

Virgin Media's response to the Department for Digital, Culture, Media and Sport Call for Evidence on the "Future Telecoms Infrastructure Review"

Introduction

This Future Telecoms Infrastructure Review asks what market structure and policy framework will best deliver Government's objective of establishing a clear path to national full fibre coverage. The terms of reference will invite proposals for a radically different framework from the one that, by 2020, will have successfully delivered ultrafast broadband to two-thirds of households and superfast to 97%.

Those proposing radical change advocate for a "coordinated approach" to full fibre deployment. The language may sound benign, but the market structure that follows is regional monopoly; a structure that Government explicitly rejects. It is right to do so. Infrastructure competition is critical to driving investment, take-up of advanced services, innovation, price declines and product differentiation. Initiating policies that stimulate infrastructure competition - lowering the costs to deployment, preserving returns on investment and creating new demand - will enhance fibre deployment and take-up. By contrast, radical proposals for new monopolies will foreclose all of the proven benefits of competition.

Virgin Media's response will argue that the surest path to investment in full fibre is if the underlying objective of the policy and regulatory framework remains to maximise coverage of competing networks. The existing framework is not perfect. Investment in full fibre networks has come slow to the UK market. However, there are clear signals that the market is entering a phase of aggressive investment and that the capability of the infrastructure being built is more than sufficient for current and future needs. Given the wide availability of capital from various sources, our response will show that under existing economic and regulatory parameters, gigabit-ready infrastructure is likely to be can be deployed to nearly 80% of UK premises in the near-term.

Government's enthusiasm for full fibre and the practical support offered by the Barrier's Busting Taskforce offers encouragement to investors. However, it must be applied consistently to decisions that make a tangible difference to investment incentives. Government can do so most immediately by removing cost and inefficiency from the planning regime, and by directly stimulating additional demand in the market through residential vouchers. It must also consider how decisions taken outside of broadband policy can reduce returns for investors or soak up capital funds that could otherwise be deployed in infrastructure. A number of decisions by Government and the regulator in the years since the launch of Project Lightning have made the economics of broadband rollout more, not less, challenging. As the market moves beyond the easiest to reach parts of the UK to more costly areas the need for policies that improve the economics of rollout becomes more acute.

1: What is the existing UK telecoms market structure and policy framework able to deliver?

By 2020, the existing market structure and policy framework will have delivered ultrafast broadband networks, offering speeds of 300Mbps or more, to a substantial majority of UK consumers. Approaching 17 million premises will be passed by cable infrastructure, 12 - 13 million premises will be served by Openreach's G.Fast and FTTP¹, one million premises will be reached by Cityfibre, 350,000 premises are served today by Hyperoptic, 150,000 by Gigaclear, and 40,000 by TalkTalk. These networks will overlap with each other and with Openreach's FTTC network and bring the benefits of choice and competition to a majority of UK consumers. The remainder of UK premises not served by either a ultrafast or superfast network by 2020 (latest estimate 3%) can rely on a guaranteed 10Mbps under the Universal Service Obligation, although regrettably, this guarantee may be delayed beyond 2020 as a result of Government's rejection of BT's voluntary commitment.

These private ultrafast investments - in aggregate amounting to more than £5 billion² - indicate that there is capital available for UK operators seeking to build. If market and regulatory conditions are conducive, it is highly likely that additional private investment will result in rollout substantially beyond these existing commitments:

¹ Openreach has committed to ten million G.Fast and on 29th January adjusted its FTTP commitment from two to three million <https://www.ft.com/content/06223b64-ff9a-11e7-9650-9c0ad2d7c5b5>

² Virgin Media is investing £3bn; we estimate that BT Openreach's FTTP deployment will cost £400 million (based on a £400 CPP); its G.Fast investment has been estimated at c.£1billion (<https://www.thinkbroadband.com/news/7490-new-estimate-for-cost-of-rolling-out-g-fast-to-10-million-premises>); Gigaclear, Hyperoptic and CityFibre have raised £400 million collectively in funding rounds over the past 18 months

- Virgin Media has identified significant volumes of additional premises that are viable within broadly the same economic parameters as the business model for the current phase of Project Lightning.
- BT Openreach is consulting with its wholesale customers on plans to deliver FTTP via a Passive Optical Network (PON) to 10 million premises.
- Former CEO of TalkTalk Dido Harding stated when in post that TalkTalk could extend FTTP to 10 million premises.
- CityFibre and Vodafone’s agreement has the option to extend to five million premises by 2025 depending on the success of the first one million³.
- Hyperoptic has outlined plans to extend its network to five million premises by 2025⁴.

If these investments come to fruition, 80% or more of the UK could conceivably have access to gigabit-capable networks by the mid-2020s.

Mixed ultrafast infrastructure model

UK operators are investing in a variety of different ultrafast network architectures, including full fibre. Each of these ultrafast variants has the capacity to remain substantially ahead of mass market bandwidth demand for the foreseeable future. Frontier Economics’ recent analysis for the National Infrastructure Commission shows that the existing mixed infrastructure model - in which the capacity of ultrafast-capable networks is incrementally upgraded in parallel with new FTTP deployment - is sufficient, and arguably preferable, to support UK digital growth. The analysis finds that each of a number of future use cases for bandwidth-intensive services is met by DOCSIS and G.Fast technologies⁵. The report concludes: “based on the use cases in the *moderate evolution* scenario, there does not appear to be a strong demand side case to invest widely in FTTP infrastructure”. Two advantages are presented in favour of an incrementalist approach. First, additional economic output is realised more quickly than under a 100% FTTP strategy wherein existing ultrafast infrastructure is replaced. The lag resulting from a 100% FTTP strategy reduces the present value of direct economic output and cost savings by £3.3 billion⁶. Second, since broadband investment has high sunk costs and demand for higher speed services remains uncertain, the risk of over-investment is also high. Frontier observes that “there could be value in waiting for more information, even if the central case suggested there were benefits in investing now”.

Frontier’s analysis also doubts that any reliability advantage that FTTP has over copper-based networks will translate to increased value added if the UK transitions to 100% FTTP. The report notes that “a household’s experience of reliability depends on more factors than the access technology (for example...the household’s equipment, Wi-Fi interference etc)”. This leads Frontier to assume that network reliability does not have any significant impact on the difference on the economic impact of different variants of ultrafast broadband networks.

This is not to dismiss the case for investment in FTTP, but simply to demonstrate that Government’s objective of stimulating further growth in the digital economy can be supported by multiple technologies. Virgin Media has built one million premises to date under Project Lightning to date, with either FTTP or hybrid fibre coaxial (HFC) architecture.

In Virgin Media’s case, the economics of full fibre broaden the potential reach of the cable network, making it more commercially rational to invest to unserved areas, as opposed to replacing HFC in dense urban areas⁷. This is for three reasons. First, the civils’ costs of full fibre deployment can be substantially lower than deployment of HFC technology (see answer to Question 2). This has resulted in FTTP rollout being cost effective where HFC build would not be viable. The most remote conurbations served by our network are connected using FTTP. Second, there are no legacy assets that would require significant investment to make compatible with FTTP technology – as is the case in areas where Virgin Media has HFC cabinets and hub sites. Third, based on current market evidence (explored fully in answer to Question 5) customers are not yet willing to pay a substantial premium for

³ <https://www.ispreview.co.uk/index.php/2017/11/vodafone-cityfibre-target-gigabit-broadband-5-million-uk-premises.html>

⁴ <https://www.hyperoptic.com/press/posts/hyperoptic-secures-100million-to-accelerate-full-fibre-rollout/>

⁵ Chapter 4, *Future Benefits of Broadband Networks*. All use cases reviewed are within the capacity of existing networks under the “moderate evolution”, while AR/VR, SOHO applications and tele-health may slightly exceed existing capacity in the mid-2030s if the “ambitious innovation” scenario emerges and network evolution halts.

⁶ Figure 2, page 11 *Future Benefits of Broadband Networks*: this assumes that moderate evolution scenario. Greater economic output and cost savings are achieved by 100% FTTP than incremental upgrade in the ambitious innovation scenario but the prospects of this emerging are slim.

⁷ BT Openreach’s consultation on FTTP implies that they will prioritise areas that have lower quality services today. It references “footprint optimisation” and states that one factor determining the prioritisation of the build will be “the quality of alternative Openreach network infrastructure available in the area (e.g. availability of VDSL or G.Fast).

higher speeds. Therefore it is hard to envisage a scenario where replacement of existing coaxial assets with FTTP would be a better use of capital than serving new areas with FTTP.

Our HFC architecture operates with DOCSIS technology. The DOCSIS 3.0 standard was developed in the mid-2000s and led to dramatic increases in available bandwidth per household. Virgin Media introduced the first superfast broadband product to the UK market in 2008 and has since delivered a ten-fold increase in top-tier download speeds over the same technology⁸. As the UK's mass market ultrafast leader, speed has undeniably played a role in attracting new customers to Virgin Media and encouraging existing customers to stay (we demonstrate in response to Question 5 that price is, however, the primary consideration above speed). As a result, our investment in higher speed services has stimulated a commercial response from Openreach. Ofcom summarised this effect in its Digital Communications Review Initial Conclusions, February 2016:

"...it has historically been competition from cable that has played a greater part in driving network upgrades. In the early 2000s, one of the factors that drove BT to increase the performance of its initial broadband service was the availability of cable broadband. Similarly, BT announced its rollout of superfast broadband shortly after Virgin Media's upgrade to DOCSIS 3.0. BT's recent announcement of G.Fast investment plans was in the context of Virgin Media offering a maximum service speed of 200Mbit/s compared to a maximum of 80Mbit/s available from Openreach for VULA."⁹

Infrastructure competition has therefore underpinned the increase in average actual download speeds across the entire market from 5.2Mbps to 36.2Mbps since the start of the decade¹⁰. The same dynamics can be seen in Openreach's commitment to deploy FTTP following Virgin Media's announcement that at least half of Project Lightning build would be full fibre.

DOCSIS has an upgrade path to gigabit download speeds. Virgin Media has already demonstrated this in trials of the existing DOCSIS 3.0 generation and intends to trial the next iteration: 3.1. The latter will have sufficient capacity to ensure that HFC can continue to offer the same consumer proposition as our FTTP should mass market demand for gigabit download speeds emerge.

Openreach is similarly investing in two ultrafast architectures. G.Fast is an incremental upgrade of its existing FTTC network, with speeds of 314Mbps and 152Mbps now available to customers. Its commitment to offer compensation should peak network performance fall substantially below headline speeds is a demonstration of Openreach's confidence in the technology. Around 770,000 premises have been connected to date, with an ambition to extend to 10 million premises by the end of 2020. Openreach's current consultation on its PON FTTP architecture proposes two models that would allow expansion to 10 million premises at a cost of £3 – 6 billion. Openreach estimates an additional £25 per month charge to the end customer if pass through is limited to only those taking an FTTP service. This appears prohibitively high based on customers' current willingness to pay a premium for higher speed services. The alternative model spreads the cost of deployment across the entire Openreach customer base, resulting in a "required incremental value" per customer per month of £7, which would be met by a combination of lower operating costs and higher wholesale prices.

Increasing value of broadband services

Virgin Media's investment in new speed tiers and strategy of migrating a large proportion of its customer base to higher speed tiers has taken place in a context of declining household spend on communications services¹¹ but higher household data consumption. Virgin Media invests substantial capital annually to ensure that our network has the capacity to cater for data throughput that is increasing by approximately 60% p.a.

Innovations in video compression have had the effect of reducing the amount of bandwidth required to process video content by half every seven years¹². UK ISPs have invested to improve network performance against a host of quality metrics. Peak time latency on Virgin Media's network declined from 25ms in 2010 to 15ms in 2014, and from approximately 35ms to 20ms on BT's network. Average bitrates for Netflix have increased by nearly a factor of two since 2013 (see Figure 1, Annex).

The combined result of increased investment, higher quality services, higher consumption and flat pricing is that end users are paying substantially less per unit (Mbps) of bandwidth and per bit of data consumed. Virgin Media produced analysis for Ofcom in

⁸ Cabinet-level investments in power and amplification have been required to support some new ultrafast tier launches

⁹ https://www.ofcom.org.uk/data/assets/pdf_file/0016/50416/dcr-statement.pdf

¹⁰ Ofcom annual speeds reports

¹¹ Average household spend on communications services fell from £86 per month in 2010 to £82 per month in 2015 (Ofcom Consumer Experience Report 2016)

¹² The bandwidth required to deliver a given video quality has halved every seven years.

2016 in which we estimated that the price per megabyte (Mb) of download speed declined at a CAGR of 27% between 2008 and 2014 – from more than £5 to less than £1 per Mb.

In January 2018, the Office of National Statistics published analysis on the method of measuring output from the telecommunications sector, identifying that previous assessments of output in the sector ignored substantial quality improvements in the services provided. To capture this effect the ONS has proposed modifications to consider throughput: converting each telecommunications service into a measure of transmitted data to quantify the price per bit transported over time.

Figure 2 (Annex)¹³ shows the effect on the price of telecommunications goods. The light blue line shows that the price per bit of data has declined by 90% between 2010 and 2015. On another measure, which improves on the current method, prices fell by 35% over the same period.

Ever-increasing value for money is both a sign of effective competition in the telecommunications market, and a source of overall high consumer satisfaction. Consumer satisfaction amongst communications customers is 85%¹⁴. Only 2% of customers reported “affordability issues”, defined as being behind on payments by one month or more in the last year Ofcom has gathered data¹⁵. This perhaps reflects the fact that spend on communications services constitutes a far lower proportion of total household spend than that on utility services¹⁶.

Ofcom gives broadband an affordability rating of 7.07 above gas, electricity and banking (Figure 3, Annex). Anecdotally, Virgin Media conducted focus groups in 2017 in which consumers from a cross-section of ISPs were asked to name their ‘cost of living’ concerns. Energy, housing prices, food were top of consumers concerns. Broadband and Communications services were not mentioned.

In summary, the existing market structure has underpinned the growth of a competitive UK Communications Market, delivering high speed, affordable, ‘all-you-can-eat’ broadband to consumers. An increasing number of communications providers are investing substantial amounts of capital in new networks and technologies that will provide sufficient speed and capacity to meet the anticipated demand. Furthermore, the quality-adjusted price of communications has fallen exponentially and will fall further with additional investment.

2: What barriers exist to long term investment in the UK telecoms market (beyond work underway by the Local Full Fibre Networks programme to stimulate demand, and by the Barrier Busting Taskforce to reduce build costs)?

Virgin Media applies three measures to our assessment of a new build area: cost per premises; ARPU; and penetration. These metrics ensure that we can meet our shareholder’s return thresholds.

Given the long-term nature of these investments, regulatory stability and confidence that we will be able to make a return on our risky, high-upfront (sunk) cost investment is critical. Liberty Global operates across 13 markets in Europe and has flexibility in where it allocates capital. Virgin Media must compete with other major markets such as Germany, Netherlands and Belgium to persuade Liberty Global of the merits of investing in the UK.

Government and our regulator have the ability to affect each of the parameters underpinning Virgin Media’s investment decisions, positively or negatively.

In the three years since Virgin Media announced *Project Lightning*, we have faced uncertainty with regards to three policies that could materially reduce the profitability of each new customer connected: cost orientation of VULA pricing under Ofcom’s Wholesale Local Access Review; the ongoing risk that ITV will extract retransmission fees from Virgin Media, prompted by the repeal of Section 73 and a 300% increase in our business rates liability.

¹³ The Financial Times covered a story on 18 February “ONS’s crossed telecom wires raise question over inflation figures”. [ONS = Office for National Statistics].

¹⁴ Ofcom Consumer Experience Report 2015

¹⁵ Ofcom Consumer Experience Report 2015

¹⁶ Average household spend on communications services represents 3.5% of total household spend (https://www.ofcom.org.uk/data/assets/pdf_file/0026/26648/uk_telecoms.pdf) compared to 11% for energy (<https://visual.ons.gov.uk/uk-perspectives-2016-personal-and-household-finances-in-the-uk/>)

Virgin Media does not doubt Government and Ofcom's enthusiasm for Project Lightning, but there has been a failure to consider the impact of individual policy decisions on the overarching objective of increasing investment in ultrafast broadband. There seems to be an (erroneous) assumption that investors are immune to the impact of reductions in the returns that they can expect on future investments and that the scale of investment will continue unabated.

Regulatory headwinds

Ofcom's proposed cost-orientation of VULA pricing risks directly undermining cable rollout incentives. Government can review Virgin Media's submission to Ofcom's initial consultation to understand why we consider price controls for fibre products to be strategically inconsistent, unsupported by evidence of consumer harm and unnecessary given competitive constraints on broadband pricing. The germane point for this review is that changes to wholesale pricing regulation of Openreach's 40Mbps product will have knock on effects for retail pricing – and therefore ARPU - of ultrafast products across the market.

HSBC undertook independent analysis of Ofcom's proposed wholesale cost controls for VULA - a £3 reduction per month per customer by April 2020¹⁷ - to assess the impact on Virgin Media's Project Lightning if 70% of that reduction was passed through to retail prices. In order to achieve the same IRR for the programme, HSBC estimates that Virgin Media would have to reduce the number of homes built to by 550,000¹⁸. Virgin Media's own analysis estimates an equivalent effect.

Ofcom's desire to set the price of Openreach's most popular FTTC wholesale product at cost appears in large part motivated by the view that the 'fair bet' has now 'played out'. Openreach's investment in its NGA network was risky at the time, but it turns out that demand has been stronger than anticipated and BT, in the next few years, will begin to earn returns in excess of its cost of capital. Put another way, BT has had a fair 'crack of the whip' and Ofcom's job is to set prices at cost (including a return commensurate with BT's cost of capital) for fear that BT will soon start to earn excess returns (which will be brought to Ofcom's attention in consultants' report commissioned by the purchasers of Openreach's wholesale products or questioning at a Select Committee).

If the UK is to encourage more investment in FTTP we need a more nuanced view of profits by the institutions that regulate communications in the UK. It is not BT's fair bet that is at issue; it is the fair bet of its competing investors that counts. It is the prospect of future profits that encourages investors to take a risk and sink capital to supply services where the demand and willingness to pay are unknown. Squeezing profits out of the system because BT's historic investment has worked out better than expected will not only make it wary of future commitments but also deter than want to wrestle profits from BT. Government might contemplate whether it should explicitly direct Ofcom to rank the prioritise longer-term investment in infrastructure ahead of short-term reductions in headline prices (remember that unit prices are fallen exponentially).

The 300% increase in Virgin Media's business rates liability will have a comparable effect to cost orientation of wholesale prices. This affects rollout decisions in three ways. It diverts substantial cash which could otherwise be spent on network expansion. It acts as a deterrent to inward investors who will not find a more burdensome property tax regime in any major Western market. It also directly affects future rollout economics: we understand that the Valuation Office will calculate the per premises cost of Virgin Media's rateable value and attribute it to every new premises connected from March 2017 onwards. Virgin Media calculates the resulting additional cost as roughly equivalent to the effect of the VULA cost orientation referenced above.

Government's Full Fibre Rates Relief can help mitigate the impact on future investments. The proposed policy has a number of limitations that require amendment if the relief scheme is to offset substantively the risk that business rates pose to new investment. Government can refer to Virgin Media's response for our detailed views. Since this review considers the long-term challenges to fibre investment, we reiterate our view that there is a strong public policy case for extending the relief programme beyond its current termination of 2022. As noted throughout this response, the job of extending ultrafast infrastructure will go on well beyond this date.

Deployment costs

Infrastructure deployment costs account for the significant majority of the capital allocated to network expansion. Virgin Media's cost per premises is dependent upon:

- a. the distance of a cluster premises from our existing network (ideally within 25km);
- b. the density of premises in an area (ideally no more than 15 metres between premises);
- c. existing local hub site capacity;

¹⁷ Assuming Ofcom's central case

¹⁸ UK Telecoms Price controls = Less work, HSBC Global Research 21 April 2017

- d. availability of contractor resource; and
- e. local authority imposed ancillary costs or restrictions that result in higher costs.

Virgin Media seeks to reduce our deployment costs in a number of ways:

Targeting multi-dwelling units (MDUs)

Blocks of flats are particularly attractive because the cost per premises can be spread across all the units within a block. There are eight million flats in the UK, three million of which are currently serviceable by the Virgin Media network. Of the remaining five million, two million flats are within 25 metres of our existing network, and around 750,000 could be connected without any meaningful civils work, making them highly attractive build prospects. Many of the remainder are also attractive despite being slightly further from the existing network.

Virgin Media's ability to connect MDUs is constrained by the requirement to negotiate with landlords or third-party intermediaries for access to the buildings. In our experience, it is possible to agree terms for access with a minority of MDU landlords - large national landlords - but not a long tail of tens of thousands of small private landlords, many of whom are registered off-shore. The disparate nature of this group of landlords makes negotiation impractical and means that the mechanism to seek Code rights via the Lands Tribunal is not viable either. The resources required to pursue this route for such a large group of landlords would simply be too high.

Virgin Media has proposed a solution to the Barriers Busting Taskforce that we believe would solve this challenge and lead to a dramatic increase in the number of flats connected to fibre networks. Government should create a notification regime for new connections to existing blocks of flats, giving landlords the right to object within a set period on a defined set of grounds.

Agreements with new developers

Deployment economics can be improved when operators form commercial partnerships with new developers e.g., developers lay duct on behalf of operators or developers pay a bulk fee for connectivity services to the entire development, recouping the costs via rent payments from the tenants.

The former is established practice with national developers. However, in Virgin Media's experience, smaller developers can be reluctant to deploy duct on behalf of multiple operators or for higher specification services. This could be overcome through more ambitious language in the National Planning Policy Framework. The current regulations¹⁹ require new buildings to have the necessary physical infrastructure to enable "superfast broadband", but do not stipulate provision of multiple networks where possible and do not stipulate that services should offer ultrafast speeds. A more ambitious NPPF will hopefully filter down and see these requirements imbedded in local plans across the country²⁰.

Commercial agreements in which the developer agrees to a bulk fee have the advantage that penetration can approach 100%, far exceeding the threshold in our core business case. Social housing developers could be encouraged by local authorities and the Department for Communities and Local Government to explore these models.

Streetworks innovation

Full fibre deployment is attractive to Virgin Media in the immediate term because of the cost efficiencies in deploying fibre compared with coaxial. Deploying fibre can be four times quicker than coaxial using a technique called narrow trenching²¹. Coaxial is a thickly insulated form of copper, deployed in ducts of 96mm in diameter and buried in a trench 30cm in diameter. It has to be fed from the cabinet to the Swept Tee at the perimeter of the customer's premises. Fibre is a hair width in diameter contained within a micro-duct of 8mm in diameter and buried in a trench 10cm or less in diameter. It is blown using compressed air from the cabinet to the Swept Tee in a process that takes a matter of seconds.

In the main, local authorities are supportive of narrow trenching, and Virgin Media has identified where this is not the case to the Barriers Busting Taskforce. However, we have encountered a variety of impediments caused by Highways Agencies that reduce the productivity of our engineers and increase the costs of deployment. One example is in the imposition of restrictions on the number

¹⁹ New Building (Amendment) Regulations 2016 came into effect on 1st January 2017

²⁰ Some forward looking local authorities – Kent and Bradford for instance – have drafted their Local Plans with these requirements

²¹ 200 metres per day versus 50 metres per day - the productivity advantage could be higher if there were not constraints on numbers of crews working simultaneously

of gangs allowed to operate - or total prohibitions on build across an entire municipality - in response to isolated faults in streetworks in specific areas. Another is the imposition of blanket permit fees for works on all roads in an area and for all forms of deployment, regardless of whether these works disrupt traffic flows. Government is well aware of these issues and work is underway to address many of them. As we look to optimise conditions for future deployment, a root and branch review of the New Roads and Streetworks Act to identify the most conducive model of collaboration between broadband operators and local authorities is required.

Physical Infrastructure Access

Virgin Media sees real potential to minimise our rollout costs by making use of Ofcom's Physical Infrastructure Access remedy. Ofcom expects that the remedy will result in 500,000 premises connected by the end of 2021. We have one trial underway and two planned. Our initial trial has identified improvements that will need to be made to make the remedy operational: better Openreach planning and ordering processes, a modification to the current product specification and new regulations.

Alternative funding models to meet up-front cost

Virgin Media has developed a novel model to connect 4,000 premises to FTTP in the Test Valley, Hampshire. The premises Virgin Media will connect are spread across 11 villages²². The cost per premises for these villages is roughly treble the typical spend in our business case. In Virgin Media's Test Valley model we require a minimum (and of longer duration) level of spend commitment from a proportion of premises before we commence digging; this gives us sufficient confidence that penetration will be sufficient to meet our business case parameters. In addition, we still require an upfront contribution in the form of a connection fee. The combination of lower churn, an upfront contribution, higher ongoing revenues and longer expected tenure has meant that the cost per premises that we can entertain has risen by around 80%.

This model has proven viable in a relatively affluent area of the UK. A private install contribution of several hundreds of pounds is unlikely to be feasible in areas with lower income demographics. Here, a Government-funded residential voucher programme would help meet the funding gap to enable rollout to areas that would not otherwise be commercially viable. We are encouraged that such a scheme is under consideration in the Local Full Fibre Networks Initiative. We urge Government to consider how it can be applied as a more central pillar of its long-term telecommunications strategy.

In conclusion, a coherent policy framework that directly improves the economics for full fibre deployment has yet to emerge. Some of the responsibility lies with Ofcom, but Government can make a direct contribution by removing inefficiencies in the planning process, rejecting any policies that divert funds away from investment and playing a more direct role in stimulating demand for residential take-up.

3: What can the UK learn from the widespread deployment of fibre networks in other countries?

The UK's comparatively low availability of full fibre versus some international markets has not constrained the growth of the domestic digital economy nor the amount of data consumed using broadband networks. The UK performs better than other advanced digital markets on a series of consumer satisfaction and outcomes metrics. As such, there does not appear to be a strong demand-side opportunity cost to the UK's current digital infrastructure composition.

The UK digital economy

As was noted in Government's 2017 Digital Strategy, digital sectors contributed over 7% of the UK's gross value added in 2015 - £118 billion – and the rate of growth of the digital sector dramatically outstrips that of the wider economy²³. UK citizens are enthusiastic consumers of digital goods and e-commerce services. They spent £2,175 per head making purchases on the internet in 2016, which Ofcom calculates to be "more than double the spend by consumers in any other comparator country"²⁴.

Clearly, a thriving digital economy is contingent on wide availability of digital connectivity. However, the evidence of the causal relationship between improvements in digital infrastructure and increases in the output and consumption of digital goods and services is mixed. A multitude of exogenous factors can influence the growth of digital consumption, as well as the readiness and rate of adoption of services in adjacent markets such as electronic devices. As Frontier Economics notes in its analysis for the National Infrastructure Commission: "given the multitude of factors that can affect a country's digital economy it is difficult to

²² Goodworth Clatford, Chilbolton, Stockbridge, Kings Somborne, Broughton, Firsdow, The Winterslows, West Tytherley, Houghton, Michelmersh, Timsbury

²³ <https://www.gov.uk/government/publications/uk-digital-strategy/uk-digital-strategy>

²⁴ Ofcom International Communications Market Report 2017 https://www.ofcom.org.uk/data/assets/pdf_file/0032/108896/icmr-2017.pdf

isolate the impact of an existing endowment of specific digital infrastructure... [other] countries have very successful digital economies with lower levels of network infrastructure (such as the USA)". The report also notes that some countries such as Japan have made heavy investments in ultrafast broadband that have not stimulated substantial increases in broadband penetration.

Virgin Media firmly believes in the direct and indirect economy value that its investment under Project Lightning will deliver. Our point here is simply that, in an already mature and productive digital economy, the extent to which Government can extract exponential growth in output from technology upgrades alone is questionable. A variety of demand-led interventions can provide a more certain route to generating additional economic growth, which ultimately is delivered by higher take-up of services.

Data consumption and consumer outcomes

Growth in UK average data consumption has outstripped that in all nations with higher coverage of FTTP with the exception of Korea²⁵. Average monthly data usage per household has increased from 132GB to 190GB from 2016 to 2017, with substantial increases in consumption identified at all speed tiers²⁶. UK retail prices are internationally competitive. Ofcom's most recent International Communications Review shows that UK customers enjoy the lowest triple play prices of major European markets²⁷. For those with lesser requirements, the UK also has the second lowest average prices for 'basic' (under 30Mbps) broadband of international competitors. UK broadband users are comparatively well served by the market on a series of other competitive metrics too (Figure 4, Annex).

These outcomes reflect the higher degree of retail competition in the UK broadband market versus other major markets. Ofcom finds that, despite a small increase in BT's retail fixed broadband market share following the acquisition of EE, the UK incumbent continues to have the smallest market share of all EU5 countries incumbent operators. Competition is intensifying at high speeds. Retail competitors TalkTalk and Sky have together taken more than 50% of the total high speed broadband net adds over the Openreach network for each of the past three quarters²⁸.

Approaches to infrastructure rollout

A variety of models can be identified internationally for the rollout of broadband infrastructure. Leaving the degree of state intervention to one side, the market factors that are identified²⁹ as having the greatest effect on FTTP rollout are:

- Population distribution: Ofcom notes in its International Communications Market report that "the per-premises cost is lower in countries with high population density or a large proportion of people living in urban areas, such as Japan, South Korea, the Netherlands and Sweden".
- Housing patterns: Ofcom finds that "nationwide roll-out is cheaper in countries where a large proportion of the population live in multiple dwelling units (flats and apartments); in Germany, Italy and Spain, this accounts for more than half the population. In the UK this proportion is less than 20%, making NGA deployment more expensive".
- Topography: "existing telecoms networks and other environmental factors also determine the cost of NGA roll-out...In the UK and Germany, shorter line lengths have led to widespread VDSL deployment by running fibre-to-the-cabinet (FTTC)".
- Lack of alternatives: in Spain the regulator did not require the incumbent to provide an active access remedy for speeds north of 30Mbps. Put simply, to compete that the higher speeds challengers had to build their own networks (in this case using access to Telefonica's passive infrastructure).

Government can do little in near-term, if at all, to affect population density and the proportion of MDUs in the housing supply. It can improve the ability of operators to connect the existing MDU housing stock (as discussed in Question 2) where there are current, addressable barriers to supply. There is evidence to suggest that passive access remedies have helped to support rollout of FTTP in Portugal and Spain - though, as noted above, it is difficult to isolate the effect of the remedy from the favourable housing and geographic characteristics in both markets. In contrast however, Ofcom, by setting the price of Openreach's most popular wholesale FTTC product at cost and legally separating Openreach from its parent, renting rather than building is made more attractive for Openreach's customers.

²⁵ Ofcom International Communications Market Report 2017

²⁶ https://www.ofcom.org.uk/data/assets/pdf_file/0024/108843/summary-report-connected-nations-2017.pdf

²⁷ Ofcom International Communications Market Report 2017, Figure 7 https://www.ofcom.org.uk/data/assets/pdf_file/0032/108896/icmr-2017.pdf

²⁸ Enders Analysis Pay TV and broadband quarterly summaries

²⁹ Ofcom International Communications Market Report 2017: https://www.ofcom.org.uk/data/assets/pdf_file/0032/108896/icmr-2017.pdf

4: The Government wants to consider all market models that will facilitate the next generation of technologies.

The existing market and regulatory model, in which infrastructure competition is encouraged to as great a degree as possible, has underpinned the positive investment and consumer outcomes identified in answer to Question 1. In its 2015 Digital Communications Review, Ofcom held infrastructure competition as the gold standard for telecommunications regulation and set an objective of achieving competition between three or more networks in around 40% of the UK.

“The best driver for investment and innovation is network based competition: and this is at the heart of our future strategy. We believe competition between different networks (including those built from scratch or built using duct and poles owned by others) is the best way to drive investment in high quality, innovative services for consumers.”

Virgin Media whole-heartedly supported this strategic priority. There is a compelling body of academic opinion and empirical evidence that demonstrates how competition between independent networks produces the following effects:

- The incumbent is forced to respond to investments by new entrants in superior technology with its own network upgrades
 - On average, incumbents invest 8% more of their revenues on network upgrade where there is strong cable penetration.³⁰
 - In the UK, BT’s FTTC, G.Fast and FTTP upgrade programmes have each followed advances in technology, coverage and speed by Virgin Media.
 - Sharon White noted in a speech to Virgin Media staff in Birmingham in December 2017, that BT Openreach’s investment in FTTP was likely to be in response to aggressive FTTP rollout by Virgin Media and alternative operators³¹. Market analyst Macquarie estimated the impact on Openreach revenue if it failed to react to a competitor building FTTP to 10 million premises by 2026. Its estimate is a 2.56m loss of customers to an alternative FTTP operator, which is equivalent to an Openreach revenue loss of £420m pa – 3% of UK fixed-line revenue.³²
- Innovation, product and price differentiation
 - Amongst the four leading ISPs, there is substantial differentiation in product and pricing. Figure 5 (Annex) shows that at each mass market speed tier, the range of prices differs by approximately £10 (between 25 and 50% of average retail price for that tier).
- Greater penetration of high speed services
 - There is a strong correlation between the presence of cable infrastructure and both the presence of VDSL and increased broadband access speeds, as shown below in Figure 6 (Annex). The left hand panel shows the correlation between cable and VDSL coverage and the right hand panel between cable coverage and average connection speed.
 - Solon Consultancy finds that, in Western European markets, superfast penetration is on average 30% higher where the cable operator has greater than 20% market share³³. By contrast, research has found that “intra-platform competition” across the incumbent platform alone (for instance, local loop unbundling in the UK), has no discernible impact on overall broadband penetration³⁴.

A radical departure from the existing regulatory model – ‘coordination’ of FTTP into a patchwork of regional monopolies or utility-like regulation of broadband - would likely be detrimental for independent network investment in the UK. Consumer choice, real product differentiation and competitive pressure on the incumbent to continually improve its quality of service and infrastructure would suffer. As well as providing firm evidence of the advantages of infrastructure competition, much of the research cited above also finds that in the counter-factual, when competition is delivered at a retail level across a single incumbent infrastructure, lower adoption and less investment in advanced broadband services results. Proponents of a local monopoly regulatory model presumably believe that the economics of full fibre rollout to many parts of the UK will only support one provider. If this is true,

³⁰ http://ec.europa.eu/dgs/secretariat_general/eu2020/docs/cable_europe_en.pdf

³¹ <https://www.ofcom.org.uk/about-ofcom/latest/media/speeches/2017/competition-britain-fibre-future>

³² Macquarie: Operators playing the network game – October 2016

³³ http://ec.europa.eu/dgs/secretariat_general/eu2020/docs/cable_europe_en.pdf page 25; In Central and Eastern European markets, average penetration was 50% higher in markets with larger cable presence.

³⁴ Mattia Nardotto, Tommaso Valletti and Frank Verboven; Unbundling the Incumbent: Evidence from UK Broadband. Centre for Economic Policy Research, Discussion Paper No. 914, October 2012

there is no need to ensure that regulation imposes it, because no one else will build. If it is false, consumers will suffer because they will not enjoy the benefits of competition. ,

As to the question of the structure of BT Group, early signs following legal separation are encouraging. Openreach's consultation on FTTP is an indication of a more outward-looking, responsive organisation. Ultimately, as a private company, it is right that Openreach's investment decisions are based on potential returns. The consultation will test the degree to which its customers believe that there is money to be made from selling full fibre services. In addition, Virgin Media is confident that Physical Infrastructure Access (PIA) can be made operational and materially reduce the costs to entry for new infrastructure investment. Ofcom should allow appropriate time for the changes to bed in before considering alternative remedies that are likely to be highly disruptive and would send damaging signals to infrastructure investors. Whatever consequences might result from structural separation, it is hard to envisage how greater confidence leading to increased investment in fibre infrastructure is one.

5: The Government wants to achieve its digital infrastructure goals at the least additional cost. How should new digital infrastructure be paid for?

In a market economy, if consumers are not willing to pay for a good, it is not supplied. While externalities result from giving citizens access to basic broadband that can support participation in society, the benefits associated with higher speed services accrue primarily to the individual. It is therefore right, in considering the roadmap to ubiquitous full fibre, that Government should ask: who pays?

The evidence available today does not support the view that end consumers are willing to pay a substantial premium for higher speed services. Consumer behaviour in the UK broadband market in fact demonstrates that: a) purchasing decisions are motivated primarily by price, with speed a secondary consideration; and b) consumers are willing to "spin down" or switch operators to take lower bandwidth cheaper products.

Consumer sentiment towards higher speeds is perhaps not surprising given how well mainstream and advanced internet applications are supported at lower bandwidths today.

Advances in video compression have supported streaming of HD and 4K video, emerging IoT applications, as well as the less bandwidth intensive mainstream activities of email, IP voice and browsing. The likelihood that a "killer app" will emerge that necessitates mass-market upgrade to gigabit download speeds, symmetrical bandwidth, or higher 'quality of experience' specifications is anybody's guess. Frontier's analysis for the National Infrastructure Commission suggests that all of the likeliest candidates amongst today's advanced technologies to reach mass take-up will be well supported by existing networks. Many of those applications are predominantly "one-way", such as 8K video streaming and various household IoT applications. Even Augmented Reality, Virtual Reality and 3D streaming, are essentially more advanced forms of video delivery that existing networks can support.

We might conceive of a future in which advanced applications that have zero tolerance to the high but inevitable capacity constraints of a contended, "best efforts" internet become mass use. As is implied in the Frontier analysis, an application like remote robotic surgery, while clearly needing very low latency, jitter and 100% reliability, will only be required in a specialist setting and therefore will not have consequences for mass-market services. A small proportion of businesses – 3% by Frontier's assessment - will have requirements for advanced network capacity, and those that do, have access to a competitive leased line market. However, should we see applications emerge that require ubiquitous networks with the advanced quality of experience characteristics that have traditionally been the preserve of dedicated enterprise services³⁵ – autonomous driving for instance – the economic model for supporting these investments is unclear. If the end user remains resistant to paying a premium for advanced service quality, it is unlikely that access network operators will be able to fund the gap.

While this challenge is unlikely to emerge in the near-term, now is the right time for Government to start to consider a new monetisation model for a more advanced future. Application developers and content platforms will be the principle beneficiaries of investments to improve quality of experience. The growth of the app economy has been facilitated by economies of scale in, and commoditisation of the costs of, distributing their content to the end consumer. The barriers to entry for these apps are now exceptionally low. Many have built enormous scale and value quickly on the back of investments by others.

³⁵ See Arthur D Little, Liberty Global report of August 2017
http://www.adlittle.com/sites/default/files/viewpoints/adl_unlocking_gigaworld_innovation.pdf

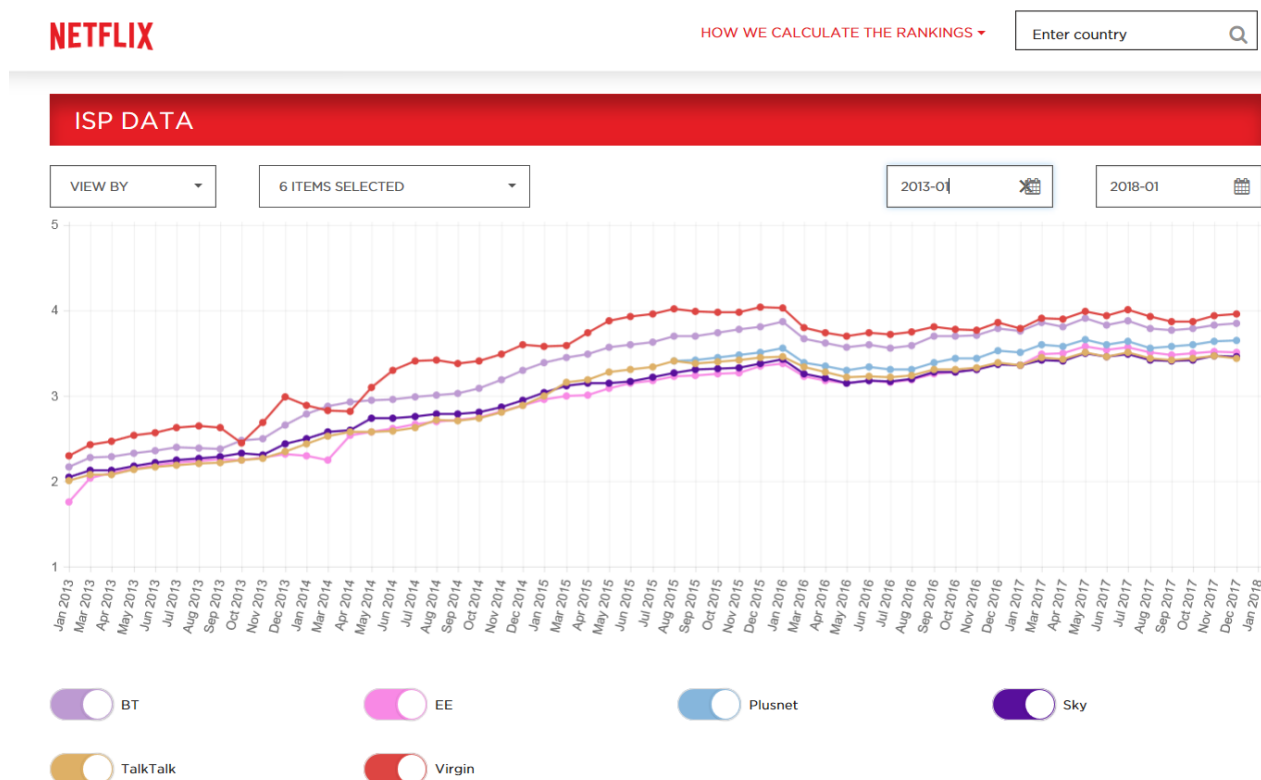
A tipping point is likely to be reached when the incentives for investing in more advanced access networks lie more with the application developers than the access operators. Government will naturally have to approach the question of whether this shift requires a new regulatory approach with caution. It will need to consider whether the protections that underpin the open internet and end users rights, and the moderating competitive constraints on the various actors in the ecosystem, are sufficient to allow the market to evolve. Overly restrictive regulatory models aimed at pre-empting theoretical bottlenecks to competition where there is no evidence to suggest they might emerge, may limit the emergence of an advanced internet. The UK approach to net neutrality has been relatively light-touch to date, and the coincidence of Brexit with the new Telecoms Single Market Regulations may present an opportunity for further differentiation. Close observance of how the US market evolves following the FCC's recent decision to lift some net neutrality constraints there will provide a live test case for whether any theory of harm is legitimate.

Conclusion

The UK's digital infrastructure is producing good outcomes for the Government, the economy and consumers today. The market is delivering over and above what consumers are currently willing to pay, and is investing in networks that will be able to exceed forecast bandwidth demand long into the future. Expansion of ultrafast networks coverage is now happening at pace after a sluggish start, and there is much that Government can do to lower the costs of deployment. Virgin Media is encouraged by Government's determination to tackle these barriers; we are hopeful that through this review, Government policy can match its rhetoric. Doing so requires the discipline to reject policies that could extract value from the market. Government could extend the economic threshold for rollout through demand-side interventions that support take-up of ultrafast services. If demand emerges for a more advanced, dedicated internet, a new investment model is likely to be required. Now is an opportune moment for Government to begin exploring what it might look like.

Annex: Graphs and figures

Figure 1: Netflix UK ISP report³⁶



³⁶<https://ispspeedindex.netflix.com/country/uk/?range=&providers=442&providers=477&providers=492&providers=479&providers=444&providers=441&datefrom=2012-10&dateto=#graph>

Figure 2: The price of telecoms (FT Source: ONS)



Figure 3: Ofcom Consumer Experience Report 2016

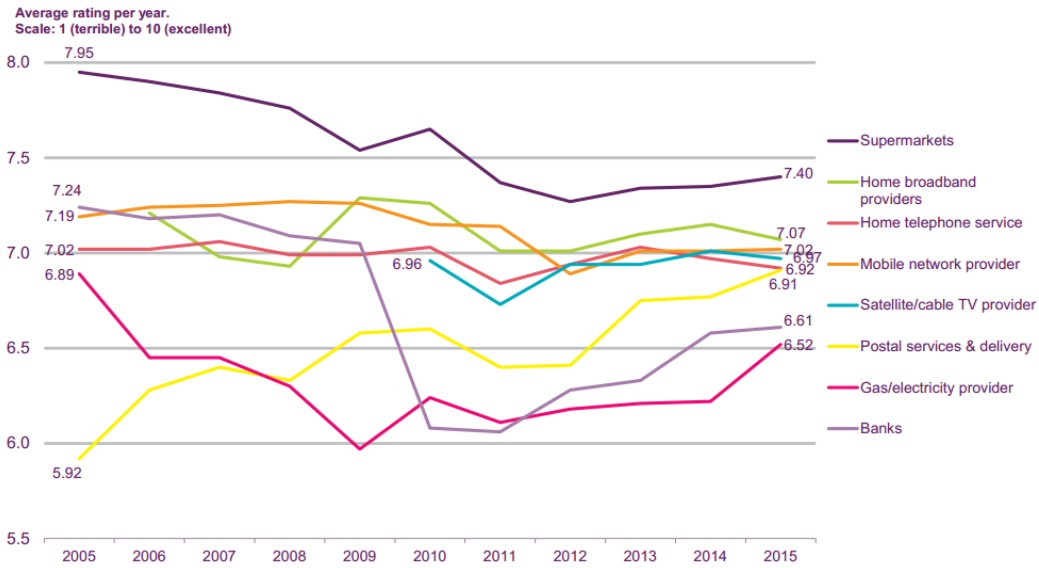


Figure 4: Satisfaction with aspects of fixed broadband service, 2017: Ofcom, International Communications Market Report

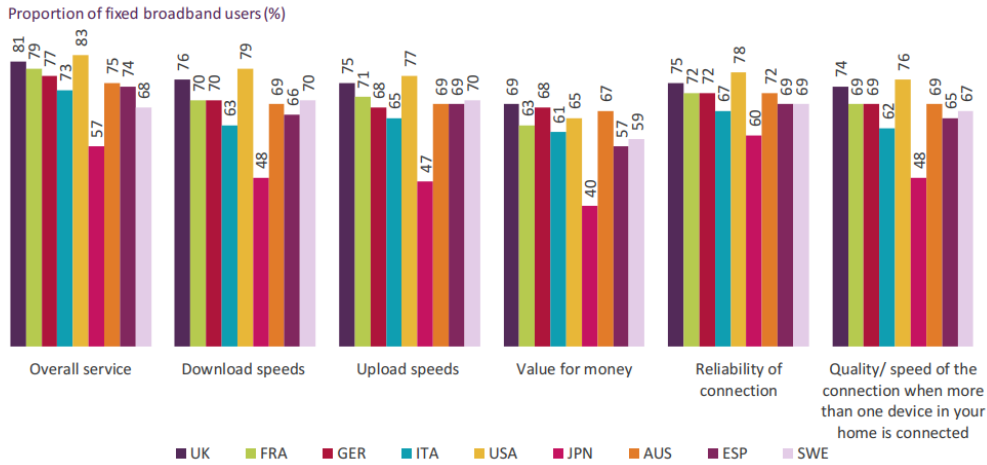


Figure 5: Unlimited broadband dual-play pricing vs. speed of connection; Enders Analysis, Dec 17

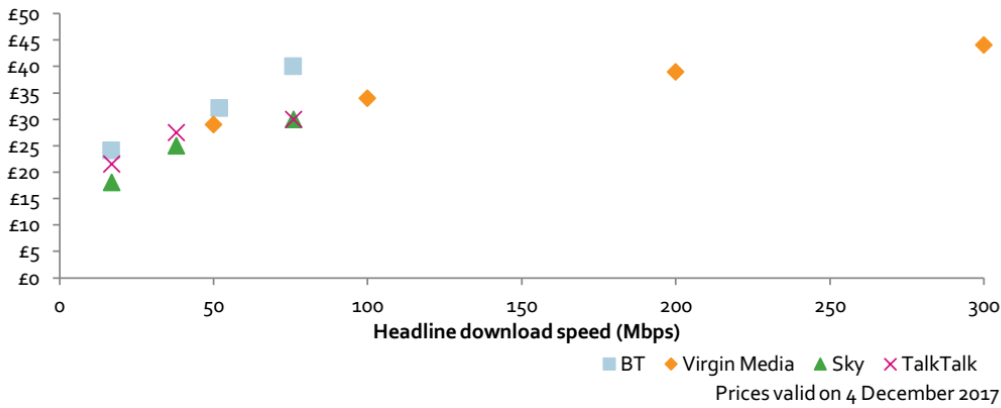
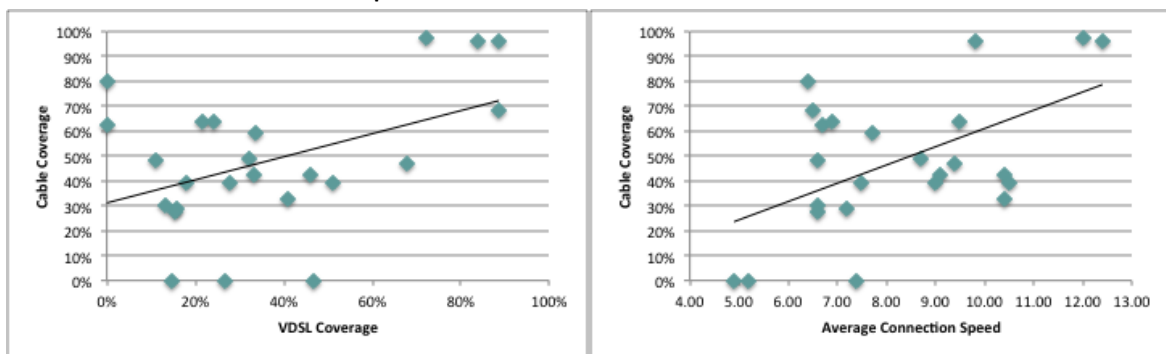


Figure 6: Correlations between Cable and Speed and Cable and DSL³⁷



³⁷ European Commission 'Broadband Coverage in Europe 2013' Prepared by IHS Ltd and VVA Consulting; and Akamai, SPC Network