ERICSSON

# ERICSSON MOBILITY REPORT

ON THE PULSE OF THE NETWORKED SOCIETY

JUNE 2015

# KEY FIGURES

*Monthly data traffic volumes by year end
**Active devices

| Mobile subscription essentials | 2013 | 2014 | 2020 forecast | CAGR 2014–2020 | Unit |
|---|---|---|---|---|---|
| Worldwide mobile subscriptions | 6,800 | 7,100 | 9,200 | 5% | million |
| > Smartphone subscriptions | 1,800 | 2,600 | 6,100 | 15% | million |
| > Mobile PC, tablet and mobile router subscriptions | 250 | 250 | 400 | 10% | million |
| > Mobile broadband subscriptions | 2,200 | 2,900 | 7,700 | 20% | million |
| > Mobile subscriptions, GSM/EDGE-only | 4,300 | 4,000 | 1,400 | -15% | million |
| > Mobile subscriptions, WCDMA/HSPA | 1,600 | 2,000 | 3,800 | 10% | million |
| > Mobile subscriptions, LTE | 200 | 500 | 3,700 | 40% | million |

| Traffic essentials* | 2013 | 2014 | 2020 forecast | CAGR 2014–2020 | Unit |
|---|---|---|---|---|---|
| > Monthly data traffic per smartphone** | 750 | 1,050 | 4,900 | 30% | MB/month |
| > Monthly data traffic per mobile PC** | 3,200 | 4,200 | 17,300 | 25% | MB/month |
| > Monthly data traffic per tablet** | 1,400 | 1,900 | 8,400 | 30% | MB/month |
| Total monthly mobile data traffic | 2 | 3.3 | 30.5 | 45% | 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 | 9 | 45% |
| > Smartphones | 10 | 50% |
| > Mobile PC | 3 | 20% |
| > Tablets | 12 | 50% |

**Traffic exploration tool**
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, Europe, Middle East and North East Africa, India, North East and South East Asia and Oceania.


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# ERICSSON MOBILITY REPORT


## Three quarters of global subscription growth came from Africa and Asia in Q1 2015. This pattern is forecast to continue to 2020

Smartphone subscriptions are set to more than double by 2020. By this time, 70 percent of the world´s population will have a smartphone. There is also a growing number of connected devices, mainly driven by an increasing range of applications and business models, and supported by falling modem costs. Our forecast indicates that there will be 26 billion connected devices by 2020.

Mobile data traffic in Q1 2015 was 55 percent higher than in Q1 2014. By 2020, 80 percent of mobile data traffic will be from smartphones. Mobile data consumption varies a lot between different user segments. In fact, in mature mobile broadband markets, 10 percent of subscribers consume around 50 percent of all data traffic. Video continues to be the key growth factor, with 60 percent of all mobile data traffic forecast to be from online video by 2020.

In this edition, we have three feature articles exploring various aspects of the consumer experience on smartphones.

The digital signatures of sport shows that real-time viewing, sharing results and social networking have become integral parts of sports events, creating a mix of real and virtual experiences. The combination of smartphones, apps and mobile broadband coverage at such events forms an enhanced spectator experience.

Beyond average data consumption compares subscriber groups based on monthly data consumption and reveals that heavy data users consume 20 times more video than average.

Screen size matters reveals that device screen size significantly affects the extent to which various services are used. For example, tablet users spend 50 percent more time watching videos online than average mobile broadband users.

We hope you find the report engaging and valuable.

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**Publisher:** Rima Qureshi
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# MOBILE SUBSCRIPTIONS Q1 2015

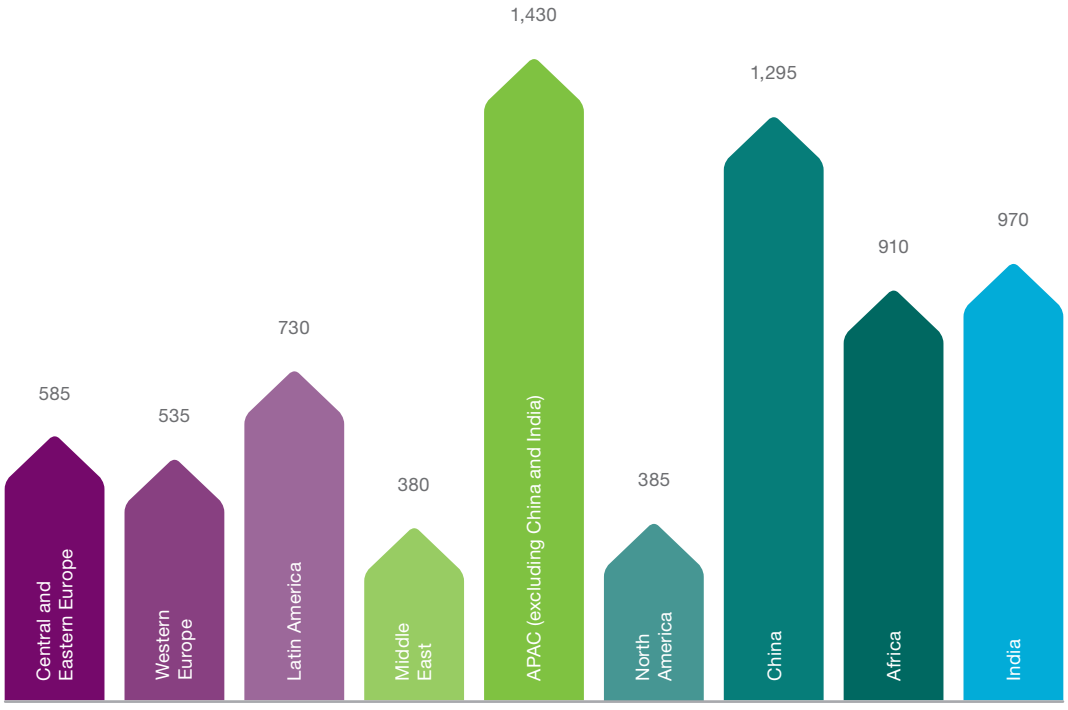
## The total number of mobile subscriptions in Q1 2015 was around 7.2 billion, including 108 million new subscriptions

Global mobile subscriptions are growing by 1.5 percent quarter-on-quarter and around 5 percent year-on-year. India grew the most in terms of net additions (+26 million), followed by China (+8 million), Myanmar (+5 million), Indonesia (+4 million) and Japan (+4 million). Global mobile penetration reached 99 percent in Q1 2015. Smartphones accounted for close to 75 percent of all mobile phones sold in Q1 2015, compared to around 65 percent during Q1 2014. However, around 40 percent of all mobile phone subscriptions are associated with smartphones, leaving considerable room for further uptake.

The number of mobile broadband subscriptions is growing globally by around 30 percent year-on-year, increasing by approximately 150 million in Q1 2015 alone.

LTE continues to grow strongly and has reached around 600 million subscriptions, with approximately 105 million additions in Q1 2015. WCDMA/GSM added around 60 million during Q1. The majority of 3G/4G subscriptions have access to GSM/EDGE as a fallback, although GSM/EDGE-only subscriptions declined by 30 million.

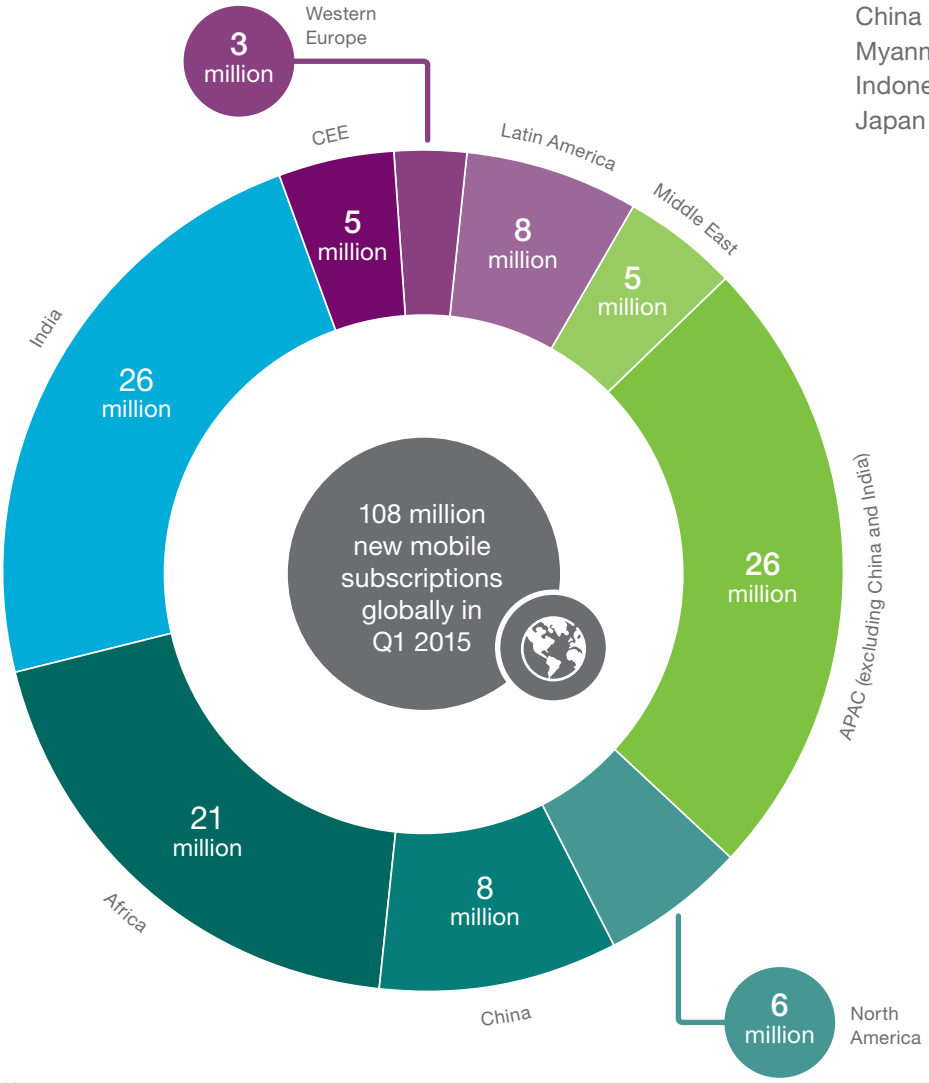
2.9 billion mobile broadband subscriptions in Q1 2015

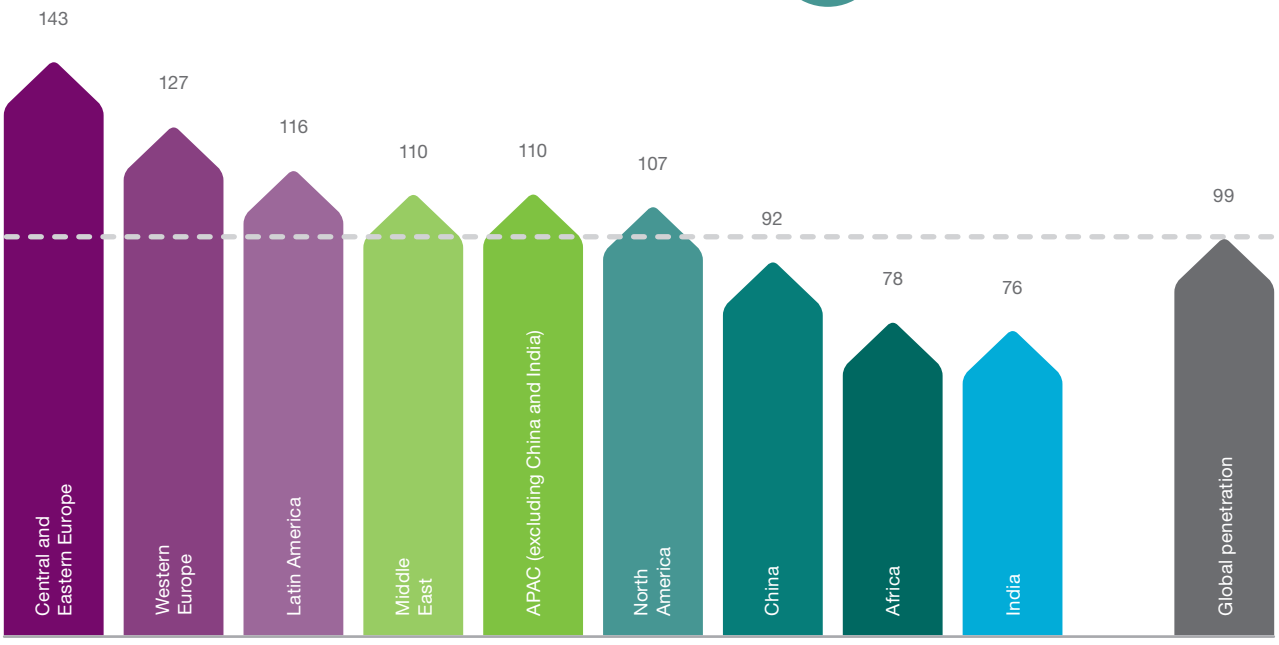



Mobile subscriptions (millions)

## Top five countries by net additions

| | |
|---|---|
| India | +26 million |
| China | +8 million |
| Myanmar | +5 million |
| Indonesia | +4 million |
| Japan | +4 million |




Penetration (percent)

# MOBILE SUBSCRIPTIONS OUTLOOK

## By 2016 the number of smartphone subscriptions will surpass those for basic phones

Smartphones make up the majority of mobile broadband devices today and subscriptions are expected to have more than doubled by 2020. This is due to greater affordability in developing markets such as Asia Pacific, the Middle East, and Africa. 5G subscriptions will be commercially available in 2020, and subscription 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 communication.

| Subscriptions | 2014 | 2020 |
|---|---|---|
| Total mobile | 7.1 billion | 9.2 billion |
| Mobile broadband | 2.9 billion | 7.7 billion |
| Smartphones | 2.6 billion | 6.1 billion |
| Mobile PCs, tablets and routers | 250 million | 400 million |

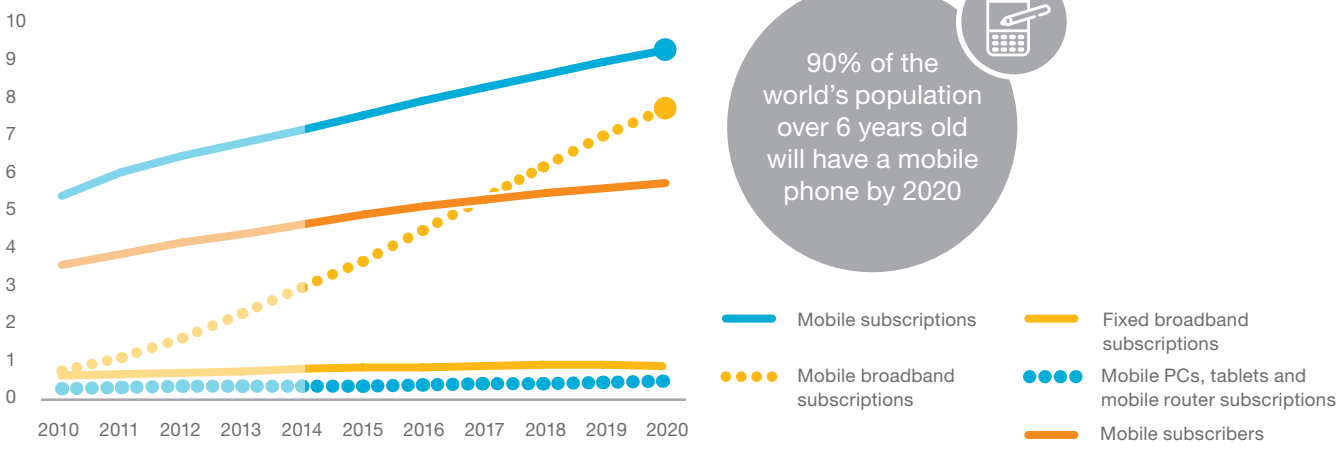
## 85 percent of all subscriptions will be for mobile broadband by the end of 2020

The number of subscriptions exceeds the population in many countries. This is largely due to inactive subscriptions and multiple device ownership – for example, 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 4.9 billion subscribers versus 7.2 billion subscriptions.

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 devices with mobile capabilities and a subscription will almost double by 2020.

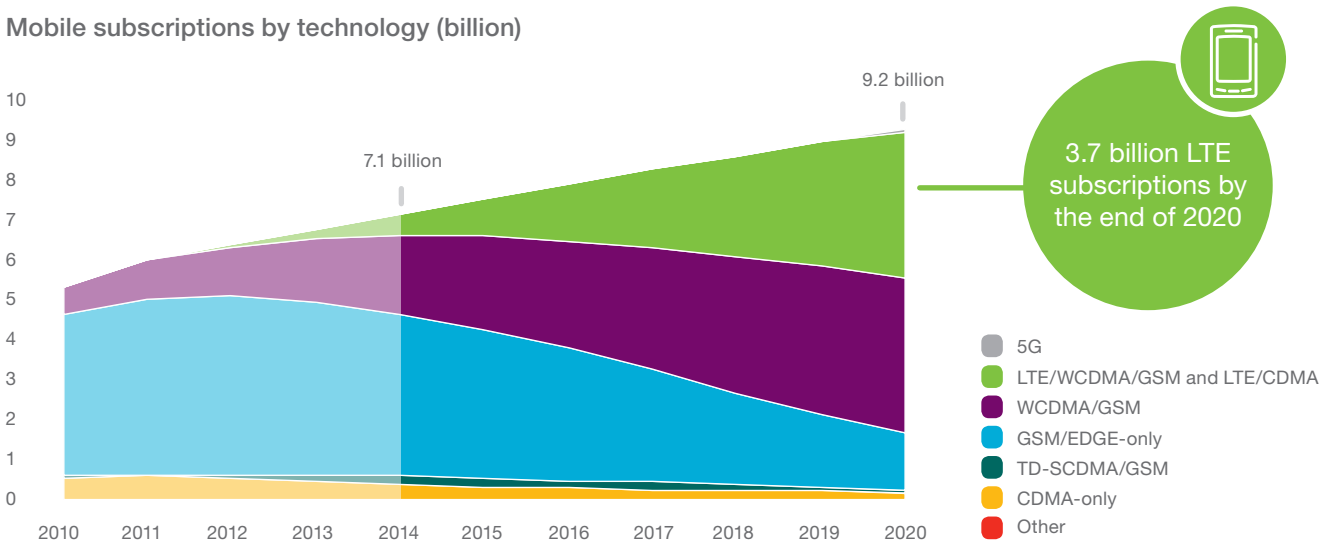
Mobile broadband subscriptions will reach 7.7 billion globally by 2020. They account for an overwhelming share of all broadband subscriptions. Mobile broadband will complement fixed broadband in some segments, and will be the dominant access in others.[1]

Subscriptions/lines, subscribers (billion)




[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

Mobile subscriptions by technology (billion)




## WCDMA/GSM will make up the largest share of all subscriptions in 2020

There will be around 3.8 billion WCDMA/GSM subscriptions by 2020, compared to around 3.7 billion LTE subscriptions.

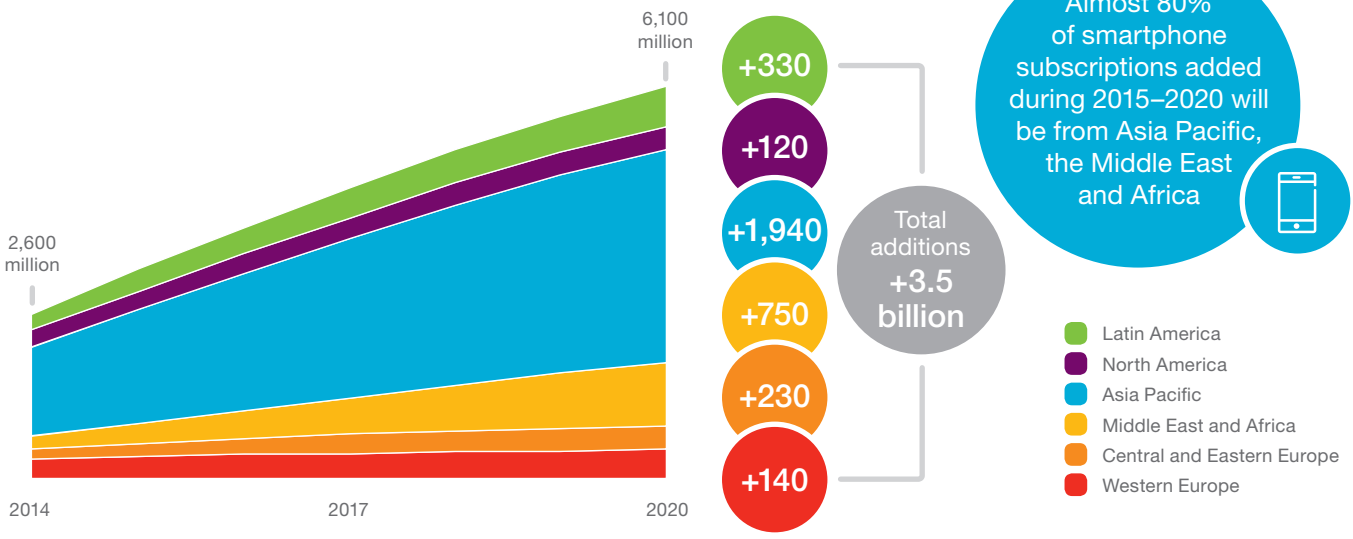
GSM/EDGE-only represents the largest share of mobile subscriptions today. In developed markets, there has been a substantial migration to more advanced technologies, and on a global level this has resulted in a slight decline in GSM/EDGE-only subscriptions.

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

## Smartphone subscriptions set to more than double by 2020

Most mobile broadband devices are, and will continue to be, smartphones. Many consumers in developing markets first experience the internet on a smartphone, usually due to limited access to fixed broadband. 2014 saw more than 700 million smartphone subscriptions added, due to the addition of new subscribers and existing subscribers exchanging their basic phones for smartphones. It took over five years to reach the first billion smartphone subscriptions, a milestone that was hit in 2012, and less than two years to reach the second billion.

Smartphone subscriptions per region 2014–2020



# REGIONAL SUBSCRIPTIONS OUTLOOK

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

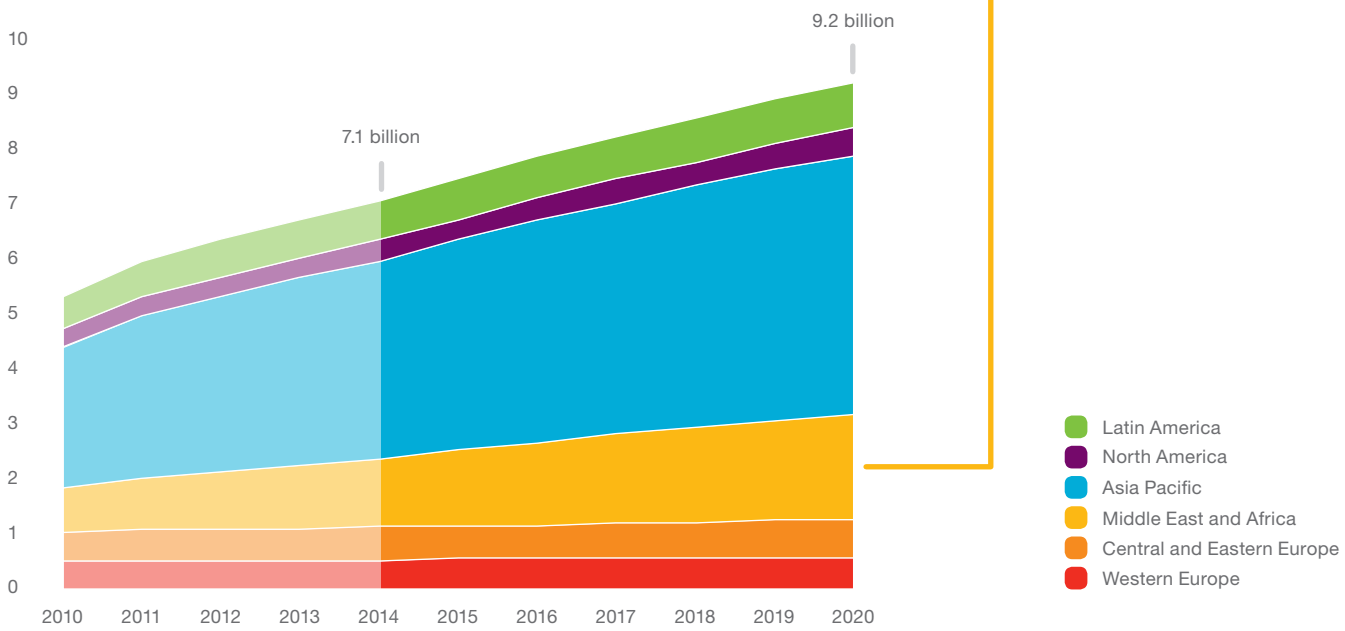
In developing regions, growth is being driven by new subscribers, as phones become more affordable. By contrast, growth in mature markets is coming from the increasing number of devices per individual. The economic situation also has an impact on the uptake of subscriptions in different regions.

| 3G/4G share of subscriptions | 2014 | 2020 |
|---|---|---|
| North America | 100% | 100% |
| Western Europe | 75% | 100% |
| Central and Eastern Europe | 50% | 85% |
| Latin America | 40% | 90% |
| Asia Pacific | 40% | 85% |
| Middle East and Africa | 20% | 70% |

The number of mobile subscriptions is continuing to grow across regions. This growth is expected to be particularly strong in the Middle East and Africa due to a young and growing population and rising GDP – as well as the current penetration being low compared to the rest of the world. Several countries in the Asia Pacific region will experience a strong subscription uptake over the next five years, while more mature regions like North America and Europe will have more moderate growth.

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

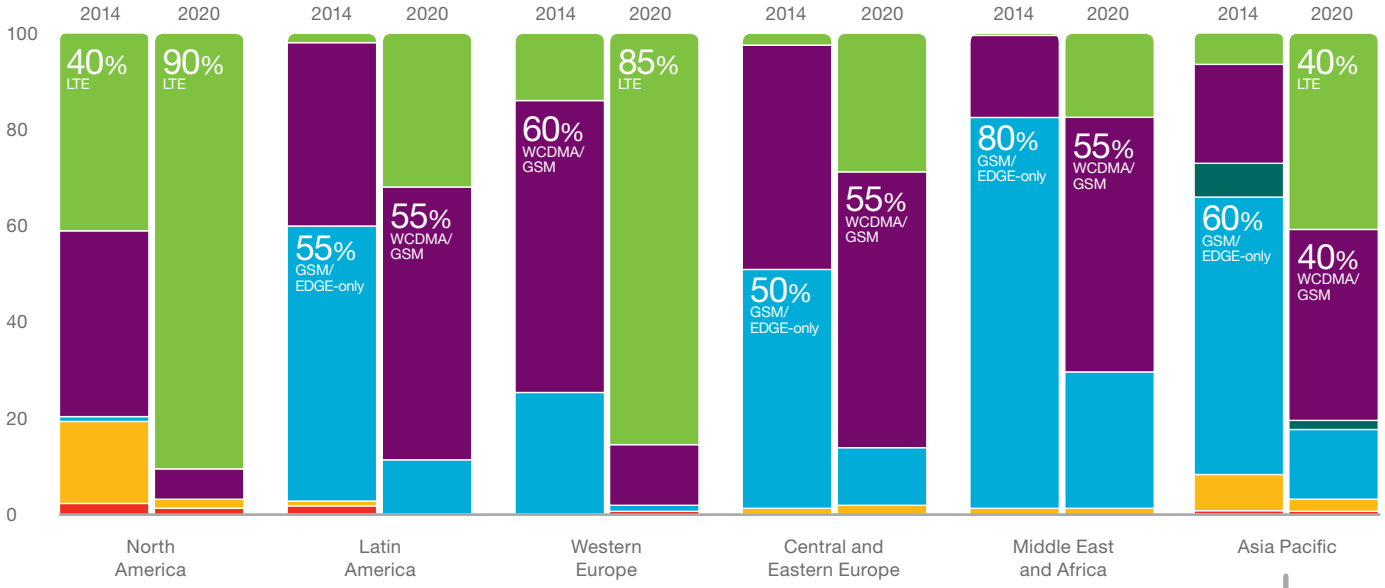
Mobile subscriptions by region (billion)



Mobile subscriptions by region and technology (percent)

North America has the highest share of LTE subscriptions in the world due to rapid migration from CDMA-based networks and HSPA

Western Europe is at the forefront of mobile broadband due to early LTE roll-out, and well-developed 3G networks




## Mobile subscriptions in North America and Western Europe are mainly WCDMA/GSM and LTE, while in Asia Pacific, Latin America and the Middle East and Africa the majority are GSM/EDGE-only

LTE is being rapidly embraced in North America, Japan and South Korea where it will represent the majority of subscriptions in 2015 (2013 in South Korea). By 2020, the first 5G subscriptions will be available: Japan and South Korea are expected to be the first countries where this will happen.

Asia Pacific will see 1.1 billion net additions by the end of 2020. Japan and South Korea were early adopters of LTE, and penetration has reached 45 percent and 70 percent, respectively. These two countries accounted for 20 percent of global LTE subscriptions at the end of 2014. Mainland China is rolling out LTE and by the end of 2020 it will have over 1.1 billion subscriptions for the technology – around 30 percent of the global total.

Asia Pacific, Latin America and Middle East and Africa will move from mainly GSM/EDGE-only markets to WCDMA/GSM and LTE

In Central and Eastern Europe, the share of WCDMA/GSM 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 the end of 2015.

GSM/EDGE-only subscriptions will still be significant in the Middle East and Africa. In Sub-Saharan Africa, GSM/EDGE-only subscriptions will remain predominant up to 2020, due to the high number of lower income consumers using 2G-enabled handsets.

# ENABLING THE INTERNET OF THINGS

**Growth in the number of connected devices is accelerating, driven by a growing range of applications and business models, supported by falling modem costs. A strong foundation for this growth is the extensive cellular coverage, with an estimated 90 percent of the world's population covered**

Mobile phones have been the largest growth segment amongst connected devices. Looking forward, Machine-to-Machine (M2M) is expected to show strong growth, driven by new use cases, e.g., in cars, machines and utility metering. The connected home is driving connectivity in consumer electronics – mostly over Wi-Fi or Ethernet. In total, 26 billion connected devices are expected by 2020, of which almost 15 billion will be phones, tablets, laptops and PCs. The total excludes passive sensors and radio frequency ID tags.

### Cellular connections

There were around 230 million cellular M2M subscriptions at the end of 2014, and this number will grow substantially in the coming years. However, more things will be connected through capillary networks, using short-range radio to cellular gateways. This will leverage the ubiquity, security and management of cellular networks. One example is home alarm systems where sensors on doors and windows, as well as motion detectors and fire alarms, all connect to an alarm center through a cellular gateway.

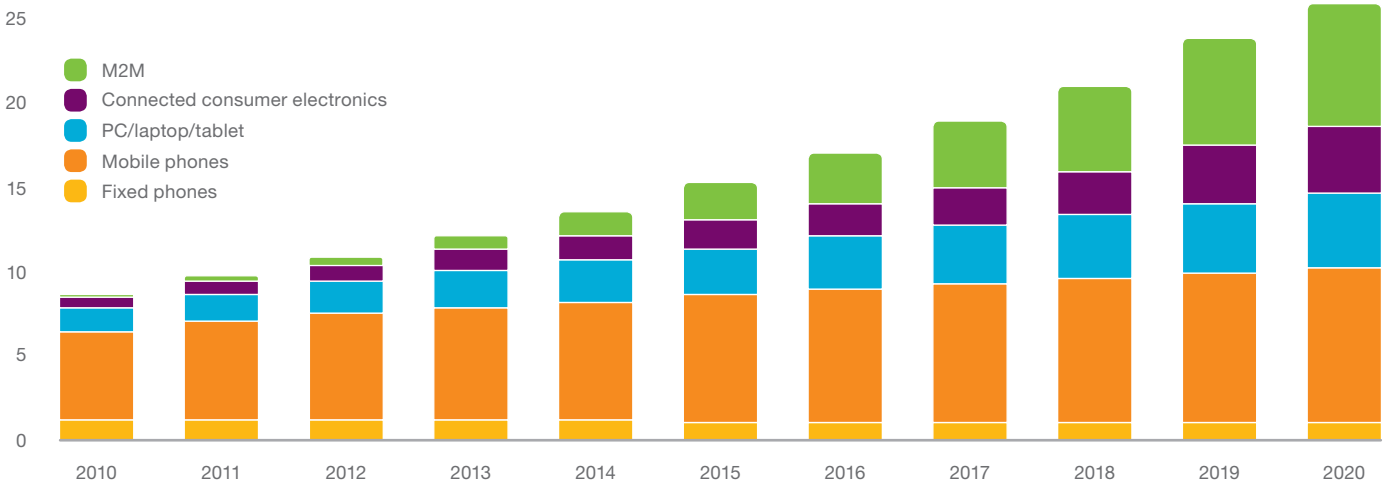
Today, 75 percent of cellular M2M modules are GSM-only and serve applications that do not require high network throughput. A reduction in LTE modem prices will enable new applications with very low latency requirements. New developments and 5G capabilities are expected to extend the range of addressable applications for massive Machine-Type Communications (MTC) deployments.

### Network evolution

The benefits of using cellular M2M connections for MTC include stable performance, security mechanisms and global reach. LTE's share of today's cellular M2M device penetration is around three percent, but further cost reductions will make LTE-connected devices increasingly viable. Additional LTE and GSM/EDGE modes are being standardized, meeting emerging MTC requirements through software upgrades of existing mobile networks. New devices will take advantage of the evolving 3GPP standards, for example system improvements to support battery lifetimes beyond 10 years for remote devices.

M2M is a rapidly growing segment and our forecast points to there being 26 billion connected devices by 2020. New use cases are emerging for both short and long range applications, which would lead to even stronger growth of connected devices, confirming we are well on the way to achieving the vision of 50 billion connected devices.

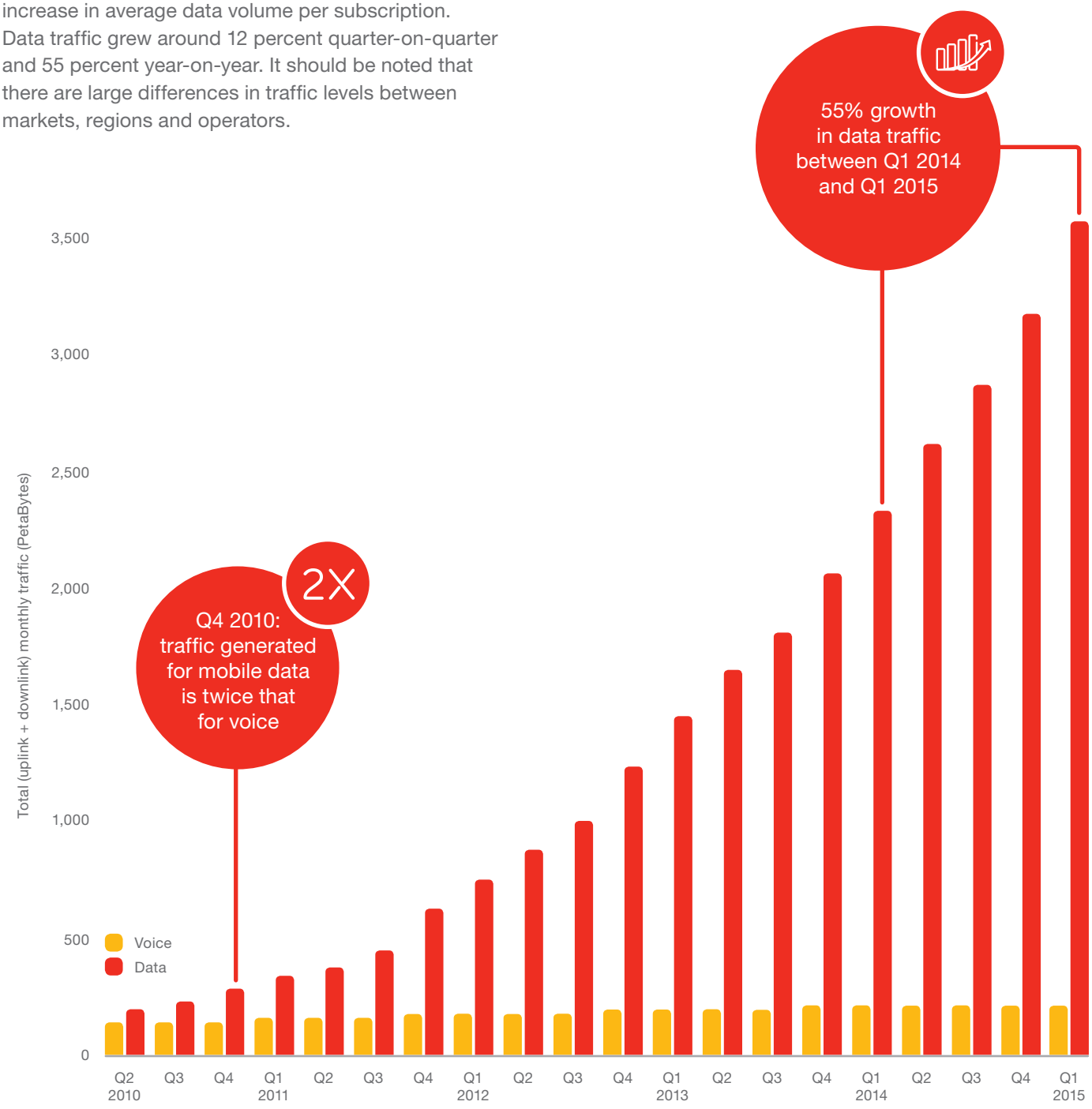
Connected devices (billions)




Examples of M2M: connected cars, machines and utility meters
Examples of consumer electronic (CE) devices networked TVs, digital media boxes, Blu-ray players, etc
Not included: passive sensors and RFID tags

# MOBILE TRAFFIC Q1 2015

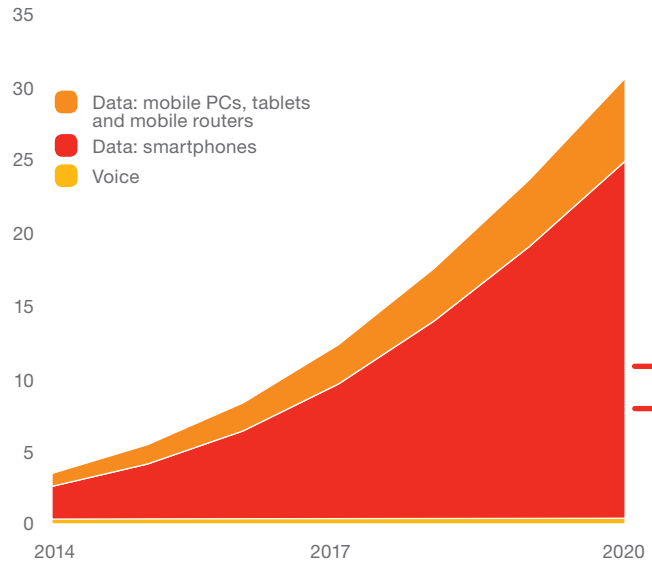
The graph below shows total global monthly data and voice traffic from Q2 2010 to Q1 2015.[1] It depicts a gradually moderating increase in data traffic, as well as voice traffic growth in the mid-single digits per year. The growth in data traffic is being driven by the rise of mobile data subscriptions, along with a continued increase in average data volume per subscription. Data traffic grew around 12 percent quarter-on-quarter and 55 percent year-on-year. It should be noted that there are large differences in traffic levels between markets, regions and operators.




[1] Traffic does not include DVB-H, Wi-Fi, or Mobile WiMAX. Voice does not include VoIP

# MOBILE TRAFFIC OUTLOOK

Global mobile traffic (monthly ExaBytes)




10X

growth in smartphone traffic between 2014 and 2020

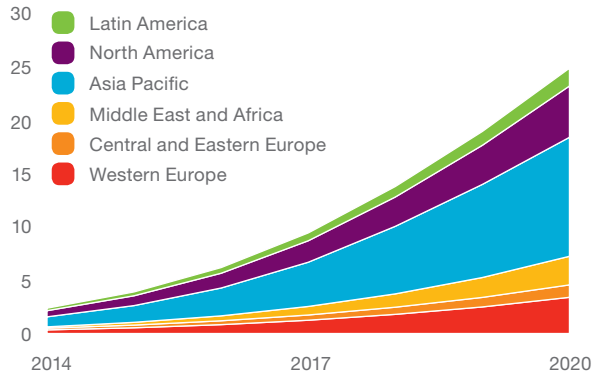
80% of mobile data traffic will be from smartphones by the end of 2020

## Total mobile data traffic is expected to rise at a compound annual growth rate (CAGR) of around 45 percent

Mobile data traffic growth is due to both the rising number of smartphone subscriptions and increasing data consumption per subscriber. This will result in a nine-fold increase in traffic by the end of 2020.

The growth in data traffic between 2019 and 2020 will be greater than the total sum of all mobile data traffic up to the end of 2013. There are large differences in subscribers' data consumption patterns between networks, markets and subscriber segments. Factors such as data plans, user device capabilities and network performance all impact data consumption per subscriber.

Smartphone data traffic per region (monthly ExaBytes)




## Asia Pacific will generate 45 percent of total smartphone traffic by the end of 2020

By 2020, monthly smartphone data consumption per active subscription in North America (14 GB) will be 1.5 times that of Western Europe (9.5 GB) and 3.5 times that of Asia Pacific (4 GB). However, the Asia Pacific region will have the largest share of total smartphone traffic in 2020, due to growth in the number of subscriptions.

# REGIONAL MOBILE TRAFFIC

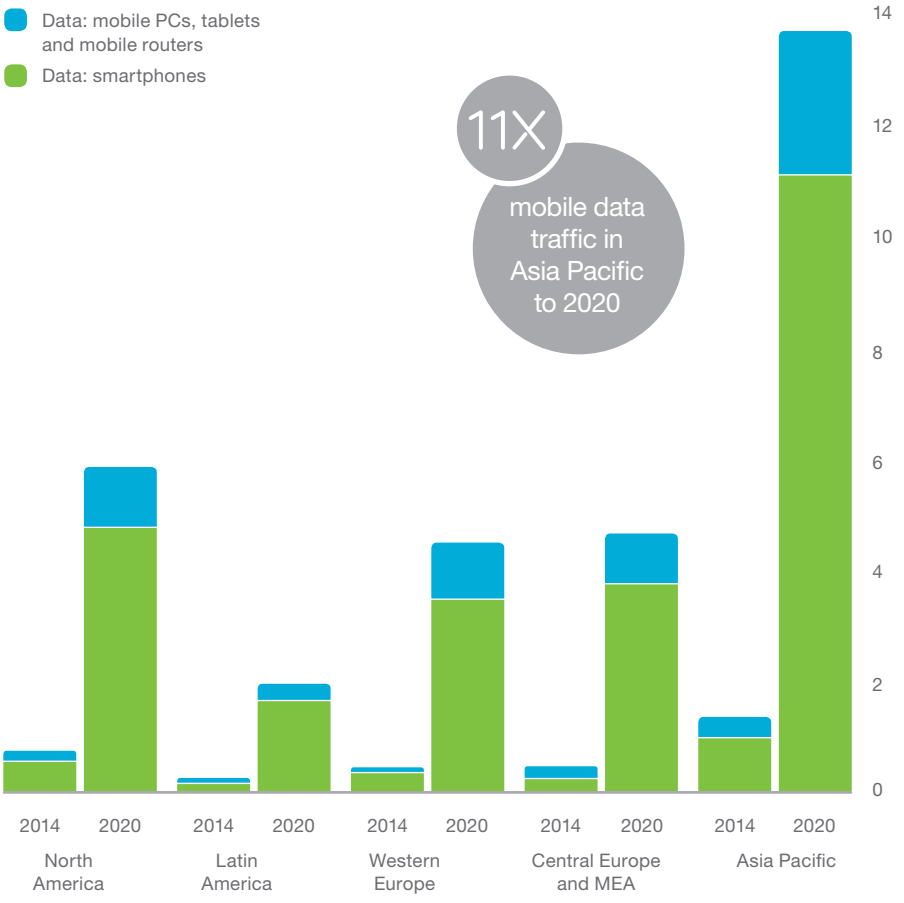
**Asia Pacific will have the largest share of mobile data traffic in 2020, due to rapid growth in subscriptions. China alone will add 400 million mobile subscriptions by 2020**

| Mobile data traffic growth by region | 2014 (EB/month) | Multiplier 2014–2020 |
|---|---|---|
| Asia Pacific | 1.3 | 11 |
| Central Europe and Middle East and Africa | 0.5 | 11 |
| Western Europe | 0.5 | 9 |
| North America | 0.8 | 8 |
| Latin America | 0.3 | 7 |

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

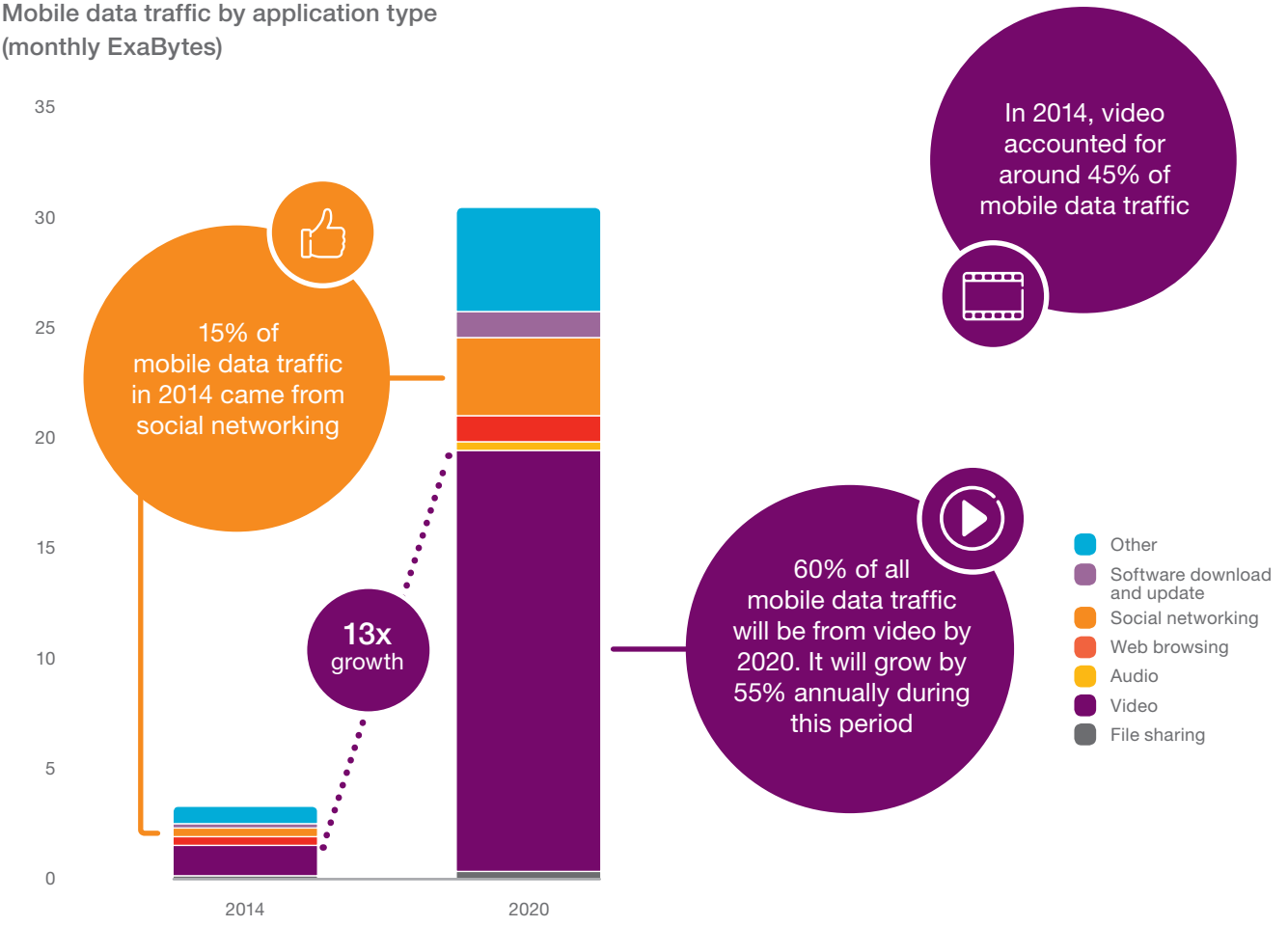
North America and Western Europe currently have a larger share of total traffic volume than their subscription numbers imply. This is due to high penetration of high-end user devices and well built-out WCDMA and LTE networks leading to higher data usage per subscription. In Western Europe, the improved speed and capacity of WCDMA networks and the deployment of LTE will meet consumer demand for a better user experience.

**Global mobile data traffic (monthly ExaBytes)**



# MOBILE APPLICATION TRAFFIC OUTLOOK

Mobile data traffic by application type (monthly ExaBytes)




## Mobile video dominates traffic growth

In many mobile networks today, 40–60 percent of video traffic[1] is from YouTube. Mobile video in general is forecast to grow by around 55 percent annually through to 2020, when it will account for around 60 percent of all mobile data traffic.[2] Music streaming is gaining popularity, but functions such as content caching and offline playlists limit the impact on traffic growth. However, audio traffic is still expected to increase in line with total mobile traffic growth. The relative share of traffic generated by web browsing will have declined from 10 percent in 2014 to 5 percent by 2020 mainly as a result of stronger growth in the video category. 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.

[1] This is based on Ericsson measurements in a selected number of commercial networks in Asia, Europe and the Americas
[2] Video is also likely to form a major part of file sharing traffic in addition to the identified application type 'video'

2015–2020
570
ExaBytes

## Total mobile video traffic over the next 6 years will be more than 22 times that of the last 6

2009–2014
25
ExaBytes

The number of video-capable devices is a prominent factor in the rapid growth of video. Devices are also evolving, with larger screens and higher display resolutions enabling better picture quality.

Video is increasingly becoming part of other online content including news, advertisements and social media. Video streaming growth is primarily driven by over-the-top providers like YouTube and Netflix.

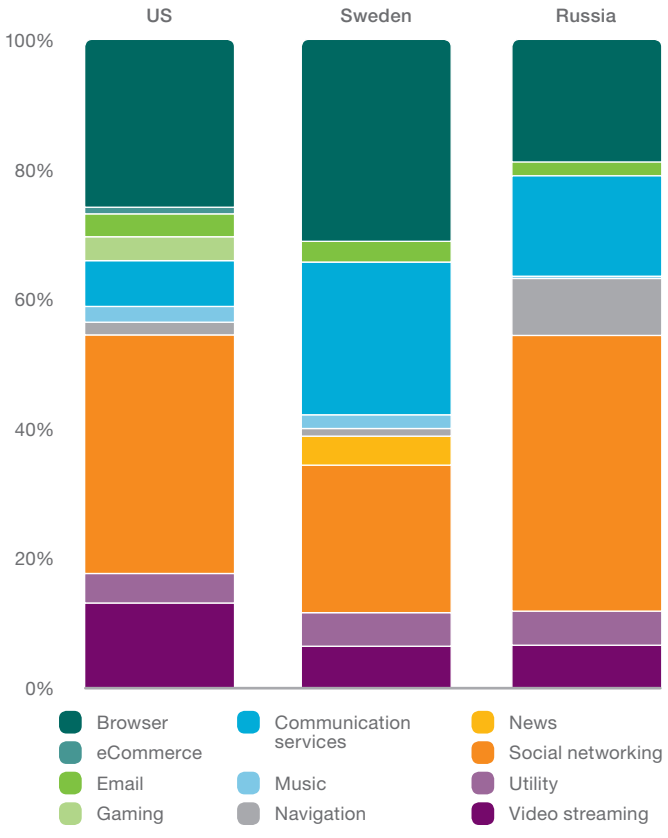
User behavior is changing, resulting in video being consumed in larger quantities – including when people are out and about – and on all types of devices. Continued WCDMA and LTE deployments enable faster networks and therefore improved video app coverage. Technological improvements, like video compression techniques, allow higher resolutions to be more efficiently transmitted over mobile broadband networks, helping operators accommodate increased demand.

## Russians navigate while Swedes communicate

The graph illustrates an Ericsson analysis based on Mobidia data on the top 25 Android apps ranked by monthly active users for three countries during February 2015. Ericsson categorized the apps for each country by type of application, then summed the minutes of use measured by screen time for each app type. In this analysis, app time represents the total time that users in each country spent using the top 25 apps (i.e., not all apps).

Usage of smart devices appears to follow similar patterns around the world. However there are differences beneath the surface. Video streaming – dominant in traffic measurements – is less prominent in the overall app mix when measured by minutes of use. In the US, around 13 percent of app time is spent streaming video, while in Russia and Sweden it is half that. Social networking is significant in all three countries. Russia stands out, with users spending more than 40 percent of app time on social networks. Russia is also notable for high levels of navigation app use, and the variety of such services available. Swedes spend a greater percentage of app time communicating.

Share of minutes of use for app categories




Note: Relative time spent on various app categories as a proportion of time spent on the top 25 apps
Source: Ericsson analysis of Mobidia data, February 2015

# STATE OF THE NETWORKS

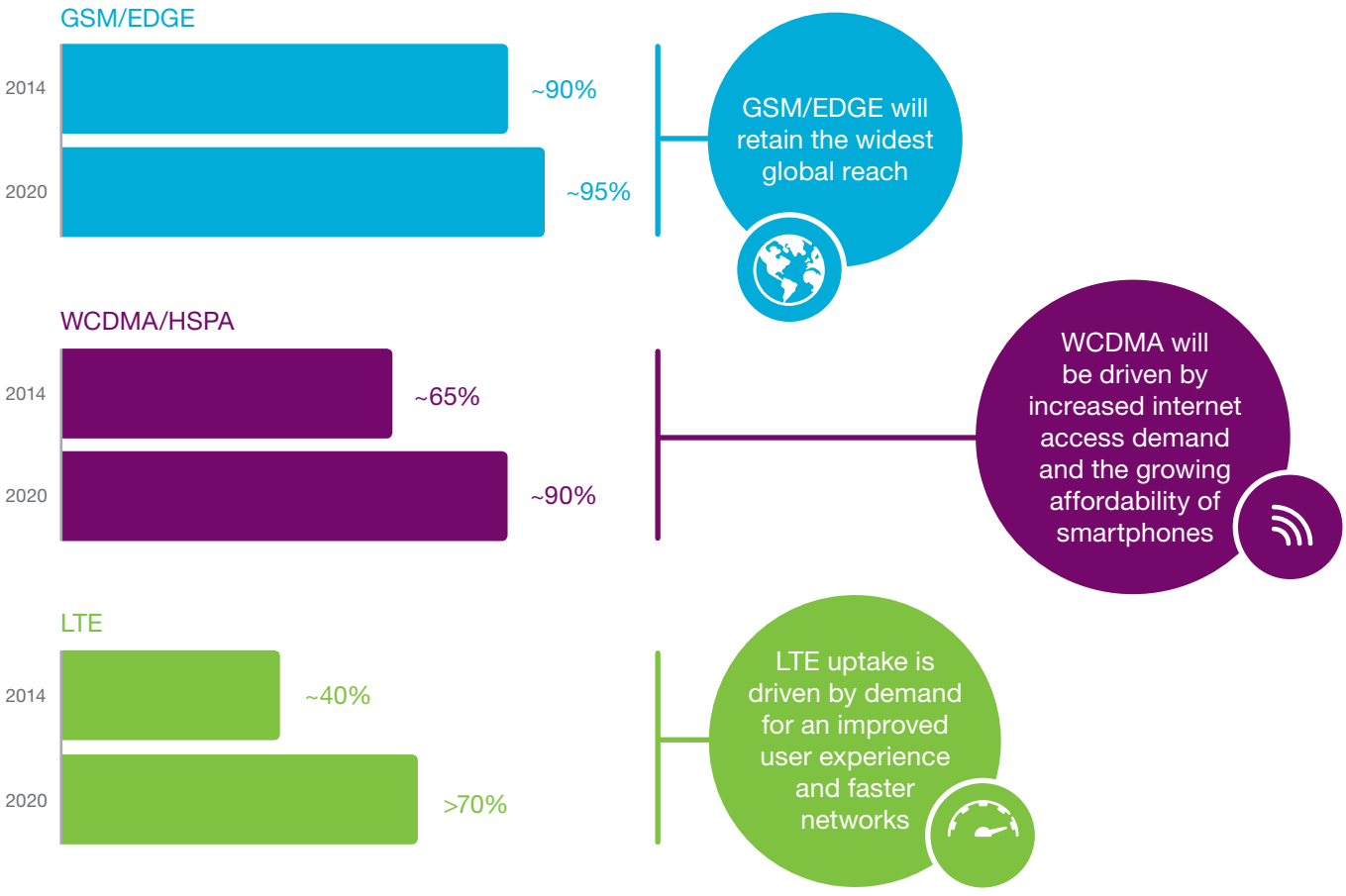
## Today's subscribers expect a high quality user experience and continual service improvement. Evolving mobile network capabilities is the key enabler to ensuring such a user experience

New network functionalities and service capabilities are being implemented for both data and voice. These include improvements to both downlink and uplink speeds and new ways to efficiently deliver content at a certain quality level, e.g. LTE Broadcast. Improved voice quality and new, richer communications services like mobile HD voice, VoLTE, video calling and enriched messaging are enabled by IP-based networks. Furthermore, with native Wi-Fi calling functionality now available on smartphones, users can be offered operator voice and communication services (SIM-based) over Wi-Fi.

With the growing demand for Machine-Type Communication (MTC) comes the need to re-think coverage. A key enabler in satisfying these demands is additional spectrum below 1 GHz. This enhances rural geographical coverage and improves deep indoor coverage in urban areas.

World population coverage by technology[1]

## By 2020, around 90 percent of the world's population will be covered by mobile broadband networks




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

## Re-thinking coverage for MTC

There were 230 million cellular M2M subscriptions at the end of 2014. M2M involves connecting devices and transferring data to networks and the internet, forming the Internet of Things (IoT). This creates demand for app coverage to meet various MTC application requirements. The two factors that will have an impact on app coverage are:

- Machines, such as temperature and humidity meters, alarms and machine supervision sensors will be located everywhere, including unpopulated areas.
- MTC applications come in various forms, with different communication and network performance demands. Data rate and latency requirements can vary widely, from low to high. Therefore new robustness, latency and security demands will be set in many applications.

These factors build demand for additional geographical coverage beyond areas where people live and work, and improved capacity to handle IoT and MTC applications.

Additional LTE and GSM/EDGE modes are being standardized, meeting IoT and MTC requirements through software upgrades of existing mobile networks.

Rural areas need expanded geographical coverage with increased data speeds, while urban areas need faster data speeds with improved deep indoor coverage. Further coverage expansion and increased data speed can be provided cost-efficiently using additional spectrum above and below 1 GHz.

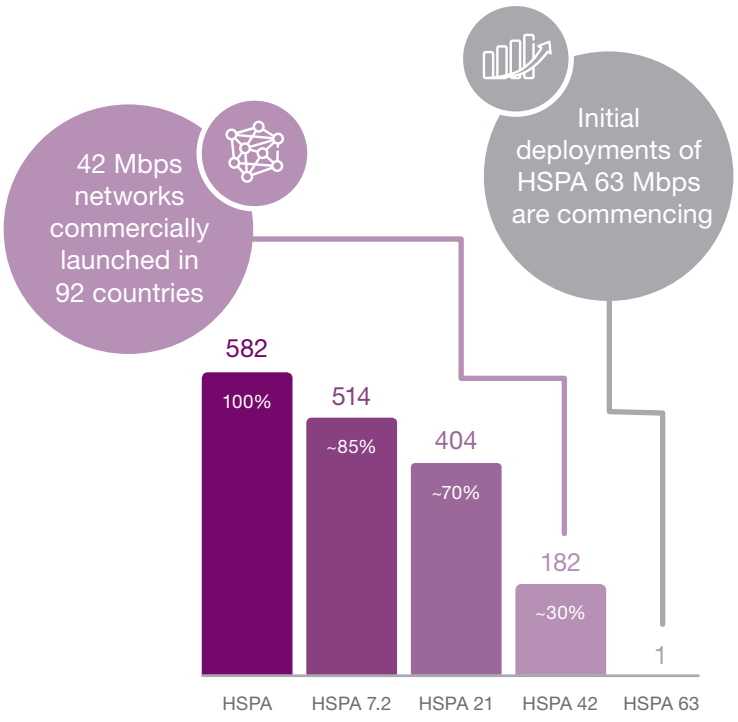
This reinforces the need for an additional 600–900 MHz of harmonized spectrum for mobile broadband applications. Data traffic from smartphones, tablets, mobile PCs and routers is forecast to increase nine-fold between now and 2020. Traffic from M2M devices is also expected to increase. 5G standards will meet future demands for high data rates, short latency and robustness after 2020.

## Mobile broadband networks are evolving higher speeds, improved functionality and better spectrum efficiency

WCDMA/HSPA is essential in evolving networks since it enables mass market mobile broadband. Over the coming year we will see continued evolutionary steps towards improved downlink and uplink speeds. In the uplink we will see 2x5 MHz providing speeds of up to 12 Mbps. These improvements will include network and terminal support. Even though many operators continue to upgrade their HSPA networks to higher speeds, around 30 percent of all networks do not yet have support for speeds of 21 Mbps or higher.

Low band networks can complement higher frequency deployments, as they improve coverage, quality of service, and the user experience. Today, WCDMA/HSPA 900 MHz deployments are considered mainstream, with 96 commercial networks in 60 countries.[2]

**Percentage of WCDMA networks upgraded to HSPA and to HSPA 7.2, 21, 42 and 63 Mbps**




[2] GSA April, 2015

Source: Ericsson and GSA (May 2015)

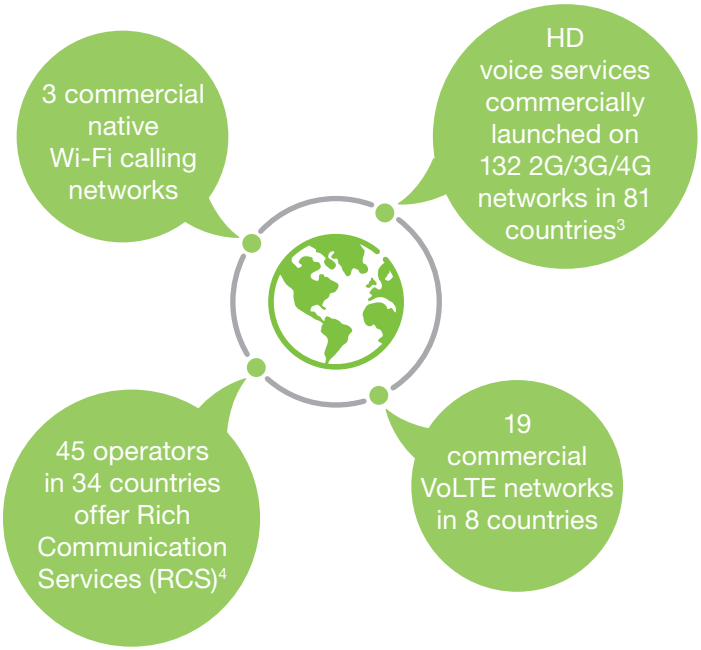
## LTE is evolving

LTE uptake is driven by the demand for an improved user experience and faster networks. This uptake is being fueled by an attractive LTE device ecosystem. 300 suppliers have launched 3,000 LTE user devices, of which nearly half were launched in the last twelve months. These include both LTE FDD and TDD (TD-LTE) models. To meet the growing demand for LTE-based services, operators are seeking new opportunities to obtain additional spectrum and solutions that better optimize its use. One additional spectrum source is unpaired spectrum for LTE TDD. So far, 54 LTE TDD networks have been commercially launched in 34 countries. 16 networks with both TDD and FDD modes together have been deployed.[3] In an aggregated FDD/TDD network, FDD uplinks improve the TDD band's effective application coverage. In addition, mobile broadband downlink data rates increase by aggregating TDD downlink with FDD downlink.

The number of LTE-Advanced (LTE-A) carrier aggregation commercial launches is increasing, improving spectrum use. Operators have aggregated up to 40 MHz of FDD spectrum, resulting in 225–300 Mbps downlink data speeds. Small cell deployments are increasingly capable of supporting better spectrum utilization, adding capacity and improving in-building coverage.


License Assisted Access (LAA) enables operators to aggregate licensed and unlicensed spectrum to effectively improve mobile data speeds while supporting indoor data traffic growth.

LTE Broadcast is gaining traction as a method for optimizing network resources and available spectrum, enabling new video services and offload networks. Trials and deployments have proven its viability, demonstrating new use cases and business models. Several new LTE Broadcast-enabled devices are expected to enter the commercial market during 2015.

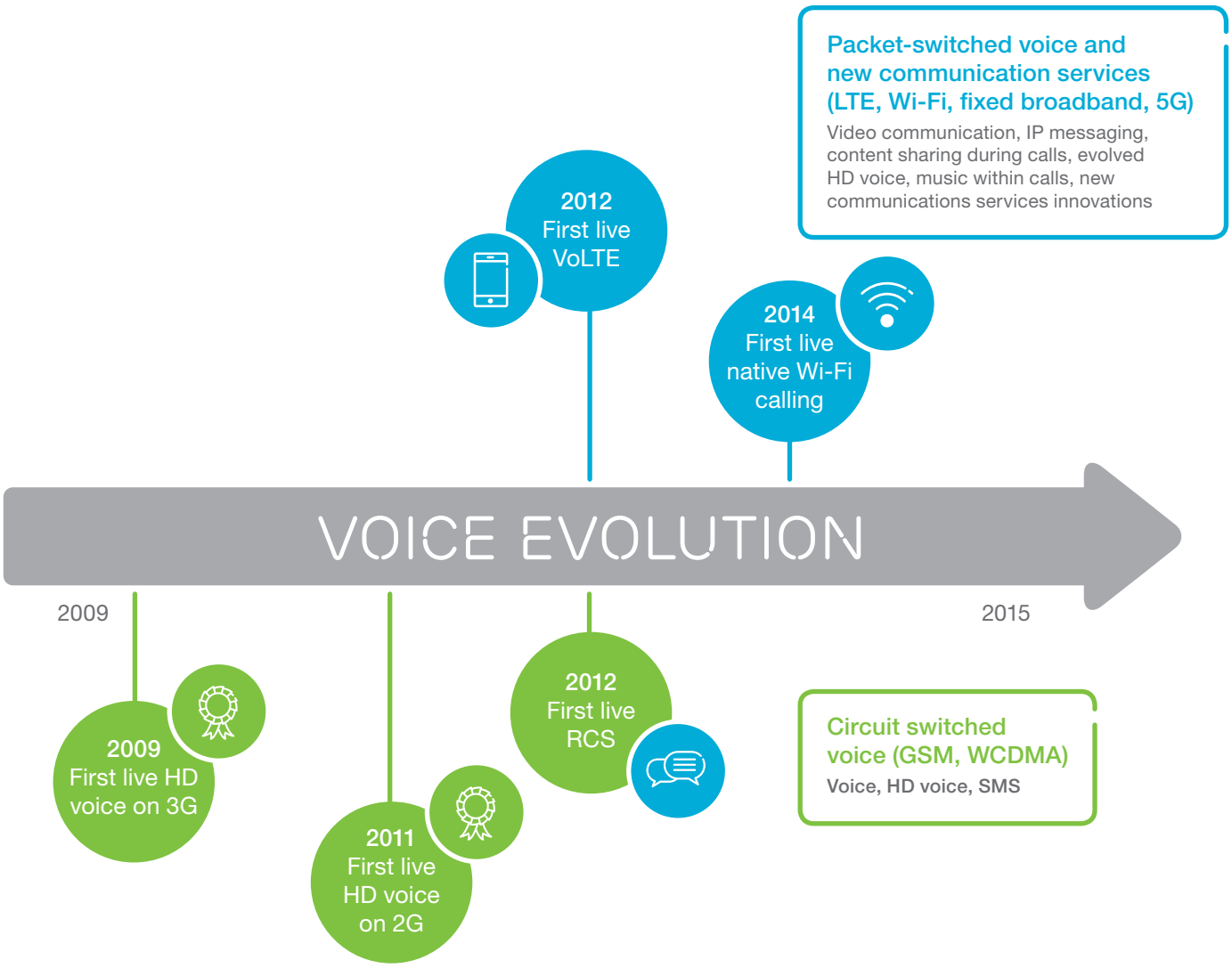



## Operators can stay competitive by launching attractive data and communication services bundles to consumers and enterprise users

The relative share of voice and messaging revenue reported by operators is declining, driven by growing data usage. Roughly 60 percent of their revenues can be derived from voice and SMS services. Many operators offer combined voice and data plans, often with unlimited voice and messaging. This has increased operator-provided voice and SMS usage in many markets. Demand for communication services is still strong, as people communicate using devices for more reasons than ever and in many new ways.

Packet-switched communication services launches based on VoLTE are renewing the voice business, enabling operators to offer bundled high-quality communication services and data packages. VoLTE provides telecom-grade HD voice, video calling and other new, richer communication services, while enabling simultaneous high speed LTE data services.

[3] GSA, April 2015
[4] GSMA, April 2015




Mobile HD voice services offer more natural sound than conventional mobile voice services by providing improved intelligibility and voice clarity. Enabling HD voice requires device support, as well as new network functionality on 2G, 3G and 4G networks. An evolved HD voice service using a new voice codec for LTE networks has recently been standardized in 3GPP – Enhanced Voice Service (EVS). This will further improve the user experience by delivering even higher quality voice and music within LTE calls, while leveraging HD voice services in 2G, 3G and LTE networks.

Several major device vendors have integrated Wi-Fi calling natively on smartphones, enabling operators to provide the service. Consumers can be offered SIM-based voice services in their homes over their own Wi-Fi access points, using any Internet Service Provider (ISP). This will benefit users with limited circuit-switched voice or VoLTE indoor coverage. Users can also make calls over Wi-Fi when roaming abroad. The service is run via the operator's upgraded Evolved Packet Core and IP Multimedia Subsystem (IMS) network. This is an extension of VoLTE-based services to Wi-Fi access, and seamless voice and video calling handover between LTE and Wi-Fi can also be supported.

The IMS enables all these packet-switched communication services and provides a foundation for their continued development. The services can be run over LTE, Wi-Fi and fixed broadband and can be enabled on any device. In the future they will continue to evolve and also be available over 5G.

# THE DIGITAL SIGNATURES OF SPORT

## Real-time viewing, sharing results and social networking have become integral parts of sports events, creating a mix of real and virtual experiences

Modern network technologies enrich the user experience for on-site spectators, and enable anyone with a smart device to take part in the event.

Many sporting events are spread out over multiple locations and several days, making it hard for spectators to feel involved. Distributing content such as live TV and video-on-demand (VoD), enhances spectators' live experiences and can be complemented with event-specific information.

Insights into mobile service usage and traffic patterns at a major event are important for operators to satisfy their customers. This article explores app usage and mobile traffic at two recent major sporting events: the 2014 football world championship in Brazil, and the FIS Nordic World Ski Championships in Falun, Sweden.

### Sharing the moment

The 2014 football world championship was one of the biggest social media events of 2014. Football fans shared their experiences by texting, talking and posting on social networks. The event generated 26.7 TeraBytes (TB) of traffic, the data equivalent of 48.5 million digital photos plus 4.5 million voice calls. 75,000 spectators generated 1.5 TB of data traffic during the final match – a rate 5 times higher than the average busy hour traffic and equivalent to 9 billion social media posts. Social media records were broken worldwide.[1] 88 million users generated 280 million interactions regarding the final, making it the most discussed sporting event ever on Facebook. A record 618,000 tweets per minute were posted when Germany beat Argentina.

### The network challenge

The challenge for operators was to secure a good user experience in arenas and surrounding areas, as data usage levels and traffic distribution were expected to differ from the norm. Network planning and optimization were important to ensure a seamless and high quality experience for users. Despite a data traffic increase of 80 percent compared to a similar large tournament in 2013, 75 percent of visitors to the 2014 football world championship rated their experience as the same or better than their everyday mobile experience.

### Connect to the world

Ericsson ConsumerLab conducted 800 face-to-face interviews in São Paulo and Rio de Janeiro at stadium exits and surrounding areas to understand visitors' experiences. Locals and foreigners aged 15–60 who watched the matches and used their smartphones for digital activities were interviewed.

The most commonly used data services during matches were instant messaging and social networking. These were used more during matches, generally peaking at half time. A significant proportion of consumers also posted or sent photos during matches. International visitors posted more videos than locals.

96 percent of interviewees used their mobiles during matches. 84 percent of locals used mobile broadband, compared to 50 percent of international visitors.

5X

During the football world championship final, mobile traffic was five times higher than the average busy hour traffic

[1] Source: Facebook, Twitter

## Smartphone usage during matches

| Data usage | Smartphone usage | Used the service |
|---|---|---|
| HIGH | Posted or sent a video via internet | 33% |
| | Watched a video on the internet | 18% |
| MEDIUM | Accessed social networks | 66% |
| | Posted or sent a picture via the internet | 61% |
| | Used the internet to find content related to the football world championship final | 25% |
| LOW | Used instant messaging programs | 81% |
| | Made/received voice calls | 75% |
| | Sent/received text messages (SMS) | 66% |

A 4G subscriber consumed around 70% more data than a 3G user on average

Source: Ericsson ConsumerLab Football Event Study, Brazil 2014

### Connection type matters

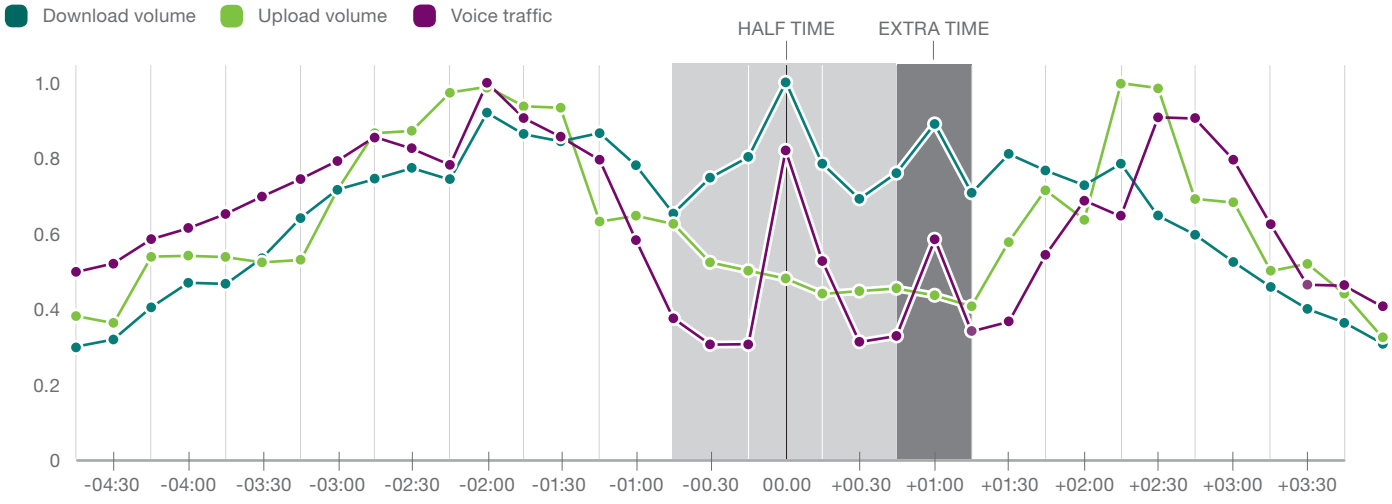
4G users were more active on their mobile phones than 3G or Wi-Fi users. 3G networks handled 70 percent of mobile data traffic, while 30 percent was on 4G. Per subscriber, 4G users consumed 70 percent more data than 3G users. They were also happier with their services, and over 50 percent were "very satisfied" overall. For most service types, 4G users were 15–20 percent more satisfied.

### The signatures of football

When many users gather in a confined area, network capacity is stretched to the limit. Profiling from major football events displays usage patterns that could help operators prepare and optimize mobile networks. Network traffic analysis shows voice and data traffic fluctuating during matches. Typically, voice traffic drops as users enter a stadium, before rising and peaking at half and full time. Compared to voice, data traffic stays high. Data traffic and call activity peaked when Germany scored the winning goal in the final.

The ratio of uplink versus total data traffic volume was 50 percent during the final, compared to the 12–17 percent average in Brazil. This is important when designing and dimensioning mobile networks, as the uplink and downlink traffic ratios can vary between applications. For example, social networking has a high uplink ratio as users actively create content.

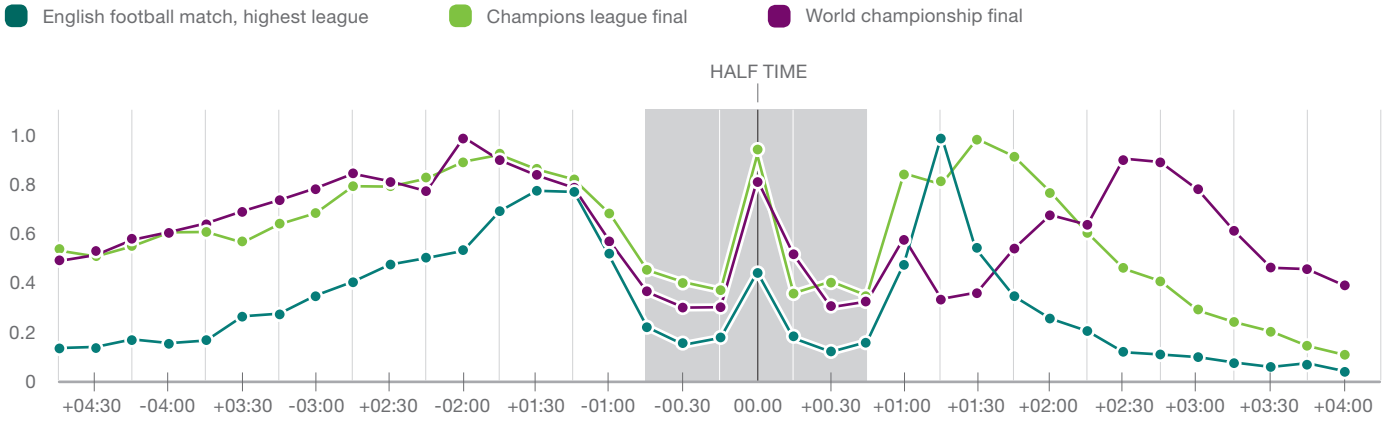
## Mobile traffic intensity during the world championship final on July 13, 2014




Source: Ericsson

Note: The figure shows the relative data traffic activity over the football world championship final. On the y-axis, 1.0 represents the peak traffic level during the event. On the x-axis, 00:00 hours denotes half time in the match. The grey area denotes match time, the dark grey area extra time. Each point represents the average traffic over 15 minute intervals

## Mobile voice call intensity during three football matches




Source: Ericsson

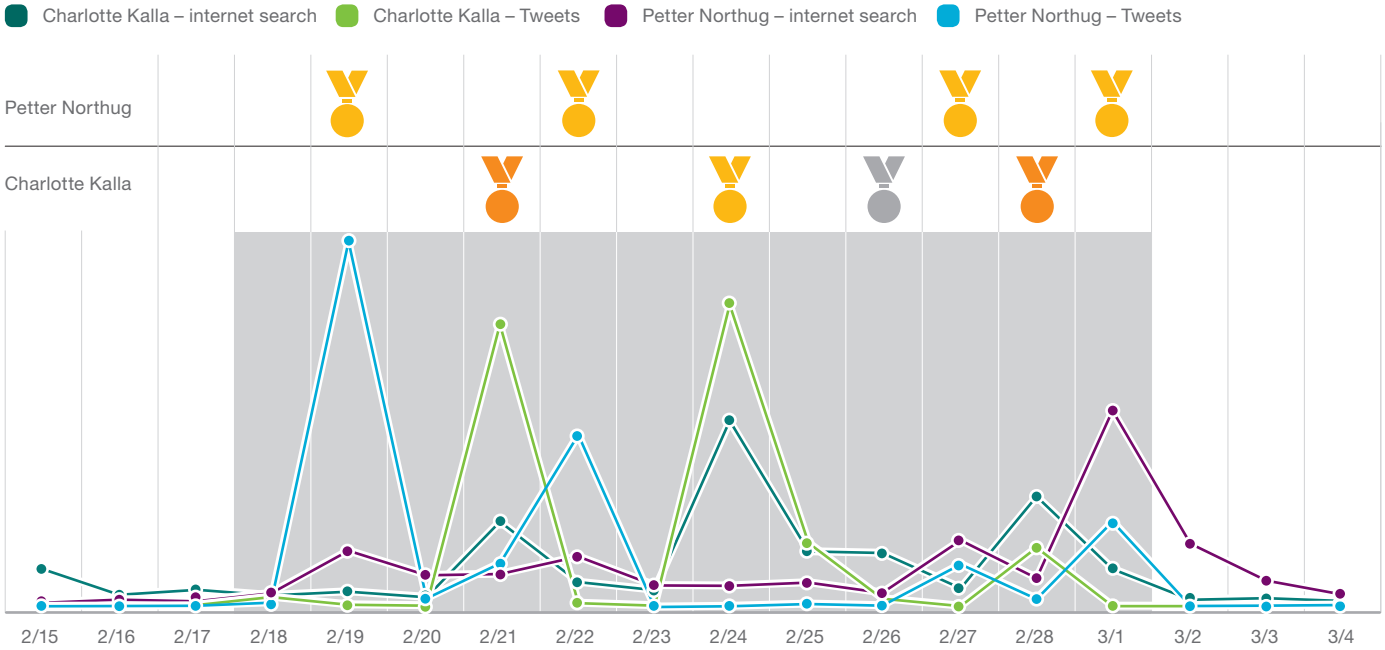
Traffic analysis from other major football matches shows similar voice call patterns. Call activity peaks 1.5 hours before kick-off, and decreases 30 minutes before kick-off. Matches are followed by 45 minutes of peak call activity. Text messaging increases substantially during breaks and when a goal is scored. This reflects people arriving, watching the game and leaving. International and local match patterns differ – the former has prolonged activity and higher peaks, reflecting visitors' earlier arrival and longer stay.

### Going digital at events – the role of apps

During February 2015, the FIS Nordic World Ski Championship was held in Falun, Sweden. Over 12 days 280,000 people visited the event and millions followed it. It featured three disciplines: cross country skiing, ski jumping and Nordic combination. The organizers aimed to provide an immersive digital experience to visitors, as well as to anyone interested in Nordic skiing by augmenting the live experience with digital event data and app feeds. A live results app provided information such as scores, programs, maps and news. A live TV and video app provided a virtualized experience, including functions to follow a skier, and real-time viewing from different cameras.

Social media and internet search activity peaks reflect the audience's mood and coincide with athletes winning medals. This is seen in Tweets and internet searches relating to Petter Northug Norway (four medals) and from Charlotte Kalla from Sweden (four medals).

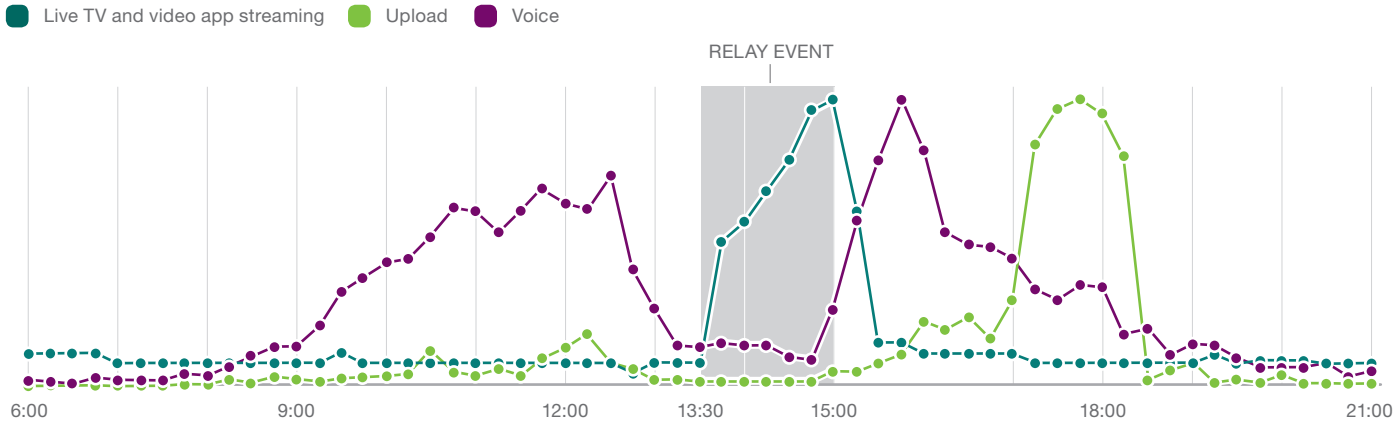
## Social media and internet search activity,[2] before, during and after FIS Nordic World Ski Championships, 2015




Source: Google, Twitter

[2] Normalized activity during the event

Data and voice traffic activity,[3] men's 4x10 km relay cross-country skiing




Source: Ericsson

### The signatures of skiing

App usage indicated that cross-country skiing was the most popular discipline of the three, with over two thirds of users following the results. The most popular single event measured through live results app usage was the men's 4x10 km relay. The live TV and video app usage was also seen to peak in the last 30 minutes of the relay event. It declined to 20 percent of this after the top teams finished. Voice activity peaked an hour after the competition and people started to upload and share content with friends. Voice and SMS activity was significantly higher than an average winter month, while download and upload data traffic were over three times higher near the arena.

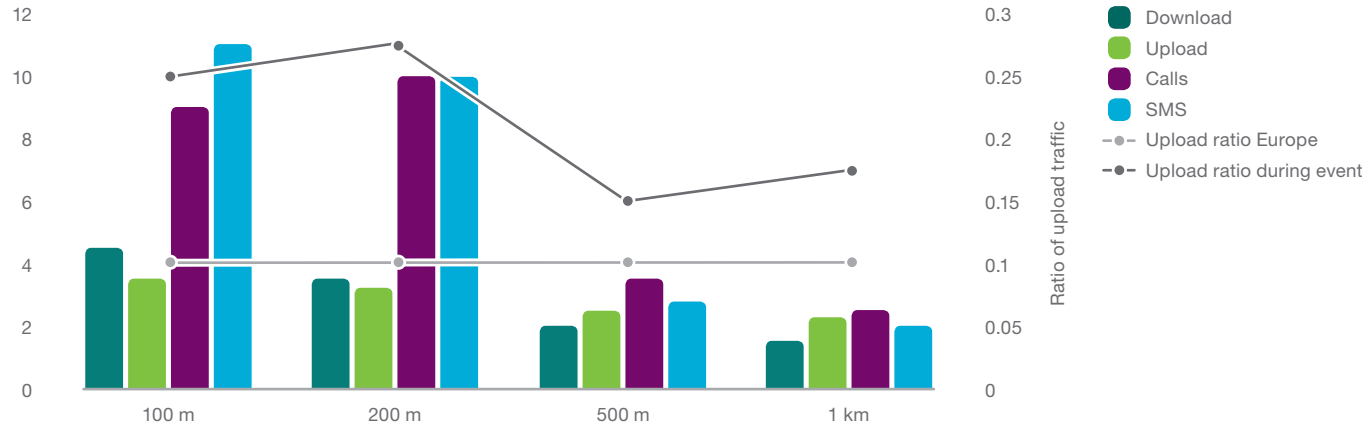
The activity differences between traffic types declined away from the arena. Near the arena, upload traffic represented 25 percent of total mobile traffic – higher than the 10 percent European average. During the event, streaming increased download traffic in the arena center, reducing the relative upload traffic ratio. Nevertheless, away from the center upload traffic was higher than normal.

### Meeting the network challenge

Existing network infrastructure is normally not dimensioned to handle the high volumes of traffic (with varying traffic mixes and user behaviors) at major events. In addition, the subsequent increased mobile traffic can extend beyond the venue to surrounding areas. Thorough network planning, real-time traffic management as well as capacity and coverage adaptations can ensure optimized network performance.

Using modern technology to enrich the visitors' experiences at sport events is a growing phenomenon which is expected to generate more usage and traffic. Along with this, operators can take advantage of technologies to efficiently meet the demand. For example, when many users request the same content simultaneously – like game replays or event live TV – LTE broadcast can effectively turn unicast into broadcast, allowing multiple users to receive the same content with efficient use of spectrum and resources. Service differentiation for targeted content or users can be applied with service awareness and quality of service functionality in cases where there is a commitment to deliver specific commercial content.

Mobile traffic activity[4] in relation to distance to the national ski stadium at Lugnet, Falun




[3] Normalized activity on February 27, 2015, 06:00-21:00 CET
[4] Activity levels compared to an average winter month

# BEYOND AVERAGE DATA CONSUMPTION

## In mobile networks, a significant proportion of traffic is generated by a limited number of users. With a 70 percent traffic share, video is the dominant traffic type among heavy and extreme data users

This article compares subscriber groups based on monthly data traffic consumption. It compares subscriber and traffic shares, as well as the application mix for different subscriber clusters in advanced mobile broadband markets. Mobile services consumption patterns of subscribers differ a lot for different monthly usage clusters. Social networking and communication services are significant among light users, while video is pervasive for heavy users.

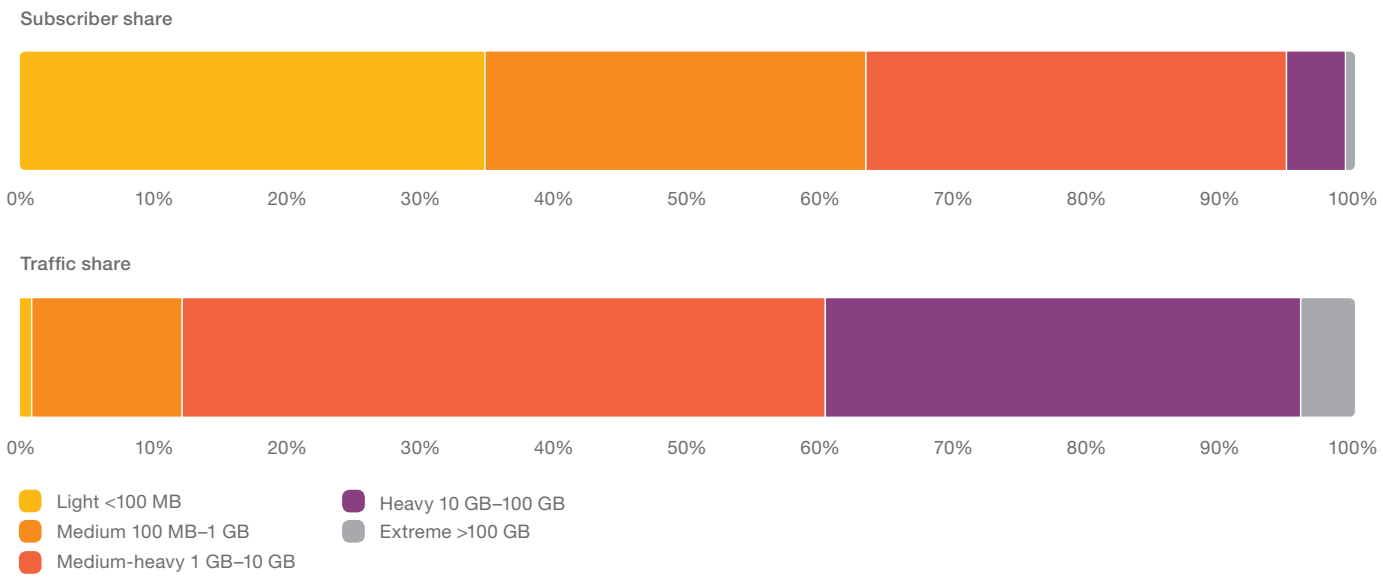
Subscriber clusters

| | |
|---|---|
| Light users | <100 MB |
| Medium users | 100 MB–1 GB |
| Medium-heavy users | 1 GB–10 GB |
| Heavy users | 10 GB–100 GB |
| Extreme users | >100 GB |

### 10 percent of users generate 55 percent of data traffic

The analysis is restricted to Android smartphones and tablets to filter platform differences[1] and only cellular mobile traffic is included. The compiled data represents average values from a selected set of advanced markets with high LTE subscriber penetration and mostly high-end devices. Subscriber groups have been named and clustered according to their monthly data traffic consumption. The distribution of subscribers in different clusters can vary from market to market, mostly depending on available data tariff plans. However, the traffic contribution of the top percentages of users is usually very similar: the top 10 percent of users generate around 55 percent of traffic and the top 20 percent generate around 70 percent. In advanced markets with affordable flat rate plans, the share of medium-heavy users can exceed 50 percent and the share of heavy users can be up to 10 percent of subscribers. Average monthly data consumption per smartphone varied between 1 and 5 GB in the advanced networks that were measured.

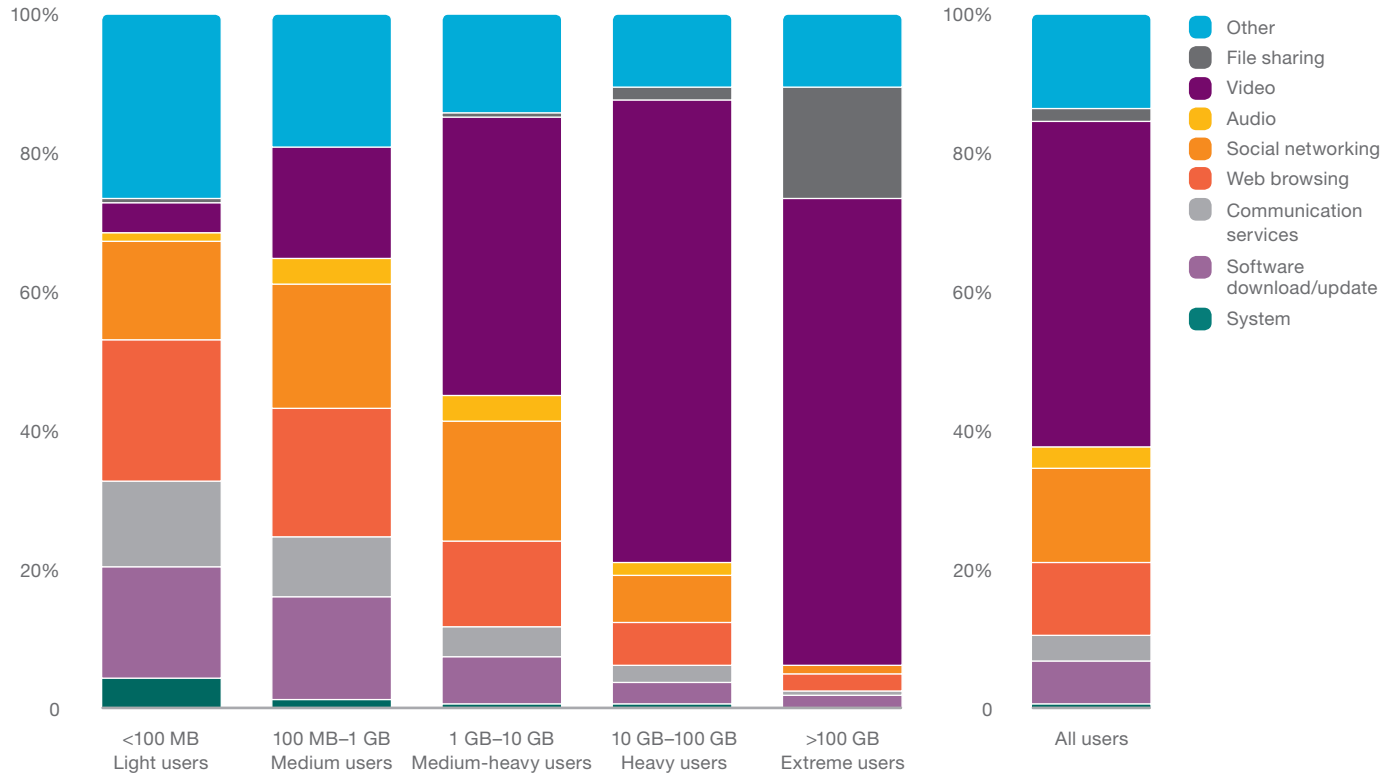
Subscriber and traffic volume shares of different subscriber groups, advanced mobile broadband market




[1] Dongles, router and M2M devices have radically different traffic characteristics

Heavy users consume 20 times more video than average

Application volume shares of different subscriber groups




## Heavy users watch video for one hour per day

The traffic mix of a given user cluster is similar across different markets but changes a lot going between light and extreme users. The share of traffic from software updates, web browsing and communication services (messaging, VoIP, video calls, etc.) is significant among light users. For this group, up to 30 percent of traffic comes from a very long tail of different apps.[2] In some developing markets, the traffic share for communication services can be even higher for light and medium users.

The social networking, web browsing and audio traffic share is highest in the medium user group, while the shift to video as the dominant traffic is apparent in the medium-heavy user group. Video is dominant among heavy users, representing almost 70 percent of traffic. A heavy user watches around 1 hour of video per day on average, which is 20 times more than an average user. Extreme users are only present in networks where tariff plans (typically flat rate) allow this. In some networks, they can have a significant share of file sharing[3] and storage services traffic.

Developing mobile broadband markets[4] show similar characteristics in terms of application volume shares for different clusters. However, the share of light and medium users is usually much higher. In terms of data consumption distribution, a similar tendency can be observed – around 10 percent of users consume 50 percent of the total data traffic. Furthermore, the shift to video dominance was also apparent for medium-heavy and heavy users in developing markets.

[2] Included in category 'other'
[3] File sharing is more common in Europe and Asia than in North America. Usage also depends on eventual blocking/throttling policy of the operator. File sharing is mostly from tethering users
[4] No LTE network, evolving 3G coverage with many 2G subscribers and mostly low-end devices

# SCREEN SIZE MATTERS

## Screen size, resolution and display clarity are important factors influencing the mobile user experience and affecting the extent to which various services are used

Today, a 4.5" smartphone display is considered medium-sized, while phablets[1] and devices with screens of 5.5" and up have become more popular over the last couple of years. The growing number of pixels on device displays is driven by increases in both screen size and resolution. Screen size is a factor that significantly impacts usage of different services.

### Smartphones, phablets and tablets – service usage can differ

Services such as streaming video usually require a large screen to provide a good user experience. This relationship is indicated by the correlation between the significant growth in video usage and increased screen sizes. Video consumption on tablets is 50 to 70 percent higher on average compared to usage on phablets. Also, the average tablet user spends 50 percent more time watching videos online than average mobile broadband users.

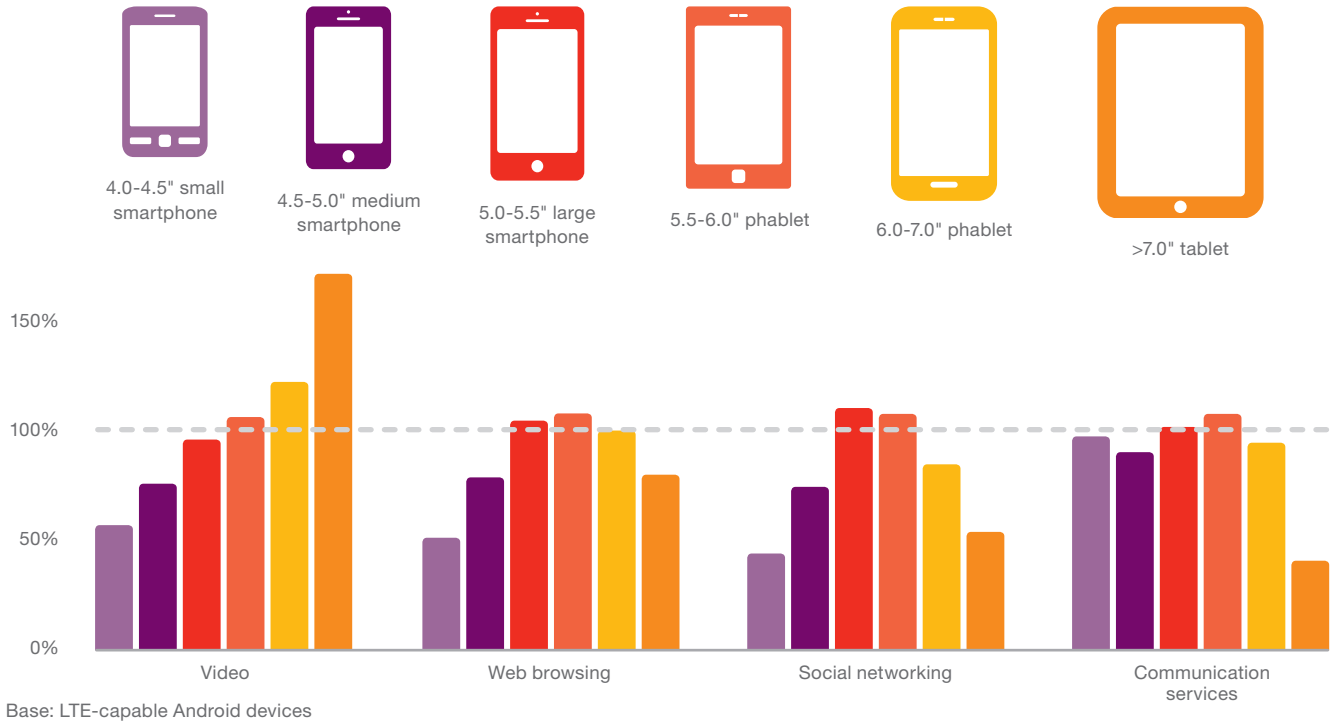
Small screens could be a barrier for web browsing and social networking due to, for example, the inconvenience of reading and writing on smaller screens. However, too large a screen also decreases usage. This is probably due to larger devices not being as portable as pocket-sized ones. The highest usage for these services can be seen on large screen smartphones and phablets.

For communication services (e.g. WhatsApp, Skype, Viber, etc.) screen size does not seem to matter. However, the significantly lower usage on tablets indicates that these services are mainly used with devices that can be held and used in one hand.

This analysis has been performed only on Android devices to limit the statistical impact of differences between platforms. These devices also have the largest variety of screen sizes. Only LTE-capable devices in cellular networks without throttling were included in order to limit the impact of differences in device radio capabilities and network technology.

Users with tablets spend 50% more time watching videos online than average mobile broadband users

Screen size impact on service usage (bytes)




Base: LTE-capable Android devices

Note: Percentages on the y-axis denote relative values compared to average per subscriber usage (100 percent) for the entire measured population

[1] A phablet is larger than a typical smartphone, but much smaller than most tablets and can be held and used in one hand

# 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, 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
**GERAN:** GSM EDGE Radio Access Network
**GSA:** Global Supplier Association
**GSM:** Global System for Mobile Communications
**HSPA:** High Speed Packet Access
**IoT:** Internet of Things
**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)
**MTC :** Machine-Type Communication
**OS:** Operating System
**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
**TB:** TeraByte, 10^12 bytes
**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, business and society 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 approximately 115,000 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 2014 were SEK 228.0 billion (USD 33.1 billion). Ericsson is listed on NASDAQ OMX stock exchange in Stockholm and the NASDAQ in New York.

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