

MOBILE DATA GROWTH: HOW GERMAN MOBILE DATA TRAFFIC WILL GROW BY 2016

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German and international Mobile Network Operators alike are faced with soaring data traffic. Driven by an increase in mobile broadband-enabled devices and a significant growth in individual data consumption, Solon expects German mobile data traffic to increase by more than 15-fold between 2011 and 2016, to more than 2,100 Petabytes p.a. This is equivalent to, for example, 37 billion streams of the 15-minutes 'Tagesschau' news program or 22 billion downloads of Herbert Grönemeyer's album 'Mensch'. While this tremendous data growth is a great opportunity to offset the decline in mobile voice revenue, it also requires mobile operators to find cost-efficient ways to expand network capacity.

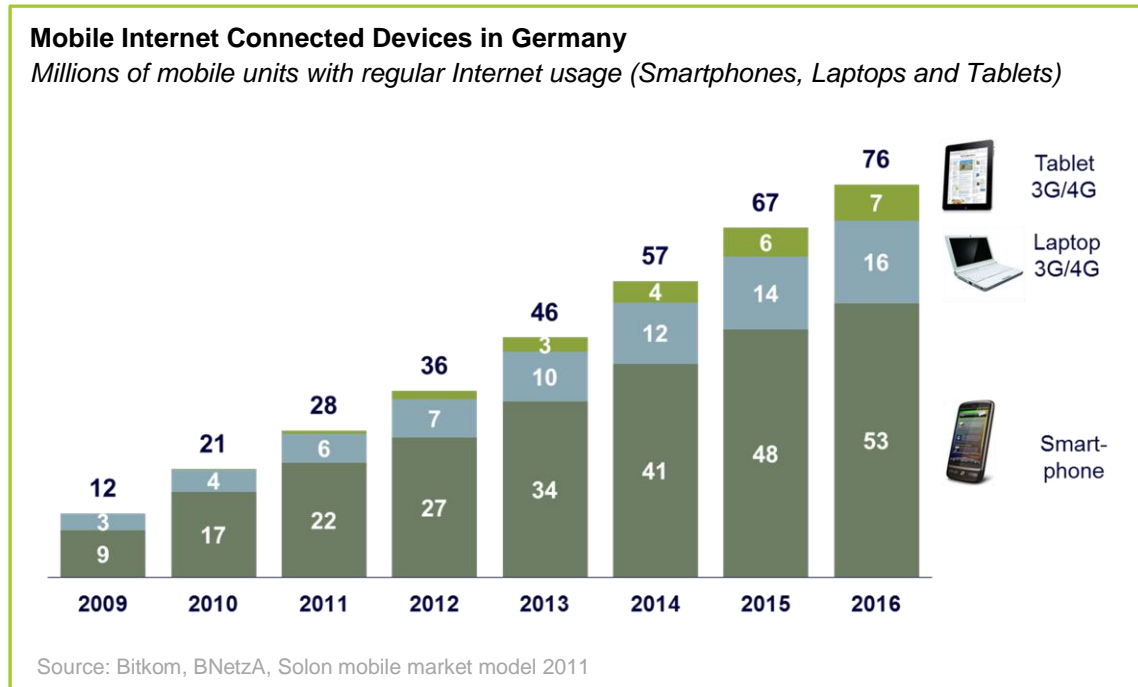
Around the globe, mobile operators have big hopes that data growth can offset the decline in mobile voice revenue and stabilize ARPUs. Thus, the majority of operators are currently making significant investments in capacity increases and future-proof mobile networks such as LTE. For example, in 2010 AT&T spent an additional \$2bn to cope with a substantial traffic increase driven by the iPhone and other smartphones. Now, the big questions are: how will mobile data usage develop; and how can operators profitably grow mobile data revenues?

PROLIFERATION OF INTERNET-ENABLED DEVICES DRIVES MOBILE DATA

The key driver of mobile data consumption is the increasing penetration and usage of Internet enabled mobile devices: smartphones, tablet computers and laptops with mobile data access. Overall, we expect the number of these mobile connected devices to increase

from slightly below 21 million in 2010 to roughly 76 million in 2016 (see Graph 1). With almost 70 per cent of all devices being smartphones, this category will account for the largest share of mobile access.

GRAPH 1



- Smartphones outgrew feature phones:** While feature phones generally can't provide the user with a satisfying experience when surfing the Internet, the launch of smartphones has changed this dramatically. Their big touchscreens, proper web browsers and extensive app stores make mobile web browsing an enjoyable experience. Although Nokia introduced the first mobile phone capable of using the Internet in 1998 and RIM launched the first BlackBerry in 2002, an attractive smartphone for the average consumer only emerged when Apple launched the iPhone in T-Mobile's stores in 2007. Since then, smartphones have become even more user-friendly and operators have set up volume-based tariffs with cost-control functionality that makes mobile surfing an affordable experience. Many companies and operators have developed apps which are easy to understand and access, and so have promoted mobile web usage with smartphones.

In 2009, smartphones accounted for only a fifth of mobile phone purchases. In 2011, network operators, such as T-Mobile and Vodafone, report that more than 60 per cent of sold phones are smartphones. Overall, we expect that by the end of 2011 more than 25 per cent of Germans will be using such a device. The introduction of cheaper lower-end smartphones will open up additional market segments, and we predict that in Germany by 2016 roughly 80 per cent of handset sales and 70 per cent of handsets in use will be smartphones.

- **Increasing popularity of tablets:** With Apple's introduction of the iPad in April 2010 another popular mobile Internet device was born that pushed mobile data acceptance and was quickly followed by similar tablets made by Samsung, Motorola, HTC, Dell and Blackberry. With easy-to-use large touchscreen, tablets successfully facilitate mobile media usage, for example, watching videos and reading e-books and magazines.

We estimate that at the end of 2011 there will be more than two million tablets in Germany, of which roughly 0.6 million will be 3G-enabled and used for mobile Internet. As German MNOs come to offer an increasing range of reasonably priced contracts and an increasing range of subsidized tablets, we assume that the share of 3G/4G-enabled tablets will further increase to more than 70 per cent of sold tablets in 2016. Thus, we expect that the number of connected tablets will reach 7.2 million in Germany by 2016.

- **Mobilization of laptops:** In 2010, more than two-thirds of the 15 million computers sold in Germany were laptops and netbooks. Approximately 55 per cent of German households with a computer also have at least one laptop (on average there are 1.3 laptops per household).

In contrast with other European countries the use of mobile data sticks (or 'dongles') is still rather low in Germany at five per cent of population. For example, in Austria, mobile broadband penetration is at 18 per cent and in Sweden it is at 16 per cent. In Germany, most users connect a laptop to their fixed line when going online. Relatively low data speeds (typically not more than 3.6Mbps) and high prices meant that sales of mobile dongles rose slowly and were mainly driven by business customers. However, since 2007, prices have come down significantly. For example, Vodafone's 5GB offer is now at €30 per month (it was €50 in 2007). Furthermore, operators began to market higher speeds (up to 42.2 Mbps) after HSPA+ was launched.

Affordable prices (MVNOs currently offer entry prices of just €10 for 1GB) will stimulate the uptake of mobile data cards as a complementary means of Internet access. Thus by 2016, we expect that one in five Germans will have a mobile-connected laptop.

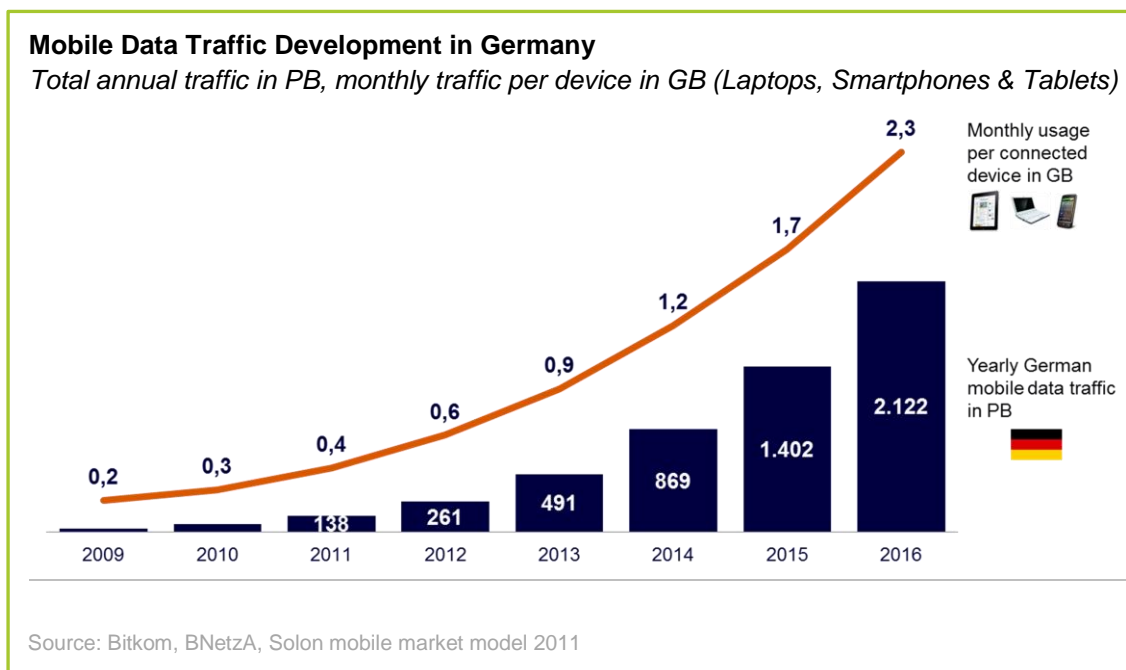
Continuous handset innovations and other hardware improvements are making it ever easier to access a multitude of Internet services and multimedia content (including video, music and games), while on the move. Content providers, aware of the growing audience, respond with optimized versions of their products for mobile use or create new services altogether. The roll-out of faster HSPA+ and LTE networks is expected to improve the customer experience. All this together will lead to profound growth in mobile data traffic.

INCREASING BANDWIDTH HUNGER OF MOBILE BROADBAND USERS

We expect German mobile data traffic to grow to more than 2,100PB in 2016, which represents an increase of more than 15 times the 2011 figures. While the average German mobile broadband user consumed only around 0.2GB in 2010, we expect mobile data usage to explode to almost 2.3GB per user by 2016 (see Graph 2). Laptop and tablet users will contribute a disproportionately high share of the mobile data traffic growth. The proliferation of smartphones, with expected average usage of more than 800MB in 2016, will fuel the traffic explosion.

In terms of services used most of the growth is expected to come from video. Even though many videos are still watched in rather low resolution (that is at 240 pixels), video already generates 40 to 60 per cent of total traffic on mobile networks. Faster download speeds and improved display resolution will accelerate (high-quality) video consumption on wireless networks. Samsung's Galaxy Nexus was recently launched with a 1280x720 screen that displays six times more pixel than Apple's iPhone 3. As an example, the streaming of the 2010 Eurovision winner's video "Satellite" on YouTube generates almost 18MB of payload. In contrast, plain web surfing generates just a fraction of the traffic from video consumption: a user could have accessed the mobile homepage of the German news magazine 'Spiegel Online' over 50 times instead.

GRAPH 2



Given the different usage scenarios and device capabilities, we expect data consumption of the various mobile device categories to grow to different levels, leading to this mobile data explosion.

- **Average smartphone traffic reaching more than 800MB per month:** Data consumption with smartphones is being spurred on by the increasing availability of applications, quality and variety of videos, cloud-based usage and many people's wish to be 'always-on'. For example, 25 per cent of Facebook's web traffic is purely via mobile access. Some sources state that, in the US today, owners of app-friendly Androids and iPhones are consuming more than 500MB per month. In Germany, consumption is currently significantly lower since usage is usually capped at 200MB per month. While this protects a network's capacity, a competitive environment will inevitably result in operators raising their traffic limits. We expect that by 2016 the average smartphone user will consume more than 800MB of traffic per month, which is equivalent to two to three hours of video streaming.
- **Average tablet customer expected to consume four times more than iPhone user:** Several recent US research surveys indicate that more than 70 per cent of iPad users spend, on average, more than one hour per day on their device, and average consumption is four to five times higher than that of an iPhone user. Games and video apps such as Tagesschau, ZDF Mediathek, RTL Now or Zattoo are popular downloads. Today, all German mobile operators offer subsidized tablets with tariffs ranging from 1GB inclusive volume at lower speeds (3.6Mbps) to high-end offers of 10GB traffic allowance at 21.6Mbps. Given continuous price/volume competition and the growing availability of high-bandwidth content, we expect an increasing share of customers to have higher volume tariffs. Consequently, we estimate that by 2016 the average tablet user will consume more than 3,500MB of traffic per month, which is equivalent to 9-13 hours of video streaming.
- **Average connected laptop consumption twice as intensive as for tablets:** In the last few years, monthly fixed broadband usage has grown to more than 11GB per connection. However, we expect that mobile connected laptop traffic will stay below the consumption of a fixed-broadband home connection. Firstly, data cards are often used by only one device compared to multiple devices and users for fixed-broadband connections. Secondly, many mobile-broadband customers (in particular, business users and people living in urban and semi-urban, multi-person households) use the service complimentary to their fixed connection. Thirdly, mobile data tariffs have a volume cap that is lower than that for fixed broadband contracts with typically unlimited usage. Nevertheless, increasing speed levels, wider video content availability and the use of LTE as primary access medium in scarcely populated areas (white spots) will lead to a continuous increase in traffic per user. We expect that by 2016 the average connected laptop user will consume roughly 7,000MB of traffic per month, which is equivalent to 18-26 hours of video streaming.
- **"Internet of things" drives machine-to-machine (M2M) traffic:** Mobile traffic is not limited to conventional user-initiated interactions with mobile devices anymore. M2M communication gains importance as ubiquitous information exchange is getting cheaper, chipset prices are declining and global operators are setting up business units to cater for industry specific needs. In the past, M2M was mostly confined to

use in road toll collection, fleet and asset management, logistic and payment systems as well as navigation devices. For future “smart” infrastructures like the smart grid or the smart meter, a continuous exchange of information and the ability for remote controlling is a prerequisite. Moreover, consumer goods like cars and e-readers will be expected to include the ability for wireless data exchange. Any devices carried around, be it for medical or entertainment reasons will ideally be connected to a network for maximum convenience, many of them with SIM cards.

The traffic profile of M2M devices is quite different from data thirsty multimedia devices, though. The vast majority of M2M links will put a continuous low-level load on mobile networks as the links typically just exchange highly compressed text information at small message sizes with long idle times. Considering the significant traffic volumes from smartphones and computers, we assume M2M will not “move the needle” and account for less than 2% of total mobile traffic in 2016.

Out of the total 2,122 PB of mobile traffic, roughly 60% are expected to come from laptop usage, while smartphones and tablets are expected to account for 25% and 13%, respectively. M2M will generate just 2% of the data volume in 2016.

MOBILE DATA UPTAKE OPENS UP NEW REVENUE OPPORTUNITIES BUT REQUIRES COST-EFFICIENT NETWORK UPGRADES

Increasing availability of content and a broader range of devices together with substantial improvements in both down- and up-load speeds have significantly enhanced the mobile data experience for consumers. Mobile browsing and video watching are a mass-market phenomenon.

Strongly growing mobile data penetration and increased usage per consumer will be the key elements for mobile operators to stabilizing mobile ARPU in a market where prices are expected to continue to decrease and voice ARPU is likely to decline further. In order to best monetize the promising mobile data opportunity, operators have to look for new price models (for example, application-based pricing) and business models (for example, prioritized content delivery) and have to limit the risk of OTT cannibalization (for example, Skype and IM).

On the cost side, a more than 15-fold increase in consumed bandwidth will put strong pressure on mobile operators’ networks. In many cases, the current network infrastructure is not yet ready to deliver the required network capacity and, thus, demands extensive investments into radio access networks and backhaul upgrades. Operators must look for intelligent ways to cost-effectively increase their network bandwidth.

A selection of appropriate revenue and cost-related measures will be discussed in two separate upcoming Solon white papers on mobile data opportunities and challenges.



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