ERICSSON

TRAFFIC AND MARKET REPORT

ON THE PULSE OF THE NETWORKED SOCIETY

June 2012

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Everything is going mobile. This evolution is driven by video, cloud-based services, the internet and machine-to-machine (M2M) connectivity. It changes how people behave and how they leverage mobility to communicate and to improve their daily lives, through new and existing services. Users now demand connectivity anywhere and anytime.

Important driving forces include new affordable smartphones, and the many new connected devices on the market. The total number of mobile subscriptions globally (excluding M2M) will reach around 9 billion in 2017, of which 5 billion will be for mobile broadband. With an increased number of subscriptions, evolved devices and 24/7 connectivity to use them, we expect global mobile data traffic to grow 15 times by the end of 2017.

Access to the internet is a prerequisite and will drive further build-out of mobile networks. By 2017, an astonishing 85 percent of the world's population will be covered by WCDMA/HSPA networks.

In today's competitive markets, it is crucial to ensure best user experience and provide differentiation. A recent consumer study shows that network coverage and speed are the most important factors for satisfaction with mobile services.

We invite you to share our enthusiasm in the insights this data offers. We hope you find it engaging and valuable.

ABOUT THIS REPORT

Ericsson has performed in-depth data traffic measurements since the early days of mobile broadband from a large base of live networks covering all regions of the world.

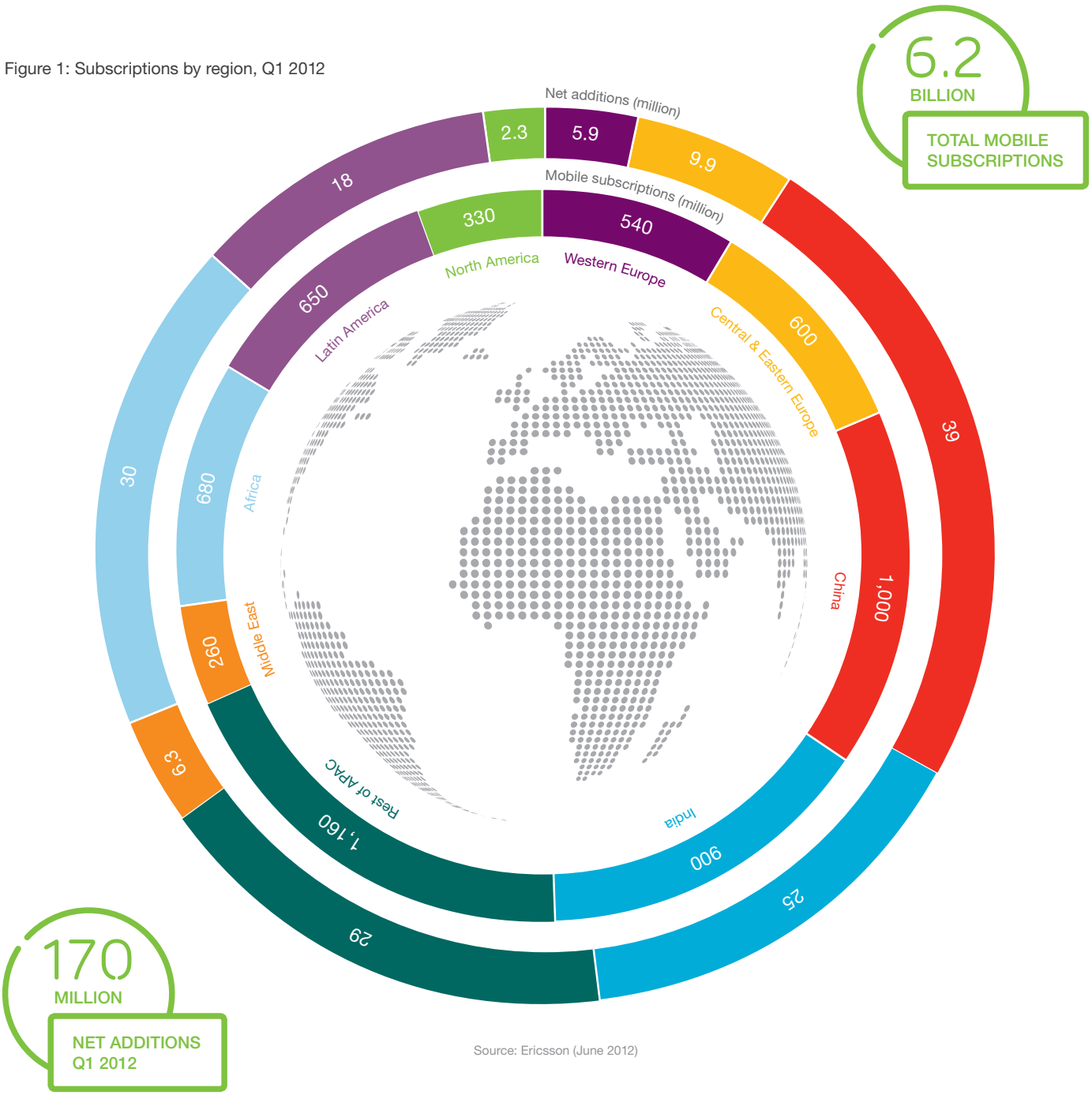
The aim of this report is to share analysis based on these measurements, internal forecasts and other relevant studies to provide insights into the current traffic and market trends.

We will continue to share traffic and market data, along with our analysis, on a regular basis.

Publisher: Douglas Gilstrap, Senior Vice President and Head of Strategy, Ericsson

MOBILE SUBSCRIPTIONS UPDATE

Figure 1: Subscriptions by region, Q1 2012



Source: Ericsson (June 2012)

Figure 1

Mobile subscription figures are estimates as of Q1 2012. Mobile net additions are estimates during Q1 2012. APAC = Asia Pacific.

The estimate of mobile net additions has been made based on historic information from external sources and regulatory and operator reports, combined with Ericsson analysis. Historical data may be revised when operators report updated figures.

- Global mobile penetration reached 87 percent in Q1 2012 and mobile subscriptions now total around 6.2 billion. However, the actual number of subscribers is around 4.2 billion, since many have several subscriptions.
- India and China accounted for approximately 40 percent of the estimated 170 million net additions during Q1 2012, adding around 25 and 40 million subscriptions respectively.
- Brazil (+10 million), Indonesia (+9 million), and Bangladesh (+5 million) follow in terms of net additions.
- Mobile subscriptions have grown around 12 percent year-on-year and 3 percent quarter-on-quarter.
- Mobile broadband subscriptions[1] have grown around 60 percent year-on-year and have reached 1.1 billion.
- There is continued strong momentum for smartphone uptake in all regions. Approximately 35-40 percent of all mobile phones sold in Q1 were smartphones, compared to around 30 percent for the full year 2011. Only around 10-15 percent of the worldwide installed base of subscriptions use smartphones, which means that there is considerable room for further uptake.
- All WCDMA networks deployed worldwide have been upgraded with HSPA. Around 75 percent of the HSPA networks worldwide have been upgraded to a peak speed of 7.2 Mbps or above and around 40 percent have been upgraded to 21 Mbps.
- Around 15 percent of HSPA networks now have speeds up to 42 Mbps in whole or parts of the network following a wave of upgrades. Today, we are already seeing evolutionary steps towards increasing speeds to well over a 100 Mbps.

Figure 2: Percentage of WCDMA networks upgraded to HSPA and to 7.2, 21 and 42 Mbps respectively

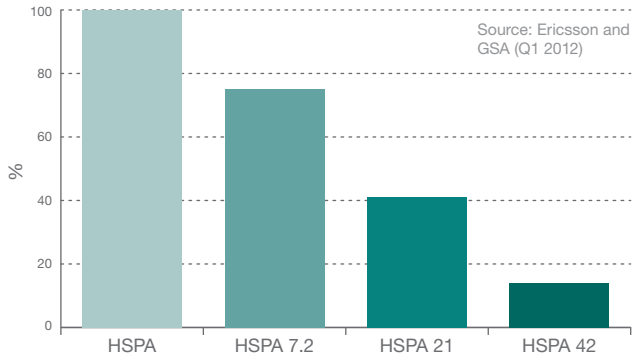
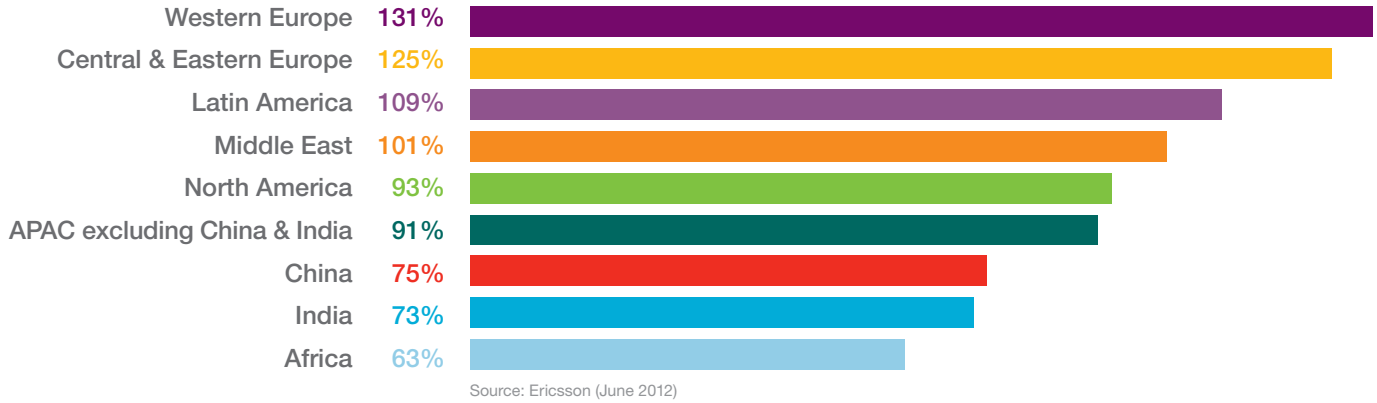


Figure 3: Mobile subscriptions penetration in Q1 2012



[1] Mobile broadband is defined as CDMA2000 EV-DO, HSPA, LTE, Mobile WiMAX and TD-SCDMA.

SUBSCRIPTIONS VS SUBSCRIBERS

There is a large difference between the number of subscriptions and subscribers. This is due to the fact that many subscribers have several subscriptions. Reasons for this could include users lowering their traffic cost by using optimized subscriptions for different types of calls, maximizing coverage, having different subscriptions for mobile PCs/tablets and for mobile phones. In addition, it takes time before inactive subscriptions are removed from operator databases. Consequently, subscription penetration can easily reach above 100 percent, which is the case in many countries today. It should however be noted that in some developing regions, it is common for several people to share one subscription, having for example a family or village phone.

SUBSCRIPTIONS OUTLOOK

Subscriptions development – fixed and mobile

By the end of 2011, total mobile subscriptions reached around 6 billion and are expected to reach around 9 billion by the end of 2017. M2M will add to this figure.

The number of mobile broadband subscriptions reached close to 1 billion, and is predicted to reach 5 billion in 2017.

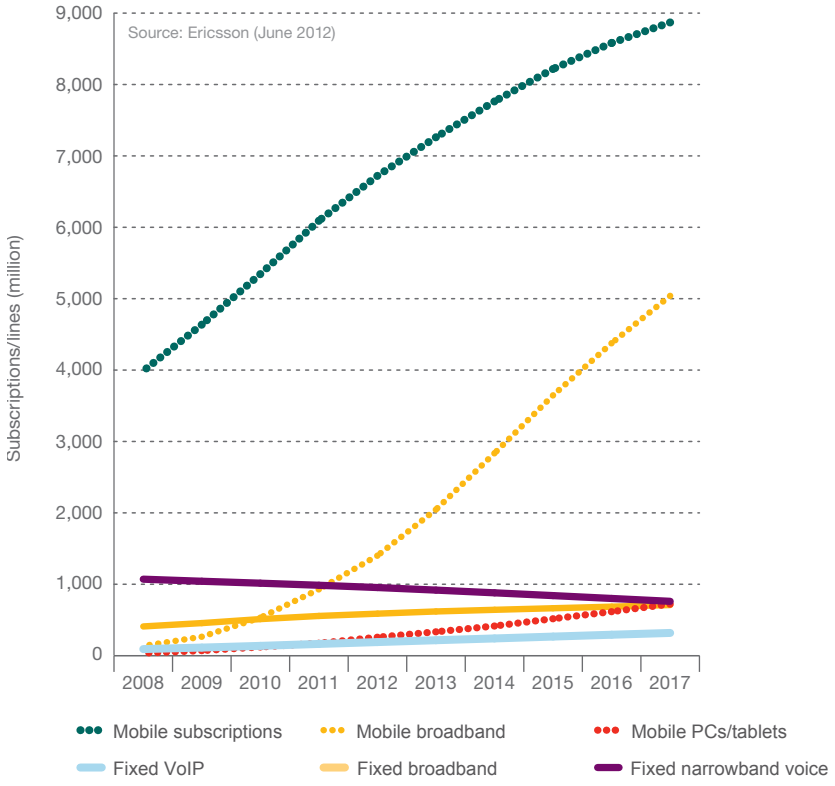
~5
BILLION
MOBILE BROADBAND SUBSCRIPTIONS BY THE END OF 2017

PC and tablet mobile subscriptions are increasing and are expected to grow from around 200 million in 2011 and almost close the gap with the number of fixed broadband subscriptions by 2017, totaling around 650 million.

The number of fixed PSTN voice subscriptions will continue its downward trend as users increasingly switch to mobile and VoIP substitutions.

Mobile PC: laptop or desktop PC devices with built in 3G modem or external USB dongle.

Figure 4: Fixed and mobile subscriptions 2008-2017



'Mobile broadband subscriptions' is a sub-segment of 'Mobile subscriptions'. 'Mobile PCs/tablets' is a sub-segment of 'Mobile broadband subscriptions'.

USERS PER FIXED SUBSCRIPTION

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 to the mobile phone situation, where subscription numbers exceed user numbers. In the latter years of the forecasting period, it is likely that the usage trend for mobile PCs will be similar to fixed broadband usage today, with several users per subscription. This is especially the case in developing markets where mobile access will be the main source of internet connection.

Mobile technology

Figure 5 illustrates reported mobile subscriptions by technology. In this graph, subscriptions are defined by the most advanced technology that the mobile phone and the network are capable of.

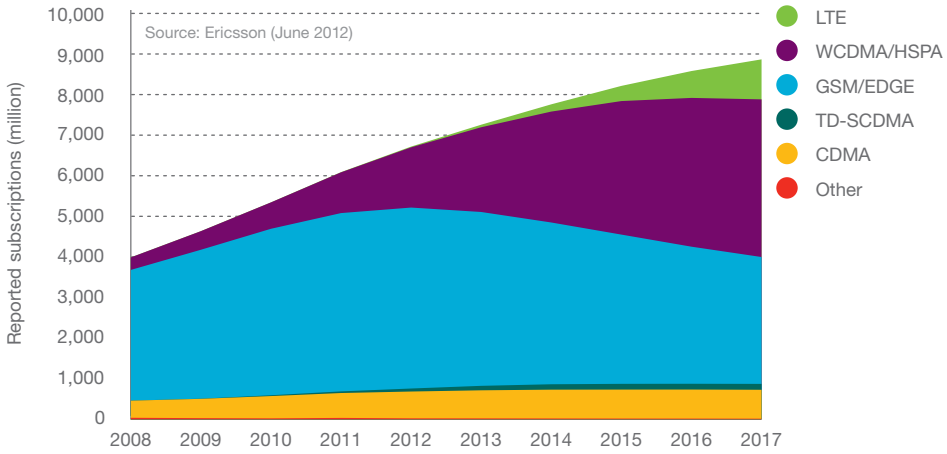
GSM/EDGE will continue to lead in terms of subscription numbers until the latter years of the forecast period, despite rapid HSPA subscriptions growth today. This is because new low-end users entering networks in growing markets will likely use the cheapest mobile phones and subscriptions available. In addition, it takes time to upgrade the installed base of phones. However, the rapid migration to more advanced technologies in developed countries means global GSM/EDGE subscription numbers will decline after 2012.

LTE is currently being deployed and built-out in all regions and will be used by around one billion subscribers. These will represent the high-end share of the total subscriber base by 2017.

Regional growth

Figure 6 illustrates mobile subscriptions in each region up until the end of 2017 and is characterized by steady growth. This is especially evident in the Asia Pacific region where there are many developing nations with strong population and GDP growth.

Figure 5: Mobile subscriptions by technology, 2008-2017



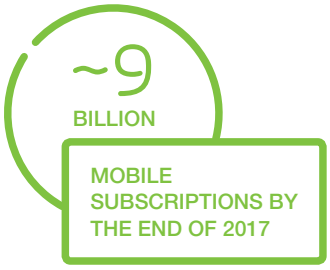
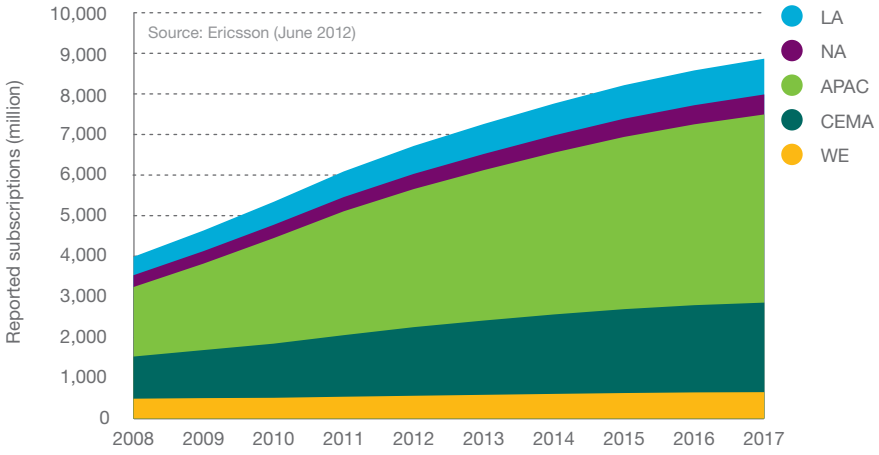


Figure 6: Mobile subscriptions by region, 2008-2017



Regional technology maturity

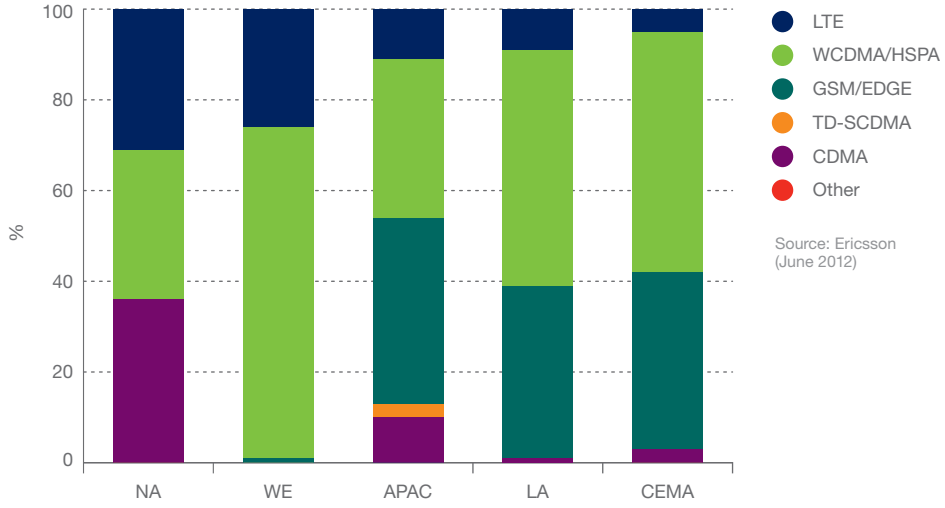
By looking at each region and comparing subscriptions in each radio technology, it is easy to see the different maturity levels between regions. Less mature regions are dominated by 2G technologies, like GSM/EDGE, while more mature regions like Western Europe are dominated by HSPA. In North America, LTE subscriptions have been growing since 2011 and the region now has the majority of global LTE subscriptions.

North America is characterized by early growth in LTE, making LTE, HSPA and CDMA of approximately equal size in 2017, with GSM/EDGE no longer present. The fast growth in LTE subscriptions is driven by the CDMA operators' early commitment to migrating to the newer technology. Overall North American subscription growth is based on multiple subscriptions per individual – for example, adding a tablet – rather than population growth.

Latin America has a large GSM/EDGE subscriber base, which will reach its maximum during 2012. The strong growth in subscriptions in this region will be driven by GDP development. In 2017, WCDMA/HSPA will be the dominant technology; however GSM/EDGE will still have a significant presence.

Figure 7: Mobile subscriptions by technology and region 2011

Figure 8: Mobile subscriptions by technology and region 2017



As a mature market, Western Europe will show little subscriptions growth in the years to come. What growth there is will come from an increasing number of connected devices. Subscriptions that have GSM/EDGE as the highest technology are declining as end users are upgrading their phone to more advanced HSPA models. In 2017, LTE is expected to have penetrated around 25 percent of the subscriptions base in Western Europe.

The Asia Pacific market will see a massive increase in subscriptions. Leading up to 2017, 1.5 billion new subscriptions will be added, driven by GDP and population growth. Almost half of subscriptions will be GSM/EDGE at the end of the period, reaching a plateau in 2012. Markets like Japan and Korea will take up LTE subscriptions very early compared to late uptake in less developed countries. China will add substantial numbers in the latter years. LTE subscriptions will cover both FDD and TDD.

Central and Eastern Europe, the Middle East and Africa (CEMA) shows strong subscriptions growth driven by population and GDP growth. HSPA will grow significantly, while LTE will be limited and take place in the latter years. The CEMA region is diverse, with mature countries showing patterns similar to Western Europe, whereas most African countries will have completely different patterns.

SUBSCRIPTIONS OUTLOOK: DEVICES

Smartphones

Total smartphone subscriptions reached around 700 million in 2011 and are expected to reach around 3 billion in 2017.

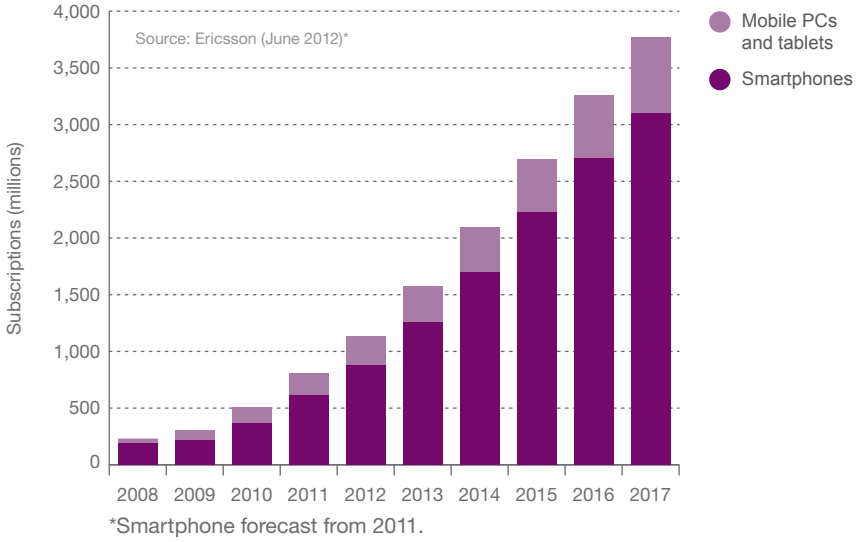
Ericsson has identified several smartphone operating systems that, on average, are associated with high traffic volumes. These are referred to as High Traffic smartphones (HT smartphones). HT smartphones are defined as a subset of open-OS phones (e.g. iPhone, Android & Windows). These devices typically generate 5-10 times more traffic than low-traffic devices. It is estimated that the HT share reached around 50 percent at the end of 2011, and will represent the vast majority in 2017.

Factors such as screen size, year of device release and popularity among high-end users have a stronger correlation with the behavior of active users generating more than 1 MB of traffic per day on average. They therefore have a stronger effect on median traffic than the OS.

Data-heavy devices

Ericsson estimates that the total subscriptions of data-heavy devices will grow from around 850 million by the end of 2011 to around 3.8 billion in 2017. This includes smartphones, mobile PCs and tablets with cellular connectivity.

Figure 9: Smartphones, PCs and tablets subscriptions with cellular connection, 2008-2017



*Smartphone forecast from 2011.

Mobile PC and tablet subscriptions

In 2017, around one third of the installed base of mobile PCs is estimated to have a 3G/4G subscription: the remaining will use Wi-Fi or ethernet. Some mobile PCs with 3G/4G capability do not have an active mobile subscription.

At the same time, only around half of tablets are expected to have a 3G/4G modem built in. Some of those will not have an active subscription. Note that in the traffic measurements presented later in this report, only traffic on 3G networks is included, not Wi-Fi traffic.

Figure 10: Mobile PCs and their share of subscriptions 2017

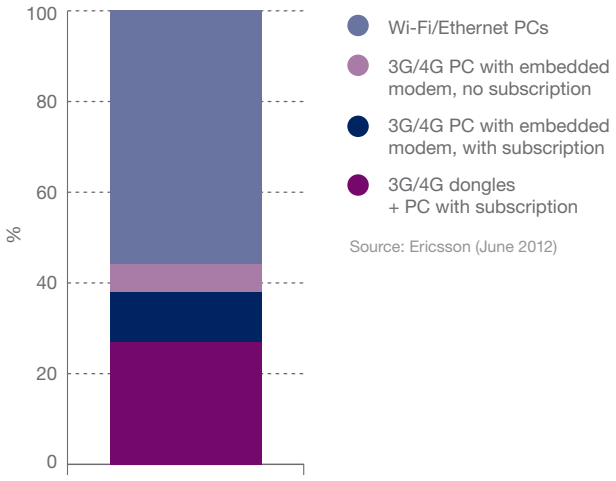
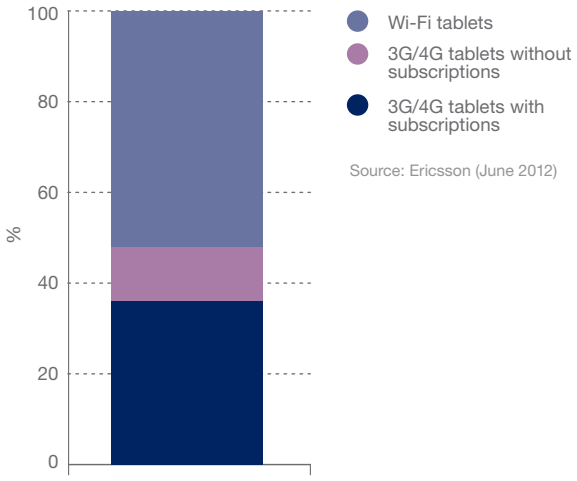


Figure 11: Tablets and their share of subscriptions 2017



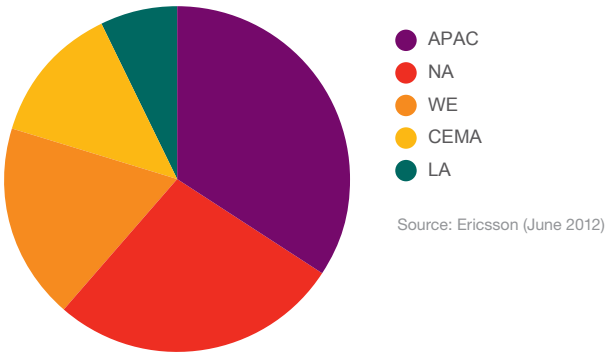
Mobile broadband

The Ericsson term mobile broadband is defined by the device's radio standard, and the prerequisite that the same standard is available in a live network. This is a good measure for understanding the uptake of new technologies and it is easy to track.

Figure 12 illustrates mobile broadband subscriptions, split by region at the end of 2011. It highlights the large share held by Asia Pacific and North America.

Figure 13 shows global mobile broadband subscriptions development. The majority of devices are, and will continue to be, mobile phones. Mobile broadband will gain a larger share of total broadband subscriptions in many markets, complementing xDSL in certain segments and replacing it in others. Mobile broadband also includes some feature phones, but this share is decreasing over time.

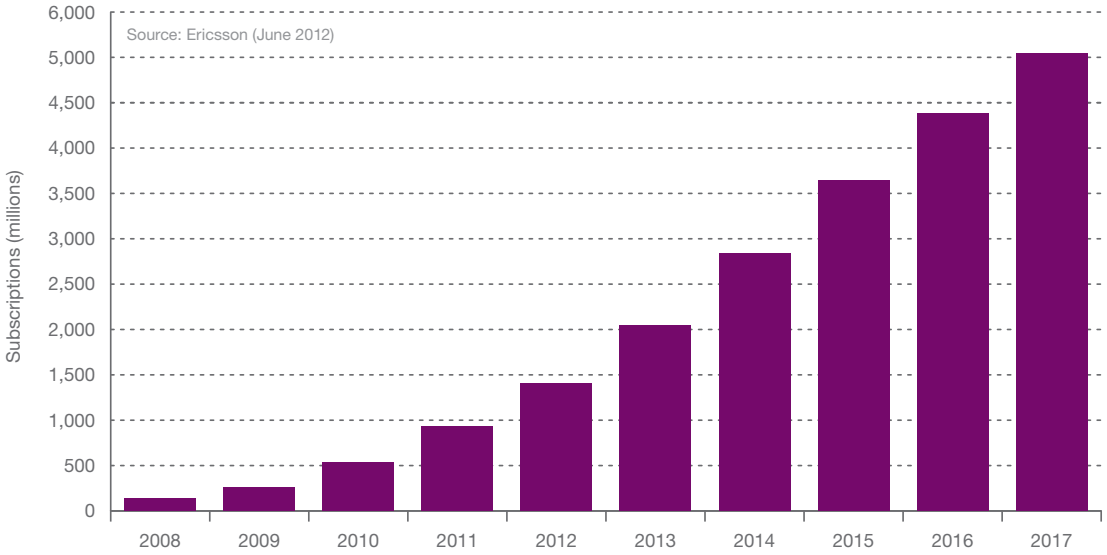
Figure 12: Mobile broadband subscriptions by region, 2011



Mobile broadband

Mobile broadband is defined as CDMA2000 EV-DO, HSPA, LTE, Mobile WiMAX and TD-SCDMA. It includes mobile PCs, tablets and mobile phones, both smartphones and feature phones. The vast majority is mobile phones.

Figure 13: Mobile broadband subscriptions, 2008-2017



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 are based on 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, documents such as industry analyst reports, on a national or regional level, together with internal assumptions and analysis.

Note that a large part of data traffic is generated by a limited number of users in each device category. These users may considerably change their usage if operators implement data volume caps or other traffic management schemes. Measures like this could significantly impact the traffic forecast.

MOBILE TRAFFIC UPDATE

Global traffic in mobile networks

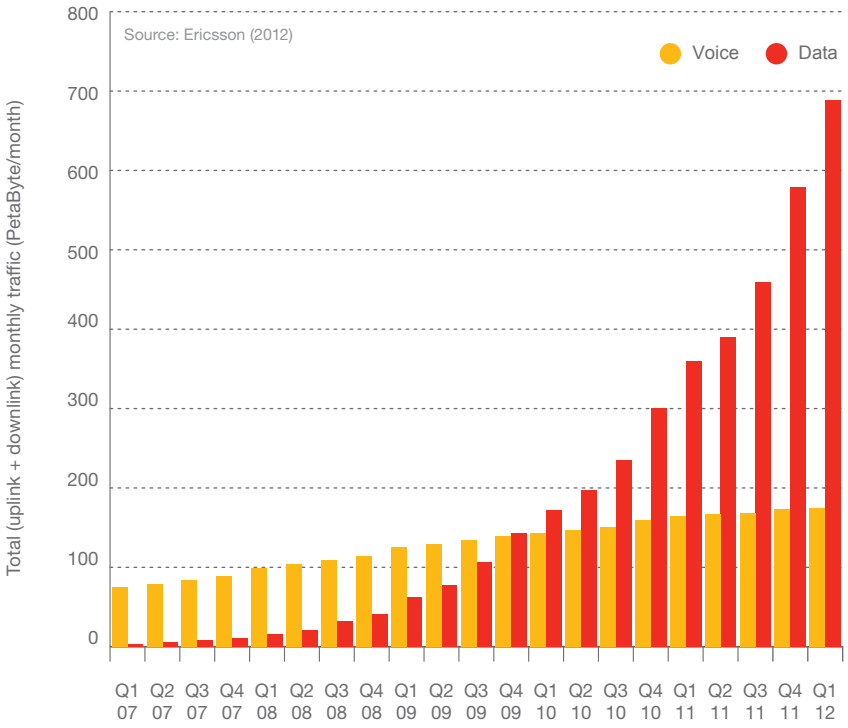
Figure 14 shows the total monthly traffic split for voice and data. It depicts a stable trend of data traffic growth with some seasonal variations. Mobile data subscriptions grow strongly, and drive the growth in data traffic along with a continuous increase in the average data volumes per subscription.

Mobile voice traffic continues to grow at a steady rate mainly driven by new subscriptions in Asia Pacific and Middle East & Africa.

It should be noted that there are big differences in traffic levels between markets, regions and operators.

These measurements have been performed by Ericsson over several years using a large base of live networks that together cover all regions of the world. They form a representative base for calculating world total traffic in mobile networks[2].

Figure 14: Global total traffic in mobile networks, 2007-2012



2X

MOBILE DATA TRAFFIC ALMOST DOUBLED BETWEEN Q1 2011 AND Q1 2012

- Data traffic almost doubled between Q1 2011 and Q1 2012
- The quarterly growth between Q4 2011 and Q1 2012 was 19%

[2]Traffic from 2G and 3G – does not include DVB-H, Wi-Fi, and Mobile WiMax.

TRAFFIC DEVELOPMENT

15X

MOBILE DATA TRAFFIC WILL GROW ~15 TIMES BY THE END OF 2017

Traffic outlook

Overall mobile data is expected to have almost doubled during 2011. Mobile PCs dominate traffic in most mobile networks today, but smartphone traffic is growing faster, due to high growth in subscriptions. In the latter years, data traffic will be split fairly equally between mobile phones and mobile PCs and tablets.

Accessing the internet from mobile devices will drive mobile traffic development. Mobile data traffic is expected to grow with a CAGR of around 60 percent (2011-2017), driven mainly by video. This entails growth of around 15 times by the end of 2017.

Traffic per subscriber partly relates to the screen size of the user's individual device. On average, a mobile PC generates approximately four times more traffic than a HT smartphone. By the end of 2011, an average mobile PC generated approximately 2 GB per month versus 500 MB per month produced by HT smartphones. An average smartphone generates around half of the volume of an HT smartphone. By the end of 2017, it is estimated that a mobile PC will generate 8 GB per month, and a smartphone just above 1 GB.

Note that there are large differences between user patterns on different networks, markets and user types. See results from live network measurements covering different types of devices, OS and regions on page 19.

Figure 15: Global mobile traffic: voice and data, 2010-2017

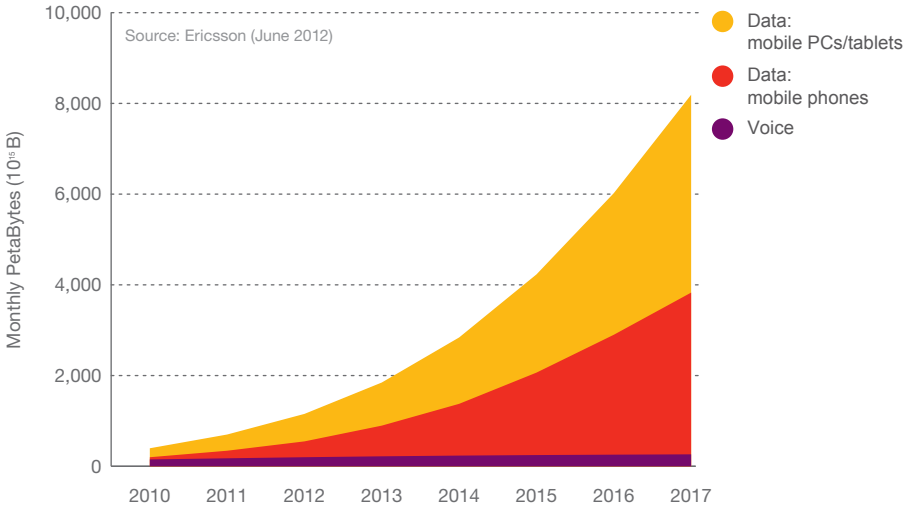
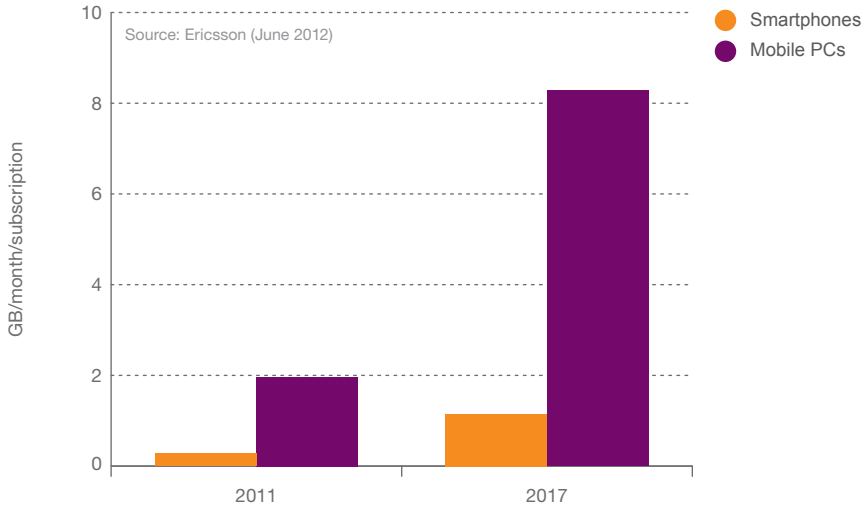


Figure 16: Smartphone and mobile PC traffic per month and subscription 2011 and 2017



Traffic refers to aggregated traffic in mobile access networks. DVB-H and Mobile WiMax or Wi-Fi traffic have not been included. M2M traffic is not included.

DATA REVENUES

Mobile data revenue continues to increase while exhibiting considerable variations. On average it represents around 35 percent of mobile operator service revenue. This figure includes SMS revenues, however the main bulk of the increase is generated from data traffic.

Regional mobile traffic variations

By looking at each region in figure 17 and comparing the traffic generated from different device types, it is easy to see the diverse maturity levels between regions. In 2011, regions with high voice usage per subscription, such as Asia Pacific and North America, had a high share of the total traffic. North America and Western Europe have a significantly larger share of total traffic volume than their subscription numbers alone would imply, due to the high penetration of 3G/4G networks, as well as that of PCs, smartphones and tablets. The Asia Pacific region has the largest amount of generated traffic in absolute volumes.

Voice traffic growth will remain at a steady level, whereas data traffic will increase strongly. By 2017, voice traffic volumes will be very small compared to data traffic volumes in all regions. As seen in figure 18 and 19, Asia Pacific is expected to increase its share of global volume from around one third today to almost 50 percent in 2017.

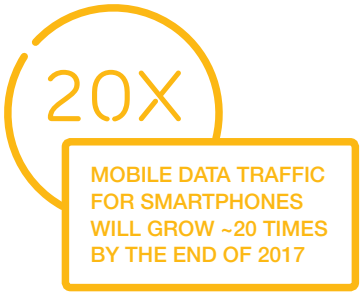


Figure 17: Mobile traffic by region and type, 2011

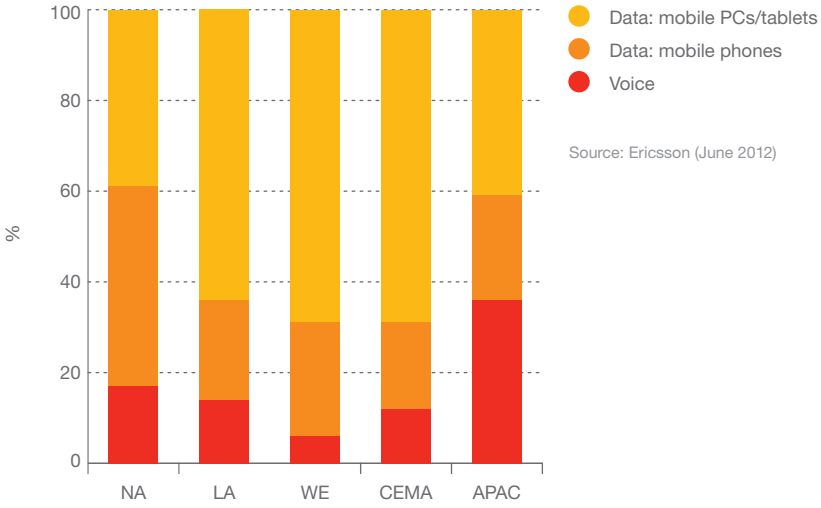


Figure 18: Mobile traffic by region, 2011

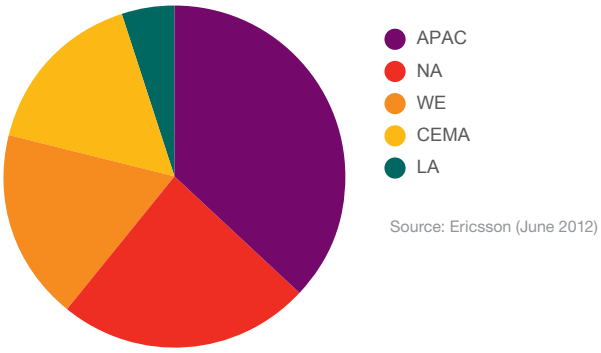
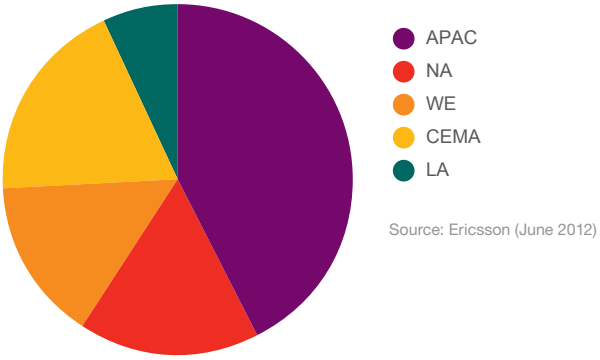


Figure 19: Mobile traffic by region, 2017



COVERAGE

85%

WCDMA/HSPA POPULATION COVERAGE IN 2017

Coverage of the world's mobile networks is constantly increasing as more base stations are deployed. GSM/EDGE technology has by far the widest reach and today covers more than 85 percent of the world's population. Geographically, only rural areas remain to be covered by GSM/EDGE.

WCDMA/HSPA covered over 45 percent of the population by the end of 2011, but is now accessible by 50 percent. There are more densely populated areas lacking WCDMA/HSPA coverage. Further build-out of WCDMA/HSPA coverage will be driven by the availability of affordable smartphones and the surge in mobile broadband services and faster speeds, as well as regulator requirements to connect the unconnected. By 2017, an estimated 85 percent of the world's population will have the opportunity to access the internet using WCDMA/HSPA networks[3].

Today, the combined 2G and 3G population coverage for CDMA is estimated to be above 50 percent. CDMA coverage is expected to grow slightly since most large CDMA operators have announced a migration plan to LTE.

LTE rollout

Several major operators have started LTE deployments, but in terms of population coverage there is a long way to go. In February, LTE was estimated to cover 325 million people globally. In five years, it is expected that LTE will cover around 50 percent of the population.

[3] The figure refers to population coverage of each technology. Other factors, such as access to devices, are also needed in order to utilize the technology.

Figure 20: Technology coverage, 2011 and 2017

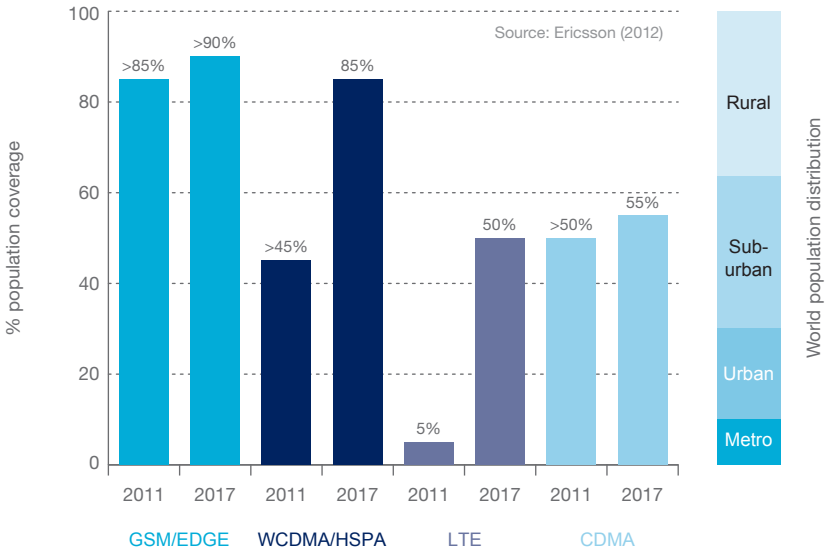
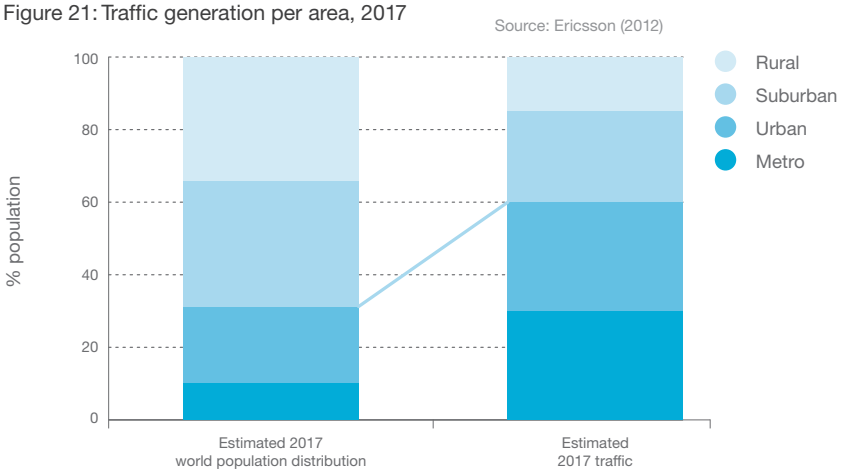


Figure 21: Traffic generation per area, 2017



* Metro: > 4,000 people/sq km
Suburban: 300-1,000 people/sq km
Urban: 1,000-4,000 people/sq km
Rural: < 300 people/sq km

Effects of urbanization

Urbanization is a major global trend. Figure 21 shows that by 2017, over 30 percent of the world's population are expected to live in metro and urban areas. These areas represent less than 1 percent of the Earth's total land area, yet are set to generate around 60 percent of mobile traffic by 2017.

In these areas, heterogeneous networks will complement macro network improvements, serving the traffic and providing good coverage and high quality user experience. In less-densely populated areas the focus will be on building cost-effective coverage and capacity.

SMARTPHONE USERS: NETWORK QUALITY

The growth of smartphones has been tremendous. 40 percent of the world's smartphone users access internet and apps even before getting out of bed. Once out of bed, internet and apps are used almost constantly, peaking during the daily commute with 70 percent usage.

Smartphone users are developing new internet access habits at a tremendous speed in many new localities and we have studied their evolving perception of network quality. 51 percent of smartphone users are very satisfied with their operator's network and only 3 percent are outright dissatisfied, leaving almost half in a position where their satisfaction could easily be improved.

47%

PERCEIVE A SLOW NETWORK TO BE THE MOST COMMON CAUSE OF SMARTPHONE INTERNET USAGE ISSUES

There is intensive smartphone use during commuting, yet at the same time, features such as subways and tunnels create obstacles to internet access. It may come as no surprise therefore, that around half of all smartphone users experience internet access issues on a weekly basis, according to our recent Ericsson ConsumerLab study.

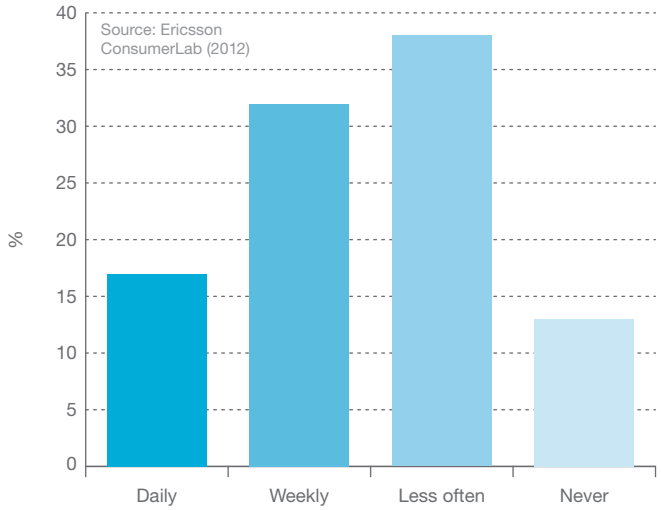
When issues do occur they are perceived to be irritating, and the frequency of the issues is in itself a cause of frustration for some. Medium to high network satisfaction levels indicate that users accept some issues today, but also expect improvements in the near future.

STUDY BACKGROUND

Ericsson's ConsumerLab has performed a smartphone user network satisfaction survey in two mature mobile broadband markets with different characteristics:
the Netherlands and Finland.

The survey was administered online and the sample size was 1,000 3G smartphone users aged 18-69 per country who use apps or access the internet more than once a week.

Figure 22: Experience of smartphone usage problems



User perceptions

Ericsson's new smartphone user network satisfaction study in Finland and the Netherlands indicates that as users are maturing, they have stronger opinions on what causes different issues. There is therefore a greater focus on improving factors which affect the user experience.

A slow mobile network is perceived to be the most common cause to smartphone usage issues, stated by 47 percent of the sample, or more specific per country, 56 percent in Finland and 37 percent in the Netherlands.

Users also perceive the network to be the main contributor to internet access problems. One third of Finnish smartphone users and 47 percent of Dutch smartphone users hold the carrier responsible for internet connectivity problems.

Coverage and data speed drive satisfaction

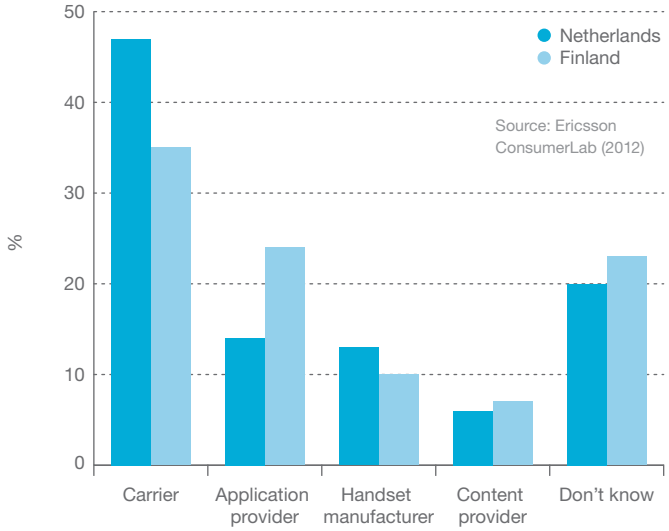
Coverage where people need it and a fast and reliable connection to the internet are "must haves" for smartphone users and are the strongest drivers of satisfaction. This reflects the need to constantly be connected and to have a positive smartphone experience.

Providing an excellent network with great coverage and data speed where apps run smoothly, is essential to satisfying users and standing out from the competition.

Satisfied users make recommendations

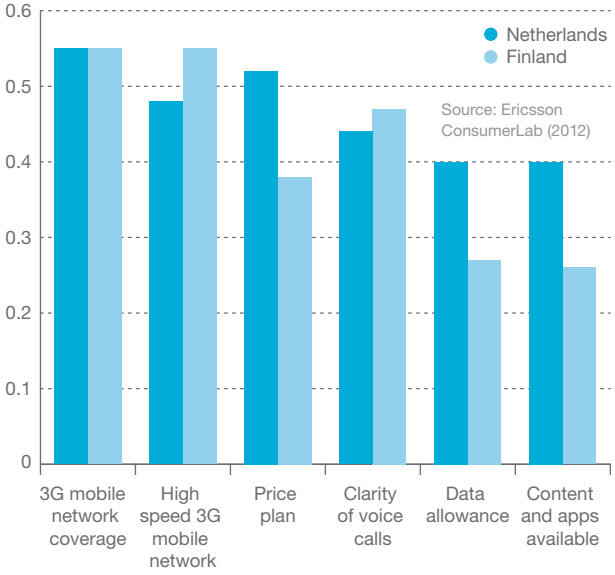
Whereas half of all users are very satisfied with their carriers, there is an opportunity to generate competitive advantage by improving consumer network satisfaction for users who experience internet access issues. If problems occur more than once a week, then overall satisfaction with the network significantly declines. Analysis shows that highly satisfied subscribers will generate good word of mouth, so this may be a worthwhile opportunity.

Figure 23: Responsibility for internet access problems



A competitive advantage can be generated by improving consumer network satisfaction

Figure 24: Correlation between satisfaction with features and overall satisfaction

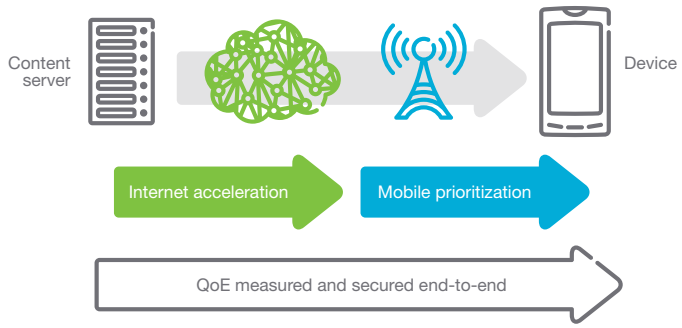


ACCELERATING MOBILE CONTENT DELIVERY

ACCELERATED CONTENT LOADS UP TO 70% FASTER

As content delivery over mobile networks is rapidly growing, it is becoming increasingly important to secure quality of experience end-to-end, from the content server across the fixed internet, and the mobile network to the mobile device.

Coverage and speed are the biggest drivers of network satisfaction (see page 17). Improving these will have the most positive impact on user satisfaction and improve both the operator and the content provider's business. For a content provider, a one second delay in page load time can result in lost conversions[4], fewer page views and a decrease in customer satisfaction.



Quality of Experience is secured end-to-end through a combination of content acceleration through the fixed internet and content prioritization in the mobile network.

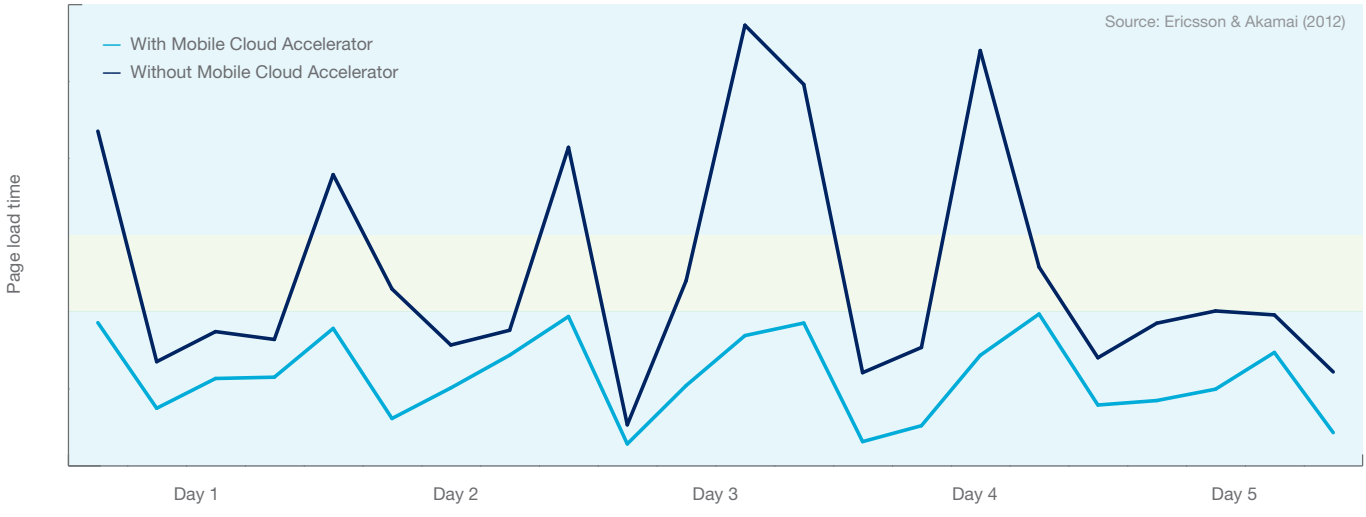
One way of enhancing the user experience is to accelerate content delivery through a combination of internet optimization and mobile prioritization.

The effect of this is threefold; it provides shorter average page load times, a more consistent user experience and page load failures are largely avoided. Being able to provide a consistently good user experience has a direct effect on a content provider's business value through increased conversion rates and brand perception.

Figure 25 shows measurements from a commercial mobile broadband (HSPA) network. The dark blue line represents page load times for content downloaded from a content provider's web server (origin) to a mobile device, and the light blue line shows page load times for the same content when the delivery is accelerated end-to-end. Page load times for non-accelerated content varies greatly over the five day period due to variation in radio network load, while the accelerated content is less affected. Page load times are, for the accelerated content, shorter on average and a more consistent experience is provided. In this measurement, the accelerated content downloads up to 70 percent faster.

[4]The conversion rate is the ratio of visitors who convert website visits into desired actions e.g. purchase of product.

Figure 25: Page load time with/without end-to-end acceleration



TRAFFIC VARIATIONS BETWEEN NETWORKS

TRAFFIC PATTERN ANALYSIS

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 detailed traffic measurements in all major regions of the world. The measurements in this section were made in a selected number of live commercial WCDMA/HSPA networks in Asia, Europe and the Americas.

Variations observed in mobile traffic patterns are dependent on many, often interacting, factors. Some of the most significant ones are:

- The data plan (price and allowance) affects user behavior. Low prices drive up user numbers and a larger data allowance typically drives higher volume per user.
- Video often represents the largest share of total traffic. The availability of video content in the respective market has a major impact on traffic patterns in all networks. Common examples are Video On Demand services, such as Netflix and Hulu, as well as a multitude of TV channels (typically local to the market) available free on the internet.
- Device type, screen size and resolution.
- Traffic management – this is regulated by each country's authorities, however, it also represents a strategic decision for the operator. For example, operators can manage P2P file sharing in different ways by either allowing it, forcing it to low traffic hours, or not allowing it.
- The overall quality of the network, speed and latency.
- Price plans and penetration of fixed broadband networks. When the primary access to the internet is via mobile access it drives usage upwards.

Ericsson traffic measurements show that there is no typical network

In the coming sections traffic characteristics are examined one factor at a time. These measurements clearly show that there are major differences between the networks depending on these factors.

Traffic variation figures

The results show that there is a big difference between the individual networks measured in this chapter. The graphs therefore reflect this broad spread of data by showing the average values of the different measured networks.

Largest average value, measured in one of the networks

Average value of the measured networks' average values

Smallest average value, measured in one of the networks

Traffic variations – devices

There are major differences in how much traffic various devices generate in different mobile networks.

Figure 26 shows penetration and share of total traffic volume for different device types (see legend at the bottom of the page for information on how to read the graph). In some European networks, traffic from mobile PCs dominate, while in North America smartphone traffic is typically predominant. The penetration of mobile PCs differs between around 1-16 percent in the measured networks. Mobile PCs users create approximately 8-88 percent of total traffic in the measured networks. One reason for the variation is the different focus operators have had on PC and smartphone segments. Operators that launched mobile broadband early, typically successful in selling dongle subscriptions, often have a large share of PC subscribers. In some markets it is still the dominant segment due to late proliferation of smartphones and a general strategy to target households with DSL replacement offerings.

Figure 27 shows the spread of average monthly data traffic per subscription and device type in the different measured networks. The largest spread can be observed in 3G routers (1-16 GB per month). For PCs, the variation is also large (1-7 GB per month) followed by tablets (300-1600 MB per month) and mobile phones (30-230 MB per month).

The observed M2M traffic is very small, with an average volume below 10 MB per subscription in all measured networks. The M2M share of mobile networks often include low data applications such as security surveillance, fleet management, and Point Of Sale terminals.

Figure 26: Penetration and share of total mobile traffic volume per device in different networks, measured in bytes

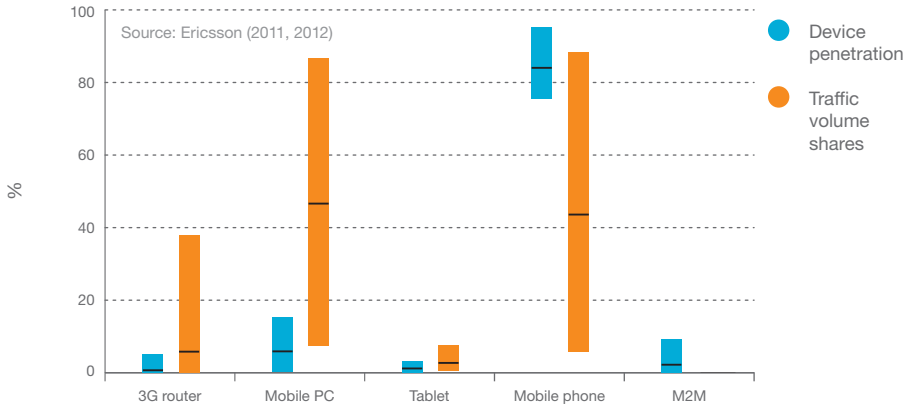
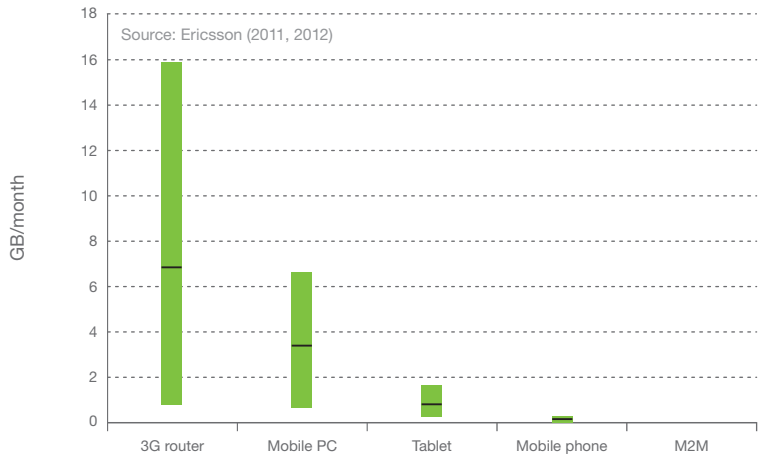


Figure 27: Average monthly mobile traffic volume per subscription and device in different networks



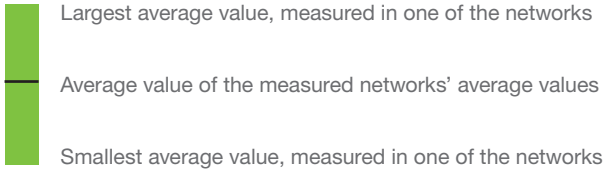
3G router: WLAN router with built-in HSPA uplink interface rather than a connection to a fixed network.

Mobile PC: laptop or desktop PC devices with built in 3G modem or external USB dongle.

Tablet: portable tablet computers with touch screen display (e.g. iPad, Galaxy Tab).

Mobile phone: any mobile phone, including both smartphones and feature phones.

M2M: machine to machine devices (e.g. vehicle tracking, fleet management, security surveillance, remote monitoring).



Traffic variations – mobile phone operating systems

Figure 28 shows the spread in average traffic volume per subscription between measured networks. iPhone[5] and Android smartphones represent the largest traffic volumes per subscription. One reason for the wide spread is the difference in data plans offered to the users (see page 23). Android models have a greater variance due to a larger diversity of device models. In networks where high-end models dominate, average usage on Android devices can exceed average iPhone usage. However, when operators focus on the low-end Android segment the average usage is usually smaller than for iPhones.

There are large differences between traffic volume of phones with different versions of Windows OS, hence average values might increase significantly in the future when Windows 8 becomes dominant.

Figure 29 shows penetration and share of total traffic volume for the different mobile phone OS types. iPhones represent, on average, nearly 50 percent of the total mobile phone traffic in the measured networks. The reason is the relatively high average usage per subscription coupled with high penetration. The variance between measured networks is high, ranging from a few percent to nearly 80 percent of the total traffic volume for iPhones.

[5]The iPhone OS is called iOS.

Figure 28: Average monthly traffic volume per subscription for different mobile phone operating systems in different networks

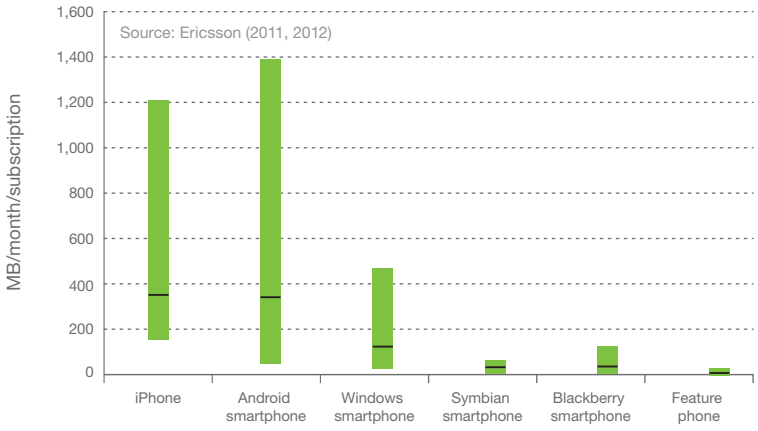
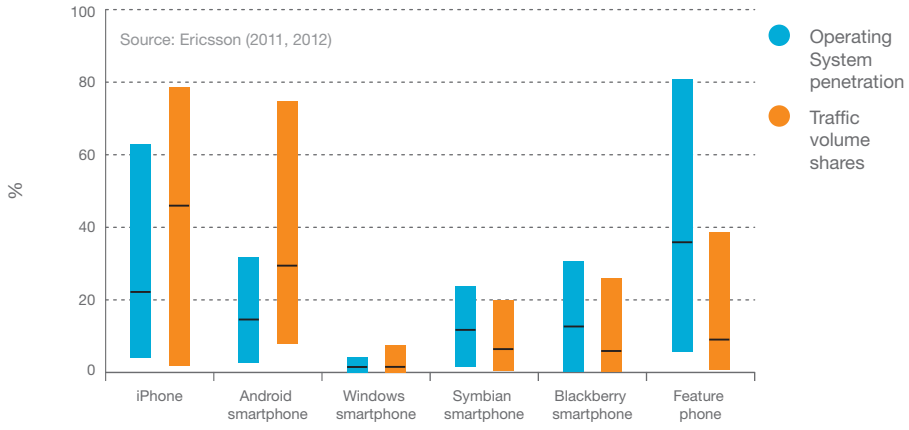
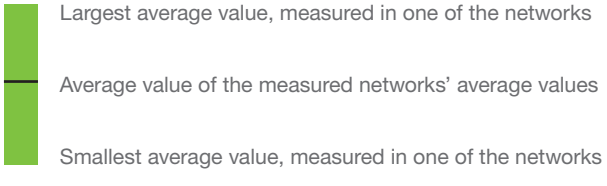


Figure 29: Penetration and share of total mobile phone traffic volume for different operating systems in different networks, measured in bytes





Traffic variations – applications

Figure 30 shows average monthly traffic volume per subscriber for mobile PC devices and how it varies between the measured operators in Asia and Europe. HTTP video represents the largest volume per subscriber. There are differences in how HTTP video applications behave and load the networks. Applications like Hulu and Netflix use adaptive bit rates, which means they use as much bandwidth as possible in order to maintain the highest possible quality at any given moment. YouTube and some similar applications use the bit rate that the user selects, starting by default at the lowest possible bit rate.

The biggest difference between Europe and Asia is in the usage of peer-to-peer (P2P) TV, which has become a common form of TV distribution in some Asian countries.

There are also large differences between networks and regions regarding P2P file sharing. Explanations include cultural differences, availability of other content distribution types and legal constraints. Differences between data plans and traffic management functions implemented by operators can have an effect.

Video represents the largest data traffic volume

P2P file sharing is typically used by rather small groups of users, but can account for a large share of the total traffic volume. These measurements were made in mobile networks, but P2P file sharing is more prevalent on fixed networks, where speeds are normally higher and data plans less restrictive.

Figure 30: Average monthly mobile application traffic volume per subscription for mobile PC, in different networks

Video definition

Both HTTP video and P2P TV are types of online video where the user watches the film while it is being downloaded (streamed). In the case of P2P file sharing the user first downloads the entire file, most often a movie, and watches it offline. Examples of applications that use HTTP are YouTube, Hulu, Netflix, and BBC iPlayer. An example of P2P TV is PPStream.

TRAFFIC VARIATIONS: DATA PLAN

As described in the previous section, there are several factors which have an impact on traffic patterns. Data plans are one of the most important. This section focuses on the measureable effects relating to data plans in a selected mature 3G network.

Variations by phone model and data plan

Figure 31 shows how the average monthly volume per subscription varies by data plan as well as by mobile phone model for a specific brand.

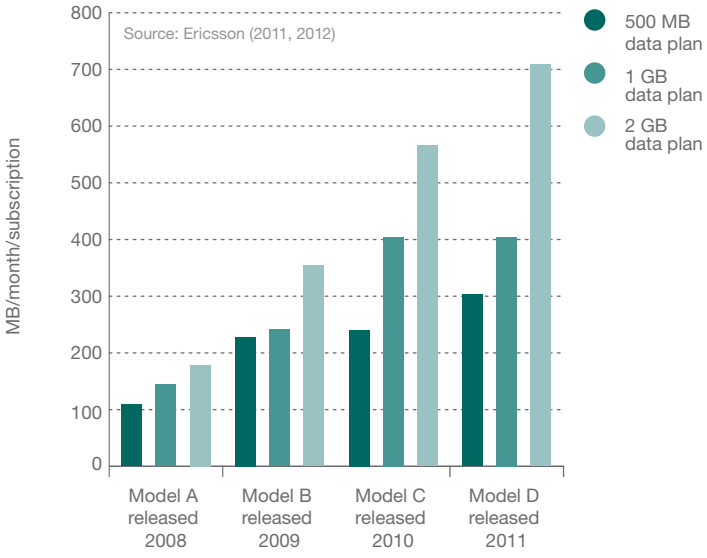
When a new device is released, there are sometimes dramatic headlines in the media focusing on the enormous increase in usage that some new devices seem to generate.

What is often overlooked is that a high volume user will tend to switch to the newest device model upon its release. Therefore this increase in usage can be attributed to both the new device and the subscriber segment it has attracted.

It is not uncommon for average usage to decrease over time for any given device model, as proliferation in the market increases and more regular users transfer to the device. Usage patterns are also related to the data plan that comes with a device. Figure 31 shows that the traffic generated from an existing mobile phone model can be higher than that of a brand new one, due to differences in the subscriber's data plan. The user's choice of specific phone model can also be dependent on the voice plan. As a result, the proliferation of different devices is also dependent on the voice plan connected to the device at the point of sale.

The data plan is one of the most important factors determining level of traffic usage

Figure 31: Average monthly traffic volume per data plan per smartphone model, from the same vendor



Traffic variations by application and data plan

Figure 32 shows the variation of a subscriber's average monthly traffic volume for different applications for mobile PC devices. It is measured at two different occasions during 2011 in one selected network.

Video traffic is still increasing

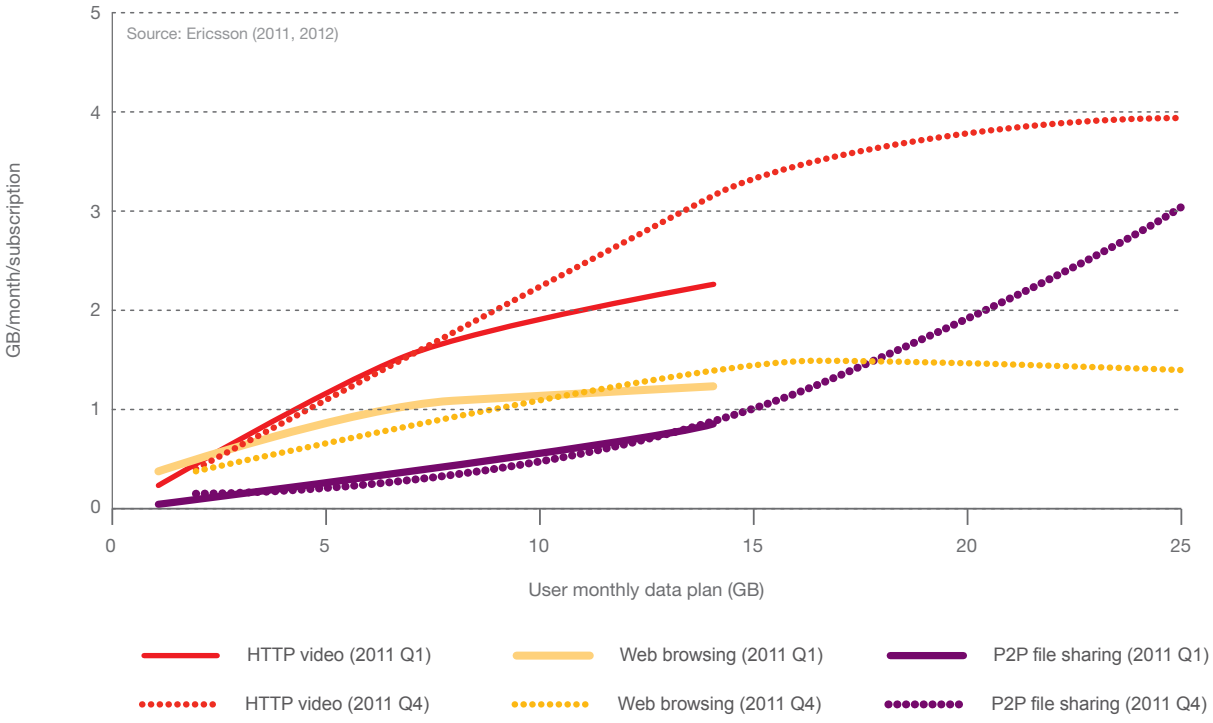
As an example, a user on a data plan of around 15 GB consumed on average 2.3 GB per month of online video in Q1, while in Q4 this figure was 3.5 GB per month.

The monthly subscriber traffic from applications such as online video and web browsing both reach saturation points, although at different levels. At the same time, P2P file sharing keeps increasing with the monthly data plan allowance.

Both web browsing and P2P file sharing usage remain fairly constant within the same data plan between Q1 and Q4, while online video has increased dramatically. The explanation for this can be found by looking at time spent online against the amount of data generated in a specific time period. There are limitations on the time an individual can spend on each application. With low bandwidth applications, such as web browsing, this limitation quickly becomes visible within the package data allowance.

Therefore, we observe a saturation of traffic from that type of application. Video has yet to reach its peak. An example of this is online video with higher bit rates becoming available from YouTube. Another reason is that improved video quality, and increased screen sizes facilitate looking at longer clips or watching for a longer time. The increasing availability of content also has an impact.

Figure 32: Average monthly traffic volume per application, per subscription, as a function of data plan



In these measurements, the majority of users are on medium data plans between 2-5 GB/month. In Q4 higher data plans were available.

THE SIGNATURE OF HUMANITY

INTRODUCING MIT
The MIT Senseable City Lab studies the relationship between cities, new technologies and people. The Lab draws on diverse fields to deliver research and applications that empower citizens to make choices and create a more liveable urban condition. Carlo Ratti is the Director of the Senseable City Lab, Pedro Cruz PhD Visiting Student and Prudence Robinson Partner Strategist and Research Fellow.

Pedro Cruz, Prudence Robinson, Carlo Ratti

Global data from cell phone networks provides unprecedented glimpses into the fabric of society and pulse of our planet. The MIT Senseable City Lab received 12 anonymous datasets from Ericsson corresponding to 12 networks from 3 different continents and consisting of 33 GB of data. These sets refer to data traffic over the networks and consist of connection time per user, amount of traffic consumed during that period and, where available, the software used and the type of activity.

The Senseable City Lab studied how data is consumed over these networks, while establishing a time-based narrative. Additionally, the inclusion of the activity type shows how the traffic is used.

The top 9 categories in descending order are video playback, web browsing, file sharing, file download, social networking, media playback, software update, audio playback and email.

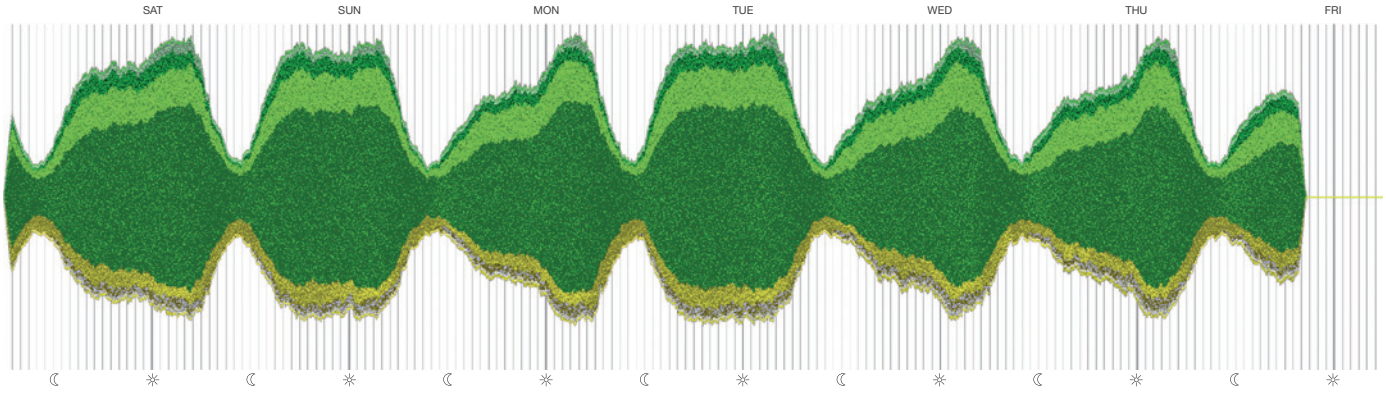
From the 12 datasets provided, 8 were selected that spanned at least 7 consecutive days, and displayed the aggregated traffic consumption from this period.

Each graph follows a classic stacked area chart. The height aligns with symmetrical categories; other applications stack alternatively above or below (figure A). This primitive visualization style is adequate for this concrete type of data since it visually depicts a flow, resulting in an almost asymmetrical form. A different color is assigned to each category with the following stacking order shown in figure B.

Figure B: Application stacking order

Audio playback
Media playback
File download
Web browsing
Video playback
File sharing
Social networking
Software update
Email

Figure A: Single operator in Asia



The noon and midnight of each day are marked with a sun and moon respectively, as well as the corresponding week day. Each vertical line marks one hour as seen in figures C and D.

Figure C has highly distinguishable features where the differences between the maxima and minima hours are clearly noticeable. It is also interesting to observe how the main categories of traffic oscillate; video playback and web browsing are good examples of this. Software updates can generate considerable traffic at night. The traffic profiles do not undergo major changes during weekends.

The graphs consist of dots of varying brightness. Each dot represents 200 users, consuming traffic of a certain category at that moment. This approach enables a comparison to be made between the ratio of connected users and the traffic consumed per category over time. This is clearly shown in figure D.

It can be argued that the density of web browsing is higher than the density of file sharing which is higher than the density of video playback. This means, for example, that a user consuming video playback consumes more in quantity than a web browsing user.

The final artifact visualizes the consumption patterns of all 8 networks combined. The scale has been modified in order to maintain legibility, each dot represents 800 users and the vertical consumption scale has been quadrupled. When the distinctive consumption patterns of each artifact are merged, their differences dissolve and create a cyclical pattern that demonstrates an almost constant periodicity in time and volume: the signature of humanity.

Figure C: Traffic consumption profiles of Northern Europe (top) and South America (bottom)

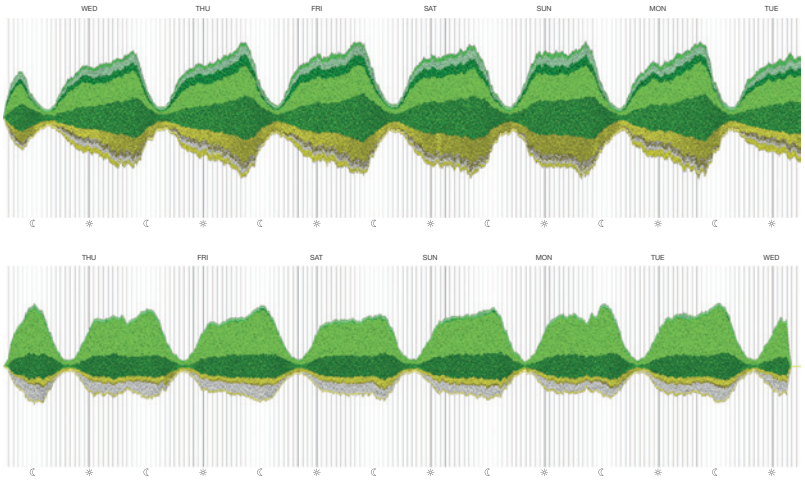


Figure D: Close-up of a specific network showing differences in texture density

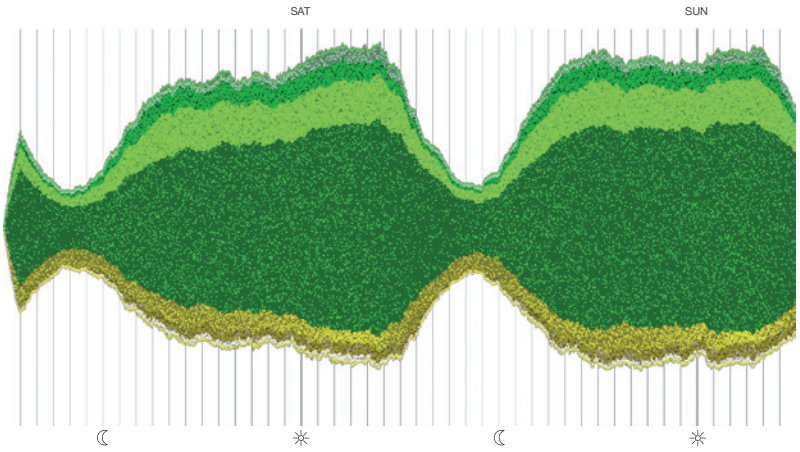
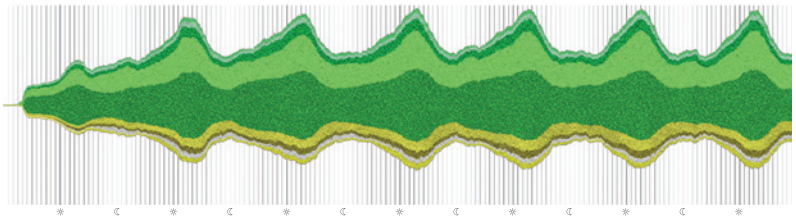


Figure E: Stacked area chart of collated networks



KEY FIGURES

Mobile subscription essentials	2011	2012	2017	CAGR 2011-2017	Unit
Worldwide mobile subscriptions	6,000	6,700	8,900	7%	
– Smartphone subscriptions	700	1,000	3,100	30%	
– HT smartphones	350				millions
– Mobile PC & tablet subscriptions	200	250	650	25%	
– Mobile broadband subscriptions	1,000	1,400	5,100	30%	

Mobile traffic essentials	2011	2012	2017	CAGR 2011-2017	Unit
– Monthly traffic/smartphone	250	350	1,100	30%	
– Monthly traffic/HT smartphone	450				
– Monthly traffic/PC	2,000	2,500	8,000	25%	MB/month
– Monthly traffic/tablet	650	850	3,200	30%	
Monthly traffic/fixed broadband connection	35,000	50,000	140,000	25%	

Traffic growth	Multiplier 2011-2017	CAGR 2011-2017
All mobile data	15	60%
– Smartphones	20	65%
– PC	10	50%
– Tablets	75	100%
Fixed broadband	5	30%

Glossary

2G: 2nd generation mobile networks
3G: 3rd generation mobile networks
APAC: Asia Pacific
CAGR: Compound Annual Growth Rate
CDMA: Code Division Multiple Access
CEMA: Central and Eastern Europe, Middle East and Africa
DSL: Digital Subscriber Line
EDGE: Enhanced Data Rates for GSM Evolution
GB: GigaByte
GDP: Gross Domestic Product
GSM: Global System for Mobile Communications
HSPA: High Speed Packet Access
HT: High Traffic
LA: Latin America
LTE: Long-Term Evolution
M2M: Machine-to-Machine
MB: MegaByte
Mbps: Megabits per second
Mobile PC: (See page 6)
NA: North America
OS: Operating System
P2P: Peer-to-Peer
PetaByte: 10^{15} Bytes
PSTN: Public Switched Telephone Network
TD-SCDMA: Time Division Synchronous Code Division Multiple Access
VoIP: Voice over IP (Internet Protocol)
WCDMA: Wideband Code Division Multiple Access
WE: Western Europe
xDSL: Various technologies for DSL

Ericsson is the world's leading provider of communications technology and services. We are enabling the Networked Society with efficient real-time solutions that allow us all to study, work and live our lives more freely, in sustainable societies around the world.

Our offering comprises services, software and infrastructure within Information and Communications Technology for telecom operators and other industries. Today more than 40 percent of the world's mobile traffic goes through Ericsson networks and we support customers' networks servicing more than 2.5 billion subscribers.

We operate in 180 countries and employ more than 100,000 people. Founded in 1876, Ericsson is headquartered in Stockholm, Sweden. In 2011 the company's net sales were SEK 226.9 billion (USD 35.0 billion). Ericsson is listed on NASDAQ OMX, Stockholm and NASDAQ, New York stock exchanges.

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