Broadband Stakeholder Group

Consultation response to the Department of Culture, Media and Sport paper: Digital Communications Infrastructure Strategy

October 2014

The Broadband Stakeholder Group (BSG) is the UK government's leading advisory group on broadband. It provides a neutral forum for organisations across the converging broadband value-chain to discuss and resolve key policy, regulatory and commercial issues, with the ultimate aim of helping to create a strong and competitive UK knowledge economy.

The BSG welcomes the opportunity to respond to this consultation on the Digital Communications Infrastructure Strategy from the Department for Culture, Media and Sport (DCMS). The BSG supports the objective of the Government to have a world class communications infrastructure that meets the demands of businesses, citizens and consumers.

It is hard to overestimate the importance of digital infrastructure and the applications that are delivered over them which play a disruptive yet transformative role. The digital networks – fixed and wireless – that form this infrastructure not only deliver broadcast, entertainment, communications and emergency services, they are now increasingly important in the provision of healthcare, the stability of the energy sector, efficiency and safety in the transport, construction and manufacturing sectors, with new business models leading to new applications in new sectors.

Presently, the benefits gained from being connected for the citizen are largely additional to what can be accomplished in the non-digital, or paper, world. However, with the increasing digitalisation of government services, the expansion of telecare and health, and even the possibility of additional charging for non-digital consumers, basic digital connectivity will shortly become a necessity. SMEs with high levels of digital maturity are more likely to have strong growth aspirations – indeed it is believed that SMEs could unlock an additional £18.8bn of incremental revenue growth by optimising their use of the internet[1].

Ensuring that people and businesses have access – both in terms of network connectivity and ability to pay – to the internet, and the necessary digital skills to exploit that access to the full, is an important and complex problem for government and policy makers. These issues are of course closely intertwined and should be regarded as being equally important, but this consultation response seeks to deal with the first component of access to digital communications networks that allow users to do what they want, and increasingly need, to do on the internet.

[1] Booz&Co, The case for universal digitalisation.

Introduction

Q1 Views are sought on:

a) Is this an appropriate role for Government?

b) What other high level principles the Government might adopt?

c) What resources do you consider the Government should aim to deploy to effectively manage its role?

The BSG agrees with the consultation's views on the Government's role; this should primarily consist of setting the challenge and the desired public outcomes, in close collaboration with industry.

Once Government has set the ambition then it needs to ensure that the right regulatory and competitive conditions are in place for the market to be able to realise that ambition. This approach will often need to span the whole of the public sector – both multiple departments and layers of government – to ensure that commercial investment can go as far as possible. The re-introduction of a cross DCMS-BIS ministerial position and the creation of the Digital Economy Unit is a welcome step forward in uniting Government policy in this way, something that should further be advanced through the Digital Task Force. To ensure that this is implemented across Government and in recognition of its importance – as well as ensuring that the best use is made of its collective buying power – Government should consider recent calls for 'digital' to be the responsibility of at least one minister in each department[2].

In some areas the commercial case for investment will always be weaker. Here the Government should seek to facilitate industry cooperation and attempt to create the right incentive scheme to encourage private sector investment. Only when all other approaches have been exhausted should the Government consider direct intervention – eg subsidy. Any such intervention should be evidence based with a clearly defined objective and must be done in a way that does not weaken retail competition. As we stress in Q26 the pace of change in this area means that just as networks need to retain scalability, policy too needs to be adaptive to changing demand.

The Government has an additional role – not looking in at the UK's market but out, ensuring that the UK's voice is clearly heard at the European and wider international level. On the whole the UK is well regarded at official level within the EU, but problems are too often dealt with at Council level rather than at an earlier stage of the legislative process. Earlier engagement would allow the UK to make stronger arguments around the benefits of competition and the need for a less prescriptive approach to pan-European legislation. Increased engagement, which may require additional resource, is needed, particularly in the run up to the next review of the EU Regulatory Framework for communications and discussions on any future Digital Single Market package to make sure that the UK is at the forefront of the debate on these issues.

This approach needs to be replicated across international standard bodies. These bodies play an incredibly important role in framing and defining the standards that are used in new technologies and the UK needs to play a particularly active role in order to fully realise the potential of the Internet of Things.

[2] techUK, Securing our Digital Future: The techUK Manifesto for growth and jobs 2015-20

Section 1

Q2 What potential opportunities are there for Government to leverage its combined buying power to support policy objectives?

The consultation highlights many of the near term opportunities for leveraging its combined buying power and existing assets. Of these a possible opportunity lies in the duct and fibre networks owned and controlled by various public sector entities (for example, the Highways Agency and Network Rail Telecom). By configuring these networks for additional traffic it could be possible to route public sector traffic over them.

In addition, this opens the possibility that the capacity of these networks could be available (on appropriate 'arms-length' terms) to support commercial traffic – creating revenue to offset the cost of these networks and possibly produce profits. However, any use of such networks would encounter significant State Aid risk and could be seen as distorting competition made by other operators in this sector.

As with any policy, the Government must ensure that the understandable push to save money does not lead to perverse outcomes.

Q3 If migration to IPV6 is required, are there any barriers to that migration and if so how might these be addressed?

IPv6, and the increase in internet addresses that it provides over IPv4, is important to the long-term growth of the internet, particularly with the likely explosion of connected devices as the Internet of Things ecosystem grows. In the near term, however, there is no reason to believe that providers will prove to be any less innovative in ensuring that supply meets demand through the use of technologies such as Network Address Translation (NAT).

In addition to the current lack of necessity, decisions over whether to transition to IPv6 have undoubtedly been affected by the incompatibility of the two protocols – networks will have to maintain both during what is likely to be a lengthy transition. This understandably has a cost implication for providers and helps explain why adoption levels of IPv6 have remained low over the past decade.

Whilst some countries are accelerating their adoption of the protocol, for instance Belgium has an adoption rate over 25% according to Google[3], other countries traditionally thought of as being in the vanguard of digital connectivity such as South Korea are even further behind than UK.

In summary, there are few technical barriers, none of which appear to insurmountable, to the transition from IPv4 in the UK. Yet whilst transition should be encouraged it remains primarily a commercial decision to be taken by operators.

[3] Google, Per-Country IPv6 adoption [retrieved: 26 September 2014]

Section 2 - What might future demand look like?

Q4 Is an ongoing disparity of provision of broadband services inevitable? If so should this be addressed and how might this be done most effectively?

Currently the digital divide, often between rural and urban areas although this differs significantly between nations and regions, is the difference between a household being unable to access basic internet services and being able to stream high quality content to multiple devices. In many respects this demonstrates a market that is functioning correctly – with higher demand being met with higher supply.

From a per household basis though, it is important to increase the basic level of broadband access available to all households if the UK is to fully reap the benefits of the digital economy and the opportunity that increased connectivity offers to both increase the efficiency and decrease the cost of public services. Indeed it can be argued that rural communities are more dependent on internet services due to their remoteness from public services[4].

The picture is rapidly changing. Investment in digital infrastructure has been on an upwards trajectory since 2010 as we see significant infrastructure deployment across a range of areas. Ongoing developments include, although are not limited to; the private investment in providing superfast broadband[5] to around 75% by Virgin and BT, the public sector investment to push superfast broadband availability to 95%, the deployment of fibre to the home by alternative providers, the rollout of 4G services by all four Mobile Network Operators and the increasing prevalence of public WiFi hotspots.

With the Government, and industry, keen to drive superfast broadband to over 99% of premises, nearly all households should have access to speeds of at least 24Mbit/s by 2020 – which is a requirement of the EU Digital Agenda 2020[6]. The success of the Government being able to do so in the current economic climate depends to a large degree on the success, or otherwise, of the market test pilots. The BSG encourages the Government to take forward those business models that have been judged to be successful and ensure that any lessons are learned from any that fail for future projects. The deployment of 4G services to over 98% of premises in the UK will offer consistent mobile broadband speeds of at least 2Mbit/s.

These network deployments will result in a step-change in the connectivity available to premises in both urban and rural areas. Yet the capabilities of digital connections in urban, or highly connected areas, is rightly a moving target. Therefore there is little reason to assume, or indeed desire, the two to converge so that broadband access is uniform across the UK – what these deployments will ensure that nearly all households' level of digital connectivity has improved.

The divide between end user experiences is therefore likely to be smaller than it is today. Generally, there is unlikely to be any significant change in the mix of service vs infrastructure competition in rural areas, with the

[4] Commission for Rural Communities, Mind the Gap: Digital England – a rural perspective
[5] For this paper we define this in line with the Department for Culture, Media and Sport as being capable of providing more than 24Mbit/s.
[6] EU, Digital Agenda for Europe: About our goals

majority of rural areas relying on service competition over a single infrastructure as they do today. Therefore it is doubtful, although again this differs significantly by region, there will be an option for rural users to change to other fixed or wireless infrastructure providers. Urban areas on the other hand will continue to have access to a range of network providers and technologies[7]. Importantly, rural areas are more likely to be well served by competition in their choice of mobile providers, with these networks being increasingly intelligent in responding to demand.

In summary differences in broadband provision between rural and urban areas is likely to persist but the ability to access increasingly rich and high quality internet services will improve across all areas.

Q5 How symmetrical will digital communications networks have to be in the future? Will this differ across user types? What implications does this have for fixed and wireless broadband provision?

Symmetry of connection is unlikely to be a critical feature in the future – but there is likely to be an increased focus on both download and upload speeds. Demand for upload is likely to vary significantly across user group, particularly when taking into account of SMEs, some of whom may require high download and upload speeds.

For households, BSG work has modelled median upstream demand as being 2.4Mbit/s by 2023[8]. With current average (mean) upload speed of 2.3Mbit/s, it is likely that modest improvements in the capability of the fixed network will ensure that demand from households is met. However, it is important to note that the BSG upload model has substantial variance, with over 30% of households requiring upload speeds above 3Mbit/s.

In both fixed and mobile broadband, the demand for upload will depend to a large extent on the requirements of applications – for instance, the iPhone 5 records video at 17Mbit/s but when uploaded to an application such as Youtube is typically compressed to around 1Mbit/s, with similar measures taken on photo sharing and social media platforms. This is largely driven by technical constraints – they are a consequence of available bandwidth today. Although the network constraint may lift there is little evidence to suggest that applications will look to increase their bandwidth requirements, particularly due to most content providers seeking to increase their penetration in developing markets where bandwidth capacity remains low.

Q6 Which countries should be our benchmarks on communications infrastructure to ensure that businesses remain in the UK and continue to invest?

The UK should continue to measure itself against major European countries, as it does through the European Broadband Scorecard, as well as looking to those countries which are traditionally seen as digital pioneers such as Japan, Hong Kong, South Korea and Sweden.

However, the Government must be careful not to become beholden to league tables, particularly those that look solely at coverage and speed (see Q7). What is important is ensuring the market in the UK works well to efficiently deliver user needs and where there is market failure (i.e. A genuine 'willing to pay for' need that is

[7] See, for instance, developments in York and Peterborough and the rollout of high speed fixed wireless broadband in central London.

[8] BSG and Communications Chambers Report, Domestic demand for bandwidth

not being served or unlikely to be served in the future) that the government intervenes promptly and without distorting competition.

Q7 What metrics do you think should or will become relevant in comparing network performance in different countries? What metrics should most appropriately be used as the basis to set objectives for government policy?

If specifically examining network performance between countries then metrics based around coverage and capability – encapsulating measures such as bandwidth, resilience, latency, faults and other quality of service experience benchmarks – are, and are likely to remain, the best metrics.

However, the BSG believes that, whilst important, this gives too narrow a view. Measuring what country is the '*best connected in the world*' requires examination beyond the performance of the physical infrastructure. Understandably physical measures, are more objective and easier to compare receive the greatest prominence. However, as access to superfast broadband becomes widespread, coupled with similar levels of 4G coverage, take-up and usage become more economically important and should be weighted as such in any scorecard.

The BSG believes that greater emphasis on take-up and usage would provide a more comprehensive approach base from which to set public policy goals. This would allow the UK to measure not only take-up of broadband services but also give an approximation of the level of digital skills, or digital maturity, of those users.

The Ofcom Broadband Scorecard does include some information around take-up and usage but the EU Digital Agenda Scorecard approach goes far further on the latter. It starts to capture application usage – from ordering goods and services online, where the UK is the highest in the EU, to the sending and receiving of e-invoices, where the UK falls under the EU average[9]. Not only does this give a far more rounded picture, it can also inform debates around the public or private benefit of enhanced broadband connectivity (see Q29). In addition to these benchmarks, metrics that examine the quality of service – ranging from the severity and number of faults to the installation timeframe on products – offered should be included.

Section 3 - Scenarios

- *Scenario 1*

Q8 Do you agree with this scenario or elements within it? Where do you agree/disagree? If you disagree what alternative scenario do you envisage?

Please see Q26 for the BSG's views on future demand.

Q9 What are your views on the technology commentary underpinning this scenario? To what extent might the infrastructure/technology discussed evolve irrespective of demand and how far will it be a direct consequence of the level of demand?

Please see Q26 for the BSG's views on future demand.

[9] Digital Agenda for Europe, Country Profile - UK [retrieved 16 September 2014]

Q10 Are there technologies not identified here that you think will have a major impact on the performance of existing infrastructure or the deployment of additional infrastructure in the next 10-15 years?

Please see Q26 for the BSG's views on future demand.

Q11 Are there wider environmental issues not reflected in the scenario e.g. the price or availability of energy that will affect any of the scenarios and in what way?

Please see Q26 for the BSG's views on future demand.

Q12 How likely is any unforeseen disruption to this scenario and what area might it occur?

Please see Q26 for the BSG's views on future demand.

- *Scenario 2*

Q13 Do you agree with this scenario or elements within it? Where do you agree/disagree? If you disagree what alternative scenario do you envisage?

Please see Q26 for the BSG's views on future demand.

Q14 What are your views on the technology commentary underpinning this scenario? To what extent might the infrastructure/technology discussed evolve irrespective of demand and how far will it be a direct consequence of the level of demand?

Please see Q26 for the BSG's views on future demand.

Q15 Are there technologies not identified here that you think will have a major impact on the performance of existing infrastructure or the deployment of additional infrastructure in the next 10-15 years?

Please see Q26 for the BSG's views on future demand.

Q16 Are there wider environmental issues not reflected in the scenario e.g. the price or availability of energy that will affect any of the scenarios and in what way?

Please see Q26 for the BSG's views on future demand.

Q17 How likely is any unforeseen disruption to this scenario and what area might it occur?

Please see Q26 for the BSG's views on future demand.

- *Scenario 3*

Q18 Do you agree with this scenario or elements within it? Where do you agree/disagree? If you disagree what alternative scenario do you envisage?

Please see Q26 for the BSG's views on future demand.

Q19 What are your views on the technology commentary underpinning this scenario? To what extent might the infrastructure/technology discussed evolve irrespective of demand and how far will it be a direct consequence of the level of demand?

Please see Q26 for the BSG's views on future demand.

Q20 Are there technologies not identified here that you think will have a major impact on the performance of existing infrastructure or the deployment of additional infrastructure in the next 10-15 years?

Please see Q26 for the BSG's views on future demand.

Q21 Are there wider environmental issues not reflected in the scenario e.g. the price or availability of energy that will affect any of the scenarios and in what way?

Please see Q26 for the BSG's views on future demand.

Q22 How likely is any unforeseen disruption to this scenario and what area might it occur?

Please see Q26 for the BSG's views on future demand.

- *General*

Q23 Are there factors, for example technical or unrelated to the regulatory framework, that could create bottlenecks and delay future infrastructure deployment in the UK in this timeframe, that would result in demand not being met or the UK not being seen as a leading digital nation?

There are some technical hurdles that need to be addressed to fully realise the scenario outlined in Q26. For instance there is some evidence that the capacity of microwave links from base stations could be reached as early as 2016-18, causing a bottleneck in those affected cells[10] - this is more of an issue in rural areas where accessing fibre access can be more difficult. There are also challenges, particularly in urban areas, of landlords not working with telecoms providers to address the connectivity needs of their tenants.

However, there appears to be no reason why these hurdles are insurmountable and ways to address these are explored in Q24 and Q27.

Q24 Do you expect commercial providers to deliver future infrastructure and meet demand on a purely commercial basis, or is some form of public intervention likely? If public intervention is likely how might that work with the commercial provision of infrastructure? What form might that intervention take?

In order to realise the sort of capacity and coverage envisaged in Q26 the telecommunications industry faces a substantial investment challenge. As the consultation recognises, revenues within the communications industry have fallen as prices have fallen, with the level of return on investment unsustainable if it persists in the long term – indeed Ernst and Young consistently rank it inside their top 3 risks in telecommunications[11].

Any investment decision depends to a large extent on investors' confidence in a level of regulatory certainty – investors want to be confident that any future returns are threatened by changes to the framework. That is not to say that regulation should remain as they are today – they should be able to evolve within a principle based

[10] Analysys Mason, Mobile backhaul market
[11] EY, Top 10 risks in telecommunications revisited: Mitigating threats to operators

framework to allow them to respond to technological and market developments effectively. The importance of a stable regulatory framework is referenced further in Q27.

Industry is of course focused on maximising revenue whilst reducing costs in order to be more efficient and profitable, as highlighted in section 5 of the consultation. Take-up of superfast broadband offers the chance to increase revenue per user – important in itself this also demonstrates to future investors that there is a consumer market willing to purchase these services. The nature of the UK's competitive market serves to drive costs down and operators are now increasingly sharing infrastructure in order to do so. Continuing to encourage competition in as much of the network as is economically feasible must be a cornerstone of the Government's strategy.

Government has a range of measures available to it that would assist industry in these two goals. With the first it should work with industry to promote the benefits of superfast broadband in conjunction and through its Digital Inclusion Strategy, the success of which will also bring direct benefit to Government as it seeks to complete the digital transformation of public services. In the second it should use all the levers at its disposal to lower the cost to industry of deploying infrastructure.

Whilst it is not a silver bullet, the Government should press ahead with reform of the Electronic Communications Code, which could significantly lower the cost of land for new sites. The phrase 'broadband is the fourth utility' is much used but this growing importance is not reflected in the code and has resulted in operators coming under pressure to provide similar universal coverage levels without the benefits granted to utilities. This can be seen in the difference in land rental of an electricity pylon (£87-147) and a mobile mast (£5-10k), and a fixed line operator (10-29p/metre per annum) and an underground power cable (2p/metre per annum)[12]. The BSG does not expect this gap to be completely closed, but it is clear that regulation should give the industry some of the benefits that utility services receive – whilst retaining the benefits that competition provides.

Important though it is, reform of the Electronic Communications Code only goes so far. In order to lower the cost and risk of infrastructure deployment there needs to further improvements to the planning system to make it faster and a more certain process so that the focus is on where rather than whether infrastructure is deployed. In addition to this the Government should ensure better access to public land/street furniture. Actions could include a presumption in favour of land held by public bodies, the promotion of concession contracts by both industry and Government to local authorities, and ensuring that new public structures and furniture have connectivity built in. Additionally the business rates applied to this infrastructure, a long running issue for industry and one that the BSG recognises is outside the direct remit of DCMS, must be carefully assessed to ensure that they do not act as a disincentive to investment.

These actions would help ensure that the commercial deployment can go as far as possible. Despite this it is likely there will be areas where it will not be commercially viable to deploy infrastructure – and these hardest to reach areas may be in urban or rural areas. In such instances, if the inability of the market to deploy infrastructure or services leads to a failure to deliver the Government's public policy goals then it should

[12] The Law Commission, The Electronic Communications Code

consider the best form of intervention – eg subsidy – to achieve these. Any intervention must be done in a way that does not compromise competition (likely in these instances to be at the retail level).

Q25 Which current or draft legislation might prevent or facilitate the emergence of any of the scenarios?

Leaving aside the changes suggested in other answers which may require changes to legislation, such as the Electronic Communications Code, the impact of overly prescriptive EU legislation on traffic management and the open internet, such as that currently found in the Connected Continent package, could be far ranging and detrimentally impact the emergence of the scenario outlined in Q26. The BSG will continue to support the Open Internet Forum which brings together the Government and Industry to discuss these issues.

Q26 Do you have views on which scenario (or combination of scenarios) is most likely and should influence the development of future strategy?

The BSG has produced several reports that seek to stimulate a more evidence based debate to understanding future demand. On the whole our work is best reflected in scenario two although elements cut across all three.

Despite this, we stress though the importance in any strategy of retaining flexibility; it is unlikely if not impossible for any prediction made today, no matter how methodically modelled[13], will wholly describe the technological landscape of 2025 and the demand for services running over those networks – Netflix only launched its video streaming service in the UK in 2012 but already accounts for up to 17% of downstream fixed access traffic during peak hours[14]. Therefore, Government strategy, just as digital networks have to be, must come with scalability built in to be able to respond to increases in demand – in both coverage and capacity.

With these caveats in mind the BSG agrees that total traffic across both fixed and mobile networks will continue to rise, particularly as devices and applications within the Internet of Things ecosystem become main stream – however, the primary driver of growth in data will be increased video consumption. Whilst the fixed network continues to carry the majority of total data, the consumer will have an increasingly blurred perception of the difference between the mobile and fixed networks and will expect seamless interaction between them. Consumer expectation will rise – the cycle of the exceptional becoming the norm will continue.

As stated in Q4 it is likely that the digital divide with regard to household access to superfast broadband will largely be resolved by 2025 – that is not to say that there will not be a difference in bandwidth connections available in different areas. The level to which it is resolved in terms of the confidence, desire and ability of users to exploit this connectivity will depend largely on the success of the efforts of both industry, which often takes an important lead in this area, and government. The Government's current aim is to reduce the numbers who have never been online and lack basic skills to 4.7million by 2020[15] - if this trend continues to 2025 then there will still be over 1 million adults in this category. Whilst the impact of these additional users varies across the access medium, its effect on the telecoms sector as a whole as it makes investment decisions is substantial.

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[13] It should be noted that few scenarios fully encapsulate the willingness of consumers to pay, nor the willingness of operators to invest – the two being intrinsically linked. Some of these issues are explored in section 4 and 5.
[14] Sandvine, Global Internet Phenomena
[15] Cabinet Office, Government Digital Inclusion Strategy

Broadcast

As noted above, video consumption is the prime drive of increasing data traffic and higher bandwidth requirements. Linear television currently accounts for the vast majority of viewing in the UK and it is unlikely that this balance will change significantly by 2025-30, indeed high quality live TV content incentivises take-up of internet services.

On-demand content is currently growing at a substantial rate, albeit from a low base, but currently appears to be largely additional, as opposed a substitute to linear viewing – with some evidence suggesting that it is having a greater impact on DVD sales. Users will continue to expect increasingly immersive and personal viewing experiences. This expectation will be met through greater integration of cross-platform applications allowing content to be accessed on a device and place of the viewers choosing. In the home IP content will blend with more traditional broadcast mediums although it is unlikely that this convergence will be replicated at a network level[16].

The trend towards higher definition content will continue although costs and incremental benefits versus television set size is likely to limit the penetration of Ultra-HD or 4K sets. The impact of this on all broadcasting mediums will largely depend on the extent to which compression technology develops. The bandwidth requirement for video has fallen steadily over time, both due to improvements of technology within standards (such as MPEG-2) and due to the transition to completely new standards (such as HEVC). This means that some broadcaster's bitrate requirements for HD content have fallen from around 30Mbit/s in 2002 to around 10 Mbit/s in 2010[17]. Improvements in compression are likely to continue – with a 6-9% annual improvement not seen as an unsustainable[18].

Fixed

The BSG's work on modelling the domestic demand for fixed bandwidth estimates that the median household will have a demand of 19Mbit/s, with the top 1% of households demanding upwards of 35-39 Mbit/s in 2023[19]. If fixed bandwidth demand sees linear, as opposed exponential, growth, demand in the 2025-30 period is like to be in the range of 20-25Mbit/s range for median households and 45-50Mbit/s or more for the top 1%.

This demand will met by superfast broadband availability to over 99% of premises. Based on current network technology it is likely that fibre-to-the-cabinet (FTTC) connections will remain the most common network configuration. However, they will likely be increasingly being replaced by connections that deploy fibre closer

[16] See initial conclusions of Plum Consulting work for European Commission, Challenges and opportunities of broadband-broadcast convergence
[17] Sky, Beyond HD Masters 2013
[18] BSG and Communications Chambers Report, Domestic demand for bandwidth
[19] BSG and Communications Chambers Report, Domestic demand for bandwidth
This modelled domestic demand for bandwidth to 2023 and found that the median household demand will require 19MBit/s, with the top 1% having a demand of 35-39MBit/s. The model makes a number of assumptions about likely application use and bandwidth requirements of video content – all of which can be found on page 65.

to, or up to, the premise such as fibre-to-the-premise (FTTP) or fibre-to-the-node (FTTN). The physical limitations of copper will continue to be the main restraint on bandwidth over FTTC or FTTN configurations although advancements in technology are likely to continue to increase the bandwidth capacity of copper lines in the timescales involved.

It is likely that large conurbations will also have increasing access to FTTP connections from a range of providers. These fixed line solutions will increasingly be supplemented by, and face competition from, fixed wireless access networks – both in urban and rural environments. Advancements in satellite technology, such as the wider deployment of Ka Band technology, will also increase the attractiveness of this technology to consumers.

Whilst the success of digital inclusion strategies in getting people online will have an impact in the total data that is transmitted over fixed network, it is unlikely to greatly impact the bandwidth requirements in the access network. This is because the main drivers in determining a household demand for bandwidth are the number of people using the internet in that household, the length of time spent using the internet, the quality of the applications used and the amount of individual multitasking that takes places. Most of the recent growth in online households has come from older, single households who are generally low-level users.

The take-up of superfast broadband connections in households will continue to rise as users require more bandwidth. Increased take-up will actually help reduce the price of superfast packages, helping to further drive take-up.

Home and remote working will have continued to increase but it is likely that the majority of demand will still be related to physical work spaces. The digital maturity and progress of the wider workforce and of SMEs in particular will have a particular impact as they seek highly resilient connections tailored to their specific requirements.

Out of home

Total traffic and device bandwidth requirements will both grow, possibly exponentially, across both the cellular and public WiFi networks. Although it is still too early in the deployment of 4G networks to quantitatively model future demand, this growth is likely to be driven by increased adoption of smartphones, increased network coverage, capacity and ease of access, along with a maturing ecosystem. In addition to this, there is some early evidence that those with 4G connections use their home broadband connection less[20].

Currently the penetration of smartphones stands at around 60% of adults; however, 93% have a mobile phone. It is likely that replacement cycles and marketing pushes will result in smartphone penetration at least matching this level by 2025. The attributes of smartphones – its mobility, range of integrated capabilities and generally intuitive user interfaces – could drive penetration higher and play a role in introducing people to the internet.

[20] EE, 4GEE Mobile Living Index, August 2014

Only 0.9% of households in the UK receive no coverage from 3G services, however, mobile networks today are capacity constrained – to the end user this reduces the footprint in which they can use some applications. LTE services, built for data with greater bandwidth and stability, will lift at least some of this constraint, particularly as LTE services must be deployed to at least 98% of the population by 2017 by O2[21], with other operators likely to match this. Linked to this capacity issue is the increase in data allowances that tend to accompany 4G connections – which goes some way to addressing any consumer issues of 'bill shock'. Developments in LTE technology such as LTE Advanced, as well as the introduction of 5G services which we can expect from 2020, will go some way to meeting increases in demand although it is likely that further network densification will be needed in high-footfall areas.

Public WiFi coverage will also increase in over this period as councils take advantage of concession contracts and utilise funding available through the Super-Connected Cities Programme to deploy city-centre wide networks and provide WiFi access in public buildings. Importantly, it is likely that Next Generation Hotspots which will incorporate Passpoint. This will possibly remove any need for user interaction to log onto public WiFi networks, making for a far more seamless experience between cellular and WiFi networks.

Ubiquity and Coverage

There are a number of developments which are likely to drive demand for increased geographic coverage of digital networks; consumer expectation to always be connected, wearable technology, particularly involving health monitoring, the increasingly smarter and possibly autonomous car and Machine to Machine (M2M) communications are just some of possible drivers.

Users will increasingly demand near constant access to the internet. Although increasingly well served at home and at work, transport routes offer, at best, inconsistent connectivity. Trains pose a particular problem for wireless communications whilst nearly 10% of A&B roads receive no 3G coverage from any operator[22]. This will quickly become unacceptable for consumers and businesses.

Many commentators now believe that smart phones themselves will become gateways or personal hubs, with wearable technology tethered to them. Indeed as a gateway to the internet this can already be seen with the tethering of tablets (which are predominantly WiFi and therefore require mobile broadband access when outside of WiFi coverage). The marketing for many of these devices emphasise their health monitoring capabilities. Whilst many of these apps – such as calories burned – will not require real-time, if any, access to the internet the use of heart rate monitor opens the possibility of autonomous notification to emergency services if someone is having a heart attack, something which will require very high levels of coverage.

Similarly many of the features of the smarter car will not necessary require a constant connection – data gathered on how safe a driver is could be uploaded to insurance providers when the car is within the home WiFi footprint – although they need to be able to communicate with other vehicles. Yet some features, such as

[21] Press release, Ofcom announces winners of 4G mobile auction
[22] Ofcom, Infrastructure Report: 2013 update

eCall[23] which is due to come into force in late 2017, will require higher levels of coverage. Although little is still known about the capabilities and requirements of autonomous cars it is likely that they too will require near universal levels of connectivity.

M2M communications, the foundation of the Internet of Things, has particular implications for coverage. Some M2M applications, particularly if they are deemed mission critical, may choose to deploy their own networks, particularly if they are in a relatively localised area. However, the majority of M2M technologies are likely to seek to use public networks or use of shared radio spectrum – with a particular focus on the cellular network.

Although M2M communications will, at least initially, require very small amounts of bandwidth, with research commissioned by Ofcom estimating[24] total M2M data traffic of 20-65 PB a year, likely to be around one per cent of total mobile traffic, the sheer volume of communications is likely to pose a significant problem for existing cellular technologies. 2G and 3G technologies are not well suited to handling mass volumes of data packets and resources on these networks will likely be further constrained. However, LTE M2M technology, which should be widely available by 2017, will contribute to the resolution of this problem.

For operators to meet this demand via private sector investment reductions will need to be made to the cost of deploying additional infrastructure, as detailed in other answers. This coverage will be provided by a mesh of heterogeneous networks. There will be a thin layer of coverage across transport routes and other areas where users can reasonably expect some level of connectivity, with increased capacity in higher footfall areas. In order to meet user expectations networks will have to become more intelligent and attentive to demand.

Spectrum

Many of these applications and networks require access to spectrum. The BSG recognises work that the Government has done and has committed to, on releasing spectrum currently held by the public sector and appreciates that this is not the main focus on this consultation. Although there is disagreement about the future spectrum requirements of each network and sector within the BSG we note the importance of the UK's Spectrum Policy Forum and the recent work on Ultra High Frequency (UHF) spectrum undertaken by Pascal Lamy for the European Commission.

Summary

In summary by 2025, the UK's businesses and users will be demanding near constant connectivity whether on the move or at home with lower levels of patience for time delays and faults. In order to meet this demand, digital connectivity from a range of technologies – cable, FTTC, FTTRn (or FTTdp), FTTP, fixed wireless, satellites, DTT and LTE amongst others – will be required and will form an increasingly mesh like ecosystem. Although users' demand for bandwidth will vary depending on their activity, there will be an expectation of being able to use basic applications across a larger geographic area of the UK than they are currently able to do so.

[23] European Commission, Intelligent Transport Systems; the interoperable EU-wide eCall
[24] Aegis Research, M2M application characteristics and their implications for spectrum

Section 4 Competition and regulation

Q27 How might efficient investment in communications infrastructure be supported, for example by changes in the regulatory framework?

As noted in previous answers the BSG believes that regulatory and policy certainty is needed to in order to encourage and facilitate investment. Generally, the 2002 EU Telecoms Framework has provided this certainty – although as noted in Q31 there is disagreement within the BSG as to whether the desired outcomes of this Framework should now be refocused.

Regardless of what decision is made with regard to possible changes to the Framework, the BSG places the utmost importance on the continued independent of Ofcom.

Q28 Are there any further measures necessary to incentivise the rollout of future mobile infrastructure in currently underserved areas?

Please see Q24 for ways to reduce the cost of infrastructure deployment.

Q29 Is there a role for a revised USO or USC to ensure that minimum consumer demand requirements are met and to reduce the potential for a new digital divide? What might this look like?

The increasing importance of affordable internet access to citizens and the economy is such that a future revision of the USC may at some point be necessary. Whilst there is general agreement about the need for 'near universality' there is a range of opinion about the level that this should be set and how this should be paid for. The BSG suggests that any USC revision be built on an application based approach that measures public versus private benefit. Work on determining a level of public versus private benefit and its impact on bandwidth requirement has started to be looked at by other Governments[25] and should be considered as basis for positioning any future USC or indeed USO.

Q30 In terms of supporting future innovation and long-term investment in infrastructure, what areas of broadcasting regulation may have served its purpose by 2025 -2030 (or indeed earlier). What future technical developments may also have longer term implications for regulation and wider public policy?

The BSG has no comment to make on this question.

Q31 Are there changes to the EU Framework that the UK might seek to encourage more competition in UK markets?

As stated in Q24 any investment decision depends to a substantial extent on the stability of the regulatory framework. Whilst not perfect, the 2002 EU Regulatory Framework has provided a stable and broadly predictable environment. Although there is a lack consensus within the BSG as to whether the Framework should continue along broadly the same lines or be completely overhauled, it is clear that the UK will need to be well represented at the next formal review. Any overhaul would be a long process which would need to be managed in a way to ensure that investors were not discouraged.

[25] Communications Chambers, Domestic bandwidth requirements in Australia

Q32 Should Government seek changes to the European Framework which put more reliance on competition law and how might this be done?

The use of Directives rather than Regulations to implement policy should be encouraged. Regulation is a last resort when the market fails but there is a tendency in Europe to use regulation in place of the market and competition. The reason often quoted is that there is a desire to affect the same market conditions throughout the Union. However this does not allow those countries with functioning markets to let them work.

Q33 In what ways can you see competition driving technological change in the UK in the future?

The BSG fully supports the Government's view that competition is the best means of ensuring that the UK innovates and invests at the right rate.

Q34 How can the regulatory framework keep up to date with new business models and changes in technology?

The best way to ensure that regulation can adapt to new business models and advances in technology is to focus on outcomes rather than methods.

Q35 Are there any changes to legislation other than the Communications Act that would incentivise the provision of communications infrastructure?

Q36 Would there be benefits to investment from a focus on broadband only services? Are there any barriers to the emergence and adoption of broadband only services, whilst still providing necessary access to emergency services?

Section 5 – Facilitating and Encouraging Investment

Q37 How might copper access networks evolve over time alongside other access technologies? Is there a role for policymakers in helping manage any transition from copper to other access networks?

The bandwidth capability of copper access networks continues to rise as new technologies are developed and brought to market[26]. Such advances likely, although not inevitably as they themselves require additional investment, will continue to extend the lifespan of copper access networks by ensuring that they can meet foreseeable future demand.

The timing of any transition is much debated within industry but any such decision should be a predominantly commercial one, although regulation would need to adapt both during and after any transition.

Q38 Views are sought on whether there are any additional actions the Government should consider to ensure:

[26] Huawei, G.fast: Moving Copper Access to the Gigabit Era

a) That the provision of all areas of the UK's digital communications infrastructure remains competitive in order to ensure that the UK can take full advantage of growth opportunities in the Digital Age;

b) Aside from legislation and adapting the regulatory framework in the broad sense which other actions should the Government take to encourage investment in communications infrastructure?

c) That potential investment in the provision of digital communications infrastructure offers a suitable risk and reward profile to ensure that they can be financed by the private sector

The BSG's views on these topics have been addressed in several other answers.

Q39 Views are sought on:

a) The case for the UK to invest to gain 'early mover advantage';

As stated in Q6 the UK must not become too beholden to international comparisons. Whilst no country wants to be the last to take advantage of new technological developments there appears to be little advantage in being first. This particularly applies to the UK, where the network technology is unlikely to be manufactured – and then exported to follower countries.

Whilst the UK's 4G deployment was later than desired from the perspective of UK plc, the rapid network deployments, level of take-up and use, and lack of interference with other platforms shows some of the advantages of not being first. Similarly the UK was not the first to deploy superfast broadband via fibre but the UK is now at the forefront of the uptake and usage – and far ahead of where other countries were at this stage of their network deployment. Equipment unit prices are likely to be significantly lower for followers, policy and regulatory lessons can be learned from the early movers and demand for products can be better understood and catered for. Broadly speaking, it is better to be best than first.

It is important to note though that the UK is a world leader/early mover in several areas – to take one, the use of ICT applications in the economy, particularly in areas of superfast broadband coverage.

b) What areas in particular the UK should aim to see investment;

Please see Q40.

c) Are there any actions not covered elsewhere in this report that the government should consider to ensure digital communications infrastructure is in place before it is needed and such that it helps generate need.

As noted in previous questions, it is extremely difficult to accurately model demand for internet applications given the fast moving and disruptive nature of technological advances. The argument within industry about whether to build ahead of demand or seek to ride the demand curve will continue beyond this consultation. The BSG would argue that the key characteristic of any policy is to ensure that networks are scalable to meet consumers demand.

Q40 How can we maximise the current R&D and innovation UK landscape to help take advantage of the opportunities provided by future technologies? What needs to be done by Government and its agencies, and industry to tackle any gaps?

InnovateUK and the 5G Innovation Centre at the University of Surrey offer successful models of industry, academia and Government cooperation that should be supported and where necessary replicated.

The Government has already rightly made several investments in funding Internet of Things networks and applications. If the Government wishes to go further in this area then it should consider creating an umbrella body that would bring these projects together and serve to join up Government strategy and actions in this area. In addition to this the Government should explore how to best create large scale demonstrators.

Q41 In which future communications technologies do you consider the UK has, or could achieve, an international leadership position?

The BSG has no comment to make on this question.

Q42 What more might government and industry do to exploit future technologies, associated new applications and emerging business models?

The BSG has no comment to make on this question.

Q43 What role might local bodies have in facilitating the future delivery of digital communications infrastructure?

Many of the planning issues discussed in Q24 are in the remit of local authorities rather than central government. Whereas central government does appear to be recognising that in order to maximise investment in networks a cross-departmental approach needs to be taken, this is too often not the case at the local level.

As mentioned in Q23 we also believe that city authorities, such as the GLA in London, should work closely with landlords and communities to explain the benefits to their tenants and to their communities of permitting the installation of telecoms infrastructure and thus enabling improved connectivity to the local citizens. There is the possibility that over time this could form some sort of connectivity rating for buildings that would likely encompass both the technologies available and the likely lead time in gaining access to that service.

Q44 How can council's maximise the digital communications infrastructure in their local area to support their work on economic regeneration?

The BSG has no comment to make on this question.

For further information please contact:

Matthew Evans
Broadband Stakeholder Group
0207 331 2024
Matthew.Evans@broadbanduk.org