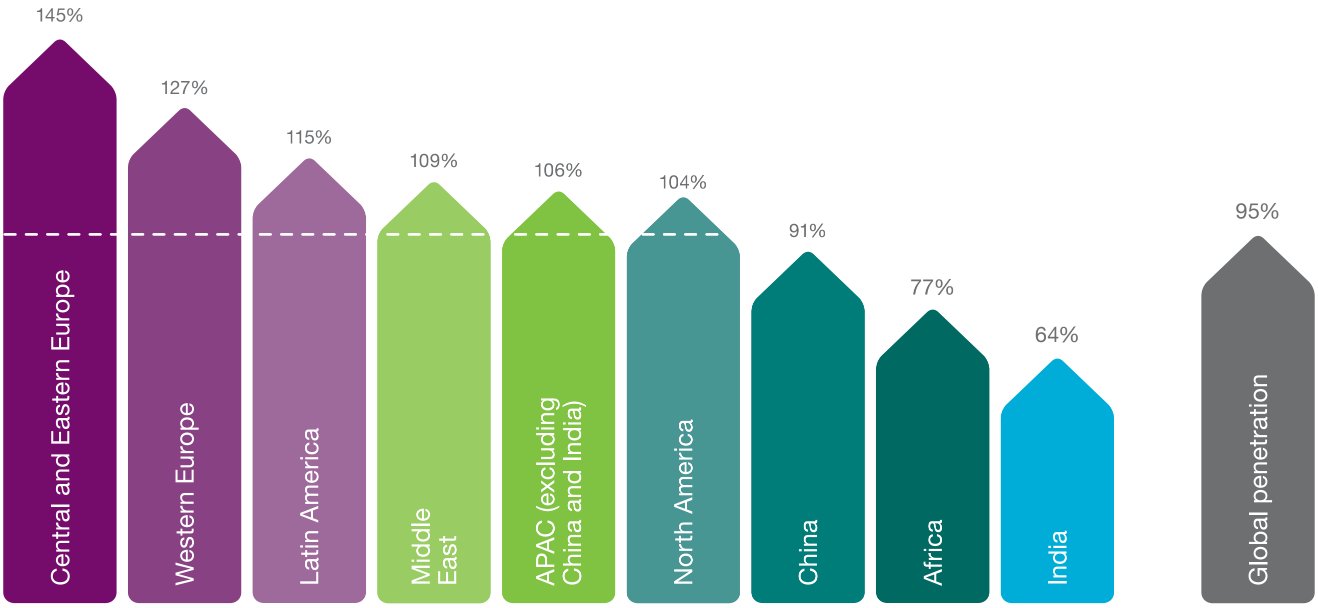


Mobile subscriptions (million)



Top 5 countries by net additions

India	+18 million
China	+12 million
Indonesia	+5 million
Russia	+4 million
USA	+4 million



Penetration

MOBILE SUBSCRIPTIONS OUTLOOK

Today, the majority of total mobile subscriptions are still for basic phones. However this is rapidly changing, and by 2016 the number of smartphone subscriptions will exceed those for basic phones as they become increasingly affordable in developing markets.

Subscriptions	2014	2020
Total mobile	7.1 billion	9.5 billion
Mobile broadband	2.9 billion	8.4 billion
Smartphones	2.7 billion	6.1 billion
Mobile PCs, tablets and routers	300 million	650 million
Cellular M2M	230 million	800 million

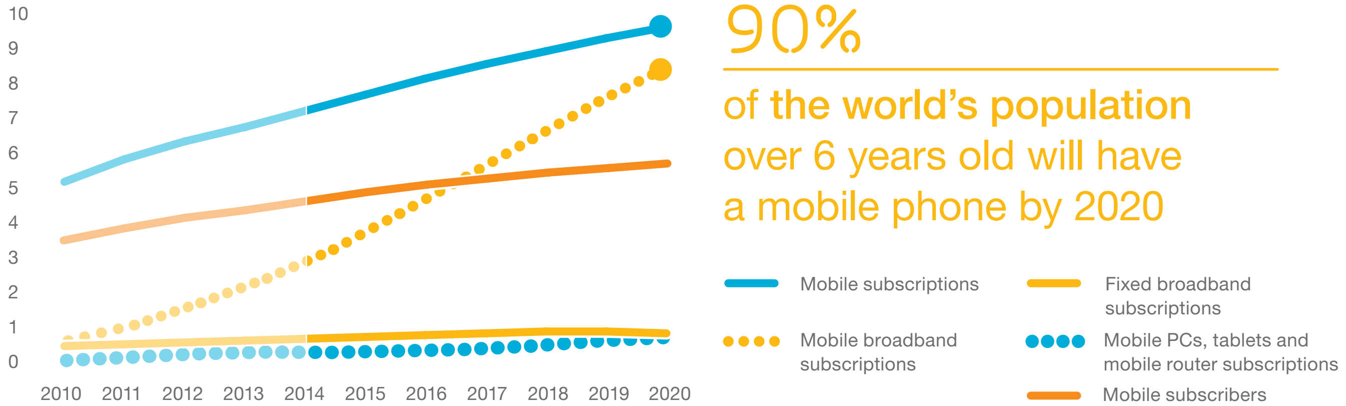
Smartphones make up the majority of mobile broadband devices today and subscriptions are expected to more than double by 2020.

By the same year, WCDMA/HSPA will make up the majority of all subscriptions and LTE will have been rolled out in all regions. GSM/EDGE networks will continue to play an important role in providing complementary network coverage in all markets. 5G subscriptions will be commercially available in 2020, and the subscriptions uptake is expected to be faster than for 4G. This growth will be driven to a large extent by new use cases, especially machine-type communications.

One of the main reasons for the rapid growth in smartphone subscriptions is that subscribers in Asia Pacific, the Middle East and Africa are exchanging their basic phones for smartphones. This is partly due to the increased availability of lower cost smartphones.

The number of subscriptions exceeds the population in many countries, primarily because not all subscriptions are active, but also because subscribers may have multiple devices – e.g. for business and private use, or to optimize pricing by using different operators for different calls (this is common in parts of Africa). In developed markets users add secondary devices such as tablets. This means that the number of subscribers is lower than the number of subscriptions – the current figures are around 4.6 billion subscribers versus 6.9 billion subscriptions.

Subscriptions/lines, subscribers (billion)



In the future there will be regional differences – for example the number of smartphone subscriptions in relation to population in Europe will be around 95% by 2020, while in the Middle East it will be 55 percent.

Many PCs and tablets are used without a mobile subscription, one reason being the price difference between Wi-Fi only models and those with mobile capabilities. Despite this, the number of these devices with a subscription will more than double by 2020.

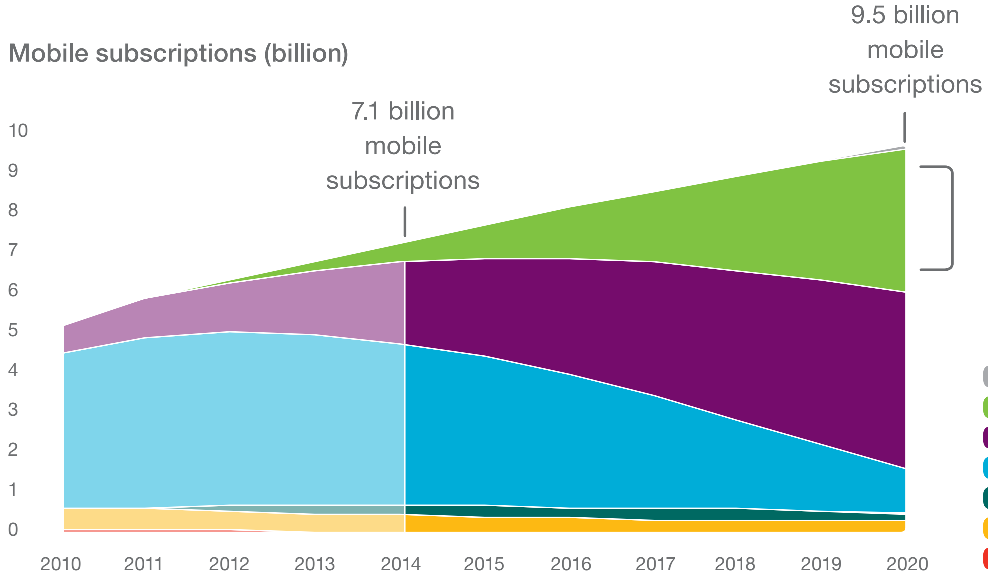
9.5 BILLION

mobile subscriptions
by the end of 2020

90%

of the world's population over 6 years old will have a mobile phone by 2020

Mobile subscriptions (billion)



3.5 BILLION

LTE subscriptions by the end of 2020

Mobile subscriptions by technology

WCDMA/HSPA will make up the majority of all subscriptions in 2020, with around 4.4 billion subscriptions, compared to around 3.5 billion LTE subscriptions.

GSM/EDGE-only represents the largest share of mobile subscriptions today. In developed markets, there has been a substantial migration to more advanced technologies, and on a global level this has resulted in a slight decline in GSM/EDGE-only subscriptions.

However, GSM/EDGE remains an option for many in developing markets, as less affluent users are likely to choose a low-cost mobile phone and subscription.

Mobile broadband

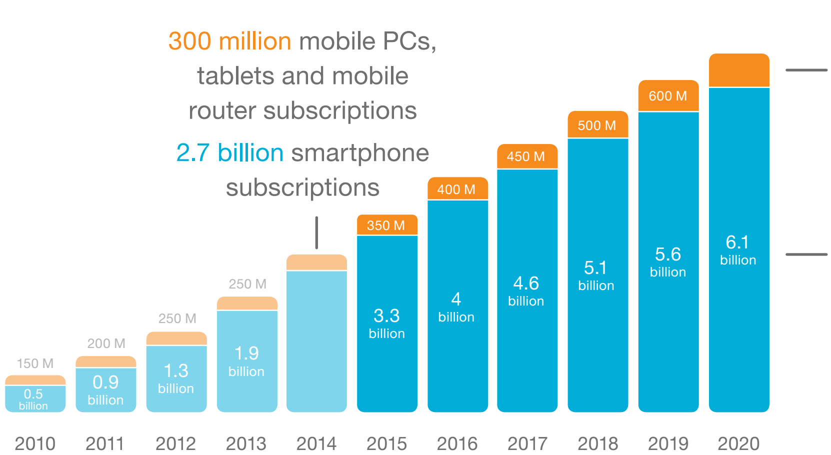
Global mobile broadband subscriptions are predicted to reach 8.4 billion by 2020, accounting for a larger share of all broadband subscriptions in many markets. Mobile broadband will play a complementary role alongside fixed broadband in some segments, and replace it in others.[1]

Most mobile broadband devices are, and will continue to be, smartphones. Many consumers in developing markets first experience the internet on smartphones – usually because they have only limited access to fixed broadband.

~90%

of **mobile subscriptions** will be for mobile broadband by the end of 2020

Smartphones, mobile PCs, tablets and mobile routers with a cellular connection



6.1 BILLION

smartphone subscriptions by the end of 2020

Mobile PCs, tablets and mobile router subscriptions

Smartphone subscriptions

[1] The number of fixed broadband users is at least three times the number of fixed broadband connections, due to multiple usage in households, enterprises and public access spots. This is the opposite of the mobile phone situation, where subscription numbers exceed user numbers.

CELLULAR M2M OUTLOOK

Machine-to-Machine (M2M) communication is taking off, driven by reduced costs, improved coverage, more capable radio technologies, regulatory mandates and a growing range of successful applications and business models.

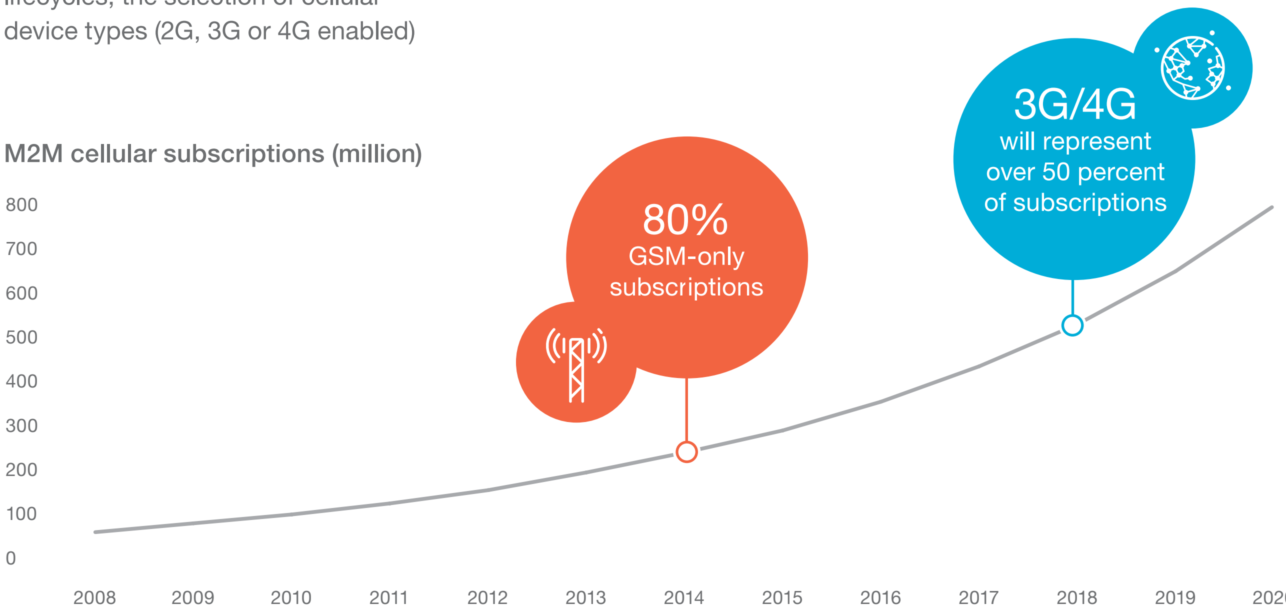
There will be around 230 million cellular M2M subscriptions by the end of 2014, and this number is expected to reach around 800 million by the end of 2020. Currently, almost 80 percent of M2M devices have GSM-only subscriptions. But that is about to change, with 3G/4G subscriptions expected to exceed 50 percent of active M2M subscriptions by 2018. M2M communications' share of total cellular traffic in terms of bytes is currently only around 0.1 percent.

Currently in North America, nearly all mobile devices are 3G or 4G, and the only 2G devices that are left are M2M. This will also be the case in Western Europe in two to three years' time. One reason for this is that the cheapest M2M modules are still GSM-only; these modules are used for low ARPU M2M subscriptions. Another reason is that many current M2M applications do not require high network speeds. A third explanation is that M2M applications often have long lifecycles. For example, a smart meter device may be intended to last for up to 20 years, in contrast to smartphones, which are typically replaced every 2–3 years. As M2M applications typically have long lifecycles, the selection of cellular device types (2G, 3G or 4G enabled) for new installations depends on a variety of factors, such as present and future connectivity needs and module cost.

Globally, almost 80 percent of M2M devices are GSM-only. Although the number of M2M devices on GSM will increase in absolute terms, the share of devices using this technology will decrease to around 25 percent in 2020. In 2018, it is expected that 3G/4G will represent over 50 percent of all active M2M subscriptions. LTE M2M device penetration is expected to increase from around 3 percent today to around 20–30 percent in 2020. By this time it will account for more than 40 percent of M2M shipments.

Today, M2M communication represents a very small share – around 0.1 percent – of total cellular traffic in terms of bytes. This traffic share will go up as LTE M2M devices and more powerful processors are included in the high bandwidth and low latency-demanding applications found in consumer electronics, vehicles and billboards. However it will most likely remain small. 5G subscriptions will be commercially available in 2020. 5G usage will be driven to a large extent by new use cases, especially machine-type communications.

M2M cellular subscriptions (million)



REGIONAL SUBSCRIPTIONS OUTLOOK

The number of mobile subscriptions is growing across all regions, but the underlying factors driving this increase are markedly different.

In developing regions growth is being driven by new subscribers, as phones become more affordable. By contrast, growth in mature markets is coming from the increasing number of devices per individual.

3G/4G share of subscriptions	2014	2020
North America	100%	100%
Western Europe	75%	100%
Central and Eastern Europe	50%	95%
Latin America	40%	95%
Asia Pacific	35%	85%
Middle East and Africa	20%	85%

Past mobile technology decisions and economic situations also have an impact on the uptake of subscriptions in different regions.

North America's rapid migration to LTE has already made it the region with the highest share of subscriptions for this technology in the world. By 2020 LTE will represent 80 percent of the region's subscriptions.

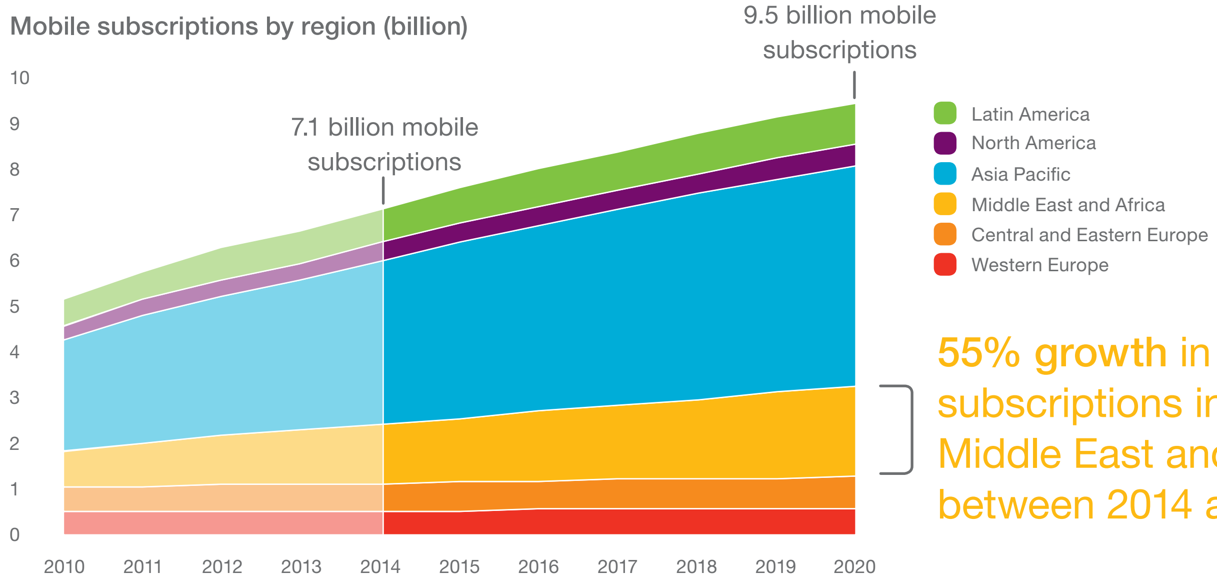
In Western Europe, the early roll-out of LTE and well-developed 3G networks have taken the region to the forefront of mobile broadband, with 65 percent of all subscriptions being WCDMA/HSPA. LTE is expected to make up around 75 percent of the subscription base by 2020.

The Asia Pacific, Latin America and Middle East and Africa regions will all move from being mainly GSM/EDGE-only subscriptions markets in 2014 to become mainly WCDMA/HSPA and LTE subscriptions markets by 2020.

Mobile subscriptions are continuing to grow across all regions. The increasing affordability of phones is complemented by operators' desire to optimize tariffs. They are launching services such as special sharing price plans for families, and providing multiple devices on one account. Another driver behind the trend towards multi-SIM ownership is the separation of private and business mobiles.

In 2014, mobile subscriptions in Asia Pacific, Latin America and the Middle East and Africa are mainly GSM/EDGE-only, while subscriptions in North America and Western Europe are mainly WCDMA/HSPA and LTE.

Mobile subscriptions by region (billion)



55% growth in mobile subscriptions in Middle East and Africa between 2014 and 2020

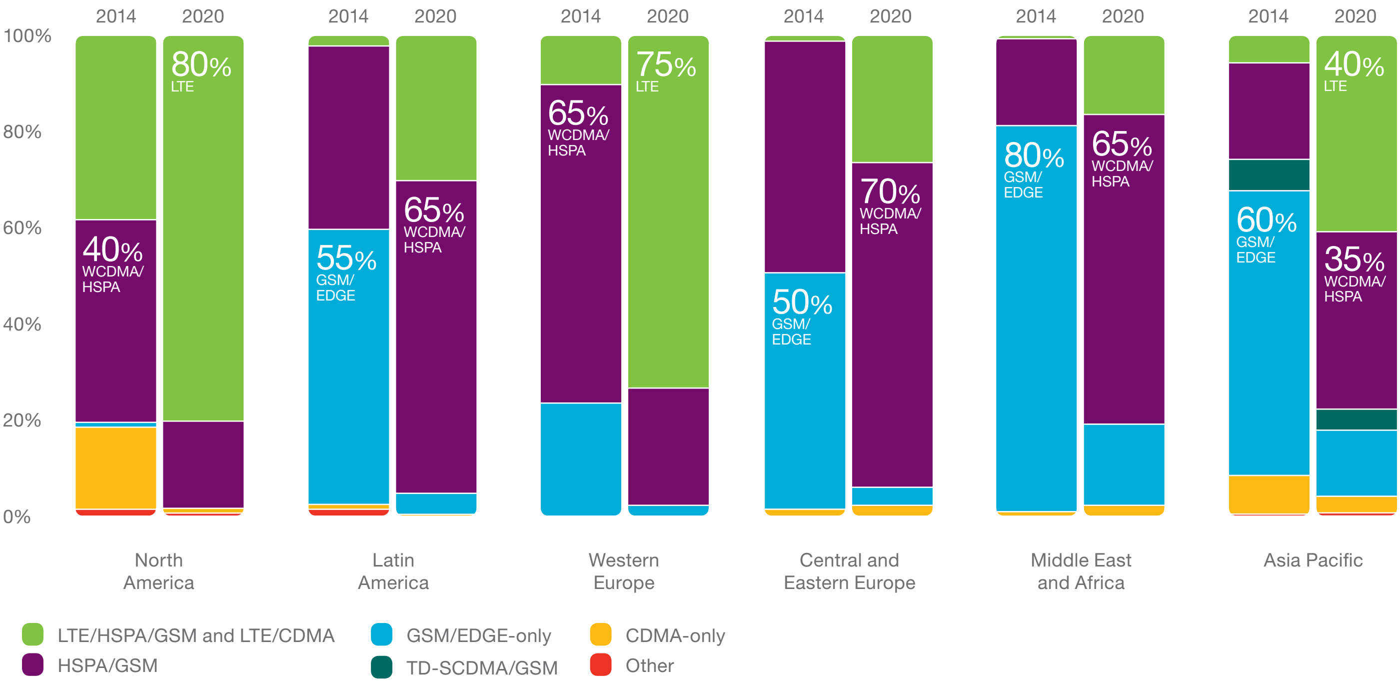
85%

of **Middle East and Africa** mobile subscriptions will be 3G/4G by 2020

85%

of **Asia Pacific** mobile subscriptions will be 3G/4G in 2020

Mobile subscriptions by region and technology



LTE is being rapidly embraced by both operators and subscribers, particularly in North America, Japan and South Korea where it will represent the majority of subscriptions as early as 2015 (2013 in South Korea). In all regions, 2G networks will remain as a fallback technology where 3G and 4G network coverage is missing. By the end of the forecast period, the first 5G subscriptions will be available, probably starting in Japan, South Korea and the US.

In Latin America, GSM/EDGE-only currently accounts for around 55 percent of mobile subscriptions. By 2020, WCDMA/HSPA will account for around 65 percent of total mobile subscriptions.

Western Europe is at the forefront of mobile broadband, with 65 percent of all subscriptions being WCDMA/HSPA. LTE will make up around 75 percent of the region's subscription base by 2020.

In Central and Eastern Europe, the share of WCDMA/HSPA subscriptions is increasing. LTE networks have been deployed in the most developed parts of the region, and will be present in almost all countries by 2015. Hence, around 25 percent of all subscriptions will be LTE by 2020.

The Asia Pacific market continues to see a significant increase in mobile subscriptions, with 1.3 billion net additions by the end of 2020. Japan and South Korea were early adopters of LTE subscriptions, and penetration has reached over 45 percent and 70 percent, respectively. It is estimated that Japan and South Korea will account for around 25 percent of global LTE subscriptions at the end of 2014.

Mainland China has started to roll out LTE and by the end of 2020 it will have over 1.2 billion subscriptions for the technology – more than one third of the global total.

GSM/EDGE-only currently represents around 80 percent of mobile subscriptions in the Middle East and Africa. By 2020 WCDMA/HSPA will account for around 65 percent of total mobile subscriptions. However, GSM/EDGE-only subscriptions will still be significant. In Sub-Saharan Africa, GSM/EDGE-only subscriptions will remain the most common subscription type during the period due to the high numbers of lower income consumers using 2G-enabled handsets.

MOBILE TRAFFIC Q3 2014

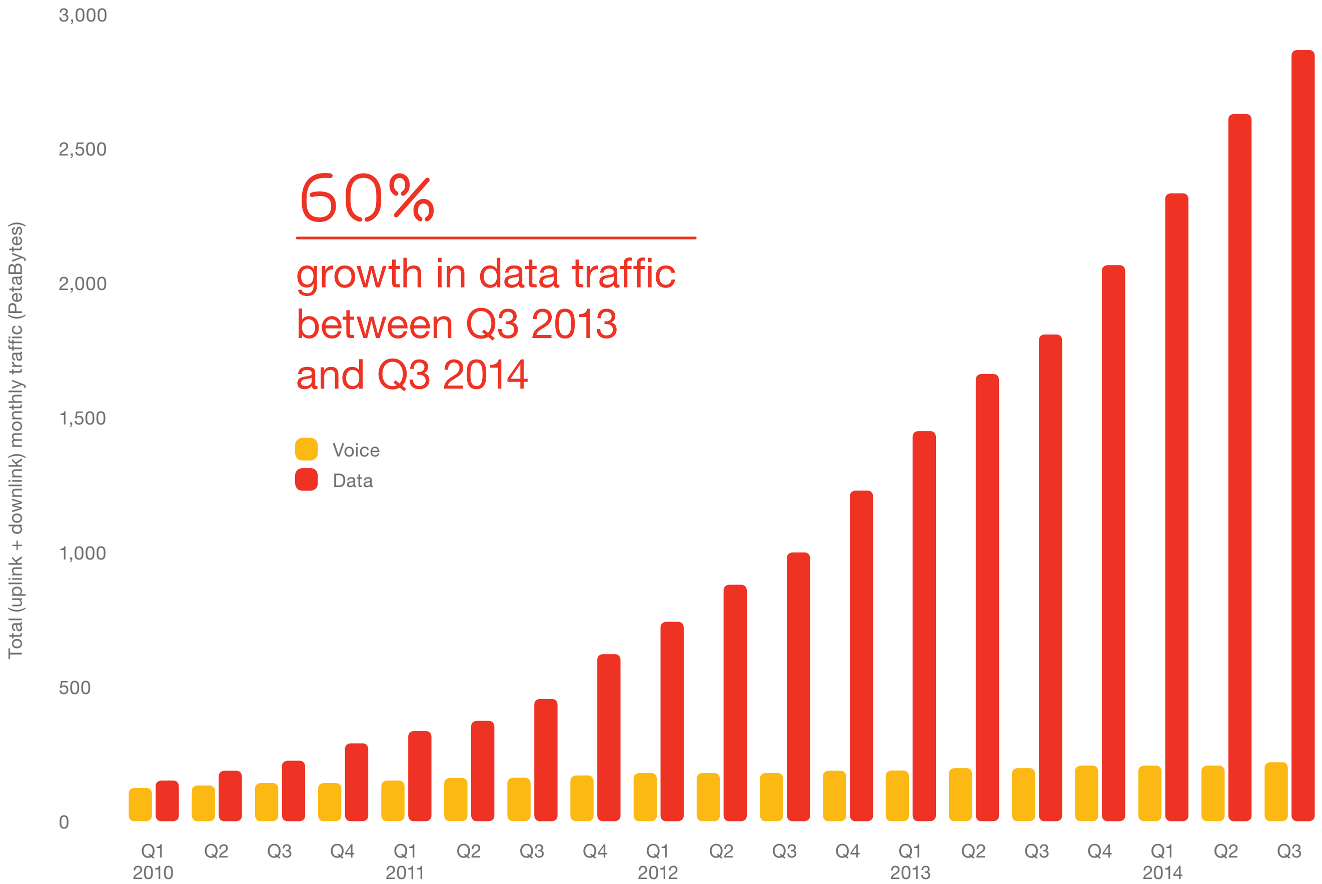
While mobile phones were once used primarily for voice communication, they are now used to access a wide range of services. As their capabilities continue to widen, they will be increasingly used for tasks that were once only performed by computers.

The number of mobile data subscriptions is increasing rapidly. This, along with a continued increase in average data volume per subscription, is driving the growth in data traffic.

Data traffic grew around 10 percent quarter-on-quarter and 60 percent year-on-year.

The graph below shows stable data traffic growth and almost flat development in voice traffic.[1]

In advanced markets, voice calls and SMS are no longer the dominant services. This can especially be seen with smartphone users, who are increasingly making use of data-based services on a daily basis.



[1] Traffic does not include DVB-H or Wi-Fi. Voice does not include VoIP. M2M traffic is not included.

MOBILE TRAFFIC OUTLOOK

Mobile data traffic growth	2014 (EB/month)	Multiplier 2014–2020
Total mobile data	3.2	8
Smartphones	2.1	8
Mobile PC, tablets, mobile routers	1.1	7

The rising number of smartphone subscriptions is the main driver of mobile data traffic growth. Increased consumption of mobile/cellular data per subscription – mainly driven by video – is also contributing to this growth.

Mobile data traffic is expected to rise at a CAGR of around 40 percent (2014–2020). This will result in an 8-fold increase in traffic by the end of 2020. Total mobile traffic generated by mobile phones is now around twice that of mobile PCs, tablets and mobile routers.

Traffic in the mobile phone segment is primarily generated by smartphones. Smartphone subscriptions are expected to more than double by 2020, resulting in rapid traffic growth. Total monthly smartphone traffic over mobile networks will increase around 8-fold between 2014 and 2020. There are large differences in data usage patterns between different networks, markets and user categories. A significant proportion of data traffic is generated by a limited number of users. Factors such as operator data volume caps, tariff plans, and the screen size and resolution of the user's device all impact data traffic volumes per subscriber.

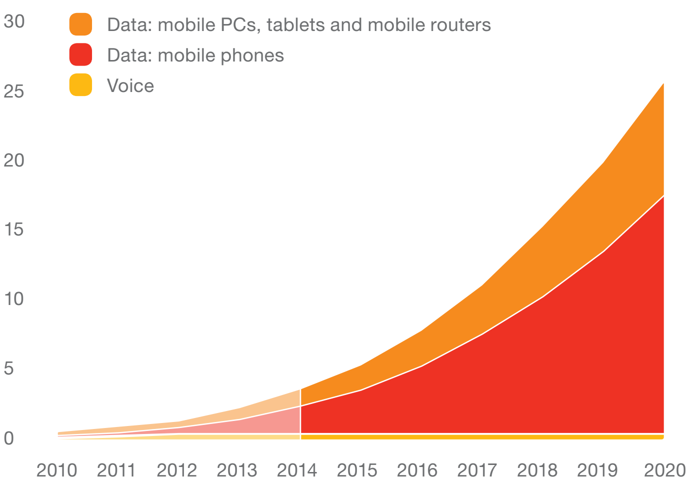
The increase in data traffic between 2019 and 2020 will be greater than the total sum of all mobile data traffic up until the end of 2013.

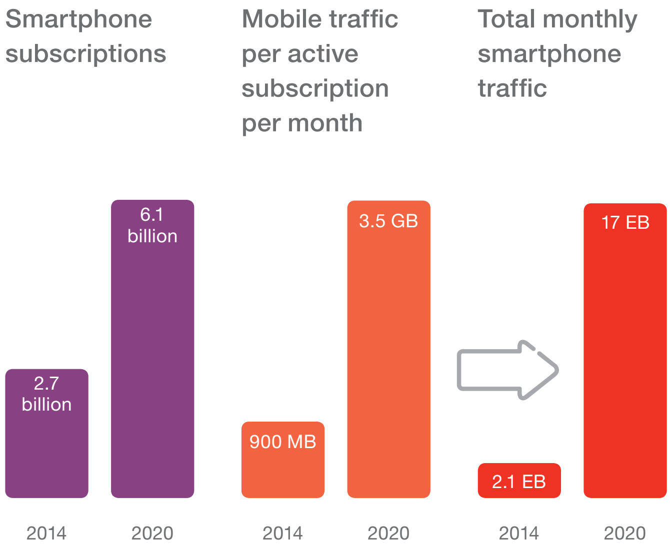
Mobile traffic generated by mobile phones is around two times that from mobile PCs, tablets and routers

8X

growth in **smartphone traffic** between 2014 and 2020

Global mobile traffic (monthly ExaBytes)





Active subscriptions here refer to the number of used devices, i.e. not including multiple SIMs or inactive devices.

REGIONAL MOBILE TRAFFIC

Mobile data traffic growth by region	2014 (EB/month)	Multiplier 2014–2020
Asia Pacific	1.3	9
Central Europe and Middle East and Africa	0.5	9
Western Europe	0.5	8
North America	0.6	6
Latin America	0.3	6

The Asia Pacific region will have the largest share of total mobile traffic in 2020, mainly due to rapid growth in subscriptions.

China alone will add over 450 million mobile subscriptions in the period up to 2020. However, due to the diversity of the region there are large differences in data usage volumes and patterns between countries.

The Asia Pacific region has a highly diverse mobile broadband market, with widely varying levels of market maturity. For example, South Korea and Japan deployed LTE early, while several world-firsts in mobile broadband have been achieved in Australia. However, GSM is still the dominant technology in other countries, and insufficient network quality and the cost of data subscriptions remain important factors behind low rates of mobile data consumption.

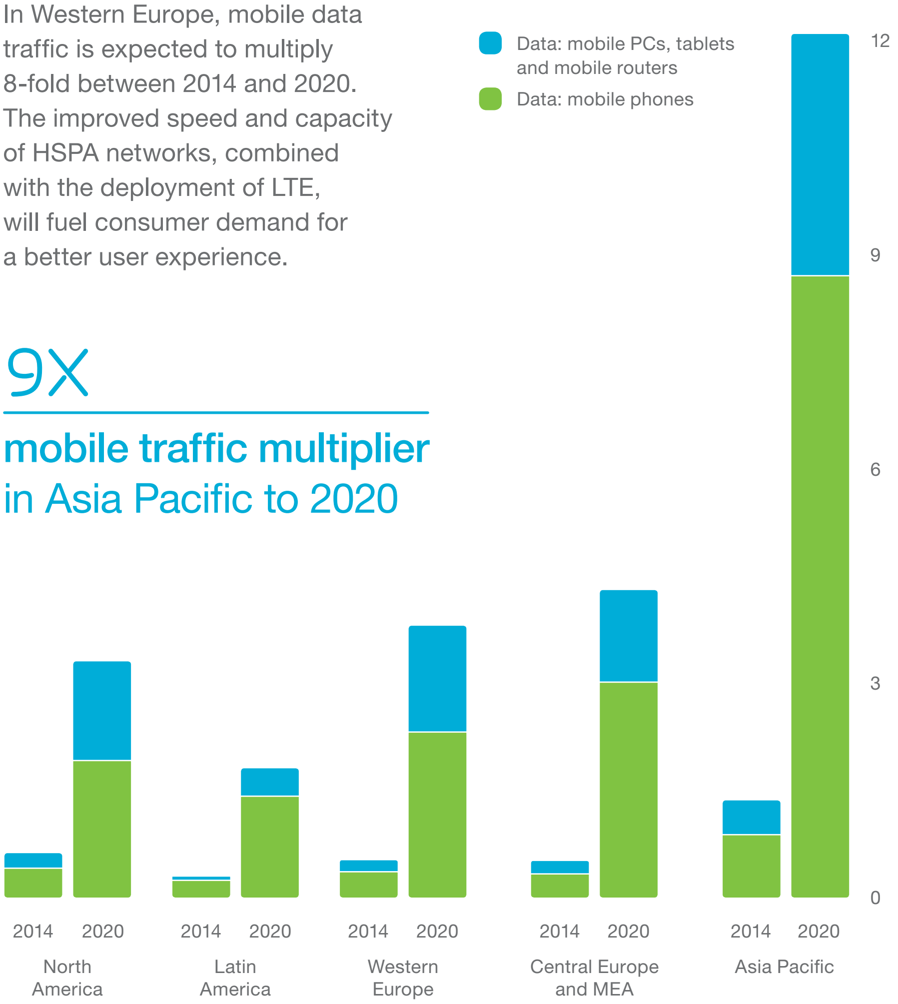
The Central Europe and Middle East and Africa (MEA) region is expected to show strong growth during the period. North America and Western Europe currently have a significantly larger share of total traffic volume than their subscription numbers alone would imply. This is due to the large proportion of high-end user devices and well built-out WCDMA/HSPA and LTE networks in those regions, leading to higher data usage per subscription. North America will have a smaller share of global traffic in 2020 than in 2014. This is because the smartphone share of total mobile phone subscriptions will be saturated before the other regions.

In Western Europe, mobile data traffic is expected to multiply 8-fold between 2014 and 2020. The improved speed and capacity of HSPA networks, combined with the deployment of LTE, will fuel consumer demand for a better user experience.

9X

mobile traffic multiplier in Asia Pacific to 2020

Global mobile traffic (monthly ExaBytes)



MOBILE APPLICATION TRAFFIC OUTLOOK

Video is the largest and fastest growing segment of mobile data traffic. It is expected to grow by approximately 45 percent annually through to 2020, by which time it is forecast to account for around 55 percent of all global mobile data traffic.

Today, YouTube still dominates video traffic in most mobile networks and accounts for 40–60 percent of total video traffic volume[1] in many mobile networks.

Music streaming is gaining popularity, but functions such as caching of content and offline playlists limit the impact on traffic growth. Audio traffic is still expected to increase at an annual rate of around 35 percent, which is in line with total mobile traffic growth.

Share of total mobile traffic	2014	2020
Video	45%	55%
Social networking	15%	15%
Web browsing	10%	5%
Audio	2%	2%

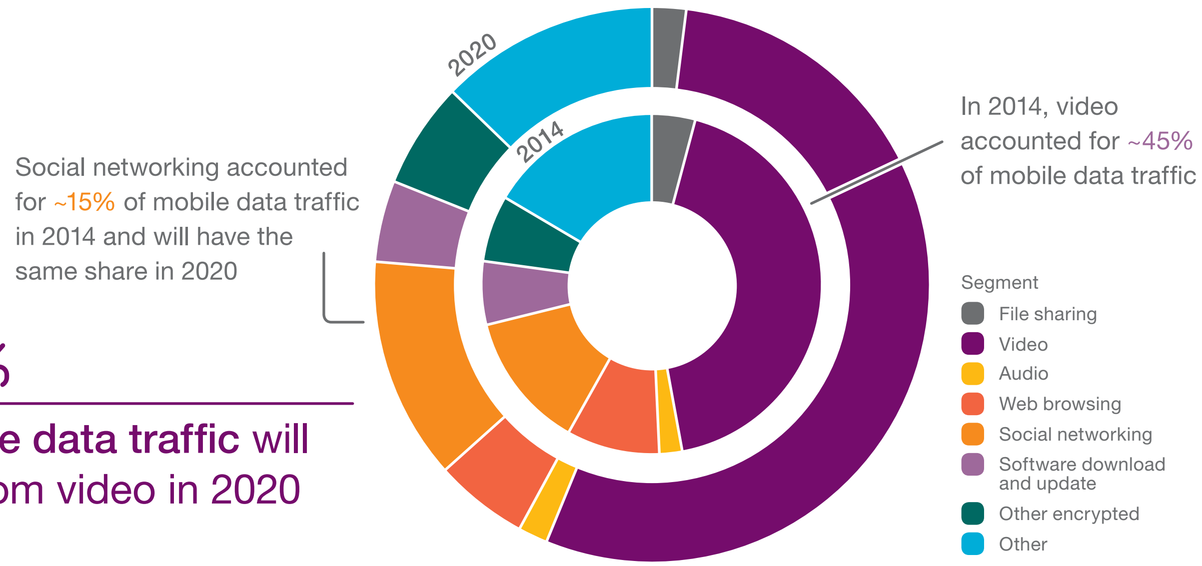
Different applications have different usage levels on different devices, implying that the availability and type of device also impact traffic volumes in a mobile network.

Today, social networking constitutes around 15 percent of total mobile data traffic. Its overall market share will remain at the same level in 2020, even though social networking will increasingly include data-rich content.

The relative share of traffic generated by web browsing will have declined by 2020 as a result of stronger growth in categories such as video and social networking. Consumer preferences are shifting towards more video and app-based mobile use relative to web browsing.

The emergence of new applications can shift the relative volumes of different types of traffic, but the proliferation of specific devices will also affect the traffic mix – for example, tablets are associated with a much higher share of online video traffic than smartphones.

Share of mobile data traffic by application type (percentage)



~55%

of mobile data traffic will come from video in 2020

Video is also likely to form a major part of file sharing traffic in addition to the identified application type 'video'. By encrypted traffic we mean encryption on the network layer (e.g. VPNs) or transport layer (e.g. TLS/SSL). Application layer encryption, such as DRM for video content, is not included.

[1] This is based on Ericsson measurements in a selected number of commercial networks in Asia, Europe and the Americas.

Mobile video traffic growth

A number of factors are contributing to growth in mobile video traffic. Prominent among them is the number of video-capable devices that are being used by consumers. The devices themselves are also evolving. Many now have larger screens, enabling higher picture quality for streamed video. Video content is increasingly appearing as part of other online applications; for example, news, advertisements, and social media. Streaming video is growing strongly, primarily driven by over-the-top (OTT) providers, e.g. YouTube, Netflix.

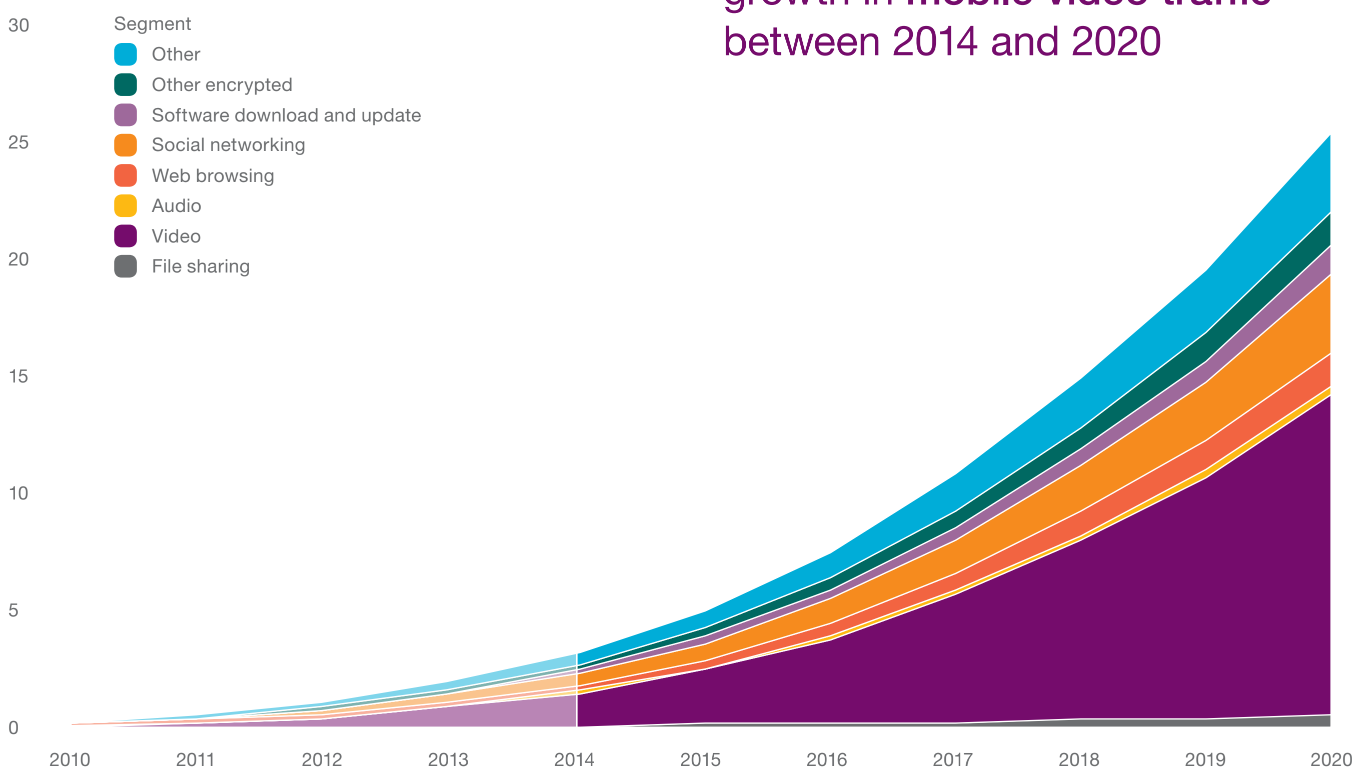
The faster network speeds that come with HSPA and LTE deployment are also an important factor, but they are only part of the story. User behavior is changing, resulting in video being consumed on all types of devices and in higher quantities, including when people are out and about. Higher video resolutions such as UltraHD are also emerging, although the impact of this on mobile devices has yet to be seen. All of these factors drive mobile video traffic volumes. The volume of encrypted video is also increasing rapidly.

Technological improvements such as new video compression techniques will lead to more effective usage of data throughput, and will help mobile network operators accommodate increased demand.

Mobile data traffic by application type (monthly ExaBytes)

10X

growth in **mobile video traffic** between 2014 and 2020



STATE OF THE NETWORKS

In today's competitive markets, subscribers expect a high quality user experience and continual improvement of their services. Constantly evolving mobile network capabilities is key to ensuring such user experiences.

By 2020, around 90 percent of the world´s population will be covered by mobile broadband networks, supporting access to the internet. New network functionalities and service capabilities are being implemented for both data and voice.

This includes improvements to downlink and uplink speeds and new ways to efficiently deliver content at a certain quality level (e.g. LTE Broadcast). Improved voice quality and the potential for new, richer communications services are enabled by mobile HD voice and VoLTE. Furthermore, the availability of Wi-Fi calling functionality in smartphones will enable users to get operator-provided voice services (SIM-based) and richer communication services in their homes over their own Wi-Fi access point.

World population coverage

As more base stations are deployed, the population coverage of the world's mobile networks constantly increases. GSM/EDGE has the widest global reach, currently covering over 85 percent of the world's population.

At the end of 2013, WCDMA/HSPA covered approximately 60 percent of the world's population. Increased demand for internet access, the affordability of smartphones, and regulatory requirements to connect the unconnected are going to drive the future growth of this technology. By the end of 2020, around 90 percent of the world's population will be covered by WCDMA/HSPA networks supporting access to the internet.[1]

It is estimated that LTE covered around 20 percent of the world's population at the end of 2013. It is predicted that this number will increase to over 70 percent by 2020.

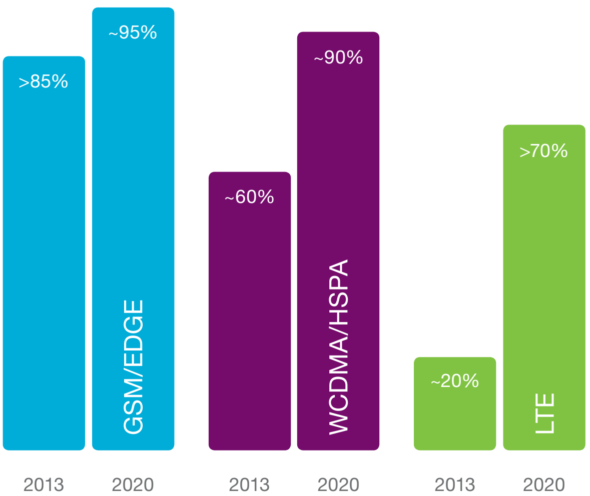
India's population coverage

GSM was rolled out in India during the mid-1990s. By the end of 2013, the population coverage for GSM/EDGE networks reached over 90 percent and it is expected to

>70%

of the global population will be covered by LTE in 2020

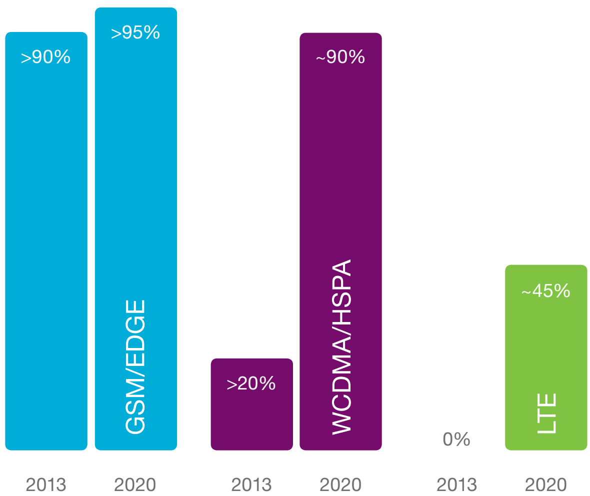
World population coverage by technology



~45%

of India's population will be covered by LTE in 2020

India population coverage by technology[2]



[1] The figures refer to population coverage of each technology. The ability to utilize the technology is subject to other factors as well, such as access to devices and subscriptions.

[2] Population coverage figures for other regions can be found in our regional appendices on www.ericsson.com/ericsson-mobility-report.

increase to over 95 percent by 2020. There are, however, still large rural areas that remain uncovered. India's commercial WCDMA/HSPA networks were first deployed in 2008. However, the roll-out has been relatively slow, and it was estimated that WCDMA/HSPA networks covered over 20 percent of population by the end of 2013.

Mobile data user demographics are evolving fast in India, with mobile broadband starting to bridge the digital divide between the rural and urban populations. Mobile data usage and services are becoming increasingly mainstream, with a growing proportion of people from lower-income groups now downloading apps and streaming video content from the internet using mobile devices. It is predicted that WCDMA/HSPA population coverage will reach over 90 percent by 2020, primarily driven by a growing demand for data services and the launch of more affordable smartphones. This demand will be further fuelled by the introduction of LTE, and it is forecast that around 45 percent of the population will be covered by this technology by 2020.

Currently, India has much less mobile broadband spectrum allocated than markets with high mobile broadband penetration. The release of additional spectrum in the relevant bands will make services more affordable, while the harmonization of spectrum will allow a lower cost device ecosystem to evolve. This will play a key role in driving mobile broadband growth in India, and will be an increasingly important driver of mobile networks' overall capacity, quality and user experience.

WCDMA/HSPA networks

There are currently 572 WCDMA/HSPA commercial networks covering over 60 percent of the world's population. All WCDMA networks deployed worldwide have been upgraded with HSPA mobile broadband technology. 384 of these HSPA networks have been upgraded to a peak downlink speed of 21 Mbps or higher.[3]

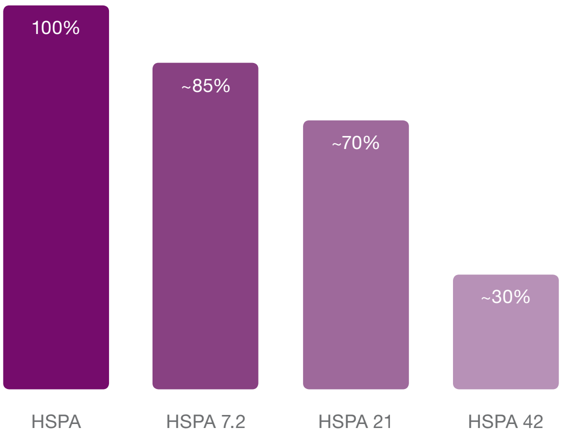
166 HSPA networks now support multicarrier modulation with speeds of up to 42 Mbps in whole or parts of the network. This provides potential for improved app coverage. During 2015 we will see continued evolutionary steps towards providing 3x5 MHz multicarrier networks with downlink speeds of up to 63 Mbps and 2x5 in uplink with speeds of up to 12 Mbps. These improvements will include network and terminal support.

[3] GSA and Ericsson, October, 2014
[4] GSA February, 2014
[5] GSA and Ericsson, September, 2014

166

HSPA 42 Mbps networks have been commercially launched in 86 countries

Percentage of WCDMA networks upgraded to HSPA and to 7.2, 21 and 42 Mbps



Source: Ericsson and GSA (October 2014)

Low band networks can complement 2100 MHz deployments, as lower frequency bands improve coverage and quality of service, as well as the user experience. Today, an established ecosystem exists for WCDMA/HSPA 900 MHz terminals and the technology is considered mainstream, with 87 commercial WCDMA/HSPA 900 MHz networks in 58 countries.[4]

LTE networks

So far, 331 LTE networks have been commercially launched in 112 countries around the world.[5] At the end of 2013, the global LTE subscriptions count passed 200 million, and is expected to pass 400 million by the end of 2014. Improved user experience, and higher network speeds are driving uptake of this technology.

331

LTE networks have been commercially launched in 112 countries

To meet the growing demand for LTE-based services, operators are seeking new opportunities to obtain additional spectrum and solutions that better optimize spectrum use. One additional source of spectrum that is gaining interest among operators is LTE TDD 4G technology. So far, 40 LTE TDD networks have been made commercially available in 27 countries, with 27 operators launching LTE services using only the TDD mode, and 13 deploying both TDD and FDD modes together.[6] In a mixed LTE FDD/TDD network, the use of FDD for the uplink can improve the effective coverage area of the TDD band, and can also make TDD more efficient on the downlink, thereby increasing mobile broadband data rates.

13

network deployments of combined TDD and FDD mode

To optimize the use of available spectrum, the number of commercial offerings of LTE-Advanced (LTE-A) Carrier Aggregation (CA) is also increasing. So far, 21 LTE-A CA networks have been launched commercially in 14 countries around the world.[6] These operators have aggregated up to 40 MHz of spectrum, resulting in service offerings with downlink data speeds ranging from 225 Mbps to 300 Mbps. To complement improved spectrum utilization, small cell deployments are increasingly capable of playing a supporting role, helping to add capacity and improve in-building coverage.

LTE Broadcast

LTE Broadcast is gaining increased interest among operators as the demand for mobile broadband video continues to grow. LTE Broadcast will enable operators to launch new video services in a way that makes the best use of their network resources and available spectrum. LTE Broadcast supports a range of use cases, from live streaming videos for high-demand content, such as live sports and breaking news, to file delivery for popular content (video, music and print), software updates, emergency broadcasts and M2M use cases such as Connected Car and Digital Signage.

LTE Broadcast was commercially launched in South Korea in January 2014, and 19 operators are trialing or deploying the service in markets across the globe.[6] A limited set of commercial phones have been used for these launches. Trial activities and several new LTE Broadcast-enabled devices are expected to be announced as more operators begin to see the commercial potential of broadband video services.

Mobile HD voice

HD voice offers a more natural sound quality than conventional voice calls by providing improved intelligibility and voice recognition. Enabling HD voice requires a level of network functionality and device capability that is already offered on several network technologies, including GSM, CDMA, WCDMA and LTE. The service has been commercially launched by more than 116 mobile operators in 75 countries and over 300 devices are compatible worldwide.[7] The majority of these launches have been on WCDMA networks, but a handful have taken place on both GSM and LTE networks (VoLTE).

A new evolved HD voice technology and voice codec for LTE networks has recently been standardized in 3GPP – EVS (Enhanced Voice Service). This will further enhance the user experience by delivering higher quality voice and music while leveraging current HD voice services in 2G, 3G and LTE networks.

>116

mobile operators in 75 countries have now launched HD voice commercially

Voice over LTE (VoLTE)

VoLTE provides users with telecom-grade HD voice, video calling and other new, richer communication services on LTE smartphones, while enabling simultaneous high speed data services. VoLTE is enabled by deploying an IP Multimedia Subsystem (IMS) to provide the telephony services over IP. The LTE radio network and Evolved Packet Core only require software upgrades. In addition,

[6] GSA, September 2014
[7] GSA and Ericsson, September 2014

LTE smartphones with VoLTE capabilities are required. Many of the latest high-end LTE smartphones already have the embedded VoLTE chipset and only require a software upgrade to enable VoLTE services. The VoLTE device ecosystem is continuously growing, with recent launches from major smartphone vendors. The world's first commercial VoLTE networks were launched in August 2012 in South Korea. So far 12 operators have launched commercial VoLTE services in South Korea, US, Singapore, Hong Kong and Japan. Several other operators are about to deploy VoLTE during 2014–2015.

12

mobile operators around the world have now launched VoLTE commercially

Wi-Fi calling

Recent developments in the industry now enable operators to deliver residential Wi-Fi calling, since major device vendors have integrated the service natively in smartphones. This means that consumers can get operator-provided voice services (SIM-based) in their homes over their own Wi-Fi access point, using any Internet Service Provider (ISP). This can be beneficial to users who have limited circuit switched voice or VoLTE coverage in their homes. The voice service is run through the mobile operator's Evolved Packet Core network and the IMS network. This is an extension of VoLTE-based services to Wi-Fi access, and it is also possible to provide seamless voice and video calling handover between LTE and Wi-Fi.

Mobile backhaul

The demand for mobile broadband backhaul capacity will continue to grow. The capacity needed per base station site will vary substantially, depending on target data rates and population density. In 2020, high capacity base stations are expected to require backhaul in the 1 Gbps range, whereas low capacity base stations are expected to require backhaul in the 100 Mbps range. Due to continuous innovations and the availability of additional spectrum, microwave can now provide over 1 Gbps per site, and has the potential to provide 10 Gbps or beyond.

Microwave and optical fiber are the transmission media technologies that are best suited to meeting these increased capacity requirements. Optical fiber transmission will continue to grow its share of the mobile backhaul market and it is estimated that it will connect more than 40 percent of all base stations by 2020. Today, microwave is the dominant transmission technology for mobile backhaul worldwide. Microwave now connects 60 percent of all base stations, and will continue to connect around 50 percent in 2020.

~50%

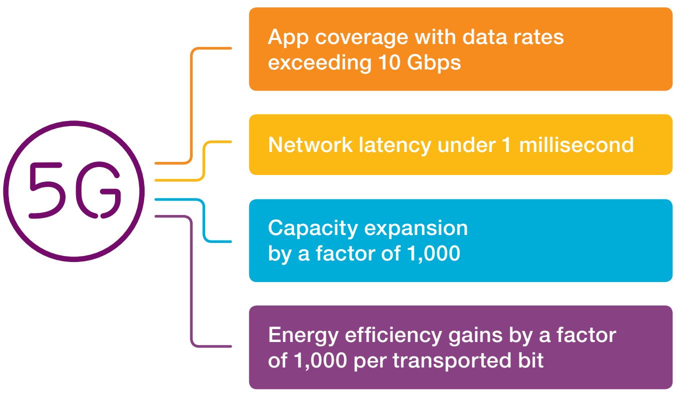
of all sites will continue to be **connected by microwave** in 2020

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:

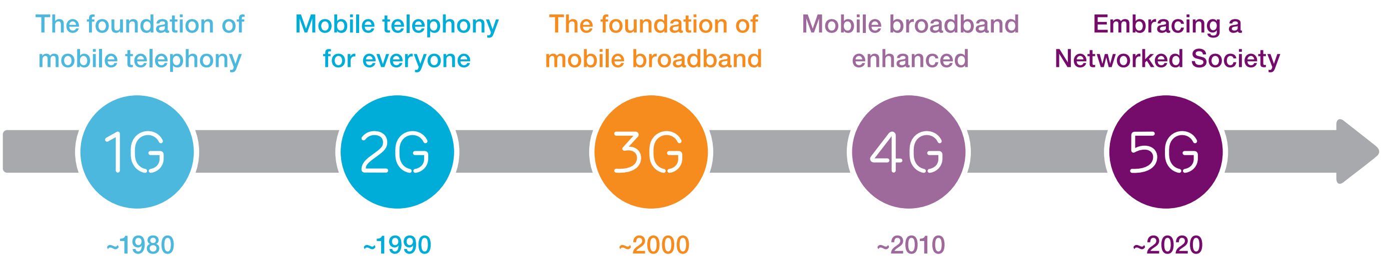
- Advanced enterprise applications
- Critical machine-type communication: Remotely controlling machinery in hazardous environments
- Media: Mass-market personalized TV
- Massive machine-type communication: Connecting massive numbers of sensors and other embedded devices, designed so that batteries can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

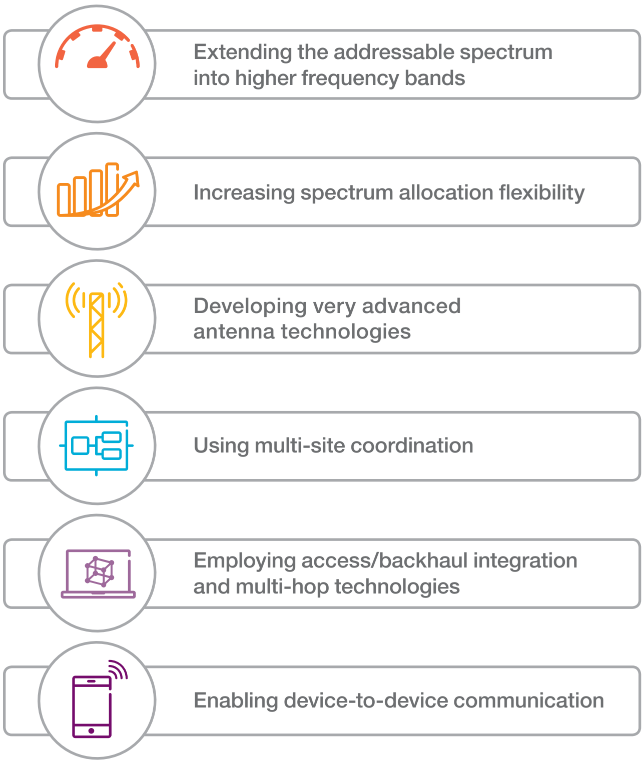


- In the core network to handle the interface between devices with traffic profiles very different to traditional profiles
- In support systems to provision and manage the devices

Finally, the network must support devices that are designed with reduced complexity to allow mass deployment at low cost – e.g. for sensors and metering applications.

Flexibility and automation are key to catering for different application types using different functionality sets. This entails the use of dynamic cloud computing techniques (including flexible control of network virtualization – the network enabled cloud). Beyond mere virtualization (consolidating virtual machines on common hardware) the advantages of advanced orchestration, dynamic (re-)deployment, and a distributed data center topology need to be fully harnessed.

While much of the focus for 5G is still on identifying use-cases and requirements, research is also ongoing into key technologies. In radio these include:



It will be possible to deploy many of these 5G radio technologies during the evolution of LTE, allowing LTE to be part of the 5G radio solution beyond 2020. Other advances will be needed to take advantage of new frequency bands, including those expected to be allocated at the World Radiocommunication Conference (WRC) in 2019.

In the core network, developments have already started in Software-Defined Networking (SDN) and virtualization that will serve as the foundation for 5G. These techniques will enable operators to configure the resources within a common physical network into multiple virtual networks, or 'slices', each with a set of characteristics mapped to the requirements of the different applications anticipated in the Networked Society.

In the area of support systems, technologies such as analytics, automation, self-care and self-provisioning interfaces and portals will continue to evolve. There will also be a clear shift from network-based Key Performance Indicators (KPIs) toward those based on services and applications, with a focus on enabling Service Level Agreements (SLAs) for each individual network slice.

Security and privacy will be critical to maintaining user confidence in the integrity of their data across all domains. New security features have been added to each new generation of mobile technology, These features were critical to upholding trust and protecting business models from the threats that were identified at the time. While 5G has not yet been fully defined, it is clear that mechanisms for supporting security and privacy will need to be both modular and agile if they are to support a significantly expanded set of use cases.

The Networked Society is evolving, and the increasing number of uses for wireless networks will play a big role in the shape and direction of that evolution. New features for LTE will be introduced continuously throughout the journey to 5G. Fifth-generation systems that meet all ITU requirements are expected to be deployed commercially in 2020 and beyond.

VIDEO SUBSCRIPTIONS DRIVE TRAFFIC

It has become commonplace for social media users across the world to share videos, send messages and post links.

YouTube is the dominant video service in many markets, typically accounting for 40–60 percent of total video traffic volume[1] in many mobile networks. Analysis from Ericsson ConsumerLab[2] shows that YouTube is the most popular video service in the UK, US and Japan. 70 percent of the UK smartphone users who use the internet on a daily basis visit YouTube at least once a month. This figure is 67 percent for the US and 30 percent for Japan, where the service has been slower to catch on because of its English language origin.

However, subscription-based video services such as Netflix are also becoming popular on smartphones, and these services are being used relatively more on mobile broadband than on Wi-Fi. Amongst Android Smartphone users, 30 percent of Netflix traffic is consumed over mobile broadband, compared to 20 percent of YouTube traffic.

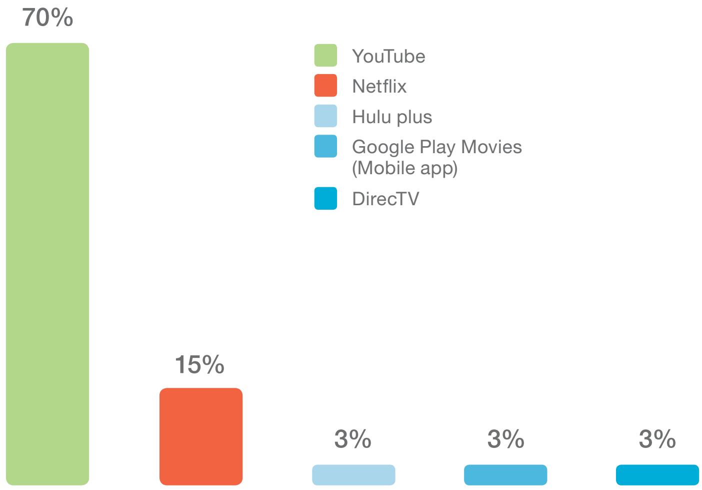
Hence, even though total mobile video traffic is dominated by YouTube, data consumption per user on mobile broadband is driven more by subscription-based video services.

Among mobile broadband users, those who are on what they perceive to be an unlimited data plan watch more videos than those who are on a limited plan.

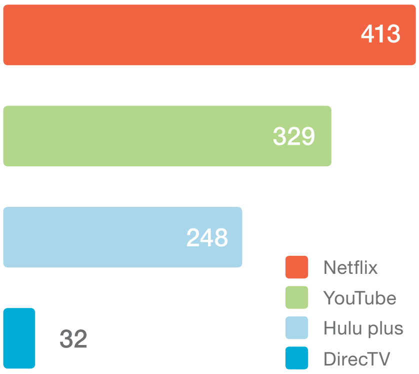
Subscription-based vs free video service

From a consumer perspective, the US is a trendsetting market in terms of smartphone use and video consumption. Analysis of data from comScore's Mobile Metrix US panel, representing smartphone owners from age 18 and over, provides more insights into the consumption of specific video services. YouTube is the top video content aggregator, and is used by 70 percent of smartphone owners, while the subscription-based service Netflix is used by 15 percent on a monthly basis.

Smartphone users in the US who use different video services



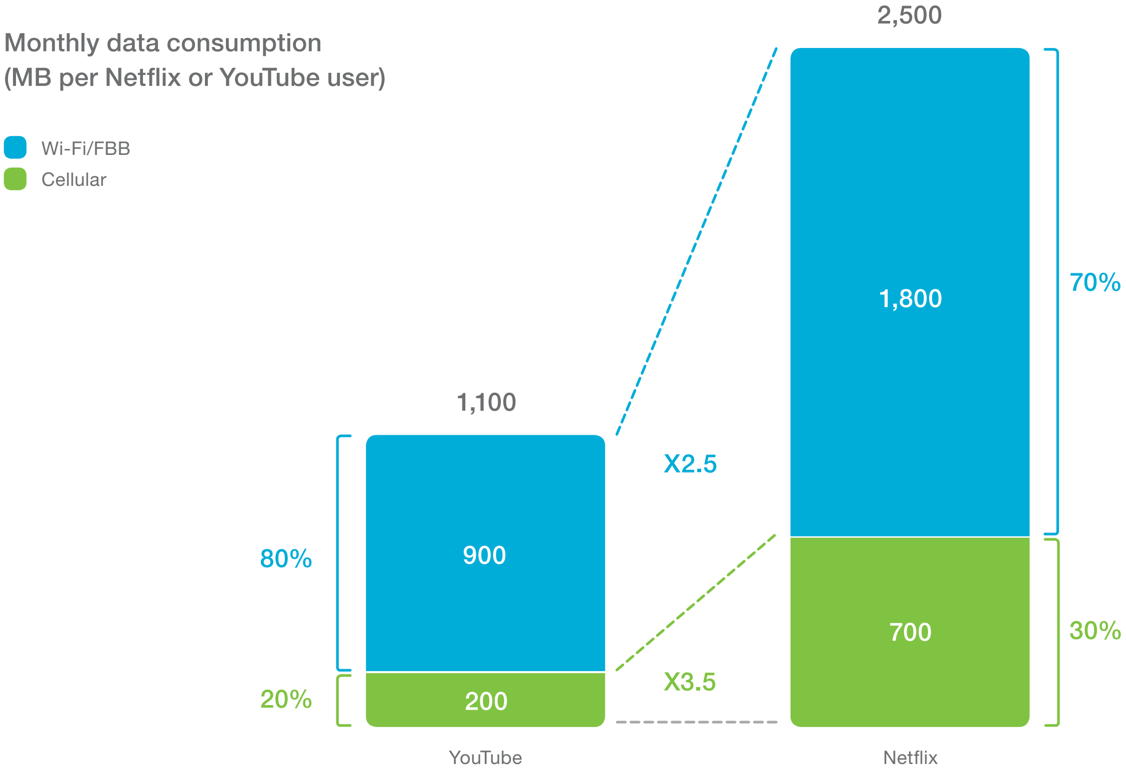
Total viewing time over cellular and Wi-Fi (average minutes per user of each service, per month)



Source: Ericsson ConsumerLab analytical platform, ComScore MobileMetrix, US – July 2014
Base: All smartphone users, who use specific video services on the internet on a monthly basis – July 2014

[1] Based on Ericsson measurements in a selected number of commercial networks in Asia, Europe and the Americas.
[2] Analysis of Nielsen on-device measurement data from a panel representing smartphone users from age 15 and over.

Monthly data consumption
(MB per Netflix or YouTube user)



Source: Ericsson ConsumerLab analytical platform – Nielsen ODM September 2014
Base: Android smartphone users who use internet on phone on a daily basis and use YouTube and Netflix respectively (US)

However, when it comes to the time consumers spend viewing video services, Netflix is clearly ahead of YouTube. Higher viewing time for Netflix could be because consumers use this service to watch movies and TV series, which are generally longer in duration than the content available on YouTube.

Viewers often access videos for both free and subscription-based services. ConsumerLab's analysis of comScore's Mobile Metrix US data shows that 19 percent of smartphone users who watch YouTube also watch Netflix.

Due to its larger user base, total YouTube traffic is around 30 percent higher than total Netflix traffic amongst Android smartphone users over cellular networks. However, comparing Wi-Fi/fixed broadband and cellular network traffic volumes for each service shows that around 20 percent of YouTube traffic and around 30 percent of Netflix traffic is over cellular networks. Altogether, this results in traffic volume per user for Netflix being 3.5 times more than YouTube traffic per user over cellular networks.

Hence, even though total mobile video traffic is dominated by YouTube, data consumption per user on mobile broadband is driven more by the subscription-based video service Netflix.

Flat rate plan users consume more video over mobile broadband

In terms of billing preferences, consumers of video services largely favor what they perceive to be unlimited plans. Among flat rate consumers in the UK, 66 percent watch YouTube, with an average of 48 sessions per month and an average viewing time of up to 5 minutes per session. In the US, 51 percent of flat rate consumers watch YouTube, with an average of 75 sessions per month and an average viewing time of 8 minutes per session. In the UK and the US, flat rate video subscribers consume two times the amount data as limited plan users consume.

In Japan, 49 percent of flat rate consumers watch YouTube with an average of 69 sessions per month, and an average viewing time of 9 minutes per session. In Japan, flat rate subscribers of video consume 10 times more data than limited plan users do. Consumption of YouTube videos on flat rate plans is higher than for those on limited plans. Over 60 percent of Japanese consumers are on a flat rate plan, which makes them less concerned about the cost of watching videos.

Hence, for both YouTube and subscription-based video services, consumers on a flat rate data plan consume more video over mobile broadband compared to users on a limited plan.

IMPROVING VIDEO STREAMING QUALITY

Consumers are embracing online video services that provide access to an ever increasing source of content – and they expect video to play smoothly and to look great on their mobile devices.

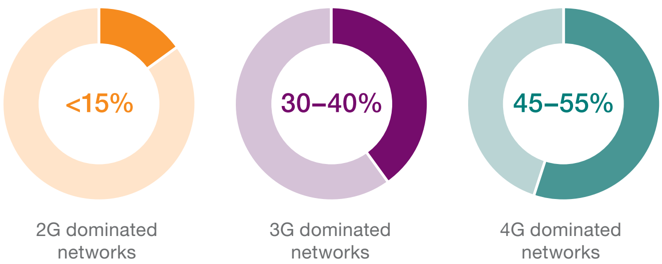
To meet these demands, there have been continuous improvements in both the user experience and the efficiency of video streaming over mobile broadband networks.

The amount of data traffic generated by video streaming is very high – one minute of video requires the transmission of more data than virtually any other type of app or service. Traffic is also affected by device screen sizes and resolution, as well as viewing patterns and duration. Due to the volume and growth of video traffic, two essential factors to explore are quality and efficiency.

According to Ericsson's measurements of mobile broadband traffic, video is the single biggest contributor to traffic volume. Its share of total global traffic is projected to grow from around 45 percent in 2014 to around 55 percent in 2020. This growth is mainly driven by the growing popularity of using video streaming services over mobile broadband, the proliferation of more content in video format and continual improvement in the quality of the mobile video experience due to more capable devices (larger screens, higher resolution).

Total video traffic share in a mobile network varies with network maturity as well as data plans (network and data plans usually correlate: for example, LTE data plans tend to have larger data buckets.)

Proportion of video traffic based on network traffic measurements



Improving video quality is, to a large extent, the result of advances behind the scenes in video codecs and content delivery mechanisms used to stream the application over mobile broadband networks. There has been a continuous evolution of the technologies that enable video to be streamed. It remains the most data intensive service on wireless networks, so it is a key focus area for the development of quality and efficiency features.

Significant engineering resources have been focused on maintaining and improving the user experience for streaming video over mobile broadband. Advances include new video coding standards and delivery mechanisms, which contribute to both an enhanced user experience and improved network efficiency.

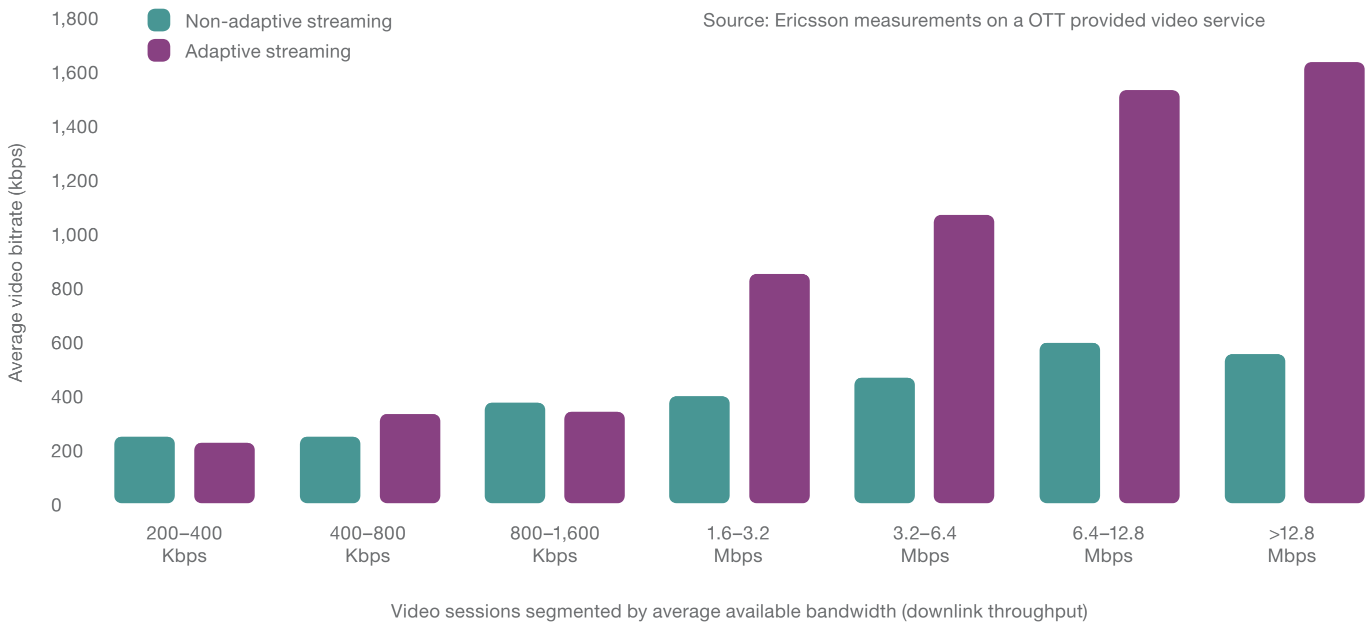
Video codecs

All digital video delivery requires a codec to efficiently compress (encode) the source and decompress (decode) the encoded data streamed between a content server and the consumer's device, respectively. Modern codecs compress video streams by a factor of up to a hundred in order to minimize the demands placed on network bandwidth and to enable even better video experiences. Standardized video codecs have taken around ten years from research to adoption, considering MPEG-2 (H.262), MPEG-4 AVC (H.264) and now HEVC (H.265). Each new generation of video codec must offer 40–50 percent more compression at a quality level similar to the previous generation if it is to be sufficiently economic to encourage its wider adoption. The emergence of each successive codec generation enables either the transport of video at a higher quality using the same network resource, or more efficient transport of video with the same quality (using less network resource).

Adaptive streaming

The success of Netflix and other Video-on-Demand (VOD) services has been enabled by techniques that adapt the streaming bitrate to network conditions in real time, which is especially important in mobile networks. This helps eliminate stopping and starting, or re-buffering of the video as it streams. Dynamic changes in the perceived quality are far more acceptable to the consumer than stops and starts. Adaptive Bitrate (ABR) delivery schemes such as Apple HLS and the standardized MPEG- DASH use segmented 'chunks' of video streams packaged in a way

Comparing video bit rates for adaptive vs non-adaptive streaming in a mature MBB network



that allows the receiving device to dynamically request higher or lower quality sections based on its performance and network throughput. Thus, a video streaming service that uses dynamic adaptation can offer higher quality video when network conditions allow. Conversely, during more challenging conditions, the subscriber viewing experience should not be interrupted by the video freezing, but switch to a lower quality without any interruption. In traffic measurements on an advanced mobile broadband network, the average bitrates for video traffic using adaptive streaming were over twice those for non-adaptive streaming. The graph above shows segmented video sessions based on average downlink throughput. It reveals that in networks exhibiting higher average downlink throughput, average video streaming bitrates are higher for dynamic adaptive video than for non-adaptive streaming.

Given our understanding of traffic analysis and trends in streaming video, including codecs and adaptation, a number of observations can be made:

- The adoption of latest generation codecs enables higher quality video to be streamed over radio networks far more efficiently, reducing cost significantly and improving the user experience.
- Video services delivered via the internet have been transformed by the adoption of dynamically adaptive streaming. This improves the quality of video streamed over all IP networks, especially mobile broadband.
- Adaptive streaming also means that increasing available bandwidth in a network will automatically increase video traffic volumes, as adaptation makes use of extra available capacity.

>2X

better quality video with adaptive streaming on higher performing networks

Beyond codecs and adaptive streaming, a number of advanced techniques are being deployed that are focused on efficient delivery of media over the Radio Access Network (RAN). Examples include radio-friendly pacing and service-based TCP optimization. These have the potential to both enhance network efficiency and save battery power on devices.

Internet-delivered VOD services are becoming available in more and more countries, and video content is increasingly appearing as part of other online applications; for example, news, advertisements, and social media. Video streaming accounts for a significant portion of global mobile broadband traffic. It represents a higher proportion in more mature markets, where high performing mobile broadband networks give subscribers a better user experience. As technology for network optimization and efficiency features further evolve, video looks set to continue to grow as a proportion of mobile broadband traffic, and to play an even bigger role in subscribers' lives.

INDOOR CONNECTIVITY EXPERIENCE

We spend more than 85 percent of our day indoors. In today's connected world, consumers expect to have instant access to the internet regardless of whether they are indoors or outdoors.

An Ericsson ConsumerLab study was conducted with 47,167 respondents using both internet and face-to-face methodologies across 23 countries. The study found that consumers are more satisfied when using online services indoors than outdoors. Despite this, consumers are willing to spend more to improve their indoor connectivity experience, which encompasses better coverage, increased speeds and a more stable internet connection.

In all 23 countries there is a greater willingness to spend more on improving indoor connectivity compared to outdoor connectivity. Respondents from countries with a high proportion of mobile broadband-only users are the most prepared to pay more for such improvements.

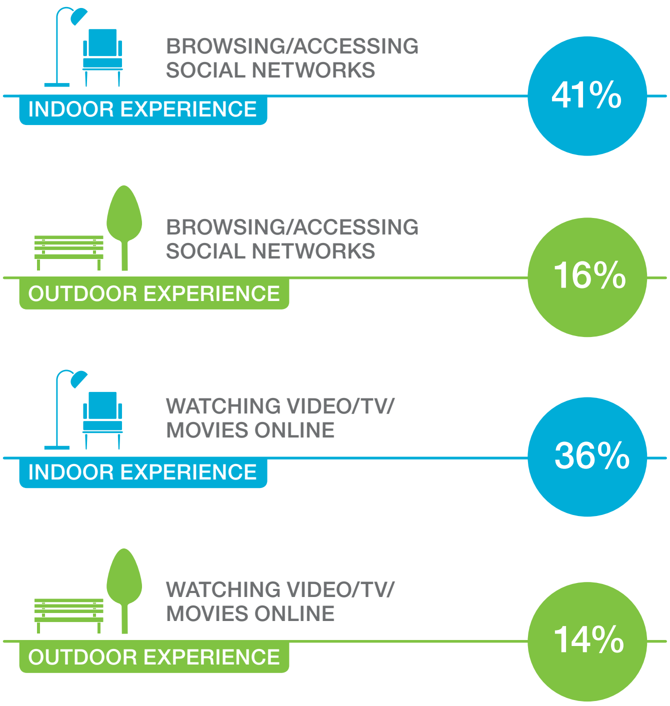
A large proportion of mobile broadband users are, in general, willing to spend more to improve their connectivity experience. 61 percent are prepared to pay more for a better indoor experience and 38 percent for improved outdoor connectivity. These figures are much lower for fixed broadband/Wi-Fi only users.[1]

Among consumers who browse the internet and access social networks, 41 percent are highly satisfied with their indoor connectivity experience. However, this drops to 16 percent when accessing the same services outdoors (including when commuting). For tasks such as watching streamed videos or online movies, satisfaction with the indoor connectivity experience stands at 36 percent, but drops to 14 percent when outdoors.

Most consumers access online services when indoors, but usage levels vary depending on age or type of service used. Among internet users in 23 countries, senior citizens (60–69 years) show a higher preference for accessing online services indoors compared to young people (15–24 years). Senior citizens are 20 times more likely to watch videos indoors compared to outdoors, while young people are 6 times more likely to do the same. Similar behavior can be seen when looking at online shopping – senior citizens are nine times more likely to engage in this activity when indoors, compared to young people who are four times more likely to do so.

Young people across 23 countries use their devices to access online content irrespective of location. In fact, this user segment accesses more online services when outdoors compared to the overall population. The most popular online activities performed by young people outdoors include watching TV/videos, gaming and online shopping.

Indoor satisfaction vs. outdoor satisfaction

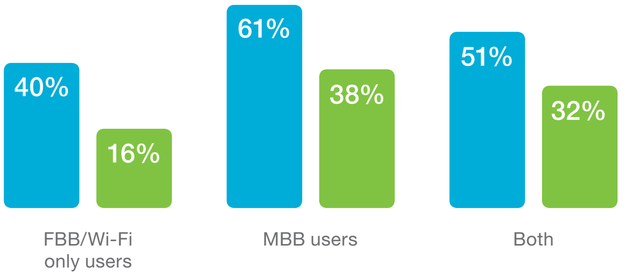


Source: Ericsson ConsumerLab analytical platform 2014
Base: Users of respective services on smartphone, tablet or PC, 23 countries

[1] Classification of users in categories FBB/WiFi-only, MBB or both is based on how respondents perceive they access the internet.

Indoors vs outdoors – willingness to pay for improved internet connectivity

Total



Per service

Source: Ericsson ConsumerLab analytical platform 2014
Base: Internet users using smartphone, tablet or PC, 23 countries

There is a willingness to spend more on an improved experience regardless of location for both mobile broadband and fixed broadband/Wi-Fi only users. However, mobile broadband users are more willing to pay extra for an improved indoor connectivity experience (61 percent).

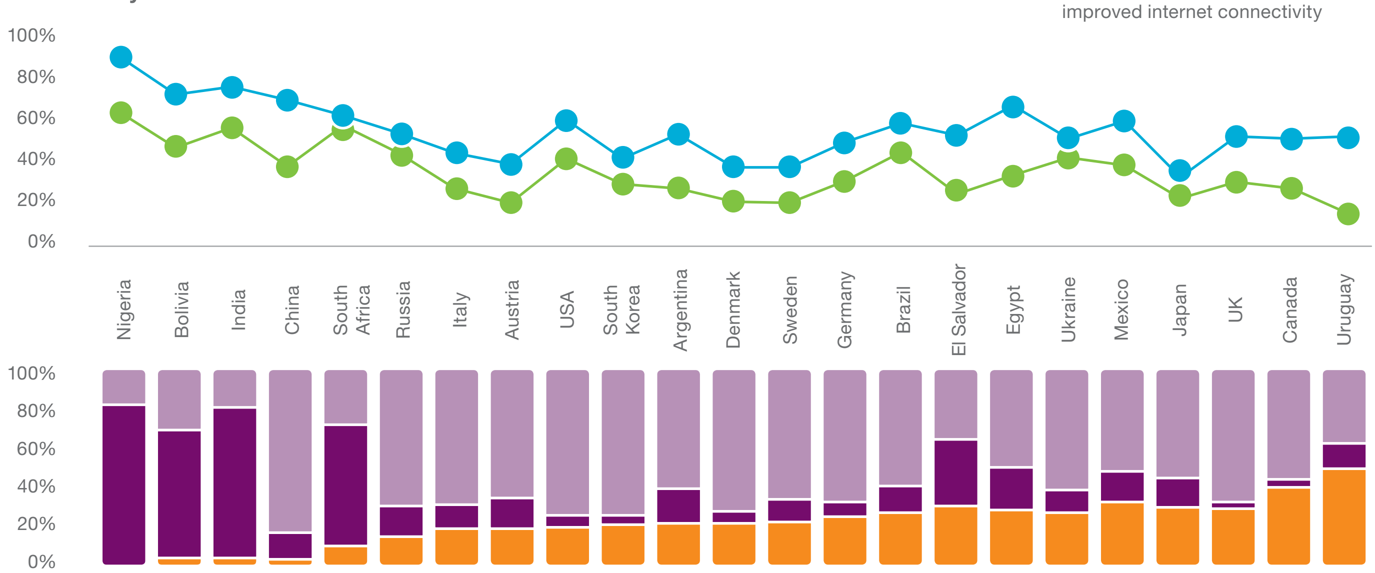
Consumers who use internet services both indoors and outdoors show a higher interest in improving their indoor connectivity when performing a range of online activities. Predictably, many of those who watch videos are willing to pay for improved connectivity experience in both environments – 60 percent are willing to pay for improved indoor connectivity as opposed to 47 percent for improved outdoor connectivity. Interestingly, the biggest difference is for music, with 56 percent willing to pay for improved indoor connectivity, but only 35 percent wanting to do so for the outdoors. Among consumers who browse the internet and use social networks, 54 percent and 56 percent, respectively are willing to pay to improve indoor connectivity, compared to 39 percent and 40 percent, respectively for the outdoors.

In all 23 countries there is greater willingness to spend more on improving indoor connectivity compared to outdoor connectivity. Respondents in countries with the highest share of mobile broadband-only users are most prepared to pay extra to improve their indoor experience. It is noteworthy that Uruguay, with its well-built fixed broadband infrastructure[2] and the highest share of FBB/Wi-Fi only users in the study, has the highest percentage of respondents willing to spend to improve connectivity indoors compared to the outdoors.

Indoors vs outdoors – willingness to pay for improved internet connectivity

Indoors – willingness to pay for improved internet connectivity
Outdoors – willingness to pay for improved internet connectivity

Per country



FBB/Wi-Fi only   MBB only   Both

Source: Ericsson ConsumerLab analytical platform 2014
Base: Internet users using smartphone, tablet or PC, 23 countries

[2] According to World Bank figures, fixed broadband penetration in Uruguay was 21 percent at the end of 2013, the highest in Latin America.

THE SIGNATURES OF CITY LIFE

More than half of the world's population lives in cities, and according to current forecasts, this will have risen to two-thirds by 2050.[1]

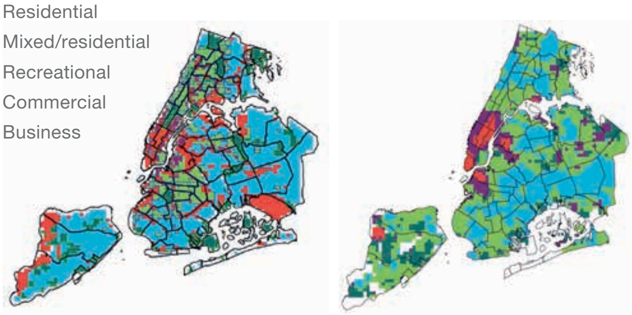
The growing global ubiquity of urban living makes it essential to understand both the commonalities in city life around the world and the differences between major urban centers, whether they be cultural or economic. The signature of city life is evident in mobile phone traffic profiles, which reveal the locations where people are most active during their daily life. Mobile phone activity profiles clearly show how residents of distinct city districts use mobile services, providing an effective traffic-based land use map that helps to identify the commonalties across the geographies of global cities.

The continuously changing landscape of workplaces and internal migration of inhabitants calls for adaptive urban planning. Standard census-based analysis of a city's structure can be complemented with traffic-based land use detection. This helps authorities cope with the evolving urban environment and prepare the infrastructure of cities to deal with the challenges of the future. Using mobile traffic data that can be updated more frequently and automatically, this information provides a much more reflective view of the modern city. In the example of New York, the traffic patterns of some manufacturing areas, like western Staten Island, are more similar to residential areas than to industrial areas. As another example, the traffic pattern of southern Central Park is more similar to commercial and business areas than to recreational areas.

Comparing land use and mobile traffic patterns

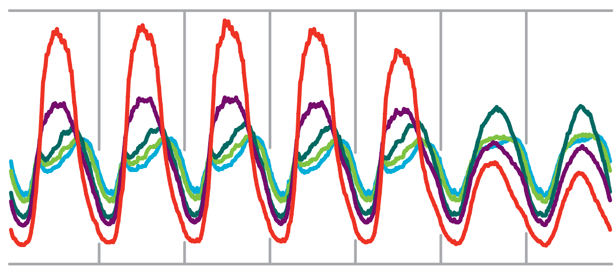
New York

- Residential
- Mixed/residential
- Recreational
- Commercial
- Business



Official census-based land use map[2] — Traffic-based land use map

Normalized signaling activity over a typical week



Empowering urban planning through traffic based land use detection

Mobile broadband networks enable people to use a range of applications, their choice of which varies depending on the time and their location. In residential areas, many people start their day by checking weather forecasts, news or social network apps, while in the evening they watch video, play games or communicate, including extensive use of SMS.

Recreational areas like amusement parks, golf courses and public parks show similar usage patterns to residential areas, but with greatly increased traffic activity over the weekends. In business areas, people call and text their clients and business associates with high intensity, mainly during work hours. Commercial areas show similarities with business areas, but with more activity during early evening.

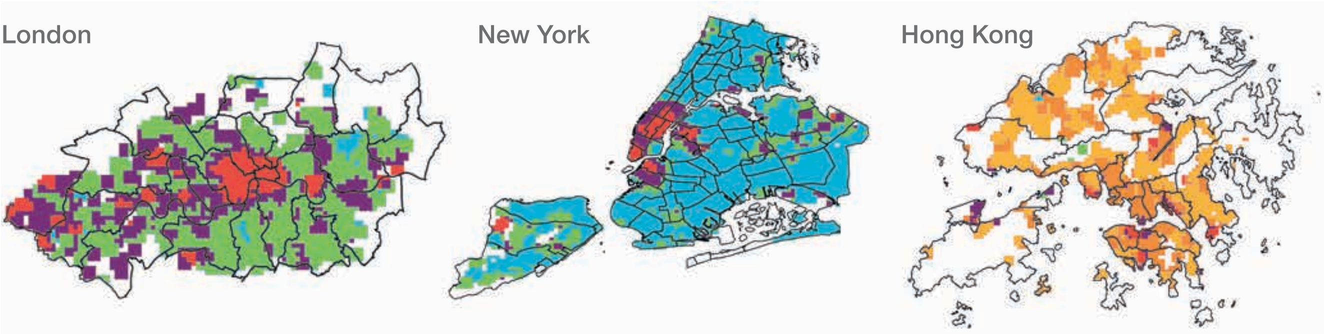
A PARTNERSHIP ON THE PULSE

This article was written by Ericsson in cooperation with MIT Senseable City Lab.

MIT senseable city lab

[1] UN Habitat, State of the World's Cities, 2010/2011
[2] Based on NYC Zoning Districts, NYC Department of City Planning 2011

Comparing clusters of mobile traffic patterns in London, New York and Hong Kong



Residential and recreational in London
Commercial and commuting hubs in London
Main business centers in all cities
Residential in New York
Residential in Hong Kong
Other mix in Hong Kong

When analyzing combined data from London, New York and Hong Kong, the main business centers of these cities emerge as a single cluster, highlighting strong similarities between them.

By contrast, signatures of residential locations differ greatly. Globalization shapes the activity patterns in large cities' financial and governmental centers, while residents' activity patterns are governed by cultural factors. That is, business areas show similar communication patterns globally, and commercial and commuting hubs also show some similarities. On the other hand, residential areas reflect unique clusters of people.

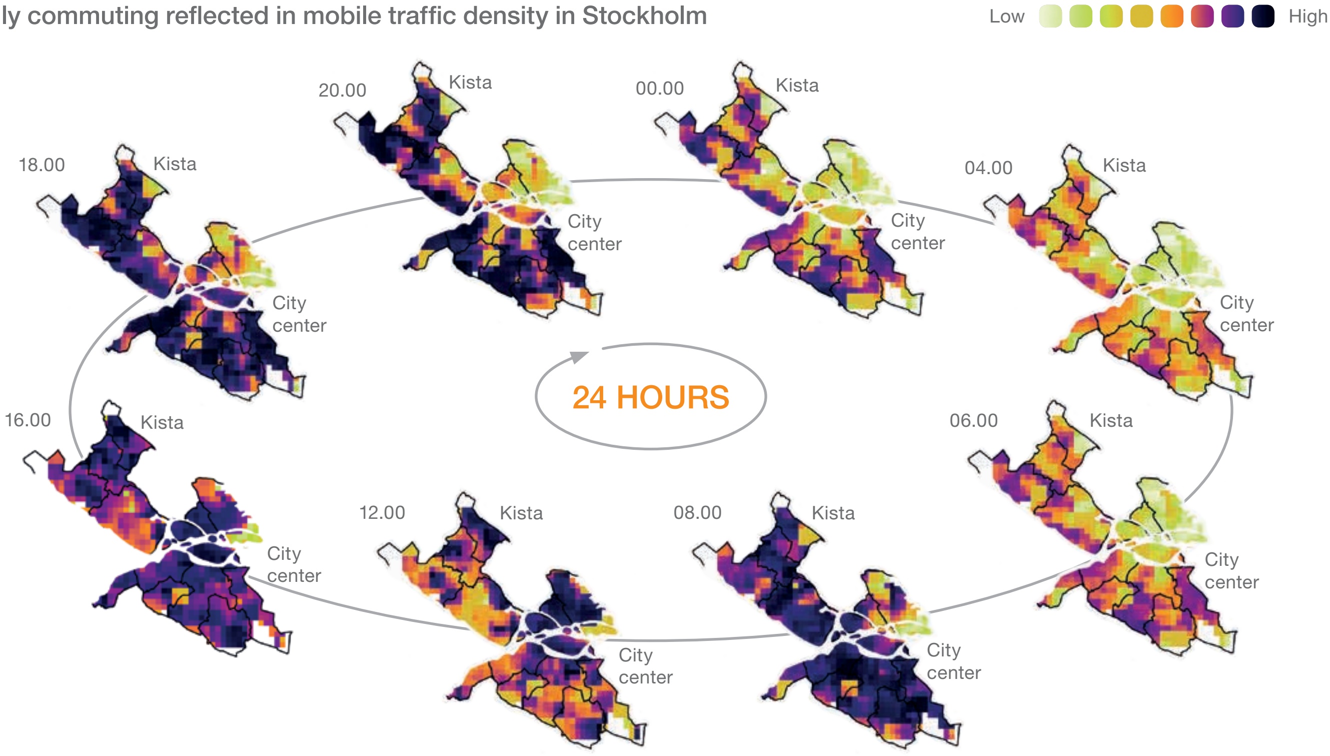
Daily traffic dynamics

Time-aggregated maps of mobile traffic capture patterns and reveal where people are active. This information could be used to complement census data. These maps are more up-to-date than those based on census polling, relatively cheaper to obtain, and more dynamic. For example, the daily dynamics of commuting to work in Stockholm are well-illustrated through mobile traffic density variations in Kista – the largest corporate area in Sweden – and in the city center areas during the course of the average day.

The implications of traffic pattern analysis

Operators already adapt their network settings to meet the major differences between weekday and weekend traffic profiles. Advances in automated network management and operation functions will allow dynamic configuration during the day, allowing the available network resources to be utilized in the most effective way. This will also lead to improved network performance and energy efficiency.

Daily commuting reflected in mobile traffic density in Stockholm



MOBILE BROADBAND SPECTRUM

With people increasingly expecting innovative services and new advanced applications, next year will be an important milestone in the development of global mobile broadband communications.

National delegates will come together at the ITU World Radiocommunication Conference in November 2015 (WRC-15) to discuss additional spectrum resources with the aim of meeting the expansion of mobile broadband traffic. Their decisions will impact tomorrow's mobile broadband traffic capacity and coverage in both cities and rural areas. The rapid rate of global urbanization is putting new strains on cities. These growing cities face a number of challenges including urban mobility and transport, security and access to health and educational services. Mobile broadband communications systems should be designed to provide similar services to both rural areas and cities. Higher frequencies, such as the L-band (1.5 GHz), the S-band (2.8 GHz) and the C-band (4 GHz) are under review with the aim of satisfying the communication services needs of urban environments. Additional spectrum resources are also being considered for mobile broadband in lower bands (600 MHz), extending network capacity and coverage into rural areas.

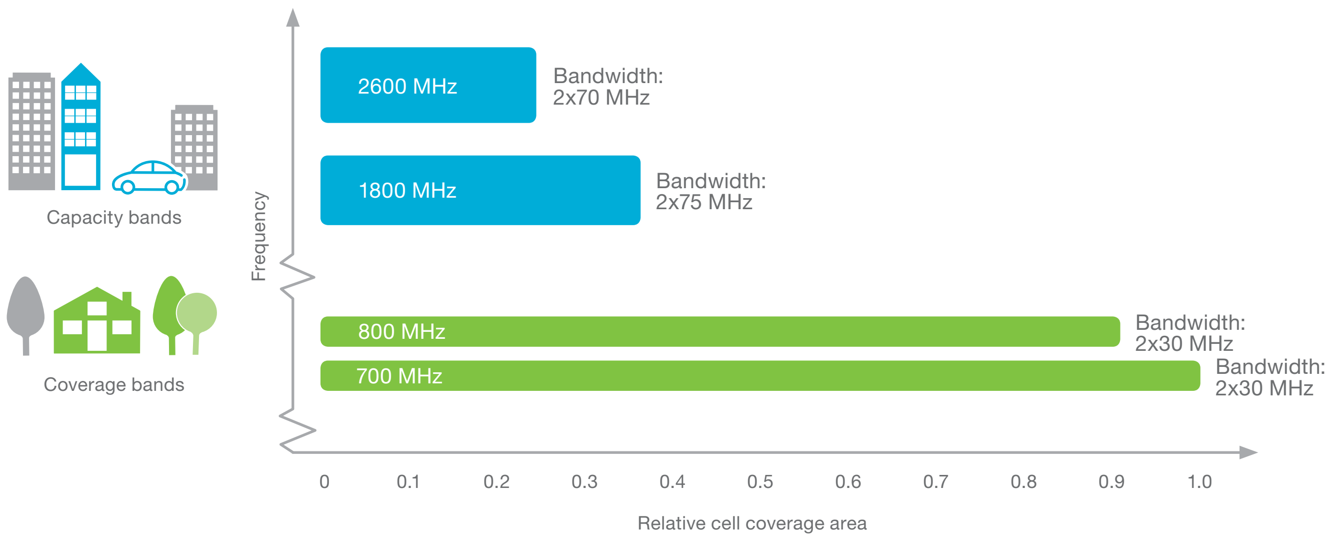
Higher frequencies for tomorrow's cities

Densely-populated cities require high to very high mobile network capacity per square kilometer. This may be achieved by increasing the bandwidth in higher frequency bands, or by introducing more cell sites to improve capacity. More demanding services could require an aggregation of two or more spectrum bands. If the 20 MHz carrier channels typically used in city areas are aggregated, e.g. in the 1800 MHz and 2.6 GHz bands, then the peak data rates for services may increase from 150 Mbps to 300 Mbps. To satisfy the increasing communication services needs in cities, 4G/LTE-Advanced networks will be able to support peak data rates of over 1 Gbps in the next few years through the aggregation of up to five radio carrier channels.

Lower frequencies for rural success

Sparsely populated rural areas require medium to high network capacity per square kilometer. Thanks to the smaller concentration of people, relatively large mobile network cells are sufficient and can be cost efficiently deployed in lower frequency bands. Therefore, rural users can enjoy a similar experience to people in cities. If the 10 MHz carrier channels typically used in rural areas are aggregated, e.g. in the 700 MHz and 800 MHz bands, then the peak data rates for services may increase from 75 Mbps to 150 Mbps. More harmonized spectrum for mobile broadband will be needed below 1 GHz to support more demanding communication services in rural areas.

Mobile broadband spectrum bands have different natures in terms of capacity and coverage



METHODOLOGY

Forecast methodology

Ericsson performs forecasts on a regular basis to support internal decisions and planning as well as market communication. The subscription and traffic forecast baseline in this report uses historical data from various sources, validated with Ericsson internal data, including extensive measurements in customer networks. Future development is estimated based on macroeconomic trends, user trends (researched by Ericsson ConsumerLab), market maturity, technology development expectations and documents such as industry analyst reports, on a national or regional level, together with internal assumptions and analysis. Historical data may be revised if the underlying data changes – for example, if operators report updated subscription figures.

Mobile subscriptions include all mobile technologies. M2M subscriptions are not included. Subscriptions are defined by the most advanced technology that the mobile phone and network are capable of. Figures are rounded and hence summing up rounded data may result in slight differences from the actual total.

Traffic refers to aggregated traffic in mobile access networks and does not include DVB-H, Wi-Fi or Mobile WiMax traffic. Voice traffic does not include VoIP.

Traffic measurements

New devices and applications affect mobile networks. Having a deep and up-to-date knowledge of the traffic characteristics of different devices and applications is important when designing, testing and managing mobile networks. Ericsson regularly performs traffic measurements in over 100 live networks in all major regions of the world. Detailed measurements are made in a selected number of commercial WCDMA/HSPA and LTE networks with the purpose of discovering different traffic patterns. All subscriber data is made anonymous before it reaches Ericsson's analysts.

GLOSSARY

2G: 2nd generation mobile networks (GSM, CDMA 1x)
3G: 3rd generation mobile networks (WCDMA/HSPA, LTE, TD-SCDMA, CDMA EV-DO, Mobile WiMax)
4G: 4th generation mobile networks (LTE, LTE-A)
5G: 5th generation mobile networks (not yet standardized)
ARPU: Average Revenue Per User, a measure of the revenue generated per user or unit
Basic phone: non-smartphone
CAGR: Compound Annual Growth Rate
CDMA: Code Division Multiple Access
DL: Downlink
EB: ExaByte, 10^18 bytes
EDGE: Enhanced Data Rates for Global Evolution
GB: GigaByte, 10^9 bytes
GSA: Global Supplier Association
GSM: Global System for Mobile Communications
HSPA: High Speed Packet Access
LTE: Long-Term Evolution
M2M: Machine-to-Machine
MB: MegaByte, 10^6 bytes
MBB: Mobile Broadband (defined as CDMA2000 EV-DO, HSPA, LTE, Mobile WiMax and TD-SCDMA)
Mbps: Megabits per second
Mobile PC: Defined as laptop or desktop PC devices with built-in cellular modem or external USB dongle
Mobile router: A device with a cellular network connection to the internet and Wi-Fi or ethernet connection to one or several clients (such as PCs or tablets)
OS: Operating System
P2P: Peer-to-Peer
PetaByte: 10^15 bytes
Smartphone: mobile phones with open OS, e.g. iPhones, Android OS phones, Windows phones but also Symbian and Blackberry OS
TD-SCDMA: Time Division-Synchronous Code Division Multiple Access
VLR: Visitor Location Register
VoIP: Voice over IP (Internet Protocol)
UL: Uplink
WCDMA: Wideband Code Division Multiple Access

Ericsson is the driving force behind the Networked Society – a world leader in communications technology and services. Our long-term relationships with every major telecom operator in the world allow people, businesses and societies to fulfill their potential and create a more sustainable future.

Our services, software and infrastructure – especially in mobility, broadband and the cloud – are enabling the telecom industry and other sectors to do better business, increase efficiency, improve the user experience and capture new opportunities.

With more than 110,000 professionals and customers in 180 countries, we combine global scale with technology and services leadership. We support networks that connect more than 2.5 billion subscribers. Forty percent of the world's mobile traffic is carried over Ericsson networks. And our investments in research and development ensure that our solutions – and our customers – stay in front.

Founded in 1876, Ericsson has its headquarters in Stockholm, Sweden. Net sales in 2013 were SEK 227.4 billion (USD 34.9 billion). Ericsson is listed on NASDAQ OMX stock exchange in Stockholm and the NASDAQ in New York.

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