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The connectivity chasms deepen: the growing gap in broadband speeds

We expect the global number of broadband homes to have grown by about two percent to 715 million by the end of 2015.[295] Average broadband speed obtained in most markets should increase by between 15 and 25 percent.[296] This average, however, obscures significant differences between households. In many markets the top decile of homes are likely to enjoy ten times or greater the average speed of those in the bottom decile. Countries with ubiquitous fiber to the premise (FTTP) are likely to have the most consistent broadband speeds.

In short, the term 'broadband' is now a blanket term which describes an ever-widening range of different performance levels, from a few megabits per second (Mbit/s) up to a few hundred Mbit/s. When broadband was first rolled out to homes in the late 1990s, services started at about 512 Kbit/s.[297]

We also anticipate a further variability in broadband speed, dependent on each home's circumstances. A diverse set of factors, from thickness of walls to age of router, from time of day to browsing habits of household members and neighbors determine the actual speeds that are attainable at each broadband-connected device.

The variability in speed attained at the device has major implications for the addressable audience for any online service.

There are two main factors that determine broadband speeds attainable.

One is location: typically, the further a home from an exchange, the lower the speeds. Rural homes are more scattered, and so typically, due to the distance from the exchange, have lower broadband speeds. For example in Germany, as of mid-2013, about 80 percent of urban homes had access to 50 Mbit/s services, but in rural areas, under a fifth had access.[298]

A second issue is technology: there are four main types of broadband technology, each of which offers a different range of speeds:

- Standard ADSL – the original broadband technology – offers a maximum speed of 8 Mbit/s. An enhanced version of the technology, known as ADSL+ offers treble that. We forecast 280 million ADSL homes (40 percent of the total) as of the start of 2015.[299] ADSL works over existing copper lines, and requires an upgrade at the telephone exchange.

- FTTC (fiber to the cabinet), the most commonly deployed upgrade to ADSL, is forecast to be in about 175 million homes (a quarter of all broadband homes) as at the start of 2015.[300] FTTC extends a fiber connection to a street-side cabinet; thereafter the connection is via the existing copper wire. FTTC is typically advertised at 30-40 Mbit/s downstream, with 70 Mbit/s and faster services also available for an additional fee. Speed declines by about half within 800-1000 meters from an exchange, by 75 percent within 1.6-1.8 kilometers.[301] By 2020 FTTC will be able to reach 100 Mbit/s, which should be sufficient for the majority of current online services.[302]

- FTTP (fiber to the premise)[303] is forecast at 110 million homes (16 percent of broadband homes) as of Q1 2015.[304] FTTP extends fiber all the way to the home.[305] FTTP speeds are currently up to 1 Gbit/s.

- Cable is in about 135 million homes (19 percent of broadband homes). Cable broadband providers with DOCSIS 3.0 networks market services starting at 50 Mbit/s. Peak speeds offered are in the hundreds of Mbit/s. The technology allows for faster speeds, but few websites today can cope with them. About 80 percent of cable broadband is DOCSIS 3.0; other networks are much slower. DOCSIS 3.0 based cable broadband speeds have increased significantly in recent years: in the UK, they rose from 11.7 to 43.3 Mbit/s between December 2010 and May 2014.[306]

295. See: The State of Broadband 2014: broadband for all (Chapter 2.2), Broadband Commission, September 2014: http://www.broadbandcommission.org/Documents/reports/bb-annualreport2014.pdf

296. Global average connection speeds increased by speed grew 21 percent to 4.6 Mbit/s as of Q1 2014, and the global average peak connection speed grew 20 percent, to 25.4 Mbit/s. See: Akamai's [state of the internet], Akamai, 30 September 2014: http://www.akamai.com/dl/akamai/akamai-soti-q214-exec-summary-a4.pdf

297. In the UK the first broadband services started at 512 Kbit/s. As of now there is no official definition of broadband, but it typically refers to services that are between five to 1,000 times faster than dial-up. See: Broadband: The first decade, The Independent, 28 March 2010: http://www.independent.co.uk/life-style/gadgets-and-tech/news/broadband-the-first-decade-1929515.html#; Media Fact Sheet, International Telecommunication Union, September 2003: https://www.itu.int/osg/spu/publications/birthofbroadband/faq.html

298. Szenarien und Kosten für eine kosteneffiziente flächendeckende Versorgung der bislang noch nicht mindestens mit 50 Mbit/s versorgten Regionen, TÜV Rheinland, 8 December 2014: http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/Studien/kostenstudie-zum-breitbandausbau,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

299. Point Topic estimated ADSL share at 47 percent as of Q2 2014. See: Point Topic, Global Broadband Statistics. The State of Broadband 2014: broadband for all (Also see these data charted at Figure 4), Broadband Commission, September 2014: http://www.broadbandcommission.org/Documents/reports/bb-annualreport2014.pdf

300. FTTC is the commonly known term for this technology; the more precise, but less used term is FTTC VDSL (very high speeds digital subscriber line); for share data see: The State of Broadband 2014: broadband for all (Figure 4), Broadband Commission, September 2014: http://www.broadbandcommission.org/Documents/reports/bb-annualreport2014.pdf.

301. Chart of BT Fibre Broadband FTTC (VDSL2) Speed Against Distance From the Cabinet, Increase Broadband Speed, 2 April 2013: http://www.increasebroadbandspeed.co.uk/2013/chart-bt-fttc-vdsl2-speed-against-distance

302. Higher speeds will be enabled partly via an approach known as vectoring, which doubles the speed available

303. FTTP is also sometimes referred to as FTTH (fiber to the home). In conurbations with apartments blocks, FTTP is the more commonly used term

304. The State of Broadband 2014: broadband for all (Figure 4), Broadband Commission, September 2014: http://www.broadbandcommission.org/Documents/reports/bb-annualreport2014.pdf

305. New build homes in developed countries often have FTTH connections as it is cheaper to install a fiber than copper.

306. UK fixed-line broadband performance, May 2014, Ofcom, 3 October 2014: http://stakeholders.ofcom.org.uk/market-data-research/other/telecoms-research/broadband-speeds/broadband-speeds-may2014/

Each technology currently supports a different set of applications. ADSL should always be good enough for general browsing and e-mail, but may be insufficient for streaming to a television set, depending on the distance from the exchange. FTTC should be sufficient to streaming video to a 40 inch TV set during prime-time, but speeds vary by distance from the exchange, as well as by grade of service chosen.

DOCSIS 3.0 cable and FTTP can cope with most broadband applications, including simultaneous high definition television streams.

Over time, at a global level, the speed of each of these technologies has increased, with cable and fiber broadband technologies getting faster, but ADSL has remained at approximately the same speed (Figure 8).

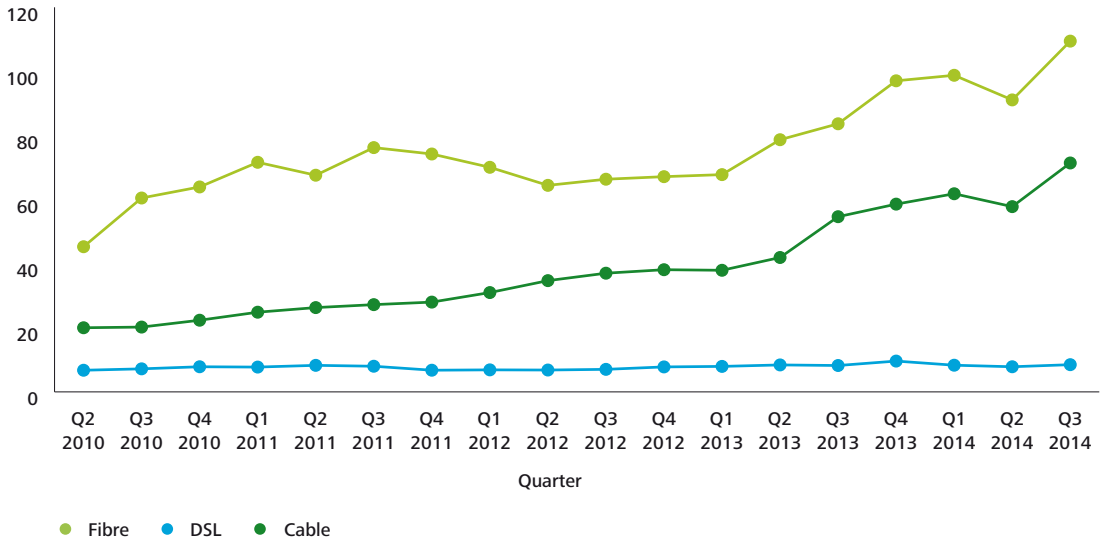
307. G.fast: The Dawn of Gigabit Copper?, LightReading, 1 September 2014: http://www.lightreading.com/huawei-ultra-broadband-forum/gfast-the-dawn-of-gigabit-copper/a/d-id/710565

308. Trials of DOCSIS 3.1 are expected to start in the second half of 2015. See: Cable Preps for DOCSIS 3.1 Debut, LightReading, 30 September 2014: http://www.lightreading.com/cable-video/docsis/cable-preps-for-docsis-31-debut/d/d-id/711156

309. For more information, see: VDSL broadband – delivering superfast broadband to Europe, Point Topic, 19 August 2013: http://point-topic.com/free-analysis/vdsl-broadband-in-superfast-europe/

Figure 8. Changes in standalone residential bandwidth offered by technology in Mbit/s (Global)

Average downstream bandwidth, Mbit/s



Source: Point Topic, 2014

Distance and technology are, however, just two of the factors affecting broadband speeds in each home. A further issue is affordability.

The variation in speeds by technology may increase in the near-term. For example a planned upgrade to FTTC, known as G.Fast, offers up to 1 Gbit/s speeds over existing copper connections, by increasing the range of frequencies over which broadband signals travel.[307] The drawback with this approach is that it works over very short distances – ideally 100 meters or less. This is an acceptable distance in neighborhoods packing in dozens of homes within 100 meters of a cabinet, but in some rural areas homes may be over 100 meters from the road, and many kilometers from the exchange.

There is also a planned upgrade to the cable broadband technology standard, called DOCSIS 3.1. This is being introduced in response to the faster speeds being offered over FTTC and FTTH networks. The new cable standard offers speeds up to 10 Gbit/s down, and 1 Gbit/s up. These enhancements will again further extend the gulf in broadband speed by household.[308]

Broadband providers could deploy cabinets in close proximity to every home wanting high speeds, but as private businesses in the absence of subsidy, they will inevitably tend to focus on upgrading connections in cities, as they offer the highest potential return.

Another approach could be to deploy fiber to every home, or to extend the reach of cable networks, but both would require significant investment.

FTTC is the most likely technology to be deployed in markets with ubiquitous pre-existing copper networks: it is a fraction of the cost of extending fiber to the premise. However its performance is markedly affected by distance from the exchange, so it may increase speeds for those with existing access to fast broadband, rather than bring slow broadband speeds more in-line with the average.[309]

Distance and technology are, however, just two of the factors affecting broadband speeds in each home. A further issue is affordability. In most markets, broadband pricing varies by technology deployed; the faster the service, the greater the cost. For some homes, paying an extra $20 per month may be immaterial, whereas for homes below median income levels, this additional cost may be unaffordable. The premium payable for faster broadband is a principal reason behind its relatively slow take-up. In the UK, as of March 2014, only 14 percent of homes passed had subscribed to either FTTC or FTTP.[310]

Affordability means that variation in broadband speeds will also exist within the same neighborhood, based on income levels, as well between urban, suburban and rural households.

So far we have focused on broadband speeds to the home. Once within the home, there are multiple factors which deplete the actual speed obtained at the device. One is whether wireless or wireline is used. A wireless router is easier to use, requiring little installation. But using Wi-Fi can result in a 50 percent drop in speed. Providing a wired connection is too complex for most households. An intermediate step uses power line adaptors, which run broadband signal along the power supply. This can work if the electrical cabling in the house is sufficiently modern, and the power line adapters used are compatible with the router provided by the ISP.

The age of the router affects speed too – the older the router, the slower the throughput. Construction materials used can also determine performance. Older houses with thick walls block wireless signals, as do newly renovated homes with layers of foil-backed plasterboard.[311] Underfloor heating based on coils of hot water pipes also deflects signal, as does anything metallic. The highest speeds within Wi-Fi home are generally closest to the router; but in some cases the device needing the fastest speeds (typically the television) may not be adjacent to the router.

The speed obtained at the device is further affected by other members of the household. Broadband is a shared resource, and a high-speed connection shared among bandwidth-hungry family members may still result in modest speeds at the point of consumption.

The range of speeds obtained is evidenced in many empirical studies. Data from a major content distribution network, found that about half of connections it interfaced with around the world were at 4 Mbit/s or faster, a fifth were at 10 Mbit/s or faster, and just one tenth were at 15 Mbit/s and up.[312]

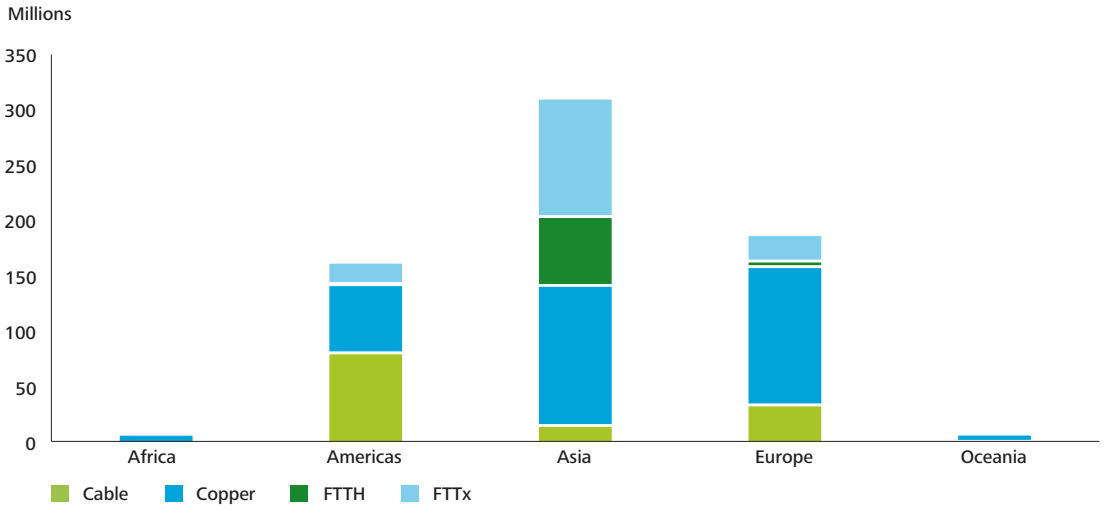
This prediction has focused on the divergence in broadband speed within specific markets. There are also marked differences in broadband speeds by geographical region which are likely to continue through 2015 and beyond. Figure 9 below shows the number of broadband homes by technology for all global regions.

310. Sluggish Take-up of Superfast Broadband Emphasises the Need For Demand Stimulation, Increase Broadband Speed, 14 May 2014: http://www.increasebroadbandspeed.co.uk/2014/superfast-demand-stimulation

311. What's killing your Wi-Fi? Wrapping your house in tin foil, PC Pro, 14 April 2011: http://www.pcpro.co.uk/blogs/2011/04/14/whats-killing-your-wi-fi-wrapping-your-house-in-tin-foil

312. See: Akamai's state of the Internet, Q1 2014, Akamai: http://www.akamai.com/dl/akamai/akamai-soti-q214-exec-summary-a4.pdf

Figure 9. Broadband homes by region and by technology



Source: Point Topic, 2014

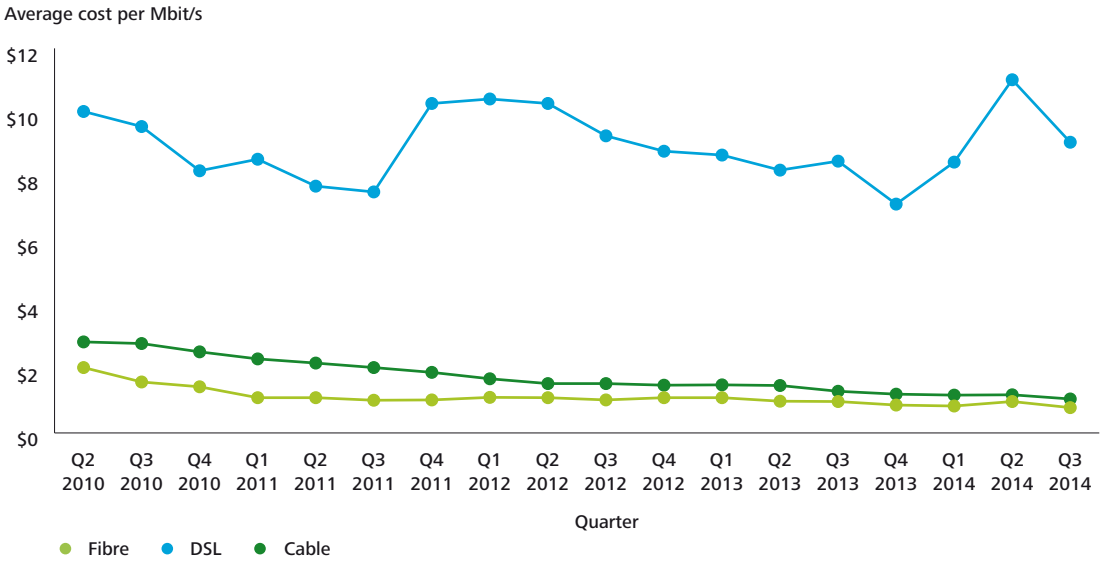
Bottom line

When we talk about broadband divides, this often refers to the gulf between the 'haves' and the 'have nots'. This gap is important, but it is also critical to recognize variations between the 'haves'. The gulf between those with access to the fastest broadband speeds and those on basic speeds has widened over recent years; and in the near term looks likely to increase further.

There are evident implications for regulators. It may not be sufficient simply to call for broadband to be recognized as a universal service, in the same way as fixed line telephony in many countries. The definition of what broadband is needs to be updated regularly. Speed is a key parameter. Historically this has focused on downstream speed, but in future, as broadband usage evolves, upstream speed will become increasingly important as users upload more content.

Regulators should also consider how price per megabit is affected by technology. Households with access only to ADSL broadband, do not just have lower speeds, but are also paying significantly more per Mbit/s (see Figure 10).

Figure 10. Changes in standalone residential average cost per megabit, US dollars, at PPP rates (Global)



Source: Point Topic, 2014

Any private or public entity looking to deliver over-the-top services (OTT), whether this is video-on-demand (VOD) or online tax submissions should consider what ranges of broadband speeds households are able to get.

Video is particularly affected by interruptions to service. Any company, whether a standalone subscription VOD provider, or a broadcaster offering on-line catch up, should monitor closely available speeds. Households that cannot access fast broadband connections but wishing to have on-demand service may need to be offered alternative approaches, such as satellite caching (whereby content is via satellite to a digital video recorder).

Companies offering online shopping ideally want to offer the richest experience possible – but this requires fast broadband connections which are not always available.

This prediction focuses on 2015 and the likely outcomes during this time period. In the long-term there is ample opportunity for more disruptive innovation with broadband delivery, including the use of hot air balloons to deliver high speed connections to rural areas. With this approach, signals are relayed between arrays of balloons before reaching a ground station which is itself connected to the Internet. This approach is expected to deliver 3G type speeds.[313]

313. For more information, see: Google's Balloon Internet Experiment, One Year Later, Wired, 16 June 2014: http://www.wired.com/2014/06/google-balloons-year-later/; http://www.google.com/loon/

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