Mobile data growth – too much of a good thing?

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Mobile smart device adoption has grown explosively and accompanying data use is projected to grow rapidly. Is forecast demand plausible and sustainable; will mobile data substitute for fixed; what spectrum demand is implied; is mobile data growth a problem or an opportunity and what are the strategy implications? We examine these questions drawing on the Plum NOMAD cost model.

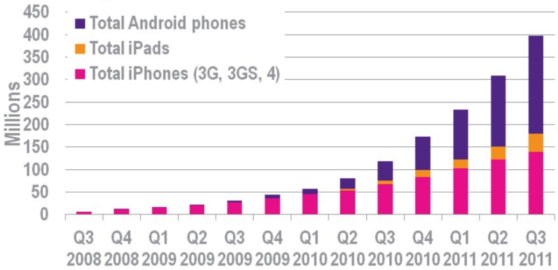
Why did mobile data take-off in 2008?

The cost of mobile data has been falling progressively whilst the speed of mobile access has been rising since 3G was first launched.

By 2007 the development of 3G HSPA technology delivered sufficient speed at a low enough price point to support useful mobile internet access. Around the same time advances in computing, battery technology and touch interfaces delivered simplicity, functionality and versatility to consumers. In mid-2008 apps stores opened up innovation to third parties.

Rapid device adoption (shown below) and rapid data traffic growth, driven also by "unlimited" data tariffs, followed.

Total global number of iPhones, iPads & Android phones sold



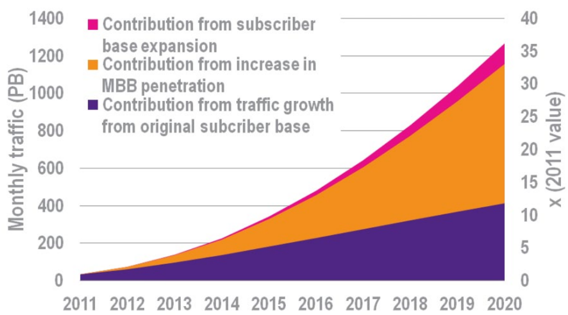
Source: Plum Consulting, Apple quarterly financial results, Gartner

More recent growth in tablet adoption is also driving data consumption. However, a significant proportion of tablets are WiFi only.

How much data growth is forecast?

The following shows the Cisco mobile data forecast for the UK (extrapolated to 2020 assuming a continued decline in the growth rate to 22% by 2020). Cisco assume relatively constant WiFi offload at around 40% of total traffic. In the following we have split out estimated contributions from population, subscriber and traffic per user growth (a PB is one million gigabytes).[1]

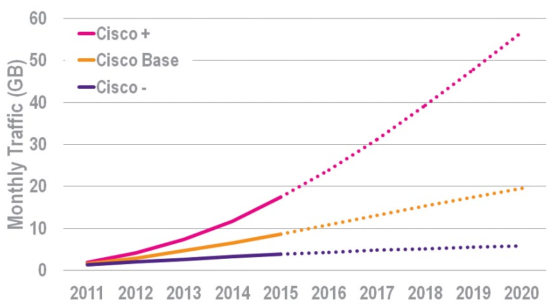
Traffic forecast breakdown for the UK



Source: Plum Consulting, Cisco

In our modelling we consider hypothetical scenarios with growth rates one-third above and below Cisco for overall traffic. Traffic for these scenarios is shown on a per user per month basis below.

Traffic scenarios per user per month



Source: Plum Consulting, Cisco

Two questions arise in relation to the above. First, what rates of traffic growth are plausible? Second, what rates of growth are economically sustainable given the costs involved and plausible bounds on willingness to pay?

[1] Cisco, "Cisco VNI Forecast Widget"
http://www.ciscovni.com/vni_forecast/index.htm

Is forecast data demand plausible?

High rates of data growth appear plausible:

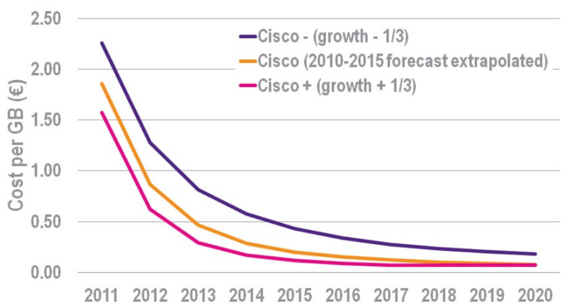
- Mobile traffic is currently a small fraction of overall internet traffic, around 2% (in-turn total internet traffic was only around 1% of household data consumption in 2009 including broadcast video etc).[2] Substitution for fixed could therefore see mobile traffic volumes rise substantially.
- The performance and cost of mobile will improve dramatically by 2015 with LTE plus additional spectrum offering higher speeds and lower costs per gigabyte (GB). This improvement will drive data consumption.
- New applications unique to mobile may generate significant traffic including navigation, location based services, augmented reality and real time sharing of user generated content.
- A number of applications including VoIP, video calling, instant messaging and location sharing are subject to network effects (Metcalfe's law). The value to each user will therefore grow; driving application use, further take-up and traffic growth.

We conclude that substantial data growth is plausible. The limits to mobile data growth may therefore depend on what it costs to carry mobile data and what users are willing to pay.

What are the costs of data growth?

Utilising the Plum NOMAD cost model with the assumptions set out in the box at the end of this note and utilising the three growth scenarios outlined earlier (Cisco growth +/- one-third) we estimate incremental data costs per gigabyte as shown below.

Cost per gigabyte for LTE



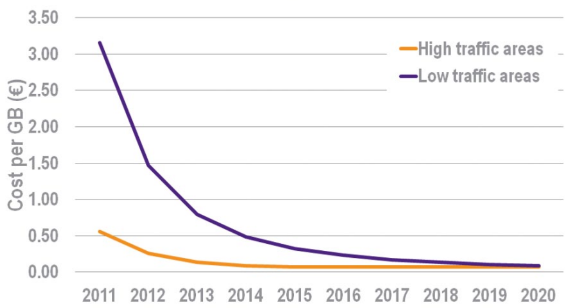
Source: Plum Consulting NOMAD model

Unit costs fall well below €1 per gigabyte over time as network utilisation improves.[3] Unit costs fall faster with higher traffic growth.

It is important to note that total costs will be higher than indicated.[4] However, available spectrum and technology are assumed to be constant in our modelling and additional spectrum and advances in technology could lower costs further.

We also considered the unit cost implications of data growth in high and low traffic areas under the central (Cisco extrapolated) forecast case – shown below.

Cost per gigabyte for LTE by traffic area



Source: Plum Consulting NOMAD

This shows a much more substantial reduction in unit costs in low traffic areas as data grows and network utilisation increases (without the need to add additional base stations).

This implies an additional source of capacity in mobile networks in addition to spectrum, base stations and spectrum efficiency, namely utilisation of existing excess capacity. It also suggests an opportunity to pursue targeted mobile-fixed substitution in low traffic areas.

Are people willing to pay for data growth?

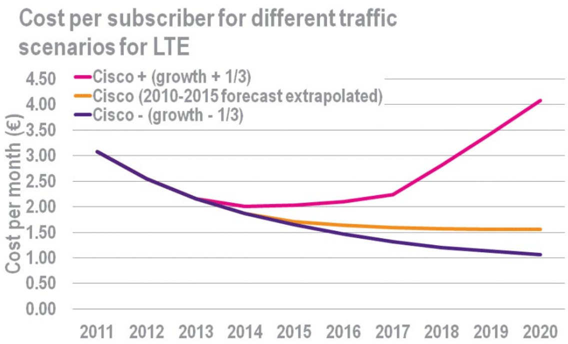
As the number of people with smart devices and data tariffs grows, these new users bring additional revenue and additional data to network operators. It is important to account for this in considering the sustainability of current rates of data growth.

[2] Bohn and Short. 2009. "How much information?"
http://hmi.ucsd.edu/pdf/HMI_2009_ConsumerReport_Dec9_2009.pdf

[3] In line with other estimates, for example: Ericsson. 2010. "Mobile broadband – busting the myth of the scissor effect."
http://www.ericsson.com/ericsson/corpinfo/publications/ericsson_business_review/pdf/210/210_strategy_mobile_broadband.pdf

[4] There are other costs that might be recovered via a fixed monthly access charge. An indication of the level of such additional charges may be provided by a basic voice and text only phone charge of perhaps €10 per month. Handset costs are also additional. One would also expect a retail mark-up on our calculated cost estimates.

Assuming the number of data users grows at 5 percentage points per annum, allowing for data growth and the unit cost estimates above, costs per subscriber per month for data are shown below.



Source: Plum Consulting NOMAD model

High rates of data growth therefore appear economically sustainable out to 2020 and beyond given the implied cost per user and comparing these with existing smartphone data charges.

Will mobile broadband substitute for fixed?

Mobile voice is near ubiquitous; however, full mobile substitution for data has been low in most countries due to limitations on the speed of mobile relative to fixed broadband access, variability in performance and the high user cost associated with data volumes comparable to those on fixed.

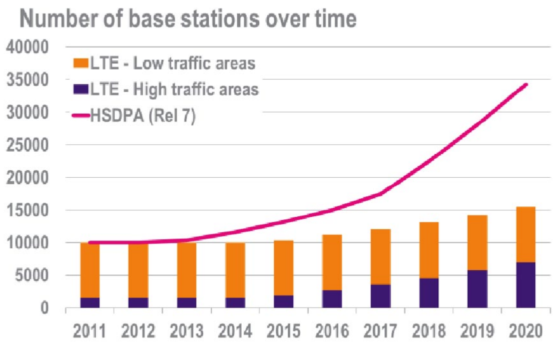
The increase in performance, from perhaps 1-2 Mbps for 3G to 10 Mbps for LTE with additional spectrum, alongside the reduced cost of carrying mobile data, is likely to shift the balance. Whilst fixed next generation access will offer higher speeds than mobile broadband it is unclear how much consumers will value increased speed.

It is therefore plausible that a significant segment of consumers will view mobile broadband as sufficient for their needs. Further, as households shift to mobile only or prospectively mobile only for voice, the relevant price comparison for fixed broadband is the line charge plus broadband charge, not the incremental fixed broadband charge alone.

We conclude that competition between mobile and fixed will intensify and that substitution presents an opportunity for mobile operators and a threat to fixed networks – particularly in areas where mobile networks are currently underutilised.

What is the implied spectrum demand?

Additional spectrum is valuable to an operator if it allows lower costs via substitution for base stations and/or higher service quality which can be monetised. We modelled the number of base stations implied by our central (Cisco extrapolated) mobile traffic scenario with LTE with 2x20 MHz of spectrum and with 3G (HSDPA) with 2x5 MHz of spectrum per operator. For LTE we considered both high and low traffic areas.



Source: Plum Consulting NOMAD

The difference in base station numbers required to support mobile traffic growth between 3G with 2x5 MHz and LTE with 2x20 MHz suggests that the business case for LTE and additional spectrum is clear cut if traffic growth continues.

The above analysis is based on a given forecast of demand. In reality future data demand and willingness to pay is uncertain. The possibility that demand may turn out higher or lower than assumed implies a higher value for additional spectrum than implied by a single central case forecast. The reason for this is that spectrum may only be available occasionally in large increments and additional spectrum acts as a hedge. Demand uncertainty translates into an option value of acquiring spectrum – just in case the high demand scenario eventuates.

Is mobile data growth a problem?

In Europe data growth has tended to be portrayed as a problem. By contrast in the US it is seen as an opportunity by key market players. Verizon commented as follows.[5]

"...with our 4G launch and the speeds that 4G give and the proliferation of video and content consumption through mobile handset, we see usage starting to be on an escalating scale… then ARPU will start to accrete because people will start to use more, they will start to buy the higher tiers…"

[5] Verizon. August 2011. Oppenheimer & Co. Technology & Communications Conference.

Initially, with unlimited data tariffs, as data use grew rapidly the costs of meeting data growth could exceed associated revenues. However, with tiered pricing - now relatively widespread (except where the strategy is to grow market share and fill an underutilised network) – data growth represents an opportunity; provided incremental revenues exceed incremental costs. Our modelling suggests that incremental mobile data costs will fall below existing data tariffs.

What are the strategy implications?

Unit costs of mobile data are anticipated to fall significantly, and are lower with higher traffic levels due to improved overall network utilisation. This has a number of implications for network service providers.

For mobile service providers:

- There may be a choice between high-growth low-price and low-growth high-price strategies. Outcomes across operators and national markets may therefore diverge.
- The growth decision implies an associated set of choices regarding data plans and pricing, marketing and spectrum acquisition.
- Under a high-price low-growth strategy mobile operators may face greater risks in terms of entry by WiFi providers and a consumer shift to nomadic rather than fully mobile behaviour.

For satellite TV service providers:

- The option of LTE and satellite TV bundles may be attractive. Satellite can deliver one way video, with LTE offering broadband access. Verizon have trialled such a package utilising an external satellite and LTE antenna (see Morgan Stanley Technology Media & Telecoms Conference, November 2011).

For fixed service providers:

- Responding to mobile (and mobile-satellite hybrids) may require greater contractual and pricing flexibility in order to meet mobile competition across different market segments.
- Promotion - rather than discouragement - of high levels of data consumption may help retain customers given that fixed has an inherent incremental data cost advantage over mobile.
- Targeting the nomadic, as opposed to fully mobile, market may offer a valuable opportunity for fixed operators and entrants.

For terrestrial broadcast providers:

- In addition to the possibility of LTE and terrestrial packages there may be a trade-off to consider between spectrum allocation for terrestrial broadcasting and LTE in terms of future demand for sites and masts.

Conclusion

Decisions taken by network owners will shape market development in ways that may be self-perpetuating leading to path dependence. Policy developments – not considered in this note – will also be driven by and drive market development. This will introduce a further source of path dependence. Low-growth high-price and high-growth low-price outcomes both appear plausible.

Plum NOMAD mobile data cost model – key assumptions

The Plum NOMAD model focuses on the cost of a network which provides national coverage and is expanded to meet growing demand. Carriers and sites (once all carriers are deployed) are added as required to meet demand and related capital and operating costs are taken into account.

Capex for equipment and sites; and opex for operation and maintenance, last-mile transmission, power supply and site rental are included. Core networks costs, billing systems, service platforms and spectrum fees are excluded. Costs estimates draw on Johansson et al (2007)[6] and a discount rate of 10% is used. The modelling time horizon is 10 years.

We assume there are four operators each with 2x20 MHz each of spectrum for LTE and 2x5 MHz for 3G and with 10,000 base stations initially to cover a subscriber base of 20 million growing at 1% per annum (approximating the UK). Mobile broadband penetration is assumed to grow at 5 percentage points per annum from 25% to 75% by 2020. 15% of sites are assumed to carry 50% of traffic until congestion drives an expansion of cell numbers. Spectrum efficiency is assumed to be 2.08 bps/Hz/site for LTE (R8) and 1.13 bps/Hz/site for HSDPA (R7)[7], and network efficiency is assumed to be 50%. Consistent with NSN[8] busy hour traffic is assumed to be 7% of daily traffic. 70% of traffic is downlink, and the ratio of uplink to downlink transmission speed is 3:5.

Acknowledgements: The NOMAD model was developed by Ken Pearson, Sarongrat Wongsaroj and Thomas Punton of Plum.

[6] Johansson, Zander and Furuskar. 2007. "Modelling the cost of heterogeneous wireless access networks." International Journal of Mobile Network Design and Innovation. Volume 2(1). http://www.inderscience.com/storage/f962711085114312.pdf

[7] Real Wireless. January 2011. "4G capacity gains." http://stakeholders.ofcom.org.uk/binaries/research/technology-research/2011/4g/4GCapacityGainsFinalReport.pdf

[8] Nokia Siemens Networks. May 2010. "Mobile broadband with HSPA and LTE – capacity and cost aspects". White Paper. http://www.nokiasiemensnetworks.com/sites/default/files/document/Mobile_broadband_A4_26041.pdf