

# ERICSSON MOBILITY REPORT

ON THE PULSE OF THE NETWORKED SOCIETY

MOBILE WORLD  
CONGRESS EDITION

FEBRUARY  
2016

# KEY FIGURES

Mobile subscription essentials	2015	2021 forecast	Unit
Worldwide mobile subscriptions	7,300	9,100	million
> Smartphone subscriptions	3,400	6,400	million
> 5G subscriptions	0	150	million
> Mobile PC, tablet and mobile router subscriptions	250	350	million
> Mobile broadband subscriptions	3,600	7,700	million
> Mobile subscriptions, GSM/EDGE-only	3,600	1,300	million
> Mobile subscriptions, WCDMA/HSPA	2,200	3,200	million
> Mobile subscriptions, LTE	1,000	4,100	million

Accumulated mobile data traffic	2010–2015	2016–2021 forecast	Unit
> Total	120	1,600	ExaByte
> Video	50	1,000	ExaByte
> Social networking	15	180	ExaByte

Monthly data traffic per device*	2015	2021 forecast	Unit
> Tablet	2.6	9.7	GB/month
> Mobile PC	5.8	20	GB/month
> Router	14	41	GB/month
> Smartphone	1.4	8.5	GB/month

Monthly data traffic per smartphone*	2015	2021 forecast	Unit
> Western Europe	2.0	18	GB/month
> Central and Eastern Europe	1.4	6.9	GB/month
> Middle East and Africa	1.1	6.3	GB/month
> Asia Pacific	1.0	6.9	GB/month
> North America	3.8	22	GB/month
> Latin America	1.2	6.0	GB/month

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



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#### Key contributors

Executive Editor: Patrik Cerwall  
 Project Manager: Monika Byléhn  
 Editors: Stephen Carson, Monika Byléhn  
 Forecasts: Richard Möller, Susanna Bävertoft  
 Articles: Jasmeet Singh Sethi, Peter Jonsson, Stephen Carson

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# ERICSSON MOBILITY REPORT MWC 2016

## Smooth browsing and video streaming increase Net Promoter Scores

In this Ericsson Mobility Report we introduce a neuroscience study by Ericsson ConsumerLab that captured objective reactions to varied levels of network performance while using a smartphone. It revealed that under time constraints delays in web page load times and video streaming can be as stressful as watching a horror movie. On the other hand, if there are no such delays, we unconsciously become more satisfied with our mobile service provider.

In November, we significantly increased our mobile data traffic forecast. In Q4 2015, data traffic grew by 65 percent compared to Q4 2014 and is now anticipated to grow at 45 percent annually through 2021.

Video streaming remains the largest mobile data traffic generator. The growth in video traffic is boosted

mainly by the growing availability and popularity of video content services, devices with larger and higher resolution screens, high performing networks enabling a better experience and changing user behavior.

Social networking is second only to video in driving traffic growth. We share more online now than we have ever done before. With the increased penetration of smartphones, it is very convenient to access social media platforms. In Q4 2015, smartphones accounted for around 75 percent of all mobile phones sold worldwide and we predict an additional 3 billion smartphone subscriptions by the end of 2021.

We hope that you enjoy this year's Mobile World Congress and look forward to an exciting 2016!

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## PUBLISHER

Rima Qureshi  
Senior Vice President,  
Chief Strategy Officer

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Smartphone users share more online than ever before. Social networking traffic over the next 6 years will be 12 times that of the last 6

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68 million mobile subscriptions were added during the last quarter of 2015, 21 million of which were in India



# THE STRESS OF STREAMING DELAYS

When consumers turn to their smartphones to find information quickly, they want an instantaneous response. A neuroscience study measuring user reactions to network performance has shown that delays in loading web pages and videos while completing tasks under time constraints are taxing – heart rate and stress levels increase. Both time-to-content and additional delays due to re-buffering lead to decreases in Net Promoter Scores (NPS). On the other hand, smooth browsing and video streaming lead to increased NPS for a mobile broadband service provider

## Forming a more objective picture of user experience

### Who?

Ericsson ConsumerLab engaged a neuroscience consultancy<sup>1</sup> to study user reactions to varied levels of network performance during a smartphone experience.

### What was measured?

Brain activity, eye movements, and pulse were recorded while subjects completed various tasks by browsing the web and watching video clips. Changes in the perception of mobile network operators and content providers before and after network usage experiences were also measured.

### How?

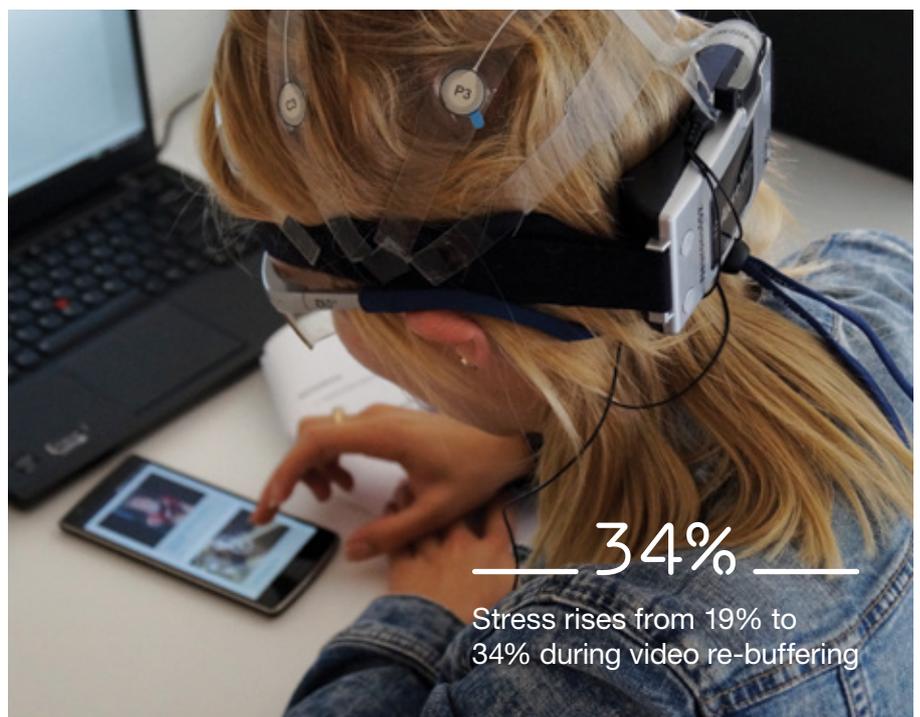
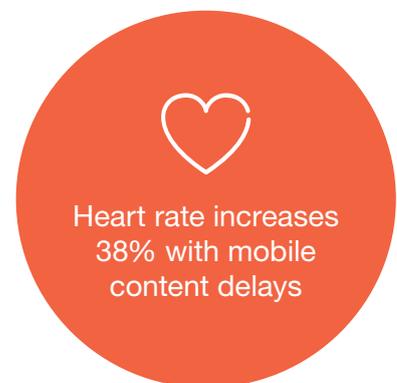
Participants were exposed to a high degree of delays, a medium degree of delays or no delays at all while they completed tasks, allowing a detailed analysis of how the duration and extent of delays affected emotional engagement and stress.

### Why?

The results help to uncover how variations in network performance can impact consumer experience and ultimately affect brand equity.

The study revealed that delays in loading web pages and videos lead to increased heart rates and stress levels. On average, single delays resulted in a 38 percent increase in heart rate.

As for stress, participants already exhibited an increase from pre-task baseline levels, which was attributed to the pressure of having to complete tasks within a set time limit. With the introduction of delays, the stress levels then increased further.



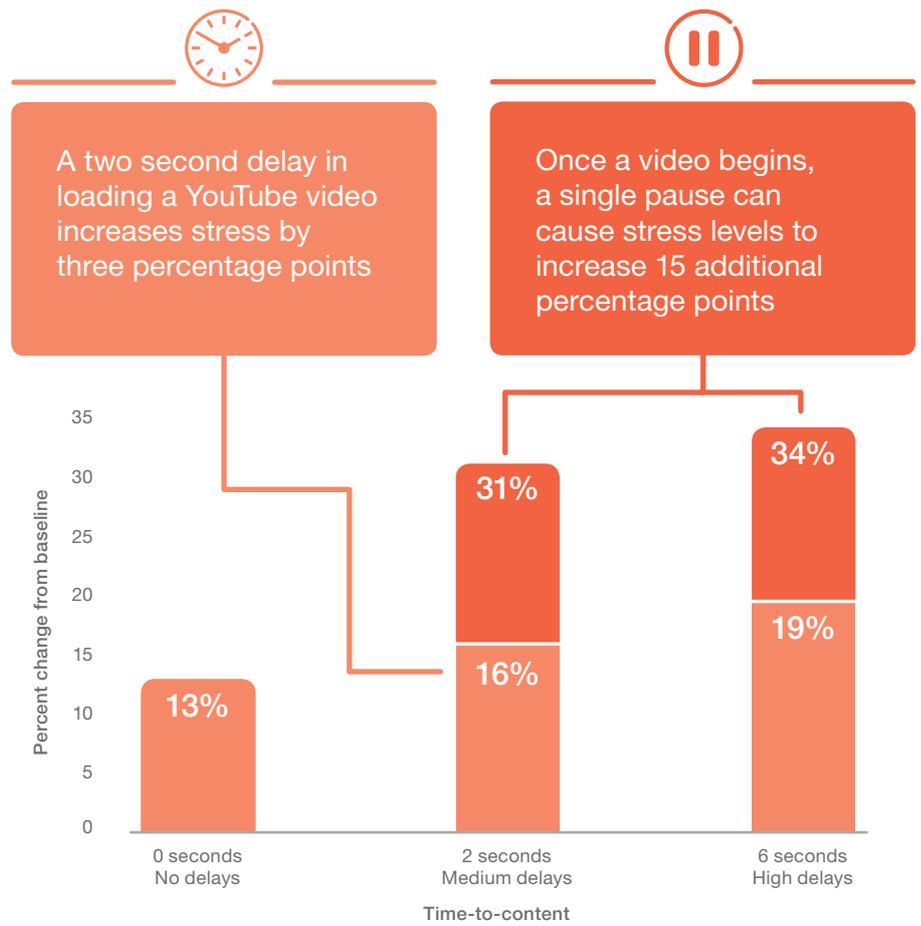
<sup>1</sup> Copenhagen-based Neurons Inc.

## Stress and streaming

Participants' responses to initial load time (time-to-content) and pauses due to re-buffering while watching videos were assessed by measuring cognitive load<sup>2</sup>, an indicator of stress. With no delays, stress levels during the video tasks averaged 13 percent above the pre-task baseline. A medium delay of 2 seconds when loading videos led to average stress levels to go from 13 percent to 16 percent above the baseline. Once a video started to stream, a pause due to re-buffering caused stress levels to further increase by 15 percentage points. With high time-to-content delays of 6 seconds, half of the participants exhibited a 19 percent increase relative to baseline levels while the other half exhibited signs of resignation – their eye movements indicated distraction and stress levels dropped.

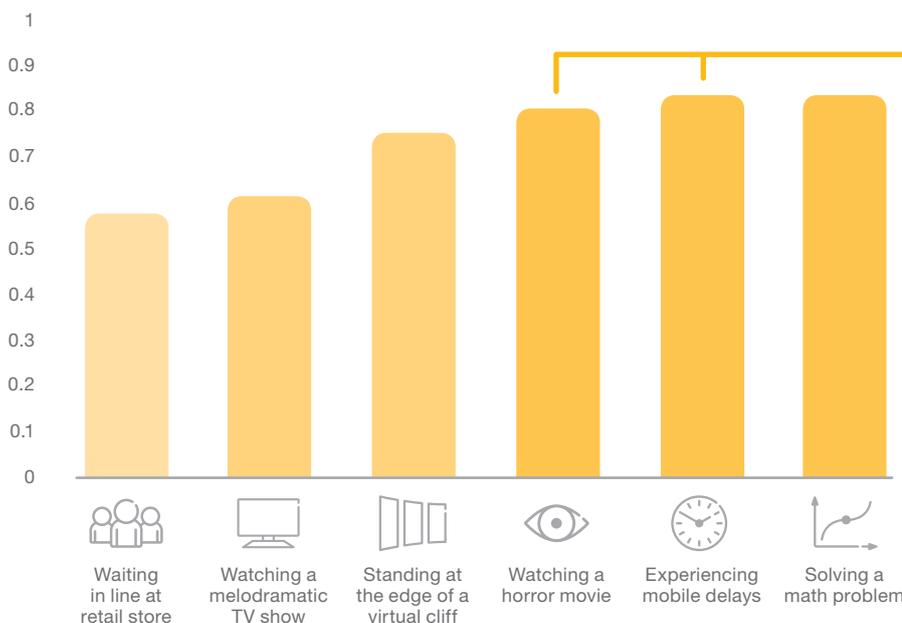
To put the findings of this study in context, the measured levels of stress can be compared to other situations in everyday life. For example, the stress response to delays was similar to that of watching a horror movie or solving a mathematical problem and greater than waiting in a check-out line at the grocery store.

## Average change in stress when facing streaming video delays



Source: Ericsson ConsumerLab neuro research, 2015  
 Base: Smartphone users aged 18–52 from Copenhagen, Denmark

## Cognitive load associated with stressful situations



Source: Ericsson ConsumerLab, Neurons Inc., 2015

<sup>2</sup> Cognitive load is described on page 7

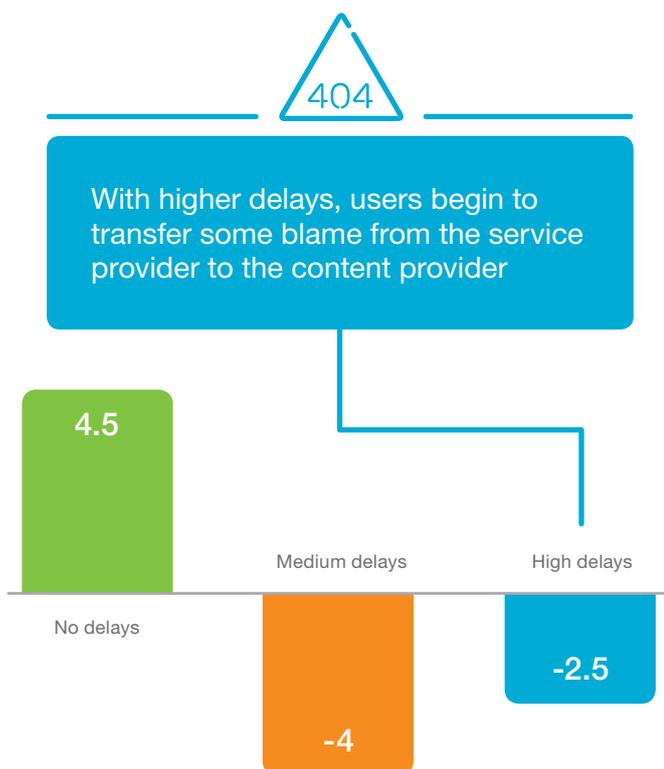
## Patience is a virtue, but not for users

Participants that experienced no performance delays demonstrated a net increase in brand engagement, measured using a motivation index.<sup>3</sup> This suggests that they became happier with their mobile service provider. In comparison, the groups subjected to medium and high delays displayed neutral and even negative brand engagement.

Interestingly, medium delays resulted in a double negative effect on the service provider, as they not only decreased brand engagement with consumers but also caused an increase in engagement with competitor brands. Meanwhile, users who faced high delays responded negatively to all mobile service provider brands. This surprising finding suggests that major delays can even cause the whole industry to suffer a loss of brand equity.

Similar effects were observed when looking at changes in NPS<sup>4</sup>, which were calculated using data gathered from a survey administered to participants both before and after they experienced delays. On a scale of 0–10, NPS fell by 4 and 2.5 points for those who faced medium and high delays, respectively.

### Change in NPS score for mobile service providers



Source: Ericsson ConsumerLab neuro research, 2015  
Base: Smartphone users aged 18–52 from Copenhagen, Denmark

<sup>3</sup> Motivation index is described on page 7

<sup>4</sup> NPS is a quantification of the likelihood that a customer would recommend a company's product or service.

Its customers are scored on a scale of 0–10 and then divided into three categories:

> 9–10 – promoters: loyal enthusiasts who keep buying from the operator and referring others, fueling growth

> 7–8 – passives: satisfied but unenthusiastic customers who are vulnerable to competitive offers

> 0–6 – detractors: unhappy customers who can damage your brand and impede growth through negative word of mouth

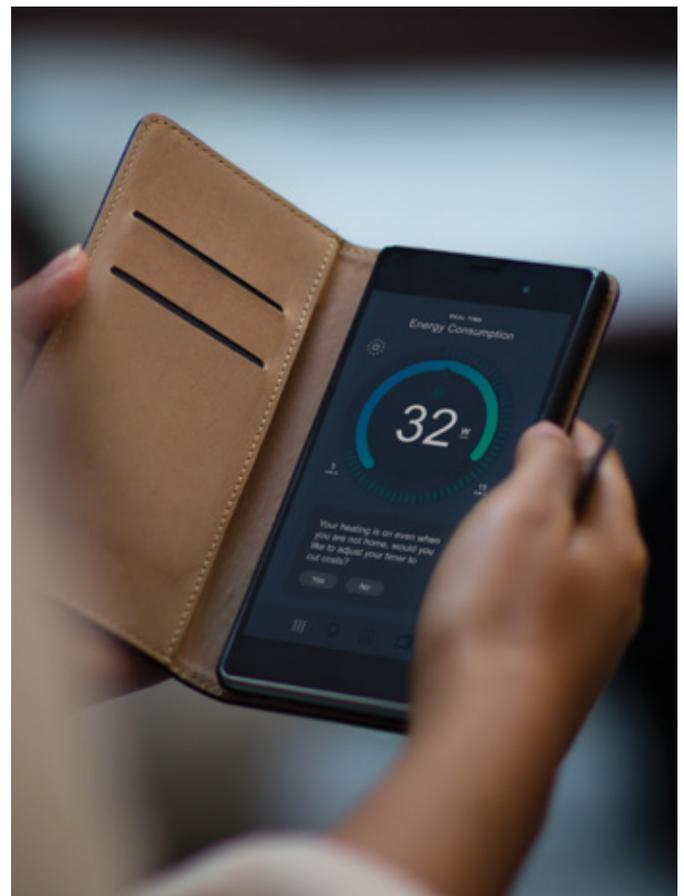
To calculate an operator's NPS, the percentage of detractors is subtracted from the percentage of promoters. NPS scores analyzed here should be taken as indicative since the study did not encompass a large enough sample of users to provide statistical significance

## -4 POINTS

Moderate time-to-content and re-buffering delays lead to a four point drop in NPS on average

The lower drop in NPS for those subjected to high delays was attributed to users transferring some of the blame to the content provider.

For those who faced no delays while completing the assigned tasks under time pressure, NPS increased significantly for their own service provider (4.5 points), suggesting that offering customers good network performance when it is needed is a key to improving brand equity.



## Methodology: Measuring user response to network performance

A total of 30 volunteers aged 18–52 in Copenhagen were randomly selected from an existing panel of online users. All of the participants were mobile broadband subscribers that regularly browsed and streamed video on their smartphones.

The participants were fitted with pulse meters and eye-tracking glasses, as well as EEG electrode headsets to record brain activity. They were each issued an Android smartphone, and asked to complete 18 tasks within a 20 minute time period. The smartphones were programmed to appear as if they were using a mobile broadband network connection. The tasks consisted of navigating through news articles on web pages and YouTube videos which were set up with a range of pre-determined delays.

The subjects were split into 3 groups of 10, and each group was exposed to a different level of network performance while attempting to complete the mobile web and video tasks. None of the respondents knew they would be subjected to pre-determined delays.

- > Group 1 (no delays)
- > Group 2 (medium delays): 4–6 seconds of web page load time; 2 seconds of video load time and 3 video pauses of 3 seconds due to buffering events
- > Group 3 (high delays): 10–14 seconds in web page loading; 6 seconds of video load time and 3 video pauses of 3 seconds due to buffering events

To measure consumers' unconscious responses to brands, the participants were shown a series of images including logos of mobile operators and content providers. Participants were also asked whether they were willing to recommend their mobile broadband service provider. The tests were administered both before and after the web and video tasks in order to measure changes in responses.



### Measuring consumers' unconscious response to brands opens up insights into how network performance impacts brand perception

The study was designed around three types of measurements: electrical activity in the brain, eye movements, and pulse. Brain activity captured with EEG headsets was used to assess the two neuro metrics described below.

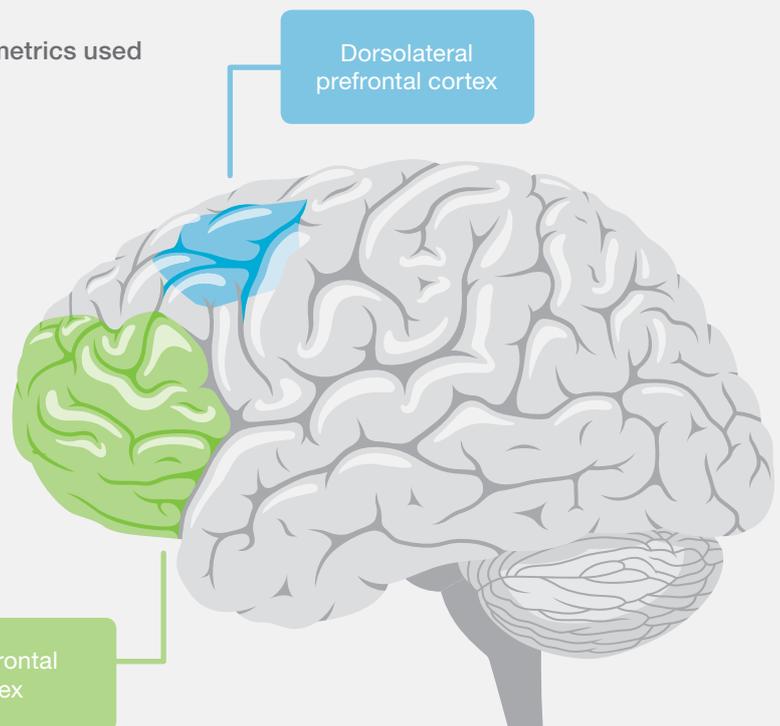
**Cognitive load** is a score that measures the amount of information that a person is processing and “holding active” in the dorsolateral prefrontal cortex (DL-PFC) part of the brain. A high cognitive load is part of a stress response. A score up to 0.7 is acceptable and considered normal for proper information processing. However, scores over 0.8 are considered very high and stressful.

The **motivation index** is a calculation of the relative activation of the left versus right orbitofrontal cortex, and is closely linked to approach-avoidance behaviors. Studies have demonstrated that a stronger left than right activation is related to approach motivation and action, while a stronger right than left activation is indicative of avoidance motivation and behaviors. The phenomenon has been studied using EEG, functional magnetic resonance imaging (fMRI) and patient studies, and is considered a simple but robust phenomenon. It was used in this study by having the participants focus on a screen where brand logos were shown for a few seconds at a time while motivation response was measured with EEG.

## Functional areas of the brain relating to the neuro metrics used



EEG electrode headsets were used to record brain activity



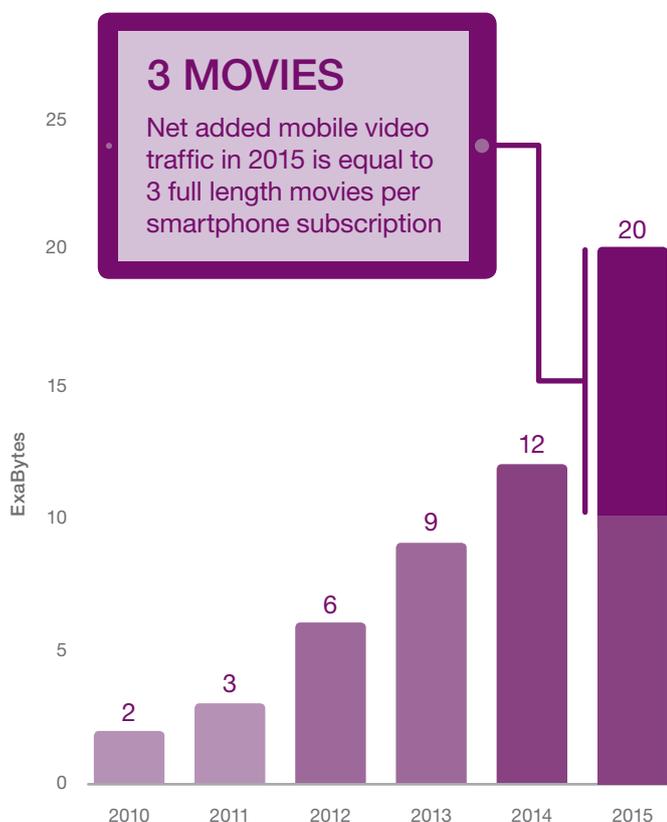
# ALL THE WORLD'S A SCREEN

In November 2015, we significantly increased our mobile data traffic forecast. This was largely based on recent network measurements indicating a stronger than anticipated growth of average data traffic consumption per user. Mobile data traffic is expected to grow at a compound annual growth rate (CAGR) of 45 percent through 2021 – a 10-fold increase in the coming 6 years

Additional factors underpinning the forecast traffic growth include the rising share of smartphone subscriptions – particularly for LTE smartphones – as well as increased data consumption per LTE subscriber. In many markets, the rate of growth for data consumption per subscriber has not declined over time as fast as presumed. A similar data consumption pattern is also expected to apply to new LTE subscribers. This increasing data consumption per subscription is mainly driven by video traffic.

Net-added mobile data traffic in 2015 was 20 ExaBytes (EB), half of which consisted of video traffic. The additional video traffic in 2015 is comparable to approximately three full length movies per smartphone subscription.<sup>1</sup>

Yearly net added mobile data traffic<sup>2</sup>



#### Mobile video traffic drivers:

-  Evolving smart devices with larger screens and higher resolution, enabling better picture quality for streamed video
-  Video content increasingly appearing as part of other online applications, including news, advertisements and social media
-  Strong growth of video streaming, primarily driven by content providers such as YouTube and Netflix (in many mobile networks today 50–70 percent of video traffic is from YouTube)
-  Uptake of video on-demand services (VoD), for example HBO and Netflix, which drives longer viewing times
-  Streaming on-demand and time-shifted content in all consumer segments, not just among early adopters
-  User behavior changes, with TV and video content being consumed everywhere – for example, increasingly over mobile networks and on multiple devices, including smartphones
-  Continued 3G and 4G deployments, enabling faster networks and therefore improved video app coverage
-  Technological improvements, such as video compression techniques, allowing higher resolutions to be more efficiently transmitted over mobile broadband networks, helping operators accommodate increased demand

<sup>1</sup> Calculation of equivalent based on the following parameters: video with DVD quality – 480p resolution, H.264 codec and 1.2 Mbps media rate. Full length movie 90 minutes long. Video accounted for around 50 percent of mobile data traffic during 2015

<sup>2</sup> Traffic does not include DVB-H, Wi-Fi, or Mobile WiMAX

# THE LIVES OF OTHERS

Consumers are increasingly participating in and sharing information on multiple social media platforms. With an expected net addition of 3 billion smartphone subscriptions by the end of 2021, many more consumers will have easy access to social networks via apps and web browsers

Ericsson ConsumerLab research<sup>1</sup> shows that today more people communicate using text than voice calls. Many are also used to instantly sharing photos and videos via social networks. For example, over 70 percent of smartphone owners say they share personal photos regularly and have an audience which sees what's been shared. 46 percent are active on more than one social network.<sup>2</sup>

Accumulated social networking traffic over the next 6 years is forecast to be around 180 EB, which is comparable to every person on earth spending around 35 minutes on social media<sup>3</sup> every day, or a total of more than 200 billion photos<sup>4</sup> viewed every day.



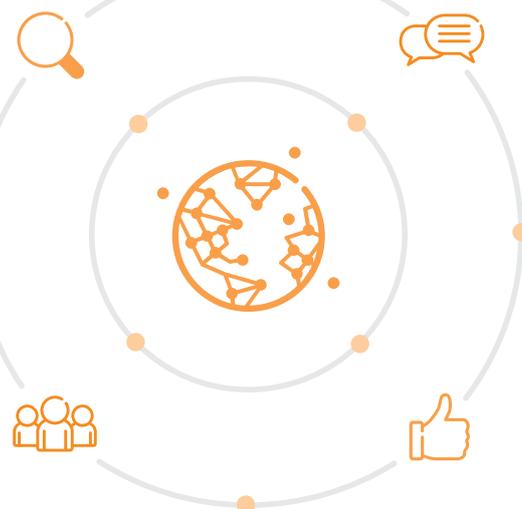
The forecast social networking traffic for the next 6 years is comparable to every person on earth using social networks for 35 minutes every day



Total social networking traffic over the next 6 years will be around 12 times that of the last 6 years



**15 ExaBytes**  
2010–2015



**180 ExaBytes**  
2016–2021

<sup>1</sup> Source: Ericsson ConsumerLab, 10 Hot Consumer Trends for 2016, 2015

<sup>2</sup> Base: 45,290 respondents aged 15–69 in 24 countries

<sup>3</sup> Assumption that 1 hour of social network use consumes 20 MB on average (not including streaming video)

<sup>4</sup> Average photo size assumed to be 400 KB

# MOBILE SUBSCRIPTIONS Q4 2015

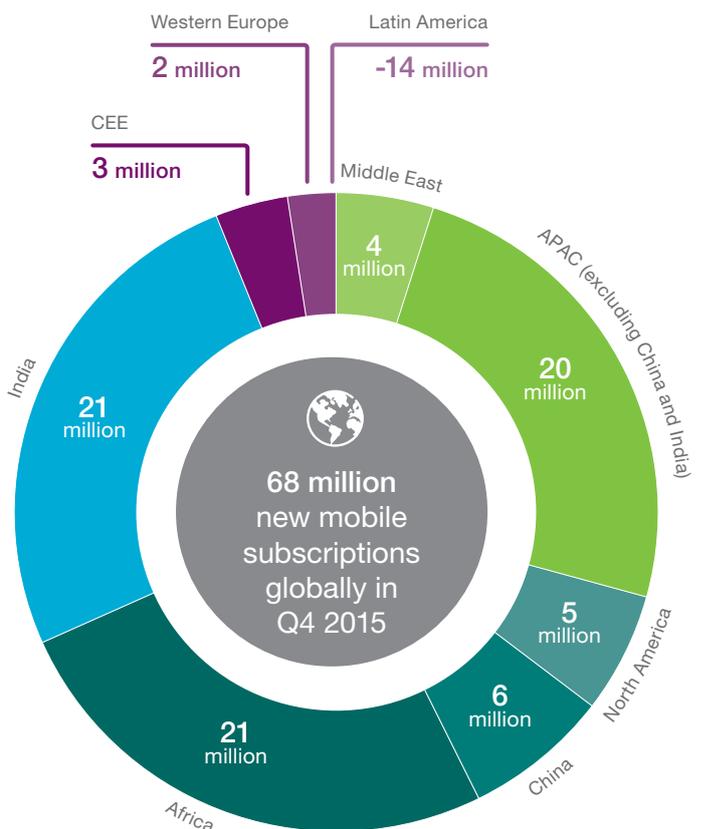
The total number of mobile subscriptions at the end of 2015 was around 7.3 billion, an increase of 68 million subscriptions during Q4 2015

Global mobile subscriptions are growing around 3 percent year-on-year. India grew the most in terms of net additions during the quarter (+21 million), followed by China (+6 million), the US (+5 million), Myanmar (+5 million), and Nigeria (+3 million).

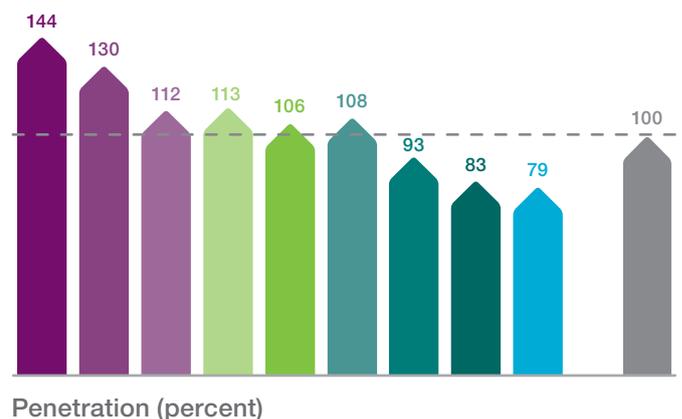
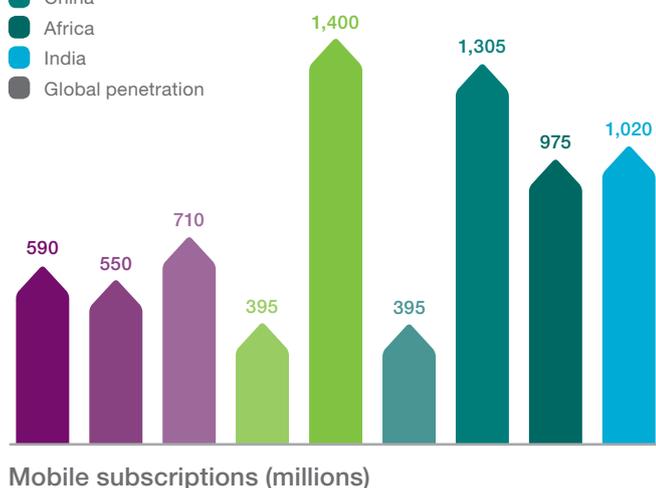
Smartphones accounted for around 75 percent of all mobile phones sold in Q4 2015, compared to around 70 percent during Q4 2014. Today around 45 percent of all mobile phone subscriptions are associated with smartphones, compared with around 40 percent in 2014, leaving considerable room for further uptake.

The number of mobile broadband subscriptions is growing globally by around 25 percent year-on-year, increasing by approximately 200 million in Q4 2015 alone.

LTE subscriptions continue to grow strongly and the total figure has reached around 1 billion subscriptions, with approximately 160 million additions in Q4 2015. WCDMA/HSPA added around 30 million during Q4. The majority of 3G/4G subscriptions have access to GSM/EDGE as a fallback, and GSM/EDGE-only subscriptions declined by 90 million.



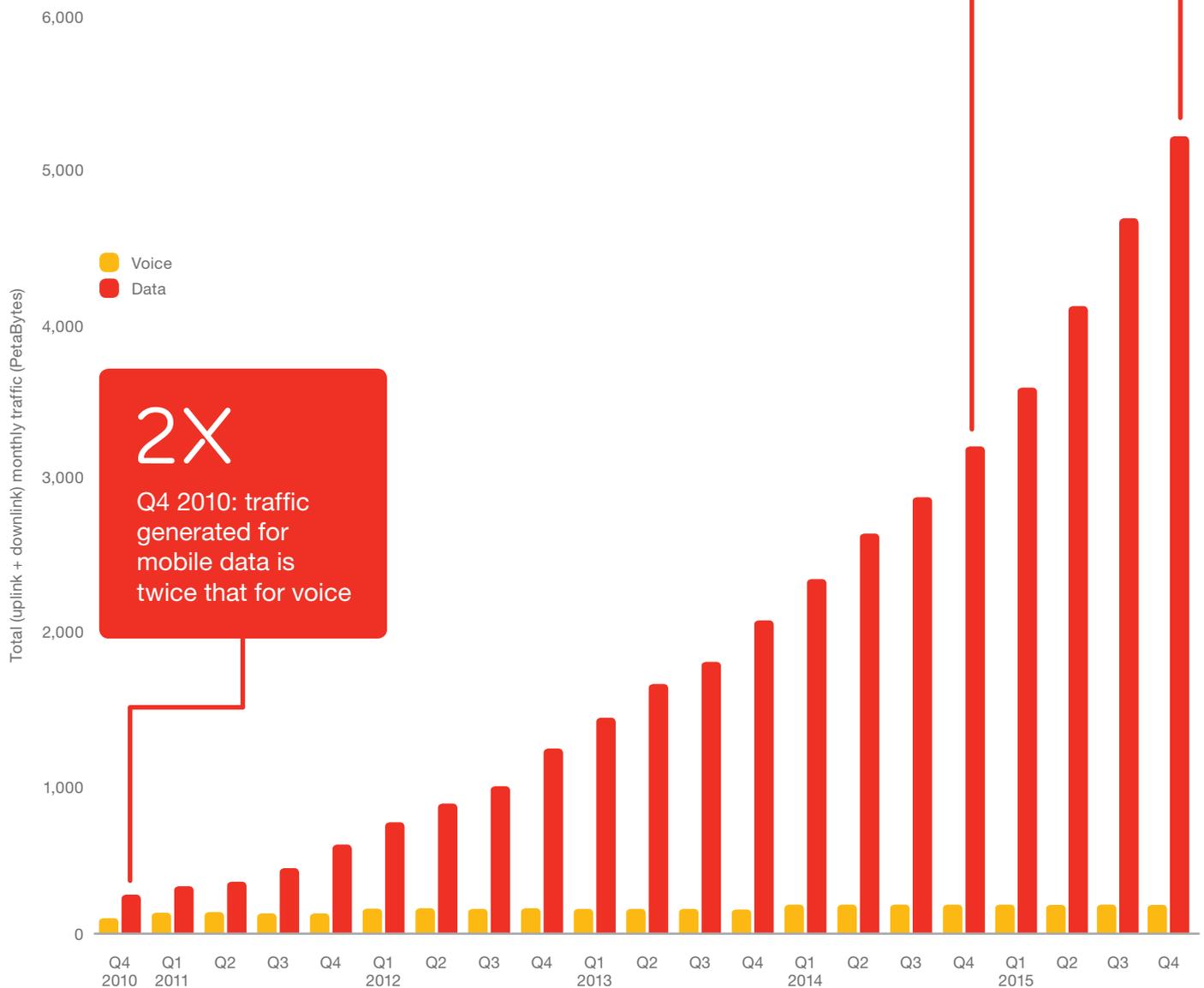
Note: The decline in mobile subscriptions for Latin America is due to the economic headwinds in the region and to a continued significant decrease/cleanout of prepaid subscriptions in Brazil



# MOBILE TRAFFIC Q4 2015

Mobile data traffic continues to grow, and the graph below shows total global monthly data and voice traffic from Q4 2010 to Q4 2015.<sup>1</sup> It depicts a continued strong increase in data traffic, and voice traffic growth in the mid-single digits per year. The growth in data traffic is being driven both by increased smartphone subscriptions and a continued increase in average data volume per subscription, fueled primarily by more viewing of video content.

Data traffic grew around 12 percent quarter-on-quarter and 65 percent year-on-year. It should be noted that there are large differences in traffic levels between markets, regions and operators.



Source: Ericsson traffic measurements (Q4 2015)

<sup>1</sup> Traffic does not include DVB-H, Wi-Fi, or Mobile WiMAX. VoIP is included in data traffic

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.