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Select Committee on Communications

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Broadband for all— an alternative vision

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References in footnotes to the Report are as follows:

Q refers to a question in oral evidence;

Witness names without a question reference refer to written evidence.

SUMMARY

There is barely an aspect of our daily lives that is not touched in some way by the internet. The revolution in communications witnessed over recent decades has had a transformative effect on commercial and social transactions creating an information world without frontiers. We have found, however, that there is a very real risk that some people and businesses are being left behind, that inadequate access to the internet and all its benefits is actually afflicting their daily lives, prohibiting them from harvesting the fruits of the information revolution.

The Government are to be congratulated for making enhanced broadband provision a key public policy priority, and progress is clearly being made. It is our contention, however, that the Government have proceeded from a flawed prospectus, that the progress being made may prove illusory. There has been an insufficient focus on properly thinking through questions of first principle, and an absence of an all encompassing vision of pervasive broadband connectivity as a key component of national infrastructure.

Government policy has become preoccupied with the delivery of certain speeds to consumers. This, in our view, has had a detrimental effect on policy-making and the long term national interest. In this report, we propose an alternative vision for UK broadband policy, which, rather than being target driven, makes the case for a national broadband network which should be regarded as a fundamental strategic asset, to which different people can connect in different ways according to their needs and demands. The delivery of certain speeds should not be the guiding principle; what is important is the long term assurance that as new internet applications emerge, everyone will be able to benefit, from inhabitants of inner cities to the remotest areas of the UK. Access to the internet should be seen as a domestic essential and regarded as a key utility. The spectre of a widening digital divide is a profound source of concern which requires the Government to address its origin with greater vigour than we believe is currently the case.

Fundamentally, the Government's strategy has fundamentally focused on the wrong part of the network—broadly speaking the outer edge and the margins, not the centre. We argue that the Government should be focusing on delivering a high spec infrastructure which is future proof and built to last; fibre-optic cable, the most future proof technology, must be driven out as close as possible to the eventual user. Then, as well as mandating open access to this optical fibre from the cabinet to the exchange, we need to ensure that there is open access to links between the exchanges that feed the cabinets, and to the higher level links into national and global networks.

Just as there is national planning for the national, regional and local hubs of our transport network, so there should be national planning for a communications network of local, regional, national, and internet exchanges where different operators can site equipment and exchange traffic, all linked by ample optical fibre that is open to use by competing providers.

We do not pretend that any of this is easy, and we welcome the Government's policy focus on broadband, but we believe that the UK can and must do better.

Broadband for all—an alternative vision

CHAPTER 1: INTRODUCTION

1. This report concerns the United Kingdom's electronic communications infrastructure. It proceeds from a consideration of current broadband policy, which focuses on broadband access, to a vision of pervasive broadband connectivity as a key component of national infrastructure.
2. This report tries to answer three questions:
 - What are the Government's plans, and what are their chances of success?
 - Are those plans the right ones? Will they bring about the broadband infrastructure the UK will need?
 - Are there any alternative approaches which might be better?
3. Broadband refers to “always-on” access to the internet at a speed greater than dial-up modems can provide. With it, a user is not compelled to dial up to their Internet Service Provider (ISP) every time they want to browse the web and can also make a telephone call or watch video content simultaneously. Broadband access is usually described by its speed or bandwidth.¹ This is the amount of data that can be transferred per second either to the user (download) or from the user (upload). Speed is a factor in, for example, how quickly pages from the internet can be viewed, or large files, like films, downloaded.
4. For the Government, the potential gains of enhanced broadband provision in economic and social terms, and in the delivery of services, make broadband fundamentally important. Similarly, for the industries involved—and broadband affects most if not all industries—questions arising from the roll-out of broadband infrastructure are crucial; to an increasing extent, their futures depend on this infrastructure and on the rules that govern their access to it. Finally, for the majority of UK citizens, broadband is becoming a domestic essential, similar in many ways to other key utilities like water or electricity.
5. It is a shame, therefore, that the debates over this vital infrastructure are conducted in terms which are utterly mystifying for most of our fellow citizens. While the telecoms industry and the Government are alive to the technical and regulatory issues surrounding wider coverage of enhanced broadband—though it is a matter for debate as to whether they are too tied to models inherited from the past—these are, at best, of marginal interest to most of the general public, and at worst entirely impenetrable.
6. The starting point for UK policy must be historical. While the broadband infrastructures of other countries, like South Korea,² are often said to be

¹ Following common usage, this report uses speed as a synonym for bandwidth, the rate at which data flows measured in bits per second.

² Q 128 (see paragraph 17)

good examples for the UK to follow, these countries benefit from something the UK cannot: being able to start virtually from scratch. The UK has various legacy infrastructures which do not reach some areas, overlap in others, and were built by companies in previously unconnected sectors such as telecoms, transport, energy and cable television. What is more, none of them was built as a general purpose communications infrastructure.

7. The outlook, however, is far from desperate. On the contrary, some of the companies involved are already investing in extending the coverage of broadband and are accelerating the available speeds. Some have suggested that gradual acceleration is the wrong strategy; that a step change is required. Some evidence has even argued that infrastructure is not the pressing issue; that the Government should instead focus on getting more people online in the first place. The great majority of the evidence we have received, however, has supported the Government in doing something about the UK's broadband infrastructure. Views have simply diverged on what that should be.
8. At a basic level, the Government's plans are straightforward: a subsidy is being provided to decrease barriers to investment in areas of the UK where the commercial case for constructing broadband infrastructure is weak. To understand these plans beyond this basic level, it becomes necessary to grasp what lies beyond the phone sockets in our walls at home and at work. The infrastructure which traditionally carried voice signals through those sockets and out across the country is a complex, articulated hierarchy carrying information from our homes to a local access network, through regional and metropolitan networks, and out to large core networks which cross countries, continents and oceans, passing various exchanges, distribution points and waystations along the way. It is necessary to step back and take in the whole of this map to realise that the Government have focused intervention on a particular part of that network—the local access network—a decision which, if one looks closely, entails a string of decisions with impact on the future of the internet in the UK.
9. A whole variety of problems with the Government's approach have been diagnosed and a number of solutions have been presented. While some proposed solutions represent minor tweaks to the plans already underway, others are wholesale departures from the Government's strategy.
10. Given the fundamental importance of broadband to millions of UK citizens, to UK industries and the wider economy, we hope this report will offer a timely update on what is happening, as well as a number of clear recommendations for how the Government might do better.
11. We would like to thank everyone who gave evidence to us, both at oral evidence sessions, which we held between March and June, and in writing. We also wish to thank our Specialist Adviser, Professor Michael Fourman from the University of Edinburgh, whose expertise greatly benefited this inquiry, and the Parliamentary Office of Science and Technology for their assistance.

CHAPTER 2: BACKGROUND AND POLICY CONTEXT

The communications revolution

12. It has become a cliché to state that recent years have seen a revolution in communications. Information can be stored, replicated, communicated and shared in ways which were unthinkable just a few decades ago. Commercial and social transactions are more efficient, connected enterprises have a global reach and machines can process and analyse information on a superhuman scale. Almost any information can be represented digitally. We live in an information world without frontiers, in which anyone can publish, anyone can consume, anyone can copy, and anyone can modify and reuse. The advent of broadband has played a crucial role in this evolving landscape. Moreover, extrapolating developments over the past 20 years, analysts foretell, for example, a future where appliances in our homes and at work, like fridges and desktops, are connected and enabled as interactive multimedia devices, and far more beyond, bringing benefits to society. Such an ever changing world would require enhanced broadband provision, offering an explanation for, and a justification for supporting, increasing consumer demand for faster broadband in telecoms networks today. The continuous development of broadband infrastructure and policy-making in this area therefore is of critical importance, requiring strategic, long term planning and collective working between governments, regulators and industry.

The UK's broadband performance

13. Like other technological advances, broadband has inspired devoted evangelists and we received evidence from a number of them. To their disappointment, when it comes to the most highly quoted broadband league tables, the UK does not—on most indices—have a place on the podium. Take average connection speed; according to the most recent Akamai 'State of the Internet' report, the UK ranks 16th in Europe and 25th globally.³ Some who contributed evidence to this inquiry have lamented that the UK is therefore “achieving speeds more than three times slower than South Korea.”⁴ Moreover, in the UK, 14% are receiving speeds of less than 2 megabits per second (Mbps),⁵ regarded by the Government as the minimum speed which allows you to use the internet reasonably effectively. Such a situation has caused much discussion of the dangers of the so-called 'digital divide', the dislocation between increasingly active users of the internet and users whose connections or whose skills do not allow them to harness the potential of the internet.
14. It has, however, also been pointed out to us on a number of occasions that the UK's performance in terms of the internet economy can be seen as

³ 'Akamai, *The State of the Internet: 4th Quarter 2011 Report*, May 2012. Available online: http://www.akamai.com/dl/whitepapers/akamai_soti_q411.pdf?curl=/dl/whitepapers/akamai_soti_q411.pdf&solcheck=1&. It is worth noting that there are a host of broadband measures and indicators, and methodologies vary. The overarching point here, without wishing to get involved in an analysis of the merits of different datasets, is that there is clear room for improvement. South Korea and Japan have repeatedly been drawn to our attention as world leaders; South Korea has the highest average connection speed in the world and cities in South Korea and Japan hold many of the top spots in the rankings.

⁴ Pitchup.com

⁵ Ofcom, *Communications Infrastructure Report 2011—Fixed broadband data*, July 2011. Available online: http://stakeholders.ofcom.org.uk/binaries/research/broadband-research/Fixed_Broadband_June_2011.pdf

hugely encouraging, trail-blazing even. Recent research by the Boston Consulting Group put the percentage of the UK's GDP derived from the internet economy at double the G20 average. The internet's contribution to UK GDP in 2010 was more than that of construction and education, and online retail is expected to account for up to 23% of total UK retail in 2016. The report concludes that, "the UK has become a nation of digital shopkeepers."⁶ Whilst there may seem to be a contradiction here between the UK's moderate broadband connectivity and its economic performance, it can be explained by the fact that much e-commerce activity does not actually require superlative broadband speeds. The conclusion to be drawn is that the UK has vast potential in this sphere. If the UK can enhance its broadband provision, then further economic benefits will follow; certainly the Government's strategy is based on the belief that enhanced broadband provision will be a catalyst for economic dynamism. Equally, it could be argued that the UK's strong performance in the internet economy means that the UK has more to lose if it falls behind.

15. There are six important indicators to bear in mind when considering broadband performance, four of which go beyond speed:
 - (a) Speed (maximum and minimum, upload and download);
 - (b) Symmetry (a symmetric connection has equal speeds for upload and download);
 - (c) Latency (how long it takes for a packet of data to arrive at its destination);
 - (d) Jitter (also known as packet delay variation, the variability of latency);
 - (e) Reliability of service and the length of time required to resolve problems.
 - (f) Contention (the number of users sharing the same link to the internet)
16. Speed alone is therefore not the only determiner of broadband performance. Symmetry, latency, jitter, reliability and contention are also critical; what use for instance is a fast connection if it is only achievable at certain times of the day?⁷

Broadband infrastructure: Where is the UK starting from?

17. At first blush, statistics about international broadband download speeds might suggest that the UK need look no further than South Korea for lessons on how to build broadband infrastructure. That is misleading for one simple reason, articulated by Francesco Caio, author of the 2008 Department for Business, Enterprise and Regulatory Reform report on broadband:

"There are other countries that have the benefit of leapfrogging the development stage of the incumbent because they are just late to the party and it is good for them, and clearly Korea is one of them."⁸

By contrast, the UK does have an incumbent communications infrastructure. Given limited resources, this somewhat removes the reason for building a new one—however technically brilliant it could be—from scratch. When it comes to raising the standard of broadband in the UK, it is vital to

⁶ The Boston Consulting Group, *The internet economy in the G-20*, March 2012.

⁷ South West Internet CIC

⁸ Q 128

understand where we start from and the way in which different communications technologies carry data in different ways.

18. In the beginning there was copper, first used for the 19th century telegraph. The physical medium over which most people receive their internet connection in the UK is a twisted pair of copper wires.⁹ Twisted pairs carry data through electromagnetic waves confined within the metal. The copper telephone network was ideal for phone calls which require only low frequency waves. The development of digital subscriber line (DSL) technology in the 1990s used higher-frequency waves to transfer data, initially at moderate speeds. While technological improvements have increased DSL's maximum download speed, higher speeds can only be carried over ever shorter distances using copper wire, and the capacity of all but the shortest copper telephone connections, it is safe to say, is now being exceeded by demand for more data-intensive applications.

Optical fibre

19. In addition to copper pairs, a range of other broadband access technologies are available. Coaxial cables also use copper to carry electromagnetic waves, but they can carry higher frequencies—and so higher data rates—over longer distances. Optical fibre networks, however, carry optical signals along glass fibres thinner than a human hair. The cable network, now mostly owned by Virgin Media, uses a mixture of optical fibre and coaxial cables. The backbone network connecting our telephone exchanges to each other, and to the global internet, is already almost entirely optical fibre. Many argue that the future depends on further deployment of optical fibre.
20. An optical fibre is a hair-thin rod made of glass along which light of different wavelengths ('colours') can travel. Investment in fibre is said to be future-proof in the sense that fibre offers data rates far in excess of current and predicted future demand, and in that there are no proposed technologies that can offer comparable data rates over long distances. To illustrate, the copper technology in use today is around 100,000 times as fast as Morse code, and is approaching its physical limits. The bandwidth limits of fibre are around 100,000 times those of copper. Fibre technology, it is therefore claimed, will accommodate our bandwidth demands for decades to come.

The network architecture and the options for fibre deployment

Fixed line

21. Much of the current debate about broadband policy therefore revolves around questions to do with how deep into the network fibre should be deployed; how close it should be to the end user.¹⁰ In beginning to understand this issue, it is important to have a grasp of the network architecture and, crucially, to note the distinctions between:

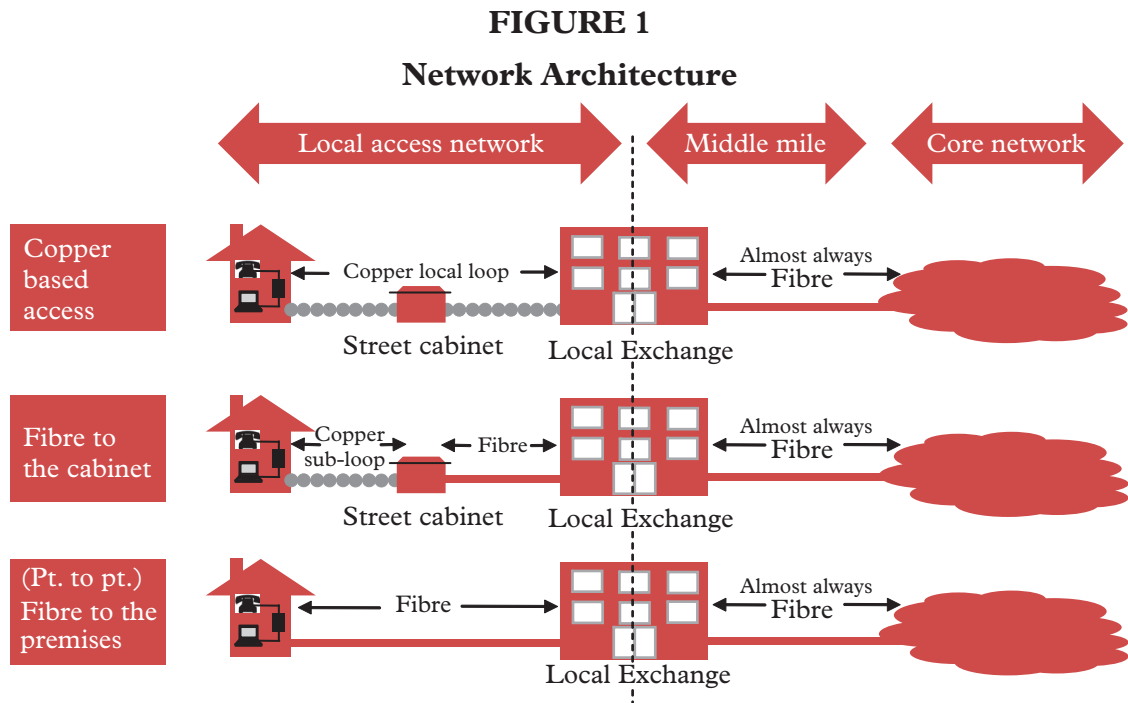
⁹ Sometimes aluminium is used. It has lower performance than copper.

¹⁰ There is some possibly counter-intuitive terminology used in this regard. While 'deep into the network' might imply the part of the network towards the core, in fact, it is generally understood to refer to the end part of the network, the 'final mile' or local access network. Network engineers view the world from the centre of their network, so they use 'deep into the network' as a city dweller might use the phrase 'deep into the countryside'.

- core communications networks, which carry data around the UK and around the world;
- the middle mile networks (also referred to as backhaul) which connect communities to the core network, and;
- local access networks (also referred to figuratively as the ‘final mile’¹¹), which provide the final link (sometimes referred to as the final drop) from a local telecoms exchange or cable television hub into a premises.

It is generally acknowledged that the use of fibre in the core and middle mile networks is needed to provide any modern communications. An issue therefore arises of whether, and to what extent, fibre, given its technological superiority, is also used for the final link to a premises, instead of copper.

22. There are two major technological options for fibre deployment in the access network, and these place different constraints on the commercial organisation of infrastructure provision and service delivery:¹²
- Fibre to the Premises (FTTP), also referred to as Fibre to the Home (FTTH), where each customer has a fibre link coming directly into the home or business, providing the highest data rates and reliability—reportedly the gold standard—and;
 - Fibre to the Cabinet (FTTC), where fibre runs from the exchange to street cabinets, but existing copper is used for the final link into the home. Since the length of copper wire used is shorter than if it were to run all the way from the exchange, higher speeds can be achieved, but data rates are still ultimately limited to a considerably lower rate than is achievable with FTTH.



¹¹ This usage is figurative. It refers to the final leg of connectivity to an end-user. This is often more than a mile in length, and may need to be made much shorter than a mile to deliver faster speeds, depending on the technology used.

¹² With reference to written evidence received from the Parliamentary Office of Science and Technology.

23. FTTP can achieve data rates many orders of magnitude greater than FTTC, but it is very expensive to install new fibre links to existing premises. The Broadband Stakeholder Group (the Government's advisory group on broadband) estimated in September 2008 that national deployment of FTTC would cost £5.1 billion, while taking fibre to every UK home could cost as much as £28.8 billion, with the largest single cost component being the civil infrastructure.¹³ New-build sites, however, can have FTTP installed at least as cheaply as a copper cable. Critics of FTTC argue that while FTTC is cheaper to install in the short term, it may prove more expensive in the long run to upgrade FTTC to FTTP. If the deployment of FTTP technology is chosen, there are still a number of options available for how the network might be structured (detailed in Chapter 4).

Mobile, wireless and satellite

24. There is also a role for wireless technologies which can be used as an alternative to copper or fibre for the final link to the premises. Wireless access networks, based on radio waves travelling freely through the air, offer a solution where installing fibre would be prohibitively expensive, for example in sparsely populated rural areas. There is also increasing use of broadband through the mobile network, where the link to the fibre network occurs at the local cellular base station. In rural areas, however, there is normally no nearby fibre network to link up to; in densely-populated areas demand for mobile broadband is already putting a strain on capacity, which is limited by the amount of radio spectrum available. Developments in wireless technologies such as 4G mobile broadband will allow wireless to achieve greater data rates, but they will not achieve faster data rates than fibre in the access network. Wireless technologies therefore seem to us to have a complementary role, standing in for fibre where there is none, and supplementing it where there is.
25. Satellite technology is also a technology option, but it has high latency (it is a long way to space and back). Furthermore, the total bandwidth available is spectrum-limited just as for terrestrial wireless, so it is not possible to have too many users in any one cell (the footprint on the ground of a single satellite beam). Moreover, satellite typically has even more stringent volume limits than mobile.

The Government's strategy

26. Against the background sketched above, in December 2010 the Department for Culture, Media and Sport and the Department for Business, Innovation and Skills published the Government's broadband strategy, in which it set out a commitment to deliver the best 'superfast' broadband network in Europe by 2015. In order to judge what 'the best' means, the Government adopted a scorecard which will take into account four key indicators: take up and coverage, speed, price and choice. Ofcom expects to publish the data for the 'best in Europe' scorecard this summer.

¹³ BSG press release, 'BSG publishes costs of deploying fibre based superfast broadband', 8 September 2008. Available online:

http://www.broadbanduk.org/component/option,com_docman/task,doc_view/gid,1035/Itemid,9/

27. The Government's specific target is to provide superfast broadband, defined as 24Mbps¹⁴, to at least 90 per cent of premises in the UK by 2015 and to provide universal access to standard broadband with a speed of at least 2Mbps by 2015. It is not wholly clear from *Britain's Superfast Broadband Future* why these speeds were chosen, but it is generally understood that they were not entirely arbitrary. Steven Unger, Chief Technology Officer, Ofcom, told us: "the rationale for... 2Mbps was that that was sufficient to support broadcast quality video."¹⁵ In turn, the 24Mbps target seemed to relate to the highest headline speed achievable over copper lines from the exchange. In addition to the UK's targets, there is also a European dimension. The European Commission has said that: "By 2020, all Europeans should have access to internet of above 30 Mbps and 50% or more of European households have subscriptions above 100Mbps."¹⁶ The Government have not put forward specific measures to reach these European targets, which could be perceived as very ambitious. Indeed, Ed Vaizey MP, Minister for Culture, Communications and the Creative Industries, described them as "challenging".¹⁷
28. In terms of progress towards the UK Government's targets, Ofcom figures report that the coverage of broadband at 2Mbps is 86% of existing connections.¹⁸ They also report that coverage of superfast broadband is around 60% of UK premises. There are striking regional variations: 94% of premises in Northern Ireland have access to superfast broadband, but for Wales and Scotland only 30 to 40% have access.¹⁹ While the Government's strategy is a UK wide strategy, the devolved administrations in Wales, Scotland and Northern Ireland have all identified broadband as a key policy area and have developed initiatives for their own nations which complement policy at a UK level. This report does not scrutinise in detail the strategies of the devolved administrations nor the plans of individual local authorities in England; it focuses on the overarching UK strategy and the progress made in implementing it.
29. For the Government, the drivers for its broadband strategy are economic growth and wider societal benefits. Unveiling the strategy in 2010, the Secretary of State for the Olympics, Culture, Media and Sport, Rt Hon Jeremy Hunt MP, stated boldly:
- "A superfast network will be the foundation for a new economic dynamism, creating hundreds of thousands of jobs and adding billions to our GDP. But it is not just about the economy, around the world there are countless examples of superfast broadband helping to build a fairer and more prosperous society, and to transform the relationship between

¹⁴ 24Mbps has certainly been the most common definition, but, as set out in Chapter 3, it has been variously defined.

¹⁵ Q 675

¹⁶ EU Commission, *European Broadband: investing in digitally driven growth*, September 2010. Available online: <http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0472:FIN:EN:PDF>

¹⁷ Q 795

¹⁸ Ofcom, *Communications Infrastructure Report 2011—Fixed broadband data*, July 2011. Available online: http://stakeholders.ofcom.org.uk/binaries/research/broadband-research/Fixed_Broadband_June_2011.pdf

¹⁹ Ofcom, *Communications Market Report 2012*, 18 July 2012. Available online: <http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr12/uk/>. Superfast is defined in this report as 30Mbps, rather than 24Mbps.

Government and citizens. And shifting Government services online will save billions of pounds of taxpayers' money."²⁰

30. *Britain's Superfast Broadband Future* stated that while the UK was in a sound position, with a competitive market and 71% of UK households having broadband access, it was clear that the UK's use of the internet was going to require improvements to the network. The Government maintained that while its strategy was technology neutral, the deployment of fibre deeper into the network seemed inevitable.²¹ The Government also acknowledged that the business case for rolling out broadband in less densely populated areas was challenging.²²
31. The Government's strategy and targets are therefore predicated on the basis that the market will deliver some, but not all of the investment required. The critical difference between deployment of 1st generation broadband and the current superfast deployment was the existence of BT's copper network which has been used to deliver several generations of broadband technology by simply upgrading the active equipment in homes and exchanges. Progress towards superfast provision now requires new fibre in the local access network and the middle mile because copper can only carry superfast speeds over a short distance—a kilometre or less.
32. There is a clear social cost of weak broadband performance in pockets of the UK. It is widely accepted that the market will deliver improvements to at least two thirds of households (58% of premises already have superfast coverage). Reaching the remainder, however, as the 'final third' of the population, requires Government support or a socially corrosive digital divide will follow. As with much of the nomenclature in the field of broadband infrastructure, the 'final third' can be misleading. It refers to the third of the population to whom infrastructure providers are less commercially motivated to build new network connections due to the weakness of the case for investment. For purposes of illustration, it would be helpful to show just where these individuals are located in the country. However, it is difficult to identify them on a map for a simple reason: when we have tried to do so, we have found that they are located almost everywhere.²³ This is because people without adequate broadband infrastructure are often surrounded by it. The final third must not be understood, therefore, as a geographical area. Nonetheless, it must be said that the geography of rural areas does make them the hardest to reach.²⁴ Broadband performance is already lower in areas of low population density across the UK because the copper lines are longer. Furthermore, there is a weaker commercial case for private investment in rural areas due to the high cost of building new networks where there is a large distance between premises.
33. To this end, the Government have allocated £530m within the lifetime of the current Parliament to stimulate commercial investment in rolling out superfast broadband in areas where the case for commercial investment is

²⁰ DCMS press release, 'Next phase of superfast broadband plans announced', 6 December 2010. Available online: http://www.culture.gov.uk/news/media_releases/7619.aspx

²¹ DCMS and BIS, *Britain's Superfast Broadband Future*, December 2010. Available online: <http://www.culture.gov.uk/images/publications/10-1320-britains-superfast-broadband-future.pdf>

²² *ibid.*

²³ Even in cities, see paragraph 38.

²⁴ Approximately a half of the 'final third' live in remote communities.

weak or non-existent. It has also indicated that a further £300 million may be available for investment in broadband up to 2017.²⁵ The Government see the lack of any commercial interest in deploying superfast broadband in the final third as a market failure that warrants state intervention. The important point to note about the Government's strategy is that they are focusing resources on the local access network, as this is the most challenging investment case for the market.

34. *Britain's Superfast Broadband Future* was clear that the Government's strategy would draw on the ethos of the 'Big Society.' Communities would be enabled to influence or take part in extending access networks; community need and aspiration should drive forward the process, not decisions made in Whitehall.²⁶
35. Broadband Delivery UK (BDUK), a unit within the Department for Culture, Media and Sport (DCMS), is responsible for managing the Government's broadband funding. *Britain's Superfast Broadband Future* envisaged that the £530 million of funding would be released by BDUK in waves, beginning with four pilot areas (Cumbria, the Highlands and the Islands, Herefordshire and North Yorkshire), to local authorities and the devolved administrations. To access funding for roll-out, local authorities in England were asked by the Government to prepare local broadband plans for approval. Moreover, local authorities in England and the devolved administrations have to put in place matching funding from their own resources, and possibly try to access EU funds (the Government have suggested that the European Regional Development Fund could provide up to £100 million²⁷). These various sources of public funding combine to fill the gap between the proposed private investment and the total required. In addition, the Department for the Environment, Food and Rural Affairs (Defra) have a further discrete broadband fund of £20 million specifically for rural areas, called the Rural Community Broadband Fund. It aims to enable communities outside the 90% coverage areas to have superfast broadband services if they can demonstrate local need or demand, feasibility and cost-effectiveness.
36. The issue of state aid has become a pivotal factor in the implementation of the Government's strategy. The European Union recognises that state aid may be needed to deliver a broadband infrastructure that will maximise societal benefits. In essence, a 'market failure' exists if markets, without intervention, fail to deliver an outcome that would yield the highest possible welfare benefits for society. This may arise for instance in terms of socially profitable investments not being undertaken. In such cases, the granting of state aid may produce positive effects and overall efficiency can be improved by adjusting incentives for firms.²⁸ Such public financing must respect EU competition and state aid rules. These are complex. However, the underlying

²⁵ DCMS, *Broadband delivery programme: Delivery model*, September 2011. Available online: <http://www.culture.gov.uk/images/publications/BDUK-Programme-Delivery-Model-vs1-01.pdf>

²⁶ *ibid.*

²⁷ DCMS press notice, 'A third of English councils set to go with broadband', 26 January 2012. Available online: http://www.culture.gov.uk/news/media_releases/8816.aspx

²⁸ EU Commission press release, 'State aid: Commission consults on draft guidelines for broadband networks', 1 June 2012. Available online, full document can be reached via this link: <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/12/550&format=HTML&aged=0&language=EN&guiLanguage=en>

principle is simple. It is to ensure that no aid granted by a Member State or through state resources in any form whatsoever may distort or threaten to distort competition by favouring certain undertakings or the production of certain goods.²⁹ This end is typically achieved by the imposition of various ‘remedies’; for example, by imposing conditions to ensure that competitors have ‘open access’ to infrastructure created with state aid. BDUK have decided, with encouragement from the European Commission, to put in place a single umbrella scheme for the benefit of all local broadband projects. The details of this scheme are currently the subject of negotiations between the UK Government and the EU Commission.

37. As of 10 July 2012, a total of 44 out of 45 local broadband plans, detailing exactly how local authorities in England will roll-out superfast broadband in their areas, have been approved by the Secretary of State. However, action is stalled pending resolution of the state aid impasse.
38. The Government have also established a separate fund to create ‘Super-Connected Cities’—many of which have pockets of low internet connectivity adjacent to areas of strong provision—with access to speeds of at least 80–100 Mbps across a wide area of the cities. In the Budget earlier this year, the Chancellor of the Exchequer revealed that the UK’s first Super-Connected Cities—Birmingham, Bristol, Leeds & Bradford, Newcastle and Manchester along with the four UK capital cities—had all successfully bid to become Super-Connected Cities with so-called ‘ultrafast’ fixed broadband access, and large areas of public wireless connectivity.³⁰ Ultrafast broadband is defined as having a minimum download speed of at least 80Mbps.³¹ The cities will share £100 million (this is a separate pot of money from the £530 million for the ‘final third’) to help deliver plans to use super-connected status to boost growth, attract new businesses and enhance the way services are provided and accessed. In addition, the Chancellor has announced that a new £50 million fund would be created to bring ultrafast broadband to further UK cities.³² Together, the Government claim, the proposals involve providing ultrafast broadband access to around 1.7 million premises and 200,000 businesses by 2015 while almost 3 million residents would have access to a municipal wireless network.³³
39. In a further strand of digital policy, the Government’s £150m investment in the Mobile Infrastructure Project (MIP) is intended to extend and improve mobile coverage—that is to say, extend the mobile network to so-called ‘not-spots’ by subsidising the construction of mobile masts and other infrastructure in remote locations. Some areas of the UK are not provided with any mobile coverage by mobile network operators and other areas receive low quality coverage which results in a poor level of service. In certain areas of the UK—particularly rural areas—there is a limited commercial case for market-driven private investment to improve coverage and quality of service.

²⁹ *ibid.*

³⁰ DCMS press notice, ‘Ten Super-Connected Cities announced’, 21 March 2012. Available online: http://www.culture.gov.uk/news/news_stories/8931.aspx

³¹ ‘Ultrafast’ does not seem to be defined uniformly across Government and industry. Virgin Media, for example, defines it as up to 100 Mbps—see paragraph 41.

³² *ibid.*

³³ *ibid.*

Industry approach

40. There are two major local access networks (the final mile) for broadband in the UK: BT's copper telephone network and Virgin Media's cable television network which almost entirely runs in parallel with BT's network.³⁴ BT is, however, undertaking a very significant upgrade of its network and has already committed £2.5 billion to roll out fibre which will deliver speeds of up to 80 Mbps to two-thirds of UK premises by the end of 2014. BT is bidding for public funds (from the £530 million pot) and working with local authorities to extend roll-out into areas where the commercial case for investment is more difficult (the final third). If successful in most of these bids, BT claims that it can deliver superfast broadband to more than 90% of UK premises. BT states that its commercial roll-out of fibre is progressing rapidly, with more than 10 million of the UK's 28 million premises now passed by a BT fibre optic connection. BT's fibre deployment is primarily by means of FTTC with its copper network being used for the final link from the local cabinet to the home. It is Openreach, the subsidiary of BT Group, which owns and manages the access network infrastructure.³⁵ Notably, BT has stressed that investing in fibre access networks is a high risk investment:

“Our fibre business case has a pay-back period of about 12 years. That is to say we do not get our money back for 12 years, and that is on the assumption that we achieve the volumes of customers we hope to achieve in our business case. That is a long-term investment that most commercial organisations would not tolerate.”

Significantly, BT has indicated that in order to support the Government's policy objectives they are “willing to spend a further £1 billion or so of BT's capital to match Government funding to do that, to roll it out into the final third, and to get as far as we possibly can into the final third...”³⁶ While BT's fibre deployment is primarily by means of FTTC, it has recently launched a FTTP range of products and has announced plans to make a form of FTTP available ‘on demand’ in areas covered by its FTTC network.³⁷

41. Virgin Media's cable network covers around 50% of the UK population. Over the last 20 years, Virgin states that the cable industry has invested over £13.5 billion in a fibre-rich network that has the capacity to deliver superfast broadband to around 13 million homes across the UK.³⁸ Virgin Media is currently offering speeds to consumers of up to 100 Mbps, which it refers to as ‘ultrafast’. Virgin has no current plans to expand its infrastructure footprint substantially.
42. Fujitsu has also been engaged in the Government's plans and the BDUK procurement process. In April 2011, it announced plans, in collaboration with Virgin Media, TalkTalk and Cisco, to deliver next generation internet services to 5 million homes in rural Britain, describing the collaboration and build of a new superfast, fibre optic broadband network as “a ground

³⁴ KCom is the incumbent infrastructure owner in Hull, where neither BT nor Virgin Media are present—a peculiar quirk of history.

³⁵ For fuller background information on BT Group, see Appendix 4.

³⁶ The data in this paragraph is derived from BT written evidence and Q466.

³⁷ BT press release, ‘BT launches ultra-fast broadband’, 2 July 2012. Available online: <http://www.btplc.com/News/Articles/Showarticle.cfm?ArticleID=709CA98E-4941-4EE1-B575-CB66CAD20D19>

³⁸ Virgin Media

breaking and innovative alternative to BT Openreach.”³⁹ In the majority of areas, Fujitsu said that it would provide fibre directly to the home, rather than to the local street cabinet. Recent reports, however, suggest that Fujitsu has withdrawn from the BDUK procurement for the time being, albeit that it is committed to bidding in the future, causing concerns about the competitiveness of the tendering process and leaving BT as the only provider that has so far secured public funds.⁴⁰

43. Companies in this sector have clearly been reluctant to participate in the Government’s procurement programme and bid for funding. Prior to Fujitsu’s recent decision to withdraw for the time being, seven of the original nine contenders had already withdrawn from BDUK’s framework procurement process. Geo, for example, cited a number of concerns, including the accusation that the gap funding model (see Box 4 in Chapter 4) adopted by BDUK and local authorities favours the incumbent.⁴¹
44. The regulatory framework for the industry designed and enforced by Ofcom is based on a number of European Union (EU) directives which have been implemented into UK law by the Communications Act 2003. The framework is based on competition law principles, meaning that market interventions are only permissible if a market assessment concludes that one or more companies hold a position of significant market power (SMP) in the market. The obligations set by Ofcom are currently targeted at addressing identified market power in specific, narrowly-defined markets. An impact/cost-benefit assessment must demonstrate that any intervention is proportionate and reasonable. The regulatory framework has a specific and defined purpose and its implementation is subject to legal challenge.
45. The regulatory framework will be elaborated on in detail in later chapters. In particular, the final paragraphs of Chapter 4 consider the implications of the fact that since May 2011, Ofcom has had the power, by virtue of Article 12 of the Revised EU Framework Directive, to impose regulatory obligations with regard to infrastructure sharing in the broadband market without reference to significant market power. This seemingly small change may have a significant impact on policy (see paragraphs 221 to 236).

³⁹ Fujitsu press release, ‘Fujitsu unveils plans to bring fibre to 5 million homes and businesses in rural Britain’, 13 April 2011. Available online: http://www.fujitsu.com/uk/news/pr/fs_20110413.html

⁴⁰ *Financial Times*, ‘Fujitsu withdraws from broadband funding’, 10 July 2012.

⁴¹ Geo written evidence and Geo press release, ‘BT’s PIA product inhibits a competitive fibre network landscape; Geo withdraws from BDUK and next generation access bids’. Available online: <http://www.geo-uk.net/press-releases/pia-announcement>

CHAPTER 3: THE CASE FOR OPEN ACCESS FIBRE-OPTIC HUBS

46. In this chapter, we will outline our vision for the UK's broadband infrastructure. In doing so, it will be immediately recognisable that our vision does not match the Government's. This is largely because, in considering the current policy, we have found that fundamental questions of first principle were not addressed. We will elaborate below, but it should be noted that despite having, in our view, misjudged their first steps, the Government appear not to have veered too far off course. Accordingly, many of the specific measures we will propose could usefully act as complements to rather than wholesale replacements for those adopted under the current policy, and so throughout this report, we offer recommendations in the hope of contributing to the success of the Government's current efforts. It will be instructive, however, perhaps for future policy makers in this area, to understand how—and why—we part company, in a rather fundamental way, at the outset.
47. Recall, therefore, that the Government's starting point is as follows:
- There are “still some 2 million households who cannot access a good level of broadband,”⁴² and additionally;
 - It is a matter of “simple fairness ... [that] virtually all homes will have access to a minimum level of service.”⁴³
48. This is a vision of a UK in which virtually all people will have access to an infrastructure with the technical capacity to carry a minimum level of service. Going further, the Government also want as many people as possible to have access to more than the minimum, with the most prominent feature of a higher level of service being the speed at which data can run over the infrastructure. Basic broadband is one thing, but the strategy document makes clear:
- “The benefits of superfast broadband have an impact across the whole economy—whether this is through greater scope for tele-working and home-working, which reduces the pressure on the transport network and lowers carbon emissions, or better delivery of public services—such as remote education services.”⁴⁴
49. It should also be noted that the Government's strategy conjures a picture of what internet services should look like—or rather, the qualities (particularly speed) which define them. The starting point for their policy, in other words, arises from thinking about broadband primarily as a commercial service proposition, and one in which the general availability of speed is the crucial factor. Then, given its spillover benefits, the question that naturally follows is how to encourage the market, as it stands, to supply it to more people, and as much as possible to an agreeable standard.

⁴² DCMS and BIS, *Britain's Superfast Broadband Future*, December 2010. Available online: <http://www.culture.gov.uk/images/publications/10-1320-britains-superfast-broadband-future.pdf>

⁴³ *ibid.*

⁴⁴ *ibid.*

50. Certainly, there are important commercial realities to be addressed by policy. In our view, however, another matter should have been considered as well, arguably above all others: what should the UK's broadband infrastructure look like in view of its place as a major strategic asset, at least on a par with the UK's roads, railways and energy networks? This is where policy on broadband infrastructure should start, before equally going on to consider how to get there. A full and rational answer to the question is liable to be rather technical in places. For the purpose of clarity, therefore, we will as much as possible maintain our discussion within the bounds of statements of principle. In doing so, we outline the makings of a coherent vision for the UK's broadband infrastructure, and as such, a more solid foundation from which the Government's policy might have started, and to which, with some judicious tweaking, it might be possible to return.

Our vision for the UK's broadband infrastructure

51. In brief, our vision is of a robust and resilient national network linked primarily by optical connectivity, bringing open access fibre-optic hubs into or within reach of every community. This would allow diverse providers, large and small, to contribute to the reach and resilience of our national connectivity and allow all individuals to benefit from whichever services, including public ones, will run over it in time to come.
52. In addition, in order to realise our vision, our view is that the UK's future broadband infrastructure should deliver the following:
- (i) Every community should be within reach of an open access fibre-optic 'hub';
 - (ii) Every such hub should be fed by ample fibre-optic cable, providing open access to optical links back to the exchange, and back to the public internet—which will not be free, but made available on fair, reasonable and non-discriminatory terms, allowing third parties to build their own local access networks meeting appropriate technical standards, using whichever technologies they choose, from that hub;
 - (iii) At the very least, we expect a hub to be able to provide backhaul for a wireless network, where there is demand, so that premises would be able to gain access to a wireless internet service from at least one of these hubs—assuming they can afford to do so.⁴⁵
53. **We recommend that the Government consider our vision for the UK's broadband infrastructure as set out in this report. As a first step, we recommend that the Government undertake to produce detailed costings of our proposal, not least because our proposal removes the final mile—the most expensive per capita component of the network—from the costs requiring public subsidy.**

⁴⁵ Though currently unlikely, it may be a matter of future welfare policy to ensure that everyone can afford to do so. Also see paragraphs 65 and 150.

BOX 1

The open access fibre-optic hub and dark fibre

The open access fibre-optic hub is, in fact, quite a simple idea. It refers to a physical object—in all likelihood a box—situated in the vicinity of a community. Its job is to act as a waystation between that community and the broadband infrastructure that spreads out across the rest of the country. Running into the hub from the wider network would be an ample number of fibre-optic cables, which in the first instance, would be ‘dark,’ in the sense that no data traffic will yet be running over them. The reason for this may be, for example, that it has not yet been connected in any way to the properties in the community around it. An important feature of the hub, however, is that the dark fibre running into it should be open access; so that anybody is permitted to build a link between a premises in the community and a fibre in the hub by installing their own passive or active electronic equipment in between, and then rent the existing fibre they are connecting to, which extends the connection from the premises out from the hub and onto the wider network. This would enable any type of compatible access network to be built by any local community, SME or infrastructure provider.

54. The idea of the open access fibre-optic hub within reach of every community is not new. In fact, the Government themselves initially had plans analogous to those above, announcing in December 2010 that: “an ambition to deliver a ‘digital hub’ in every community in the country is at the heart of the... strategy.”⁴⁶
55. It should be noted, however, that since then, the idea appears to have drifted somewhat from their plans. In oral evidence, Robert Sullivan, CEO, BDUK, told us:
- “I would not say the digital hub concept exists in pure terms, but the philosophy of getting fibre as deeply into the network as we can is still inside the system.”⁴⁷
56. In particular, the basis on which the hub can still be seen as a component of the Government’s plans is, according to Mr Sullivan, the availability of an on-demand product from BT. He told us: “FTTH on demand from BT is a good example of what we had in mind.”⁴⁸ For reasons which are made clear in BOX 1, however, the exclusive ability of one provider to build a final fibre link is actually a categorical departure from the idea of an open access fibre-optic hub in which anyone is permitted to build a link between premises in the community and a fibre in the hub. In fact, it well and truly puts the kibosh on the idea. While the Government clearly considered the proposal in general terms early on in their deliberations, it is fair to say now, that it has disappeared from their plans in implementation.
57. We note indications, however, that despite its departure from the original plan, measures which would bring about an end-result with benefits similar to those of the open access fibre-optic hub, are being considered by the European Commission as conditions of the umbrella state aid permission BDUK are seeking for projects operating within its Framework. Interestingly, reports suggest that the European Commission is particularly concerned

⁴⁶ DCMS press release, ‘Next phase of superfast broadband plans announced,’ 6 December 2010. Available online: http://www.culture.gov.uk/news/media_releases/7619.aspx

⁴⁷ Q 767

⁴⁸ Q 807

about the issue of open access and this is causing delay.⁴⁹ This is unsurprising insofar as in June 2012, the European Commission launched a consultation, which closes on 1 September, on the revision of the guidelines on public funding for broadband services.⁵⁰ This document is instructive, not least because it seems emphatic on the issue of open access.

“... Third parties’ effective wholesale access to a subsidised broadband infrastructure is an indispensable component of any State measure supporting broadband. In particular, wholesale access enables third party operators to compete with the selected bidder (when the latter is also present at the retail level), thereby strengthening choice and competition in the areas concerned by the measure while at the same time avoiding the creation of regional service monopolies...

“... Due to the economics of NGAs, it is of utmost importance to ensure effective wholesale access for third party operators. The subsidised network must offer access under fair and non-discriminatory conditions to all operators who request it and will provide them with the possibility of effective and full unbundling. Third party operators must therefore have access to passive and not only active infrastructure. Apart from bitstream access and unbundled access to the local loop, the access obligation should therefore also include the right to use ducts and poles, dark fibre or street cabinets.”⁵¹

58. This would seem to suggest, inter alia, that if the Government were to implement our approach—which, by design, incorporates open access, there would be fewer, if any, state aid complications. In a further strand of European Commission policy, consistent with its state aid consultation, the Commission has recently published its conclusions following consultation on the broadband investment environment. The first conclusion drawn states that:

“Competition needs a level playing field. In particular, alternative players should not have to compete with one hand tied behind their backs: incumbents should not be able to discriminate between their own retail arms and others’. Although often undervalued in today’s regulatory practice, securing truly equivalent access by alternative operators to incumbent networks is probably the most important guarantee of sustainable competition, on existing and new networks.”⁵²

59. **We endorse the European Commission’s suggestion that open access to dark fibre at the cabinet-level should be introduced as a condition of BDUK’s umbrella state aid permission.**

⁴⁹ Guardian, ‘UK rural broadband on hold as European commissioners dig in heels’, 3 July 2012. Available online: <http://www.guardian.co.uk/technology/2012/jul/03/bduk-broadband-scheme-delayed-european-commission>

⁵⁰ EU Commission press release, ‘State aid: Commission consults on draft guidelines for broadband networks’, 1 June 2012. Available online: <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/12/550&format=HTML&aged=0&language=EN&guiLanguage=en>

⁵¹ Paras 67(g) and 76(b). The consultation document is available from the link in footnote 50 above.

⁵² European Commission—policy statement by Vice-President Kroes, ‘Enhancing the broadband investment environment’, 12 July 2012. Available online: <http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/12/554&format=HTML&aged=0&language=EN&guiLanguage=en>

60. **Accordingly, not least, in order to expedite its own programme, we recommend that the Government incorporate open access to dark fibre voluntarily as a feature of its Framework agreement with suppliers.**
61. **More broadly, we endorse and invite the Government's view on the European Commission's conclusion on the broadband investment environment that: "securing truly equivalent access by alternative operators to incumbent networks is probably the most important guarantee of sustainable competition, on existing and new networks."**
62. The state aid negotiations are a useful illustration of the point made earlier that, while the Government may have made an initial misstep in failing to stop and think strategically about what the UK's broadband infrastructure should look like, perhaps serendipitously, they have not veered too far from the path down which proper consideration of this question would have led them. To that extent, we will be able to make a number of recommendations throughout this report which could relatively easily help put the Government's strategy back on course. For the purposes of clarifying the differences between our vision and the Government's, it will remain more straightforward to think of the open access fibre-optic hub idea as an entirely alternative proposal to the approach being pursued by the Government. Accordingly, we will continue to refer to it as such.
63. With just this brief outline in place, the significance of the differences between our vision and the Government's may be somewhat opaque. In the remainder of this chapter, we will try to make this significance clearer. In straightforward terms, there are three principles behind our vision and the open access fibre-optic hub approach which could usefully be incorporated into the Government's thinking:
- Broadband policy should be driven, above all, by the need to arrest and ultimately eliminate the digital divide, creating the opportunity to unleash its social benefits for all UK citizens;
 - It should also be driven by an avowedly long-term, but also flexible view of the infrastructure's future, avoiding prejudicing any particular technology, or falling into the trap of specific speed targets.
 - Broadband policy should also strive to reinforce the robustness and resilience of the network as a whole.

We will take these in turn.

Principle 1: Reducing the digital divide

64. The first principle that lies behind our vision is as follows: policy in this area should be driven, above all, by the need to arrest and ultimately eliminate the digital divide, creating the opportunity to unleash its social benefits for all UK citizens. In fact, the Government really have to be aware of two 'divides.' The first separates those communities who can access the infrastructure of their choice from those who cannot. The second separates those who, once they have access to the internet, take it up and use it effectively, from those who do not or cannot.
65. The digital divide with most obvious relevance to the present inquiry is the first one, between 'haves' and 'have-nots,' separating communities who can gain access to the infrastructure they would choose from those who cannot.

Of course, the potential benefits of reducing this divide are inestimable, with effects on, among other things, the ability of individuals to work from home, on the ability of socially isolated people to stay in contact, and ultimately the ability of national and local government to provide public services, even to far-flung, remote communities. The Government's own strategy document makes a similar point that: "for example tele-working can:

- Help reduce the barriers to entering the labour force for those groups which may be less mobile (e.g. disabled and parents with child-care responsibilities who wish to work part-time);
- Potentially contribute to the reduction in traffic congestion and carbon emissions;
- Improve work-life balance".⁵³

66. In our view, social benefits of this type are the most significant reason for public policy interest in broadband access, and the use of public money is therefore justified to ensure everyone has the opportunity to benefit from them. We were interested to hear from Suvi Lindén, former Finnish Communications Minister and Special Envoy for the Broadband Commission for Digital Development, about the social benefits, particularly in healthcare, that could be realised from enhanced broadband connectivity:

"We just cannot afford to provide the same level of care as we are doing now and that people are used to having in Finland. I have quite often said that, for some municipalities that have these elderly people living, for example, 80 kilometres from the centre of the municipality, 'It is cheaper for you to build up the fibre to this old lady than to take her to live in the city centre in the nursing home.' It costs what it would cost for the municipality to have her living in the public-provided nursing home for two months."⁵⁴

67. It is not clear, however, whether the Government's strategy will eliminate the divide between those communities who can and those who cannot enjoy these benefits. This is because, on the one hand, there is no guarantee that the Government will meet their targets; and on the other, the targets themselves are inherently divisive. In concrete terms, they set a course for a UK in which "virtually all homes will have access to a minimum level of service"⁵⁵ and in which "superfast broadband should be available to 90% of people in each local authority area."⁵⁶
68. The divide inherent in these targets is, as noted above, a natural consequence of developing policy in response to the wrong question. With the proposition in mind that policy needs above all to stimulate the market to widen the provision of broadband as a service, the investment challenge is the obvious obstacle. In the stated absence of sufficient Government resources to subsidise provision in all areas which present such a challenge, it then becomes inevitable that some areas will be left behind. This is all the more

⁵³ DCMS and BIS, *Britain's Superfast Broadband Future*, December 2010. Available online: <http://www.culture.gov.uk/images/publications/10-1320-britains-superfast-broadband-future.pdf>

⁵⁴ Q 24

⁵⁵ DCMS and BIS, *Britain's Superfast Broadband Future*, December 2010. Available online: <http://www.culture.gov.uk/images/publications/10-1320-britains-superfast-broadband-future.pdf>

⁵⁶ DCMS press notice, '90% of homes and businesses should have superfast broadband by 2015', 12 May 2011. Available online: http://www.culture.gov.uk/news/news_stories/8098.aspx

disappointing for the fact that the communities who would enjoy the greatest uplift in their quality of life from enhanced broadband provision are precisely those likely, on such a policy, to find that it still lies beyond their reach, maintaining if not widening the digital divide.

69. By contrast, if policy development begins by asking what the UK's broadband infrastructure should look like, and with the principle that whatever the answer, it must serve to reduce if not eliminate the digital divide, it will set itself a challenging task, but one which puts the Government on the right track. This is precisely the principle which lies behind our vision for the UK's broadband infrastructure: a national network which brings open access fibre-optic hubs within reach of every community. Over time, this would ensure that all communities are able to benefit from the advantages of access to broadband.
70. It may be helpful, briefly, to explain how the open access fibre-optic hub idea could make this work, and hence why it is an improvement. As things stand, the exact capacity provided to individual premises with relatively poor internet connections is generally a factor of the length and quality of the copper wire that runs between their property and the local exchange. For example, to take speed as an indicative measure, with the latest DSL technology:
 - a 700 metre line could achieve 40 Mbps;
 - for 2km of copper, the download speed may reach 'up to 5Mbps';
 - with more than 3km of copper, the download speed will probably be less than 2Mbps.⁵⁷
71. This degradation in capacity of a copper line means that, at a certain point, capacity is so compromised, that a community would be better served by radio connections or by laying more local fibre. The obvious question that arises is how a new radio mast could be connected back to the existing network, or how fibre connections could be extended out to reach a community. At present, a number of regulatory and proprietary obstacles would stand in the way—we will discuss these and their specific remedies in Chapter 4. At the moment, no one wanting to undertake either of these projects, except the incumbent provider (overwhelmingly BT or Virgin Media), would realistically be able to do so.
72. By contrast, as noted in Box 1, a key feature of open access fibre-optic hubs would be the fact they are precisely that—open access, meaning any third party, not merely the incumbent provider, would be able to use them. This would enable any type of access network to be built by any local community, SME or infrastructure provider to make the final connection between the hubs and people's properties, so long as they meet certain mandated technical standards.
73. To that end, once fibre is driven out to the hub, we anticipate the emergence of a new industry of infrastructure providers who will be able to respond to local demand and build out local access networks accordingly (see Chapter 5). As these emerge, the choice between fibre and wireless technologies in the local access network will naturally be driven by local demand and market forces. Certainly, fibre will represent a premium choice, but where resources

⁵⁷ Extrapolated from BT data.

cannot stretch to it, wireless links will provide a more affordable option. A wireless network serving over 200 subscribers on Knoydart and the Small Isles, in one of the most remote areas in the UK, is already providing symmetric speeds of up to 30 Mbps. These speeds are currently constrained by the limited capacity of the backhaul connections available, not the local wireless links. The fibre-optic hub idea, therefore, represents a way to reduce significantly if not eliminate altogether the digital divide.

74. It should be noted, however, that we do not see the introduction of the open access fibre-optic hub as a silver bullet. A number of measures, both regulatory and policy-related, would need to be in place to enable its success. We will elaborate on these points later, noting that many of them could, as we have indicated, help to bring the Government's approach closer to ours; it is certainly not *too* late. For now, what matters is to recognise that policy ideas are available which can make a substantial difference to the digital divide. To bring them into view in good time, however, policy development must start by asking what the UK wants its infrastructure to look like, and what's more, with the principle firmly in mind that any measures undertaken should strive, above all, to reduce and ultimately eliminate the digital divide.
75. **Broadband policy should begin from the question: what should the UK communications infrastructure look like?**
76. **In addition, it should be a fundamental principle of broadband policy that whatever measures are undertaken to enhance or extend its availability, they strive to bring about equality of opportunity to access broadband across all communities in the UK.**
77. **In this sense, Government policy on broadband should be driven, above all, by the social benefits it can unleash, and the need to arrest and ultimately reduce a damaging digital divide.**

Principle 2: Taking a long-term, but flexible view, and avoiding the 'speed trap'

78. The second principle that lies behind our vision, as set out in paragraph 63, is as follows: policy should be driven by an avowedly long-term, but also flexible view of the infrastructure's future, avoiding prejudicing any particular technology, or falling into the trap of specific speed targets. We also note that different factors—whether speed, symmetry, contention, latency, resilience or a combination—will be critical for different users, depending on their needs (see paragraph 15).
79. Consider the Government's goals. By the end of this Parliament in 2015, they are aiming for:
- “providing everyone in the UK with access to broadband speeds of at least 2Mbps”;
 - “and superfast broadband should be available to 90% of people in each local authority area.”⁵⁸

⁵⁸ DCMS press release, ‘90 per cent of homes and businesses should have superfast broadband by 2015’, 12 May 2011. Available online: http://www.culture.gov.uk/news/news_stories/8098.aspx

80. First, it has to be said that in a field quite so riddled with jargon and industry branding as broadband, it has been singularly unhelpful for the Government to use a term as vague as ‘superfast,’ and in so doing, to give it quite such a flexible meaning. By our count, they have used three varying definitions:
- In its early guidance to local authorities, the meaning was clear: “BDUK has defined superfast broadband as having a potential headline access speed of at least 20Mbps”;⁵⁹
 - Later, in the glossary of its delivery model, “BDUK defines superfast broadband infrastructure as infrastructure capable of delivering speeds higher than 24Mbps, in line with the Ofcom definition”;⁶⁰
 - More recently, in its guidance on state aid, this definition has shifted to “infrastructure capable of delivering superfast broadband speeds (meaning speeds of 30 Mbps or in any event more than 24 Mbps)”;⁶¹
 - Furthermore, the BT Infinity product used to deliver ‘superfast’ in Cornwall only guarantees a minimum of 15Mbps.
81. Due to this variability, the Government have been forced to maintain ‘superfast’ as a somewhat moving target:
- “All new projects must target delivery of superfast broadband speeds of 30 Mbps or more, which is in line with the EU’s superfast/NGA broadband targets. However, due to earlier UK definitions of superfast referring to speeds of more than 24 Mbps, projects already underway will be satisfying the superfast broadband speed requirement if they seek to deliver speeds of more than 24 Mbps.”⁶²
82. Second, the shifting nature of this target also points to a conceptual problem with the notion of superfast—and any speed target—more generally: the relatively arbitrary differentiation it creates between a particular marker, ‘superfast,’ on the one hand, and ‘basic,’ as a minimum level of service, on the other.
83. Speed is a continuum. The Government may have upgraded their definition of superfast to 30 Mbps, but the industry often defines this at higher levels, and sometimes at 100 Mbps or more. Vint Cerf, Google’s Chief Internet Evangelist and renowned ‘father of the internet,’ is often quoted as half-joking that, in the end, “‘broadband’ is whatever network speed you don’t have, yet!”⁶³

⁵⁹ DCMS, *BDUK Broadband Delivery Project. Bidding guidance for Local Authorities and other local public bodies. Award Round Spring 2011*, 6 December 2010. Available online:

http://www.culture.gov.uk/images/publications/BDUK_bidding_guide.pdf

⁶⁰ DCMS, *BDUK Delivery Programme. Delivery Model*, September 2011. Available online:

<http://www.culture.gov.uk/images/publications/BDUK-Programme-Delivery-Model-vs1-01.pdf>

⁶¹ DCMS, *National Broadband Scheme for the UK: State Aid Guidance: Overview of the Scheme and Criteria for use*, 20 March 2012. Available online:

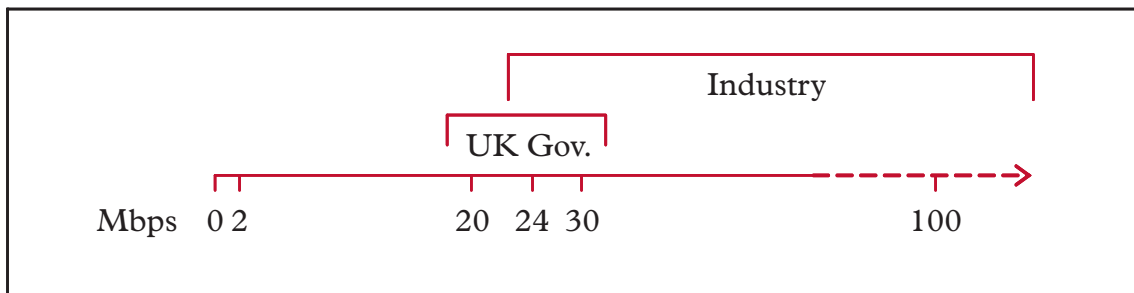
http://www.culture.gov.uk/images/publications/State_aid_Guidance_Overview_of_the_Scheme.pdf

⁶² *ibid.*

⁶³ BBC News Online, ‘Vint Cerf on Alan Turing: Why the tech world’s hero should be a household name’, 18 June 2012. Available online: <http://www.bbc.co.uk/news/technology-17662585>

BOX 2

Definitions of Superfast



84. By planting specific speed targets on this continuum, the Government have been forced to orient their strategy around ways of ensuring that people necessarily get these speeds. This may sound like a virtue, but this early focus on superfast speeds, has, further down the line, in our view, had a serious and compromising effect on the detail of Government policy, regulation and the industrial decisions which have followed from it.
85. The root of these problems is the following: guaranteeing end-users specific speeds as part of policy obliges the UK to build an infrastructure which goes all the way to people's homes and businesses; it forces the Government to focus their investment—and policies to stimulate investment—on the local access network.
86. As reported in Chapter 2, local access or the 'final mile' is the part of the network whose construction presents the most challenging investment case. As a result, infrastructure providers face weak incentives to invest in upgrades which might be in the long-term and wider interest of the UK, but for which there may be no commercial case in the shorter time horizon palatable to their shareholders. It might be worth explaining why this is the case.
87. Recall that the starting point for the Government's policy arises from thinking about broadband primarily as a commercial service proposition, and that then, given its spillover benefits, the question that follows is how to encourage the market to supply it to more people, and as much as possible to an agreeable standard. Given the foregoing discussion, the question the Government—within the scope of this policy thinking—are therefore forced to answer is: how to encourage the market to act in the wider interests of the UK? Of course, they cannot simply make choices for investors. The option which remains is to stimulate the market to act in a responsible way through other means—by providing subsidy for the areas of the country which the market would otherwise ignore. Such a policy, however, assumes that in accepting this subsidy and proceeding with investment, the market will do so in a way that reflects the wider interests of the country—in other words, as we argue below, in a way that makes the infrastructure suitably inclusive, flexible and straightforward to upgrade in the future as needs and demands change and evolve.
88. The market, in current circumstances, is unlikely to act in this way. To extend out the 'final third,' access to backhaul is required. Where the market has failed to generate competition, connections to backhaul are predominantly owned by the incumbent, BT. BT benefits from economies of scale and scope; it can aggregate demand from a range of the segmented

markets that fall under the broad umbrella of providing connectivity.⁶⁴ These advantages provide BT, *inter alia*, with the opportunity to take greater risks than its competitors when it comes to its investments, which as we will clarify in Chapter 4, can have the effect of discouraging others from investing at all. In turn, this ‘competitive flight’ removes the threat of competition and hence the presence of any real pressure or urgency on BT to invest itself—a set of circumstances which may have one of two outcomes: no investment, and no further infrastructure construction at all (this is the market failure associated with the final third, and the problem the Government’s policy seeks to address); or investments are made, perhaps stimulated by subsidy, but which may be short term, with no easy upgrade path to accommodate future demand for enhanced capacity, and which will not serve the interests of the UK more widely, as described above.

89. In summary, given the—at present—relatively non-competitive nature of infrastructure provision, if you start from the proposition that policy needs above all to stimulate the market into providing its services more widely, you risk allowing the market to make decisions about a vital component of national infrastructure which are not in the longer-term and wider interests of the UK. Embarking on policy making in such a way moves the focus away from the right starting point: what should the UK’s broadband infrastructure look like in the first place, given its status as an asset of strategic, national value?
90. As well as leading to an over-reliance on the market, the Government’s failure to start from the right question, and instead focus straightforwardly on the delivery of faster speeds, has created other problems. These are probably best understood in the light of a wider debate which the Government’s focus on superfast has generated. Its central question is: what speed of broadband does the UK really need?

BOX 3

The speed debate

The debate ranges widely and often features strong views about the uses to which superfast speeds could be put—and in turn logically sophisticated discourse about whether these uses and services are of the kind which merit Government support for the infrastructure over which they would run. On one side, speed evangelists cite applications such as tele-health, cloud computing, and HD IPTV (Internet Protocol Television) as providing justification for public support. These, it is argued, carry significant positive externalities or ‘spillover’ effects, and may have considerable impact on the wider UK economy and society. These spillover effects range from the creation of new, ‘distributed’ industry models, and a whole variety of effects on home-working, socially isolated people and the provision of public services to remote communities. On the other side, sceptics argue that the same behaviours and industries can thrive on an infrastructure that has undergone an evolutionary upgrade, rather than a revolutionary overhaul, and so can be brought about at far lower public cost. In short, there is not yet a ‘killer application’ (killer app) which puts the case for wider or universal access to superfast speeds beyond all question.

⁶⁴ We will elaborate on this point in Chapter 4.

91. Our view is that the debates about speed are somewhat of a red herring. There is justification for the approach of those sceptical about the need for high speeds:
- asking first whether the purposes to which broadband infrastructure will be put create a genuine need for certain speeds;
 - and in turn, whether those end uses are sufficiently in the public interest that public subsidy is justified to hasten the construction of the infrastructure they will rely on.
92. Indeed, we endorse this second point and believe strongly that broadband access is socially useful and merits public subsidy. However, definitive answers to these questions are pivotal, only if policy has been oriented around delivering specific speeds to individual end users in the first place. Doing so is flawed for the reasons we have given, as well as because it inevitably forces Government to make dogmatic statements about things which are better left flexible. By contrast, where policy making begins by asking what the UK's communications infrastructure should look like, and with the principle that it should be driven by an avowedly long-term, but also flexible view of the infrastructure's future, it will set itself a challenging task, but one which, in our view, puts the Government on the right track.
93. This is precisely the principle which lies behind our vision for the UK's broadband infrastructure: a national network which allows diverse providers, large and small, to contribute to the reach and resilience of our national connectivity and individuals to benefit from whichever services, including public ones, will run over it in time to come. Again, it may be helpful to explain how the open access fibre-optic hub idea could make this possible.
94. As outlined in Box 1, the significance of the open access fibre-optic hub is that it brings accessible, and flexible points of connection to the wider network within the reach of individuals and communities. Accompanied by changes to the regulatory backdrop of the market discussed in Chapter 4, this would create a fertile environment for competition in the local access network and allow these people to choose (and pay for) the kind of final link or drop which they want themselves—with all of the consequences this may have for upload and download speeds, contention, latency, jitter and so on. This flexibility to build out a local access network sufficient for demand at any given point in time not only eliminates the need for relatively arbitrary mandates for speed in the present, but will also make it possible to meet whatever foreseeable demand there may be in the future.
95. One undeniable feature of the killer app debate is the impossibility of predicting which services will be in demand, and what the needs of society will be in the longer term. Even sceptics concede, however, that we have at our disposal a specification for broadband infrastructure whose technical capacity is so immense, that with it, even the most stretching estimates of our likely needs could be met well into the future. It is called point-to-point FTTP.⁶⁵
96. What is more, the most stretching and long-term estimates are ones we should take seriously and, at a minimum, ensure our infrastructure can flexibly be upgraded to cope with. There are a number of reasons why.

⁶⁵ We refer to Fibre to the Premises (FTTP) rather than Fibre to the Home (FTTH) in this report as FTTP captures both homes and businesses.

97. First broadband infrastructure is an asset of strategic, national value. It does not itself bring about, but it does enable, meaningful social and economic innovation and change; if we want to be ambitious for ourselves, we have to be ambitious for it, and under any circumstances it should not hold us back. In this respect, we agree with the FTTH Council Europe: “While the future needs of society cannot really be fully anticipated, a network which has theoretically almost infinite capacity is preferable to networks which are already constrained.”⁶⁶
98. Second, there is also a basis on which we believe we can, with some confidence, come to a view of the speeds the infrastructure will have to support in the future. Neilsen’s law,⁶⁷ like Moore’s law,⁶⁸ extrapolates from past experience to predict the future. It has proved a remarkably accurate predictor of bandwidth capacity and demand. On this basis, we should expect that those who are satisfied with 2Mb/s today will demand ~8Mb/s in 2015 and ~64Mb/s by 2020, and so on. Our infrastructure must be designed to cope with this advancing demand.
99. Finally, the history of the internet suggests that it has enabled new developments, not because it was designed with any of them in mind, but because it offered a very simple, technical capacity for the transfer of information from one place to another which people could then use their creativity and ingenuity to exploit. We would expect greater capacity to unleash a plethora of new ideas and services. As Francesco Caio, author of the 2008 Department for Business, Enterprise and Regulatory Reform report on broadband, put to us in oral evidence: “once you have optical continuity between point A and point B, the internet will do the rest for you.”⁶⁹
100. We acknowledge that the local access network presents a challenging investment case and moreover, that point-to-point FTTP, as a gold standard, represents the technical specification with the highest capital outlay required to construct it. There are two options to be considered:
- Given limited resources, policy should be directed at building out an end-to-end infrastructure which is affordable, however likely it may be that in the first instance, some will be left with nothing, and in time, this will itself become redundant and require replacement;
- or
- Given limited resources, policy should be directed at building out an infrastructure to a high specification, not necessarily all the way to people’s doors but within their reach, and providing them with the technical and affordable means to connect to it—in whatever way they choose—themselves.
101. The former option appears to have formed the basis of the current policy, while the latter is the one we endorse.
102. Consider in the light of these points, what is happening. The Government’s procurement process is widely expected to award Openreach a clear majority

⁶⁶ FTTH Council Europe

⁶⁷ Neilsen’s law says that we can expect bandwidth demand to increase roughly 8-fold every five years.

⁶⁸ The IT industry is driven by Moore’s law: which essentially states that we should expect and plan for revolutionary upgrades every 3–5 years as performance grows exponentially.

⁶⁹ Q 125

of the contracts to upgrade local access networks around the country.^{70 71} In turn, Openreach is planning to use this public funding to invest in types of network and specific technologies which may meet the speed targets set by the Government, but which, looking beyond 2015 are both relatively constrained and liable to necessitate an expensive phase of upgrade, if not outright replacement in the future. We will explain our specific concerns in more detail in Chapter 4, but we identify for now two particular problems which arise from the industrial choices being made in the light of current policy:

- New and unnecessary barriers to the future upgrade of the UK's broadband infrastructure will be erected;
- Availability of enhanced capacity broadband, and any services which this might enable, will not be equal and the digital divide is likely to widen.

103. These preferred choices are entirely understandable as representing the rational choice of an investor under present market conditions with all the relevant pressures that arise from being a public limited company with an existing infrastructure supporting a profitable business. As noted, they are also the natural consequences of a policy developed in response to misconceived considerations—solely about how to stimulate the market into doing more of what it already does.
104. In contrast, properly thinking through questions of first principle brings into view policy routes which can avert these problems. Before considering this, we note that, even within the bounds of the Government's market-stimulation approach, one route to overcoming this challenge might be simply to accept as unrealistic the emergence of any competitive pressure in the market liable to increase the ambition of commercial players' plans. Such an acceptance could, of course, leave the Government in thrall to the commercial interests of such businesses rather than providing them with an ability to direct broadband infrastructure in the wider interests of the UK. For these reasons, this line of analysis, could prompt calls for nationalisation, and these might well have been deafening in a different era. Curiously, and as a matter of fact, we note that there have been calls, not for nationalisation, but for dispensing with competition and handing to Openreach the necessary public money and the entire job of rolling out fibre.⁷²
105. We note, however, that one of the advantages of focusing policy around the promotion of open access fibre-optic hubs, as we recommend, is the credible introduction of competitive pressure to invest in local access networks for the long term. Public subsidy should therefore be used to roll out open access fibre-optic hubs to within reach of every community; the local access network, given a reformed regulatory and policy backdrop which we consider in Chapter 4, then becomes a different economic phenomenon to the rest of the network and one in which competition, and indeed community involvement would be newly stimulated. Under such an approach, it would be possible for technical enhancements to be introduced without specific, centralised mandates for speeds or any other quality, for which demand may only exist in the future. With the middle mile within the reach of individuals

⁷⁰ Q 555

⁷¹ i.e. in the areas of the country in which the commercial case for upgrading the local access network has been deemed not to be viable in the absence of subsidy.

⁷² BBC News Online, 'Fast broadband – who can compete with BT?', 7 February 2012. Available online: <http://www.bbc.co.uk/news/technology-16924004>

and communities, such decisions can be made locally. They can, through the operation of the market, choose the kind of final link or drop which they want themselves and upgrade this flexibly as and when they choose to, or there is need to do so.

106. What matters for the network, and therefore for policy is not speed per se, but a simple, long-term assurance that, as innovative new applications emerge—some of which may be core public services—everyone in the UK will have the ability and opportunity to access an infrastructure which means they can benefit from them. To achieve this, a suitably far-sighted vision for a national, strategic asset like the national broadband network is of an infrastructure that provides robust and efficient communications reaching every community in the UK, and which also allows anyone to procure and exploit connectivity—where possible, optical fibre connectivity—between any two or more points in the UK.
107. The focus of the current policy on ensuring specific speeds in end-to-end networks is, however, likely to support investment in technologies which will certainly help carry faster speeds to a proportion of UK citizens by 2015, but which will not do so universally and may confound and positively work against progress to be made beyond 2015 towards an infrastructure capable of supporting whatever technical capacity the UK as a whole might come to need.
108. For these reasons, we believe policy in this area should be driven by an avowedly long-term, but also flexible view of the infrastructure's future, and inasmuch, should avoid falling into the trap of orienting itself around speed targets, which in the main, serve to provide useful material for sloganeers but also obstruct a more sophisticated approach to building the communications infrastructure the UK requires.
109. As this report was being finalised, HM Treasury unveiled a new UK Guarantees scheme with the aim of accelerating major infrastructure investment and providing support to UK exporters.⁷³ Under this scheme, the Government's intention is to ensure that where major infrastructure projects are struggling to access private finance because of adverse credit conditions, these projects can proceed. Applications can be made to Infrastructure UK, the HM Treasury body focused on prioritising and enabling investment in UK infrastructure. It is thought that around £40 billion of projects could qualify for the provision of guarantees and these projects could come from a range of sectors including transport, utilities, energy and communications. This is, in our view, an interesting development and we think that broadband infrastructure projects would be appropriate beneficiaries of guarantees.
110. **We recommend that future broadband policy should not be built around precise speed targets end-users can expect to receive in the short-term, however attractive these may be for sloganeers.**
111. **In addition, broadband infrastructure policy should be driven by an avowedly long-term, but also flexible view of the infrastructure's future.**
112. **As an overriding principle, we recommend that Government strategy and investment in broadband infrastructure should always be based on a minimum ten year horizon and possibly beyond.**

⁷³ HMT press notice, 'Government uses fiscal credibility to unveil new infrastructure investment and exports plan', 18 July 2012. Available online: http://www.hm-treasury.gov.uk/press_62_12.htm

113. **While we acknowledge the presently elusive nature of a ‘killer app,’ we believe there is a clear need for the Government to state in explicit terms a long-term vision for a pervasive, robust and resilient broadband infrastructure, central to national policy and infrastructure planning.**
114. **We anticipate and recommend that policy should be ultimately directed towards universal, point-to-point FTTP as this is a technology not only able to accommodate current demand, but at current rates of growth, will be able to accommodate the UK’s bandwidth demands for many decades to come.**
115. **In this sense, we recommend that the Government should set out an even bolder vision for broadband policy than is currently the case.**
116. **Given the impossibility, with current constraints on resources, of rolling out universal point-to-point FTTP, we recommend that Government policy should, as an intermediate step, aim to bring national fibre-optical connectivity—which would include, as a minimum, fully open access fibre backhaul—within the reach of every community. This will provide the platform from which basic levels of service can be provided to all, and an improved service where there is sufficient demand.**
117. **As a point of principle, we believe it is incumbent on the Government to ensure that policy and regulation in the interim guarantee that there is a clear path from any intermediate steps which may be taken to the roll-out of point-to-point FTTP and that, crucially, these steps will not serve to hinder or hold back any future upgrade.**

Principle 3: Reinforcing the resilience of the network

118. The third principle that lies behind our vision, as set out in paragraph 63, is as follows: policy in this area should strive to reinforce the robustness and resilience of the network as a whole.
119. We note with interest that in the mid Nineteenth Century, a Select Committee set up to consider the UK’s contemporary transport networks subscribed to a similar principle. Chaired by Viscount Cardwell, their report recommended that:

“Parliament should secure freedom and economy of transit from one end of the kingdom to the other and should compel railway companies to give the public the full advantage of convenient interchange from one railway system to another”.
120. This Committee’s work, the essence of which is encapsulated in this statement, paved the way for the Railway and Canal Act 1854.
121. At present, data in the UK seldom takes the logically most efficient course from A to B. Traffic from Edinburgh to Edinburgh, for example, travels via Manchester, Skipton or London. This is because different proprietary networks erect barriers to data originating on one, travelling over the other, even if permitting traffic across networks would allow data to take a more rational route. We rather suspect that the Cardwell Committee would not have approved.

122. Aside from forcing data around irrational routes, the effect of these barriers to cooperation is also to render the whole network more vulnerable. Curiously, the architecture of the Internet provides robustness through redundancy. Whereas the tree architecture of the legacy telephone network makes whole communities vulnerable to single points of failure,⁷⁴ a network with built-in redundancy which allows data flexibly to travel over any of part of it, would increase the robustness and resilience of the whole. As people become more reliant on broadband for day to day services, this will become ever more important.
123. Again, if the work of policy development in this area were to begin by asking what the UK's broadband infrastructure should look like, we would argue that the robustness and resilience of the network would emerge as a fundamental principle—and, therefore, ought to be an explicit component of policy.
124. **It should be a fundamental principle of broadband policy that measures be undertaken, where possible, to reinforce the robustness and resilience of the network as a whole.**
125. **We recommend the Government ensure freedom and economy of passage for communication of data across the UK.**
126. **We recommend that Ofcom, in addition to its duties on competition and investment, be given an additional duty to monitor and foster the efficient utilisation of existing capacity (including, for example, use of the communications infrastructure owned by other infrastructure providers) to provide a robust and resilient national network that promotes affordable open access to wholesale and retail connectivity across the UK.**
127. In outlining these three principles—driving broadband policy to reduce the digital divide, taking a long-term, but flexible view, and reinforcing the resilience of the network—we have clarified the significance of the differences between our vision, outlined at the start of this chapter, and the Government's. As has been made clear, many of our differences could have been avoided if the Government had started its policy thinking in the right place, namely by asking: what should the UK's broadband infrastructure look like in view of its place as a major strategic asset, at least on a par with the UK's roads, railways and energy networks?

Additional points relating to the Government's vision

128. In addition to clarifying and proposing a reorientation of the very vision behind Government policy, there are three other issues which the Government could usefully take into account in light of its current policy:
- Continuous upgrade and average speeds;
 - Universal service obligation;
 - Uptake and effective use of the internet;
129. First, however much we would resist them, the focus placed by the current policy on specific speed targets raises the importance of measurement. Currently, the scorecard which Ofcom proposes to use to determine the

⁷⁴ BBC News Online, 'Attempted subsea cable theft takes out phones and internet in Highlands,' 8 June 2012. Available online: <http://www.bbc.co.uk/news/uk-scotland-highlands-islands-18365150>

Government's success in achieving their targets appears to include measures of *average* speed. This is a problem.

130. Evaluating speeds which end-users receive on the basis of an average across a population is fraught with problems:
 - It is difficult to know whether any increase in the average results from improvements for the 50% with speeds greater than the median;
 - By extension, it is impossible to know whether higher average speeds are an indication of a narrower digital divide or a wider one.
131. Furthermore, because the distribution of speeds is highly skewed, the median is a more informative statistic.⁷⁵
132. **We recommend that the Government's targets should refer to minimum and median levels of service, and that Ofcom adapts its scorecard accordingly.**
133. By extension, in order to ensure that the digital divide is braced and gradually drawn in, it will be important for the UK's low-end speeds to increase in line with the increase in median speeds. Otherwise, those with the slowest connections will not share in the advances elsewhere, and we will create a widening digital divide which will be socially divisive.
134. **In order to ensure the digital divide is not widened, we recommend that the Government commit to reducing the digital divide between the minimal service levels guaranteed to all and the median service levels enjoyed by the majority.**
135. Second, an unavoidable point of debate in connection with the stipulation of specific speeds and minimum service levels is whether it might be appropriate to introduce a Universal Service Obligation (USO) to oblige infrastructure providers and ISPs to provide both specific speeds and minimum service levels.
136. **It is our view that a Universal Service Obligation (USO) is not an appropriate way to bring about universal access to minimum levels of service, not least because in practice, imposing legal obligations on ISPs could easily and quickly lead to drawn out proceedings in the courts.**
137. **We do, therefore, endorse the approach adopted by the Government: pledging a Universal Service Commitment, to which it will be politically accountable, and stating explicitly a clear political aspiration to provide universal access to a minimum level of broadband provision. This, in our view, is at this stage a more appropriate approach than introducing a legally-binding USO.**
138. However, there is an important, and foreseeable, set of circumstances in which we would be likely to express an alternative view on this point. A view which appears to be commonly shared by the major ISPs is that, initially, the strongest driver of consumers moving from basic to enhanced broadband will be Internet Protocol Television (IPTV) services. The widespread involvement in YouView and the recent battle between BSkyB and BT Vision for rights to broadcast Premier League football games has only reinforced this point.

⁷⁵ See, for example, Laerd statistics webpage:

<https://statistics.laerd.com/statistical-guides/measures-central-tendency-mean-mode-median.php>

139. It is likely that IPTV services will become ever more widespread, and eventually the case for transferring the carriage of broadcast content, including public service broadcasting, from spectrum to the internet altogether will become overwhelming. This may well be a more sensible arrangement, as spectrum is perfectly suited to mobile applications, as Richard Hooper, OBE, Chairman of the Broadband Stakeholder Group, told us:

“Most people watch their television in fixed locations from fixed sets. Actually, spectrum’s great wonder is its ability for mobility.”⁷⁶

140. As such, it might be argued that spectrum’s current use for fixed, broadcast purposes is wasteful.

141. **We recommend that the Government, Ofcom and the industry begin to consider the desirability of the transfer of terrestrial broadcast content from spectrum to the internet and the consequent switching off of broadcast transmission over spectrum, and in particular what the consequences of this might be and how we ought to begin to prepare.**

142. As and when this occurs, and particularly if Public Service Broadcasting channels begin to be delivered primarily through the internet, the case for a USO, echoing that for television and radio, will become, in our view, significantly stronger.

143. **While we do not support the introduction of a USO at present, we do believe that broadcast media will increasingly come to be delivered via the internet. As and when that happens, and particularly in circumstances where this applies to PSB channels, the argument for recommending a USO becomes stronger. The Government should begin now to give this active consideration.**

144. Third, 8.12 million or 16.1% of adults in the UK have never been online⁷⁷ and many of these people are from some of the most vulnerable social groups, as Dido Harding, CEO of TalkTalk and board member of GO ON UK, underlined in oral evidence: “older, disabled or people for whom English is not their first language—those are the three big groups” and “the most digitally excluded people in society.”⁷⁸

145. These people are clearly at a manifest and material disadvantage. According to a report prepared by PwC for UK Digital Champion, Martha Lane Fox, there are a number of direct benefits to individuals of going online, including:

- Saving £560 a year by shopping and paying bills online;
- Better educational opportunities: “access to a computer and the internet can improve children’s educational performance”;
- Better employment opportunities: “people with good ICT skills earn between 3% and 10% more than people without such skills.”⁷⁹

⁷⁶ Q 609

⁷⁷ Office for National Statistics, *Internet Access Quarterly Update, 2012, Q1*, 16 May 2012. Available online: <http://www.ons.gov.uk/ons/rel/rdit2/internet-access-quarterly-update/2012-q1/stb-internet-access-quarterly-update-2012-q1.html>

⁷⁸ Q 428

⁷⁹ PwC, *Champion for Digital Inclusion: the Economic Case for Digital Inclusion*, October 2009. Available online: http://www.parliamentandinternet.org.uk/uploads/Final_report.pdf

146. Equally, moving people online is very much in the wider interest of the UK economy and the Government. According to the same report: “each contact and transaction with Government switched online could generate savings of between £3.30 and £12.00”⁸⁰ Evidence received from Arqiva, a media infrastructure and technology company, cast a spotlight on “studies undertaken by McKinsey, Allen, OECD and the World Bank [showing] that a 10% increase in broadband penetration results in a 1% increase in the rate of growth of GDP.”⁸¹
147. In this inquiry we have focused on broadband infrastructure rather than digital literacy, although we may well look at this area more closely in the future. We are aware, however, that the achievements of Race Online 2012, the predecessor of GO ON UK, include helping to drive the number of people who have never been online down from 10 million to the current figure of 8 million over 2 years from 2010 to 2012. With further support, it may be possible to drive this down still further. In particular, we have heard a number of calls from those working in this area for the Government to elevate digital literacy and internet uptake to a higher level of priority. For example, Dido Harding told us:
- “Government needs to explicitly set out that getting everyone online is a policy priority and therefore drive further activity in this area.”⁸²
148. We have also heard of an innovative scheme run by Three promoting digital inclusion:
- “We have been looking at identifying organisations and individuals who have contact with people likely to be socially, economically and digitally excluded. These people are already delivering services. We tried to encourage them to use our connectivity in their service provision. We give that connectivity for free to those organisations and individuals so that they can incorporate it into the work that they do, so it does not become, ‘Come along and have a six-week taster course to enjoy the benefits of the internet’. At times, that can be quite off-putting. It just becomes part of the service that you are already accessing—be it the library or hospice-at-home service, where the volunteers sit with the individual for a number of hours, keeping them company. It is about making it relevant to that individual.”⁸³
149. We welcome this initiative and hope that similar initiatives can be devised and extended in the future.
150. **We bring to the Government’s attention the fact that we have heard a number of calls during this inquiry, with which we agree, for uptake and effective use of the internet to become a higher priority.**

⁸⁰ *ibid.*

⁸¹ Arqiva

⁸² TalkTalk

⁸³ Q 356

CHAPTER 4: MODIFYING THE GOVERNMENT'S STRATEGY

151. Broadband and its infrastructure inevitably represent a highly technical field; and the regulatory arrangements which structure and govern the territory are no less complex. One can be forgiven, therefore, for finding a journey into the detail of policy implementation in this area forbidding. However, it has been our discovery that many of its smaller, more intricate features are responsible for the contours of the wider landscape. As a result, it is important, for the proper scrutiny of the area, not to be deterred by its jargon or detail.
152. It is for this reason that we have taken a substantial amount of evidence on the implementation of the current policy, as well as the regulatory arrangements that surround it. Having considered this, we make a number of observations and recommendations, some of which are inevitably expressed in more technical language. As much as possible, however, we will try to explain the terms used, occasionally by placing background information in boxes, and certainly, we have sought throughout to spell out the important implications of our proposals in the most straightforward terms. Broadly, the observations and recommendations which we now make fall into three groups:
- Those which assume no change in the Government's overall approach;
 - Those which call on the Government to change its approach, effectively bringing it closer to our alternative proposal;
 - Those which call on the regulator, Ofcom, to change its approach, with the same effect;

We will take these in turn.

Recommendations assuming no change in the Government's overall approach

153. Our focus up until this point has been on a reorientation of Government broadband strategy away from the edges and towards a reorganisation and enlargement of the middle mile of the network, and in particular to the introduction of open access fibre-optic hubs. However, to a large extent, the Government have set the direction for broadband policy to 2015, and clearly much of the work this has set in train is already underway through four strands of activity:
- Three of which are under the auspices of BDUK:
 - BDUK management and allocation of £530 million for the 'final third';
 - The Mobile Infrastructure Project (MIP);
 - Superconnected Cities.
 - One further strand of which is a responsibility of Defra:
 - Rural Community Broadband Fund (RCBF).
154. Problems with the last of these, the RCBF, are particularly startling. Fortunately, the solutions should be equally straightforward for the Government to develop. By design, the RCBF is intended to subsidise

enhanced broadband infrastructure to those areas of the UK considered to be, not only in the final third, but also in the final 10%, which will almost certainly be rural. The reason they need special attention is that communities and properties in these areas are generally acknowledged to present the most severely challenging investment case; even with BDUK subsidy, it is considered to be too weak.

155. Accordingly, the RCBF is only available “if your community is in a rural location identified as being in the 10% hard to reach area covered by your Local Authority’s Local Broadband Plan.”⁸⁴ In other words, it is only available if you are excluded from your Local Authority’s Local Broadband Plan.

156. Miles Mandelson, Chairman, Great Asby Broadband, explained that when local authorities are asked whether they can guarantee that a specific community falls outside the boundaries of its roll-out, the answer is:

“No, we cannot. We have not finished our procurement. We do not know what the boundaries are going to be and the situation keeps changing. But, if you like, you can exclude yourself from the county council roll-out and we will not come anywhere near you.”⁸⁵

As there is equally no guarantee of inclusion within the RCBF scheme, communities are naturally wary. After all, as Miles Mandelson put to us, if: “their application [to the RCBF also] fails... they are then left with nothing more than the 2Mbps universal service commitment (USC).”⁸⁶

157. As a result, remote communities—particularly those engaged as part of BDUK’s pilot scheme—are being forced to take on a considerable amount of work and responsibility, with the entirely likely result that they will ultimately be told they fall outside the boundary of the roll-out.

158. A further failure of the RCBF arises from its specific stipulation that communities in the final 10% fund the construction of their access networks with no guarantee of grant payment from Defra; they will only be able to recover the expenditure once they have provided evidence that they have paid for it—and even then there is no guarantee. According to Defra’s RCBF Handbook:

“In simple terms, you will need to spend first—and then claim later.”⁸⁷

159. In our view, it is ludicrous to expect all remote communities to be able to provide the levels of funding required to build broadband access networks in their areas. While there may be some which can, inevitably others will not be able to do so. The RCBF process, therefore, will present a number of communities, whom it is intended to assist, with a Catch 22. It must be said that there is a lack of clarity over the origin of this stipulation. The RCBF funds derive from a wider Defra programme called the Rural Development Programme for England, which in turn draws its funds from both the UK Government and from the European Agricultural Fund for Rural

⁸⁴ RCBF webpages: <http://rdpenetwork.defra.gov.uk/funding-sources/rural-community-broadband-fund>

⁸⁵ Q440

⁸⁶ Miles Mandelson

⁸⁷ Defra, *Rural Community Broadband Fund (RCBF): Applicants’ Handbook – Expression of Interest Round Two*, 10 May 2012 to 6 July 2012. Available online: http://rdpenetwork.defra.gov.uk/assets/files/New%20Offer/DEF-RDPE-RDPE-Bk-R2_WEB.pdf

Development. Whether the stipulation derives from a Europe-wide policy or is one of the Government's own making, however, does not alter the absurdity of its assumptions, which must be resolved.

160. **We urge the Government to provide a more coherent mechanism for the provision of enhanced broadband infrastructure in the final 10% than currently is the case with the Rural Community Broadband Fund. In particular, a new mechanism for distributing funds must meet the criticism that its predecessor was flawed in assuming all communities have the capital required, up front, to invest in their own access network.**

161. We also wish to highlight a number of other ways in which the Government could usefully intervene without fundamentally having to change their current approach. The most obvious examples relate to the planning system, street works permissions and the Electronic Communications Code; aspects of all of these, as they stand, can cause delays to the roll-out of broadband infrastructure.

162. The planning system can cause delays because of the length and cost of consultation processes. As Antony Walker, CEO of the Broadband Stakeholder Group, told us:

“One of the biggest barriers to the use of poles is the planning system. The consultation processes that are required if you want to utilise poles or put up new ones are pretty onerous and off putting to investors.”⁸⁸

Similar points were made by Vodafone:

“Many delays during the planning process are caused by tokenistic opposition which is more often than not overturned on appeal. Delays add significant actual costs, as well as the opportunity costs for the local economy.”⁸⁹

163. Street works permissions can equally add serious delay. Sean Williams, Group Strategy Director, BT, told us:

“The street work guidance for permit schemes can result in councils designating the putting up of the street cabinet as a major work, and if it does that then it causes all sorts of costs and delays.”⁹⁰

164. Finally, delays can also arise from the process for gaining wayleave permissions—a licence granted by the owner and occupier of land giving a third party the right to install, use and maintain its equipment on that land—provided for in the Electronic Communications Code. Vodafone argued that: “The current system of high annual ground rents for the lifetime of the site imposed by the code is one of the greatest disincentives to the roll-out of mobile coverage and should be reviewed.”⁹¹

165. Sean Williams, Group Strategy Director, BT, argued that a better mechanism for dispute resolution with regard to wayleave permissions was required. Wayleaves, he argued, are:

⁸⁸ Q 583

⁸⁹ Vodafone

⁹⁰ Q 509

⁹¹ Vodafone

“particularly important for multi-occupancy dwellings, whether they are blocks of flats or retail centres with businesses in them, where it is very often difficult and costly to negotiate wayleaves, and indeed there is no effective mechanism for resolving wayleave disputes. We could very readily do with some support in that area, to get a dispute mechanism, and also to put some obligations on landlords to make this possible, as I think they do in other countries.”⁹²

166. As part of its wider communications review, the DCMS has asked the Law Commission to conduct an independent review of the Electronic Communications Code. This project began in September 2011 with a consultation paper being published on 28 June 2012. The Commission expects to publish its report in spring 2013 and for any reforms to be implemented through legislation, anticipated in 2015.
167. **In their deliberations over the potential reform of the Electronic Communications Code, we encourage the Law Commission to consider the impact of the Code on the roll-out and availability of broadband infrastructure throughout the UK.**
168. **We urge the Government to consider reform of street works permissions and the current planning system, given their wider impact on the pace and sheer viability of the roll-out of broadband infrastructure throughout the UK.**
169. Finally, we note that new build sites can easily have ducting for fibre installed. It is, therefore, our view that for new developments, the provision of fibre connectivity should be as automatic as the provision of mains electricity.
170. **We recommend that the Government require that all new building developments be ducted for fibre, with appropriate provision for an internet connection, and that building regulations for this be developed perhaps analogous to those which already require adequate provision, for example, for the delivery of mains electricity and sewage connections.**

A change of approach in Government policy

171. Up to this point in the chapter, we have made recommendations which the Government are able to act on now, without rethinking the broader strategy they have set for 2015. However, in exploring its detail and implementation, we have also encountered a number of features which reinforce the case for considering an alternative strategy altogether.

We will pick up three particular points:

- The impact of inflexibility in the current policy targets;
- The wider potential of the Mobile Infrastructure Project (MIP);
- The importance of monitoring infrastructure providers in relatively non-competitive markets

⁹² Q 511

The impact of inflexibility in the current policy targets

172. In its original strategy document, the Government maintained that: “our approach to delivery... [is] technology-neutral.”⁹³ However, it is widely acknowledged that the significance of the original 24Mbps target lies in the fact that it specifically aimed to exclude as an eligible technology any copper between the exchange and the cabinet; as noted in Chapter 2, 24Mbps relates to—what was at the time—the highest headline speed achievable over copper lines from the exchange.
173. In line with the alternative strategy sketched in Chapter 3, we endorse the replacement of copper by fibre deeper into the network. However, there are indications that mandating this shift by means of a speed target has built inflexibility into the implementation of the current policy, with a number of undesirable consequences.
174. One of these was described by Rory Stewart MP, in reference to Northern Fells, an area in his constituency. Having formed plans to bring fibre within reach of its village, the community considered the use of the wireless technology, ‘white space’, as a way of reaching its outlying properties. The problem that arose was that white space spectrum is technically limited to delivering a maximum of roughly 15Mbps, and as this falls short of the Government’s targets, it is ineligible for public money, stranding the outliers with a lower level of service. As Rory Stewart MP put it:
- “I think it is about flexibility. I think it is about loosening the reins a little, loosening the criteria and being prepared to look at each case on its merits.”
175. Curiously, by mandating a specific speed target, with the intention of pushing fibre—and by extension, enhanced capacity—deeper into the network, the Government have in some cases ensured that communities reliant on more experimental, innovative technological solutions will not get any enhancement at all. In short, because their plans do not meet the Government’s aspirations in full, they will be condemned to nothing.
176. We note that the European Commission’s draft guidelines on State Aid stipulate that financial support should be provided only to those projects which can deliver a “step change.” This is not defined, however, in terms of speed:
- “A “step change” can be demonstrated if as the result of the public intervention (1) the selected bidder makes significant new investments in the broadband network and (2) the subsidised infrastructure brings significant new capabilities to the market in terms of broadband service availability and capacity.”⁹⁴
177. **The refusal to provide financial support for a project, like that in the Northern Fells, on the grounds that its proposal to use a technology (in this case white space spectrum) which would not meet the Government’s speed targets, is a further illustration of the way in which such targets are actually counter-productive. We urge the Government to reconsider using speed targets to define the goals of**

⁹³ DCMS and BIS, *Britain’s Superfast Broadband Future*, December 2010. Available online:

<http://www.culture.gov.uk/images/publications/10-1320-britains-superfast-broadband-future.pdf>

⁹⁴ European Commission, EU Guidelines for the application of state aid rules in relation to the rapid deployment of broadband networks. Available online:

http://ec.europa.eu/competition/consultations/2012_broadband_guidelines/en.pdf

their broadband policy. This would allow them to be more flexible with regard to the technologies used to provide enhanced connectivity, particularly to outlying communities. Loosening the reins a little could very quickly have the effect of bringing enhanced broadband capacity to the final 10%.

178. **The alternative strategy we have put forward would avert the situation which has arisen under the current policy whereby communities are left stranded with a minimal service because a viable enhancement falls below the—relatively arbitrary—mark set for public funding. We invite the Government to respond to our proposal that bringing open access fibre-optic hubs within the reach of every community would liberate communities and enterprises to evaluate the cost—benefit calculation themselves of the various different technological solutions available in the access network.**

The wider potential of the Mobile Infrastructure Project (MIP)

179. The second area of policy implementation which helps make the case for an alternative strategy relates to the Mobile Infrastructure Project (MIP) whose first two “design principles” are as follows:⁹⁵

- “To improve mobile voice coverage to outside of premises for the five to ten per cent of consumers and businesses that live and work in areas of the UK where existing mobile coverage is poor or non-existent;
- To enable the removal of ‘complete’ voice not-spots without converting them to ‘partial’ not-spots.”

180. The Government do not refer once to data coverage, emphasising instead the role of the MIP in eliminating voice not-spots.⁹⁶ This point was reinforced by Robert Sullivan, CEO, BDUK:

“It is important to make that distinction—that rather than being a broadband programme [the MIP] is a voice programme”⁹⁷

181. This strikes us as odd. According to Ofcom’s most recent *Communications Market Report*, “the usage of smartphones as a means of accessing the internet has... risen quickly. Ofcom estimates that in 2011, 32.6 million subscribers accessed the internet via their mobile phones, an increase of nearly 10 million since 2010.”⁹⁸ They also note the ways in which “new devices shape an explosion in mobile data use” and that “volume of data use increased significantly in 2011.” Similarly, a recent report commissioned by O2 showed that among smartphone users, internet access is by some margin the most popular activity.⁹⁹

⁹⁵ DCMS, *Mobile Infrastructure Project: Industry Stakeholder Engagement*, January 2012. Available online: http://www.culture.gov.uk/images/publications/Mobile_Infrastructure_engagement_Rel_1_0.pdf

⁹⁶ DCMS, *Mobile Infrastructure Project: Industry Stakeholder Engagement*, January 2012. Available online: http://www.culture.gov.uk/images/publications/Mobile_Infrastructure_engagement_Rel_1_0.pdf

⁹⁷ Q 780

⁹⁸ Ofcom, *Communications Market Report 2012*, 18 July 2012. Available online: http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr12/CMR_UK_2012.pdf

⁹⁹ O2 news release, ‘Making calls has become fifth most frequent use for a smartphone for newly-networked generation of users,’ 29 June 2012. Available online: <http://news.o2.co.uk/Press-Releases/Making-calls-has-become-fifth-most-frequent-use-for-a-Smartphone-for-newly-networked-generation-of-users-390.aspx>

182. **It should be a fundamental ‘design principle’ of the Mobile Infrastructure Project that where mobile coverage is being widened for the purpose of eliminating voice not-spots, coverage for data is widened and enhanced at the same time.**
183. In addition, we note that BDUK is considering implementing the MIP objectives by means of “an investment by government in building Serviced Sites... in an appropriate location to serve one or more not-spots, where site facilities, power, backhaul, connectivity, cabinet and mast space were made ready and available for ‘occupation’ by all mobile operators.”¹⁰⁰
184. In other words, the MIP, in establishing a number of ‘base stations’ or ‘serviced sites’ with fibre backhaul, may bring about something equivalent to the open access fibre-optic hub which we introduced in Chapter 3. In fact, should the MIP be implemented along the lines outlined above, these serviced sites will be procured with clear open access stipulations, allowing any mobile network provider to set up their own access network services from those points.
185. There is a technically strong argument, therefore, given the virtually unbounded capacity of fibre, that it would be a significant enhancement to incorporate into the MIP plan the following stipulation: that access be open not only for mobile network providers, but also for any prospective network provider to build out an access network from that point, should they see a commercial opportunity or otherwise believe there is value in doing so.
186. **The Government should consider the potential for serviced sites constructed as part of the MIP to be used as open access fibre-optic hubs more generally, from which independent third parties could extend out their own alternative, local access networks.**
187. Incidentally, in considering the harmonies between mobile and broadband policy more widely, we note that in parallel with the investments being made into fixed infrastructure, the forthcoming 4G auction will equally serve, in its own way, to widen access to enhanced capacity broadband. We do not comment other than to welcome this development, in particular the recent announcement by Ofcom that the 4G auctions are set to get underway by the end of 2012 and that a stipulation of these auctions will be that one of the lots of spectrum “will carry an obligation to provide a mobile broadband service for indoor reception to at least 98% of the UK population by the end of 2017 at the latest.”¹⁰¹ Our focus in this report, however, has purposefully been on the fixed infrastructure, and where relevant, the ways in which this provides a necessary foundation for mobile data networks.

The importance of monitoring infrastructure providers in relatively non-competitive markets

188. A final area which reinforces the case for the Government to re-orient their strategy, in the way we advocate, towards the establishment of open access fibre-optic hubs lies in a consideration of the non-competitive nature of much of the UK’s broadband infrastructure. From the nine original bidders in the BDUK Framework process, only two remain: Fujitsu and BT. In fact, this may now be reduced to one as recent reports suggest that Fujitsu has

¹⁰⁰ DCMS, *Mobile Infrastructure Project: Industry Stakeholder Engagement*, January 2012. Available online: http://www.culture.gov.uk/images/publications/Mobile_Infrastructure_engagement_Rel_1_0.pdf

¹⁰¹ Ofcom press notice, ‘Ofcom unveils plans for 4G auction of the airwaves,’ 24 July 2012. Available online: <http://consumers.ofcom.gov.uk/2012/07/ofcom-unveils-plans-for-4g-auction-of-the-airwaves/>

withdrawn from the process for the time being, albeit that it is committed to bidding in the future.¹⁰²

189. For some witnesses, this is merely evidence of the inevitable characteristics of investors in broadband infrastructure. Richard Hooper OBE, Chairman, Broadband Stakeholder Group, told us: “this is, whether one likes it or not, an industry of scale.”¹⁰³
190. For others, the outcome is evidence of the way in which BDUK’s Framework has excluded less established bidders. Gap-funding, the lack of open access to existing infrastructure, and the relatively homogenous nature of the customer base within an area as small as a local authority gives very considerable advantage to bidders with scale. We outline in Box 4 the ways in which the BDUK process may have reduced the ability of a wide range of bidders to compete.

BOX 4

The non-competitive nature of the BDUK process

There are two particular features of the BDUK process which may have limited the ability of some providers to compete:

- the size of the bodies, particularly in England, acting as procurement bodies (local authorities)
- the gap-funding model adopted by BDUK. The “investment gap” is the public contribution required by a supplier’s investment in broadband infrastructure to make a project commercially viable.¹⁰⁴

In the case of the size of the investment authorities in England, networks within a local authority area may not be of sufficient scale to be sustainable without the assumption that the provider building the network already has scale across the country. If they do, to simplify the point, they can cross-subsidise from densely populated areas of the country with lots of potential end-users, to sparsely populated areas with only a few. As a local authority area may not contain sufficient diversity for this sort of sustainable cross-subsidy itself, an infrastructure provider unable to draw on national scale, and the ability to cross-subsidise over county borders, is likely to be unable to compete. Equally, the selection of the local authority as the focus for investment, rather than fewer bodies representing larger franchise areas, has resulted in a proliferation of procurement processes, requiring more resources to compete in a number of them at once. Inevitably, this has reduced the number of businesses in a position to bid across the country.

Similarly, consider BDUK’s preference for gap-funding as the investment model to be used by local authorities. This favours large-scale businesses with a high level of knowledge about the market and likely level of demand. Having this knowledge enables them to make accurate judgements about the value of an investment, and therefore bid with a greater degree of capital, presenting a smaller, more attractive investment gap to the body making the investment. Similarly, it favours incumbents with reliable existing revenues, as these too decrease their risk and mean they can bid with a greater degree of capital, and present the procurement authority with a smaller investment gap.

¹⁰² *Financial Times*, ‘Fujitsu withdraws from broadband funding’, 10 July 2012.

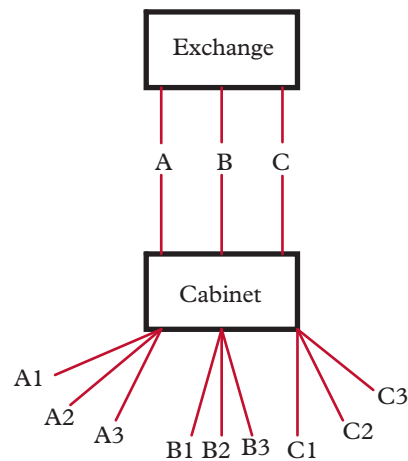
¹⁰³ Q 555

¹⁰⁴ DCMS, *Broadband delivery programme: Superfast pilots – Lessons learned report*, November 2011. Available online: http://www.culture.gov.uk/images/publications/BroadbandPilots_lessons_learned-Dec2012.pdf

191. Equally, regardless of the BDUK process, the history of UK communications infrastructure is such that there is now a provider, BT, to whom advantages accrue given its ability to draw on diverse and reliable revenue streams, and an extensive understanding of demand across the UK. These characteristics reduce the level of risk presented by infrastructure investment, and therefore afford those who benefit from them an unparalleled advantage in the competition for infrastructure investment (see paragraph 88).
192. Both views, therefore—those associating the non-competitive nature of infrastructure provision with the characteristics of the UK market and, those associating it with the characteristics of the BDUK process—are right to an extent. In fact, there are other reasons too, relating to the regulatory regime; we discuss these later in this chapter. In our view, however, the foregoing observations are ultimately less important than what one concludes from them. These conclusions should be straightforward:
193. There are clear competitive advantages in the market for infrastructure provision which accrue to those able to draw on economies of scale and scope. If unchallenged, these may result in the dominance of a single provider.
194. **As suggested in Chapter 3, the danger that results from the lack of competitive pressure in the construction of the UK's broadband infrastructure lies in the fact that the Government can easily find itself in thrall to the commercial interests of private enterprise, and therefore unable to direct broadband infrastructure in the wider interests of the UK.**
195. **We urge the Government, therefore, to recognise as a general principle that it will be vital to monitor the dominant, national providers vigilantly and to deploy appropriate incentives to ensure they, and the market in which they operate, behave in the public interest as this will not necessarily follow automatically from competitive pressures alone.**
196. **In addition, we note the argument of Chapter 3, that despite the presently non-competitive nature of much infrastructure provision in the UK, open access to existing connectivity can enable competition to play a role in extending the reach, connectivity and diversity, and hence also the resilience and performance, of these networks.**

PON

197. In the light of the previous discussion, we are concerned about some of the decisions currently being made by the providers bidding for BDUK projects. In particular, where it is rolling out FTTP, BT is doing so using a technology called PON (Passive Optical Network)—see diagram below.

FIGURE 2**Illustration of PON**

198. This involves single fibres being laid from the exchange to the cabinet. However, from the cabinet to the premises, these single fibres are not simply extended out, creating a single fibre link all the way from the exchange to the property. Instead, at the cabinet, each fibre (e.g. fibre A in the diagram above) is split into a number of strands, and each premises receives a strand from it (e.g. A1, A2 or A3). As a result, this form of FTTP tends to be called a point-to-multipoint, rather than a more straightforward point-to-point, solution. BT's decision to employ PON for its roll-out of FTTP has a number of consequences about which we harbour concern, notably on the issues of unbundling and future upgrade.

BOX 5**Consequences of PON**

At present, physical 'unbundling' of PON is impracticable. Physical unbundling is the mechanism whereby competitor communication providers take control of a single connection from the exchange to the premises even though the physical line (currently in the form of copper) is owned by an incumbent. As well as taking control over the line, the competitor also installs their own 'active' equipment in the exchange and customer premises. As the active equipment is partly responsible for the characteristics of the service (speeds, reliability etc.), this kind of Local Loop Unbundling currently allows BT's ISP competitors such as TalkTalk to differentiate their products from BT—and this in turn forms the basis for real competition.

It is not practicable, however, to unbundle PON because of the way each fibre splits at the cabinet. To do so, given current technology, it would be necessary for an ISP to attract as customers all of the premises which happen to be connected to a single fibre through one of its strands (in the region of 30–100 separate customers). There are technologies in development (e.g. wavelength-division multiplexing) which would enable unbundling of PON and the targeting of individual customers, but these are currently unproven, and require expensive active equipment. As such, until a commercial model emerges to enable a competitor to take over a connection to all premises served from a single fibre, or until new technology emerges, PON cannot be physically unbundled, and it is not possible for BT—as long as it is installing PON technology—to provide a desirable level of open access to its publicly-funded fibre access networks. As TalkTalk put

to us in written evidence:

“Under a GPON¹⁰⁵ architecture, all ISPs share the same bandwidth and equipment. This means that BT specify most of the features of the product such as: the maximum speed; the total shared bandwidth; how different traffic is prioritised (important for IPTV and business services); and, the electronics/equipment placed on the both ends of the fibre.”¹⁰⁶

It is on this basis that the European Commission has agreed to Ofcom’s proposal that BT must offer an alternative to full, unbundled open access, namely Virtual Unbundled Local Access (VULA). This simulates unbundled access to BT’s fibre but is different from full unbundling in one crucial respect: the competitor ISP not only uses BT’s physical fibre connection, they must also use BT’s active hardware at each end. This makes it impossible to differentiate products to customers, and means that the main basis for competition is brand. It appears to us, therefore, that Government subsidy is being used to fund a new world in which there may actually be less competition than there was over copper—reinforcing BT’s market power.

Another unfavourable, consequence of the use of PON technology relates to its ‘upgrade path.’ PON is not—technically speaking—an interim step towards full point-to-point fibre; in fact, it is something of an evolutionary cul-de-sac. If a future Government were to have as a policy goal the achievement of full point-to-point fibre, much equipment and fibre, once PON is already installed, will simply have to be replaced, conceivably with further public outlay.

199. In the light of Box 5, we believe it is incumbent on policy to ensure that there is a clear upgrade path from any intermediate steps which may be taken, to the roll-out of point-to-point FTTP. This will avoid major investments being made, particularly with public money, into technologies which represent an evolutionary cul-de-sac, and cannot be upgraded to point-to-point FTTP without being completely replaced, possibly with more public money.

200. **We recommend that the Government’s approach be explicit in its insistence that the technologies and infrastructures in which companies using public funds decide to invest be ones which offer a clear ‘upgrade path’ to point-to-point FTTP.**

201. Incidentally, there is an approach using PON with fewer harmful effects on competition than is suggested above. If a network is operated as a PON but the splitter is moved up to the level of the local exchange, and alternative operators can connect at that point, this would realise most of the capital expenditure savings of PON, but would also enable passive unbundling, and as a result, would equally enable real competition between ISPs.¹⁰⁷

202. **Where infrastructure providers using public money decide to invest in Passive Optical Networks, we recommend that the awarding of public money should be contingent on the installation of the splitter at the level of the local exchange rather than the cabinet, as this would enable passive unbundling, and thereby real competition between ISPs.**

¹⁰⁵ GPON is a variety of PON; see glossary.

¹⁰⁶ TalkTalk 2

¹⁰⁷ OECD, *Convergence and next generation networks*, 2008, Available online: <http://www.oecd.org/dataoecd/25/11/40761101.pdf>

Regulatory changes

203. The final area in which we propose changes to the current regime in order to make it possible to realise our vision is regulation. The success of the alternative strategy we outlined in Chapter 3 would depend partly on a number of specific shifts in the overall regulatory model for the broadband industry. One shift in particular would be crucial: the establishment of a set of open industry-led standards for both the physical network, and the administrative interface between infrastructure and services providers.
204. In order to understand the significance of this measure, envisage the alternative broadband infrastructure we depicted in Chapter 3, providing newly established open access fibre-optic hubs within reach of every community. Now consider a prospective infrastructure provider, weighing up the decision to build and own a new access network, connecting the hub with the local premises around it. This could be a community interest group, an SME or a large-scale infrastructure provider. Beyond the investment case itself, they will be aware of a number of hypothetical risks and pitfalls, including the possibility that once the network is built, no service provider will be willing to provide a service to the premises on the network, effectively rendering it stranded and redundant.
205. Unfortunately, this has happened. Digital Region Limited, a regional FTTC network in South Yorkshire, provides the textbook case, as Antony Walker, CEO, Broadband Stakeholder Group, told us, “where a network was built and then the operator really struggled, in fact failed, to get any big national ISPs to provide service on its network.”¹⁰⁸
206. There are a number of reasons why an ISP might find it uneconomic to provide a service over such a network. These include:
- The administrative systems of the infrastructure provider and the interface through which the ISP interacts with them are a serious hurdle. Most seriously, an ISP will not be able to countenance the administrative cost of dealing with a proliferation of different such interfaces and procedures. Equally, administrative systems have an impact on the procedures for matters such as switching customers and handling complaints. For example, when an issue is raised with the ISP about a fault whose source is in reality something physical (e.g. a broken line), there needs to be an easy mechanism in place for alerting the infrastructure provider and arranging a repair visit.
 - The technical standards of the products which the ISP can offer over the infrastructure are partly determined by the wholesale product offered by the infrastructure provider. This creates two additional issues. First, the ISP will want these technical standards to be harmonious with those of the wholesale product it purchases elsewhere in the country, in order to avoid a situation in which its retail product, and by extension its brand, are tarnished through an inconsistency in their quality. Second, the ISP will also be concerned that these standards remain under continuous improvement, and again, as such, in harmony with the wholesale product it purchases elsewhere from other infrastructure providers.

207. The effect of these concerns is manifest in the current broadband market, where ISPs face overwhelming disincentives to provide services over fragmented and isolated access networks. If unresolved, this will continue to be the case, and would be a particularly acute issue under the alternative strategy we propose in which a greater degree of competition at the access network level would be a desired outcome.
208. One significant source of these issues lies in the absence of a universally adopted and open set of standards with definitions for both the technical specifications of the network and its wholesale products, and for the operation, administration and maintenance (OAM) systems which create the interface between infrastructure and service providers. Universal adoption of such a set of standards would have an important effect: it would make it easier—in fact actually make it possible—for ISPs to provide services over networks other than just those belonging to the dominant, national providers.
209. The exact nature of these standards is important. Unfortunately, specifying them, even in outline, can only be done sensibly in light of a brief tour through another area of dry, regulatory detail. This is contained in Box 6.

BOX 6

Background to the introduction of open standards

At present, there is no set of standards for the broadband industry which meets all of the following criteria:

- (1) is open, and industry-led
- (2) is universally adopted
- (3) contains a technical specification for:
 - (a) the physical network itself;
 - (b) the wholesale products it should provide;
 - (c) and stipulations regarding the operation, administration and maintenance (OAM) systems interface between infrastructure providers and ISPs.

The significance of a set of standards which succeeds in meeting these criteria is partly set out above in paragraphs 204–208, and is elaborated below.

There is, however, an existing regulatory tool with some of these characteristics. As such, unless its inadequacies are made clear, there may be a temptation for some to suggest that, to an extent, the criteria above have been met. We will briefly, therefore, describe this tool.

Its name is Virtual Unbundled Local Access (VULA). VULA is a requirement placed on Openreach by Ofcom. Ofcom would normally require full physical unbundling of Openreach's local access network, in line with European Commission guidelines. As mentioned in Box 5, the benefit of full physical unbundling—and the reason for the European Commission to require it—is that it enables any ISP to take control of a single, independent connection from the exchange to a premises. As the connection is physically unbundled, the ISP can physically attach their own active equipment to each end, and that, in turn, is the basis on which they are able to tune the service they provide over it. Without full physical unbundling, on the other hand, ISPs cannot physically install their own equipment, and lose, therefore, their ability to tune and differentiate their service

from their competitors.

While the European Commission, and by extension Ofcom, normally require full physical unbundling, there are cases where this is accepted as impracticable.¹⁰⁹ One has already been mentioned: PON (see Box 5), which is the FTTP network technology in which Openreach is investing; another arises in Openreach's FTTC network. While in this latter case, full physical unbundling is now technically achievable, in order to achieve it, an ISP would face the prohibitive cost of installing their own complex, active equipment (specifically, a Digital Subscriber Line Access Multiplexer, or DSLAM) in the cabinet; a cabinet serves less than 300 subscribers—there is no commercial justification for each ISP to install this equipment in the cabinet even if there were space available. As a result, in these two cases (where Openreach is investing in PON, and in its FTTC access network), full physical unbundling has been accepted to be impracticable, and Ofcom requires Openreach to offer Virtual Unbundled Local Access (VULA) instead. To reiterate, VULA refers to a requirement placed by Ofcom on Openreach; it is a regulatory tool.

Openreach, in implementing this requirement, has developed a specific wholesale product called Generic Ethernet Access (GEA). In summary, GEA is a wholesale product which ISPs can buy from Openreach; GEA is an implementation of the VULA requirement placed on Openreach by Ofcom because of the impracticability of Openreach offering full physical unbundling over its PON and FTTC local access networks.

Returning to the standards set out at the top of this Box, which would help pull down a major barrier to the ability of ISPs to provide services over networks other than those belonging to the major, large scale providers, it should now be understood that GEA, which implements VULA, does not meet all of the criteria we mention for these standards.

The most important criterion which GEA fails to meet—quite fundamentally—is the first (that the standards be open and industry-led) which, by extension, means that it cannot meet the second (be universally adopted). GEA is a closed, proprietary specification.

210. While it is outside the scope of this report to define precisely what an open set of standards should specify, a set of industry-defined standards does already exist which, in our view, provide a very good model. These are the Active Line Access standards (ALA) fostered by Ofcom and defined by the UK's Network Interoperability Consultative Committee (NICC), a technical forum for the UK communications sector that develops interoperability standards for public communications networks and services in the UK. They are designed to provide a standard interface marrying the needs of Communications Providers and Infrastructure providers in the UK, and meet all of the requirements mentioned in Box 6, barring universal adoption:

¹⁰⁹ In June 2010, the European Commission released a press notice, announcing it had “decided to accept, in view of the specific circumstances of the case, the proposal of UK telecoms regulator Ofcom to oblige telecoms operator BT to provide ‘virtual’ access to its optical fibre infrastructure to alternative operators.” Source: EU Commission press release, ‘Commission accepts UK regulator proposal to mandate virtual unbundling of BT’s fibre networks but requests full unbundling as soon as possible,’ 2 June 2010. Available online:

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/654&format=HTML&aged=1&language=EN&guiLanguage=fr> <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/654&format=HTML&aged=1&language=EN&guiLanguage=fr>

Openreach, of course, applies its own proprietary specification, Generic Ethernet Access (GEA); see Box 6 for more detail.

211. As is made clear in Box 6, Active Line Access distinguishes itself from Generic Ethernet Access on a number of fronts. As Chi Onwurah, MP for Newcastle upon Tyne Central, former Head of International Technology Strategy, Ofcom, told us:

“The most obvious difference is that GEA is a set of proprietary specifications defined by BT Openreach ... while ALA is a set of openly standardised specifications defined by industry consensus through NICC.”¹¹⁰

212. This distinction is equally as obvious as it is important. As Chris Gallon, Ethernet Working Group Chair at the NICC told us:

“This difference in open standard rather than BT product is important because a small operator cannot implement GEA but they can implement ALA.”¹¹¹

213. In other words, the universal adoption of an open set of standards like Active Line Access is absolutely crucial in enabling local access network providers without national scale to compete with large-scale national networks like that of Openreach which envelope many parts of the country, and at present apply their own exclusive, proprietary specification, inaccessible to others.

214. While there are a number of detailed technical distinctions between GEA and ALA, and differences in how they meet the letter and the spirit of Ofcom’s VULA regulations, such detail is outside the scope of this inquiry. We do not necessarily suggest that Active Line Access provides a perfect set of standards—indeed any such standards will need the flexibility to adapt to commercial and technological changes. However, ALA seems to provide a good initial standard, and a good model for the open standardisation process which is manifestly required

215. It still remains to conclude exactly what Ofcom should do. In fact, there are a number of mechanisms at Ofcom’s disposal to bring about the universal adoption of open, industry-standards like ALA. We will briefly mention three of these: General Conditions of Entitlement, SMP obligations and gentler encouragement and facilitation of the industry.

216. First, under the European Communications Framework (as enacted through UK legislation), Ofcom has the power to impose conditions on all providers of communications networks and services (known as General Conditions of Entitlement). Such conditions can include an obligation to comply with relevant national or international standards, such as General Condition 2 on Standardisation and Specified Interfaces, which facilitates interconnection between providers in order to promote competition. Ofcom can impose such obligations to fulfil its duties to further the interests of citizens and consumers, where Ofcom deems such conditions to be objectively justifiable, not unduly discriminatory, proportionate and transparent in relation to what they are intended to achieve. Were Ofcom to judge it appropriate to do so, Ofcom could impose an obligation on all providers of wholesale local access

¹¹⁰ Chi Onwurah

¹¹¹ Chris Gallon

services to comply with ALA or an analogous set of open, industry-led standards.

217. Second, Ofcom can impose specific conditions on providers, where they are found to have significant market power (SMP) in a relevant market. Although using this mechanism inevitably means any such obligations would not apply universally, we note that this may not actually obstruct universal compliance with them. While this mechanism may not provide Ofcom with the means to impose the adoption of these standards on those without SMP, recall that it is those without a dominant market position who are likely to find it entirely in their interest to adopt such standards anyway, as they help to level the playing field. As such, it is likely only to be necessary for Ofcom to use coercive measures to impose their adoption on those like Openreach, who do have SMP in relevant markets. Using SMP remedies, Ofcom can impose an obligation to adopt these standards where it counts.
218. Finally, Ofcom can use its ‘soft power’ to convene telecoms stakeholders, facilitate dialogue and encourage the take up of open, industry-led standards more gently.
219. **We recommend that Ofcom draw on one of the mechanisms at its disposal to encourage, if not require, the universal adoption of standards like Active Line Access, if not ALA itself, which are open, and industry-led, and contain a technical specification for the physical network itself, the wholesale products it should provide, and stipulations regarding the operation, administration and maintenance (OAM) systems interface between infrastructure providers and ISPs. The universal adoption of such standards would do much to level the playing field between alternative infrastructure providers and would help to stimulate competition at the access network level.**
220. The institution of the standards raised in the foregoing discussion would have a significant, mitigating effect on the disincentives which confront ISPs considering providing a service over dispersed and isolated networks. We recognise, however, that even once these standards are in place, ISPs would face a number of other challenges, equally likely to discourage them from providing services over such networks. Chief among these is the commercial viability of offering services over networks with a small number of potential customers. This is an important issue in its own right, but is not a regulatory problem, and does not have a regulatory solution. Accordingly, we discuss it further in Chapter 5, where we describe the realisation of our alternative vision in greater depth.
221. An area in which a change in regulatory approach could have a significant impact on the ability of different infrastructure providers to compete—and which would form an important part of the regulatory backdrop of our alternative proposal—relates to the provision of access to passive infrastructure such as ducts and poles. At present, Ofcom requires that Openreach provide open access to its ducts and poles at a regulated price. This manifests itself in a product Openreach offers to its competitor infrastructure providers, called Physical Infrastructure Access (PIA). It provides prospective infrastructure providers with access, not to any fibre, but to the passive infrastructure through which new fibre can be run. By using these existing passive elements of infrastructure, other providers can lay

their own access networks from an exchange, for example, to the community or end-user; once they have done so, they would arrange for a connection to backhaul from the exchange and be able to offer wholesale and retail products over the new access infrastructure which they then own.

222. At face value PIA would appear to provide a powerful stimulus to competition in the access network; it is commonly recognised that 80% of the cost of laying access networks lies in the civil works,¹¹² which to a significant extent can be avoided altogether by using existing passive infrastructure.
223. PIA, however, comes with a number of important restrictions. In origin, PIA was designed by Ofcom as a remedy to Openreach's SMP in the fixed line, local access market. By design, therefore, it has been constrained so as not to have any impact on other adjacent markets as Ofcom defines and segments them. Accordingly, networks built using PIA are not currently permitted to provide middle mile backhaul, leased line services to businesses or backhaul for mobile and wireless masts; they are restricted to supporting fixed line services in the local access market.¹¹³
224. The effect of these restrictions, however, appears, in the end, to be a significant limitation on the potential of PIA to provide stimulus to competition in the local access network. In fact, in its recent *Business Connectivity Market Review*, Ofcom acknowledges the following argument which had been put to it by a number of stakeholders in the foregoing consultation:
- “the current usage restrictions of PIA could place bidders of public funds available from Broadband Delivery UK (BDUK) to support investment in superfast broadband infrastructure in less populated parts of the UK at a disadvantage relative to BT who benefits from economies of scope”¹¹⁴
225. By ‘economies of scope’, Ofcom means that an investor laying a fibre network is, in the end, in the market of optical connectivity, and will naturally seek to aggregate demand from a range of the segmented markets that fall under that broad umbrella; these will include domestic, mobile and business markets. BT Group Plc, as a parent company of both Openreach and BT's other divisions, has ‘scope’ across and is able to draw revenues from all of these markets. Accordingly, the risk of investing in local access networks is less intimidating to BT Group Plc than it is to an infrastructure provider without the scope across these revenue streams. Lifting the restrictions on PIA could help provide other infrastructure providers with that breadth and thereby, in our view, play a significant role in introducing more competition at the level of the access network.
226. Ofcom keeps these considerations under review and states straightforwardly that:

¹¹² DCMS and BIS, *Britain's Superfast Broadband Future*, December 2010. Available online:

<http://www.culture.gov.uk/images/publications/10-1320-britains-superfast-broadband-future.pdf>

¹¹³ Ofcom, *Review of the Wholesale Local Access Market: Statement on Market Definition, Market Power Determinations and Remedies*, October 2010. Available online:

http://stakeholders.ofcom.org.uk/binaries/consultations/wla/statement/WLA_statement.pdf

¹¹⁴ Ofcom, *Business Connectivity Market Review*, 18 June 2012. Available online:

<http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/summary/condoc1-4.pdf>

“We remain open to evidence that shows that investment in next-generation access networks could be unlocked if PIA could be used for leased lines services, to help us formulate our policy in relation to such investment.”¹¹⁵

227. However, at present, Ofcom is not minded to do so for a number of reasons. These include real concerns that:

- “introducing PIA as a remedy into the business connectivity market could undermine the remedies that we have already imposed in that market.”
- VULA already provides “an additional option to support competition and investment in NGA networks”
- And finally, “in response to the point about BT not being subject to any restrictions in the use of its ducts and poles, we would note that the purpose of remedies is to appropriately address the identified SMP in the relevant market.”¹¹⁶

228. In our view, these arguments are understandable, but not persuasive. Under the Communications Act 2003, which implements the EU telecoms package, Ofcom is generally bound to duties both to promote competition and to promote investment, and in particular in so doing, to secure “the availability throughout the UK of a wide range of electronic communications services.”¹¹⁷

229. On occasion, Ofcom’s duties are likely to conflict, and such an issue seems to arise in the case of PIA. Ofcom’s competition-based regulatory mechanism has led it to a logically sophisticated segmentation and sub-division of the broadband market, while its duties to promote investment would, on the evidence, appear to suggest that a more open field is what is required.

230. Confronted by this, we fully appreciate Ofcom’s cautious stance. It has built up a coherent framework for promoting wholesale competition and serving consumers’ needs through its remedies in the various sub-divisions of the broadband market; it is perhaps reluctant, understandably, to undermine these.

231. Such a cautious stance may, we believe, be usefully complemented by a more creative approach alongside it. Its regulatory edifice is not to be preserved for its own sake, and where a conflict emerges between its existing remedies to promote competition and those it might draw on to promote investment, it may be that a root-and-branch reconsideration of the relationship between the two and of the entire framework is required. This is not an easy job, but it is Ofcom’s responsibility and it could lead to a clearer, more coherent vision of the total market. As an OECD report concluded: “segmentation of the market may be excessive, resulting in an overly complex regulatory environment.”¹¹⁸

¹¹⁵ *ibid.*

¹¹⁶ Ofcom, *Review of the Wholesale Local Access Market: Statement on Market Definition, Market Power Determinations and Remedies*, October 2010. Available online: http://stakeholders.ofcom.org.uk/binaries/consultations/wla/statement/WLA_statement.pdf

¹¹⁷ *ibid.*

¹¹⁸ OECD, *Convergence and next generation networks*, June 2008. Available online: <http://www.scribd.com/doc/18264128/Convergence-and-Next-Generation-Network>

232. **We understand Ofcom’s cautious stance with regard to the removal of restrictions on Physical Infrastructure Access. However, we urge Ofcom to give the benefits of doing so full consideration.**
233. **In our view, the benefits of opening up the restrictions on PIA are likely to be significant, particularly were policy to be re-oriented towards the establishment of open access fibre-optic hubs, as we advocate. Removing the restrictions on PIA may, of course, have knock-on effects for the effectiveness and coherence of other aspects of the overall regulatory edifice. We, therefore, recommend that Ofcom evaluates alternative approaches to the regulation of the broadband market as a whole, in line with EU guidelines.**
234. In the light of this discussion, we note that since May 2011, Ofcom has had the power by virtue of Article 12 of the Revised EU Framework Directive, transposed into UK law,¹¹⁹ to impose regulatory obligations with regard to infrastructure sharing in the broadband market without reference to SMP.
235. While Ofcom is cautious about putting these powers into practice, as they are new and untested and any use would have to be justified by a legally robust proportionality test, imposing regulatory obligations on the basis of Article 12 may have a number of benefits, including but not limited to:
- Allowing Ofcom to impose regulatory obligations on the basis of a broader set of considerations than merely SMP, e.g. public interest and its duty to promote investment to secure the availability of a wide variety of electronic communications services throughout the UK;
 - Adapting its regulatory obligations to marry with Government policy, where this is proportionate;
 - Removing the imperative to maintain the distinction between fixed and mobile access markets, which is increasingly illusory.
236. **In light of the potential benefits, we recommend Ofcom actively considers the possible implications of putting its Revised EU Framework Directive Article 12 powers to use, by undertaking an Impact Assessment of doing so, including an open public consultation. Of course, some of Ofcom’s existing remedies in the broadband markets may be rendered ineffective or incoherent by implementing these powers. In consulting on their use, therefore, Ofcom should make positive proposals for how these issues would be overcome.**

¹¹⁹ The Electronic Communications and Wireless Telegraphy Regulations 2011(1210/2011). Available online: <http://www.legislation.gov.uk/ukSI/2011/1210/schedule/1/paragraph/38/made#schedule-1-paragraph-38-b>

CHAPTER 5: OUR ALTERNATIVE VISION: FINAL CONSIDERATIONS

237. In this report, we have made a number of recommendations which the Government and industry could act on immediately. As we have suggested throughout, their implementation could have a profound effect on the roll-out of broadband infrastructure in the short term—and have the effect of bringing the current approach closer to the alternative vision we outlined in Chapter 3. As noted, however, it has been useful within the context of this report to continue to refer to our vision and the open access fibre-optic hub idea which it informs, as an entirely alternative proposal. We also hope that doing so might lend our proposal greater clarity in its role as stimulus to future policy makers in this area. We are aware, for example, that a further £300 million may be available for investment in broadband infrastructure in the new Parliament up to 2017.¹²⁰
238. In presenting a more in depth picture of our alternative proposal, we do not pretend that what follows is comprehensive. It simply proposes to give a clearer impression of what we have in mind and should answer some, if not all, of the questions which may naturally have arisen from the outline we have provided of our alternative approach so far. From that point, it will be for others, as they see fit, to elaborate further and to incorporate into their thinking as many of these ideas as may be useful.

An alternative direction for broadband policy

239. To reiterate, our vision is of a robust and resilient national network linked primarily by optical connectivity, bringing open access fibre-optic hubs within reach of every community. This would allow diverse providers, large and small, to contribute to the reach and resilience of our national connectivity and allow all individuals to benefit from whichever services, including public ones, will run over it in time to come.
240. To realise this vision, we believe a reorientation is required in Government policy away from the absolute edges of the network and towards that part of it which brings fibre-optic closer into communities. Conventionally this part of the network is referred to as the ‘middle mile.’ However, as fibre is laid deeper into the network, to terminate in open access fibre-optic hubs, it will be possible—desirable, even—for networks, to be extended on further from these points to still further outlying hubs, and so on. To build in the redundancy and resilience we described in Chapter 3, it will be equally desirable for these hubs themselves to become inter-connected. Over time, therefore, we envisage a network in which the boundaries between the middle mile and the local access network increasingly dissolve, and the entire system may take on characteristics, less of a rigid hierarchy, and more of a living organism—an ever growing and ever more interwoven web.
241. In the first instance, what will be required is to establish open access fibre-optic hubs that reach deep into every community. The hubs themselves will need to be specified, and the detail of this, we leave to others. However, we can say now that they are likely to vary greatly. In some circumstances,

¹²⁰ DCMS, *Broadband delivery programme: Delivery model*, September 2011. Available online: <http://www.culture.gov.uk/images/publications/BDUK-Programme-Delivery-Model-vs1-01.pdf>

cabinets will provide much of what is needed—accommodation for passive connections, splices and splitters. If the hubs serve masts, for example, these may need to be adjacent, or may be some distance away, but all that is needed from the cabinet is a fibre connection; power can be supplied separately. What will be needed in addition, however, is open access to any relevant links at the exchange as this will then be where the necessary active equipment is installed. In some parts of the country, it may even be more sensible to establish new hubs from scratch with space and power for active equipment themselves. These would then play a role more akin to an exchange, and would accordingly need to be specified differently. They would need to be reliably inter-connected and given the space required for the installation of active equipment, would inevitably be larger, certainly larger than a cabinet tends to, or even—in urban areas—can be. In these cases, therefore, public spaces such as schools and libraries may provide a sensible location, not least because they have the advantage of a presence in most communities.

242. Clearly a more detailed specification of open access fibre-optic hubs would eventually be required. At this stage, however, our intention is only to provide a clearer impression of the alternative direction for broadband policy we have advocated throughout this report. As such, we reiterate that in fact, despite having set off in a different direction without—in our view—having asked proper questions about where policy should take the UK’s broadband infrastructure, the Government’s approach could to an extent be brought closer in line with ours by virtue of a number of measures at its and the regulator’s disposal.
243. **Ofcom should consider employing its Article 12 powers to oblige infrastructure owners to provide open access to dark fibre at the level of the cabinet, and active and passive access, together with rights to install and collocate active equipment on relevant links at the level of the exchanges and other nodes.**
244. As discussed in Chapter 3, we note that there are indications that access to dark fibre has been suggested by the European Commission among a set of conditions for the umbrella state aid permission BDUK are seeking for projects operating within its Framework.
245. We also noted in Chapter 3 that under the right conditions, we anticipate the emergence of a new industry of infrastructure providers in the final mile who will be able to respond to local demand and compete effectively with their national cousins to build out local access networks accordingly. We also suggested that this is not simply a vain hope, and that there are an increasing number of such businesses thriving in areas of the UK where open access to backhaul can be secured. Among these are, for example, WiSpire—a joint venture between the Diocese of Norwich and Freeclix, a local ISP—and the Tegola network in the Scottish Highlands. In both cases a significant degree of success has been achieved in bringing connectivity to rural or remote communities at reasonably low cost by using wireless technologies for the final drop. In Norwich, backhaul is provided by Freeclix, transmitting connectivity wirelessly to a mast on Norwich Cathedral, from where the signal is distributed further to masts on churches elsewhere in the Diocese, and then finally onto homes and businesses themselves. In the case of the Tegola network, Professor Peter Buneman FRS outlined a similar approach had been taken in the Scottish Highlands. As he put it to us: “The only

technical obstacle to the development of more of these access networks is the lack of backhaul.”¹²¹

246. Additionally, as noted in chapter 4, we have made a firm recommendation to Ofcom to encourage, and consider mandating open industry-led standards, which among other things, would specify the systems interfaces between infrastructure and service providers. This would have a significant impact on the ability of prospective network owners to attract ISPs onto their networks as it would provide a single open standard that could be implemented by any infrastructure provider and eliminate the prohibitive administrative burden for an ISP of having to deal with a proliferating array of interfaces.
247. A large ISP will still be reluctant to deal with, and rely on, a large number of small and disparate infrastructure providers. One way of resolving this issue lies in the virtual aggregation of networks into larger units. If an ISP interacts not with the network owner itself, but a management organisation acting as an intermediary between them, this would to a significant extent avert the problem. We would, therefore, urge the industry to work to ensure there is such an organisation, and that it is fit for purpose. We are aware, for example, that INCA, the Independent Networks Cooperative Association, may be able to act in this capacity.
248. **We urge the industry to work to ensure there is an organisation with the capacity to act as an intermediary between an array of separate network providers and larger-scale ISPs. We note that the existence and effectiveness of such an organisation would be vital to the success of an open access fibre-optic hub model.**

Long-term considerations

249. We note with interest that one effect of the open access fibre-optic hub idea that we are promoting may be to alter the conceptual framework for the final mile. Currently, most people’s conception of broadband infrastructure derives from their conception of the telephone network or other utilities whose termination point is at the curtilage of the household, after which ownership of the network is taken over by the owner of the premises. An alternative way of thinking about the network might be that broadband roll-out has more in common with the railways: the traveller has to get him/herself to the station and once there the train takes the strain. In other words, the open access fibre-optic hub model makes it possible for individual property owners to build out the access network themselves, or at least have it built for them. In fact, this may be less radical than it sounds, given that, after all, the UK’s general model of utility provision is not comprehensive in any case: property owners already need to supply their own hardware, interfaces, taps and so on. A similar idea was sketched by Francesco Caio:

“One alternative way of thinking of ownership structure is if the network is what I would define as the home with a tail, that is the household owns the last bit of fibre. Instead of having competition among suppliers to serve those homes, the ones you have somehow captured because services and the networks are together, you might think of a reverse model where you have the household auctioning the ability to connect with the backhaul and to the network, and then I, as a household,

¹²¹ Peter Buneman

choose the services I want because I do not need the network provider to be the service provider.”¹²²

250. **The Government should consider, not least in light of the EU Commission’s current consultation and the issues this raises concerning open access to dark fibre as a condition of State Aid, what the implications might be for broadband policy of a new ‘house with a tail’ model emerging in which the property owner becomes responsible for the construction and maintenance of their own final drop.**
251. This report began by noting that copper technology, first used for the 19th century telegraph, is no longer fit for purpose as the capacity of all but the shortest copper telephone connections is now being exceeded by demand for more data-intensive applications. Having considered a UK communications infrastructure beyond copper, it occurs to us that as the roll-out of fibre continues, capacity will increase, as will the appeal and number of services that rely on it. As such, a new digital divide may emerge between those with respectable and those with elite connectivity, separating those who can access what will in some cases be critical public services or public interest content from those who cannot. As a result, just as with digital switchover, a time may come when it is appropriate for the Government to mandate a form of Universal Service Obligation in the shape of a similar measure which might be called fibre switch over.
252. **We recommend that consideration should be given over time by the Government, Ofcom and the industry as to when and under what conditions fibre switchover would be appropriate and what implications it would have.**

CHAPTER 6: SUMMARY OF RECOMMENDATIONS

253. We recommend that the Government consider our vision for the UK's broadband infrastructure as set out in this report. As a first step, we recommend that the Government undertake to produce detailed costings of our proposal, not least because our proposal removes the final mile—the most expensive per capita component of the network—from the costs requiring public subsidy. (Para 53)
254. We endorse the European Commission's suggestion that open access to dark fibre at the cabinet-level should be introduced as a condition of BDUK's umbrella state aid permission. (Para 59)
255. Accordingly, not least, in order to expedite its own programme, we recommend that the Government incorporate open access to dark fibre voluntarily as a feature of its Framework agreement with suppliers. (Para 60)
256. More broadly, we endorse and invite the Government's view on the European Commission's conclusion on the broadband investment environment that: "securing truly equivalent access by alternative operators to incumbent networks is probably the most important guarantee of sustainable competition, on existing and new networks." (Para 61)
257. Broadband policy should begin from the question: what should the UK communications infrastructure look like? (Para 75)
258. In addition, it should be a fundamental principle of broadband policy that whatever measures are undertaken to enhance or extend its availability, they strive to bring about equality of opportunity to access broadband across all communities in the UK. (Para 76)
259. In this sense, Government policy on broadband should be driven, above all, by the social benefits it can unleash, and the need to arrest and ultimately reduce a damaging digital divide. (Para 77)
260. We recommend that future broadband policy should not be built around precise speed targets end-users can expect to receive in the short-term, however attractive these may be for sloganeers. (Para 110)
261. In addition, broadband infrastructure policy should be driven by an avowedly long-term, but also flexible view of the infrastructure's future. (Para 111)
262. As an overriding principle, we recommend that Government strategy and investment in broadband infrastructure should always be based on a minimum ten year horizon and possibly beyond. (Para 112)
263. While we acknowledge the presently elusive nature of a 'killer app,' we believe there is a clear need for the Government to state in explicit terms a long-term vision for a pervasive, robust and resilient broadband infrastructure, central to national policy and infrastructure planning. (Para 113)
264. We anticipate and recommend that policy should be ultimately directed towards universal, point-to-point FTTP as this is a technology not only able to accommodate current demand, but at current rates of growth, will be able to accommodate the UK's bandwidth demands for many decades to come. (Para 114)

265. In this sense, we recommend that the Government should set out an even bolder vision for broadband policy than is currently the case. (Para 115)
266. Given the impossibility, with current constraints on resources, of rolling out universal point-to-point FTTP, we recommend that Government policy should, as an intermediate step, aim to bring national fibre-optical connectivity—which would include, as a minimum, fully open access fibre backhaul—within the reach of every community. This will provide the platform from which basic levels of service can be provided to all, and an improved service where there is sufficient demand. (Para 116)
267. As a point of principle, we believe it is incumbent on the Government to ensure that policy and regulation in the interim guarantee that there is a clear path from any intermediate steps which may be taken to the roll-out of point-to-point FTTP and that, crucially, these steps will not serve to hinder or hold back any future upgrade. (Para 117)
268. It should be a fundamental principle of broadband policy that measures be undertaken, where possible, to reinforce the robustness and resilience of the network as a whole. (Para 124)
269. We recommend the Government ensure freedom and economy of passage for communication of data across the UK. (Para 125)
270. We recommend that Ofcom, in addition to its duties on competition and investment, be given an additional duty to monitor and foster the efficient utilisation of existing capacity (including, for example, use of the communications infrastructure owned by other infrastructure providers) to provide a robust and resilient national network that promotes affordable open access to wholesale and retail connectivity across the UK. (Para 126)
271. We recommend that the Government's targets should refer to minimum and median levels of service, and that Ofcom adapts its scorecard accordingly. (Para 132)
272. In order to ensure the digital divide is not widened, we recommend that the Government commit to reducing the digital divide between the minimal service levels guaranteed to all and the median service levels enjoyed by the majority. (Para 134)
273. It is our view that a Universal Service Obligation (USO) is not an appropriate way to bring about universal access to minimum levels of service, not least because in practice, imposing legal obligations on ISPs could easily and quickly lead to drawn out proceedings in the courts. (Para 136)
274. We do, therefore, endorse the approach adopted by the Government: pledging a Universal Service Commitment, to which it will be politically accountable, and stating explicitly a clear political aspiration to provide universal access to a minimum level of broadband provision. This, in our view, is at this stage a more appropriate approach than introducing a legally-binding USO. (Para 137)
275. We recommend that the Government, Ofcom and the industry begin to consider the desirability of the transfer of terrestrial broadcast content from spectrum to the internet and the consequent switching off of broadcast transmission over spectrum, and in particular what the consequences of this might be and how we ought to begin to prepare. (Para 141)

276. While we do not support the introduction of a USO at present, we do believe that broadcast media will increasingly come to be delivered via the internet. As and when that happens, and particularly in circumstances where this applies to PSB channels, the argument for recommending a USO becomes stronger. The Government should begin now to give this active consideration. (Para 143)
277. We bring to the Government's attention the fact that we have heard a number of calls during this inquiry, with which we agree, for uptake and effective use of the internet to become a higher priority. (Para 150)
278. We urge the Government to provide a more coherent mechanism for the provision of enhanced broadband infrastructure in the final 10% than currently is the case with the Rural Community Broadband Fund. In particular, a new mechanism for distributing funds must meet the criticism that its predecessor was flawed in assuming all communities have the capital required, up front, to invest in their own access network. (Para 160)
279. In their deliberations over the potential reform of the Electronic Communications Code, we encourage the Law Commission to consider the impact of the Code on the roll-out and availability of broadband infrastructure throughout the UK. (Para 167)
280. We urge the Government to consider reform of street works permissions and the current planning system, given their wider impact on the pace and sheer viability of the roll-out of broadband infrastructure throughout the UK. (Para 168)
281. We recommend that the Government require that all new building developments be ducted for fibre, with appropriate provision for an internet connection, and that building regulations for this be developed perhaps analogous to those which already require adequate provision, for example, for the delivery of mains electricity and sewage connections. (Para 170)
282. The refusal to provide financial support for a project, like that in the Northern Fells, on the grounds that its proposal to use a technology (in this case white space spectrum) which would not meet the Government's speed targets, is a further illustration of the way in which such targets are actually counter-productive. We urge the Government to reconsider using speed targets to define the goals of their broadband policy. This would allow them to be more flexible with regard to the technologies used to provide enhanced connectivity, particularly to outlying communities. Loosening the reins a little could very quickly have the effect of bringing enhanced broadband capacity to the final 10%. (Para 177)
283. The alternative strategy we have put forward would avert the situation which has arisen under the current policy whereby communities are left stranded with a minimal service because a viable enhancement falls below the—relatively arbitrary—mark set for public funding. We invite the Government to respond to our proposal that bringing open access fibre-optic hubs within the reach of every community would liberate communities and enterprises to evaluate the cost—benefit calculation themselves of the various different technological solutions available in the access network. (Para 178)
284. It should be a fundamental 'design principle' of the Mobile Infrastructure Project that where mobile coverage is being widened for the purpose of

eliminating voice not-spots, coverage for data is widened and enhanced at the same time. (Para 182)

285. The Government should consider the potential for serviced sites constructed as part of the MIP to be used as open access fibre-optic hubs more generally, from which independent third parties could extend out their own alternative, local access networks. (Para 186)
286. As suggested in Chapter 3, the danger that results from the lack of competitive pressure in the construction of the UK's broadband infrastructure lies in the fact that the Government can easily find itself in thrall to the commercial interests of private enterprise, and therefore unable to direct broadband infrastructure in the wider interests of the UK. (Para 194)
287. We urge the Government, therefore, to recognise as a general principle that it will be vital to monitor the dominant, national providers vigilantly and to deploy appropriate incentives to ensure they, and the market in which they operate, behave in the public interest as this will not necessarily follow automatically from competitive pressures alone. (Para 195)
288. In addition, we note the argument of Chapter 3, that despite the presently non-competitive nature of much infrastructure provision in the UK, open access to existing connectivity can enable competition to play a role in extending the reach, connectivity and diversity, and hence also the resilience and performance, of these networks. (Para 196)
289. We recommend that the Government's approach be explicit in its insistence that the technologies and infrastructures in which companies using public funds decide to invest be ones which offer a clear 'upgrade path' to point-to-point FTTP. (Para 200)
290. Where infrastructure providers using public money decide to invest in Passive Optical Networks, we recommend that the awarding of public money should be contingent on the installation of the splitter at the level of the local exchange rather than the cabinet, as this would enable passive unbundling, and thereby real competition between ISPs. (Para 202)
291. We recommend that Ofcom draw on one of the mechanisms at its disposal to encourage, if not require, the universal adoption of standards like Active Line Access, if not ALA itself, which are open, and industry-led, and contain a technical specification for the physical network itself, the wholesale products it should provide, and stipulations regarding the operation, administration and maintenance (OAM) systems interface between infrastructure providers and ISPs. The universal adoption of such standards would do much to level the playing field between alternative infrastructure providers and would help to stimulate competition at the access network level. (Para 219)
292. We understand Ofcom's cautious stance with regard to the removal of restrictions on Physical Infrastructure Access. However, we urge Ofcom to give the benefits of doing so full consideration. (Para 232)
293. In our view, the benefits of opening up the restrictions on PIA are likely to be significant, particularly were policy to be re-oriented towards the establishment of open access fibre-optic hubs, as we advocate. Removing the restrictions on PIA may, of course, have knock-on effects for the effectiveness and coherence of other aspects of the overall regulatory edifice. We, therefore, recommend that Ofcom evaluates alternative approaches to the

regulation of the broadband market as a whole, in line with EU guidelines. (Para 233)

294. In light of the potential benefits, we recommend Ofcom actively considers the possible implications of putting its Revised EU Framework Directive Article 12 powers to use, by undertaking an Impact Assessment of doing so, including an open public consultation. Of course, some of Ofcom's existing remedies in the broadband markets may be rendered ineffective or incoherent by implementing these powers. In consulting on their use, therefore, Ofcom should make positive proposals for how these issues would be overcome. (Para 236)
295. Ofcom should consider employing its Article 12 powers to oblige infrastructure owners to provide open access to dark fibre at the level of the cabinet, and active and passive access, together with rights to install and collocate active equipment on relevant links at the level of the exchanges and other nodes. (Para 243)
296. We urge the industry to work to ensure there is an organisation with the capacity to act as an intermediary between an array of separate network providers and larger-scale ISPs. We note that the existence and effectiveness of such an organisation would be vital to the success of an open access fibre-optic hub model. (Para 248)
297. The Government should consider, not least in light of the EU Commission's current consultation and the issues this raises concerning open access to dark fibre as a condition of State Aid, what the implications might be for broadband policy of a new 'house with a tail' model emerging in which the property owner becomes responsible for the construction and maintenance of their own final drop. (Para 250)
298. We recommend that consideration should be given over time by the Government, Ofcom and the industry as to when and under what conditions fibre switchover would be appropriate and what implications it would have. (Para 252)

APPENDIX 1: SELECT COMMITTEE ON COMMUNICATIONS

The Members of the Committee which conducted this inquiry were:

Baroness Bakewell (from 16 May 2012)
 Lord Bragg
 Lord Clement-Jones
 Baroness Deech
 Lord Dubs (from 16 May 2012)
 Baroness Fookes
 Lord Gordon of Strathblane
 Lord Inglewood (Chairman)
 Bishop of Norwich
 Lord Macdonald of Tradeston (until 30 April 2012)
 Lord Razzall
 Lord St John of Bletso
 Earl of Selborne
 Lord Skelmersdale

Michael Fourman, Professor of Computer Systems in the School of Informatics at the University of Edinburgh, acted as Specialist Adviser for this Inquiry.

Declarations of Interest

The following relevant interests were declared:

CLEMENT-JONES, Lord

Member, International Advisory Committee of Huawei

ST JOHN OF BLETSO, Lord

Advisor, Board of 2e2 Group, a private IT services company

Patron, Citizens on Line (a charity promoting universal internet access and tackling issues of digital inclusion)

Advisor, Mooter Media (Australian company which is a developer and provider of digital media solutions; the advisers meet on one day a year only)

A full list of Members' interests can be found in the Register of Lords' Interests:

<http://www.parliament.uk/mps-lords-and-offices/standards-and-interests/register-of-lords-interests>

APPENDIX 2: LIST OF WITNESSES

Evidence is published online at www.parliament.uk/hlcommunications and available for inspection at the Parliamentary Archives (020 7219 5314)

Evidence received by the Committee is listed below in chronological order of oral evidence session and in alphabetical order. Those witnesses marked with * gave both oral evidence and written evidence. Those marked with ** gave oral evidence and did not submit any written evidence. All other witnesses submitted written evidence only.

Oral evidence in chronological order

**	QQ 1–28	Suvi Lindén
**	QQ 29–74	Dr Peter Cochrane OBE
*	QQ 75–114	Objective Designers Limited
**	QQ 115–135	Francesco Caio
*	QQ 136–249	FTTH Council of Europe
**		Communications Chambers
*	QQ 250–282	Chi Onwurah MP
*	QQ 283–319	Virgin Media
**	QQ 320–353	Steve Robertson
*	QQ 354–378	Three
*		Vodafone
*	QQ 379–407	SSE
*	QQ 408–429	TalkTalk
**	QQ 430–465	Rory Stewart MP
*		Great Asby Broadband
*	QQ 466–549	BT Group plc
*	QQ 550–622	Broadband Stakeholder Group
*	QQ 623–649	Microsoft
*	QQ 650–747	Ofcom
*	QQ 748–809	Ed Vaizey, Minister for Culture, Communications and Creative Industries, Department for Culture, Media and Sport; and BDUK

Alphabetical list of all witnesses

	Aardman Animations
	Arqiva
	Avanti Communications
**	Francesco Caio (QQ 115–135)
	Bentley Walker

- Boundless Communications Ltd
British Film Institute
British Recorded Music (BPI)
Broadband Stakeholder Group (BSG)
Broadway Partners
- * BT Group plc (QQ 466–549)
Buckinghamshire Business First
Professor Peter Buneman
Click4Internet
The Coalition for a Digital Economy (Coadec)
- ** Dr Peter Cochrane OBE (QQ 29–74)
Communication Workers Union (CWU)
- ** Communications Chambers (QQ 136–249)
Communications Consumer Panel
David Cooper
Cotswold Community Networks Ltd
The Country Land & Business Association
Creative Coalition Campaign
Cumbria County Council
David Hall Systems Ltd
- * Department for Culture, Media and Sport (QQ 748–809)
Digital Outreach
Directors UK
Everything Everywhere
Federation of Communications Services
Federation of Small Businesses
Fibre GarDen (the Garsdale & Dentdale Community Fibre Broadband Initiative)
Film Distributors Association
Forum of Private Business
- * FTTH Council (QQ 136–249)
Fujitsu
Geo Networks Limited
Dr Tehmina Goskar
- * Great Asby Broadband (QQ 430–465)
GreySky Consulting
Peter Griffin

Groupe Intellex
John Howkins
Huawei
The Independent Networks Cooperative Association (INCA)
KCOM Group PLC
Robert Kenny
Leire Exchange Broadband Action Group
The Liberal Democrats Action for Land Taxation and Economic Reform (ALTER)
Suvi Lindén (QQ 1–28)
John McDonald
Dr Christopher T Marsden
* Microsoft (QQ 623–649)
Microspec
Dr Catherine A. Middleton
Middleton Tyas Parish Council
Milton Keynes Council
Tom Morris
Motion Picture Association
The National Education Network
NG Events Ltd
NICC Ethernet Working Group
Northern Fells Broadband (Cumbria)
* Objective Designers (QQ 75–114)
* Ofcom (QQ 650–747)
* Chi Onwurah MP (QQ 250–282)
Parliamentary Office of Science and Technology (POST)
John Peart
Mike Phillips
Simon Pike
Pitchup.com
Prospect
The Publishers Association
** Steve Robertson (QQ 320–353)
Les Savill
South West Internet CIC
* SSE plc (QQ 379–407)

- ★★ Rory Stewart MP
Sunderland Software City
- * TalkTalk Group (QQ 408–429)
Taxpayers' Alliance
- * Three (QQ 354–378)
UCL Centre for Digital Humanities
Upper Deverills Broadband Action Group
- * Virgin Media (QQ 283–319)
- * Vodafone (QQ 354–378)
Vtesse Networks
Wispa Limited

APPENDIX 3: CALL FOR EVIDENCE

Will superfast broadband meet the needs of our “bandwidth hungry” nation?

The House of Lords Select Committee on Communications, chaired by Lord Inglewood, is announcing today an inquiry into the Government’s superfast broadband strategy. The Committee invites interested organisations and individuals to submit written evidence as part of the inquiry.

Written evidence is sought by Tuesday 13 March 2012. Public hearings are expected to be held in March, April, May and June. The Committee aims to report to the House, with recommendations, before the summer recess. The report will receive a response from the Government and may be debated in the House.

Consumer demand for bandwidth has increased significantly in recent years and is certain to continue to rise with the increased take-up of internet services and their ever increasing applicability. Superfast broadband enables high-bandwidth content to be delivered quickly across the network, enabling users to access a range of services such as telemedicine, improved video conferencing and the streaming of HD or 3D video content. In addition, the development of the UK’s broadband infrastructure will determine what opportunities UK innovators and entrepreneurs have to develop a thriving ecology for the creation and exploitation of new services. The depth of penetration of superfast broadband infrastructure into communities is therefore of strategic importance: it is a key factor in ensuring no community is left behind, and that innovation and competition are stimulated in the provision of local access and in the development of new services.

In December 2010, the Department for Culture, Media and Sport and the Department for Business, Innovation and Skills published the Government’s broadband strategy, *Britain’s Superfast Broadband Future*, which aims for Britain to have “the best superfast broadband network in Europe by 2015”. The Government have committed £530 million to help stimulate private investment in those locations where the commercial investment case is weak; the Government’s ambition is to provide superfast broadband to at least 90% of premises in the UK by 2015 and to provide universal access to standard broadband with a speed of at least 2 Mb/s.

BT and Virgin Media have led the way with their investment in superfast broadband networks. At the same time, a range of other players, often with innovative business models, have been developing their own networks. Some of these run on fixed-line (primarily fibre optic) cable, others on mobile and satellite platforms. The resulting infrastructure is as complex technologically as it is economically and in terms of regulation. In addition, despite the progress that has been made, given that consumer demand for bandwidth is growing by around 60% a year and given the critical importance of superfast broadband to innovators, entrepreneurs and ultimately economic growth, speeds of 1Gb/s may be needed by 2020 and current investment looks unlikely to be sufficient to deliver this.

The Committee would welcome written submissions on the Government’s superfast broadband strategy and related issues. Questions the Committee will consider include:

- What is being done to prevent a greater digital divide occurring between people who can access superfast broadband and people in areas where the roll-out of superfast broadband may not be commercially attractive? How does the UK communications market vary regionally and what is the best

way to connect the areas that the market alone cannot reach? Is a universal service obligation necessary to avoid widening the digital divide?

- The Government have committed £530 million to help stimulate private investment—is this enough and is it being effectively applied to develop maximum social and economic benefit?
- Will the Government's targets be met and are they ambitious enough? What speed of broadband do we need and what drives demand for superfast broadband?
- In fact, are there other targets the Government should set; are there other indicators which should be used to monitor the health of the digital economy? What communications infrastructure does the UK ultimately need to remain competitive and meet consumer demand over the next 20 years?
- How will individuals and companies use cloud services for distributed storage and computation? What network properties are required to enable efficient provision and use of such services?
- To what extent will the advent of superfast broadband affect the ways in which people view, listen to and use media content? Will the broadband networks have the capacity to meet demand for new media services such as interactive TV, HD TV and 3D content? How will superfast broadband change e-commerce and the provision of Government services?
- Will the UK's infrastructure provide effective, affordable access to the 'internet of things', and what new opportunities could this enable?
- How might superfast broadband change the relationship between providers and consumers in other sectors such as content? What aspects of this relationship are key to enabling future innovations that will benefit society?
- What role could or should the different methods of delivery play in ensuring the superfast broadband network is fit for purpose and is as widely available as possible? How does the expected demand for superfast broadband influence investment to enhance the capacity of the broadband network?
- Does the UK, for example, have a properly competitive market in wholesale fibre connectivity? What benefits could such a market provide, and what actions could the Government take to ensure such a market?
- What impact will enhanced broadband provision have on the media and creative industries in the UK, not least in light of the increased danger of online piracy? What is the role of the Government in assuring internet security, and how should intellectual property (IP) best be protected, taking into account the benefits of openness and security?

You need not address all these questions. The Committee would also welcome any other views of which stakeholders think the Committee should be aware.

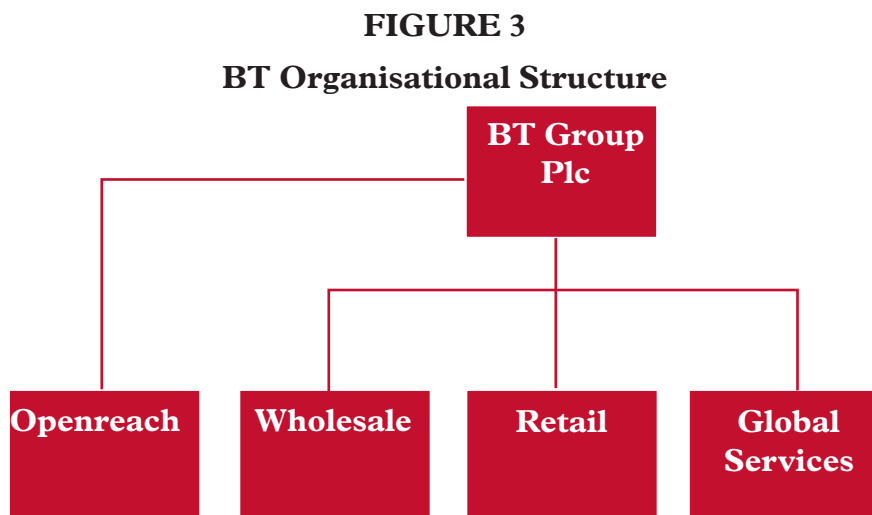
14 February 2012

APPENDIX 4: BT

Having been separated from the Post Office in 1981, BT—then British Telecom—was privatised in 1984, transferring its business to the newly instituted British Telecom Plc, and over 50% of its shares to the public.¹²³ A second share issue took place in 1991 and a third issue followed with the Government “selling off virtually all of its remaining shares” in 1993.¹²⁴ They then relinquished their Special Share in 1997, retained at the time of flotation which had allowed it to block a take-over of the company and appoint two non-executive directors to the board.¹²⁵ Since then, aside from changing its name from British Telecom to plain BT, the company has undergone a number of significant transformations. The most striking of these came in 2005. Ofcom had made clear that: “it has the power to make a reference to the Competition Commission under Section 131 of the Enterprise Act 2002.”¹²⁶ These references can be made where there are:

“reasonable grounds for suspecting that any feature, or combination of features, of a market in the United Kingdom for goods or services prevents, restricts or distorts competition in connection with the supply or acquisition of any goods or services in the United Kingdom or a part of the United Kingdom.”¹²⁷

Pursuant to Section 154 of the same Act, however, which allows ‘undertakings’ to be accepted in lieu of such a reference, in 2005 BT offered and Ofcom accepted a set of such undertakings, which included the creation of Openreach, the new owner and management company for—what was—BT’s local access network. The introduction of Openreach radically altered the organisational structure of BT, a simplified illustration of which is below.¹²⁸



¹²³ BT, *The historical development of BT*. Available online:

<http://www.btplc.com/Thegroup/BTsHistory/History.htm>

¹²⁴ BT, *Archives Information: Privatisation*. Available online:

<http://www.btplc.com/Thegroup/BTsHistory/Privatisationinfosheetissue2.pdf>

¹²⁵ *ibid.*

¹²⁶ Ofcom, *Undertakings given to Ofcom by BT pursuant to The Enterprise Act 2002*. Available online:

<http://stakeholders.ofcom.org.uk/binaries/telecoms/policy/bt/consolidated.pdf>

¹²⁷ Enterprise Act 2002, Section 131 (1)

¹²⁸ BT, *Group Businesses*. Available online:

<http://www.btplc.com/Thegroup/Ourcompany/Groupbusinesses/index.htm>

In line with its undertakings, Openreach is obliged to:

“provide the same products and services to ALL of our customers on the basis of “Equivalence of Inputs”, which means (subject to some limited exceptions): at the same prices; using the same processes; to the same timescales.”¹²⁹

The intention is to ensure that Openreach offers no unfair advantage in the provision of wholesale products to the retail ISP of its parent company. As such, even though—as discussed in Chapter 4—Openreach offer a wholesale product, GEA, over their FTTC and FTTP PON networks which does not allow ISPs to tune and differentiate the service they provide to end-users, there should be a strong enough separation between Openreach and the rest of BT Group to ensure the wholesale product is not designed in a way that provides an unfair advantage to its retail arm rather than serving the wider market on an equal basis.

The separation does not affect investment decisions. These are made at the level of BT Group. As Sean Williams, Group Strategy Director, BT Group, told us:

“Openreach is completely separate, but it is a visible part of the overall capital expenditure envelope that we manage across the whole group. But Openreach has a very distinct capital expenditure budget. So does retail, so does wholesale, so does global services. It is just a very visible choice. It is not without competing tensions, but we do not think that that is a barrier in this instance.”¹³⁰

One final point of interest in relation to BT is its pension deficit, which stands, according to BT Group’s Annual Report 2012, at £3.9bn, even after a lump sum payment of £2bn was made to reduce the figure.¹³¹ The deficit is significant, not least because it is covered by Crown Guarantee, which “requires the UK Government to pay any outstanding liabilities, transferred to BT on privatisation, for the payment of pensions.”¹³² The exact scope and extent of the Crown Guarantee is subject to a High Court decision.¹³³

¹²⁹ Openreach, *Equivalence: Ensuring a level playing field for all*. Available online: <http://www.openreach.co.uk/orpg/home/aboutus/equivalence/equivalence.do>

¹³⁰ Q 508

¹³¹ BT, *Annual Report 2012*. Available online: http://www.btplc.com/Sharesandperformance/Annualreportandreview/pdf/BTAnnualReport2012_smart.pdf

¹³² BT Pension Scheme, *Crown Guarantee Update*. Available online: <http://www.btpensions.net/56/277/crown-guarantee-update>

¹³³ *ibid.*

APPENDIX 5: GLOSSARY

4G	Fourth Generation Mobile systems—intended to provide significantly faster data rates than previous generation systems for both upload and download.
Access network	The “final mile” connections linking the backhaul network to the end user’s premises.
Active Device	An electronic device used to receive and send data; normally connecting two or more passive links.
ADSL	Asymmetric Digital Subscriber Line—a broadband technology using the copper phone network. It provides higher download speed at the expense of upload speed, hence ‘asymmetric.’
ALA	Active Line Access—an open industry-led standard for providing Virtual Unbundled Local Access (VULA) together with technical standards for the operations, maintenance and administration (OMA) interface between an internet service provider (ISP) and an infrastructure provider.
Backhaul	The part of the broadband network, which constitutes the intermediate link between the backbone, core network and the access network.
Bandwidth	The channel capacity (speed) of a data link (measured in bits per second) or the width of a band of frequencies (measured in Hz).
BDUK	Broadband Delivery UK—the unit within the Department for Culture, Media and Sport responsible for managing the Government’s funding programme.
Bit	The smallest unit of information on the internet—a bit can take one of two values. Communication speeds are measured in bits per second.
Bitstream access	Access to the level of the network that communicates a stream of bits without reference to the information it represents (see bit).
Cabinet	A street cabinet has a connection to the exchange and individual connections to each of the premises it serves. In the telephone network it served primarily as a junction box with copper connections in both directions. With Fibre to the Cabinet (FTTC) its function is changed as the connection to the exchange is replaced by fibre and it houses active electronic equipment. With Fibre to the Premises (FTTP) it again becomes passive and houses optical splices (in the case of a point-to-point network) or splitters (in the case of a point-to-multipoint network).

Contention ratio	Where traffic from many users travels over a single link, the contention ratio is the ratio of the potential maximum demand to the actual bandwidth: in simple terms, the number of users sharing a single link. The higher the contention ratio, the greater the number of users that may be trying to use the actual bandwidth at any one time and, therefore, the lower the effective bandwidth offered, especially at times of peak demand.
Cable connection or Coaxial cable connection	A cable connection normally refers to an access link using coaxial cable. Coaxial cables use copper to carry electromagnetic waves, but they can carry higher frequencies than ordinary copper cable—and so higher data rates—over longer distances.
Copper connection	A copper connection normally refers to an access link using legacy copper phone lines.
Dark fibre	Unlit fibre with no active equipment connected. Dark fibre may be leased from the owner to be lit by the lessee.
Duct	Underground pipe or conduit used to house (fibre, copper or coax) cables of a broadband network.
DSL	Digital Subscriber Line—a family of technologies that provide broadband connectivity by transmitting digital data over the wires of a local telephone network, utilising high frequencies that are not used by a voice telephone call. See also ADSL, VDSL.
DSLAM	Digital Subscriber Line Access Multiplexer—an electronic device, typically located in the exchange or cabinet, that connects multiple customer digital subscriber lines (DSL) to a high-speed digital communications channel.
Exchange	In this report ‘exchange’ normally refers to a telephone exchange now used as a node of the broadband network in which key pieces of active infrastructure are installed and exchange of data traffic takes place. This should be distinguished from what is usually meant by an ‘internet exchange,’ which instead refers to a node at a higher level of the architecture at which communications providers exchange traffic between their networks.
FTTC	Fibre to the Cabinet, sometimes known as Fibre To The Copper. The fibre is terminated in a street cabinet some distance away from the customer premises, with the final connection being copper (in fibre to the cabinet networks) or coaxial cable (in the cable network).
FTTP	Fibre to the Premises (homes and businesses), which reaches the end user premises with fibre.
Full unbundling	Physical unbundling grants access to the end-consumer access line and allows the competitor’s own transmission systems to directly transmit over it.

GEA	Generic Ethernet Access—a proprietary BT product providing Virtual Unbundled Local Access (VULA).
Gbps	Gigabit or 2^{30} bits per second, a unit of throughput or bandwidth.
GPON	Gigabit Passive Optical Network—a variety of Passive Optical Network (see PON).
Internet	The internet is a global system of interconnected computer networks that use the standard Internet Protocol Suite.
IP	Intellectual Property or Internet Protocol.
IPTV	Internet Protocol Television—television services delivered over the internet.
ISP	Internet Service Provider.
Killer app	A use to which a connection to the internet can be put which requires a certain level of broadband capacity to function, and which puts the case for wider or universal access to enhanced capacity broadband beyond all question.
Latency	The round-trip time between two nodes, measured as the time for a ‘ping’ to be answered.
Lit fibre	Fibre connected to active equipment that shines an optical signal down the fibre to communicate data.
Local loop	Another name for the copper pair between the exchange and the premises.
Local Loop Unbundling (LLU)	Local Loop Unbundling (see unbundling).
Mbps	Megabits (2^{20} bits) per second, a unit of throughput or bandwidth, commonly referred to as ‘speed’.
NGA	Next Generation Access—also known as next generation broadband, or superfast broadband.
Ofcom	The Office for Communications—the UK’s regulatory authority for, inter alia, telecommunications.
Open access	Open access refers to a horizontally layered network architecture and business model that, by allowing competing providers direct access to the lower layers of the network infrastructure, enables competition in the provision of higher-layer services.
Point-to-point	Point-to-Point—an access network where each end-user has a dedicated passive link to the backhaul node.
PIA	Physical Infrastructure Access—A remedy imposed by Ofcom on Openreach, obliging Openreach to provide as a product access to its ducts and poles.

Point-to-multipoint	A network topology that has dedicated individual customer lines to an intermediate passive node (e.g. street cabinet) where these lines are aggregated onto a shared line. Aggregation could be either passive (with splitters such as in a PON architecture) or active (as with FTTC, where each cabinet houses a DSLAM).
PON	Passive Optical Network—a point-to-multipoint network including a passive ‘splitter’ so that many end-users share a single fibre.
PSB	Public Service Broadcaster.
SLU	Sub-Loop Unbundling.
SME	Small and Medium-sized Enterprises.
SMP	Significant Market Power.
Spectrum	In the context of communications, ‘spectrum’ refers to a band, or range, of frequencies in the electromagnetic spectrum (see bandwidth).
Trunk	Part of the core network which provides a major link carrying data from many different users.
Unbundling	The regulatory process of requiring an incumbent operator to allow other providers to provide services using its infrastructure (see open access).
USO	Universal Service Obligation.
VDSL	Very-high-bit-rate Digital Subscriber Line (see DSL).
VULA	Virtual Unbundled Local Access—a set of regulatory requirements imposed by Ofcom.
Wayleave	The right to make and use a connection running over the property of another.