

1. Introduction

BT is pleased to respond to the Rural Economy and Connectivity Committee's Call for Evidence on broadband connectivity. BT fully recognises the benefits that can accrue to individuals, businesses and the wider economy and society as a result of effective access to broadband services. This is why we have committed significant amounts of our own money to investments that have delivered superfast networks across the majority of the UK, including working with the Scottish Government to ensure that 95 per cent of Scottish premises will have access to high-speed broadband infrastructure by the end of March 2018. The Scottish Government intends to go even further by committing to deliver superfast broadband (>30Mbps) to 100 per cent of premises by 2021¹, and we will do all we can to support that ambition.

- **Digital communications is a Scottish and UK success story.** The UK is already ahead of its European peers on superfast broadband coverage, take-up and average speeds and has one of the most competitive broadband markets in the world.
- **BT has played a major role in this success.** We have invested £20 billion in the UK in the last ten years, of which £10.5 billion has been invested by Openreach to maintain, repair and upgrade the access network. Our R&D budget of £500m a year delivers innovations that keep Scotland and the UK ahead, such as the G.Fast technology we will use to deliver ultrafast broadband. Our Openreach and EE businesses will spend around six billion pounds in capital expenditure over the next three years in the first phase of a plan to extend superfast broadband and 4G coverage beyond 95 per cent of the UK by 2020.
- **We are now at a critical point in the development of Scotland and the UK as digital nations.** Consumers and businesses are already driving increasing demand for data. This trend will accelerate as new data-hungry technologies and applications enter the mainstream over the next decade. Speed and network reliability will be absolutely essential to the functioning of society and the economy.
- **BT is committed to playing a leading role in delivering this transformation.** We are willing to deliver a minimum broadband speed of 10Mbps to all premises in the UK, without a USO and without further public funding. We can do this by the end of 2020 and are working with the UK Government and Ofcom on how best to achieve this. New technologies will need to be approved and we will also need the right regulatory support to make such a commitment commercially viable.
- **With respect to the Scottish Government's superfast for 100% ambition,** if there is public funding to support higher speeds and to deliver the wider benefits that are achievable at higher speeds then we are fully behind that. The challenge exists if we are expected to pay for the delivery of a higher speed when it does not make commercial sense currently. If there is gap funding available to deliver these societal and economic benefits then we absolutely stand ready to assist.

2. High-speed Fibre Investment in Scotland

In Scotland, no organisation has done more to deliver high-speed broadband. BT's investment of hundreds of millions of pounds means our high-speed, fibre broadband network now reaches more than two million homes and businesses.

Around 1.4 million premises have been included in BT's commercial fibre rollout and 660,000 more have been reached to date through the £410m Digital Scotland rollout with the public sector. BT is investing £126m in the project – the biggest single funder of all the partners. To deliver value for

¹ http://www.publiccontractsscotland.gov.uk/search/show/search_view.aspx?ID=SEP256710

money, our planners have a contractual obligation to reach the most premises possible with the funds available.

Delivering fibre broadband across Scotland is the biggest challenge of its kind in the UK, arguably anywhere in Europe. The Digital Scotland rollout is on budget and ahead of schedule, reaching dozens of remote and rural communities from Sullom Voe in Shetland and Dores at Loch Ness to Tobermory in Argyll and Ettrickbridge in the Scottish Borders. This has been confirmed in the recent Audit Scotland report '*Superfast broadband for Scotland: a progress update*'².

On speeds, more than 86 per cent of households in Scotland are already able to access superfast broadband speeds in excess of 30Mbps, according to the independent website Thinkbroadband.

By March 2018, 95 per cent of all Scottish premises will have access to high-speed broadband infrastructure. The Scottish Government intends to go even further, and we will do all we can to support that ambition³.

3. Commercial, financial and technical challenges in reaching the final 5%

A fundamental feature of telecoms networks is that it is more expensive to deploy networks to customers that are geographically dispersed than to customers that are densely located. This is in principle true for both fixed and mobile networks. As a result it becomes commercially challenging to provide ubiquitous coverage. At some point the costs will exceed the likely revenues and the commercial case for deployment will fail. The issues are commercial rather than financial.

It is also not a technological challenge. The technological issue is one of trade-offs between cost of networks versus the speed, capacity and coverage that they deliver. Different technologies, fixed fibre solutions, terrestrial wireless (4G) or satellite delivery, can all have a part to play in delivering a mix of outcomes between cost, speed capacity and coverage in different circumstances. Fibre is by far the highest speed and capacity technology. 4G may have a role to play in dispersed localities, but its speed and capacity is less than fibre. BT's fibre broadband network has about 10 times the capacity of a typical 4G network dedicated to mobile data services. Satellite has a role in the hardest to reach places, but its capacity is limited.

Fibre to the premises (FTTP) could be delivered virtually everywhere in the UK, even in the 'hardest to reach' areas, and has the potential to deliver unmatched speed and capacity. There is not a genuine technical challenge to delivering such a future-proof high-speed network in all but the very most challenging areas. However, it is very expensive to deploy and well beyond any current commercial case for investment or public intervention intentions, though BT's laboratories are working to reduce cost and time to deploy. Also, on top of being very expensive, it would take considerably longer. Coverage would be considerably less than now if FTTP had been the default technology to deliver high speed fibre services.

BT has developed a range of technologies and we are continuing to develop them to be as flexible as possible in meeting potential future demands within the current commercial investment case. The three main technologies are:

² http://www.audit-scotland.gov.uk/uploads/docs/report/2016/nr_160818_broadband_update.pdf

³ BT is also working with a number of communities who are not included in any current programme to roll out high-speed fibre broadband to explore co-funded solutions through our BT Community Fibre Partnership programme. www.communityfibre.bt.com.

- **Fibre to the Cabinet (FTTC)**⁴, which allows superfast services to be delivered to most of the UK at speeds of up to 80Mbit/s currently. It can be delivered quickly and at relatively low cost, with over 20 million premises already delivered commercially under our UK-wide £2.5bn commercial programme. FTTC is also the main stay of the Digital Scotland/BDUK programme. It is based on Very high bit-rate Digital Subscriber Line (VDSL) technology. High-speed fibre is used to connect exchanges to cabinets so only relatively short lengths of copper run from cabinets to individual premises⁵.
- **Fibre to the Premises (FTTP)** is the most 'future proof' of the current technologies, offering the ability to deliver multi Gigabit speeds. However, the costs of delivering the fibre to individual premises would be very expensive and prohibitive due to the need for new infrastructure (ducts/poles, etc.) all the way to every premise. Also, every premises would need to be visited, accessed and have equipment installed, which would extend such a scheme by years potentially. FTTC requires no premises access.
- **G.Fast** is a new technology BT is currently trialling⁶ that offers much higher speeds than FTTC such that it is capable of delivering the very high speeds typically only seen via FTTP but at a cost to deploy much closer to that of FTTC. BT is aiming to deliver ultrafast broadband speeds (300-500Mbps) to 12 million UK premises by 2020, with premium fibre broadband services of up to 1Gbit/s being made available where there is demand. FTTP will be a sizable proportion of this deployment, but the large majority will be provided by G.Fast solutions. G.Fast is on track to begin a UK rollout next year and, together with FTTP, will take BT's overall ultrafast footprint to half a million premises by the end of March next year. We intend to deliver ultrafast broadband speeds to the majority of UK users by 2025, at a significant cost saving compared to using FTTP only.

Mobile is also part of the overall picture. EE is extending its 4G UK network to reach 95% geographic coverage (which is over 99% of premises) by 2020. The latest Scottish site to go live is on Coll, bringing EE's superfast 4G mobile services to the island's businesses and residents for the first time. Five new 4G sites were switched on in the Orkney Islands recently, in addition to sites on the neighbouring Shetland Isles.

4. UK Government Universal Service Obligation

BT is fully supportive of the UK Government's ambition to deliver universal accessibility to modern broadband with speeds of 10Mbps to every premises in the UK. However, BT does not consider that a broadband universal service obligation enacted through primary legislation is a necessary, pragmatic or effective means of delivering this ambition.

The specification and scope of the service to be delivered under any new obligation, including the expected timescale it is to be in force for (i.e. the extent and potential for review and change over time) is critical. It will dramatically impact the scale of the delivery problem, the cost/burden on any fund or providers, the technology choices, the timescales to deliver and indeed potentially all other aspects of this analysis. It is therefore imperative that Ofcom and indeed the UK Government seek to understand the impact of key aspects of the specification and potential scope of changes to the specification. All of these factors will impact on the cost, deployment and potential burden of this

⁴ We will also look at other solutions where they are a better fit, such as Wireless-to-the-Cabinet which has been used in Bressay, Shetland. This works in a similar way to FTTC, offering similar speeds at up to 80Mbps. Wireless to the cabinet uses a point-to-point radio link to substitute a section of the fibre that feeds the green cabinet. A fibre service is then offered by service providers as per usual process.

⁵ For long copper lines BT is developing Long Reach VDSL- a technology currently being tested in North Tolsta on Lewis which has also been extended to a small group of long lines in Barvas on the other side of the island. Further details can be found here: <http://www.btplc.com/News/regions/#!/pressreleases/openreach-tests-boost-fibre-broadband-speeds-over-long-lines-in-the-hebrides-1525869>

⁶ The first locations in Scotland to be included in Openreach's G.Fast pilot will be Glasgow Langside & Edinburgh Donaldson exchange areas.

proposed service and thus need to be understood prior to implementation. For example, must a USO broadband service always be capable of delivering multiple streams to multiple users at the same time? Social inclusion is unlikely to require multiple simultaneous usage and even if it did the typical household is approximately 2 people and less than 20% of households have 4 or more people. Furthermore, Ofcom will need to assess fully the impact that frequent review and/or changes to the specification will have on the market's choice of solution, and the investment uncertainty such reviews will create for a number of currently very viable solution options.

A broadband USO that required just a headline download speed of 10Mb/s, with no commitment beyond peak speed and no commitment on data download, latency or other quality parameters, could be met through a range of technical solutions including satellite, mobile/4G, Fixed Wireless Access, traditional copper networks, hybrid copper/fibre networks and full Fibre-to-the-Premises (FTTP) networks. The more the specification requires, in terms of committed or guaranteed bandwidth, download capability (e.g. unlimited volume), latency, upload speed or ability to meet rising requirements over time, the more technical options will be removed from viability, with satellite likely to fall out of scope first then most likely wireless/mobile options due to the shared access capability, followed by copper and potentially even hybrid copper networks until only full FTTP networks might be viable. The cost/burden of any solution would also rise as the technological options were ruled out.

How should the minimum technical performance of the USO be specified?

There are a number of factors that need to be considered when defining the performance of a universal service, for example:-

- What services will users need to access, now and in the future?
- How will the demands of those services change over time (up and down)?
- How many services will need to operate in parallel on a USO service (contiguous use issue)?
- Will more than one voice channel (as IP voice) be required given current voice USO requirement for 1 per premises?
- How long will such services be needed in a typical period (monthly data usage issue)?
- Over what time period will the specification remain valid (review/future proofing issue)?
- Are services to be offered (and any bandwidth specification, etc. determined) at Wholesale or Retail level?
- How would performance/compliance against any USO specification be assessed, e.g. at build/delivery and ongoing?

5. Scottish Government 100% Superfast Commitment

In what is undoubtedly a significantly more aspirational objective than the UK Government's proposed 10Mbps universal service obligation, the Scottish Government is committed to delivering superfast broadband (>30 Mbps) to 100 per cent of premises by 2021. Reaching 100% will carry on the work of the two current superfast broadband programmes by investing in infrastructure that will help deliver superfast broadband to anywhere it is needed. It will measure the "broadband gap" left after commercial operators and the current programmes have finished deployment, investing funds and procuring a number of different solutions across the country.

The current stage, being run by the Scottish Government, is to determine the areas for intervention. Subsequent stages will define and design an approach to the market to determine the best value methods of delivering and deploying. The programme is scheduled to last to 2021, with significant progress being made during 2017/18. Naturally, this brings a variety of challenges, including stakeholder management, best use of funding, public communications as well as meeting the technical and commercial demands of a national infrastructure programme.

BT believes that a gap funded model⁷ is an appropriate assumption for the procurement of this challenging policy objective. The nature of broadband network deployments as civil infrastructure projects that benefit from consistency of service offering across the market; the need and ability to maximise their attractiveness to the full range of retail ISPs⁸; and the challenging economic conditions for deployment in the remaining areas of Scotland yet to be served all mean that only an investment gap funding model would be viable for these remaining areas.

Other models approved under EU state aid rules do of course exist but we consider that there are either inappropriate (e.g. the Market Efficient Investor Principle (MEIP) model is effectively a commercial investment by the government at normal commercial returns and these final areas of Scotland are, effectively by definition, not addressable via commercial models) or effectively operate at the passive layer only and are likely to require significant new build of passive infrastructure in order to meet the access requirements. This would potentially risk significant overbuild of existing passive infrastructure, with potential state aid concerns as a result.

There are technological solutions for delivering on a 100% superfast coverage goal. The viability of such a delivery is therefore an economic one not a technological one⁹. BT has technical solutions available but these will not currently deliver against the normal commercial criteria. Viability will therefore be dependent on the costs of delivering these technological solutions compared with the acceptable benefits/costs of such a delivery.

These costs will be significantly impacted by the definition that is applied to the goal. For example, what is meant by 100% coverage? Even accepting that this is to 100% of premises in Scotland, then there are multiple sources of premises lists (e.g. "Address base" or local authority lists – and these large databases are also known to contain errors within them) and definitions of what constitutes such a premises. This potential lack of clarity at the start, coupled with the fact that the number of premises is not static over time, means that clarity of what is included within the target for all bidders will be critical.

Costs will also be affected by the service specification – e.g. Superfast under State Aid rules typically requires a fixed network solution or a fixed wireless access network that is designed to behave in an equivalent manner to a fixed network. Solutions that do not meet the EU state aid rules would not be fundable under an EU state aid compliant scheme, given the very high risk imposed on suppliers in the event of such a failure to comply.

BT therefore believes that the most cost effective means of delivering on such an objective is a gap funded procurement model to build out network solutions to the majority of any remaining premises. Such a build-out would take time but could be on the basis of a supplier committing to make service available to an area by a given build date. The remaining premises beyond that committed pre-build coverage would then be addressed/assessed via an "on demand" requirement where network was not already pre-built (due to the very high costs in these remaining locations). We would expect such locations to be confined to the last circa 1% where we expect aggregated network solutions are

⁷ A gap funding model makes subsidy available for planning, operational management and deployment costs to ensure that the in-life period is sustainable.

⁸ The economics of network build is that once built it is essential that as many customers as possible are attracted onto the network to use it. This is best done by having an open and effective wholesale service offering that enables the widest possible range of service providers to offer and deliver service over the resultant network. Our Openreach business is fundamentally established as such an open access wholesale supplier and already delivers such wholesale product offerings to all major ISPs and hundreds of smaller players across the UK. We would expect this to extend to any such new network in Scotland.

⁹ The Scottish Government anticipates that there may be between 200,000 – 300,000 white premises to be addressed by the R100 programme. Initial thinking is that the remaining premises will be split into several procurements or lots. BT would favour fewer lots as any lotting boundaries risk distorting the efficient deployment of infrastructure, potentially increasing costs and reducing value for money. The use of multiple, comparatively small, lots can introduce inefficiencies into any deployment which will inevitably be constrained by the boundaries of each lot.

unlikely to be viable – i.e. areas where a per premises solution, rather than an aggregated one, are likely to be the most economic.

We believe that extending the rollout of our standard fibre based products is the key to the ambition of attaining full coverage with a sustainable and future-proofed solution. Wherever possible and economically viable, we would aim to utilise our industry standard fixed technology capability and use the different methodologies and technologies of our extended reach Fibre-to-the-Cabinet/Fibre-to-the-Premises (FTTC/FTTP) innovations to meet the requirements of rural communities and not-spot areas. BT's Generic Ethernet Access (GEA) products have been designed to ensure that once deployed, the infrastructure can be upgraded as required at minimum cost. In general, because GEA is part of our standard product portfolio, any future upgrade would be applied across the entire installed infrastructure and therefore our solution would benefit from any future upgrade by default.

6. Conclusions

The issue of universal service availability, at any speed, is not a technology issue, but an economic one. The technology solutions are present to deliver widespread service availability, i.e. technologies such as Fibre-to-the-Premises are capable of delivering service to any fixed location in the UK. However, the challenge is the commercial case: it is vital to ensure that returns to network providers are sufficient to support the necessary upfront and ongoing investment commensurate with quality of service expectations. There are lots of studies on the overall consumer and economic benefits that such services deliver; however these benefits do not necessarily flow commensurately to the network provider¹⁰.

BT has already committed to deliver a minimum broadband speed of 10Mbps to all premises in the UK, without a USO and without further public funding. We can do this by the end of 2020 and are working with the UK Government and Ofcom on how best to achieve this. New technologies will need to be approved and we will also need the right regulatory support to make such a commitment commercially viable.

With respect to the Scottish Government's 30Mbps ambition, if there is public funding to support higher speeds and to deliver the wider benefits that are achievable at higher speeds then we are fully behind that. The issue is if we are expected to pay for the delivery of a higher speed when it does not make commercial sense currently. If there is gap funding¹¹ available to deliver these societal and economic benefits then we absolutely stand ready to assist.

BT therefore supports the ambition of delivering superfast broadband across the whole of Scotland, and has the means to deliver this in a long-term sustainable manner that will ensure the network can continue to handle growing traffic needs as demand and usage increases. However, as the Scottish Government recognises, the commercial viability of these solutions at the network build level is currently very unlikely which is why our solution seek to enable other beneficiaries to also contribute in order to deliver benefits to communities and the economic growth of Scotland as a whole.

BT Scotland,
November
2016

¹⁰ The benefits of broadband and thus how any cost might be best recovered are multi-faceted. Benefits flow to the network provider in the form of network service rental but also to the serving CP from the revenues generated by the end user offsetting the additional installation costs that may have been incurred. There are, however, also potentially significant benefits to the end user from being able to carry out their business or social needs online and from their chosen location. There are also considerable benefits for other service providers, for example: paid-for premium streaming service such as Netflix, government benefiting from lower online costs compared with premises-based service, etc., which should be factored into any cost/benefit calculation.

¹¹ What the gap funding/state aid approach allows is for such economic benefit "mismatch" to be addressed by extracting value from the economic benefits in taxation and reinvesting it via government funds into the infrastructure.