

BT Response to the Ofcom call for inputs on: “Designing the broadband universal service obligation “

Executive summary

- 1) BT continues to support the objective of universal, effective broadband. For us, this will continue as a journey to bring new technology and speeds to the UK
- 2) Industry including BT continues to invest. Creating the right environment for this continued commercial investment will help to ensure the delivery of universal coverage and will minimise and possibly remove any need for a formal USO. (Introducing new USO legislation does not of itself change the essential economic problem of reaching unserved areas)
- 3) Any regulatory or legal intervention must be driven from a clear diagnosis of shortcomings in current regulation and markets.
- 4) If the Government and/or Ofcom proceed with setting a universal service definition for any purpose then they must set down clear, permanent criteria that reflect how the societal problem will be addressed and equally reflect industry, customer and government costs.
- 5) The UK has a successful broadband industry. The design of any intervention the Government chooses to make must not be a barrier to investment or a distortion of the market.

Introduction and premise for BT Response.

BT recognises that the Ofcom call for inputs results from a request from government to investigate the details of a potential new USO for broadband, including the key items on specification, demand, cost etc. identified in the Ofcom document. BT has made it clear, both publicly and in responses to DCMS that a service as required by the Government can be delivered commercially by the market to all premises in the UK that require it, given the right regulatory environment. BT stands ready to invest in these areas. We are therefore unconvinced that it is possible currently to determine various factors such as “the expected market availability of broadband” required by the EU Commission for the implementing a formal USO.

We therefore consider that Ofcom should, through this analysis process, seek to adjust the regulatory environment so that the market can invest more fully in rural areas rather than seeking to impose a regulated solution on the industry. Our analysis shows that a market led, coverage based solution could address over 99% of UK premises with a solution that delivers at least a 10Mb/s download speed with acceptable characteristics in terms of capacity, latency etc. aligned with the rest of the UK market. This would leave the remaining <1% of UK premises which may still be best addressed via an “on demand” scheme. These remaining premises, depending on the capabilities required, may require and be best addressed via specific funding on demand. However an on demand approach across the whole of the “final 5%” will be very inefficient and will not represent good value for money, however it is paid for.

Key to the “market led” approach and commercial delivery is our analysis that the most cost effective and efficient means of delivering the remaining coverage entails the pre delivery of aggregated network build solutions to the majority of any remaining premises. (E.g. to over 99% of the UK.) Any “certainty” of delivery implied by a USO can be delivered via a supplier (or suppliers) committing to make services available to an area by a given build date. Individual requests to connect customers to the built network would then follow in the served area. Any “on demand” requirement where network was not already pre built would be confined to the last less than 1%

where we expect aggregated network solutions are unlikely to be viable i.e. areas where a per premise solution, rather than an aggregated one are likely to be the most economic.

BT believes that Ofcom need to make the following enabling changes to the regulatory environment in order to enable the market to deliver:

- 1) Ensure continued regulatory freedom for wholesale fibre product prices to ensure the market has the confidence to make the commercial investments associated with delivering to these premises
- 2) Actively support the introduction of new LR-VDSL technology that will lower costs
- 3) Commit to a stable environment for universal services enabling the market to have certainty over returns rather than being unsure as to the outcome and potential escalating requirements from frequent reviews.
- 4) If the Government and/or Ofcom proceed with setting a universal service definition for any purpose then they must set down clear, permanent criteria that reflect how the societal problem will be addressed and equally reflect industry, customer and government costs.

Specification and scope of the USO;

This aspect is to the analysis for any assessment of impact, benefits and costs of a USO. It is also key in determining the technology options that are likely to be able to play a part in delivering the requirement and the contribution each can make. 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 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 proposed service and thus need to be understood prior to implementation. For example; must a USO broadband service always be capable of delivering multiple video streams (HD or SD) to multiple users at the same time? Social inclusion is unlikely to require multiple simultaneous uses and even if it did the typical UK household is approximately 2 people and less than 20% of UK households have 4 or more people. Furthermore Ofcom will need to assess fully the impact of 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 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 solution including satellite, mobile/4G, Fixed Wireless Access, traditional copper networks, hybrid copper/fibre networks and full Fibre To The Premise 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 in extremis only full FTTP networks might be acceptable. However, the cost/burden of any solution would also rise as technological options are ruled out.

Assuming any form of broadband USO is considered to be appropriate, it should extend only to occupied premises. Non-served premises, site offices and temporary sites should not be included as

standard as the limited benefits, costs and unpredictability will be prohibitive unless the customer agrees to pay above a reasonable limit.

We would also make the general point that any consultation or output should be forward looking and future proof for the introduction of “single order” broadband products from Openreach and other network providers. Today, customers get a telephone line as a pre-requisite to having a broadband services. With single order broadband, customers will no longer get a telephony service with their line, they will get a physical line over which broadband is delivered. From 2018, we expect on the BT network that if the customer also wants a telephony service, there will be a pre-requisite of having a broadband line and that by 2022 we anticipate that the PSTN voice service will be withdrawn.

So we need to make sure that any broadband USO if implemented:

- will be fit for purpose for future broadband products;
- may need to be combined with the USO for telephony;
- would need to interact effectively with the voice USO even if provided by different designated providers;
- is consistent in terms of charges for telephony and broadband.

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 premise?
- 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 be performance/compliance against any USO specification be assessed e.g. at build/delivery and ongoing?

There are various models and predictions of broadband demand that are available e.g. Cisco growth curves (although this primarily focusses on total data download NOT access bandwidth and thus can be very misleading), predictions from the European cable forum, surveys conducted by the European Commission and indeed the models produced in the UK by the Broadband Stakeholder Group¹ in conjunction with the UK industry and Ofcom/DCMS. And of course Ofcom themselves produce detailed data sets on current speed, coverage and usage for the UK networks. Some of these studies also specifically look at SME/business use going forward.²

¹ <http://www.broadbanduk.org/2013/11/05/bsg-publishes-new-model-for-analysing-domestic-demand-for-bandwidth/>

² <http://www.broadbanduk.org/2015/09/02/bsg-publishes-new-model-on-small-businesses-connectivity-requirements/>

All of the relevant models have as a prime focus, peak bandwidth demand for unconstrained bandwidth for commercial services, with varying degrees of consideration of other factors such as latency, jitter etc. and also to a varying extent upload speed and monthly download capacity etc. The prediction of a future USO requirement is potentially different however in that it is not looking at unconstrained demand but at a demand associated with a minimum service level needed for social inclusion. As a result issues such as how many simultaneous users should be assumed to be able to access services via the link may have very different answers in a USO based model, and particularly for video based services, issues such as the image quality (SD, HD, 4K, etc) may not be as relevant. For example, must a USO delivered video service always be available in the highest quality even though such quality differences may not be perceived by the human eye or indeed have a marginal impact on the viewing experience? Must a USO broadband service always be capable of delivering multiple streams to multiple users at the same time, even though the typical UK household is less than 2 people, and social inclusion is unlikely to require multiple simultaneous usage? Even Ofcom's own assessment of why a household may need 10Mb/s, as shown in the latest connected nations report appears to require 4 simultaneous users and at least one HD video stream (presumably to a large screen device) to require this speed, and this is of course before any further advances in video compression technology are factored in.

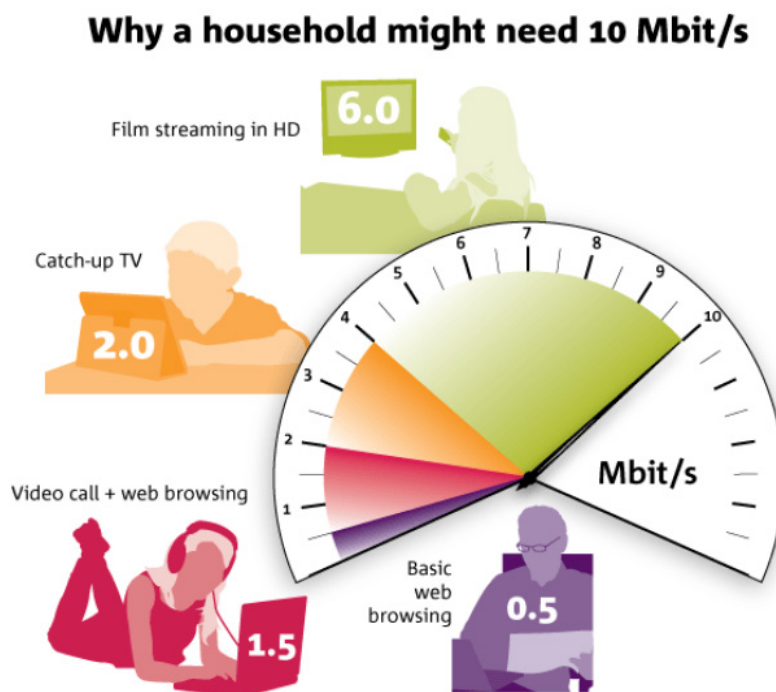


Figure 1 - Ofcom illustration (source "connected nations report 2015") of potential need for 10Mb/s showing reliance on HD video AND multiple simultaneous usage.

Another key component in any assessment, given the likely continued dominance of video as a broadband payload, either as current VoD/TV type services or via future video based applications, is the impact of data compression on video payloads. Video compression techniques have proven

hugely successful in the past in dramatically reducing the data payload of video streams, whilst preserving and indeed enhancing the video capability perceived via the user (see chart below).

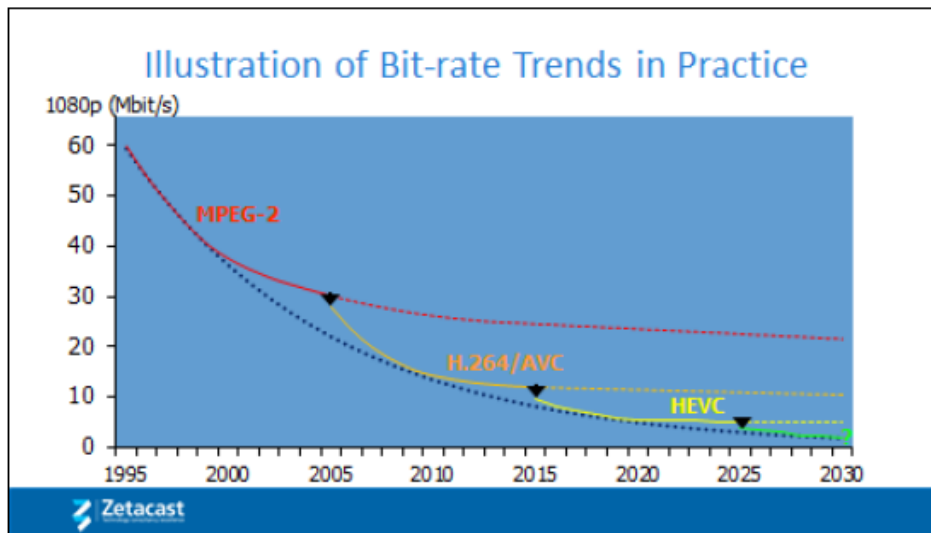


Figure 2 - Bit rate required overtime to transmit HD video content via various encoding schemes. (Historic and expected)

It is therefore imperative that when considering the capabilities of any USO service, Ofcom take into account the types of usage considered necessary for a USO service that enables social inclusion, the current service specification needed to convey those services, AND how that specification is expected to change, both up and down (e.g. as a result of compression) over the investment period of any USO build.

We have conducted our own modelling work in this respect utilising the principles and approach of the BSG model, since this is both publicly available and also supported and underwritten by all the key players in the UK industry and government etc. This bottom up approach also allows us to consider the key factors of what services/service types will drive a USO demand, how those drivers are likely to change over time e.g. through data compression, as well as the potential or need for simultaneous use of services in a USO situation.

EU legislation and its impact on USO performance specification:

In addition to the various considerations above which are generally relevant to any plans for universal coverage of broadband in the UK, we understand Ofcom and the Government are seeking to define what may be required under a formal legal USO under the terms of the EU Directives. It will therefore also be necessary to ensure that any specification and requirement are considered against the current and any emerging EU position on USO.

The current Universal Service Directive requires the provision of access to fixed telephony and “functional internet access, taking into account prevailing technologies, used by the majority of subscribers and technological feasibility.” The scope of Universal Service is not fixed under the Directive. Instead, it must be reviewed periodically. The last revision took place in 2011. The

European Commission used the following set of criteria when reviewing the Universal Service concept:

- “ 1. Are specific services available to and used by a [substantial]⁴⁰ majority of consumers and does the lack of availability or non-use by a minority of consumers result in social exclusion?
2. Does the availability and use of specific services convey a general net benefit to all consumers such that public intervention is warranted in circumstances where the specific services are not provided to the public under normal commercial circumstances?”

This set of criteria is coherent with Recital 25 of the Universal Service Directive. Also, Recital 25 mentions that “evolving social, commercial and technological conditions” should be considered. Part of the 2011 review was the question of whether mobile telephony and broadband should be within the scope of Universal Service. The European Commission concluded that neither service should be considered as Universal Service. For mobile they concluded at the time that the market was competitive and consumers were able to get access at affordable prices without the help of a USO.

In contrast, broadband penetration was deemed too low to justify intervention at that time. The requirement of ‘a substantial majority of the population’, as set out in Recital 25 of the Universal Service Directive, was not met. Broadband’s penetration rate of homes was still insufficient in a few Member States (in 5 Member States it was below 50%) to include broadband within the scope of Universal Service. To achieve Universal Service it was concluded, service providers would have to bear unreasonably high costs and consumers in Member States with a low penetration rate would be likely to suffer from high prices.

As a result the European Commission concluded that it “does not see a need to change the basic concept and principle of Universal Service as an instrument for preventing social exclusion. At this stage it would not be appropriate to include mobility or mandate broadband at a specific data rate at EU level.” However, Member States were free to incorporate access to basic broadband in the scope of Universal Service especially when the market does not provide “universal broadband coverage.” Nevertheless, the European Commission suggests following a common approach and provides guidelines. Specific data rates can be included in cases where broadband penetration has reached “at least half of all households”, and where the data rate is achieved “by at least 80% of all households with a broadband connection.” This approach by the European Commission ties the USO to both ubiquity of access and penetration rates.

It therefore appears important to BT that Ofcom, in seeking to determine a possible performance value of a broadband USO under the current EU Directive, would need to understand the speed/performance that “at least 80% of UK households with a broadband connection are using” currently. Although the data to enable such an analysis is, we understand provided to Ofcom as part of their Connected nations report data gathering exercise, we are not aware that any formal analysis to determine the performance that “at least 80% of UK households with a broadband connection are actually using” (as opposed to capable of receiving) has been done on such data. However based on our own data for performance of the Openreach network only, a figure in the region of 8-10Mb/s would currently be likely for services that are actually being used by customers even though superfast availability on our network now stands at more than 25 Million premises. This may of course be an underestimate once the contribution of the Virgin network is added in.

In addition to outlining how a relevant USO performance level could be set, the European Commission also suggests including the following criteria when assessing whether broadband should be become part of a USO:

- the expected market availability of broadband without public intervention;
- the social and economic disadvantages incurred by those without access to a broadband connection, including disabled end-users;
- the cost of public intervention via USO and a comparison of this cost against the use of other approaches;
- the benefits of public intervention and its effects on competition, market distortions and broader policy objectives.

These criteria are very relevant given the task set by Ofcom of determining what a broadband USO (if needed) should be and we have addressed them in more detail in relation to a potential UK broadband USO below.

On the first point: *“the expected market availability of broadband without public intervention”* The UK already has broadband availability at Superfast speeds of over 90% at a premise level and is on track to achieve 95% availability by the end of 2017. In addition at the proposed USO level of 10Mb/s, the UK already has availability of over 95% today³ and given the continued roll out plans of fibre networks to over 95% of the UK this is likely to rise on current plans. In addition BT has publicly stated that it is *“Ready to deliver a 10Mbit USC”* and is *“Developing and testing technology and commercial options for voluntary delivery of universal broadband”*⁴ subject to Ofcom removing regulatory barriers to enable the economic viability of its plans. It therefore appears very clear to us that there is a strong expectation that the market can deliver universal broadband without public intervention.

On the second point: *“the social and economic disadvantages incurred by those without access to a broadband connection, including disabled end-users”* although there is a large body of evidence of the advantages to consumers and business that broadband access can bring, there are also 22% of UK premises that choose not to use a fixed broadband connection in the UK today⁵, implying that any social disadvantages there may be are not universally acknowledged. At the end of 2015, Ofcom reported that 83% of premises had access to superfast speeds and yet 29% of premises currently consume broadband products at less than 10Mb/s⁶. Even making the simplistic assumption that all premises outside superfast coverage are broadband customers not capable of greater than 10Mb/s, this implies that at least 12% (approx. 3.6m) of all premises choose to remain on a sub 10Mb/s line when superfast is available.

On the third point: *“the cost of public intervention via USO and a comparison of this cost against the use of other approaches”* BT has estimated, in evidence given by Gavin Patterson to the DCMS Select committee that our solution for a USO is in the order of £1Billion pounds and potentially much higher depending on specification and thus technology needed. These figures also take no account of any administration or running costs associated with a potential USO fund including for example procurement, monitoring, validation etc. In the case of USO these would normally be met either via levies applied directly to industry players or through other taxation methods. Alternatively

³ <http://labs.thinkbroadband.com/local/>

⁴ <http://www.btplc.com/Sharesandperformance/Quarterlyresults/Investormeetingpack23May2016.pdf>

⁵ Ofcom Communications Market report August 2015

⁶ http://stakeholders.ofcom.org.uk/binaries/research/infrastructure/2015/downloads/connected_nations2015.pdf

a commercial approach of delivery as proposed by BT would see cost borne by a combination of BT customers and or shareholders with no direct cost impact on the industry or the public purse.

On the fourth point: *“the benefits of public intervention and its effects on competition, market distortions and broader policy objectives”* it is clear that any intervention has the potential to distort the market, but such distortions would need to be minimised consistent with seeking to achieve the broader policy objective. In the current UK case we understand the broader policy goal to be to deliver a good high speed broadband service to all fixed premises that need it, at a speed consistent with general internet services, currently presumed to be 10Mb/s. Given that BT has already stated that it is prepared to commercially deliver such a service across virtually all the UK subject to the right regulatory environment; that Virgin, through their Project Lightning, are actively building new network coverage; that the current and future BDUK contracts, plus the impact of any gainshare or other efficiency gains will result in yet further build; and that there are a number of other competing providers who have secured funding, both public and private, to build fibre networks in rural areas over the next few years, the potential for a USO to distort these investments if done too early or with a specification that could compete with commercial deployments is significant. Thus any intervention will need to be very carefully designed and targeted if it is not to unduly impact these various ongoing and planned investments.

How should we ensure the USO is affordable?

The underlying challenge that the suggested USO is intended to address is universal availability of an effective broadband service. We have therefore looked at how we believe this underlying goal can best be delivered before turning to a USO approach.

In the absence of further public funding, we suggest that creating the conditions for voluntary commercial investment will meet the goal of universal coverage more effectively, more economically and more quickly than creating legally enforced obligations, at the very least we believe that commercial options should be maximised and encouraged to deliver as far as possible prior to any universal obligation being imposed in order to minimise any burden or market distortion and maximise affordability. For commercial investment to deliver universal coverage we suggest industry needs a framework with the following characteristics in principle:

- Sufficient cash can be generated to fund the investment (cash-flow challenge),
- Sufficient return can be generated over a reasonable period to make the investment worthwhile and to reflect market and execution risks (profitability challenge),
- Sufficient confidence that the framework will be stable for many years reflecting the long payback periods required (certainty challenge),
- Sufficient confidence in market demand, particularly at higher prices (market challenge),
- The ability to aggregate premises together to share build costs and plan network rollout over a realistic timeframe (deployment challenge)– meaning that some may need to wait for deployment to reach them,
- Equitable across industry, to avoid distorting a successful market and to ensure that currently planned commercial investments continue, and equitable for end-customers (policy challenge).
- Flexibility to allow commercial decisions on the right technology to deliver 10Mb/s where needed; for example, using fibre, wireless or satellite as appropriate (technology challenge).

We do not at this stage have specific proposals to offer on the nature and design of an industry funding scheme. However, to illustrate how a scheme that encourages commercial investment to deliver universal availability could work, we suggest the following key elements be considered:

1. Continuing to allow the market to price fibre broadband services at the wholesale and retail levels. This will allow sufficient profitability and cash to be generated to support further investment with prices constrained by market demand (willingness to pay) and by competition (between fibre, cable and mobile players). In contrast, the introduction of price regulation to reduce prices artificially will reduce the funds available for commercial investment.
2. Continuing support for market based pricing so that different prices could potentially be charged to connect to customers in areas that are more expensive to deliver or revenues from across the market used to invest in more expensive areas. This is essential for building to more dispersed areas to be profitable. The design of pricing schemes would be for each market player to consider.
3. A high degree of confidence that these key elements will not change for a reasonable period of time (i.e., at least a decade) to allow investments that give 10+ year paybacks.

A complete framework may need further elements but these three points are the most fundamental. We believe that with such a commercial framework in place, industry players including BT will invest to take good broadband services, of around 10Mb/s, to coverage of about 99%.

We do expect that there will be a small number of very remote premises that will always be beyond the reach of commercial fixed or wireless deployments (less than 1%). We believe the best solution is that these be served by satellite or mobile-wireless type solutions if they are to be "affordable" on a similar basis to the rest of the UK. However, if fixed solutions are required for these most remote locations, then due to the disproportionately high cost to deploy such solutions in these locations there may be a need for customer or further public funding at a later stage to reach these premises with such a solution if needed. The location of these final premises would become clear as commercial deployment nears completion. A Government voucher-style scheme may be appropriate at a later date to deal with these isolated cases, with vouchers available according to agreed criteria.

In such cases i.e. where the limits of a commercial build out have been reached and a fixed type service capability, beyond the capabilities of satellite or similar then the following fundamental points may need to be considered:-

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1. Initial charge set for end customer based on market,
2. A maximum cost for CPs per connection to be set,
3. Government funding available e.g. via voucher or similar when charges in 1 & 2 are insufficient.
4. Option for customer to agree to pay additional amounts above amounts in 1 & 2 if service is required and/or funding not available.
5. CP does not have to provide service if limits in 1 & 2 would be exceeded and neither the customer nor government funding is made available.

So far, our answer to this question has focused on the underlying goal of universal coverage rather than how a USO scheme could work. This reflects our view that, in the absence of further public funding, creating the conditions for voluntary commercial investment will meet the goal of universal coverage more effectively and more quickly than creating legally enforced obligations.

Turning to a USO scheme, we are unclear how this could work effectively and we remain willing to help DCMS and Ofcom in their analysis to develop an approach. At this time we would like to note the following key points:

- The impact of any obligation if it were to be imposed should be fairly distributed across the broad and competitive industry that would benefit from the resulting coverage. In the UK, consumers benefit from a choice of 300+ ISPs who deliver broadband across copper, fibre, cable, mobile, wireless and satellite technologies. All of these are within scope as contributors to USO funding, in our view.
- A universally available service will also enable users to access services from a whole range of global, regional and national “over the top” providers such as Amazon Prime, Netflix, Skype, Facebook, Google, the BBC (iPlayer) and many others. Indeed the BBC licence fee funding was a significant contributor to the BDUK funding for Superfast in the final third. These are also within scope as potential contributors to USO funding, in our view.
- Therefore, any USO cost distribution will need to consider the breadth of players who sell and benefit from broadband, the full range of technology used in its delivery and the range of players investing to deploy and those who benefit from that deployment.
- Any obligation should not deter or harm commercial rollouts. For example, we note the challenge that any delivery to a premise driven by a USO would first need to check whether that premise is already covered or planned to be covered by commercial build.
- Broadband service is built to cover areas not individuals. The economic imperative of sharing high build costs across many customers means that fixed and mobile networks are built to cover multiple premises not one. An obligation driven by an individual citizen’s right to request would lead to highly expensive, slow and inefficient build and would distract players from their commercial build plans.

Should there be a social tariff for broadband services?

Social tariffs already exist in the UK for broadband services for consumer customers and are offered by BT voluntarily and proactively in addition to the requirements of the current USO requirements for voice to people in receipt of relevant government benefits to enable all consumers regardless of wealth or social position to access broadband services. We would seek to encourage other broadband providers to follow BT’s lead in this respect and offer their standard broadband services to relevant groups as part of a social package. The extension and continuation of this approach could therefore ensure that the issue of affordability of broadband services continues to be addressed in the UK, without the risk of current and potential future local broadband network monopolies not offering “affordable” services. We see no reason for social tariffs, either voluntarily offered or compelled via regulation to be made available to business users.

The issue of ensuring a broadband capability is available at a bandwidth and service specification suitable for delivering universal broadband (a more universally available technical capability) is the prime issue for Government and Ofcom as we understand it in this call for evidence. i.e. How to ensure a minimum technical capability to deliver these services is available across the UK? That does not mean that these technologies should be made available in other parts of the UK where existing technologies and services already exist that can deliver the required capability.

Where the provision of the required USO service to a location involves particular cost barriers. E.g. very remote/difficult to reach location etc. that we expect to be confined to less than 1% of the UK there may however need to be consideration of additional funding e.g. in the form of vouchers or other targeted assistance to help overcome these initial connection costs. Targeting these funds at particular social groups or community based business may be desirable.

Demand for the USO;

What might the potential demand for the USO be?

It is likely that demand for a broadband universal service in those areas where it cannot currently be reliably delivered at the proposed USO speeds, will tend towards the national take up levels for fixed broadband as a whole. According to Ofcom's latest Communications market report this would represent a maximum take up currently in the region of approximately 78% for fixed broadband services (including respondents with fixed only and fixed plus mobile). However many customers in sub 2Mbit/s areas already receive and indeed take up an existing broadband service albeit at speeds of less than 10Mb/s. The take up of a new USO based service at 10Mb/s is therefore highly likely to be influenced by the existing speed available and the relative differential in both performance and price between the current commercial offering and any future USO product.

Customers are willing to pay for access to networks that meet their needs for a broadband service. BT believes that the basic pricing model for communications networks (that customers will be willing to pay for services fit to meet their needs) is sound. Customers typically pay a connection charge and a monthly rental charge.

UK broadband prices are amongst the lowest in Europe. This is likely to be because the UK is also the most competitive broadband market in the world. As a result, it is generally not possible for one operator to act independently of the pricing conditions prevailing in the market. We do not generally consider that it is possible to increase broadband prices out of step with market pricing conditions.

It is possible to charge higher prices for higher speed broadband services in some instances. For example, the average revenue per user per month generated by BT from a fibre broadband service (up to either 40Mb/s or 80Mb/s) is higher than that generated from a copper broadband service (up to 24Mb/s). However, the willingness to pay an increment for superfast speeds over standard broadband speeds is limited. Furthermore, a willingness to pay an increment for ultrafast speeds is concentrated in a small proportion of the customer base. There is public domain evidence from a number of countries that illustrates this e.g. in Australia where FTTP speeds have been available alongside a range of other speed packages for some time and where the evidence is that users are predominantly selecting the lower speed/lower price services.⁷

⁷ <https://www.linkedin.com/pulse/nbn-missing-superfast-customers-robert-kenny>

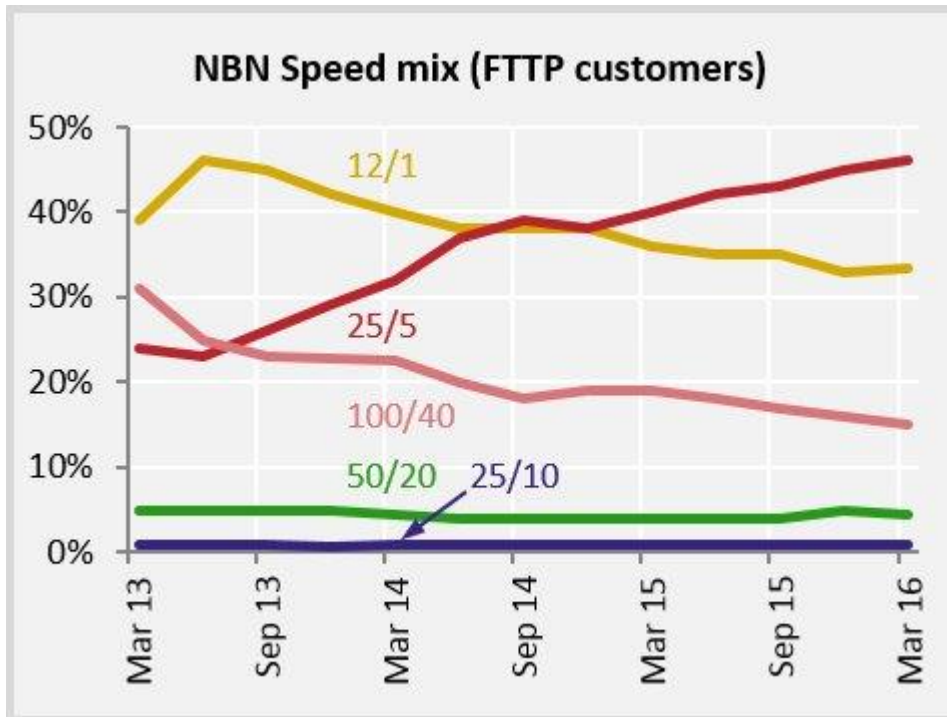


Figure 3 – Mix of broadband speed packages purchased by customers over time in the Australian fibre market- Source: Communications Chambers/Robert Kenny

We are concerned therefore that price elasticity of demand may also be low between 2 and 10Mb/s – particularly once customers have at least 5Mb/s. Customers are unlikely to be willing to pay for small improvements; for example, an increase from just below 10Mbit/s to 10Mbit/s is unlikely to be an increase customers would be willing to pay for. Re-pricing services at this level of speeds would have to be a matter of a change in market pricing conditions in general.

We find that customers show a greater willingness to subscribe to fibre broadband when they are currently receiving slow broadband speeds with customers on less than 5Mb/s more likely to pay the extra to get superfast speeds than those who already get more than 5Mb/s. This is indicative to us of a theory that 5Mb/s broadband is at present an important speed experience expectation for customers.

All of the above tends to point to take up of a USO service in areas where such a capability is not currently available being higher than that typically seen for superfast services but lower than that for broadband as a whole. Take up rates in the region of 40-50% may therefore be expected for a 10Mb/s USO service, although this may be significantly lower where existing commercial services are already delivering close to the USO speed.

Cost, proportionality and efficiency of the USO;

Cost evidence

As we have stated above, a key driver of the cost of delivering any USO service will be the specification of the actual service to be delivered. Our response above goes into some detail on how changes to the specification would impact on the technology choices available to deliver the required service and thus the cost implications of deploying a suitable mix of technologies. Also

important here is consideration of the longevity of any solution and thus the scope for review and future change of the service requirement. The more frequent the review period the greater the likelihood that service requirements will increase and thus any solution will need a varying degree of “future proofing” to match this risk.

Thus the definition of a USO service will be a key determinant of the technologies that could be considered to fulfil it and thus the cost of deploying such technologies. In particular we note the following characteristics to be considered in any future obligation:

- The level of sustained bandwidth required alongside a peak requirement; for example, a sustained bandwidth of 5Mb/s alongside a peak requirement of 10Mb/s.
- The threshold below a defined level at which a scheme would apply; for example, there would be little customer benefit in upgrading a 9Mb/s line to deliver 10Mb/s.
- The longevity of a definition: whatever broadband speed level is set, changing it frequently could undermine investments made to deliver a previous definition.

In addition, we believe that a goal for a scheme is that it should be technology neutral as far as possible, allowing the best solution to be chosen for a circumstance and allowing new technology to be introduced should it be relevant.

A discussion of technologies follows:

- **Copper broadband** – ADSL technology is able to deliver speeds of up to 8Mb/s. However since this is below the 10Mb/s speed threshold the government is seeking we have included it here only for completeness.
- **Copper broadband (2nd generation)** – ADSL2+ is the most wide-ranging copper broadband technology today, covering approximately 95% of premises when all providers are taken into account (ADSL2+ is an exchange-based broadband technology, which lies in the domain of the many Communications Provider that offer service in the UK, including LLU-based providers as well as BT). It is able to deliver speeds of up to 24Mb/s, which should be sufficient to meet a 10Mb/s speed requirement for most customers. On longer lines ADSL2+ will not be able to meet a 10Mb/s broadband speed requirement (fixed broadband speed attenuates with line-length), so the applicability of this approach to meet a USO will be limited to fewer (shorter) lines the more demanding is the USO standard. Also, if the target USO rate were to be increased over time, then the applicability of ADSL2+ technology will be limited to shorter lines, as there is no clear upgrade path for this exchange based technology. It is clearly a relevant wide-ranging technology for consideration in this policy development.
- **Fibre broadband (FTTC)** – BT is in the process of deploying a fibre broadband network, both commercially (currently approximately 20m premises) and for BDUK (approximately 5m premises), primarily based on an approach of deploying fibre to street cabinets (fibre-to-the-cabinet or FTTC) and implementing VDSL broadband in these cabinets. This technology is able to deliver super-fast (up to 80Mb/s) broadband at present. As with the copper broadband, speeds attenuate with line-length, such that on a small proportion of much longer lines FTTC is still not able to meet the 10Mb/s speed threshold.
- **Fibre broadband (FTTP)** – BT (and several smaller operators) are in the process of deploying fibre access networks, with the fibre directly connected to the end-premises (fibre-to-the-

premises of FTTP). These networks are able to deliver ultra-fast services to connected premises and so provide a path well beyond the requirements of a 10Mb/s USO data rate. They are relatively more expensive to deploy and consequently have limited coverage (less than circa 500k premises to date). However following a review of BT's FTTP product deployment designed to lower the cost of FTTP delivery and ongoing network trials we have recently announced our ambition to deploy up to 2million FTTP connections by 2020 in new build homes, rural areas and where it makes economic sense to do so. With FTTP, speed does not generally attenuate with the length of the optical fibre, but the costs of deployment are dependent on line length. Consequently FTTP can be relevant in relation to very distant and dispersed premises, but at a very high cost.

- **Cable broadband** – The current cable network (belonging to Virgin Media) is also a relevant technology. (BT does not own cable networks but we have included the technology for completeness). Cable networks are able to exceed 10Mb/s so can meet the proposed USO rate and are capable of super-fast speeds and ultra-fast broadband speeds too. Virgin Media have announced expansion of their existing footprint (by 4m premises) to give them more than 60% coverage of premises in the UK, which is expected to enable a 10Mb/s service for some of those premises to which this data rate is not currently available.
- **Long Reach VDSL (LR-VDSL)** – LR-VDSL is an emerging technology to increase the range of cabinet-based broadband from new and existing installations at the street cabinet. Equipment to support this is not currently available and industry standards need to be completed, but BT is making significant efforts within the industry to bring these to fruition. A significant challenge to deployment is that the technology is incompatible with exchange based broadband. LR-VDSL could deliver 10Mbit/s speeds to more and more distant premises served by cabinet-based broadband (FTTC), but is unlikely to deliver super-fast speeds over relevant distances.
- **Ultrafast broadband (G.Fast)** – BT has announced its intention to deploy an ultrafast broadband network to 10m premises in the UK by 2020. We intend to use G.Fast technology deployed in street-cabinets to deliver speeds of between 300Mb/s and 500Mb/s. However, this is not generally a technology relevant to a 10Mb/s broadband USO. Because the G.Fast technology uses a wider range of higher frequencies on the copper line, and because these higher frequencies propagate less well than lower frequencies, G.Fast does not improve line speeds on longer lines, only on shorter ones. To address long lines with such an approach it would be necessary to deploy G.Fast equipment beyond the cabinet and deeper in the network which is likely to involve considerable cost.
- **Fixed line bonding** – Summing the capability of multiple connections to a premises to achieve a target rate can be achieved if the additional lines are available. The combining of the two connections to meet USO requirements can be done by the Internet Service Provider in their own servers. This service is available today. ISPs buy multiple pairs of copper connectivity to deliver higher performance and resilience. Further study is required to determine the availability of multiple lines in areas of sub 10Mb/s premises. The ability to upgrade to higher data rates will be dependent on the availability of additional fixed connections. But this could be a technology relevant to a 10Mb/s USO in some areas.
- **Mobile Broadband** – The coverage of current 4G networks is expanding rapidly and all operators have announced an expectation to reach 98% population coverage (by 2017). Some operators (Including EE) are already using their 4G networks to deliver a fixed wireless

broadband service of 10Mb/s, but volumes are very small (we believe less than 5k lines). Mobile broadband faces two key issues, but these may or may not be a problem depending on the specification and purpose of any USO service. Mobile broadband signals do not always penetrate into buildings well; however to solve this problem to a fixed location it is generally straightforward to install an external antenna. The second potential issue is that the inherent shared capacity of mobile networks is limited. This shared capacity leads to the possibility of high peak rates being available when the network is quiet but significantly reduced sustained rates if the network is busy with simultaneous heavy data use (e.g. streamed video). The definition of USO peak and sustained rate requirements will have a significant impact on the applicability and ability for upgrade of mobile broadband. The extent to which this shared capacity is a limitation will depend on the specification of the USO in terms of contiguous use and data download limits etc.

- **Fixed wireless broadband access**– There is also a small market in fixed wireless broadband access, which is capable of delivering 10Mb/s broadband in some areas with some capacity. This may be relevant as part of the Ofcom’s consideration.
- **Fixed and mobile bonding (hybrid access)**– The bonding of fixed and mobile connections to provide a target data rate could be used in circumstances where the fixed line cannot provide the target data rate but is capable of carrying most of the data generated by a user and where a higher rate is needed occasionally, which can be achieved by the data flowing onto the mobile network. This increases the end-user speed while reducing the capacity concerns of standalone mobile broadband. This service has already been deployed by Deutsche Telekom in Germany. Further study is required to determine the level of overlap between mobile network coverage and capacity and the location of slower fixed broadband lines. The definition of USO peak and sustained rate requirements will have a significant impact on the applicability and ability for upgrade of mobile broadband. Thus again as with mobile networks above the extent to which this shared capacity is a limitation will depend on the specification of the USO in terms of contiguous use and data download limits etc.
- **Satellite broadband** – Satellite provides the benefit of near ubiquitous coverage but the disadvantage of capacity limitation, in a more severe way than mobile broadband. Peak rates to meet the USO target can be delivered when demand is low but concurrent use will reduce the sustained rate in busy periods. The definition of USO peak and sustained rate requirements will have a significant impact on the applicability and ability for upgrade of satellite. The extent to which this shared capacity is a limitation will depend on the specification of the USO in terms of contiguous use and data download limits etc.

The cost of deploying a service will therefore depend on:-

- the mix of technologies needed to meet the service definition,
- the deployment method for those technologies e.g. managed network build out vs “on demand”
- how many premises are delivered with each technology,
- how dispersed they are relative to each other.

For example in BT’s case sub 10Mb/s premises are currently distributed across the whole of our UK network. When we analyse our network according to the geographic areas covered by our (approximately) 5,600 exchanges, our estimates show that the vast majority of the approximately 5,600 exchange areas in the UK will have some sub 10Mb/s premises after 2018 when the currently

funded BDUK deployments will conclude. However, circa 50% of these are likely to be in 750, predominantly rural, exchange areas. This implies that the range of solutions may well be different in different areas to match the different “problem densities.”

When Gavin Patterson appeared in front of the DCMS select committee he outlined the expected range of costs to deliver a USO based on our current view and against a potential mix of solutions including FTTC, Long range VDSL and some FTTP in the most remote areas. Such a solution is likely to cost in the range of £1 billion to £2 billion.

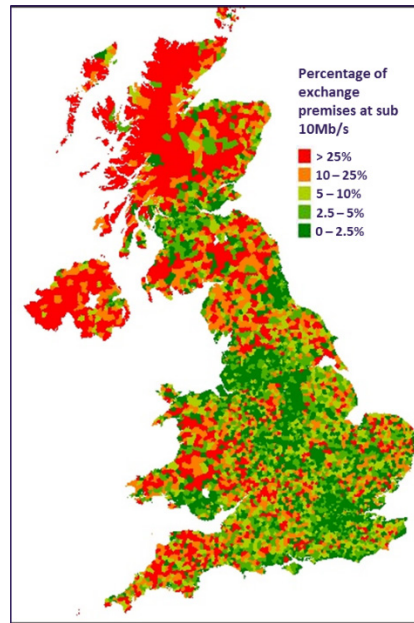


Figure 4. Map of BT exchange areas coloured by the proportion of the exchange premises that could not receive a 10Mb/s connection in 2018

These costs are primarily related to the build costs of a network that would then need to be made available for use by providers at the wholesale level. The costs and mechanisms for providing and consuming such wholesale access services are also key if a local monopoly situation or at least restricted consumer choice is to be avoided.

We expect that CP customers of these networks would expect input costs to be the same across all geographic areas and without large upfront costs that need to be borne by them or passed on to their customers. Remote locations, new sites, and non-served premises should be subject to the customer bearing the costs if they exceed a defined threshold to prevent inefficient decisions being made about location. Similarly CPs are likely to expect any process or systems required to offer their services over this infrastructure to be fully tested and agreed as being fit for purpose before any commitment is made.

The benefits of broadband and thus how any cost might be best recovered are multi-faceted and more complicated than those of a simple telephony service. 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 services such as Amazon, Apple, Spotify, Netflix, government benefiting from lower online costs compared with premises based service, etc.,

which should be factored into any cost/benefit calculation and a way found to generate contributions from these beneficiaries should they prove necessary to fund such a service.

Proportionality and definition of a 'reasonable request'

Ensuring efficiency

The issue of what constitutes a reasonable request under a USO and also the issue of efficiency are potentially linked, depending on the deployment method chosen. For example the government have proposed that the USO could be delivered "on demand" rather than via a general network build. The reasons given for this approach appear to be based on uncertainty over the demand for such services, thus "on demand" would limit the need to build where the service was not taken up. However, if demand is indeed uncertain then the definition of these services as essential and thus relevant to a formal USO should also be questioned.

In addition, given the nature of most technological solutions for delivering these services, apart from potentially satellite, and that they involve significant capital outlay to build to an area initially with a generally relatively small additional cost to connect individual customers within the built area, an on demand response for the majority of the final few % of the UK is likely to be highly inefficient, expensive in comparison to a network pre build, and take much longer to deploy. For example BT has been consistently deploying its main FTTC solution in rural areas as part of the BDUK programme at a rate of 60,000-100,000 premises per week even in remote areas, and at the peak of the commercial deployment programme we were building over 2 Million premises per quarter. In contrast even, as part of our community build programme where we work to deploy individual FTTC cabinets to serve a community "on request" this process takes many months from initial survey and planning through to actual deployment. Offering such a bespoke service on a per premise request basis is likely to rule out a number of key technologies that rely on aggregated demand and drive up per premise cost and delivery timescales.

In BT's view therefore a "reasonable request" would need to be consistent with the pre-delivery of aggregated network build solutions to the majority of any remaining premises. (e.g., to over 99% of the UK) by a supplier or suppliers committing to make services available to an area by a given build date. Individual requests to connect customers to the built network would then follow in the served area after build complete. For premises outside of a build area and where proactive build was not economically viable then a "per premise" request service should be established in which a reasonable request could be one that would be met potentially be a range of options for example:-

- Delivery of a satellite based service at a standard price, but with potential service limitation compared to other parts of the UK (e.g. download limits, or latency constraints etc.)
- A fixed network solution such as FTTP on demand but where the potentially significant costs of individual connection would be capped for the network provider, in a similar manner to the current voice USO, with the end user responsible for additional costs above this level.
- Such excess connection costs to the user could be further offset via grant or voucher scheme using direct government funds for relevant business or social groups.

The universal service provider or providers;

How should the universal service provider be designated?

It is difficult to identify how a broadband USO provider could be designated without further clarity on the purpose of the USO, the specification of the service to be delivered and the potential for this

to change over time. All of these points significantly impact the solution chosen as discussed at length above and thus the likely providers who are best placed to deliver on a USO. (e.g., a satellite based requirement vs an FTTP based requirement would involve different potential providers).

The actual designation process for USO however, as opposed to who is technically best placed to deliver is covered in the EU directive as is the process of determining benefits and the extent to which any designated USO provider can recover those benefits.

The current approach to the voice USO, based on an assessment that BT (and KCOM in Hull) derive more benefit than the cost of supporting a voice USO would not be appropriate in our view for a UK wide broadband USO scheme. All the evidence we are aware of for the areas where a commercial deployment will not be viable for good broadband shows that these areas are very expensive to provide, have limited technical options available, and are in areas where it is clear that the costs to any provider at the network build level of providing a viable USO scheme would far outweigh the additional benefits achievable as a result of deploying any new infrastructure. A process that aligns more with that used in other countries for USO's whereby costs a USO provider is reimbursed for the additional costs of provision would need to be established, in those areas where a USO was deemed necessary.

In the event that there are to be multiple USO providers, it would be important for Retail CPs to be able to identify the appropriate supplier simply and quickly and ensure that their services could be effectively offered over the USO network via industry standard interfaces between the suppliers and CPs. All USO providers must offer access to their networks equivalently.

BT does not believe that there should be a designation process for any bids that a reverse auction process does not cover – or are not bid for during the process. Bidders in any auction process should have to also cover all areas rather than cherry picking better areas, or just choosing a few properties closer to their existing network. Cherry picking would result in an increasing patchwork of networks, creation of local monopolies and lack of supplier choice at the retail level.

Funding of the USO and potential market distortions

Funding of the USO

How could any potential market distortions of competition be minimised?

BT considers that the proposal to introduce a broadband USO has significant potential risk of market distortions. BT's view is also widely shared across Europe by operators and indeed regulators based on the EU Commissions synopsis of responses to the ongoing framework review⁸ e.g:-

*“Most **operators and their associations, several Member States and regulators** consider that broadband under universal service bears high risks of market distortions and cost inefficiencies. In particular, industry funding is considered too distortive. The risk of lowering incentives to invest, crowding-out effects, delays in network expansion and unpredictable large financial transfers between competitors (if industry funding is used) are considerable. Instead, an investment-friendly regulatory framework, lowering of deployment costs, demand stimulation, and well-designed public subsidy schemes targeted at cases of clear market failure (evaluated by an impact assessment)*

⁸ <https://ec.europa.eu/digital-single-market/en/news/full-synopsis-report-public-consultation-evaluation-and-review-regulatory-framework-electronic>

should be used for fostering broadband instead of USO. Many also highlight the need to promote competition and commercial investment via regulatory tools."

Such a USO requirement therefore risks creating huge uncertainty in the market over how it would be implemented, maintained, reviewed and paid for. Such uncertainty would potentially impact investment decisions and infrastructure build for many years, to the detriment of the UK economy. Similar conclusions have been reached elsewhere in the EU, most recently in Denmark where the regulator has concluded that there is a significant risk for a possible competition distortion through introducing a USO obligation for broadband; that such an obligation would also involve significant costs that would have to be covered by the industry (i.e. through a universal fund); and that this would be a significant financial burden for all broadband providers which would be passed on to the end users. The alternative approach of a range of policy initiatives to stimulate the market actors to establish broadband connections commercially to the worst covered areas has been preferred.

In addition to the general market uncertainties, service providers would also need to assess if it was possible or cost effective for them to access such networks. If the networks built were not compatible with existing systems and process used to offer current broadband services then further cost and uncertainty would ensue for CPs who were unable to access the networks.

BT therefore considers that the best way to minimise market distortions is to seek to ensure that the current model of predominantly commercial deployment, supported if necessary with focused government investment to assist with the wholesale access economics of building out infrastructure with an on demand approach for the final fraction is continued. This approach has proven very successful to date in the UK in delivering real benefit and should not be given an opportunity to continue to deliver and not ruled out by premature intervention. Ensuring that such networks also offer truly effective wholesale access such that CPs can continue to offer their standard services over the networks without the need for major system and process changes will also be key to avoiding distortion.

Review of the USO.

When, and on what basis, should the USO be reviewed?

This aspect is potentially as impactful on solution choice and cost/affordability as the initial service definition. A review process that does not enable a stable definition of the USO service over the investment period for USO solutions will mean that any USO deployment will have to be "over engineered" to cater for future reviews within the investment lifetime. The alternative will require the need for further investment to cater for new requirements prior to the cost recovery period of the initial investment. We have highlighted above, in our discussion on technology choices, the fact that certain technologies that could meet an initial 10Mb/s requirement are likely to be unable to meet a future requirement significantly above that level. As a result, any review period within the expected pay back of the initial USO deployment will significantly increase the risk of/need for either further reinvestment as a result of the review or alternatively over-engineering of the initial solution to ensure it can cope with all likely review conclusions. This additional risk will inevitably increase the cost of any USO requirement with a short review period.

While we agree that demand for broadband services are increasing over time, it is impractical and uncommercial to hit a moving speed target, because a significantly higher speed requirement might change the technology solutions that is chosen to be deployed (and thus costs). This increasing demand, largely driven by video based services currently is also highly likely to be mitigated by

further advances in video compression techniques that will enable better service capability over the same bandwidth.⁹

⁹ <http://www.ispreview.co.uk/index.php/2016/03/the-importance-of-video-compression-to-broadband-isp-speeds.html>