OFFICE OF COMMUNICATIONS

Future broadband

Policy approach to next generation access

Consultation

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Contents

Foreword

The services offered by the telecoms sector have changed dramatically over recent years, in a large part due to the introduction of broadband access in 2000. During its relatively short life, the changes we have seen in the broadband market itself have been particularly marked: today there is strong competition delivering a wide range of products spanning many price points, and available to most consumers in the UK. Despite a slow start, over half of all households now have a broadband connection, and almost three quarters have a choice of at least two network providers. We continue to see broadband services with steadily falling prices and rapidly increasing headline speeds. These services have had profound impacts on our society and economy by changing the way people conduct business, entertainment and education.

At the same time, consumers are increasingly experimenting with a diverse range of new applications and services over their broadband connections, such as video content. As a result, their expectation of services is moving beyond the relatively low speed examples that are currently the norm. In the future, these usage changes will place an increasing strain on the underlying communications infrastructure on which broadband is built.

Communications companies are already responding to this trend with a range of investments in upgrading the current access network infrastructure, including cable network improvements, and the ADSL2+ technologies being deployed by a number of operators delivering speeds of up to 24Mbps. Even with these upgrades, the existing broadband networks will ultimately be limited in terms of the combination of speed and coverage they can provide.

We are also seeing the first announcements of investment in new technology which can overcome such limitations: next generation access networks. However, so far, these announcements have been limited to a small number of new build premises and several technical trials seeking to experiment with the services that can be offered. There is still much uncertainty about the demand for these services and therefore when these new networks will be deployed more widely in the UK. Despite this uncertainty, we can be sure they have the potential to have a profound impact upon the broadband market for many years to come.

In the future, the changing consumer usage and expectations of broadband services look certain to create opportunities for significant investment in next generation access networks. We think that Ofcom has a key role to play. As part of our statutory duties, we are required to give regard to the desirability of encouraging the availability and use of high speed networks. We want to ensure that the UK secures investment in these new networks and sees a competitive market structure that will meet consumer needs and increase consumer benefits. To achieve this, we are committed to helping remove any barriers to the development of next generation access, especially by giving certainty about the regulatory environment and by ensuring any future regulation is proportionate.

This consultation sets out our strategy for addressing the regulatory challenges ahead. We believe the time is right to share our emerging thinking and so provide as much certainty on the future regulatory environment as possible. This will help parties considering investment, both in current and next generation networks, to plan effectively. The current broadband market has delivered one of the best combinations of choice, widespread availability, low

prices and high take-up of any large economy in the world, and we need to ensure regulation plays its part in ensuring this continues into the next generation. To this end, the principles underlying our approach are based on those we have applied to current broadband services. At the same time, they are designed to encourage the deployment of this exciting technology as soon as the time is right.

A move to much higher broadband speeds, widely available throughout the UK, could have profound effects for our society and economy. At the same time, it will involve major investment. We think it is important that there should be a widespread debate about the issues this raises, involving those representing consumers, small and large businesses, and government, as well as companies in the communications sector.

We are planning a range of activities over the coming months to provide a forum for this debate. I would very much encourage anyone with an interest in these issues to take part, and to respond to this consultation document.

Ed Richards
Chief Executive

Section 1

Executive Summary

1.1 There are unprecedented changes occurring in the telecoms industry right across the globe. The current networks and technologies, on which most telecoms operators rely, have used the same fundamental elements for decades. These fundamentals are now changing with a move to completely new, "next generation" networks. The results of these changes and the impact they have on consumers will be with us for many years. Ofcom's approach to these changes sets out to balance the need to remove any unnecessary barriers to investment in the new networks with the need to ensure they deliver positive outcomes, where appropriate by ensuring the continued presence of strong competition.

1.2 When considering next generation networks, they are often logically divided into two separate components, because these have very different implications for operators, regulators and consumers. The first is the backbone or core networks, often simply known as next generation networks (NGNs). There is considerable industry debate already underway on how NGNs will affect telecoms markets in the UK. The second component, next generation access networks (NGA), are formed from the section of the operator's network which links end customers into the operators' backbone networks. Last year, Ofcom published a discussion document about next generation access, which set out our view of the most important regulatory issues they raise. We feel the time is now right to present our proposed policy approach to these issues and in doing so, seek to stimulate a broader public debate about next generation access networks.

1.3 The current generation of consumer broadband services were launched in earnest in the UK around the turn of the millennium by BT and the cable operators. These had a slow start, with the services having limited geographic coverage and with the absence of sufficiently strong competition between providers. The regulatory approach to broadband has had an important role in shaping how the market developed. This approach is based on principles which Ofcom established in our Strategic Review of Telecommunications. The most relevant aspects for the broadband market have been:

- **contestability:** making the opportunity for entering the market accessible to a wide range of companies**;**
- **innovation:** allowing the maximum scope for innovation by the promotion of competition at the deepest level at which it will be effective and sustainable; and
- **equivalence:** the requirement for operators with market power to make the inputs used by their downstream businesses available to their competitors on the same basis.

1.4 Partly as a result of this approach, since its slow start, the market has developed rapidly in terms of competition, coverage and customer take up. Today, over 52% of households in the UK have broadband, up from 16% three years ago[1], and over 99%

[1] Ofcom Communications Market Review, 2004 & 2007

can access at least one access network. The average headline speed[2] of the products delivered to consumers increased three fold in the past 18 months to 4.6Mbps by June 2007. There is a very wide range of products available, covering many different price points, speeds, customer service and bundling options.

1.5 The development of the broadband market is far from complete. In particular, the desire for operators to offer ever faster speeds, and for customers to purchase them, shows no sign of slowing. New high speed services, such as high definition video will place increasing demands on current networks. We are already seeing some upgrades to current cable networks, and they continue to offer the opportunity to deliver very high bandwidths to end customers. At the same time, there is also no doubt that upgrades to copper based broadband networks will continue. However, there is likely to be a point beyond which the today's access networks will no longer be able to address increasing speed and coverage requirements. Next generation access networks are designed to overcome these limitations and, as with current broadband networks, their deployment will accelerate the development of exciting new services that can take advantage of them.

1.6 Ofcom believes that the deployment of next generation access networks has the potential to be very positive for consumers. We are keen to see investment take place at the right time and in an efficient manner. This will involve removing any unnecessary regulatory barriers which might delay this investment. One important factor to achieve this is sharing our policy framework and clearly setting out the practical options for the regulation of these new networks where ex ante regulation may be appropriate at the earliest opportunity possible. This is a key objective of this consultation.

1.7 Next generation access networks may take many forms. They may be based on upgrades to BT's existing copper access network or Virgin Media's cable network, or a completely new deployment of wired or wireless infrastructure, each of which has different advantages and disadvantages. BT has direct copper connections between the exchange and almost every customer premise in the UK. In contrast Virgin's network covers around half of all households, and offers a shared access network using very high capacity fibre and coaxial copper cables. Wireless networks have obvious advantages for delivering mobile services but new technologies may also have a role in delivering very high speed access over large areas in the future. The organisations that deploy next generation access networks may also vary, and could include: communications providers; utilities; building developers; community broadband projects; other new entrants; and, in some instances, the public sector.

1.8 In the UK, we are seeing the first signs of next generation access deployment, for example the Digital Region project in South Yorkshire and a new housing development in Ebbsfleet Valley, part of the Thames Gateway project in Kent. In some countries, next generation access networks are already being deployed more widely. This has required operators to make risky investments, often relying on the predicted success of the new, untried, products that the networks will support. In each case however, there are commercial, geographical or political factors which are not features of the UK context that have led operators to deploy new access networks. These include:

- current generation broadband services which appear less able to meet most customer's needs at the moment compared to the UK;

[2] The complex relationship between headline speed and actual consumer experience is explored in Section 3

- greater scope to generate additional revenues from services such as pay TV, whereas the market is already relatively mature in the UK; and

- relatively lower deployment costs of next generation access than in the UK, in part due to more densely populated urban areas.

1.9 It may therefore be that the efficient deployment of next generation access is simply earlier in some other countries than in the UK. We do not yet see evidence that the UK will be significantly disadvantaged economically or socially as a result. It is important that we continue to monitor the situation closely for any new evidence that would change this view. However, we continue to think that promoting investment which is timely and efficient in the context of the UK market is the correct approach.

1.10 We are proposing to achieve the conditions for this investment by adapting the existing principles of contestability, innovation and equivalence that we have used for the regulation of current generation broadband. In addition we think that two further principles will be necessary as we move to next generation access, to reflect the commercial risks and different characteristics of these investments compared to existing access networks, which are largely sunk cost investments. The five principles underlying our proposed approach are:

- **contestability:** we think that timely and efficient investment will best be achieved by making the investment contestable, allowing any operator who considers that there is a business case for deploying next generation access infrastructure to invest, as soon as they wish;

- **maximising potential for innovation:** as we recognised in the Telecoms Review for current networks, we believe that the scope for innovation and differentiation is essential for competition in next generation access, and that infrastructure investment is helpful in achieving this. We are consulting on an approach which maximises the potential for innovation, while allowing for the current economic and technical uncertainty around next generation access;

- **equivalence:** strong competition in current generation broadband has been helped by ensuring that all operators are able to buy exactly the same wholesale products, with the same processes and at the same price, as operators with market power. We propose to apply this principle to next generation access, supported by approaches such as functional separation, essential to reduce incentives for anti-competitive behaviour while retaining incentives for efficient investment;

- **reflecting risk in returns:** we recognise that anyone who makes investments in next generation access is likely to face significant commercial risks. Regulation should reflect these risks in order to provide appropriate incentives for investment in the first place. We are consulting on a range of approaches to reflect such risk such as anchor product regulation, and risk-adjusted returns; and

- **regulatory certainty:** It is also important that the regulatory regime we adopt is clear and in place for a reasonable period of time, to allow investors the clarity that they need to invest with confidence. We are publishing this consultation and establishing a program of seminars and meetings supporting it to provide this clarity.

1.11 The consideration of these principles leads us to several specific remedies that may be appropriate to deal with concerns raised by any future next generation access

networks that give their owners significant market power (SMP) in the relevant markets. The most appropriate remedies will vary with the technology used to build the network, but those most likely to be relevant are:

- **Sub-loop unbundling** – this passive line access[3] remedy already applies to BT's copper access network but is not yet used by any competitors. We believe it will become increasingly important if we see next generation access networks that still rely on this copper infrastructure. Like LLU today, making the passive bottleneck asset directly available to third parties best supports our principle of allowing innovation by competitive network investment. However, there are practical and cost issues that may mean unbundling is not a viable remedy for all next generation access technologies, or for all parts of the UK; and

- **Active line access** – Due to the practical concerns about future passive unbundling remedies, a wholesale product, giving competitors access to active bottleneck assets, may be required as well[4]. It is essential that such a remedy gives those relying on it the maximum possible control over the underlying network's innovation potential. Technology developments suggest that the difference in innovation potential between a carefully conceived and implemented future active line access product and an unbundling remedy may be less than today. However, delivering on this potential will require a step change improvement in the effectiveness of the development processes used for similar bitstream products today.

1.12 In order for these remedies to be effective, it is imperative that they are supported by appropriate backhaul products to transit traffic from the access network to competitors' own core networks. These may take a number of forms and apply at a number of locations within the network depending on the extent to which communications providers own their own infrastructure for the transit of services.

1.13 In addition, as demonstrated by today's broadband market, all access remedies need to be supported by appropriate and robust processes, for example in provisioning, fault management, maintenance and product enhancement. Effective processes are necessary to ensure that any access remedies are viable for practical use by alternative operators to deliver an effective and sustainable competitive environment.

1.14 Alongside possible future remedies, we have also set out our approach to the evolution of current regulation and potential implications on the deployment of next generation access. Any change to existing regulatory products following a move to next generation access will affect operators who currently rely on them. We will consider factors such as the location and timing of existing and potential future investments in current generation broadband before undertaking any changes.

1.15 Although we are keen to ensure regulation is not a barrier to companies investing in next generation access when it makes sense for them, this investment should not be achieved at any cost. In particular, it should not be detrimental for consumers, for example in having to pay higher prices for today's services, nor by sacrificing competition. Specifically:

[3] Passive line access refers to wholesale products based on direct access to physical elements of the access network, but does not include any form of electronics. Examples could include: access to ducts; unbundled copper loops; or dark fibre.

[4] Active line access refers to wholesale products that are based on both the active electronics and the physical elements of the access network. Examples include today's IPStream product offered by BT.

- we do not currently see evidence of a market failure that would warrant direct intervention by Ofcom in commercial investment decisions. Therefore, we do not propose incentivising operators to deploy next generation access in ways which would result in all consumers paying higher prices for today's products; and

- neither do we think there is a case for withdrawing all regulation from next generation access networks, bearing in mind that they are likely to be bottlenecks, and the presence of competition has greatly benefited today's broadband consumers.

1.16 The principles we have set out are designed to further citizen and consumer interests and the wider benefits for the economy that flow from these, but there are other specific issues that that may result from next generation access deployment and must be addressed. One is the availability of the appropriate information to allow consumers to make informed purchasing decisions about next generation products and services. Current concerns that the headline "up to" speeds of broadband products may not reflect the actual speeds a customer will achieve demonstrate the importance of this issue. Another important concern is that next generation networks may be more likely to be deployed in densely populated areas, hence widening the geographic differences in access to high speed services. The significant uncertainty around next generation access deployment suggests it would be premature to attempt to address this potential problem now, but that we must work with the appropriate agencies and be ready to respond quickly at the appropriate time. Our aim is to secure the wide availability of high speed networks across the UK.

1.17 The first, small scale, commercial deployments of next generation access will occur quite soon as part of planned large housing developments, such as the development project in Ebbsfleet. The new networks deployed to these developments raise very specific policy challenges for Ofcom, especially where these networks and the operators deploying them are covered by existing market definitions and regulatory remedies. We explore the principles we will use to consider these shorter term issues here, and we will address them in detail in a future consultation.

1.18 We believe the deployment of next generation access networks offers important potential benefits for consumers and will represent both a significant investment, and a fundamental change, for the whole telecoms industry. The new networks and the competitive landscape they bring will be with us for many years. We must ensure there is a full and open debate around the many complex issues they raise, and that the policy approaches we have proposed here are appropriate and widely understood by all interested parties.

1.19 Our objectives in undertaking these activities include gathering the views of as many stakeholders as we can, and ensure the evidence base used to determine our regulatory approach is kept up to date. To this end, we are keen to seek the views of a wide range of stakeholders on the issues explored in the consultation. Specifically, we have a number of questions for consideration.

Question 1 When do you consider it would be timely and efficient for next generation access investment to take place in the UK?

Question 2 Do you agree with the principles outlined for regulating next generation access?

Question 3 How should Ofcom reflect risk in regulated access terms?

Question 4 Do you agree with the need for both passive and active access remedies to promote competition?

Question 5 Do you consider there to be a role of direct regulatory or public policy intervention to create artificial incentives for earlier investment in next generation access?

Section 2

Introduction

Access networks are facing fundamental change

2.1 The only part of a telecom service provider's infrastructure which is directly visible to end customers is the access network. This is the common term for the segment which connects between a consumer's home or business premise and the nearest location which houses their provider's equipment. These networks and the services they provided existed essentially unchanged for decades. More recently, the advent of computers and digital communications has led to significant changes to these services. Some have been largely invisible to end customers, but the introduction of broadband has brought perhaps the most obvious sign that services have changed. Large business customers have seen even more radical changes, with the widespread replacement of old access network's copper cables with fibre optics and with it the availability virtually limitless service speeds. For the majority of customers, despite the recent changes in services, the underlying network is still based on the same elements as the first telephone networks which were established in the first half of the last century.

2.2 The copper access networks supporting today's mass market broadband services have proved remarkably flexible, having originally been designed to offer very different services. They do have limitations though, which will restrict the type, and speed, of technologies and services that can be delivered across them. At the same time, developments in cable and wireless technologies are allowing increasing bandwidths to be delivered over these networks. The continuing development of high speed services, for example broadband-delivered high definition video, may mean that current generation access networks will be unable to meet future demand. Next generation access networks are designed to overcome these limitations. Unlike today's broadband, which involved relatively modest changes in the equipment at the customer and service provider's premises, next generation access will involve fundamental changes to the infrastructure of the underlying network as well. Typically, for wireline access networks, this will involve the installation of new cables for at least part of the route between the customer and the service provider, which involves very high levels of investment.

2.3 It is important to note that despite the similar name, next generation access is not the same as next generation networks (NGNs), the name commonly given to the upgrades that many providers are making to their backbone, or core, networks. These upgrades are linked in the sense that they both involve significant investment in new technology and they will both lead to far reaching and long lasting changes to the telecoms market. However, they are independent of each other; a given provider can decide to invest in either one without having any interest in the other. There is considerable industry debate already underway about how core NGNs will affect telecoms markets in the UK, and Ofcom has set out its emerging regulatory position in several previous consultations. This document will not discuss core NGNs: its focus is next generation access networks.

2.4 The issue of next generation access networks has been rising in profile rapidly over the last three years. We first raised the issue of next generation access networks as part of Ofcom's Strategic Review of Telecoms in November 2004. In November 2006 we published a discussion document on the regulatory challenges posed by these

new networks, and outlined a range of prospective approaches that could be adopted.

2.5 Since then, the interest in next generation access has increased markedly. Now, a wide range of stakeholders expect next generation access deployments and the resulting higher speed broadband services to be the next major development in the communications sector, and the most important development in access networks since the start of broadband deployment services by BT in 2000. We believe that the deployment of next generation access networks has the potential to be very positive for consumers. With these points in mind, we feel the time is now right to present our proposed policy approach to these issues and in doing so, seek to stimulate a broader public debate about next generation access networks

2.6 The timing, reach and nature of next generation access investments are vitally important. These networks will comprise the fixed access infrastructure for communications services for years to come – it is therefore important that, when it is time for these investments to be made, they are made correctly.

2.7 Current generation broadband has been one of the single most important developments in the communications industry to date, delivering higher bandwidth services to customers. Adoption of broadband services has been rapid, outstripping the take-up of many previous technologies, with now more than 50% of households having access to broadband internet services. At the same time, there is increasing evidence that current generation broadband services are contributing to both social and economic welfare.

2.8 Next generation access network deployments may in time offer further scope for development, innovation and economic gains. They will support faster access than current generation broadband services and could facilitate the development of new products and services that may further drive competitiveness and productivity. It is these prospects that have made next generation access developments a topic of increasing debate in the past 12 months.

2.9 At the same time, next generation access represents a fundamental change to the way telecoms services are delivered to end customers, raising new challenges for everyone in the communications sector, including regulators. For current access network owners, while next generation access network deployments offer the prospect of very high end customer bandwidths, they will require significant investment in infrastructures. For competitors and new entrants, these networks may result in changes to the wholesale products and services they can purchase. For service and application providers, these networks may result in a change to the way customers consume services or the business models adopted for service delivery. And for consumers and businesses, these networks may offer access to a range of new and innovative services at new pricing points.

2.10 The migration to next generation access networks will also pose fundamental questions for competition and the regulatory environment for fixed communications services. The UK has fostered an increasingly competitive fixed telecoms sector, including broadband. We have witnessed a continuing increase in the level of competition in retail broadband service provision in part through the take-up of unbundled lines. The level of investment required, and the new forms of competition that can be supported, by next generation access mean that it may not be appropriate to simply roll-over the current regulatory regime to apply to next generation access networks. We are therefore seeking to set out the regulatory

principles we consider to be most appropriate for next generation access networks and consult on their application into approaches to regulation.

Next generation access networks remain difficult to define

2.11 In our November 2006 discussion document, we described how a formal definition of next generation access is relatively difficult to reach in advance of the emergence of new applications and services that utilise these new infrastructures. Next generation access is still largely defined on the basis of bandwidth, other service characteristics or services that these networks can deliver. For example, some definitions consider 25Mbps or more as the point that would define what a next generation access network would need to provide. This is on the basis that 25Mbps may be sufficient to support services (such as simultaneous multiple HDTV channels, broadband internet and voice services) that cannot be delivered by existing broadband technologies to the majority of customers, increasing the availability of a more modest bandwidth to the majority of customers.

2.12 However, some others consider that the most significant benefits of next generation access technologies will not be about much higher headline speeds to a limited number of customers, but rather ensuring that the best peak speeds of current generation access consistently available on a sustained basis to the majority of customers through the use of a range of different technologies.

2.13 Tightly constrained definitions of next generation access are problematic. For example, we now see services operating over current generation access networks which boast headline speeds of 24Mbps. We outlined in our November document a more general definition of next generation access, describing it as:

> *"broadband access services that are capable of delivering sustained bandwidths significantly in excess of those currently widely available using existing local access infrastructures or technologies."*

2.14 A general definition is useful as next generation access can be delivered by a number of different technologies and architectures, each with their own unique characteristics. These include fibre deployments, including fibre-to-the-cabinet and fibre-to-the-home, as well as cable, terrestrial fixed or mobile wireless services, satellite, bonded copper pairs or further upgrades to existing copper-based access networks. In practice, there are likely to be a number of alternative options for deployment of next generation access infrastructure by incumbent telecoms operators, competing operators and new entrants. There may be prospects for further bandwidth increases and service improvements in current broadband, including new investments e.g. in ADSL2+ equipment at the exchange, or in improvements to compression technologies. However, eventually bandwidth requirements may exceed what current technologies can deliver to the mass market.

2.15 Given current uncertainty surrounding next generation access and ongoing developments in current generation access, we still think that a general definition is a useful way to consider next generation access. However, in practice, in defining next generation access we will draw on a number of the factors outlined above, including the services supported, service characteristics, bandwidth, reach and technology.

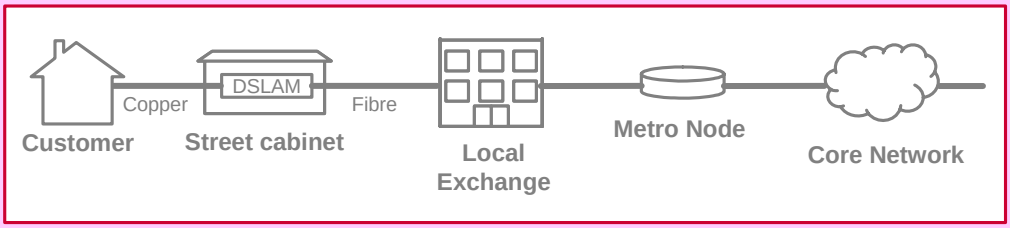
2.16 At certain points in this document, it is helpful to focus on the impacts on regulation and competition that may arise from the use of specific next generation access technologies to upgrade the existing copper access networks. The approaches adopted to delivering higher speed services over cable networks may differ, and may

require less substantial changes to the existing network infrastructure. As mentioned above, there is actually a large range of technology that might be used for these networks. Figure 1 introduces two such technologies, commonly known as Fibre to the Cabinet (FTTC) and Fibre to the Home or Premises (FTTH). We chose to focus on these specific choices in some later sections for a number of reasons:

- BT has the only current generation fixed access network with virtually 100% UK coverage. It also has significant market power (SMP) in many relevant markets. It is therefore important that we consider how this network could evolve. FTTC and FTTH seem the two most likely technology options for upgrading this type of network;

Figure 1: Overview of next generation access technologies

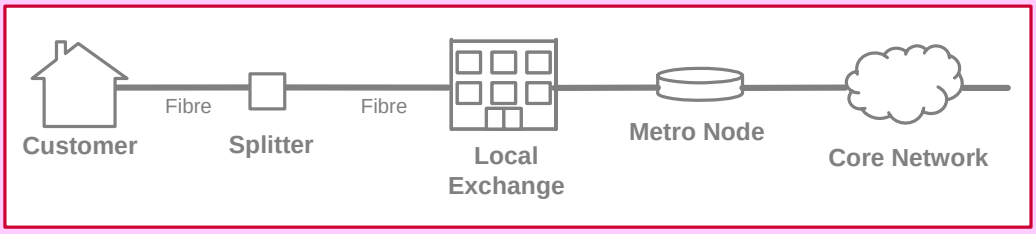
Fibre-to-the-cabinet (FTTC)



In a fibre to the cabinet (FTTC) next generation access deployment, active electronics (typically VDSL2 DSLAMs) are installed within the street cabinet, which is connected to the exchange with a fibre link. The existing copper sub-loop from the cabinet to the subscriber premises (with an effective average length of 420 metres) is retained. This shorter portion of copper loop, compared to exchange based DSL broadband, allows higher bandwidths to end customers. Depending on deployment choices, speeds of up to 100Mbps in both downstream and upstream directions can be achieved. However, as with other copper based DSL deployments, actual performance will vary according to the length and quality of the copper loop being used.

Current generation cable networks use a similar architecture to this for the delivery of broadband and TV services. However, rather than using individual pairs of twisted copper wire and DSL to connect to each house, they use a shared coax arrangement.

Fibre-to-the-Home (FTTH)



Fibre to the home (FTTH) deployments involve the complete replacement of copper loops with fibre all the way to the customer's premises. There are two main types of FTTH network deployment:

- Passive optical network (PON) – A single fibre from the exchange serves multiple customers, by having its capacity divided or 'split', typically to 32 customers in current systems. Sharing the capacity, which can be up to 2.5Gbps, equally, each customer will receive around 80Mbps, however much higher peak speeds can be achieved
- Point to point (P2P) fibre – Each customer has a dedicated fibre connection from their premises. This architecture allows virtually limitless access speeds to be offered.

Most incumbents are choosing to deploy variants of PON networks, such as GPON (Gigabit PON), whilst new entrants may be more likely to deploy point-to-point fibre.

- Virgin Media is the other significant owner of underlying access infrastructure for the mass market: its network covers around half of UK households. This network is somewhat different to BT's and has elements of the FTTC approach already, which means that consideration of this model has relevance to them. FTTH is a viable upgrade path for this network, both inside Virgin Media's existing footprint and in the situation where it were to be extended;

- wireless networks have had a limited deployment for the provision of fixed communications services. The nature of wireless services may make the provision of the sustained high bandwidths that may define next generation access services difficult through wireless networks. At the same time, wireless local access networks are likely to display significantly lower barriers to entry than wireline based next generation access networks, increasing the prospects for competition in wireless deployments; and

- looking internationally, most, if not all, current deployments of next generation access are relying on variants of FTTC or FTTH.

2.17 All of the technologies mentioned above will have a role to play in the delivery of services to end customers in the future. However, as we outlined in our November discussion document, it may be wireline access networks that pose the greatest regulatory challenge. We have therefore focussed on these network deployments in this consultation.

Ofcom has an important role to play in next generation access

2.18 It is vital that the regulatory policy applied to next generation access networks is correct. It is one of the major factors taken into account by organisations when making their investment decisions. At the same time, regulatory policy is one of the fundamental factors in determining the competitive environment which will prevail for these new access networks. It is through competition that a large number of consumer benefits can be delivered, including innovation, choice and price competition.

2.19 In assessing the most appropriate regulatory approach for next generation access, Ofcom must have regard to its statutory duties as defined in the Communications Act 2003. Under section 3(1) of the Communications Act 2003, the principal duties of Ofcom, in carrying out its functions, are: to further the interests of citizens in relation to communications matters; and to further the interests of consumers in relevant markets, where appropriate by promoting competition.

2.20 Ofcom has a number of statutory duties and powers relevant to next generation access deployments. In meeting those duties, Ofcom:

- is required to secure the availability throughout the UK of a wide range of electronic communications services[5];

- must have regard, where relevant, to the desirability of encouraging investment and innovation in relevant markets[6]; and

[5] Communications Act 2003, Section 3(2)(a)
[6] Communications Act 2003, Section 3(2)(d)

- must have regard, where relevant, to the desirability of encouraging the availability and use of high speed data transfer services throughout the United Kingdom[7].

2.21 In order to assess the relative merits of different regulatory approaches to next generation access, it is important that we have an objective against which specific approaches can be measured. At a high level, our objective is to ensure that:

- the UK witnesses timely and efficient wide scale, market led investment in next generation access networks and services that meet residential consumer and business customer demands. The environment to enable these investments should be supported, where necessary, by proportionate and timely regulatory intervention; and.

- that there is a competitive environment for the delivery of next generation access services that facilitates service and business model innovation and experimentation, and that allows service differentiation based on wholesale inputs.

2.22 There are many possible market developments which could achieve this objective. In practice, the market structure and technology availability following next generation access network deployment is likely to be complex. A range of different technologies are likely to be utilised to deliver broadband services in different geographic areas. This is likely to include a combination of exchange based ADSL, cable, new build fibre to the home deployments and overlay fibre to the cabinet deployments. In addition, some organisations and customers may use combinations of alternative distribution mechanisms for service delivery, including wireless, satellite and localised storage based solutions.

2.23 We may also witness deployments from a wide range of different organisations in different locations, including: communications providers; utilities; building developers; community broadband projects; other new entrants; and, in some instances, the public sector.

2.24 The objective outlined leads to two main challenges for Ofcom: how to secure timely and efficient investment in next generation access; and how, following investment in next generation access, can a competitive environment for service delivery be promoted.

2.25 We also have a role to play in facilitating and participating in a wider debate on the public policy and economic implications of next generation access. The movement to next generation access may well be fundamental facilitator for developments in the economy and society.

2.26 Finally, we also have a role to play in assessing the risk of and prospective policy responses to any digital divide in next generation access networks. Given the economics of communications networks and the potential deployment strategies that could be adopted, it is likely that there will be areas of the UK that do not have access to next generation services. It is appropriate for Ofcom to consider the degree to which such areas may be disadvantaged as a result of having no access to next generation services, and what the appropriate policy responses may be. However, it may be premature at this stage to consider specific policy options in advance of

[7] Communications Act 2003, Section 3(2)(e)

announced next generation access deployments even in those areas where we could reasonably expect the market to deliver.

Scope of this consultation

2.27 At the moment, the UK is in a pre-investment stage with respect to next generation access. Many organisations are considering how best to address developments in broadband services, and what the commercial case is for significant investment in next generation access technologies.

2.28 We believe next generation access networks have the potential to play a very important role in the future of UK telecoms. When deployed, they will shape the telecoms market and its implications for consumers and the economy for many years to come. Therefore we need to ensure that conditions are in place so that when the time is right, we see the right level of investment in the right types of networks. One important requirement to achieve this is for Ofcom to share our proposed policy approach for the regulation of these new networks at the earliest opportunity possible. This is a key objective of this consultation.

2.29 This consultation sets out the principles we are proposing to adopt to deliver such an approach and consults on the detail of how these principles should be applied. It also explains our views towards strategies such as direct regulatory intervention and the withdrawal of regulation to promote investment. This document is not proposing to implement any new policy at this stage – this will be achieved at the appropriate time through a combination of market reviews and the Undertakings given to Ofcom by BT.

2.30 At the same time as sharing our proposed approach to regulation, given the prospective importance of next generation access networks to consumers, citizens and the economy, Ofcom has a role in promoting a wider discussion on the need for next generation access and the ways in which investment and competition in these networks could be secured. In exploring many of the complex issues involved in detail, we hope this document will contribute to this debate.

2.31 This consultation focuses on the issues posed by mass market next generation access network deployments, targeted at consumer and small and medium sized enterprise (SME) customers. Many larger businesses can already secure access to very high speed bandwidth connections through the current supply of leased lines. However, these mass market deployments may still have implications for larger businesses, especially those with connectivity requirements for satellite offices or remote workers.

Consultation structure

2.32 The rest of this consultation is divided into eight sections:

- The broader context for next generation access – what lessons can be learned from international developments in this area, and what are the potential implications for the UK position?

- The regulatory challenge – what are the main challenges posed by next generation access to Ofcom both in advance of deployment and following roll-out?

- Securing investment in next generation access – what options are available to ensure the right incentives are in place to secure efficient and timely investment in next generation access?

- Promoting competition under next generation access – following deployments, what options are there for the promotion of competition in next generation access networks?

- The case for direct intervention in next generation access investment – are there public policy issues that require intervention now?

- Implications for existing regulation – how will existing regulation need to evolve to meet the challenges of next generation access?

- Next generation access and new build developments – what are the challenges and issues being posed by next generation access deployments to new building developments, including Openreach's proposed fibre-to-the-home deployment in Ebbsfleet?

- Next steps – how will this consultation and the wider range of next generation activity led by Ofcom be taken forward?

Section 3

Next generation access: the broader context

3.1 Since we published our discussion document in November 2006, we have witnessed an increasing number of announced international next generation access deployments. At the same time, the prospects for wide scale UK deployments in the near term appear lower. To understand why this is the case, and whether it is a potential cause for concern, it is necessary to consider the varying reasons for deployments in different countries, and the extent to which these factors may influence the development of next generation access in the UK.

3.2 This section looks at other countries' experiences with next generation access and compares them to the UK situation. It considers:

- where we have seen international next generation access developments, and the factors that have facilitated these deployments;
- the reasons why we have seen no announced wide scale deployments of next generation access in the UK, although with some interest in trials and smaller scale deployments; and
- how evidence of UK demand for broadband services compares to these international experiences.

3.3 A high level analysis of international next generation access deployments shows that a wide degree of variation is displayed across nations: different organisations are choosing to deploy different types of next generation access networks for a number of different reasons. It is not clear at the moment whether there is a compelling business case for wide scale deployment of next generation access in the UK on the same basis as investments are being made in other countries. Because of this, it is possible that the efficient timing of commercial next generation access deployments may be naturally later in the UK than elsewhere.

Announcements continue to be made regarding overseas next generation access deployments

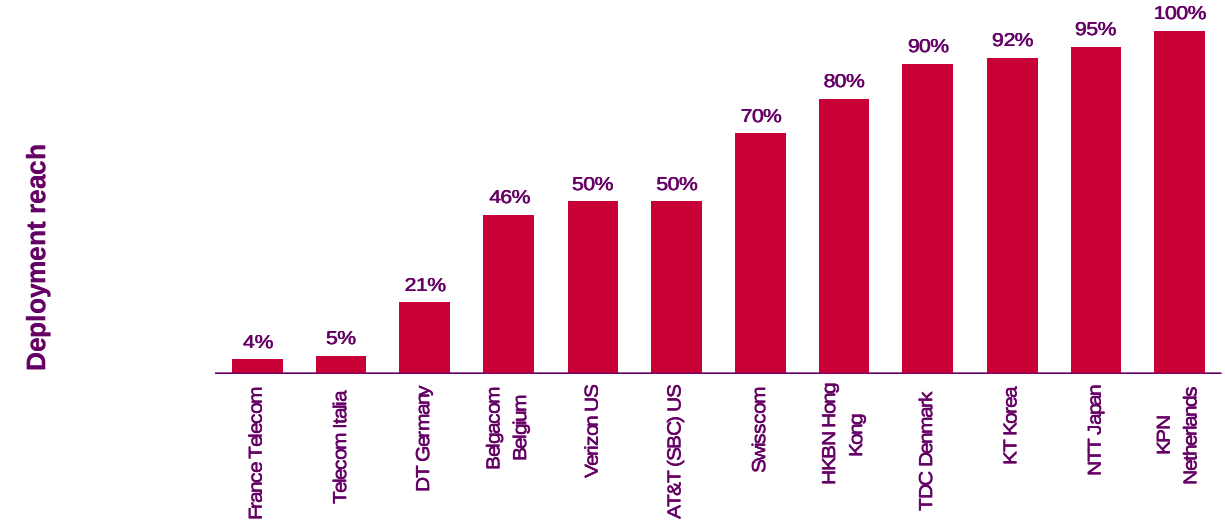
3.4 In contrast to the UK, where no operator has announced any intention to make wide scale next generation access investments, operators in some other countries are already deploying and operating next generation access networks on a commercial basis. These developments are relevant from a UK perspective in that they may provide information on the potential:

- deployment timings, technologies, costs and reach of next generation access networks. They may also provide some indication of potentially efficient timing and circumstances for deployment; and
- end customer usage of, and demand for next generation access services.

3.5 Figure 2 indicates the variation in announced international deployments between countries. Substantial differences in technology, reach, timing and cost can be seen.

In Japan, Korea and the US, a significant number of broadband customers already use next generation access. FTTH already accounts for 31% of Japanese broadband connections (7.9m connections) at Q4 2006, and in Korea there were approximately 3.4m million Ethernet LAN and FTTH subscriptions in December 2006, which accounted for 24% broadband subscriptions. This does not include the large VDSL subscriber base. In the US, there were approximately 1.3m FTTH subscribers at April 2007, representing 99% growth in a year. In some European countries, next generation access deployments have been announced, but with relatively few customers so far. For some countries, notably France and Italy, it is possible that further investment will be committed to next generation access in the future – the current announced plans are initial investments.

Figure 2: Incumbent next generation access deployment plans by target date



Year	2009	2009	2008	2006	2010	2008	2008	2008	2010	2010	2010	2009
Target homes (m)	1	1	8	2	18	18	2	2	2	12	47	8
Investment	£190m	£120m	£2bn	£200m	£11bn	£3.2bn	£285m	£67m	N/A	N/A	£25bn	£670m
Technology	FTTH	FTTC	FTTC	FTTC	FTTH	FTTC	FTTC	FTTH	FTTC	FTTH	FTTH	FTTC
Target Year	2009	2009	2008	2006	2010	2008	2008	2008	2010	2010	2010	2009

Source: Various

3.6 The types of network deployed vary between countries, with communications providers adopting both FTTC and FTTH depending in part on whether the network is deployed to a greenfield site, or whether there is an existing copper network. In some countries, we have seen multiple operators announce deployment of their own FTTH networks, whilst cable operators are responding to incumbent next generation access plans through network upgrades of their own. A brief summary of these technology choices by country shows the degree of variation:

- KPN intends to deploy FTTC on a national basis by 2009, whilst Deutsche Telekom is intending to deploy FTTC to the 50 largest German cities by 2008. Outside the EU, AT&T has deployed FTTC in some of its access network footprint areas as an overlay network.

- In Korea, the incumbent operator, KT is targeting 92% FTTH coverage by 2010, while the US carrier Verizon intends to pass 18m homes with its $23bn FiOS FTTH network, also by 2010.

- FTTH networks are being deployed by alternative carriers in Europe. In France, Iliad and Neuf Cegetel have recently announced fibre-to-the-premises (FTTP) deployments to 4 million and 1 million homes respectively. Iliad is budgeting €1bn for its point-to-point metropolitan area FTTH network.

- In Europe and the US, cable operators are trialling network upgrades to allow them to offer 100 Mbps contended services based on a range of developments around the DOCSIS standard.

- A number of projects to deploy fibre deeper into the access network are as a result of public private partnerships. In the Netherlands, there are a number of municipal deployments that are forecast to deliver fibre access networks to around 370,000 homes by end 2007[8]. One specific example is Citynet in Amsterdam, which is seeking to connect 40,000 homes with FTTH by mid-2008 in its first phase of deployment. Sweden has also witnessed a large number of municipal fibre deployments.

3.7 Deployment strategies may also vary between countries. Typically, it is believed that next generation access networks will be deployed to areas with high population density first, bringing very high bandwidths to these customers. Alternatively, since these customers may already have access to high quality current generation broadband services, operators may instead seek to use next generation access networks to increase the reach of the best of today broadband access services. These networks could be deployed to address the problem of areas with lower current generation access broadband speeds for example some suburban areas. For example, one deployment strategy may be for operators to continue to use ADSL2+ from the exchange for customers on shorter copper loops or directly connected to exchanges, use FTTC for customers on longer copper loops and deploy FTTH in new build developments.

3.8 There are a number of core rationales emerging that combine to make the case more appealing in those countries where next generation access is being deployed. While it is highly likely that there is no one single driver behind next generation access deployment in a country, it is worth considering some specific details:

- current generation access network owners may view the deployment of next generation access as an option to generate additional revenues, particularly through the deployment of IPTV services where there is a relatively underdeveloped multi-channel or pay TV market;

- intense competition from cable or LLU has been an important driver in markets such as the US, Belgium and the Netherlands. For example, incumbent cable operators in these counties are already trialling network upgrades to enable them to offer 100 Mbps+ contended bandwidth to end users;

- next generation access deployment decisions are also impacted by the cost of deployment, which may vary significantly between geographies. In France, the ability to access existing physical infrastructure, including Paris' sewers, has

[8] Source: Telecom Markets, July 2007

been important in encouraging fibre deployments. This may allow such developments to avoid up to 60 to 80% of deployment costs for next generation access[9]. In other countries, such as Japan, telecoms networks have a high proportion of their infrastructure installed overhead, making it much less expensive to upgrade than buried networks;

- in some circumstances, deployment of next generation access enables network operators to reduce their cost base by enabling the sale of exchange buildings, as KPN intends in the Netherlands. Next generation access may also lead to reduced operating costs. For example, experience from Verizon suggests that outside plant network problems have reduced by up to 80% for its FTTH FiOS service compared to its legacy voice and DSL services;.

- in some locations, poor copper quality or long local loops mean that exchange based DSL is subject to significant limitations on download and upload speeds. This has been a driver behind fibre deployments by US local loop incumbents, where DSL speeds were typically lower than those available in Europe; and

- central government intervention has played a key role in countries such as Japan and Korea, where fibre deployment has been outlined in national technology plans. In other countries, including Sweden and the Netherlands, local government has played a role in deploying municipally owned next generation access networks.

3.9 In practice, the reasons behind each country's deployments are often complex and may involve a combination of a number of different factors. Examples of how these factors may have combined in practice are shown in Figure 3. Nevertheless, it is useful to look at individual factors to understand why next generation access deployments may vary in timing, reach, cost and technology across countries and regions as this may provide some guide as to the potential for next generation access deployments in the UK.

Figure 3: Key drivers behind next generation access deployment

	IPTV	Competit-ion	Lower cost build	Cost savings	Lower quality copper	Public sector inter-vention
Belgium	✓	✓				
France	✓	✓	✓			
Germany	✓					
Japan			✓			✓
Netherlands		✓		✓		
South Korea			✓			✓
Sweden						✓
US	✓	✓		✓	✓	

Source*: Ofcom*

[9] Sources: JP Morgan, Idate, Analysys

There have been no wide scale announcements in the UK, but some interest

3.10 In contrast to the situation in other countries, there have, so far, been no announcements of wide scale next generation access deployments in the UK. However, the level of interest in and debate surrounding next generation access has increased markedly in the last year.

3.11 We have witnessed several announcements of limited commercial deployments and small-scale next generation access trials. In addition to these commercial activities, there has been interest in deploying next generation access from several UK regions, with one region in the early stages of deploying a network.

- BT Group has announced its intention to deploy FTTH based on passive optical network (PON) technologies to new build developments from 2008. This deployment is planned to commence in Ebbsfleet in Q3 2007, with commercial launch in Q2 2008. Openreach intends to deploy this technology to all new build developments where it connects customers from 2008.

- Digital Region is the first large scale next generation access public intervention in the UK, based in South Yorkshire. This scheme is using FTTC to offer 25Mbps+ to all households and business premises within South Yorkshire.

- Virgin Media is currently trialling services offering 20Mbps to 50Mbps in Ashford. It has recently doubled the bandwidth of its premium broadband product from 10 Mbps to 20 Mbps.

3.12 At the same time, further impetus has been added to the debate on UK next generation access by a number of recent reports on the subject, including those by the Broadband Stakeholder Group[10], and the Scottish Executive'[11]. These reports, along with the limited scale announcements and trials announced, are indicative that both industry and public bodies are interested in engaging in discussions about the potential benefits and challenges of next generation access in the UK, despite the current lack of announced deployment plans.

3.13 It is useful to consider the reasons why there may have been no wide scale announcements coming out of the UK. As we outlined above, there are several factors that may drive the deployment of next generation access in a market, including competitive pressures, the cost of deployment and public policy. With these factors in mind, reasons why the UK may witness later deployment could include:

- the high levels of digital and pay-TV take-up in the UK;

- relatively low reach of cable networks;

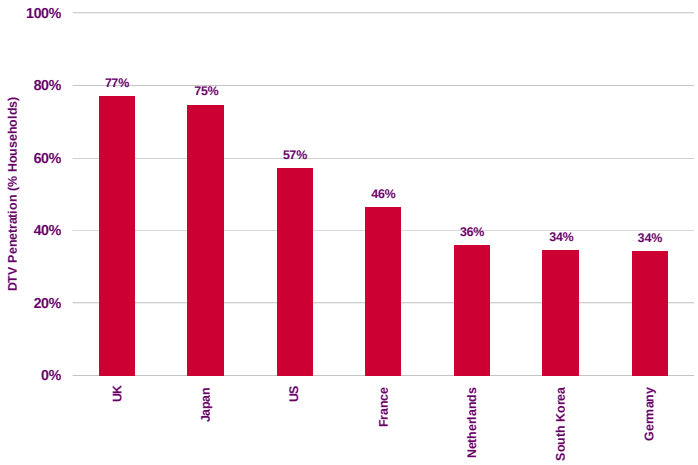
- higher cost of deployment of next generation access in the UK compared with some other countries; and

- the capabilities of existing copper access network infrastructure to deliver services.

[10] *Pipe Dreams? Prospects for next generation broadband deployment in the UK*, Broadband Stakeholder Group, April 2007
[11] *Next generation broadband in Scotland*, SQW Limited, commissioned by the Scottish Executive, January 2007

3.14 Figure 4 shows that the UK has one of the highest levels of digital TV penetration in the world, with services being provided over four platforms (digital terrestrial, both pay and free to air satellite, cable and ADSL broadband). The UK also has one of the most mature multi-channel pay TV markets, with a take-up of 45% of UK households[12]. The high level of digital TV take-up and maturity of the multi-channel TV market in the UK suggest that it may be more difficult for a next generation access based TV platform to gain scale in the UK than in some other counties, reducing the opportunity for new revenues from these services. That is not to say that IPTV services would not be offered on UK next generation access networks following deployment for a range of reasons beyond new revenue generation.

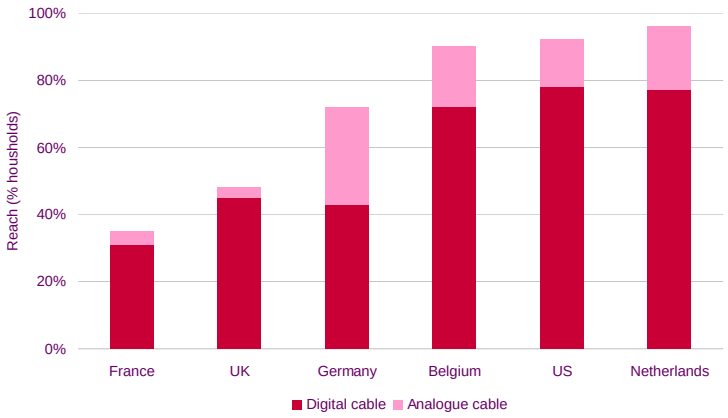
Figure 4: Digital TV penetration, 2006



Source: Screen Digest

3.15 Within the UK, cable has a more limited footprint compared to many other countries, with around 45% of households passed by digital cable networks. As a result, the competitive pressure faced by fixed communications network operators from cable networks is lower here than in some other countries. While the presence of cable infrastructure competition may increase the incentives for rival operators to deploy next generation access networks, this is likely to be less significant than in countries where cable poses a competitive threat on a national basis.

Figure 5: Reach of digital cable in selected counties



Source: Cable Europe / Screen Digest estimates

[12] Source: Ofcom Research

3.16 Competitive pressure does not only come from cable networks. In some markets, notably France, we have witnessed announcements of next generation access deployments from incumbent operators as a result of the competitive threat posed by developments by local loop unbundlers or other new entrants. However, in the UK there appears to be limited appetite for such investments by third parties so far.

3.17 The cost of network deployment is a major factor influencing any commercial case for next generation access investment. There are a number of factors that may result in lower build costs, including the proportion of customers living in multi-dwelling units, and the need to lay fibre in underground trenches. However, the UK has a relatively small proportion of people living in flats (less than 10% in England and Wales[13], in contrast to half of South Korean households). At the same time, UK planning laws mean that a relatively small portion of UK premises are served by overhead drop points, with the majority of lines being provided through underground access. Finally, there is a limited availability of existing municipal wayleaves that can be cheaply used to deploy next generation access networks. All of these factors mean UK next generation access deployments may be more expensive than those in some other countries.

3.18 The quality of copper and average local loop length in the UK means that up to 78% BT lines may be able to support headline download speeds in excess of 4Mbps[14]: enough for simultaneous web browsing and a single standard definition IPTV stream. The current capability of copper based DSL means that the copper access network is able to offer sufficient bandwidth to many customers for services that meet a wide range of customer needs for longer than might otherwise be the case. However, the increasing penetration of broadband and uptake of video rich content services over the Internet may start to test the limits of what copper based broadband access can deliver.

3.19 Given these UK specific factors, it appears that the business case for an earlier deployment of wide scale next generation access may be weaker than that in some other countries. This is not evidence of any particular form of market failure: rather, that the efficient timing for next generation access networks in the UK may be later than elsewhere.

Consumer demand for higher speed broadband in the UK is hard to judge

3.20 Because next generation access networks are only now being deployed in some countries, it is very difficult to judge what will be the level of consumer demand for the services they enable. Simply asking people their views is unlikely to offer much insight, because most find it impossible to accurately predict how useful a service they have never used or even seen will be. One way to tackle this problem is to develop an understanding of current usage trends and consumer attitudes towards broadband in the UK. This may provide some indication as to which next generation access applications may become important, and how these services may be used, marketed and priced. This will have implications for the commercial case for next generation access deployment.

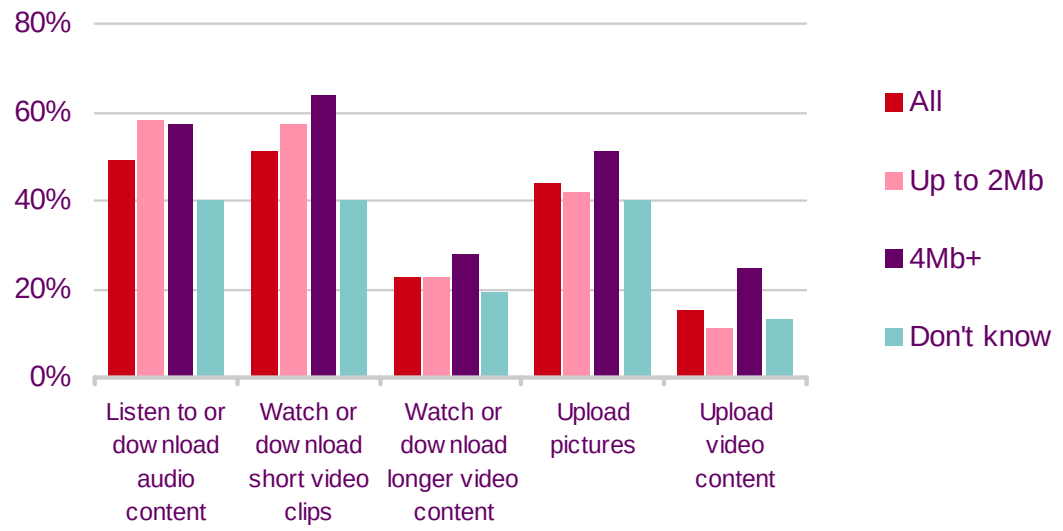
3.21 On the basis of current evidence, it is unclear that the majority of customers are yet demanding significantly higher bandwidths for broadband access. Ofcom's recent research[15] showed high levels of consumer satisfaction (86% of users) with the

[13] ONS, 2001
[14] Source: BT, 2 March 2006
[15] The Communications Market: Broadband - Digital Progress Report, Ofcom, April 2007

speed of UK broadband residential services. Separate research conducted by ICM for Ofcom in June 2006 showed that 77% of consumers thought that their broadband was uncapped; this may be because these customers were unaware of the any download cap simply because they had never reached their download limit.

3.22 This is supported by evidence on customers' usage of internet connections: the majority of users continue to make most use of lower bandwidth services, including email (88%) and general internet browsing (77%) as compared to short video downloads (50%) or online games (38%). Very high bandwidth consumption remains focussed on a relatively small number of customers in the UK – data from some ISPs suggests a significant skew in overall usage towards a small proportion of very heavy users[16].

Figure 6: Use of online content by claimed broadband speed



Source: Broadband Digital Progress Report, Ofcom (2007)

3.23 Barriers to usage of higher bandwidth services are, in general, related to factors other than access speeds. In recent research, Ofcom found that most broadband users mentioned lack of interest in online longer video downloads (37%), rather than any technical knowledge issues (7%) or speed limitations (6%) of current broadband services. Indeed, of consumers surveyed, 48% of broadband customers were not aware of their broadband connection speed[17].

3.24 There may be some reasons to suggest that the apparent satisfaction with current broadband speeds could change in the future. For example, recently the use of video based applications is rising with the proportion of consumers ever using video content services increasing from 44% in Q1 2006 to 50% two quarters later[18]. Usage is currently highest in the 16-24 age group, but interest may increase across age groups as more professionally produced content is available on-line. Many traditional broadcasters have launched video-on-demand propositions, for example 4oD, ITV.com, and iPlayer, which will sit along new Internet video services such as Joost,

[16] Source: Plusnet (The Communications Market: Broadband - Digital Progress Report, Figure 34)
[17] Source: Ofcom Research (The Communications Market: Broadband - Digital Progress Report, Figure 32)
[18] Ofcom's Digital Progress Report, Figure 18

Babelgum, hybrids such as BT Vision and video-sharing portals such as You Tube or Dailymotion.

3.25 However, there is significant uncertainty as to when and how bandwidth demands will increase to a point where next generation access is required to satisfy customer demand. The Broadband Stakeholders' Group (BSG) recently noted the difficulty in predicting the take-up of new technology and future bandwidth demands[19]. Even as demand does emerge for these video-rich services, the extent to which they require next generation access network connections will depend on:

- the extent to which the demand for higher quality video content is offset by improvements in compression techniques, rather than needing to addressed by faster access speeds; and

- whether, in the short to medium term, the most significant bottleneck or capacity constraint might have less to do with the access network and more with the backhaul network. As take-up and usage of high speed broadband service increases, the access speed may prove to be less of a limitation than backhaul contention (the capacity of the network between the exchange and core network, shared between all concurrent users). In such a case, network operators may focus on reducing contention or increasing backhaul capacity, rather than deploying next generation access in the short term. This issue has been raised by a number of broadband ISPs recently following the launch of the BBC's iPlayer service.

3.26 This raises a new challenge for consumer information, transparency and service quality. As broadband take-up and average bandwidth consumption increases, the customer experience of broadband services may actually reduce as a result of increased network traffic and contention in the network, specifically in the backhaul portion. This may even happen at the same time as increases in the headline 'up-to' speeds offered as a result of upgrades to current or next generation access technology. It is important that customers are aware of the impact of increased contention, and understand the reasons why products that are marketed on the basis of 'up-to' speeds may not actually deliver the quality of service expected. This consumer education is a challenge for industry as well Ofcom. In recent research, Ofcom found that 90% of broadband customers had not heard of the term 'contention', with only 61% of customers aware that broadband speeds were affected by the number of simultaneous users[20].

3.27 Our conclusions about the consumer demand for services enabled by next generation access are based on the currently available evidence, but as we have set out, this evidence is imperfect and furthermore, may change rapidly. For example, as we outline above, the UK is likely to see some next generation access deployments quite soon, albeit on a relatively small scale. We will need to monitor closely the usage patterns emerging from these networks, deployments internationally, and any changes to broadband usage on current generation networks, and update our demand conclusions accordingly.

[19] P.18, *Pipe Dreams? Prospects for next generation broadband deployment in the UK*, Broadband Stakeholder Group, April 2007
[20] Ofcom Communications Market Review, 2006

Ofcom should continue to monitor developments and ensure the correct conditions for efficient investment are in place

3.28 From this assessment of the UK's specific situation, it appears likely that the UK will witness later deployment of large scale next generation access networks than some other countries. This does not mean that the UK is inefficiently 'late' to deploy next generation access: many of the factors that have impacted the nature and timing of next generation access deployments internationally differ substantially in the UK.

3.29 Current generation access technologies have been adequate to meet the majority of current consumer demands in the UK so far, but this may be partly because judging the real demand for higher speed services is so difficult. Also, while it may be that a shortage of backhaul bandwidth will be an important factor alongside access speed in determining overall customer experience for services such as video, the balance between these factors is uncertain and may change rapidly. We are already witnessing issues arising from contention and a lack of clarity on the difference between advertised headline speeds and actual service speeds delivered to customers for an increasing number of customers. Further usage of high speed broadband applications and mass market adoption of video rich services are likely to compound this issue, resulting in a worsening consumer experience and increasing consumer frustration with broadband.

3.30 The solution to this issue will include further investment in network infrastructure, both in backhaul networks but also in access networks. Next generation access is therefore likely to become of increasing interest to customers as they witness further reductions in the user experience for current generation broadband services.

3.31 It is essential that we keep these issues under close review to ensure the UK's position does not become one of inefficiently 'late' next generation deployment with resulting detriment to consumers and businesses. We believe that, if deployed at the right time and in the right way, next generation access networks have the potential to be a very positive development for UK consumers. Monitoring the market conditions is not enough; we need to ensure the conditions are in place to ensure that, when it makes economic sense, the appropriate investment in next generation access occurs, without the need for direct intervention from Ofcom or any other body. The following sections of this document explore the regulatory challenges in ensuring the conditions for efficient investment and competition are in place and our proposed approach to addressing them.

Consultation questions

Question 1 When do you consider it would be timely and efficient for next generation access investment to take place in the UK?

Section 4

The regulatory challenges

4.1 The move to next generation access networks is one of the largest changes facing the UK communications sector and Ofcom, yet significant uncertainty remains around the timing and manner in which next generation access deployments will be made. For example, on one hand, these developments could eventually mean the complete replacement of copper access networks with new technologies, and upgrades to cable and wireless networks. On the other hand, it may result in a mixed solution of multiple technologies and standards in different locations, drawing on copper, cable, wireless and fibre technologies. However, despite the uncertainty surrounding next generation access, we can be sure that these developments will pose both significant challenges and opportunities for regulation.

4.2 In terms of challenges, the first is to ensure that investment in these new networks occurs in the first place and this about setting the right conditions for timely and efficient investment to be undertaken.

4.3 As next generation access deployments occur, they will represent a potential cross-road for competition and for competition regulation. These networks will be in place for a long time, and so their deployment offer us the chance to consider the forms of competition that may deliver most consumer benefit far into the future. Stakeholders across the value chain have a chance now to influence the competitive structure for wireline communications access services for potentially decades to come.

4.4 At the same time, we need to consider the most appropriate approach to migrating from today's regulatory regime to one that is designed for next generation access while continuing to protect consumers' and citizens interests.

4.5 In meeting these challenges and opportunities, we think it is important that Ofcom sets out the principles by which we would seek to regulate in the future. These principles will apply in circumstances where we find significant market power in the provision of services that may be delivered over next generation access networks. We consider that these principles will be relevant for all types of network deployment that could be undertaken by a range of different organisations, including: communications providers; utilities; building developers; community broadband projects; other new entrants; and the public sector.

Clear and transparent principles for regulating are required

4.6 In an environment of uncertainty, it is important that regulatory policy is clear and transparent in order for industry to make informed choices on the technology, timing and reach of next generation access investments. In defining our approach to regulation of next generation access we think we should adhere to two underlying principles:

- ensure that disproportionate regulatory policy does not inhibit efficient and timely investment; and
- ensure that the timing of regulatory decisions, or inaction, do not result in foreclosure of options for competition in the future.

4.7 At the same time, we must consider how the principles laid out within the Strategic Review of Telecoms may apply to next generation access deployments, and whether theses new networks should result in a change in these principles. These principles are to:

i) promote competition at the deepest levels of infrastructure where it will be effective and sustainable;

ii) focus regulation to deliver equality of access beyond those levels;

iii) as soon as competitive conditions allow, withdraw from regulation at other levels;

iv) promote a favourable climate for efficient and timely investment and stimulate innovation, in particular by ensuring a consistent and transparent regulatory approach;

v) accommodate varying regulatory solutions for different products and where appropriate, different geographies;

vi) create scope for market entry that could, over time, remove economic bottlenecks; and

vii) in the wider communications value chain, unless there are enduring bottlenecks, adopt light-touch economic regulation based on competition law and the promotion of interoperability.

4.8 As we outlined in our November 2006 discussion document, we continue to believe that these principles remain appropriate for next generation access network investments. However, their implementation into regulatory policy may vary given the characteristics of next generation access networks. The current regulatory policy for access networks adopted by Ofcom and other European regulators has been based on the existence of existing copper networks that constitute an enduring economic bottleneck and are characterised by high levels of sunk costs and high demand certainty. Access network owners have already recouped their initial investment in these networks during the period of state owned monopoly. In this environment, the correct approach to promoting competition was to mandate access on cost based terms.

4.9 Next generation access poses a new set of questions. While these new investments may also constitute an enduring economic bottleneck, there is significant risk involved in their deployment, including demand side uncertainty. In this environment, it may not be appropriate to simply roll-over our existing regulatory approach to these new networks.

4.10 As a result, there are four regulatory challenges for Ofcom arising from next generation access deployments:

- In advance of deployments, how do we ensure that there are the right conditions for timely and efficient investment in next generation access networks?

- Once next generation access investments have been made, how do we promote competition in the case where these networks are an enduring economic bottleneck?

- How should existing regulatory obligations and remedies evolve following next generation access deployments?

- Following next generation access investments, how should policy address any prospective issues with respect to social inclusion and the digital divide?

4.11 Below we outline the principles we feel are key in developing policy to address these challenges. Later in the document we set out in detail our proposed policy approaches to the first two challenges – securing efficient and timely investment and promoting competition following next generation access deployment.

Principles for securing timely and efficient investment

4.12 In meeting its principal duty, Ofcom is required to secure the availability throughout the UK of a wide range of electronic communications services. For next generation access, this means ensuring the conditions are right for timely and efficient investment in these new networks. We need to consider the factors that may drive decisions to deploy next generation access networks.

4.13 Competition is one of the single most effective drivers of investment in new technologies and services as outlined in a recent analysis based on a survey from ECTA: countries with the most competitive telecoms industries delivered the highest level of net investment[21]. For next generation access, this competition may come from existing market players, including LLU operators, cable or wireless network providers. In this context, cable is a key driver of new investment by incumbent telcos to upgrade to higher access speeds, as witnessed in the US and Netherlands.

4.14 However, the regulatory environment also has a role to play in securing efficient and timely investment. In light of this, we feel Ofcom should adhere to the following principles with respect to next generation access, based on our existing regulatory approach to current generation broadband services formulated as part of the Telecoms Strategic Review:

- **contestability** - allow competition to drive investment by ensuring that the opportunity to invest is contestable by as many parties as possible, once they see a viable business case;

- **reflecting risk in returns** - recognise that next generation access investments are inherently risky, and structure future access regulation to ensure that expected financial returns reflect the level of risk at the time of investment; and

- **regulatory certainty** - providing this certainty is fundamental to Ofcom's treatment of next generation access investments for potential investors to make informed decisions, and to provide them with confidence that this regulatory regime will be in place for some time to come, to reflect the long term nature of these investments.

4.15 At the same time, we consider it is important to maintain Ofcom's regulatory philosophy by keeping necessary regulation to a minimum, and avoiding intervention where this is not required.

4.16 It is worth highlighting that we feel these principles should be applied to ensure **efficient** and **timely** investment. This is a more complex issue for regulation to deal

[21] http://www.ectaportal.com/en/news_item382.html

with than sometimes indicated. Efficient and timely investment involves investment in the right technology at the right time and in the right location, rather than a simple black and white decision between investing and not investing. At the same time, investment decisions may also need to consider overlay versus new build networks. There is a large set of potential options for investments of differing cost and value to end customers in different locations; efficient and timely investment involves choices across the changing set of options over time that maximises expected total welfare. The complexity involved is one of the reasons why we believe these investment decisions are best left to the market rather than regulatory policy or public intervention.

4.17 Given this potential complexity, we explore the options for regulatory policy to secure efficient and timely investment in next generation access in detail in Section 5. We also explore a range of other regulatory options that could be employed to incentivise investment in next generation access, and consider their relative merits and risks.

Principles for promoting competition

4.18 The competitive environment that next generation access investments will be made in remains uncertain. It may be that multiple operators make separate investments in a range of different distribution technologies, resulting in consumers being able to choose between several competing next generation access networks or distribution networks that can substitute for next generation access for specific services, including satellite and fixed and mobile wireless networks.

4.19 In such an environment, competition between distribution platforms, where competing retail services are delivered over a range of different platforms may mean that there are fewer competitive concerns for next generation access, alleviating the need for regulation.

4.20 However, the risk remains that not all services would be able to be delivered across multiple platforms. In this situation, the costs of deploying competing wireline access networks suggests that a competitive market for the delivery of next generation access services may be unlikely, especially in less dense areas of the UK. At the same time, the substitutability of different distribution networks for next generation access networks remains uncertain until we understand better what applications and services consumers will use these new networks for. Given this potential outcome, we therefore need to consider how to ensure that consumers will still have a choice of competitive services, even if only one next generation access network is deployed in their area.

4.21 To this end, we consider that the principle laid out in the Strategic Review of Telecoms of promoting competition at the deepest level that is effective and sustainable continues to be applicable for next generation access networks. Specifically, three principles are of key importance:

- **contestability** – as with securing investment, we continue to consider contestability a key requirement in order to deliver a competitive environment, by allowing third party operators the flexibility to choose when to make investments independent of bottleneck asset owners;

- **maximising potential for innovation** – this continues to be appropriate, given the linkage between innovation and competition, which can then lead to substantial consumer benefits; and

- **equivalence** – this remains one of the fundamental starting points for the development of a healthy competitive environment in the presence of significant market power.

4.22 In order to secure competition, we need to assess what the correct level in the network is for the promotion of competition under next generation access. This 'level' can be expressed in two ways:

- the form of competition; and
- the physical location of competition.

4.23 Competition can take two forms: the competitors can build their services on wholesale products which give them direct access to the dominant operator's passive network assets, or they can rely on active line access wholesale products, such as bitstream. To date, we have promoted competition based on passive elements, for example unbundling copper local loops. The physical location of competition relates to where physically in the network competition may occur. For example, under the current policy of promoting competition through local loop unbundling this occurs at the local exchange. These two issues are explored in more detail in Section 6.

4.24 In assessing the most appropriate form and location of competition, there are a range of principles that we feel are appropriate:

- continue to promote competition at the deepest level in the network where competition is likely to be effective and sustainable, in order to maximise the scope for competing operators to innovate. In next generation access networks, this implies competition where possible based on access to passive inputs, or active inputs which offer the most scope for downstream innovation;
- recognise that multiple types of competition, based on passive and active inputs at different locations in the network, might need to exist alongside each other to reflect the different economics of next generation access in different geographic areas; and
- while the economics of next generation access and technology choices remain unclear, ensure that regulatory policy allows maximum scope for experimentation and innovation in future.

4.25 Today, we remain in a 'pre-investment' period, with uncertainty surrounding the commercial case for investment and with no large scale announcements of next generation access network deployments. In this climate, we feel it is appropriate to put in place a regulatory policy that allows experimentation and innovation in different types of competition, initially through trials, and later through commercial deployments. Therefore, our preferred policy approach to promoting competition is to keep a range of options open until there is greater clarity on the prospects for next generation access investment. Options to achieve this are explored in detail in Section 6.

Implications for existing regulation

4.26 It is important to recognise that the principles by which we will regulate next generation access will not operate in a vacuum. Existing regulation has evolved to address concerns about the market in light of current generation networks. We will need to manage carefully the transition from current to next generation access

regulation. Section 8 considers this issue in more detail, but in summary, the three main areas of challenge for existing regulation in light of next generation access will be:

- **market definitions and the Undertakings** – as the services which next generation access will deliver are uncertain, there is some uncertainty which, if any, existing market definitions will encompass them. In the specific case of BT, some of the products it offers, and the terms on which they are offered, are as a result of the Undertakings which BT gave to Ofcom[22]. These Undertakings are also applicable to next generation access;

- **migration from existing regulation** – some of the existing regulatory remedies may no longer be appropriate following the deployment of next generation access. This could have significant implications for competition, for example, in the case where a specific wholesale product on which a competitor has built their current business is withdrawn at some point in the future.

- **the impact of existing regulation on incentives for next generation access deployments** – it is important that the structure of existing regulation does not reduce an operator's incentives to invest in next generation access. Some concerns have been raised about the implications of functional separation as specified in BT's Undertakings. However, this remedy is designed to address the issue of significant market power through the delivery of equivalence. As a result, it removes the incentives for inefficient investment designed to foreclose competition, but should not adversely affect timely and efficient investment in next generation access.

Digital divide

4.27 Given the economics of wireline next generation access deployments, it is likely that the deployment of this infrastructure will be viable in some regions before others. Furthermore, there may never be a compelling business case for an operator to deploy in some areas of the UK; certain regions may remain unserved by next generation access networks. There is much concern and discussion over the 'digital divide' between those with and without access to current generation broadband services. With the introduction of next generation access, it is possible that the digital divide may in fact get wider. Customers in dense urban areas, who already benefit from the fastest current generation broadband speeds, may be the first to see further speed increases as a result of next generation access deployment, while rural customers may see no improvement in their current, limited connectivity. This raises a number of issues, in terms of:

- the net benefits that consumers and citizens will derive from the availability of higher bandwidth broadband services, and the impact of these not being available to people who are not served by the new networks; and

- the minimum level of service which consumers and citizens should have a right of access to.

4.28 Addressing the issue of a digital divide can be considered in two time frames – in advance of wide scale deployments, and once we have witnessed next generation access roll-out. For the former, the issue is how far policy makers should seek to anticipate any future digital divide and address it pre-emptively. While it may be

[22] http://www.ofcom.org.uk/consult/condocs/statement_tsr/

relatively easy to identify some regions which are very likely and some which are very unlikely, to be commercially viable, the majority of areas will lie between these extremes.

4.29 We remain concerned about attempting to identify the potential future boundaries of a digital divide before widespread deployment of next generation access given uncertainties on likely commercial reach. Pre-emptive intervention is risky and could conceivably lead to perverse results because we do not yet know when and where commercially led deployment will take place.

4.30 This is a very significant potential issue for next generation access, but a complex one in which the intuitive outcomes may not occur. We may see early commercial deployment in some rural areas, if operators choose to use the new technology to address the coverage limitations of current generation access. Given this complexity, we remain concerned about attempting to identify the potential future boundaries of a digital divide before widespread deployment of next generation access has taken place. Pre-emptive intervention risks wasting significant public funds and could lead to the distortion of incentives for commercial deployment and inefficient results. This issue was discussed further in a joint DTI/Ofcom best practice guide earlier this year[23].

4.31 Therefore, despite the clear importance of this issue for society and the economy, given the current status of next generation access in the UK, we consider that it may be premature to consider specific policies to address a future digital divide. However, we will continue to gather evidence from overseas deployments and the extent to which they give rise to geographic and other social inclusion issues, while at the same time remaining aware of the differences in the UK situation. We will also continue to consider the issue of a digital divide, both present and future, with regional development authorities and the governments of the UK, and how our proposed policies for next generation access will affect social inclusion.

Consultation questions

Question 2 Do you agree with the principles outlined for regulating next generation access?

[23] http://www.ofcom.org.uk/media/mofaq/telecoms/pbs/dti_pbs.pdf

Section 5

Securing investment in next generation access

5.1 We have explained the importance for the UK in witnessing efficient investment in next generation access. We have also described how our approach to regulating current generation access has resulted in very positive consumer outcomes. However, simply rolling forward this current regulation to next generation access might artificially delay investment, or lead to inefficient investment choices. This section considers how to ensure the regulatory climate allows timely and efficient investment, while at the same time, along with our approach to promoting competition explained in the following section, ensuring that the positive outcomes for consumers of current regulation endure.

5.2 To date, addressing significant market power in access networks has been achieved through mandated access for competitors at specific prices. These prices have been calculated by estimating the cost of the access assets, plus an allowable return for the asset owner. This approach is suitable to current generation access networks as they are legacy networks with low demand side risk and substantial sunk costs that have already generated a return on the initial investment.

5.3 This approach may be less appropriate for next generation access networks. So far, these networks are characterised by high uncertainty about consumer demand and willingness to pay, with limited clarity on the applications and services they will deliver. In this situation, investors in a free market would seek higher returns from their investment to compensate for the higher degree of risk. Applying traditional cost based approaches may not adequately reflect this higher risk profile, and therefore could disincentivise investment. As a result, deployment of next generation access could occur inefficiently late.

5.4 Ofcom therefore considers that, in advance of deployments, the right regulatory regime needs to be in place to ensure that the incentives for investment are not distorted by regulation such that next generation access network deployments are not made, or made inefficiently late. As discussed, the timing of investments is not the only consideration - the regulatory environment should also seek, as far as possible, to encourage an efficient technology selection and reach for next generation access networks. The principles which we believe will ensure desirable investment occurs are:

- contestability;
- reflecting risk in investment returns; and
- regulatory certainty.

5.5 The remainder of this section considers these principles in more detail and discusses our resulting views on some of the regulatory approaches that could be adopted to promote timely and efficient investment.

Contestability and competition can incentivise investment

5.6 As discussed in Section 2, one of the main drivers of next generation access investment is competition. The incentives and ability for communications providers to invest in next generation access differ between different operators, depending on their specific circumstances. Competition in next generation access may come from a number of sources, including: cable, wireless and local loop unbundlers. Of these, some players, like cable or wireless operators, have greater freedom on the choice of when to invest in next generation access given ownership of their own network or resources. Others however are more constrained - local loop unbundlers may be largely dependent on the timing of investment in next generation access by copper access network owners before they can launch their own next generation access services.

5.7 Ensuring an environment in which investment in next generation access is contestable – where other organisations have the chance to make this investment when they are ready – is therefore important. It reduces the dependency on a significant market power network operator, and their potential ability to block efficient investment by other parties. It may also incentivise them to invest themselves when the time is right, as a result of the risk of a competitor doing the same.

5.8 Making investments in next generation access contestable delivers two types of benefits:

- it ensures competitors have the freedom and ability to invest in next generation access in advance of operators with significant market power in current generation access networks and services. The possibility of a competitor making next generation access investments may ensure a significant market power operator is incentivised to deploy its own network in a timely manner in response to emerging consumer demand; and

- ensuring that competitors are not precluded from making investments in next generation access after operators with significant market power have deployed their own infrastructure. This will result in an environment that allows greater competition where the economics support more than one infrastructure deployment. At the same time, it may further incentivise operators that have made next generation access investments to develop high quality active wholesale products to sell to third parties. If competitors have a viable alternative to purchasing wholesale access services (i.e. their own investment in next generation access), wholesalers are more likely to develop an active wholesale access product that is of a high quality and meets wholesale customers' needs.

5.9 There is a wide range of options available that could be used to ensure contestability. In part, these vary depending on the technology deployed and the type of deployment. For example, an overlay FTTC network is likely to offer different options for contestability as compared to FTTH deployments to new build premises. Options include:

- mandating or influencing the next generation access network design or technology selection of a communications provider with significant market power, in order to aid competitive investment. We are generally uncomfortable with such direct intervention, given the risk that the regulator is not best placed to make technology choices;

- adopting a regulatory policy that directly favours competitive investment in active infrastructure as close as possible to the customer (for example electronics at the cabinet, also called sub-loop unbundling). We explore this issue further in the next section;

- adopting a policy that directly favours competitive investment in passive infrastructure as close as possible to the customer (for example duct sharing which requires competitors to install their own cables as well as electronics). While this may offer greater contestability than the previous approach, it requires greater investment by prospective competitors and has more practical difficulties to overcome. Again, this is explored further in the next section;

- mandate access to a specific product or service on equivalent terms to a significant market power operators' access. This would seek to ensure that, where possible, competitive operators can get access to the same passive or active inputs as an operator with significant market power on similar terms to provide retail services; and

- encouraging or facilitating the deployment of alternative next generation access infrastructures or technologies. This could include cable or wireless services. With regard to cable, actions by Ofcom which might directly influence the further deployment of cable infrastructure are likely to very interventionist. For wireless based services, Ofcom could seek to package spectrum in a way specifically designed to ensure competitive wireless next generation access services to become feasible. However, this is inconsistent with Ofcom's principles for market led spectrum allocation. At the same time, a consensus opinion seems to be emerging that suggests fixed wireless services are likely to provide limited substitutability for wired next generation access.

5.10 However, there is also a risk that regulatory policy focussed on contestability actually results in inefficient investments by some operators that seek to foreclose the risk of new competition. Such inefficiency may take the form of selecting a specific technology that precludes the risk of competition through contestable investments. One such risk could arise from a regulatory approach that sought to promote contestability in next generation access through sub-loop unbundling. For example, there may be circumstances where, given the risk of competition to a significant market power operator from competitors investing in sub-loop unbundling, it may respond by inefficiently choosing to invest in FTTH technologies that may be more difficult to unbundle, and therefore reducing contestability. We need to remain alive to the risk of any such anti-competitive behaviour.

5.11 In conclusion, we consider that contestability in next generation access, both in advance and following deployment by significant market power operators, is vital both in securing timely and efficient investment and in delivering a well functioning, competitive market place that meets end customers' needs.

Regulation that mandates access should reflect risk

5.12 While contestability and competition can incentivise investment, we must also bear in mind that the risk of ex ante regulation and mandated access can work against this by reducing incentives for efficient investment.

5.13 In those circumstances where significant market power is found, regulation generally mandates third party access to certain elements of a network, and the regulator sets the price of this access. As we explain above, the high degree of demand

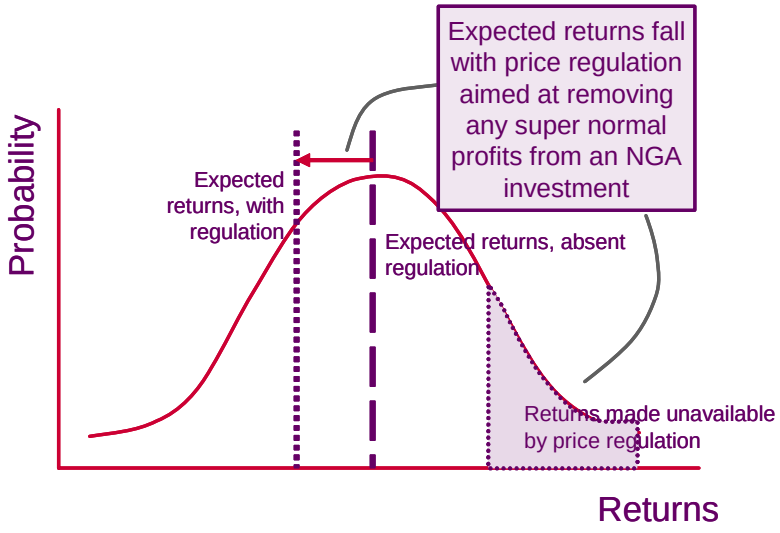
uncertainty, coupled with the risk of mandated access to next generation access networks at a specific price may reduce operators' incentives to invest.

5.14 The imposition of regulatory remedies that mandate access at a specific price may result in asymmetric risk borne by investors and a change to the prospective returns available for an investing firm. When a firm makes an investment in a situation when demand may be highly uncertain, the firm's actual achieved returns may vary significantly depending on whether demand for the services in question turn out to be high or low. Absent regulation, a firm would invest and bear the full risks of favourable or unfavourable demand outcomes, resulting in expectations of a specific return.

5.15 If the demand outcome was favourable then it may make significant returns and if it was unfavourable it may make significant losses. Given the range of possibilities on each favourable and unfavourable outcome, the firm would make its investment decision where the expected returns exceeded its cost of capital.

5.16 However a straight-forward application of the standard cost plus pricing approach may result in lower incentives to invest. This approach would cap the total returns that the firm could make if demand turned out to be high but force the firm to bear all of the losses in the event that there was virtually no demand, as displayed in Figure 7.

Figure 7: Risk of regulation may skew expected investment returns



Source: *Ofcom*

5.17 We therefore consider it is appropriate for regulation to take into account its potential effects on investment incentives. This can be achieved by incorporating or allowing for some degree of systematic risk in regulated access terms.

5.18 However, any attempt to reflect risks within regulated access terms raises a number of potential drawbacks. These include:

- Ofcom applies the wrong risk factor to investments. This is an issue as the estimation of risk is complex, and requires a very high degree of information that may not be available to the regulator at the time it forms its policy. In addition, the risk profile of investments changes over time, with later tranches of investment

potentially being lower risk than initial investments. Therefore, any estimation of risk needs to vary over time;

- indicating to an investor that we would allow a potentially greater return on new investments compared to investment in current access networks may provide inefficient incentives for investment and migration to next generation access networks; and

- Ofcom's ability to commit to setting access terms that adequately reflect risk at the time of investment. For any approach to be credible, prospective owners of next generation access networks need to be confident that access terms will be set that reflect the risk incurred at the point of investment for much of the life of the asset. Under the European Framework, however, it is difficult to make such contingent commitments over a long period of time. This is in part because the findings of one market review cannot bind the findings of a subsequent one.

5.19 Approaches to address risk in next generation access network investments do not reside solely with the regulator. Commercial organisations also have a range of options available to them to de-risk some elements of these investments. They include:

- *incremental investments* can reduce companies' exposure to risk, with the potential for making limited investments in specific areas to test the business case and consumer demand. This exposes consumers' willingness to pay for new services, reducing the demand uncertainty;

- *cost* reduction - the presence of cost savings to underpin an investment case in next generation access will reduce the significance of demand uncertainty. However, significant uncertainty remains on the prospects for total lifetime cost savings in next generation access compared to copper access networks. The availability of cost savings to communications providers will in part depend on individual circumstances.

- *long term contracts* – these provide a means for sharing risks across a number of parties and providing a degree of certainty for the asset owner. Such contracts have arisen in relation to undersea fibre optic cable, satellite capacity and in other sectors, including the gas industry. However, their emergence may be challenged if downstream customers believe they can secure a greater degree of flexibility from access based on short term regulatory 'contracts';

- *demand aggregation* - this was an approach employed at the retail level in current generation broadband, where BT committed to upgrade exchanges to ADSL once there was evidence of sufficient demand to make this investment pay. In next generation access, demand could be aggregated from a number of sources, including wholesalers, public sector or consumers. An investor in next generation access could set a trigger point at which, with evidence of demand for services, it would undertake the investment; and

- *co-operative deployments* - this approach is similar in some ways to the proposals being made in Australia by the G9 group of telecoms operators and being explored in Sweden. Such a deployment shares risk across all investors in a network, while at the same time reducing the risk of discriminatory behaviour between the downstream divisions of the various investors.

5.20 However, it is unlikely that operators will be able to fully diversify away all risk relating to next generation access deployments, or that the approaches above will reduce the risk that regulation will result in asymmetries in expected returns. Therefore, it may still be necessary to reflect risk in mandated access terms.

There are a number of regulatory approaches to reflecting risk in access terms

5.21 As discussed in our November document, the standard approach to price setting for upstream bottleneck assets has been based on the cost of investment, with no account taken of project specific risks beyond those systematic risks faced by the business as a whole. Today's access networks face very low demand side uncertainty. Alternatives to this traditional approach attempt to balance the investment decisions and incentives of commercial entities while retaining some form of access regulation for new access investments in the face of substantial demand side risk.

5.22 The aim of any approach that reflects the degree of risk incurred at the time of investment is to ensure the environment is right for efficient and timely investment. As we outlined earlier, efficient investment refers to the timing, location and technology choice of investors. Investors need to know how they might be regulated, in cases where they are regulated, in order to assess their prospects for making a return on risky new investment.

5.23 We are considering a number of characteristics from the pricing mechanisms adopted to define access terms to next generation access networks. Specifically, the approach should seek to: allow flexibility for access owners to price services according to demand; minimise the risk of anticompetitive behaviour, for example margin squeeze; be clear and transparent; and be operationally efficient. The approach should also be credible and practically implementable by Ofcom in the face of information constraints and uncertainties.

5.24 We consider that it is important to allow a degree of flexibility for investors to price access. The reason for this is that the total value derived from next generation access networks is the sum of different valuations by different end users – some will value next generation access services highly while others may value it only marginally more than services delivered over existing access networks. The objective of providing this degree of flexibility is to:

- provide investors with flexibility to price differentiate across consumers or service levels to capture sufficient surplus to ensure that the efficient investment option is viable;
- allow variable pricing in different locations and in different circumstances to incentivise efficient and timely investment;
- allow investors the opportunity to experiment with different pricing propositions and to change strategy as the demand for next generation access services becomes clearer; and
- minimise risk that the regulator gets the pricing wrong – the market is better informed than the regulator.

5.25 However, providing access network owners with pricing flexibility may result in some risks. One potential downside of such flexibility is that asset owners will be able to extract more of the consumer surplus from next generation access products in the

form of informational rents. This is a trade-off to counter the risk investors are incurring in making these investments: the question for us is how much of this rent an asset owner should be able to capture. Should an operator be able to earn monopoly rents in return for undertaking the risky investment?

5.26 We outline three main approaches here, and consider the risks and benefits of each. It is assumed that all of them are implemented on the basis of equivalence. The three main options available are:

- a mandated upstream price that is based on a project-specific cost of capital that includes estimates of risk;
- upstream prices set by the asset owner; and
- anchor product pricing, with pricing freedom for non-anchor products but equivalence of input on all products.

5.27 Defining a mandated price with a project specific cost of capital is similar to some of the options outlined in Ofcom's August 2006 cost of capital consultations and statement[24], and is a form of traditional cost plus approach where wholesale charges are set by the regulator. Detailed benefits and risks of such an approach were outlined in these consultations and statement. In this case a project-specific cost of capital may be used to reflect the higher systematic risk (i.e. risks which cannot be diversified away) for the particular project or activity that is being undertaken. The approach is demanding in terms of regulatory information since costs must be modelled and demand estimated in setting the price control, as well as estimating the degree of systematic risk incurred by the investing company at every stage of its investment. This makes it difficult to implement.

5.28 An alternative option is to allow the owner of access infrastructure to set access terms, so long as these were non-discriminatory and provided on an equivalent basis to all third parties, including its own downstream divisions. This approach has the benefit that the regulator does not need to assess the degree of risk incurred in investment in next generation access. There remains a risk with this approach that the bottleneck asset owner would attempt to distort competition by trying to extract monopoly rents from its upstream division and margin squeeze all competitors. It may be incentivised to do this either to maximise its upstream profitability or to foreclose competition downstream. However, its incentives to do so may be relatively weak given that the organisation's goal may be to promote take-up of next generation access services and rapidly increase traffic on the network.

5.29 Anchor product regulation is an alternative to the two general approaches described above. Annex 7 provides more specific information on the new potential pricing approach of anchor product regulation. This approach would involve offering one or more products on the next generation access network that replicate existing offerings to end users in terms of price and service for a period of time. This would be particularly important where existing services are no longer available e.g. where there is no parallel copper network. The price of these anchor products would be defined by Ofcom. The approach has the following characteristics:

- regulated wholesale anchor products are specified such that end users are expected to face the same price and service that was available over copper, for those services that remain dependent on the new bottleneck;

[24] http://www.ofcom.org.uk/consult/condocs/cost_capital2/

- prices are not cost based since those prices that are controlled are set on the basis of prices on the previous platform (with a different cost structure);

- outside of these regulated anchor products, prices for higher performance or new service offerings would not be subject to price control. However, the asset owner would be required to provide them on the basis of equivalence. In effect, only a few prices in the value chain are fixed by regulation. Prices of other products would be set by the access network owner in negotiation with its customers, including its own downstream divisions.

5.30 In addition to these three discrete options, there are a range of combinations that draw on the approaches listed above. For example, anchor product pricing plus an overall return or price cap. We have not focussed on these specific combinations in our assessment. However, we will explore anchor product regulation in more detail because it is an innovative approach which appears to offer some desirable features.

Any approach based on anchor products requires careful definition

5.31 In defining any regulatory approach based on anchor product regulation, there are a range of specific requirements and potential drawbacks that would need to be considered. These are detailed in Annex 7 to this consultation.

5.32 The form that any approach to anchor product pricing takes will depend on the underlying principles and aims for this approach. There can be a number of objectives that Ofcom could be seeking to achieve with anchor product regulation. These include ensuring that:

- no customers are made worse off today as a result of the introduction of next generation access networks;

- no customers are made worse off in the future, relative to the position they would have found themselves in with respect to current generation access networks, as a result of next generation access investment; or

- absent competition, there is an effective constraint on the pricing of next generation access services by an operator with significant market power.

5.33 Each of these objectives may result in a different application of anchor product regulation – the first suggests that there is no need for anything more than a static anchor product that does not evolve over time. The second objective would require a greater degree of flexibility in the anchor to take account of future developments in next generation access network products. And the final objective would suggest that a, possibly rapidly, moving anchor product that always acted as a relatively close substitute to the prevailing next generation access services was the most appropriate approach. The overall aim of price regulation is therefore of key importance to the form that anchor product regulation may take in the future.

5.34 In summary, any approach to pricing mandated access that leaves price setting to the asset owner offers the potential for promoting efficient and timely investment by leaving the risk and reward related to the capabilities of next generation access with the investor. The investor has significantly better information than the regulator, and with flexibility, may be able to learn about customer preferences and therefore determine the optimal investment.

5.35 However this approach does have requirements that need to be considered in defining it. These are:

- ensuring flexibility in wholesale prices is key to making the approach work;
- co-existence of with other remedies and pricing approaches – it is important that anchor product regulation, which may apply more to some regulated products, is not inconsistent with the pricing approaches adopted in other regulatory remedies;
- initial definition of the anchor products – defining the initial anchor product is key. If the anchor is over-specified, it may reduce options to upsell higher quality services to customers. Equally, if it is under-specified it may no longer provide an effective price constraint on non-anchor products;
- evolution of the anchor product over time – as customers' demand for higher bandwidth services evolve, it may be necessary for the anchor product specification to increase over time to ensure it remains a viable substitute to non-anchor products; and
- conditions and triggers for migration away from anchor product regulation - eventually, once any risk incurred in next generation access deployments has been paid back, it may be appropriate to transition to a more traditional approach to regulation.

5.36 Anchor product regulation has advantages over the more simplistic approach of allowing access owners to set upstream prices completely independently of the regulator, including:

- providing the option for continuity in service pricing and quality for end users during any transition from current to next generation access networks.
- providing discipline on potential abuse of market power via a chain of substitution at the retail level between the anchor product, which is price regulated, and non-anchor products, which are not;
- with retail minus and anchor product approaches, which involve greater pricing flexibility at the access level, there may be greater scope for margin squeeze compared to cost based forms of regulation. However, if a vertically integrated next generation access investor is allowed to take profit from the upstream wholesale products then it has much weaker incentives to discriminate against rivals in the downstream markets. This, combined with the recognition that communications providers might help increase overall demand for next generation access could both act to diminish incentives to discriminate; and
- an approach based on anchor products requires less information on the part of regulator than some other approaches, at a time when information asymmetries may be large.

5.37 While anchor product regulation does have some notable benefits compared to other approaches, any emerging regulatory approach to pricing may be expected to also face some challenges. The most notable of these for anchor product regulation include:

- the need for co-operation amongst stakeholders in the negotiation and agreement of access terms. In the event of any complaints being raised on access terms, prohibition of margin squeeze would be covered by competition law, and could result in ex post price regulation as a result of complaints as opposed to ex ante price regulation of services. If this is a likely outcome, it may be more suitable to determine prices ex ante in order to provide clarity on the terms of access and to ensure that, before the conclusion of any margin squeeze assessment, no parties can gain a competitive advantage in terms of market share.

- the approach is based on the ability to differentiate services to end customers. This requires differentiation at the wholesale level as well. Therefore, as an approach, it is only applicable to those access services that support differentiation.

We are interested in hearing other views on anchor product regulation

5.38 Anchor product regulation is a new and innovative approach, which, on the basis on our current analysis, appears to offer a number of advantages worthy of further investigation. However, we are aware of the practical issues that this approach would have, and that it has not been implemented in the form proposed here anywhere. Significant uncertainty remains on its appropriateness as a mechanism to price regulated access terms for risky investments, and it may require significant development.

5.39 If we are to pursue this approach further, defining an anchor product and the regulatory environment in which it would operate would require input from stakeholders across the communications value chain, including network operators, service providers, content and application providers and consumer and business groups. We are therefore keen to gather stakeholders' opinions on the degree to which this is a suitable approach for price setting for certain next generation access services.

5.40 Once this input has been received, an assessment of the relative merits of all the approaches outlined to reflecting risk in regulated access terms will be necessary before Ofcom could indicate its preferred approach in this area.

Regulatory certainty

5.41 Next generation access networks will be with us for many years following their deployment. They therefore represent a long term investment. It is unlikely that operators will be able to justify their deployment when considering returns over two or three years; a much longer term view of the future costs and revenues will need to be considered. To allow analysis to take place, it is important that a potential investor has as much certainty about the future of the market as possible. In general, as we have discussed, there is much uncertainty in next generation access, particularly in terms of future demand and willingness to pay.

5.42 Whilst many of the areas of uncertainty facing an investor in next generation access are inherent, one area where Ofcom can contribute certainty is with its regulatory policies. An important factor for investment is understanding the likely regulatory climate and how this will develop over time.

5.43 The proposed approaches that we set out in this document have been formulated with this in mind. As well as considering the issues of transition, where possible, we

have focussed on regulatory remedies that are likely to be relevant for the medium to long term and are therefore less likely to need major modification in the future. One example is in our requirements for an active wholesale access product. The product that we propose is intended to be as 'raw' as possible, minimising the technology choices that need to be made before it can be made available to the market. This should maximise its flexibility and continuing relevance as an input for competitors into the future.

5.44 As well as affecting potential investors directly, the inherent uncertainty around next generation access means there are areas of future regulatory policy where we can be less specific and offer less long term certainty than investors might like. We need to retain sufficient flexibility in our approach to address currently unforeseen market situations as they occur. However, we have set out the various guiding principles which we will use to determine specific policies in such cases. This gives all stakeholders the greatest possible ability to predict how regulation will develop in light of changing market conditions.

While suitable in some countries, forbearance is not appropriate for the UK

5.45 Forbearance is the explicit removal of any regulatory requirement for owners of next generation access networks to provide access to third parties. This approach is most likely to be appropriate in markets where there is the prospect of widespread effective end-to-end infrastructure competition in next generation access services. It can take two forms:

- permanent forbearance, where regulators state that they have no intention of requiring access at any point in the future. This has been the approach adopted in the USA; and

- time-limited forbearance, where the regulator indicates that it will avoid regulating specific services for a pre-defined period of time. This is the approach at the heart of the debate on emerging markets.

5.46 Forbearance does offer some benefits, specifically for risky investments where there is a high degree of demand uncertainty. For example, the absence of any regulation reduces the risk that investment decisions are inefficiently distorted though the imposition of price controls.

5.47 However, there remain a number of specific policy risks and drawbacks arising from a policy of forbearance where there are limited prospects for market entry and end to end competition in next generation access networks:

- forbearance without suitable levels of end to end competition may result in next generation access owners acquiring significant market power, increasing their ability to price at monopoly levels, at the expense of competition and consumer benefit;

- in order to avoid existing regulation, owners of current access networks may be incentivised to invest inefficiently rapidly in new technologies that are not regulated;

- forbearance from regulating a specific technology could result in incentives for communications providers to inefficiently select specific technologies to avoid regulation;

- allowing a position of market power to emerge upstream as a result of a policy of forbearance risks a rapid decline in competition at other points in the telecoms value chain. This risk has been highlighted recently in the US debate on network neutrality and telecoms operators' role as 'gatekeepers' to end customers. Within the UK, competition in delivery of broadband services has resulted in significant benefits to end customers; and

- time limited forbearance may actually increase uncertainty for operators. These investments have very long payback periods, but the period for time-limited forbearance would be likely to be for a much shorter period. Uncertainty about the impact of regulation on revenue streams in later years after the forbearance period may impact a business case much more than uncertainty in the early years.

5.48 Ofcom also notes that certain legal issues can arise with respect to regulatory holidays or forbearance. [25]

5.49 At this time the prospects for wide scale, effective and sustainable end-to-end competition in next generation access networks in the UK appear relatively low. In this situation, and for the reasons above, we continue to believe that equivalence, rather than forbearance, is the correct basis for regulating enduring economic bottlenecks. This applies equally to new investments as it does to legacy networks.

Consultation questions

Question 3 How should Ofcom reflect risk in regulated access terms?

[25] http://www.europa.eu/rapid/pressReleasesAction.do?reference=IP/07/237&format=HTML&aged=1&language=EN&guiLanguage=en

Section 6

Promoting competition in next generation access

6.1 The previous section described our proposed approaches to securing efficient and timely investment in next generation access networks. One of the key elements of this was contestability: ensuring there is competition for the initial investment to deploy next generation access. In ensuring the best citizen and consumer outcomes from next generation access, it is important that there continues to be strong competition even after initial investment has taken place. Effective competition has been a key component in the success of current generation broadband services and we expect this to continue with the next generation.

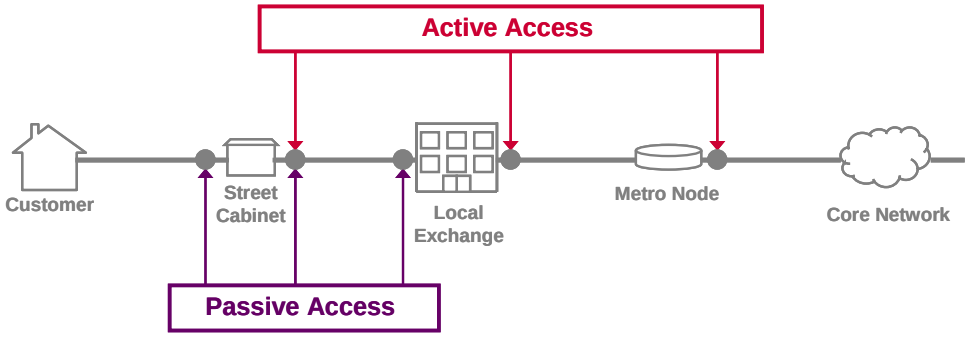
6.2 As we have explained previously, the scope for multiple investments in duplicate competing next generation access networks in a given region may be limited due to the economics involved. The possibility that next generation access will be comprised of a small number of networks, or perhaps only one, makes the promotion of competition more complex. In determining our approach to this problem, it is important that we consider how we should implement our five principles for regulating next generation access:

- contestability;
- maximise potential for innovation;
- equivalence;
- reflecting risk in investment returns; and
- regulatory certainty.

6.3 This section sets out our preferred approach to promoting competition in the event that there are enduring economic bottlenecks in the provision of next generation access services. In such circumstances, it may be necessary for Ofcom to consider remedies to prospective market power by ensuring competitors have appropriate access to these bottlenecks. There are many options for how and where this access can occur, as shown in Figure 8. It is helpful to consider two dimensions which together define the exact nature of the competition:

- the form of competition – whether the competitors use passive or active input products based on the bottleneck assets; and
- the physical location of competition – where the competitors gain access to the input products.

Figure 8: Range of options for the form and location of competition



Source: *Ofcom*

6.4 Passive access refers to wholesale products based on direct access to physical elements of the access network, but does not include any form of electronics. Examples include access to ducts, unbundled copper loops or dark fibre. These assets continue to be owned by the access network owner, but are rented by competitors. Active access refers to wholesale input products that are based on both the active electronics and the physical elements of the access owner's network. Examples include today's IPStream product offered by BT, which uses both BT's copper local loop and its electronics (DSLAMs) to provide a wholesale broadband service to competitors.

Options to promote competition will be specific to technologies deployed

6.5 Before considering the options for the form and location of competition in more detail, it is useful to identify the most likely technical options for the deployment of next generation access that may result in some form of market power. This is important because the options to promote competition are likely to vary depending on the technology deployed.

6.6 Market power can arise as a result of access networks tending to be enduring economic bottlenecks. This could apply equally to deployments of new infrastructure deployment by either an existing incumbent operator or a new entrant. Greater barriers to contestability may arise for wireline next generation access infrastructure deployments by an incumbent telecoms operator, as opposed to wired or wireless deployments by new entrants, due in part to the advantages of incumbency through the re-use of existing wireline bottleneck asset infrastructure by operators with end-to-end wireline networks today.

6.7 We believe two of the most likely network architectures to be deployed by owners of current generation access networks are Fibre to the Cabinet (FTTC) and Fibre to the Home (FTTH). FTTH is also likely to form the basis of any next generation network built by new entrant operators (as we have seen, for example, with Illiad in France or Fastweb in Italy), which may also result in an enduring economic bottleneck following network deployment.

6.8 It is important to understand the main features of these two technologies, because the differences between them dictate the precise forms of competition that are applicable to each, and hence will offset the options that will be considered in the rest of this section. They are described in more detail in Section 2.

- **FTTC** – in this architecture, optical fibre is used at all points from the core network out to the street cabinet. The cabinet itself then houses electronics that

can deliver high data rates over the copper wires (sub-loops) that form the final link out to the customer's premise. These electronics are currently expected to be VDSL DSLAMs.

- **FTTH** – in this architecture, copper is eliminated, with fibre running all the way from the core to the end customer. There are several technology options for the section between the exchange and customer, but the most likely is a passive optical network (PON). Unlike FTTC, in the case of a PON, the street cabinet in this case would not contain any electronics. Instead, passive optical "splitters" are used to combine the signals on the individual fibres from each customer onto a much smaller number of fibres which are connected back to the exchange. These splitters may be placed at the street cabinet, or at an alternative location, closer to the customer.

6.9 It is also important to note that, in order to offer alternative services, a competitor needs both an access network to the customer and a backhaul connection to carry traffic to their own core network. The economics of deploying infrastructure for backhaul are similar in some ways to those of the access network. As a result, there is a risk that this will also constitute an enduring economic bottleneck. There is no fixed boundary between the access and backhaul portions. Generally speaking, as the point at which the competitor connects moves further from the customer (to the right in the above diagram) the more backhaul components will be included in the input product they buy from the access network owner. As the amount of backhaul that is included increases, so does the amount of traffic aggregation that takes place.

6.10 Traffic aggregation is concerned with how the traffic from all the competitor's customers is combined onto one interface. Flexible aggregation allows the various quality parameters associated which each customer's traffic and the services they use, to be altered individually. This flexibility is important if the competitor is going to retain the scope to innovate and differentiate the products they offer – it allows them to offer specific services to individual customers. It can be maximised either by the competitor providing as much of their own backhaul as possible (by taking access products towards the left of the diagram), or in the case that they rely on the access infrastructure owner for backhaul, by ensuring that backhaul products offered are sufficiently flexible.

6.11 In addition, effective and sustainable competition will only be achievable if access remedies put in place are supported by effective processes and systems, for example in order processing, fault management, maintenance and product enhancement. As we have seen in today's broadband networks, effective and efficient processes are fundamental to the success of access remedies.

Form of competition: a balance between passive and active inputs

6.12 For the purposes of simplification, the different forms of competition can be divided into two broad categories:

- those which rely on the access network owner providing the competitive operator with direct access to its **passive** network assets, such as optical fibres, copper lines or ducts; and

- those relying on access to **active** network assets, such as DSLAMs or Optical Line Terminals (OLT).

6.13 In the case of active access, the interface between the operators is likely to transfer a simple digital signal (commonly known as a “bitstream”) in all cases. The signals from different numbers of end customers will be combined, or aggregated, onto the interface, depending on the location at which the competitive access occurs.

6.14 Passive access is more complex; it can offer the choice of several different interfaces at any given location, for example duct access or fibre unbundling. These choices may also vary depending on the location at which the interface occurs. However all forms of passive access share a common advantage – the ability for the competitive provider to choose and deploy their own active assets rather than relying on those of the access network owner.

Benefits of competition based on passive versus active inputs

6.15 In the past, in both core and access networks, we have promoted competition based on passive assets wherever it was economically feasible. It is on this basis that we chose to support competition on copper access networks of operators with significant market power, through a combination of local loop unbundling (a passive line access product) and wholesale bitstream access (an active line access product). Initially, we expected local loop unbundling, the preferred, passive, form to be viable for around 50% of the population, with competition in the remainder of the country being delivered through active line access products e.g. IPStream. In practice, some local loop unbundling operators have chosen to cover up to 70% of the population with their services.

6.16 While the network deployment of local loop unbundling (LLU) has exceeded our expectations, the main reason for the coverage limitations of passive asset based competition is its costs, which increase as customer density decreases. As deployment progresses out from dense urban areas, there comes a point beyond which it is no longer viable to use passive inputs, and offering services based on active inputs may become more efficient. One reason for this is the amount of equipment that needs to be installed by the competitive operator to make use of the passive inputs is higher than for active inputs.

6.17 Another issue is that the majority of options for competition based on the passive inputs suffer from the same general drawback that they require relatively costly and time consuming ongoing manual interventions in order to make them work (for example, rejumpering in unbundling when customers move broadband supplier).

6.18 By comparison, competition based on active inputs does not suffer from these additional operating costs and may require less initial equipment investment. However, it does have a number of different drawbacks, most of which are linked to a reduction in the scope for the competitive operator to innovate. Specifically, active wholesale products:

- are based on the access network owner’s choice of transmission technology, for example, ADSL versus ADSL2+;
- are based on the access network owner’s selection of networking technology, for example, IP vs ATM;
- only offer the product configuration, including degree of control and flexibility, that the access network owner has built into the active product; and
- are dependent on the access network owner’s choice of investment timing.

6.19 There are a number of specific examples of the additional benefits that may accrue from passive input products based competition versus active input product based

competition. For example, these can include higher bandwidths, different contention rates, different upstream and downstream bandwidths etc. Some case study examples of these benefits are included in Table 1.

Table 1: Benefits of passive versus active asset based competition

Benefit of competition based on passive inputs	Practical examples
Competitors deploying their own active assets have full choice over timing of investment in new technologies; competitors using an SMP operator's active assets must wait for them to make that investment decision. This can give passive asset based competition a window of innovation to gain market share.	• In London VNL (Homechoice) offered IPTV over LLU starting in 2003; it is only recently that BT have developed a flexible IPStream offer which can support the live video streaming necessary for IPTV, and this is offered at a premium price • Belgacom were able to invest in VDSL in 2005 enabling them to launch TV services which could compete with the cable operators. Belgacom's LLU competitors are still awaiting a wholesale VDSL product.
Past experience suggests there is a risk that the wholesale electronic access product offered by an incumbent may not be as timely, highly configurable and competitively priced as competitors require.	• In 2000 VNL launched a commercial video on demand service in London using BT's Videostream product - a low contention version of Datastream. Videostream did not support multi-cast or sufficient speed for high quality real time video and was expensive. It also lacked flexibility and offered VNL little scope for control of key aspects of the service. A move to a much more flexible, and potentially less expensive, LLU product offered the opportunity to overcome many of these issues and resulted in the re-launched end product being far more successful. • The recent BT Openreach consultation on a proposed GPON Ethernet product highlights that reaching consensus on a new product that will form a key input for many independent businesses presents significant challenges for all involved.

Source: *Ofcom*

Next generation access may reduce the gap between the forms of competition

6.20 In choosing to focus on supporting competition in current generation broadband through passive inputs, namely LLU, Ofcom assessed:

- the dynamic benefits arising from competition, including strong price competition and the scope for innovation. For LLU, this constituted operators entering the market with faster transmission speeds, different contention ratios and different traffic shaping policies compared to BT, versus;

- the associated static costs, resulting from duplicated investment in active assets, fragmentation of the market, regulatory distortions from ensuring sufficient margin between the prices of the passive and active inputs consumed by competitors, and the additional cost of requiring equivalence for all communications providers, including the downstream divisions of BT.

6.21 We concluded that the potential dynamic benefits of LLU competition outweighed the static costs. The same analysis is appropriate for next generation access. However, it may be too early to make a detailed assessment of these factors for next generation access; there are too many uncertainties about when and how the networks will be deployed and how the market will have developed by then.

6.22 However, our initial work indicates that the net benefit of passive input based competition over the active alternative may reduce under next generation access. This is partly because the relative static costs of passive based competition may be higher than today, and partly because the relative benefits in terms of scope for

innovation it offers over active competition may be lower as the prospects for innovation from competition based on active inputs improves.

Table 2: The expected costs and benefits of next generation access competition, when compared with current generation

Costs		Dynamic Benefits	
Static costs for passive competition	Static costs for active competition	Practical innovation scope for passive	Practical innovation scope for active
Increase	Broadly similar	Broadly similar	Increase

Source: *Ofcom*

6.23 Looking first at costs, when considering next generation access it is possible that the static costs of introducing passive asset based competition may be higher than was the case with LLU. The new networks may make it less economically feasible to build the duplicate infrastructure required to take advantage of passive assets. This is primarily because the points at which passive competitors will be required to install their own equipment will be much more numerous, hence increasing cost.

6.24 The second change is that competition based on passive inputs may offer relatively less benefits when compared to competition based on new active inputs, for example next generation active line access products. In particular, the innovation gap between the passive and active options may narrow with next generation networks. This is not due to passive inputs offering any less scope for innovation. Rather, it is about the prospects of active input products that could be developed for next generation access, where there is the potential to offer more innovation than current generation active input products.

6.25 The increase in the innovation potential of next generation active inputs results from two main sources:

- the developments in networking standards such as Ethernet, which allow the technology to be used for an increasing range of applications in the operators' own network; and

- the general trend in next generation networks, both access and core, for the intelligent features that define innovative new services to be implemented in higher software layers, rather than hard-wired into the network itself.

6.26 Regardless of the physical location at which the competitive operator takes them, active inputs are likely to offer some form of wholesale electronic line access product. Ethernet increasingly appears to be a viable, and beneficial, technology on which to base such future products. The ubiquity and simplicity of Ethernet as a networking technology has led to huge equipment volumes and subsequently low costs. Also, as 'Carrier Ethernet' standards are being developed, features required for major telecoms operators to use the technology in their large core networks are being added. These new variants are designed to overcome the limitations of standard Ethernet which make it problematic to run networks with large numbers of customers and different services. As a result, Ethernet may be a promising basis on which future active input products could be developed to offer more flexibility and scope for innovation than today.

6.27 For an active line access product to deliver its maximum innovation potential, whether it uses Ethernet or any other technology, it will need to be carefully designed

and implemented. This will pose a significant challenge to industry. Such a product needs to offer very high levels of flexibility and transparency, allowing competitive operators as much control of the underlying infrastructure as possible. This will overcome a problem of many previous products, where, as end customer needs change, the input product lacks enough flexibility to allow the new services required to be built upon it.

6.28 There is a tension between adding flexibility to a product in an attempt to ensure that all possible future needs can be accommodated, and keeping it as simple and light weight as possible. Keeping the product simple is beneficial because adding complexity tends to mean the resulting product is further separated from the underlying network and relies on more and more technology choices made by the network owner, reducing the opportunities for real innovation by the competitor.

6.29 It is clear that the extent to which any next generation access active line access product agreed by industry fulfils its potential to deliver innovation will depend on how well the network owner and its equipment suppliers do in designing and delivering it. Ofcom's principle of equivalence may help in this regard: whatever active input product is offered to competitive operators would also be used by the access network owners' own downstream divisions. This increases the incentive to develop a high quality and timely product. However, we need to ensure that the access network owner does not simply design a product which meets its own needs, but that forecloses other communications providers' options to offer a differentiated or innovative new service.

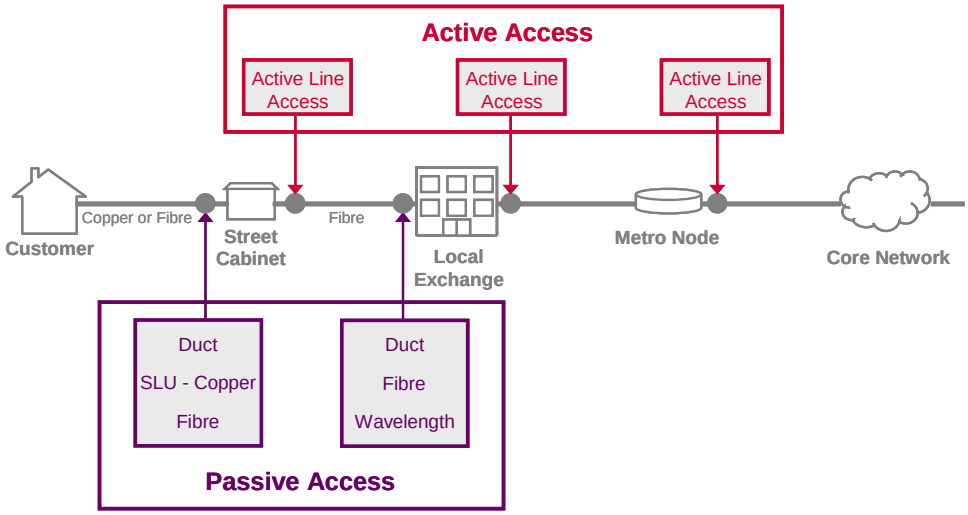
6.30 The degree to which regulatory policy should be based either on active or passive inputs depends on the relative benefits between the two, specifically in terms of the scope and flexibility offered to competitors to innovate and differentiate their product offerings from those of the access owner. Where active inputs offer a very high degree of flexibility and configurability to competitors, the inherent benefits of competition based on active inputs, such as the need for less manual interventions and less risk of upstream market fragmentation may mean this approach is more attractive. However, if these next generation access active inputs do not live up to their promise and do not deliver a high degree of flexibility and configurability to competitors, it would imply that focussing more on an approach to promote competition based on passive inputs would be appropriate.

Location of competition

6.31 The second aspect relevant to determining the correct 'level' for competition in next generation access is the physical location at which competition takes place. In the Telecoms Strategic Review, we outlined our principle of promoting competition as deep in the network as was effective and sustainable. In terms of physical location, this means as close to the customer as is effective and sustainable. We still feel this is the right principle on which to base regulation, as deeper access may, in many circumstances, increase the scope for service differentiation and innovation by competitors.

6.32 In practice, there are a range of points between the customer and access network owners' own core network that competitors can gain access to either passive or active inputs, on which they will build their own services. The following figure illustrates the locations and lists the most likely products that could be offered at each:

Figure 9: The specific competition options at each physical location in the network



Source: *Ofcom*

6.33 The range of possibilities, and the optimum choices, will vary depending on the network architecture and technology choices made by access network owners. The main options under the most likely architectures, FTTC and FTTH, are discussed below. More detail is provided in Annex 8. To ease the discussion of the various locations at which competition can take place, we have further subdivided the passive and active inputs that the competitive operator would purchase into a number of categories:

- **Passive inputs** - the options for passive inputs can all be considered to fit into either the category of **duct access** or **unbundling**.
- **Active inputs** - there is less variation in active inputs. All possibilities can be considered to be forms of **active line access**.

Passive inputs

6.34 The options for competition based on passive inputs fit either into the category of duct access or unbundling.

Duct access

6.35 This is the most basic, and therefore potentially most flexible, of all inputs considered here: operators can choose the type of cabling they want to install in ducts. Giving access to ducts would also substantially reduce the cost barriers to entry, with ducting and trenching accounting for up to 70% of the cost of underground next generation access deployments. Practically, duct access can occur at two locations. Between the cabinet and the exchange is the most likely option to offer contiguous duct that is in good serviceable condition and accurately documented. Between the customer premises and the cabinet is less likely to be practicable, with less chance of contiguous or good quality duct.

6.36 Duct access faces two main drawbacks:

- significant duplication of network infrastructures e.g. cabling and electronics, raising questions on whether this is the most economically efficient way of delivering competition; and

- practical issues with access to existing ducting. While new ducting is likely to be high quality, be well documented and have vacant space, this may not be the situation for existing duct. At the same time, granting access to duct for multiple operators to install and maintain their own networks raises significant logistical and work management issues.

6.37 If the practical issues with duct access could be overcome, it could lead to significant benefits to competition. However, these practical issues may be difficult to resolve. For new build ducting, or existing ducting that is high quality and well recorded, duct access does offer some interesting options. However, if viable, this would only be a solution to competition issues in certain locations, and is less likely to be a wide scale solution.

Unbundling

6.38 Unbundling, or passive line access, implies control of the passive physical connection to an individual customer given to competitors by the access network owner. Exactly what form this physical connection takes will vary depending on the choice of technology (e.g. FTTC vs. FTTH) and the location at which the hand over occurs. Today, the complete copper connection, or local loop, from the customer to the exchange is used for LLU competition.

6.39 Most options for unbundling require manual interventions in the access network to migrate customers from one operator to another, which is both time consuming and potentially expensive.

6.40 Unbundling in next generation access could occur at several different locations in the network. Each of these options is described in more detail in Annex 8:

- **copper line at the cabinet** (or sub-loop unbundling) – this is similar to LLU, but applies only to FTTC deployments, with competitors taking access of the copper 'sub-loop' between the cabinet and customers' premises. Compared to LLU, the economic viability of this option is more uncertain given the greater number of locations that competitors would need to 'unbundle' – up to 88,000 cabinets as opposed to 5,500 exchanges. There are also a range of practical difficulties arising from sub-loop unbundling, including space in cabinets to locate active electronics and availability of power at cabinets;

- **fibre at the cabinet** (or fibre unbundling) – this can take two forms. For point to point fibre deployments, this would involve unbundling each customer's dedicated fibre between the cabinet and customer premises. This would face many of the same issues as LLU. For GPON based FTTH deployments, there is a theoretically possible option to unbundle access to a portion of the fibre network at the 'splitter' (see Annex 8). However, this would be highly problematic on a practical basis as the number of customers on each splitter is very small, reducing the economic viability of unbundling at this point;

- **fibre at the exchange** (or fibre unbundling) - this option would only be applicable to an FTTH architecture such as point-to-point and not GPON; and

- **wavelength at the exchange** (or wavelength unbundling) - some PON systems deliver a different wavelength, or 'colour', of optical signal to each end customer. Wavelength unbundling makes this available to a competitive operator at the exchange. The technology to achieve this is very expensive and typically used in core, not access, networks.

Active inputs

6.41 The alternative to competition based on passive inputs is to rely on active inputs instead. This is where the access network owner has installed equipment to transmit signals across its cables, and makes the data signal, or 'bitstream', from this equipment available to competitors.

6.42 A comparison of the benefits of passive versus active competition has been included above. Below is a consideration of the physical location of access to active inputs. There are three main locations where active inputs could be offered:

- **active line access at the cabinet** - access to the bitstream signal emerging from the transmission equipment housed in the cabinet. If the competitive operator taking this service chose to build its own backhaul network, it would need to install backhaul transmission equipment in the cabinets, encountering many of the costs and practical problems of sub-loop bundling;

- **active line access at the exchange** – where competitors chose not to build their own backhaul network, the next level up for active inputs may be at the exchange. This would result in some loss of cabinet to exchange backhaul flexibility, but may significantly reduce the total cost of active input access compared to active access at the cabinet; and

- **active line access at the metro or core node** – this option minimises the competitor's need to deploy its own infrastructure, but at the same time may limit the opportunity for service differentiation and innovation. However, some scope for service differentiation may still exist if sufficient flexibility was built into the active input product.

Availability of appropriate backhaul services is fundamental

6.43 In addition to access products, competitors will also need access to backhaul connections to transit traffic from the access network to their own core network. These connections can either be provided by the competitor, or bought from the access network owner. In practice, communications providers may need to source multiple backhaul links in order to reach their core network, for example from the cabinet to the exchange and from the exchange to their own core network.

6.44 Options for backhaul are to some degree dependent on the technology deployed and the form of local access product consumed, either active or passive. In addition, they could be required at different points in the network by different operators depending on the extent to which they own their own infrastructure for the transit of services. The main options for backhaul include use of:

- **own build infrastructure** - this could take the form of duct and fibre deployments by each operators using one of the access products. Alternatively, some operators may seek to use wireless networks for this backhaul link;

- **duct sharing** – communications providers deploy their own fibre in spare space within existing communications ducts or alternative wayleaves;

- **dark fibre access** – in this situation, communications providers lease access to dark fibres deployed by the access network owner. They attach their own equipment to these dark fibres to 'light' them and backhaul services themselves; and

- **wholesale backhaul services** – the access network operator owns and operates backhaul connections and provides an active wholesale backhaul product, for example Ethernet backhaul, to competitors.

6.45 Each of these options has its own merits and drawbacks. To some degree, these are similar to those for passive and active access remedies. In practice, the feasibility of these different options will vary depending on location, and we may witness more than one approach to backhaul being adopted by operators. However, the availability of appropriate backhaul services is fundamental to the effective support of competition based on both passive and active access products. Where economics of backhaul infrastructure deployment are similar to those of the access network, there is a risk that this will also constitute an enduring economic bottleneck. Where this is the case, it may be necessary to mandate access to some form of backhaul service from network operators with significant market power.

Our preferred approach to competition depends on the technology deployed

6.46 The above assessments of the relative benefits of passive asset versus active asset based competition, and the physical locations at which this competition could be promoted, leads to differing conclusions for FTTC and FTTH. We outline these conclusions below, as well as an initial analysis of the impact of implementing the proposed approach.

Competition in FTTC deployments

6.47 With an FTTC deployment, passive line access to the copper at the cabinet, commonly known as sub-loop unbundling, appears to be the most promising option for introducing competition based on passive assets:

- it maximises the scope for innovation and differentiation among competitors;
- it fits well with the current structure of the market, being a natural next generation evolution of LLU; and
- most importantly, because a sub-loop unbundling product would offer access to passive assets which already exist, namely the copper loops between customers and cabinets, it makes the initial investment in next generation access contestable. As soon as a third party decides there is a business case for deploying FTTC, they can use a sub-loop unbundling product to do so, even if the incumbent operator has not yet made a positive investment decision.

6.48 As discussed, this option does have some potential drawbacks. The economics appear challenging for multiple operators deploying infrastructure at this level; depending on the modelling assumptions, the proportion of the market that can support sustainable competition may be much less than with LLU. This means that if used on its own, there is a risk that sub-loop unbundling may still leave many consumers without a choice of more than one next generation access service provider. It is also possible that making a fit for purpose sub-loop product available may be quite expensive.

6.49 On balance, we feel if implemented correctly, the benefits could outweigh the drawbacks. In particular, the ability to make investment in next generation access contestable means that it is important that we retain this remedy. While it may be that the areas of the UK which will directly benefit will be limited, it is important to bear in mind that the coverage achieved by both LLU competition and BT's own broadband

network are significantly greater than was predicted before passive infrastructure based competition was introduced for today's services. The economics of sub-loop unbundling may improve as the market develops and the contestability may incentivise today's providers to deploy next generation access faster, and over a larger area than they otherwise would.

6.50 Given the current uncertainty over the likely footprint of competition based on sub-loop unbundling, due to the practical and economic difficulties associated with it, it would be very risky to rely on this remedy alone. We are therefore proposing an additional remedy based on active line access, which we would expect to be economically viable for competitors over a greater proportion of the UK, while still offering good opportunities for differentiation and innovation. Compared to current equivalents, an active line access product in next generation access networks has the potential to offer significantly more benefits. However, realising these benefits will require a step change improvement in design and implementation over today's active products.

6.51 There is a risk in practice that the active line access product may fall short of the promise of a delivering a highly configurable 'raw' service to competitors. Instead, technical limitations, design decisions, poor implementation, or the inability to foresee what retail services the product may need to support in the future, could reduce scope for innovation and the consumer benefits from such a product. This reinforces the need to retain a viable alternative mechanism for the establishment of effective competition, namely the passive sub-loop unbundling remedy.

6.52 As a result, for FTTC, Ofcom would consider the following two remedies, which we believe will compliment each other:

- **sub-loop unbundling, offering passive copper line access at street cabinets, with appropriate supporting backhaul products; and**

- **a new, high quality, flexible, Ethernet based, active line access product available at a number of points in the network.**

6.53 Retaining two remedies at different points in the value chain may have undesirable cost implications. However, given the various uncertainties that surround next generation access, Ofcom believes it is premature to select between these options: both have their own potential merits and drawbacks. Our proposed alternative is therefore to retain both remedies in the medium term. This has the benefits that:

- it allows contestable investment in next generation access;

- it allows the market, rather than Ofcom, to select the most appropriate access method through a period of innovation and experimentation;

- it may allow communications providers to gain scale in next generation access services through an active line access product before making additional investments in infrastructure at the cabinet; and

- initially, the availability of each product may have beneficial impacts on the quality and success of the other.

6.54 The sub loop unbundling remedy is already imposed on BT, to address its significant market power in the Wholesale Line Access market. However, the current form of the product is untested and unlikely to be a suitable input for a viable next generation

access operator. Ofcom would like to consider options for improving the robustness and scalability of the product, while being mindful of the need to avoid placing an undue financial burden on BT. We propose therefore, that initial work be undertaken to explore how the product could be improved, subject to the level of interest expressed by industry. We envisage such work being undertaken by the Office of the Telecoms Adjudicator, working with industry. This work should consider the product design, pricing and order management and maintenance processes. However, it would be premature to expect a similar level of industrialisation at this point for sub-loop unbundling as has been put in place for local loop unbundling input products.

6.55 We also feel it would be inappropriate at this stage in the market's development to require sub-loop unbundling to become an upstream input into BT Group's downstream products such as the MPF/SMPF products used for local loop unbundling.

Competition in FTTH deployments

6.56 Most operators in Europe are expected to base any FTTH deployments on GPON technology, as evidenced by BT's proposals for its new build fibre build in the Ebbsfleet housing development. With no clear option to physically unbundle a PON at the moment, and if the practical problems of duct access were to continue, viable competition in the proposed FTTH deployments will be likely to come from active inputs e.g. an active line access product. This places even greater emphasis on the need for a high quality, highly configurable product that offers third party communications providers a significant degree of control over the underlying infrastructure.

6.57 For FTTH, we believe the most appropriate remedy for the medium term will be:

- **a new, high quality, flexible, Ethernet based, active line access product available at a number of points in the network.**

6.58 Whilst we believe that next generation active input products offer greater scope for innovation than those available today, they are still unlikely to match passive products in the respect. For this reason, we will keep the options for introducing a passive wholesale product under careful review as technology develops. In the future, new options for passive competition in FTTH networks may emerge, such as viable duct access or new forms of unbundling, e.g. GPON or wavelength unbundling. Ofcom will consider such options as they become practical and assess whether the inherent benefits of passive competition would be worth the costs of introducing them. This would be a particularly important consideration if a fit for purpose active line access product had not emerged.

Consultation questions

Question 4 Do you agree with the need for both passive and active access remedies to promote competition?

Section 7

The case for direct intervention in next generation access investment

7.1 We explored in Section 2 the reasons why the UK may be likely to witness a later deployment of next generation access than other countries or regions. This section explores the question of whether a later deployment should be of concern for policy makers and if so, whether this justifies direct intervention to hasten it.

7.2 By direct intervention, we mean a regulatory or public policy approach to next generation access which departs from the principle of trying to create the conditions for efficient and timely investment by the market. For example, this could be by explicit regulatory incentives on operators to invest, funded by increases in the costs of telecoms services across-the-board. For such an approach to be justified there would have to be strong evidence that a market-based approach to investment would for some reason deliver the benefits of next generation access to society or to the economy inefficiently late.

7.3 In order to assess whether later deployment is a matter for concern, we need to consider:

- the services that will be delivered over next generation access networks, and whether these are likely to result in significant social value. This is informed by the applications and services that consumers and businesses are demanding;
- the potential impact on the UK economy through improvements in its competitiveness and productivity from prospective next generation access deployments; and
- the benefits and costs arising from being the first nation to deploy a new technology, and how quickly next generation access networks could be deployed if it was shown in the future to deliver significant value.

The impact of later deployment partly depends on prospects for social value

7.4 In the Section 2 we outlined a number of reasons why the later deployment of next generation access networks in the UK may not be inefficient, but rather as a result of country specific characteristics. These characteristics mean that efficient and timely deployment may occur at different times for different countries. We also explored whether there was a latent demand for applications and services that would warrant the roll-out of next generation access networks.

7.5 However, in assessing the potential value that next generation access could bring, we need to consider more than the commercial case for efficient and timely investment. It may be that these networks will result in significant social, or public, value to the UK as a whole, as opposed to just their private value to potential investors. If significant social value, an ‘externality’ to the business case considered by an individual operator, can be demonstrated this may warrant their construction now, possibility facilitated by public policy intervention. Even in a well functioning market, efficient deployments may not deliver the form or reach of next generation access networks that maximises potential social welfare. In other words, there might

be significant public value which derives from the use of services that the market alone will not deliver.

7.6 Generally, if there is demand for a particular good or service where the value that customers derive from it exceeds the costs of provision, we would expect the market to meet such demand. Situations where this may not occur include:

- situations where the conditions of competition are imperfect or if significant market power exists at some point in the value chain. In such situations, ex-ante regulation might be justified; and

- situations where public and private benefits combined exceed the cost of provision, but not private benefits alone. This is in what is known as an 'externality': wider social benefits that arise as a result of the existence of next generation access networks and that will not be taken into consideration by individual firms when deciding whether to make an investment. When such social value exists, a later market led deployment of next generation access, while privately efficient and timely, would be of concern to the UK.

7.7 In this section, we focus on the second of these two. Externalities can be caused by a range of different factors. Typically, in communications markets, network externalities exist if consumer benefit from connectivity increases as additional users join the same network – so called 'network externalities'. Externalities might also have a strong social value component. For example, citizens may derive value from factors such as access and inclusion, belonging to a community, or being part of an informed democracy. These factors would not necessarily be taken into account by private industry in making its investment decision.

There is limited evidence of social value from next generation access

7.8 The assessment of potential social value or externalities in next generation access markets is a very difficult task in advance of deployment. Evidence on the benefits arising as a result of current generation broadband is only now emerging in quantity, nearly a decade since deployments commenced. Current generation access services have contributed to increasing standards of living, lower prices and increased choice, more efficient and effective public service delivery.

7.9 However, the experiences from current generation broadband may not provide an indicator of the potential social value from next generation access. The question is whether there exists any source of incremental social value that may only be derived from applications and services delivered over a next generation access network. Evidence of the existence of positive externalities in next generation access markets is lacking at present.

7.10 In advance of deployment, one way to consider the potential social benefits of next generation access is to consider the applications and services that these networks could deliver to consumers and businesses. We then need to consider how these applications and services may contribute to wide scale social value.

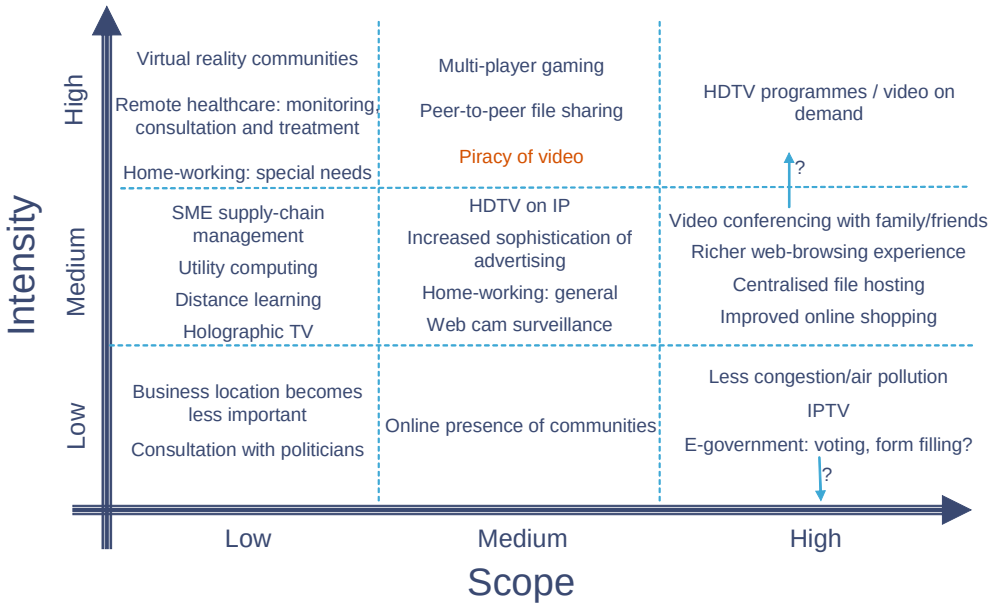
There are few clear consumer applications that may contribute to social value

7.11 Increasingly, there is significant excitement about the potential for bandwidth-intensive video-rich services that could be delivered over broadband and next generation access networks. However, so far, there are few applications or services that have been identified that require a next generation access network for delivery.

Even among those that do, the additional value they might offer to society as a whole, beyond their private value to consumers, is uncertain.

7.12 Figure 10 shows an indicative list of applications and services that could be delivered over next generation access networks. It assesses a range of different applications and services in terms of their relative scope, the number of people that may be affected by their availability, and their intensity, the incremental impact on consumers and businesses from their availability. Both of these factors are assessed in comparison to the benefits that may be delivered by current generation broadband access networks.

Figure 10: Potential next generation access applications and services



Source: *Ofcom*

7.13 For example, High Definition TV (HDTV) services are in the top right of this diagram: these may become very popular at some point in the future, and will require significant bandwidth, therefore being potentially high both in scope and intensity. Similarly, peer-to-peer file sharing is increasingly popular among a wide range of users, and, although files can still be transferred through current broadband connections, next generation access would allow for a more efficient transfer. By contrast, applications such as distance learning or tele-health may have a relatively minor scope, although their impact, when used, could be very high.

7.14 This analysis suggests the following applications are likely to be most influential in terms of both scope and intensity as a result of next generation access network deployment:

- video on demand, including high definition television (HDTV) programmes and movies, as high speed broadband offers a new and highly effective distribution mechanism for streaming or downloading video;

- multi-player online gaming and virtual reality simulations, as high speed broadband could allow these applications to be much more complex, engaging, effective and appealing (many games increasingly use HD video format);

- peer-to-peer file sharing and file hosting, as high speed broadband (and increased symmetry of bandwidth) allows for the rapid transfer of much larger files, mostly business specific applications and video services. It is likely to be used by a large proportion of broadband users, including business, small and medium size enterprises (SMEs) and private individuals; and

- supply chain management, as SMEs improve their interaction with customers and suppliers through their intranets by sharing large files, videos or software.

7.15 These conclusions are supported by a number of other studies and reports that identify IPTV and HDTV services as one of the single largest drivers of requirements for higher bandwidth access services[26].

7.16 Therefore, with the exception of applications benefiting the activity of SMEs, which we consider in the next section, these are primarily entertainment services. The incremental social, as opposed to private, value of these four applications compared to the applications and services available over current generation broadband access networks remains highly uncertain. For example, with HDTV, research conducted in 2006 for the Digital Dividend Review[27] suggested that consumers place little or no additional social value above private value on HDTV services.

7.17 It should be noted that some of these services may contribute to the growth of the UK's creative industries, although the scale of this benefit remains uncertain. In the recent report 'Staying ahead: the economic performance of the UK's creative industries' from the DCMS, a lack of next generation access infrastructure was not cited as a major barrier to the development of the creative industries sector at this time[28].

Evidence from international deployments is limited

7.18 Given the difficulties in assessing social value of next generation access in the UK in advance of deployment, it may be useful to examine countries in which these networks already exist. However, most deployments have been made relatively recently, meaning there is little definitive information relating to commercial propositions, take-up and usage and the value that may derive from this. Nevertheless, while it would appear some new commercial models and consumer demand is emerging, current evidence suggests that service pricing, packaging and usage of next generation access services is similar to current generation broadband.

7.19 In general, commercial propositions for next generation access are typically similar to today's broadband: bundles of broadband access services with a TV service, and fixed-line telephony. Premium services offered typically include sports and film TV channels, on demand video, high definition content and symmetrical or very high bandwidth services. Absolute pricing for connectivity and value-add services vary by market, but there is an emerging trend for these charges to be similar to existing triple play services over cable or DSL.

[26] Predicting UK future residential bandwidth requirements (http://www.broadbanduk.org/content/view/185/)
[27] http://www.ofcom.org.uk/consult/condocs/ddr/
[28] http://headshift.com/dcms/index.cfm?fuseaction=main.viewBlogEntry&intMTEntryID=3095

Table 3*:* Example commercial next generation access propositions

Deutsche Telekom (Germany)	Triple play bundle with 25 Mbps VDSL, telephony and pay-TV is available at €69.95/month (£47), with 50 Mbps available for an additional monthly fee of €5. Stand alone VDSL has been priced at €34.99/month (£23.50) for 25 Mbps and €44.99 (£30.20) for the 50 Mbps service.
France Telecom (France)	"La fibre" triple play bundle priced at €44.90/month (£30) for 100 Mbps download and 10 Mbps upload. 100 Mbps symmetric service available for a €20/month (£13.50) premium and high definition content and video on demand available for an additional €7 each per month (£4.70).
Free (France)	Price point of €29.99 (£20) for basic 100 Mbps downstream 50 Mbps upstream service bundle including basic TV package and IP telephony – the same price as its LLU service. A wholesale product will be offered at €15/month (£10.20).
Japan	FTTH connectivity is priced at around ¥3300/month (£13) and additional optional IPTV and VoIP services are also offered. Triple play is priced at around £30/month for flats. Next generation access prices vary with the type of housing, being around 40% higher for detached houses than flats.
Swisscom (Switzerland)	Broadband connectivity at 15Mbps up, 1Mbps downstream priced at CHF89 per month (£36.80). Blu-Win IPTV available for additional monthly fee of CHF29/month (£12).
Verizon FiOS (US)	Broadband connectivity package prices vary between $39.99/month (£20) (5Mbps down, 2Mbps up) and $179.99/month (£89) (30 Mbps down, 5Mbps up). Optional FiOS TV premier package priced at additional $42.99/month (£21).

7.20 Anecdotal evidence from some countries suggests that people do not initially use online services in a significantly different way when they upgrade from broadband to next generation access. Some operators suggest that next generation access may have a role to play in providing current generation broadband services to larger households, to enable simultaneous multiple PC and television use, as well as HDTV. Potential next generation access specific applications may include new web based full-screen video services, online gaming, media-rich online user environments and mass-market video conferencing.

7.21 It is important to stress that, to date, there are very few applications which are likely to be exclusive to next generation broadband. Generally, the debate concentrates around bandwidth or better quality for the same bandwidths. Currently, there is very limited empirical evidence either way on this question arising from next generation access deployments overseas. As mentioned earlier, the only clear observation so far is that, while some consumers do appear to value additional bandwidth privately, they are using the access network for a broadly similar range of activities as current generation broadband services.

Next generation access may have a greater effect on economic rather than social value

7.22 Next generation access deployments are often linked to their prospective implications on competitiveness and productivity, similar to that witnessed as a result of current generation broadband services. The link between competitiveness and productivity and current generation broadband is increasingly accepted and demonstrated by empirical evidence.

7.23 Given the continued growth in the UK's knowledge based economy and its reliance on modern telecoms networks and services, it may be expected that this link will continue following a move to next generation access. Both the Broadband Stakeholders Group and the Government have indicated concern about the risk that non-availability of next generation access networks may pose for the competitiveness of the UK economy and for wider social welfare. They have outlined the potential for next generation access to profoundly affect consumers, citizens and the economy.

7.24 However, any move to accelerate the deployment of next generation access networks through either regulatory or public policy intervention would require a significant threshold in terms of the evidence on the potential social and economic benefits. The evidence to support such activity is currently limited and this is likely to continue until next generation access networks are more established.

7.25 Whilst the business case for wide scale next generation access networks may only exist for the delivery of mass market services to residential consumers, it may be small to medium sized enterprises (SMEs) that are the real beneficiaries of such a deployment in terms of economic value. Given the lack of current direct evidence on the economic benefits, we will instead examine the potential benefits for SMEs in more detail.

7.26 It may be that SME usage of next generation access networks that drives the most economic benefit, while also making a significant contribution to the common costs of delivering next generation access networks to both consumers and SMEs. Therefore, as important as the average consumer demand for a particular service may be, the expected level of demand from premium customers may be of greater importance to achieving a return on these investments. We outlined earlier that there is limited evidence for substantial latent residential consumer demand for higher bandwidth services, combined with a low willingness to pay. In light of the importance that demand and revenue from business customers might play in justifying next generation access investment, we need to consider whether this might be different in their case.

7.27 The benefits for SMEs from broadband access have primarily been associated with improvements as regards transaction management, product details, shipping information, sales assistance and electronic supply chains. Remote access and tele-work practices also offer important advantages. It is not yet clear if, or how, next generation access will result in further incremental productivity gains for businesses. The question is whether there are new applications and services businesses could make use of that would not be available over current generation access networks.

7.28 The argument that the UK requires a next generation access network on the basis of the benefits that may result for SMEs is largely predicated on the assumption that the higher bandwidths services made available would be made available at prices that are similar current SME focussed broadband services. However, this is based on the assumption that there will be substantial demand for these access services from a

large group of consumers. As already discussed in previous sections it is not clear to what degree this demand will emerge. At the same time, it is not clear that SMEs would purchase these services if they were required to cover all of the costs of deployment, even despite a potential higher willingness to pay than residential consumers may display.

7.29 In addition, a consumer focussed mass market may well not deliver the levels of connectivity that SMEs require, for example in terms of symmetry, uncontended bandwidth or very high speeds. A perhaps more immediate issue for SMEs might be the extent and quality of current broadband availability for their distribution business models and the management of and coordination between satellite offices.

7.30 As a result, the impact of next generation access network deployment on productivity of UK companies remains uncertain. However, given the applications and services often linked to next generation access deployments, it may be easier to imagine next generation access having a greater effect on UK SMEs than on social value in the near term. In the longer term, it would seem that these economic benefits may grow to be more important.

There are reasons why there may be limited risk from investing later

7.31 Much of the debate and concerns on the timing of national next generation access deployments relates to the risk of being 'left-behind' in investment and the loss of benefits generally associated with the development of new applications, new services and innovation. Given that regions with abundant infrastructure become more attractive to inward investment, next generation access might represent a comparative advantage for a particular country, especially in certain sectors or areas of activity.

7.32 This concern was highlighted by the recent report from the Broadband Stakeholders Group on next generation access. While it is indeed a potential concern, it needs to be considered in light of two important factors: the comparative advantage of being a first mover versus the value in waiting to deploy new infrastructure; and how long it may take for the UK to catch up with its peers.

7.33 The prospective advantages of being an early adopter of new technologies are often cited in respect to next generation access, including potential benefits in terms of competitiveness and inward investment. However, these should be weighed up against the fact that later adoption of a new technology might actually prove beneficial. Gains can be made in terms of clarity on standards selection, choice of the best available technology, scale economies on equipment manufacture and practical lessons learned from network deployments elsewhere. In addition, as commercial cases become clearer in countries that have deployed these networks, the demand side uncertainty surrounding next generation access networks may dissipate. This means there may actually be some benefits in not being a 'first-mover'.

7.34 However, as time goes by, and the lag time increases, so the prospective risk of being left behind may increase. This is compounded by the fact that any intervention or policy change that may be required to encourage investment where it is determined that deployment will be inefficiently late will entail a lead time of its own for adoption. Therefore, it is important to understand what the lead time would be for next generation access network deployments.

7.35 There is limited information to suggest how long a UK deployment of a next generation access network would take and evidence from other countries suggests that in practice, this is highly variable. For example, Deutsche Telekom predicted its FTTC deployment to 30% of homes would take up to 3 years, compared to Verizon in the US that predicted it would take around 5 years to reach 62% of homes. These variances depend on the technology chosen, reach, need for underground infrastructure and the availability of qualified resources.

Options for direct regulatory interventions may distort efficient investments

7.36 So far in this section we have set out the current evidence on the impact of later next generation access deployment in the UK. If it were concluded that there was significant detriment in the short term due to the lack of next generation, direct regulatory intervention aimed at speeding deployment could be considered. For the regulator, such interventions are most likely to take the form of investment rewards based on regulation to incentivise operators to make this investment.

7.37 This is the general approach adopted in some of the countries where we have witnessed deployments to date: some incumbents have been incentivised to invest either through direct regulatory forbearance, implicit rewards for investment, or an agreement with incumbents that this is in the country's wider interest and best served through their investment.

7.38 The downside of any form of direct regulatory intervention is that it risks resulting in inefficient levels of investment, timing of investment and technology choice. It considers investment as a goal in itself rather than as an input to deliver consumer, citizen or economic benefits. It breaks the link between consumer demand and investment; in effect, the regulator is deciding or influencing decisions on the correct level and timing of investment.

7.39 There is a wide range of options to directly promote next generation access investments in an environment of demand side uncertainty. They include:

- **the pricing of new services** – for example, explicitly guaranteeing investors a high price for next generation access services. However, this does not negate the risks resulting from demand side uncertainty: even with a regulatory agreement to allow high prices, the investor is not protected from the risk of no demand. At the same time, the demand for these new services, while uncertain, may be relatively elastic – increasing prices may not therefore increase total revenue;

- **pricing of existing services** delivered over next generation access. This approach would spread the risk of these investments across all customers consuming telecoms services delivered over next generation access networks. The costs of next generation access deployment would be recouped through higher prices for all regulated telecoms services delivered over these networks. Such an approach may result in inefficiency: large numbers of customers may pay for an investment to support services that they do not demand;

- **pricing of all regulated products**, recovering the costs of next generation access across all regulated services on both current and next generation access networks. This would increase the base of customers over whom these costs are distributed, but would suffer from the same issue of proportionality and efficiency as the above approach. While the cost increase spread across such a large base of customers may be relatively small, it is important to remember that, for some

vulnerable consumer groups, even a small increase in telecoms services prices may be problematic;

- **relative prices and margins of current and next generation access services** could be actively managed, which may encourage a migration from current to next generation access. It could take two forms: manage the next generation access margins up; or manage the current generation margins down to make next generation access product margins more attractive. Ofcom does not favour this form of intervention – it is likely to skew efficient investment decisions, and would not necessarily result in the least cost solution to delivery of services; and

- **utility style regulation**, where the regulator agrees the industry's investment plans for a period of time, similar to models adopted by some utility markets. This form of regulation is similar to approaches involving the pricing of all regulated telecoms services above. It requires the costs to be covered by all customers and for the demand for services over which these costs are spread to be highly inelastic (e.g. utilities). It is not apparent that many communications services are considered as utilities by customers. Another downside is that this approach seeks investment as a goal in itself, rather than as an input into increased consumer welfare, social welfare or economic productivity. This may be appropriate if the aim of regulation was only to deliver investment. However, as we have outlined, Ofcom's objectives are broader than securing investment only.

7.40 Many of these result in the risk involved in next generation access investment being transferred to end customers. The likely outcome is that consumers will have to pay more for their services in order to the recover the additional costs of investing at a time which was not the most efficient. In most cases this would apply even to consumers who do not use the new services: prices for their current services would rise with no direct benefit to them.

7.41 All of the approaches for direct regulatory action outlined above are highly interventionist by their nature, and likely to result in distorted incentives for investment, reduced flexibility in terms of the market's response to emerging consumer demand, and distortions to the competitive environment as a whole. We do not believe that such regulatory led investments are likely to result in the efficient and timely deployment of next generation access networks.

7.42 Some of these approaches may be more appropriate if there is a consensus between all stakeholders, including government and citizens, that there is a need for intervention to accelerate the deployment of next generation access to deliver social welfare or economic benefits. For example, with such consensus and a willingness to transfer risk to end users, utility style regulation may be an appropriate mechanism to deliver next generation access investment.

On balance, intervention today appears premature, but may be necessary at some point

7.43 This section has explored the prospects for incremental social or economic benefits resulting from the deployment of next generation access services in the UK, over and above current generation broadband access.

7.44 There would appear to be limited evidence to believe that next generation access deployments will result in significant social value in the near term based on the applications and services these networks are likely to support. Similarly, there is limited evidence to date to suggest that next generation access deployments will

result in significant incremental economic benefit. It is therefore very difficult to conclude on the potential sources of value from next generation access that would suggest risks arising from these networks' later deployment. However, it is possible to envisage that there will be potential sources of benefit, particularly economic benefit, arising from next generation access in the future.

7.45 Given the analysis and evidence above, it seems inappropriate to have public or regulatory policy intervention designed to accelerate next generation access deployment in the UK at this stage in order to deliver social or economic value. There is no sufficiently compelling evidence to justify direct public intervention to promote or accelerate deployment faster than the commercial rate of deployment. A lack of availability at present does not seem to be significantly detrimental - there appear to be few, marginal rather than substantial, benefits for individual users, business or the UK economy from the wider use of next generation access services, over and above current generation broadband access.

7.46 The lack of direct evidence to support any decision to undertake direct intervention may be to some extent a circular problem: the demand for next generation access networks may be limited until new applications and services are developed, yet such new applications and services may not be developed until next generation access networks are available to deliver them over. However, intervention may carry a high direct cost and carries significant risk to the efficient operation of the market and competition in the future. To be justified therefore, evidence suggesting intervention would need to be absolutely compelling and to date it is simply insufficient to support such an interventionist approach.

7.47 However, we remain alive to the risk of complacency. Evidence of potential next generation access benefits or consumer harm from a lack of next generation access will take time to emerge, but if or when it does, relatively quick action may be required. We must therefore remain vigilant to the prospect of new, innovative services that can only be delivered over next generation access networks and which may confer significant social benefits for consumers and citizens, as well as advantages to the UK economy. At the same time, international deployments over the next two to three years may result in faster development of new mass market bandwidth intensive services that could result in a heightened concern from non-availability in the UK.

7.48 Accordingly, we believe the best course of action today is to continue to closely and carefully monitor developments in this area, regularly reviewing broadband data and taking due account of emerging international developments and metrics. This information will enable all stakeholders to understand when the availability of next generation access may become a cause for concern for the UK. We will pay particular attention to issues such as bandwidth, penetration, content usage, pricing, and the impact on social inclusion. To implement these actions, we will seek to use our market intelligence publications to collect, assess and disseminate this information. Finally believe that it will be important to facilitate and encourage the exchange of best practices and experiences between operators within and outside of the UK.

7.49 Work is being undertaken by some stakeholders to consider the likely sources of, and ways to measure, the potential social and economic value of next generation access. For example, the Broadband Stakeholders Group is developing a framework for the measurement of potential public value that could be derived from these investments. Ofcom strongly supports this work, and will contribute as appropriate.

7.50 Given these conclusions, public policy or regulatory intervention at some point in the future cannot be ruled out today. However, we continue to favour a market based approach to investment in new technologies and services. Any intervention would need to be evidence based, and agreed across a wide range of stakeholders as being the most appropriate approach.

Consultation questions

Question 5 Do you consider there to be a role of direct regulatory or public policy intervention to create artificial incentives for earlier investment in next generation access?

Section 8

Implications for existing regulation

8.1 There is a wide range of regulation in place to deal with concerns relating to current generation access networks and services. We need to consider the extent to which the current approaches will still be applicable in light of next generation access and how we will manage the transition between the two regulatory environments. The challenges for existing regulation can be divided into three main areas:

- market definitions and the Undertakings;
- the migration from existing regulation; and
- the impact of existing regulation on incentives for next generation access deployments.

Market definitions and the Undertakings

8.2 The proposed regulatory approach outlined in this consultation would be implemented following consultation and impact assessment through the appropriate market reviews, in light of the findings of these reviews, and the Undertakings given to Ofcom by BT.

Market definitions and significant market power

8.3 Ofcom has not to date defined which market next generation access networks may fit within – whether an existing market(s) or a new one. Part of the reason for this is that markets are not in general defined by technology but rather in terms of the services they provide. At this time it is not clear whether services provided over fibre access networks would constitute a separate market or fit within the definition of an existing one. Given this uncertainty on the retail services that may be offered over a next generation access network, it is not possible to define the relevant wholesale products. This is because demand for wholesale broadband services is derived from retail demand.

8.4 In the UK, the existing economic markets which are likely to be most relevant to next generation access networks are the wholesale local access market and the wholesale broadband access market. The main issues with applying these markets in light of next generation access are:

- **Wholesale local access**[29] – following a review of this market conducted in 2004 considering the retail substitutability of different local access services, this market was defined in a technology-specific manner, and covers local access networks that utilise copper or cable in the local loop or sub-loop. The current market definition excludes local access networks utilising wireless or fibre technologies. This is because, when at the time of market review, fibre-based access was determined not to constrain the pricing of loop-based and cable-based local access as its price meant it was not a suitable substitute. It was therefore excluded from the relevant wholesale product market. This is significant because next generation access networks are likely to be based on fibre technology.

[29] http://www.ofcom.org.uk/consult/condocs/rwlam/statement/

- **Wholesale broadband access**[30] – this market is defined to include those products capable of supporting broadband internet access and other multimedia applications, which have the capability to be always-on and have a potential downstream speed that exceeds that achievable on a traditional dial-up service. Wholesale broadband access products, as defined in the market review, do not have an upper speed limit. This is because there does not yet appear to be a break in the chain of substitution between asymmetric broadband internet access services available today.

8.5 The European Regulators Group (ERG) consulted on next generation access in June 2007[31]. In this consultation, the ERG made some general proposals as to how the Recommendation on relevant markets susceptible to ex-ante regulation and the ECNS Regulatory Framework may be adjusted to cope with the regulatory challenges arising as a result of the different next generation access deployment scenarios. Within this paper, the ERG considered two broad technology deployment scenarios – FTTC and FTTH. The consultation outlined how next generation access may necessitate a change to the current market definitions:

- **Market 11** (the Wholesale Local Access market in the UK) - the ERG recommended that the market definition could be adapted to include both FTTC and FTTH deployments. The ERG concluded that the inclusion of fibre loops into Market 11 is compatible with the definition of the European Access Directive, but would require a change of the Recommendation to include fibre into the relevant market.

- **Market 12** (the Wholesale Broadband Access market in the UK) - the ERG concluded that Market 12 does not require a change of the Recommendation as, by definition, it already comprises all kind of wholesale broadband access products irrespective of the technology used or speed offered.

8.6 Ofcom recently consulted on the Wholesale Broadband Access market[32], indicating that our economic analysis of this market suggests there are four specific geographic markets for wholesale broadband access based on differing competitive conditions. It may be that, for market 3 areas with four or more competitors the wholesale broadband access market is increasingly competitive based on competition from cable and other operators using local loop unbundling as an upstream input into wholesale broadband access services. This raises the question of what the most appropriate regulatory approach to next generation access would be if there was a finding of no significant market power in a specific geographic market.

8.7 Should higher speed broadband services arise in the future, it may be that the chain of substitution across broadband access services suggests that next generation access services fall within the current definition of wholesale broadband access market. We would need to assess this chain of substitution as and when new retail applications services using the next generation access were launched to ensure that it remained unbroken. Additionally, if following a new market review there was a finding of no significant market power in the wholesale broadband access market, Ofcom would not require any operator to offer active products on regulated terms.

8.8 It is worth noting a number of points with respect to this outcome.

[30] http://www.ofcom.org.uk/consult/condocs/wbamr/
[31] http://erg.eu.int/doc/publications/consult_regprinc_nga/erg_cons_doc_on_reg_princ_of_nga.pdf
[32] http://www.ofcom.org.uk/consult/condocs/wbamr/summary/

- any finding of no significant market power in the WBA market, including next generation access, would be on the basis that there was deemed to be sufficient and effective competition in this market, potentially based in part on effective upstream remedies;

- in any geographic markets that are competitive, we may still expect operators to seek to offer commercial active input products. This is because of the scale economics of communications networks, making it attractive to build scale at the wholesale level to reduce unit costs; and

- with respect to Openreach, the requirement for it to provide access to products supplied to other parts of BT on an equivalence of inputs basis is not dependent on BT having significant market power in the relevant market[33].

8.9 This consultation has considered a number of potential approaches to ex ante regulation that could be applied if enduring economic bottlenecks in next generation access networks were to emerge. Ex-ante regulation is usually only imposed after conducting a thorough market review under the EU Framework Directive. The process for market reviews is to define the relevant economic market(s), to assess competition in each market, in particular to assess whether any firms in that market have Significant Market Power (SMP), and to apply appropriate ex-ante regulatory obligations for any firms that are found to have significant market power.

8.10 Ofcom does not presume that any organisation that invests in next generation access services will have market power. It may be that the market structure for next generation access services means that there are no access network providers with market power. We would need to conduct a market review before identifying any next generation access provider as having significant market power. We have considered the policy issues that may arise if one or more next generation access operators were to be found to have significant market power.

The Undertakings

8.11 The Undertakings given to Ofcom by BT[34] are also relevant to next generation access deployments. Section 5.3 of the Undertakings states that significant market power products that are predominately provided using the physical and / or transmission layers of BT's access and backhaul networks shall be provided by a separate division within BT (now called Openreach). The definition of access networks includes the provision of both copper and fibre based access services to the end user. If in future Openreach provides new forms of network access product to other parts of BT, such as those based on next generation access networks, it must (except in certain specific circumstances) also provide it to other communications providers on an equivalence of inputs basis[35].

8.12 In addition, section 5.7 of the Undertakings make clear that if: a new Network Access is provided using BT's NGN; is based on MSAN access; is in a market where BT has significant market power; and the MSANs contains no network layer functionality then Ofcom can require that new Network Access product (and any relevant handover product) to be provided by Openreach. MSAN is defined as a Local Access Node in BT's NGN which is capable of supporting the provision of multiple services to End-Users whether over fibre or copper. This is significant as access to any active next

[33] Undertakings, section 5.46
[34] http://www.ofcom.org.uk/consult/condocs/statement_tsr/
[35] Undertakings,section 5.46.1

generation access wholesale services may take place at the MSANs and/or the Metro nodes (see Section 6 of this consultation). At the same time, the Undertakings require that products based on MSAN access must be provided by Openreach, and hence on an equivalence of inputs basis as described above.

Migration from existing regulation

8.13 Currently, local access network owners that are deemed to have significant market power are required to offer a range of wholesale access products under the ex ante framework. Following the deployment of next generation access networks, some of the access technologies that a local access network owner might choose to deploy may make it difficult or expensive to offer such products in future. As a result, some forms of next generation access deployment raise questions about the ongoing feasibility of today's regulatory remedies and products.

8.14 The actual treatment of current wholesale access products will depend on the technology deployed, the timescales over which it is rolled out, the location and reach of investment and the prospects for competition in next generation access. It may not be possible to provide a detailed approach on how these current regulatory wholesale access products will be dealt with until we have firm proposals on next generation access deployment on which to base this.

8.15 However, it is important that we provide as much clarity as possible on this issue. The future decisions that Ofcom takes about today's wholesale access products could affect both current access network owners' incentives to make an investment in next generation access as well as the incentives of competitive operators to invest in current and next generation access infrastructure.

8.16 Ofcom's role is not to protect any organisation's investments against market risks that may arise, for example from the emergence of new technology developments that supersede some operators' current market propositions. However, it is appropriate for Ofcom to consider operators' interests in terms of the availability of wholesale inputs, throughout the life of the assets in which they have invested i.e. to protect purchasers of today's regulatory products from regulatory risk of products being withdrawn in an inappropriate timescale. However, this is an issue of when, rather than if, existing regulation should be updated, withdrawn or replaced at some point in the future.

8.17 Ofcom remains committed to the supply of current wholesale products as set out in its market reviews. We are keenly aware of the risk that upgrades to existing bottleneck assets and an associated removal of current wholesale access products may pose to current competitive communications providers and hence consumer interests.

8.18 However, it is often the case that, at some point in the lifecycle of any wholesale product, it may no longer be sensible to continue to support the product. The specific timing of such decisions need to be made on a case-by-case basis, taking into account the prevailing market environment and the impact on consumers and industry from the removal of regulatory obligations to provide certain wholesale products.

8.19 Transparency in any decision to remove regulated wholesale products, including suitable signalling of intent and a well defined migration period for operators and consumers using these products is fundamental. We therefore think it is important to

outline the principles by which we would assess and address any next generation access deployment with respect to existing regulated wholesale products.

8.20 There are a range of factors for consideration in assessing the question of when existing regulation may need to be updated following next generation access investments. These include:

- the time competitors have had to recoup investments which rely on products resulting from current generation access remedies;
- whether further investment by competitors is likely in specific geographic areas. For example, the treatment of existing wholesale access products may differ between areas where there is current competition, or the prospect of competition, based on these products compared to areas where competitive investment using these products is unlikely;
- whether there are viable alternatives for competitors to the existing wholesale access products that will allow them to continue in competition, following a cost effective migration of existing customer bases;
- whether the removal of existing wholesale access products as a result of new network deployment is proportional when considering the balance of cost savings made available to the access network owner versus the risks to competition.

8.21 The first practical case where these issues will need to be considered is likely to be as a result of Openreach's proposals to deploy FTTH to new build premises from 2008. We examine this issue in Section 9.

Impact of existing regulation on next generation access deployments

8.22 In considering the incentives for efficient and timely investment in next generation access, the role of existing regulatory policy must be considered. It is important that existing regulatory policy does not disincentivise investments that would otherwise have been made. Recently, the most high profile example of where there have been claims that existing regulatory policy is hindering investment in next generation access is functional separation.

8.23 We do not consider functional separation and the Undertakings given to Ofcom by BT in lieu of a reference under the Enterprise Act have resulted in the inefficiently late deployment of next generation access.

8.24 In Europe, it is well-established that fixed telecoms is a natural monopoly upstream but has the potential to be competitive downstream. The way to deliver that downstream competition is through non-discrimination rules. Functional separation is a mechanism by which to ensure non-discrimination through the principle of equivalence.

8.25 Equivalence of input and functional separation have the potential to minimise the ability of upstream monopolists to discriminate, and remove the incentive for inefficient investment resulting from the ability to leverage upstream market power. It would be possible to improve a bottleneck asset owner's incentives to invest by allowing it to act anti-competitively by leveraging its market power in the downstream market – one of the major risks of regulatory forbearance on next generation access – but the cost of doing so is in terms of the long run dynamic benefits of competition.

8.26 In practice, the nature of any regulated access terms applied to next generation access investments is likely to have much more impact than equivalence of input or functional separation. It is for this reason that we consider it vital to adequately reflect investment risk in our regulatory approach to next generation access to ensure efficient investment incentives. This is expanded in Section 5.

Section 9

Next generation access and new build premises

9.1 While the timescale for wide scale next generation access in the UK is unclear, and may differ compared to some other countries, we are likely to witness smaller scale deployments in much shorter timescales. The first implementation of these new networks is likely to occur for developments of new housing. For these new build housing developments, the availability of next generation access is increasingly becoming a pre-requisite of the developers to ensure that their developments' communications infrastructure is 'future-proofed'.

9.2 The deployment of next generation access to new build premises is to be welcomed as bringing with it the opportunity to test new business models and the benefits of new services. However it does raise a number of specific policy challenges in addition to the principles and policy options outlined elsewhere in this consultation. These include the issues of technology selection, implications for current regulatory requirements, and new wholesale access products. In response to this challenge, we plan to develop an approach to next generation access deployments for new build developments that draws on the principles and proposed approaches outlined here. Given the specific nature of next generation access to new build premises, and the more pressing timescales, we are planning to formally consult on specific new build proposals towards the end of the year.

9.3 One of the first of these deployments may occur in the Ebbsfleet valley, where Openreach is planning to deploy FTTH. This is a pilot project for Openreach, to trial a new technology, and as such it is not necessarily appropriate that all existing regulation apply in its current form. Openreach have discussed with us their proposals for Ebbsfleet and here we set out our view on the competitive and regulatory implications, noting that this does not set any precedent for the regulatory policy that will apply to wider next generation access deployments.

9.4 Openreach is also consulting on its proposed point to multipoint unidirectional broadcast service, Integrated Reception System (IRS), which it intends to deliver over a parallel fibre deployed to new premises in Ebbsfleet. Any regulatory issues arising from this product will also be considered within our upcoming new build fibre consultation.

Next generation access to new build housing poses some specific challenges

9.5 The situation of new build housing where there is no existing access communications infrastructure raises a number of different issues. For example, the investor has a choice to make on the access network technology to deploy; if they choose wireline networks this could be copper, cable or fibre access networks.

9.6 Given that all wireline access network deployments in new build developments will incur civil works costs, including trenching and ducting, the cost variance between installing a current generation and next generation access network may be relatively small. At the same time, the total lifetime cost between current and next generation access networks for new build may be relatively similar – higher technology costs of next generation access networks may be outweighed by reduced ongoing costs of operation and maintenance. As a result, the economic case for deploying next

generation access networks to new build housing developments may be more attractive than for the upgrade of existing access networks.

9.7 While the deployment of next generation access to new build developments is unlikely to be wide scale in the near term by comparison to some announced international projects, they could still account for a significant proportion of the UK housing stock over time. In 2006, the UK Government announced a target of 2 million new build homes by 2016: a revised target of 3 million new homes by 2020 was announced in 2007. Today, it is estimated around 246,000 new residential and business premises are being built each year. New build housing will therefore account for up to 8% of the total housing stock by 2016.

9.8 However, the importance of these developments is not just around the total number of homes passed: it will be the first time that a next generation access network has been built on any scale in the UK. As such, these developments offer the chance to trial technologies and business models, develop applications, and demonstrate the feasibility of the next generation access to the home as a platform.

9.9 Ofcom is committed to ensuring the right regulatory environment is in place to support next generation access to new build developments, while at the same time continuing to protect consumer interests. Regulatory policy should seek to:

- provide clarity on the regulatory environment for investors in next generation access networks to new build developments;
- be consistent with our more general approach to next generation access outlined in this consultation;
- promote competition and innovation; and
- protect consumers' interests.

9.10 Next generation access networks for new build developments is likely to be a significant development for the industry in the near term. We therefore feel it is appropriate to consult on the specific issues this raises separately from the issues posed by wide scale next generation access deployment. This is in part due to the different challenges posed, but also as a result of the different timescales that may apply to overlay versus new build developments. Our consultation on this issue is intended to address two main issues:

- technology selection for new build next generation access networks; and
- how existing regulatory requirements may be met by these developments.

9.11 Our proposed new build fibre consultation will consider the issues posed for all parties who may become involved in the roll-out of next generation access networks to new build developments. Ofcom plans to undertake this consultation before the end of the year.

Technology selection

9.12 As we outlined above, investors' technology choice is fundamental to considering the most appropriate regulatory approach to adopt in order to promote competition in the presence of significant market power. New build next generation access could be delivered via a number of different technologies, including fibre, cable and wireless.

However, the current debate is largely around the available options for FTTH deployments. There are a number of technologies to deliver FTTH, but the most basic distinction is between point to point technologies and shared infrastructure technologies. The most prevalent shared infrastructure technology is a Passive Optical Network (PON).

9.13 The choice between infrastructure based on point to point or PON has significant consequences for the number of fibres that need to be laid: PON requires significantly less fibres compared to an equivalent point-to-point fibre roll-out. In its recent consultation on Ebbsfleet[36], BT Group outlined its view that PON architecture is a more cost effective technology for new build deployments. Its intention is therefore to deploy PON-based FTTH networks to all new build developments. Elsewhere, some investors continue to consider the options provided by point to point fibre.

9.14 As we outlined in the principles stated above, we do not believe it is Ofcom's role to recommend one technology architecture over another. However, we do feel it is important that the selection of technology should be an issue for broad industry discussion and debate in advance of deployment.

9.15 Technology selection also raises implications for regulation, both in terms of the promotion of competition and for existing regulation. Investors in new build require clarity on regulatory requirements to assess whether their technology choice enable them to meet their obligations.

Regulatory requirements

9.16 Where next generation access networks are deployed, we will need to consider how the existing regulatory framework will apply to them. As discussed above, our expectation is that the regulatory framework for next generation access will be implemented as part of the appropriate market reviews and the Undertakings, thus reflecting the evolving market environment. However, the expected scale of next generation access deployments to new build developments is likely to be relatively small in the near term and not material in comparison to the overall market. Based on that assumption, Ofcom does not expect that these changes would require Ofcom to immediately conduct a new market review.

9.17 In advance of the roll-out of next generation access to new build developments, we will need to consider how existing regulatory policy may continue to meet its underlying objectives with regard to both promotion of competition and consumer protection. This will be considered within the new build consultation. We have currently identified five areas of focus for the new build fibre consultation planned for later this year:

- **general conditions of entitlement** apply to all electronic communications network and service providers. Next generation access deployments may have implications for the means by which the general conditions can be implemented. We will therefore need to consider whether this has any significant consequences in practice. Examples of specific issues resulting from the deployment of next generation access include access to line-powered telephony. This has implications for the maintenance of emergency services access in the event of a power failure;

[36]http://www.openreach.co.uk/orpg/news/tiles/downloads/FTTP%20Industry%20Consultation%20Issue%201.pdf

- **wholesale broadband access and geographic markets** – the competitive environment that applies to new build developments in terms of wholesale broadband access may be different from adjacent areas served by other technologies, including copper, LLU and cable. We therefore need to consider the most appropriate approach to wholesale broadband access regulation in these areas. The choice of physical network architecture is not the only area of debate in considering next generation access network deployments. There is also a potential debate on the appropriate active line access interface for transmission and aggregation of end user services. There seems to be general consensus that wholesale Ethernet access is the appropriate interface. However, we feel there should be significant debate on this point;

- **wholesale local access and unbundling** – currently, one of the specified remedies to significant market power in this market is local loop unbundling. This remedy is technology specific, and may only be effective for specific technology deployments. Where operators choose to deploy GPON based FTTH, this remedy may no longer be practically viable. Ofcom understands that there are substantial challenges associated with unbundling PON technology, greater than or equal to those associated with sub loop unbundling discussed in Section 6. However, other forms of passive access may be more practical or effective in new build developments than for existing access networks. For example, information on the location and availability of space in new build ducting may be substantially better than in existing access networks. Therefore, we must consider whether there are more appropriate forms of passive access that could be used to address market power in wholesale local access services. These could include duct access or dark fibre services;

- **universal service obligation** – BT is the universal service provider for the UK, and is required to ensure that basic fixed line services are available across the UK. Consideration needs to be given to how specific requirements relating to universal service will evolve following next generation access deployment;

- **wholesale narrowband call origination** – currently, where there is significant market power in the market for narrowband call origination, there is a requirement to provide carrier pre-select (CPS), indirect access (IA) and FRIACO services. The CPS and IA remedies flow directly from the European directives and are mandatory where significant market power has been found in call origination. Following the deployment of next generation access in these areas, we will need to consider how these products will need to evolve in the new environment, including the appropriate functional specifications as well as processes and interfaces for competitors purchasing these services; and

- **residential and business exchange line services –** significant market power in these markets result in a requirement to provide wholesale line rental (WLR) services. This product is widely used by competitors to BT. The deployment of next generation access services may result in changes to the specification of this product, the interfaces used in its provision, or the technical ability to provide these services. Its evolution in a next generation access environment therefore needs to be considered carefully.

9.18 Ofcom considers that the new build next generation access consultation should be conducted on the basis of the principles and proposed regulatory approach outlined in this consultation document. In advance of the planned new build consultation, no regulatory decisions can be made on the long term regulatory environment that will apply to next generation access or fibre to the home for new build developments.

One of the first deployments is likely to be in Ebbsfleet

9.19 Ebbsfleet in the Thames Valley is likely to be the first large scale deployment of next generation access in the UK. Part of the Thames Gateway Kent Partnership Urban programme, Ebbsfleet Valley will incorporate 10,000 homes and 750,000 square metres of commercial space, transport and leisure facilities. The developer of this site has engaged Openreach to build a communications network for Ebbsfleet residential and business properties based on FTTH. The target completion date for the first batch of 300 homes is Q3 2008; at this time, the developer is seeking to have communications services based on fibre access ready for the first residents.

9.20 We consider it important to support new and innovative technologies and end customer services. Ebbsfleet is a good example of technical innovation that may lead to further application and service innovation and lessons for the wider UK. We are therefore keen to ensure that regulation does not unnecessarily hinder its successful execution. We understand that Openreach is considering the Ebbsfleet development as a pilot of FTTH services that it may later seek to deploy more widely. To this end, we wish to enable this pilot to proceed quickly and to generate useful lessons learned for all stakeholders, while at the same time protecting consumer interests and ensuring there is a diverse supply of communication services and providers for end customers.

9.21 As set out above, it is not necessarily the case that all existing regulation can or should apply to new build environment in its present form. However, the products and services to be trialled in Ebbsfleet need to be specified before we can develop the appropriate regulatory framework with the input of our stakeholders. We have therefore reviewed with Openreach, as the network operator in Ebbsfleet, the regulatory and competition implications of their planned product offering, in order to enable network build, service development and delivery to proceed as quickly as possible, whilst protecting consumers and competition. On the basis of these discussions it is our understanding that Openreach intends to meet all their regulatory obligations with the exception of the WLR and CPS functional specification as described below. It should be noted that Ebbsfleet is a pilot of technology and services, not regulation: it sets no precedents with regard to our future regulatory approach to next generation access of fibre to new build premises.

9.22 We are conscious that Openreach and BT Group would like to use the lessons learned and products developed to deploy fibre access services to a wider customer base, and welcome this use of the Ebbsfleet pilot. However, in advance of such a wider deployment, it is imperative that Openreach consults widely on this issue with its customers and other stakeholders, and consider the input from this consultation in its decisions surrounding fibre to new build premises. Ofcom will also need to consult on and define the regulatory policy that will apply to these wider developments.

9.23 It remains the responsibility of BT Group to ensure that, in delivering a fibre access network in Ebbsfleet, it meets all of the regulatory obligations incumbent upon it. We are also keen for BT Group and Openreach to engage and consult with the full range of its customers to ensure that their requirements are met as far possible within the Ebbsfleet, and wider new build next generation access, development.

9.24 Once Ofcom's approach to new build next generation access networks has been determined, and where proportionate, we would expect any necessary changes to be made so that Ebbsfleet conformed to the regulatory environment for wider new build fibre as far as technically and practically possible.

Proposed wholesale and retail services

9.25 In its consultation on Ebbsfleet, Openreach has proposed to develop a new wholesale access product, called Generic Ethernet Access (GEA), based on Ethernet. This product will have both voice and broadband specific versions, supporting communication provider provision of these services to end customers. The proposed voice product will have a bandwidth of 135Kbps and inbuilt quality of service compatible with existing PSTN voice services. The broadband product will be 10Mbps down stream and 2Mbps upstream uncontended service. It is also proposed to make a compatible interconnect product available at the exchange. The consultation suggested that the Generic Ethernet Access product will enable end customers to purchase both voice and broadband services from up to two different communications providers at the same time.

9.26 The definition of these products is still evolving, in particular service level agreements, processes and systems interfaces. Openreach have indicated that the Generic Ethernet Access products will be offered on an equivalent basis. The product will allow communications providers to provide a single bill to an end user. It will also allow the incorporation of supplementary services if required. It is Openreach's view that with Generic Ethernet Access as an input, communications providers should be able to offer a wide range of services. In order to do so, however, communications providers will need to provide more of the end user service functionality themselves. For example, communications providers purchasing the Generic Ethernet Access product will need a call server to route calls: this will no longer take place at the BT switch in the exchange. Whilst it is Ofcom's view that this offers more opportunity to communications providers to control the services they deliver, and therefore to innovate, we recognise that this may also increase the technical, operational and capital investment requirements for communications providers. As part of our New Build consultation, we will seek communications providers' views on this proposed product and approach in the longer term.

9.27 Some communications providers may not wish to implement call functionality and may prefer a simple reseller role as now. Ofcom would expect that Wholesalers would offer such a simple resale product where there was demand.

9.28 Openreach are continuing to review a number of different pricing approaches for these wholesale services. One such framework being considered is 'anchor product pricing'. Further details from Openreach are expected to be made available shortly.

9.29 If this is the commercial model adopted, this therefore presents an ideal test case for this emerging pricing approach. Ebbsfleet is an opportunity for industry to demonstrate that agreement can be reached on pricing of access to wholesale services outside of the anchor product without regulatory intervention. Ofcom will closely monitor the performance the commercial model applied, and the implications it has for communications providers and end customers.

Existing regulation and Ebbsfleet

9.30 It is incumbent upon BT to ensure it meets all its existing regulatory obligations in Ebbsfleet: as part of our discussions with BT we have identified. three main groups of regulation which apply:

- regulation arising from general conditions;
- obligations as a universal service provider; and

- regulations arising from market reviews.

9.31 **The General Conditions**[37] apply to all providers of electronic communications networks. They set out basic requirements such as interconnect and number portability as well as emergency services access and network integrity. In Ebbsfleet, BT will be required to fulfil all of the requirements placed upon it by the General Conditions. As fibre access networks are not line powered, the change of transport technology from copper to fibre will impact the implementation of those General Conditions associated with the Publicly Accessible Telephony Service requirement (PATS) for emergency services access. In the statement Regulation of VOIP Services, Ofcom set out the responsibilities for communications providers regarding the reliability emergency services access.[38] In this statement Ofcom imposed a mandatory code of practice that among other things required information to be given to customers explaining any limitations of the service, including the absence of line powering and its consequences in the event of a power failure. Additionally, Ofcom is currently consulting on mandating access to emergency services in the context of VoIP service providers and has already canvassed a number of views[39]. Within the Ebbsfleet development, Openreach has indicated that it will provide battery backup for the customer premises equipment used by the Generic Ethernet Access product and ensure customers are adequately informed of the implications of the Generic Ethernet Access product and the battery backup for their service. Openreach are continuing to review the technical options to support the provision of caller information for all calls to the emergency services.

9.32 **The Universal Service Obligation**[40] sets out services which BT, as a universal service provider, must provide in order to ensure that basic fixed line services are available at an affordable price to all citizen and customers across the UK. BT has informed us that it intends to meet its USO requirements within Ebbsfleet.

9.33 **Market reviews -** there are two main market reviews that may be impacted by the deployment of GPON based FTTH in Ebbsfleet:

- *Wholesale Local Access* **-** currently, one of the remedies to significant market power in this market is local-loop unbundling. This remedy is described in a technology specific way, as access to a metallic path facility. As a result, it is not required to be delivered in Ebbsfleet where there is no copper. At the same time, Openreach have chosen to deploy FTTH based on GPON technology. This is a contended access network that cannot support a functional equivalent to unbundling at the passive layer. Alternative options for passive input products are outlined in Section 6. However, at this time, Ofcom feels it would be disproportionate to require one of these remedies in Ebbsfleet, given the scale of initial rollout and the flexibility of the GEA product. This does not imply that the approach to wider next generation access in new build developments will not include passive input products.

- *Fixed narrowband wholesale exchange line, call origination, conveyance and transit* - BT have committed to meeting the underlying obligations addressed by WLR and CPS through use of the Generic Ethernet Access (GEA) product. As a raw, transport service, the GEA product should give communications providers greater opportunity to innovate and differentiate their services and as a

[37] http://www.ofcom.org.uk/telecoms/ioi/g_a_regime/gce/gcoe/#content
[38] http://www.ofcom.org.uk/consult/condocs/voipregulation/voipstatement/voipstatement.pdf
[39] http://www.ofcom.org.uk/consult/condocs/voip/voipservices/
[40] http://www.ofcom.org.uk/consult/condocs/uso/

consequence there may. be more onus on communications providers to implement internally functionality associated with both WLR and CPS which could previously only be implemented by BT. Examples of this include:

- WLR supplementary services including voice mail and 1471; and
- CPS as a wholesale feature

The GEA product seems unlikely therefore to meet all the current functional specification requirements for the WLR and CPS products even where it might meet the underlying competition concerns. If this is the case, Ofcom intends to consult on the possibility to exempt the Ebbsfleet pilot from meeting the functional specification requirement for CPS and WLR.

Additionally, the processes to order and implement the GEA service are likely to be, for Ebbsfleet at least, different from those for WLR and CPS: initially, some parts of the process may be less automated, though Openreach have confirmed that they will be provided on an equivalence basis to all downstream service providers. Given that the adoption of Ethernet products may raise challenges for communications providers Ofcom understands that Openreach will work with communications providers to promote a smooth transition.

In our view, it would not be proportionate to require BT to implement an exact replica of the current WLR and CPS products on the new FTTH network in Ebbsfleet, if the underlying competition concerns in these markets can be addressed by the Generic Ethernet Access product.

Like CPS, Indirect Access (IA) aims to promote consumer choice by enabling consumers to switch provider on a call by call basis. In practice it is implemented by BT through routing codes configured at the exchange switch. The architecture of next generation access networks and calling may not lend itself to an 'exchange' based implementation of IA services. BT has confirmed that it is continuing to assess technical options to support IA call routing at Ebbsfleet in order to meet this obligation,

Consumer experience in Ebbsfleet

9.34 Ofcom is keen to ensure that, as far as possible, there is no significant reduction in the level of choice in communications service provider for consumers in the Ebbsfleet development. We are encouraged by the Openreach product specification, industry involvement and indications of interest from a number of communications providers to provide service in Ebbsfleet using the Generic Ethernet Access product that customers in Ebbsfleet may have access to a wide of communications providers and services.

9.35 Nevertheless the consumer will have a different experience in Ebbsfleet in the short term at least. It is likely that residents and businesses in Ebbsfleet:

- may not be able to access the full range of propositions from all communications providers offered nationally;
- may be able to access some propositions that are not available nationally; and
- may face 'different' processes to other consumers, for example, when ordering.

9.36 We believe it is imperative that the building developer and Openreach work with third party communications providers to ensure that people who buy properties in the Ebbsfleet development are fully aware of the service differences in Ebbsfleet at the time of purchasing their homes. At the same time, we are keen for third party communications providers to take full advantage of the opportunity presented by Ebbsfleet to acquire valuable experience in fibre technology and to experiment with new and innovative applications and services.

Section 10

Next steps

10.1 The movement to next generation access networks comprises one of the most fundamental changes to the communications industry for many years. As a result, we are very keen to hear the views of a wide cross-section of stakeholders on the issues raised in this consultation. However, we believe this document is just one element of a much wider debate. We will be undertaking a number of activities over the next few months which are designed to facilitate this debate.

10.2 A central element of these activities will be an industry seminar, which is intended to address questions arising from the consultation itself and to provide a forum for initial discussion. We are then planning some more focussed engagements, including:

- technical discussions to consider the practical issues with developing a suitably flexible and high quality active line access product. These will be held with interested stakeholders on a bi-lateral and multi-lateral basis. The primary objective here is to work towards an industry consensus on the requirement for, and features of, such a product;

- technical and regulatory workshops on our proposed approaches to ensuring returns that adequately reflect risk incurred for those making risky investments in next generation access. These would include, for example, investigating views on the practical implementation of anchor product regulation; and

- national and regional meetings to consider in more detail the particular issues raised by next generation access for particular geographic areas and its relationship to a potential future digital divide.

10.3 Our objectives in undertaking these activities include gathering the views of as many stakeholders as we can, and ensure the evidence base used to determine our regulatory approach is kept up to date. We also wish to understand more about how our plans might work in practice and develop them accordingly. Understanding technology developments and the constraints these impose will also be important. However, perhaps the most important objective is to ensure everyone fully understands the approach we set out in this consultation, to allow them to comment on it and to provide as much regulatory certainty as possible.

10.4 In the spring of 2008, we intend to publish a statement on next generation access. This will take into account the many opinions we hope to have heard by then. It will set out the principles that we will apply to next generation access, as well as the way in which we will approach the application of these principles, in more detail. This will reflect any modifications to the approach given in this document that we feel are required in light of the opinions we gather. In doing so, we will balance as fairly as possible the varying needs and views of the diverse stakeholder community who will be affected by next generation access.

Annex 1

Responding to this consultation

How to respond

A1.1 Ofcom invites written views and comments on the issues raised in this document, to be made **by 5pm on 5 December 2007**.

A1.2 Ofcom strongly prefers to receive responses using the online web form at http://www.ofcom.org.uk/consult/condocs/nga/, as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response cover sheet (see Annex 3), to indicate whether or not there are confidentiality issues. This response coversheet is incorporated into the online web form questionnaire.

A1.3 For larger consultation responses - particularly those with supporting charts, tables or other data - please email clive.carter@ofcom.org.uk attaching your response in Microsoft Word format, together with a consultation response coversheet.

A1.4 Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.

Clive Carter
Strategy & Market Developments
Riverside House
2A Southwark Bridge Road
London SE1 9HA

Fax: 0207 981 3706

A1.5 Note that we do not need a hard copy in addition to an electronic version. Ofcom will acknowledge receipt of responses if they are submitted using the online web form but not otherwise.

A1.6 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together in the Executive Summary and at Annex 4. It would also help if you can explain why you hold your views and how Ofcom's proposals would impact on you.

Further information

A1.7 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Clive Carter on 0207 981 3541.

Confidentiality

A1.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, www.ofcom.org.uk, ideally on receipt. If you think your response should be kept confidential, can you please specify what part or whether all of your response should be kept confidential, and specify why. Please also place such parts in a separate annex.

A1.9 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and will try to respect this. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.

A1.10 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's approach on intellectual property rights is explained further on its website at http://www.ofcom.org.uk/about/accoun/disclaimer/

Next steps

A1.11 Following the end of the consultation period, Ofcom intends to publish a statement in Spring 2008.

A1.12 Please note that you can register to receive free mail Updates alerting you to the publications of relevant Ofcom documents. For more details please see: http://www.ofcom.org.uk/static/subscribe/select_list.htm

Ofcom's consultation processes

A1.13 Ofcom seeks to ensure that responding to a consultation is easy as possible. For more information please see our consultation principles in Annex 2.

A1.14 If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at consult@ofcom.org.uk . We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.

A1.15 If you would like to discuss these issues or Ofcom's consultation processes more generally you can alternatively contact Vicki Nash, Director Scotland, who is Ofcom's consultation champion:

Vicki Nash
Ofcom
Sutherland House
149 St. Vincent Street
Glasgow G2 5NW

Tel: 0141 229 7401
Fax: 0141 229 7433

Email vicki.nash@ofcom.org.uk

Annex 2

Ofcom's consultation principles

A2.1 Ofcom has published the following seven principles that it will follow for each public written consultation:

Before the consultation

A2.2 Where possible, we will hold informal talks with people and organisations before announcing a big consultation to find out whether we are thinking in the right direction. If we do not have enough time to do this, we will hold an open meeting to explain our proposals shortly after announcing the consultation.

During the consultation

A2.3 We will be clear about who we are consulting, why, on what questions and for how long.

A2.4 We will make the consultation document as short and simple as possible with a summary of no more than two pages. We will try to make it as easy as possible to give us a written response. If the consultation is complicated, we may provide a shortened version for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.

A2.5 We will normally allow ten weeks for responses to consultations on issues of general interest.

A2.6 There will be a person within Ofcom who will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organizations interested in the outcome of our decisions. This individual (who we call the consultation champion) will also be the main person to contact with views on the way we run our consultations.

A2.7 If we are not able to follow one of these principles, we will explain why. This may be because a particular issue is urgent. If we need to reduce the amount of time we have set aside for a consultation, we will let those concerned know beforehand that this is a 'red flag consultation' which needs their urgent attention.

After the consultation

A2.8 We will look at each response carefully and with an open mind. We will give reasons for our decisions and will give an account of how the views of those concerned helped shape those decisions.

Annex 3

Consultation response cover sheet

A3.1 In the interests of transparency and good regulatory practice, we will publish all consultation responses in full on our website, www.ofcom.org.uk.

A3.2 We have produced a coversheet for responses (see below) and would be very grateful if you could send one with your response (this is incorporated into the online web form if you respond in this way). This will speed up our processing of responses, and help to maintain confidentiality where appropriate.

A3.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore Ofcom would encourage respondents to complete their coversheet in a way that allows Ofcom to publish their responses upon receipt, rather than waiting until the consultation period has ended.

A3.4 We strongly prefer to receive responses via the online web form which incorporates the coversheet. If you are responding via email, post or fax you can download an electronic copy of this coversheet in Word or RTF format from the 'Consultations' section of our website at www.ofcom.org.uk/consult/.

A3.5 Please put any parts of your response you consider should be kept confidential in a separate annex to your response and include your reasons why this part of your response should not be published. This can include information such as your personal background and experience. If you want your name, address, other contact details, or job title to remain confidential, please provide them in your cover sheet only, so that we don't have to edit your response.

Cover sheet for response to an Ofcom consultation

BASIC DETAILS

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

Please tick below what part of your response you consider is confidential, giving your reasons why

Nothing ☐

Whole response ☐

Part of the response ☐

Name/contact details/job title ☐

Organisation ☐

If there is no separate annex, which parts?

If you want part of your response, your name or your organisation not to be published, can Ofcom still publish a reference to the contents of your response (including, for any confidential parts, a general summary that does not disclose the specific information or enable you to be identified)?

DECLARATION

I confirm that the correspondence supplied with this cover sheet is a formal consultation response that Ofcom can publish. However, in supplying this response, I understand that Ofcom may need to publish all responses, including those which are marked as confidential, in order to meet legal obligations. If I have sent my response by email, Ofcom can disregard any standard e-mail text about not disclosing email contents and attachments.

Ofcom seeks to publish responses on receipt. If your response is non-confidential (in whole or in part), and you would prefer us to publish your response only once the consultation has ended, please tick here. ☐

Name

Signed (if hard copy)

Annex 4

Consultation questions

Question 1 When do you consider it would be timely and efficient for next generation access investment to take place in the UK?

Question 2 Do you agree with the principles outlined for regulating next generation access?

Question 3 How should Ofcom reflect risk in regulated access terms?

Question 4 Do you agree with the need for both passive and active access remedies to promote competition?

Question 5 Do you consider there to be a role of direct regulatory or public policy intervention to create artificial incentives for earlier investment in next generation access?

Annex 5

Impact Assessment

Introduction

A5.1 The analysis presented in this annex represents an impact assessment, as defined in section 7 of the Communications Act 2003 (the Act). Although the strategy outlined in this document will be consulted upon during the usual regulatory processes as they are implemented, we have set out an impact assessment here to give stakeholders an early indication of the options that are being considered.

A5.2 You should send any comments on this impact assessment to us by the closing date for this consultation. We will consider all comments before deciding whether to implement our proposals.

A5.3 Impact assessments provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice policy-making. This is reflected in section 7 of the Act, which means that generally we have to carry out impact assessments where our proposals would be likely to have a significant effect on businesses or the general public, or when there is a major change in Ofcom's activities. However, as a matter of policy Ofcom is committed to carrying out and publishing impact assessments in relation to the great majority of our policy decisions. For further information about our approach to impact assessments, see the guidelines, Better policy-making: Ofcom's approach to impact assessment, which are on our website: http://www.ofcom.org.uk/consult/policy_making/guidelines.pdf

The citizen and/or consumer interest

A5.4 Next generation access network investments are one of the largest changes to the communications sector, raising the potential for wide reaching implications for consumers, citizens and the economy. The communications networks that are deployed following these upgrades offer the potential to support a range of new applications and services that can be used for the benefit of both consumers and citizens. They may also support new applications and business processes that could result in significant benefits to the UK economy. As a result, the timely and efficient deployment of next generation access networks may be of fundamental importance.

A5.5 At the same time, following deployments of these networks, we need to ensure that there is effective and sustainable competition. This can result in significant consumer benefits, as witnessed in the current generation broadband access market, in terms of choice, innovation, and prices. Following their deployment, we need to consider how a competitive environment can be fostered in next generation access networks.

A5.6 Whilst there is limited evidence of the benefits of next generation access at present, this is to some extent a chicken and egg problem – the benefits may not become clear until new applications and services are used, but the development of these new services may depend on the deployment of the new networks. There is now considerable evidence of the benefits of current generation broadband, and it seems reasonable that the next generation will have an even greater role to play in the UK economy.

A5.7 Our proposed policy approach is designed to:

- ensure investment in next generation access when the market determines it is efficient to do so;
- make that investment contestable, so that any players who see a business case have equal opportunity to execute it;
- ensure that there is strong competition in the subsequent delivery of next generation access services; and
- ensure that competitors have the greatest opportunity for innovation and differentiation that is economically sustainable.

A5.8 This extends the approach we use for current generation access, with additional measures to deal with the need for timely and efficient investment and an effective transition from the current networks to the new. This approach has led to some of the best outcomes for consumers with respect to broadband in the UK of any major country in the world.

Ofcom's policy objective

A5.9 Ofcom's policy objectives for next generation access flow from a number of statutory duties and powers relevant to next generation access deployments. In meeting those duties, Ofcom must have regard where relevant, in particular, to:

- securing the availability throughout the UK of a wide range of electronic communications services ;
- the desirability of encouraging investment and innovation in relevant markets ; and
- the desirability of encouraging the availability and use of high speed data transfer services throughout the United Kingdom.

A5.10 In order to assess the relative merits of different regulatory approaches to next generation access, it is important that we have an objective against which specific approaches can be measured. At a high level, our objective is to ensure that:

- the UK witnesses timely and efficient wide scale, market led investment in next generation access networks and services that meet residential consumer and business customer demands. The environment to enable these investments should be supported, where necessary, by proportionate and timely regulatory intervention; and.
- that there is a competitive environment for the delivery of next generation access services that facilitates service and business model innovation and experimentation, and that allows service differentiation based on wholesale inputs.

A5.11 The success of Ofcom in achieving these policy objectives will in part be measured by the final outcome in terms of next generation access investments being made in a timely and efficient manner. A successful outcome will be for the UK to see:

- operators investing in next generation access networks as soon as it is economically efficient for them to do so, and regardless of what other operators of doing;
- that these networks are deployed in the most efficient way, using the most appropriate technology;
- that consumers of existing services are not disadvantaged as a result of the deployment; and
- that diverse and innovative competition continues to deliver the consumer benefits we see with current generation access.

A5.12 More detail on the regulatory challenges posed by next generation access, and Ofcom's policy objectives can be found in section 4 of this consultation. Specifically, it should be noted that the preferred options outlined below would be implemented thought either market review, based on the outcomes of those reviews, or the Undertakings. In either case, Ofcom would consult further on the most appropriate option, and would be required to perform a further impact assessment on basis of the evidence at the time.

Analysis of the options considered

A5.13 Current regulatory policy relating to access networks has been formulated based on the history of current access network investments. The policies that apply to access networks adopted by Ofcom and other European regulators have been based on the existence of existing copper networks that constitute an enduring economic bottleneck and are characterised by high levels of sunk costs and high demand certainty. Access network owners have already recouped their initial investment in these networks during the period of state owned monopoly. In this environment, the correct approach to promoting competition was to mandate access on cost based terms.

A5.14 Next generation access poses a new set of questions, given that there is significant risk involved in their deployment, including demand side uncertainty. As a result, in this environment, it may not be appropriate to simply roll-over our existing regulatory approach to these new networks. This is explored in more detail in Section 4.

A5.15 Therefore, we considered a wide range of options that could deliver on our objectives of securing efficient and timely investment and ensuring a competitive environment for the delivery of next generation access services.

A5.16 We identified five main options that could be employed to secure efficient and timely investment, and assessed their advantages and disadvantages, as summarised in Table 4. The full range of options assessed as part of this consultation to are explored in more detail in Section 5.

Table 4: Options to secure efficient and timely investment

	Advantages	Disadvantages
Contestability	• Altnets able to invest ahead of SMP operators • Incentivises next generation access operators to develop high quality active line access product	• Risk of inefficient investment by operators attempting to foreclose competition
Risk reflective returns	• Investment incentives may be skewed by the risk of price regulation distorting the expected returns on investment	• Wrong risk factor might be applied to investments • May incentivise inefficient investment through regulatory arbitrage • Difficulty in Ofcom committing to terms
Regulatory certainty	• Certainty on the regulatory policy that will apply to next generation access investments is necessary for investors to make informed choices and reduce uncertainty	• We may be limited by the level of certainty we can provide in advance of deployments, both in terms of proposed policy, and in terms of the period for which a specific policy will apply beyond the period of a current market review
Regulatory intervention	• Regulatory intervention to incentivise investment may result in earlier deployment of new infrastructure	• Interventions to accelerate or promote investment risks distorting efficient investment incentives, and result in investment that is too early • The risk surrounding next generation access investments would be passed to consumers, potentially resulting in higher prices
Forbearance	• Removes risk that price controls distort investment incentives	• May enable operators to acquire and exploit SMP • May encourage inefficiently rapid over investment

A5.17 Our preferred approach to securing efficient and timely investment is to ensure that the incentives for investment are right for the market to make this investment. This can be achieved by ensuring that both risks are adequately reflected in the terms of regulated access and that investments are contestable. These combine to provide good incentives for investment by both operators with significant market power, while at the same time retaining the option for investment by third parties in advance of a significant market power operator. The remaining options considered, including forbearance and regulatory intervention, raise significant concerns relating to the distortion of efficient investment incentives or the risks of significant market power. A detailed assessment of why these options are preferred can be found in Section 5.

A5.18 In promoting competition in next generation access networks, we identified two main options – competition based on passive and active wholesale access products. For each of these options, there is a range of specific wholesale products that could be used to promote competition. A summary of the full range of options assessed for the promotion of competition following next generation access deployment, and a summary of their benefits and risks, are outlined below. More detail on these options can be found in section 6.

Table 5: Options to promote competition following next generation access deployment

		Advantages	Disadvantages
Passive	**Duct access**	Greatest scope for innovation and differentiation based on full alternative end-end network infrastructure	Potentially limited practicability in UK given anecdotal evidence and uncertainty on available space in ducts
	Sub-loop unbundling	Large scope for product and service innovation	Small number of customers served from each cabinet may limit ability to gain scale and impact on economics
	Fibre unbundling	Large scope for product and service innovation	May be technically difficult depending on fibre architecture selected
	Wavelength access	Large scope for product and service innovation. High bandwidth per customer	Expensive equipment required, limited commercial deployment so far
Active	**Active line access at cabinet**	Most flexible form of active line access, nearest to the customer and requiring least aggregation	Potential duplication of backhaul equipment at cabinet by multiple operators
	Active line access at exchange	Avoids duplicate equipment at cabinet	Reduced ability to differentiate given aggregation occurring between cabinet to exchange
	Active line access at core/metro node	Minimal investment in infrastructure required by competitors	Highest requirement for aggregation, possibly resulting in least prospects for innovation and differentiation

A5.19 On promoting competition, our preferred options depend on the next generation access technology deployed. Given an assessment of the relative benefits and risks arising from each of these products, our preferred approach by technology is:

- for FTTC deployments, Ofcom proposes the following two remedies, which we believe will compliment each other:
    - sub-loop unbundling of the copper line at street cabinets, with appropriate supporting backhaul products; and

- active line access - a high quality, flexible, Ethernet based, wholesale product available at a number of points in the network.

Given the various uncertainties that surround next generation access, Ofcom believes it is premature to select between these options; both have their own potential merits and drawbacks. Our proposed alternative is therefore to retain both remedies in the medium term.

- For FTTH deployments, we propose a remedy based on a high quality, flexible, Ethernet based, wholesale active line access product available at a number of points in the network, given the challenges faced by passive access products in FTTH deployments.

A5.20 A more detailed assessment of the rationale for preferring these options is included in Section 6.

Annex 6

International regulatory approaches

A6.1 The European debate on the most appropriate regulatory approach to next generation access has demonstrated the wide range of diverse situations and characteristics that different countries face. However, there are a number of specific positions emerging. We summarise these positions below.

Germany

A6.2 The debate continues on the issue forbearance for VDSL services that are not substitutable by current generation broadband products. However, at the same time, BNetzA has indicated its preferred approach to promote sub-loop unbundling by allowing alternative communications providers to gain access to Deutsche Telekom's ducts between the cabinet and the exchange. This would allow them to replicate Deutsche Telekom's backhaul from its VDSL cabinets. However, the consultation makes no reference to terms for access to Deutsche Telekom's cabinets.

France

A6.3 ARCEP has discounted sub-loop unbundling as a potential remedy on the basis that FT's network topology is not suitable for a FTTC with VDSL deployment. It is therefore focussing on options to ensure end-to-end competition in access networks. Therefore, it is seeking to 'mutualise' next generation access investment i.e. sharing common costs and bottleneck assets, typically ducting and in building wiring. It is therefore focussing on:

- access to France Telecom's ducts – given the Commission's unfavourable current position on duct as a new market under the EU framework, ARCEP is exploring whether it can mandate duct access as an ancillary service in support of physical unbundling. It released a consultation on this subject in June 2007.
- promoting municipal duct access – France continues to promote usage of municipally owned alternative utility wayleaves and ducting; and
- in building wiring – given the high proportion of multiple dwelling units in French cities, ARCEP is concerned that building access, including in-building wiring, does not become a new bottleneck. It is therefore exploring options for an industry agreed approach to sharing of in-building wiring. It released a consultation on this subject in June 2007.

Netherlands

A6.4 OPTA originally favoured sub-loop unbundling as the best approach to enduring economic bottlenecks in next generation access deployments. Following Analysys' assessment of the commercial feasibility of this remedy , it has modified its position, seeking to:

- promote a commercially favourable sub-loop unbundling product wherever possible, in part through discussion with KPN and Altnets to ensure the most favourable terms possible for sub-loop access. This may result in a limited degree of sub-loop unbundling, either in the largest exchanges or for business

customers. One LLU operator is apparently interested in the sub-loop unbundling product;

- encourage KPN to come to commercial agreement with LLU operators on compensation payments to be made in advance of exchange closures; and

- ensure KPN offers a high quality layer 2 wholesale access product which offers the greatest degree of flexibility to communications providers for innovation and service differentiation.

A6.5 OPTA has encouraged KPN and alternative operators to seek commercial agreements relating to network access. In July 2007, OPTA was notified that KPN had concluded memoranda of understanding (MOU) with three alternative operators regarding future use of MDF sites, unbundling at the street cabinet and WBA access, and KPN will offer these terms to other alternative operators. OPTA will take these MOUs into account during its market analysis, due to be published by the end of 2007.

European Regulators Group

A6.6 The focus of the ERG has been to determine how the current EU framework could be applied to next generation access deployments. It has recently issued a consultation on regulatory principles under next generation access which discusses potential market definitions and regulatory remedies under next generation access. Overall, it recommends:

- that the market definition for market 11 (wholesale local access) be modified to become technology neutral, as opposed to copper access network specific;

- that the definition of market 12 (wholesale broadband access) incorporates higher speed broadband services, and therefore requires no modification;

- that the available remedies for significant market power in next generation access networks are:

    - layer 0 products e.g. physical access to ducts, enforced as an ancillary service to unbundling remedies (i.e. duct access to allow cabinet to exchange backhaul to make sub-loop unbundling feasible);

    - layer 1 products, specifically sub-loop unbundling for FTTC deployments, with various ancillary services required to make this feasible (e.g. co-location at the cabinet etc)

    - layer 2 products e.g. next generation access wholesale active line access in the event that upstream layer 1 remedies are not effective.

USA

A6.7 The US continues to favour forbearance of wholesale access regulation, relying instead on the duopoly between cable and fixed operators in the majority of areas. This is having a number of side effects – the number of ISPs in the US has concentrated significantly, with the only real choice now from the vertically integrated downstream arms of cable and telecoms network companies. This has resulted in an increasing focus on the market power that these companies may

have elsewhere in the communications value chain, manifesting itself in the highly political and vocal net neutrality debate in the US.

Japan

A6.8 Infrastructure competition has been promoted, with official guidelines sanctioning the use of public utility infrastructure for the use of fibre deployments. This has seen multiple operators deploying access fibre in some areas, often using the same infrastructure. Unbundling of fibre local loops has been specified as a remedy by the regulator. The cost-orientated fibre local loop access charge was set for 7 year period in 2001 at ¥5,074 / month, reflecting higher fibre costs in the early period of the settlement being offset by savings in the latter half of the review period., Discussions are taking place regarding alternative operator access to customer optical termination equipment, described as 'logical layer unbundling'.

Spain

A6.9 CMT recently consulted on the regulation of next generation access in Spain, seeking opinions on issues regarding the applicability of regulation both during and after a transition to next generation access. In particular, CMT consulted on whether an obligation to provide dark fibre should form part of market 11, and how sub-loop unbundling and co-location should be implemented. CMT also consulted on whether relevant markets for physical infrastructure (ducts and poles) are required.

Italy

A6.10 Debate in Italy has centred on functional separation and 'equality of access' as a remedy to Telecom Italia's significant market power in the access network. AGCOM has proposed requiring Telecom Italia to provide access to duct, as well as an obligation to offer sub-loop unbundling and collocation (for FTTC) or access to fibre (dedicated or wavelength WDM), along with an active line access next generation access product. AGCOM is considering imposing on Telecom Italia an obligation to provide backhaul from the cabinet to the alternative operator's point of presence for VDSL deployments with dark fibre or an active bitstream product.

Belgium

A6.11 In Belgium, BIPT has intervened to impose conditions on Belgacom's reference unbundling offer to prevent interference from Belgacom's FTTC/VDSL deployment from preventing continued use of alternative operator's exchange based DSL services, with changes in the reference offer being subject to BIPT's approval.

Annex 7

Anchor product regulation

Anchor product regulation as an approach

A7.1 The attraction of both anchor product regulation and approaches where upstream access prices are set by the asset owner is that both would promote efficient and timely investment by leaving the risk and reward related to the capabilities of next generation access with the investor. This is achieved by allowing experimentation to learn about customer preferences and therefore optimal investment over time and by ensuring that investment is not motivated by an opportunity to escape from existing obligations. In assessing anchor product regulation, it is useful to consider the merits, drawbacks and requirements for anchor product regulation to work in practice.

A7.2 Anchor product regulation is an approach to regulation, rather than a detailed regulatory remedy, and can take several forms, depending on the weighting given by the regulator to several policy objectives, for example the promotion of competition, the promotion of investment and the promotion of the availability of services to consumers. Because of this, the exact form of anchor product regulation adopted will be dependent on these weightings, and beliefs about the potential evolution of market. Potential examples of anchor product regime are outlined below; these are neither definitive nor exhaustive.

A7.3 In a ‘static’ anchor regime, the anchor product is defined and priced at the start of the regime such that consumers are not made worse off by taking the product. This suggests a definition of an anchor product being similar to those of current generation broadband at the time the anchor is imposed, at a price akin to that of existing current generation broadband. The anchor definition and price do not vary over time, and the next generation access platform operator has pricing and product definition flexibility over all other products deployed on the next generation access platform. In situations where LLU is maintained alongside a next generation access deployment, LLU could act as the static anchor. Although a static anchor may provide the greatest incentive of any anchor product approach for investment in next generation access by providing maximum scope for pricing flexibility (which increases over time), it may be felt less appropriate if it is felt that there is a risk that the anchor will fail to remain a constraint on the pricing of higher bandwidth products if the chain of substitution weakens.

A7.4 A ‘floating’ anchor product can be adopted to potentially mitigate the risk that the anchor fails to remain an effective price constraint on higher bandwidth products over time by incorporating a mechanism to update the anchor product over time, and also to take account of market conditions and to potentially address wider concerns about consumer access to higher bandwidth services. How, and in what way the anchor product floats may vary, but could for example, be based on actual improvements in average copper DSL speeds and quality. This means that as well as ensuring that consumers are not made worse off by the adoption of next generation access, such a ‘floating’ anchor might be used to ensure such that consumers are not worse off than they would have otherwise been if the investment had never been made and had remained using a copper DSL product.

A7.5 An even more interventionist form of anchor product regulation might be suggested if there was a primary concern to minimise the ability of the next generation access platform operator to make supernormal profit from its next generation access deployment. Under this form of 'rapid floating' anchor product regulation, the regulator may modify the anchor specification and pricing on a relatively frequent basis to reflect hypothetical improvements in broadband over time. Whilst this approach is less likely to raise concerns about the continuing ability of the anchor to restrain the pricing of other products, and may address concerns about access to high speed broadband services in some areas, it might provide the lowest incentives to invest in next generation access of all the three examples of anchor product regulation.

Requirements of anchor product regulation

A7.6 Anchor product regulation is an emerging area of thought, and one that has very limited practical implementations. In structuring any approach based on anchor product regulation, it would be necessary to address a number of specific issues. These are:

- flexibility in wholesale prices;
- co-existence of with other remedies and pricing approaches;
- initial definition of the anchor products;
- evolution of the anchor product over time; and
- conditions and triggers for migration away from anchor product regulation.

A7.7 **Wholesale prices** - Often, the concept of anchor products is considered in terms of the retail proposition to end customers. This is where operators can seek to improve returns on investment through price differentiation. However, in order to support retail price differentiation, there also needs to be wholesale price flexibility. If price flexibility is permitted downstream but not upstream, then price differentiation downstream on the basis of upstream service attributes such as bandwidth, contention, symmetry will not be sustainable due to the risk of arbitrage. At the same time, as we mentioned above, if a bottleneck access network owner is able to make profit on anticipated access revenues, rather than in leveraging upstream dominance in downstream markets, it may have weaker incentives to discriminate against its downstream competitors.

A7.8 **Co-existence with other remedies** –as we mention above, this approach is based upon a bottleneck access network owner offering upstream access at variable qualities of service for differentiated prices. Therefore, it is ideally suited to the pricing of access to active network elements (e.g. active line access services). However, this approach may also need to co-exist with other upstream remedies based on access to passive network elements, for example, duct, or unbundled sub-loops. These remedies have also traditionally been based on a cost plus basis, and may not be suitable for an anchor product type arrangement. How two forms of mandated access to passive ad active elements of the network may work in practice are explored in the next section. However, it would be necessary to ensure that there is no potential for one to undermine the other.

A7.9 **Initial definition of anchor products -** anchor product regulation is dependent on a firm definition of the anchor product being laid out. This definition needs to cover four factors:

- *Services* – to date, customers retain the choice of having voice only or voice and broadband services. In the future, these choices may expand to cover voice only, broadband only and voice and broadband services. In defining the anchor products, it may be appropriate to define anchors for to support all three of these options.

- *Service characteristics* – in defining the anchor product, a number of service characteristics that are specific to the access product could be taken into account, including: downstream and upstream bandwidth; degree of symmetry; contention rates; failure rates and repair times. In order to define these metrics, a number of mechanisms could be used. However, there may be some service characteristics that it would be preferable not to have in anchor product e.g. cross talk and interference. The available approaches to defining the anchor are outlined in the table below:

Table 6: Approaches to defining the anchor product service characteristics

Basis	Rationale
Current DSL connections	There are a number of ways that current DSL services could be used to define the anchor product: • using 'average' broadband connection would be used to avoid the issue of 'headline' speeds and of variability in the quality of service DSL offers to different customers. However, any form of average may mean that, while the anchor product s better that what some customers can receive over broadband, it is worse for others. • Best of breed current DSL could be used to define the anchor product. However, this could risk specifying the anchor product too highly (e.g. at 24Mbps), limiting options for differentiation through higher quality services As average DSL connection speeds improve, so the anchor product may evolve. This is explored further below.
Service characteristics of all broadband products	The above approach could be expanded to include all competitive access products, including DSL, cable and wireless services
Service thresholds required for specific applications and services	Anchor products could be defined on specific thresholds required for identified services that customers may wish to purchase. For example, a single MPEG-4 HDTV channel may require downstream bandwidths of 7-9Mbps. However, this approach requires the regulator to determine which services should and should not be supported by the anchor product.

- *End customers* – different customer segments require different quality of service and characteristics from their broadband connection. It may therefore be necessary to define different anchor products for different customer groups. The intention would not be to have a plethora of anchor products for a multitude of customer segments. However, there may be some customer groups which have clearly differing needs, for example residential consumers and small business customers.

- *Price* – one of the aims of anchor product regulation is to ensure that, in the migration to next generation access networks, no customers are made worse off. It would therefore look to use existing retail prices as the basis for price setting. However, the anchor product price defined would need to be a wholesale price – some consideration of the cost of retail service provision would need to be made. Therefore, prices could be set on retail minus basis, using the prevailing price for today's broadband services, or could be based on existing wholesale prices for toady's broadband services (e.g. IPStream). Consideration of the actual cost of the anchor product would not be appropriate given the large degree of common costs a next generation access network is likely to have across both anchor and non-anchor products.

A7.10 Correct definition of the anchor product is vital for this approach to be successful. If the initial definition of the anchor product is too low compared to other non-anchor products, it may be that this product does not act as an effective substitute for non-anchor products, breaking the chain of substitution and increasing the risk of a bottleneck asset owner leveraging market power in these non-anchor products. Alternatively, if the anchor product is highly specified, the ability to offer price differentiated higher quality products may be reduced, affecting incentives for investment.

A7.11 **Evolution of anchor products** – anchor products and prices may need to evolve over time to maintain parity with either copper based broadband services, or broadband services available on other platforms. Over time, the service characteristics on offer over copper may change – average bandwidths may increase with technological development, prices may fall further. At the same time, customer demand and expectations from a 'basic' broadband service may change significantly, especially if consumption of HD video content takes off. These variations could be reflected in the anchor product specification to ensure dynamic consistency between copper and the anchor product. Such a dynamic definition would improve the prospects that the anchor product continued to provide a constraint on potential market power in the provision of non-anchor next generation access services.

A7.12 **Triggers for migration from anchor product regulation** – there might at some point in the future be a need to transition to an alternative form of regulation. This could arise if:

- anchor product regulation no longer provided sufficient assurance against abuse of dominance in the access market

- access platform competition including cable, satellite TV and wireless develops further may be more likely to develop as effective restraints on market power under anchor product regulation, since pricing flexibility and price differentiation increase the prospects for cost recovery for all players in the market.

- the flexibility offered by anchor product regulation may also allow long term contracts to emerge, offering a different form of constraint on market power; or

- the demand and cost uncertainty of the next generation access investment will decline over time, as consumer demand for products and willingness to pay will become clear and the cost of the next generation access becomes clearer.

A7.13 It is important for investors in next generation access to have clarity on the potential reasons and approaches to the migration away from anchor product regulation. Many of the above reasons revolve around the assessment of market power, and would be considered within the process of market reviews. However, the last is an example where there may still be market power, but anchor product regulation is no longer appropriate as the market for next generation access services has moved on to a different lifecycle. In this case, it may be appropriate to transition to a different form of access regulation.

A7.14 When any such transition would be appropriate could be defined in advance by a number of specific triggers, including:

- Profitability – evidence of 'excess' profitability could suggest that an anchor product approach is not effectively constraining any market power in bottleneck next generation access networks. However, excess profitability is difficult to determine, and using it as a trigger to transition away from anchor product regulation would raise the same issues for skewing expected returns and investment incentives that anchor product regulation is attempting to avoid. Such profitability measures may also incentivise perverse behaviour by asset owners, including cost inefficiency or inefficient levels of investment on which profitability measures are assessed.

- price benchmark – this approach would seek to benchmark retail and wholesale prices charged for next generation access service across different operators, regions or countries. However, it would depend largely on the individual competitive environment, consumer propositions and the regulatory environment in the benchmark countries. All of these factors may make this approach, on its own, unsuitable for assessing the effectiveness of the UK regulatory regime.

- Time based – a simple trigger for regulatory transition would be to define a period for anchor product regulation to apply. This approach has the benefit of providing certainty for investors on the regulatory environment that investments were made. However, it is relatively arbitrary – access owners may still not have made a return on investment in the period identified. This approach may also suffer from low credibility – under the European framework, it is hard for regulators to make such commitments. This is in part because the findings of one market review cannot bind the findings of a subsequent one.

- non-anchor product market share – another trigger may be the proportion of customers who are purchasing non-anchor products. A specific threshold could be set, for example, 50% of customers. This may be based either on the share of customers on a bottleneck asset owner's network taking non-anchor products, or the share of the total relevant economic market on non-anchor products. There is some risk that this trigger could be affected by the access network owner, either by raising the specification of anchor products, or reducing the specification or raising the price of non-anchor products in order to remain within the threshold for review. However, these activities may in themselves present evidence for a review of the approach.

A7.15 Ofcom would continue to monitor the performance of anchor product based regulation over time, looking at each of these measures periodically within the process of market reviews. However, we may indicate that, absent any evidence of anti-competitive behaviour or the leveraging of market power, one or more would constitute an appropriate trigger to consider transitioning to a new regulatory approach. In practice, none of the above mechanisms to trigger a review of anchor product regulation may be satisfactory in isolation.

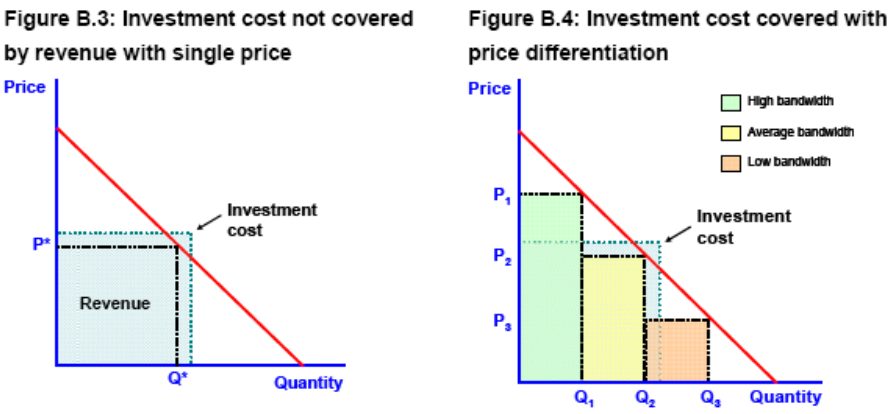
A7.16 It should be noted that these triggers would only be appropriate to commence a review of the competitive environment and regulatory approach adopted for next generation access networks – it would not necessarily suggest an automatic transition to a new form of regulation.

Merits of anchor product regulation

A7.17 Anchor product regulation has advantages over the more simplistic approach of allowing access owners to set upstream prices completely independently of the regulator. They provide the option for continuity in service pricing and quality for end users during any transition from current to next generation access networks. At the same time they also provide discipline on potential abuse of dominance via a chain of substitution at the retail level between the anchor product, which is price regulated, and non-anchor products, which are not. As a result, anchor products could provide a degree of assurance for individual end users that they will be made no worse off by the transition to next generation access since they can continue to purchase products with the same capability and at the same price that they currently pay - investment can be considered an actual Pareto improvement.

A7.18 Anchor products provide a high degree of flexibility for investors in new access networks, allowing the option to secure higher returns for new or higher performance services. This flexibility also provides operators with an ability to experiment with service offerings and tailor them to end customer needs. Such price differentiation is also welfare enhancing. Price differentiation also allows access network owners to capture more of the value that customers place on next generation access services, which could in turn allow investments to take place that would, with a single price, not be possible. This is unlikely to be possible under a flat rate pricing system (such as cost based pricing).

Figure 11: Price differentiation may enable investments to proceed



Source: *Indepen Consulting*

A7.19 One key consideration in any approach that is not based on a regulated price being set is the risk of margin squeeze by the access network owner. It is useful to think about how anchor product regulation may influence the ability and incentives for margin squeeze by access networks owners.

A7.20 With retail minus and anchor product approaches, which involve greater pricing flexibility at the access level, there may be greater scope for margin squeeze compared to cost based forms of regulation. However, if a vertically integrated next generation access investor is allowed to take profit from the upstream wholesale products then it has much weaker incentives to discriminate against rivals in the downstream markets. This is particularly important given the growing importance of downstream applications in terms of competition and innovation. On its own this consideration might not eliminate the incentive to discriminate, however, other considerations in relation to next generation access would also appear to reduce the incentive to discriminate.

A7.21 In particular, the elasticity of demand for higher bandwidth services over next generation access may be higher (and more uncertain) compared to voice or basic broadband over copper access. This, combined with a proliferation of downstream services and recognition that others might help increase overall demand for next generation access, could act to diminish incentives to discriminate.

A7.22 Finally, an approach based on anchor products requires less information on the part of regulator than some other approaches, at a time when information asymmetries can be expected to be large.

Drawbacks of anchor product regulation

A7.23 One of the major drawbacks to anchor product regulation is the need for co-operation amongst stakeholders in the negotiation and agreement of access terms. In the event of any complaints being raised on access terms, prohibition of margin squeeze would be covered by competition law, and could result in ex post price regulation as a result of complaints as opposed to ex ante price regulation of services. If this is a likely outcome, it may be more suitable to determine prices ex ante in order to provide clarity on the terms of access and to ensure that, before the conclusion of any margin squeeze assessment, no parties can gain a competitive advantage in terms of market share. This may be of greater significance in fast growing markets.

A7.24 However, it may be the case that private contracts are also more likely to emerge in an environment where there is considerable flexibility and a credible commitment to a degree of forbearance so that there are incentives for access providers and seekers to negotiate over the allocation of risk, and to negotiate with one another rather than resorting to seeking to influence a regulatory determination of access terms.

A7.25 The approach is based on the ability to differentiate services to end customers. This requires differentiation at the wholesale level as well. Therefore, as an approach, it is only applicable to those access services that support differentiation. The following section explores specific access services, but in general it is the case that access to passive elements of an access network are less likely to be able to support differentiation that access to active elements. This approach may therefore only really applicable to access to active elements of a next generation access network.

Annex 8

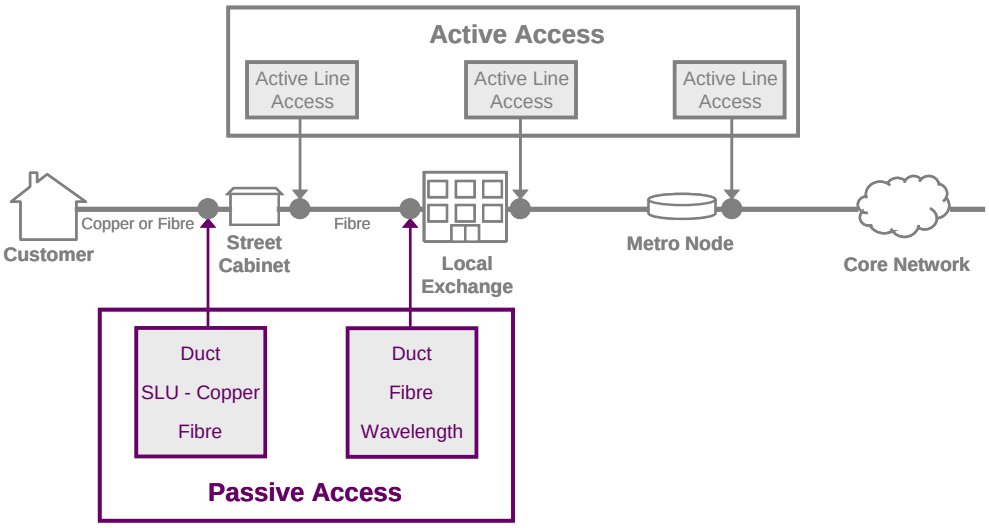
Options for the location of competition

A8.1 The range of possibilities, and the optimum choices, will vary depending on the network architecture and technology choices made by the dominant operator. The main options under the most likely architectures, FTTC and FTTH, are discussed below. To ease the discussion of the various locations at which competition can take place, we have subdivided the wholesale inputs that the competitive operator would purchase into several categories:

A8.2 **Passive inputs** - the options for passive inputs can all be considered to fit into either the category of **duct access** or **unbundling**.

A8.3 **Active inputs** - there is less variation in active inputs. All possibilities can be considered to be forms of **active line access**.

Figure A12: Options for competition based on passive inputs



Source: *Ofcom*

Passive inputs – duct access

A8.4 Duct is the name commonly used to describe the buried infrastructure, usually some sort of solid tube, through which a network operator's cables run on their way to customer premises. Installing duct is very expensive as it usually involves digging trenches along the entire route, with all the disruption that entails. As a result, it can account for up to 70% of deployment costs for underground next generation access networks. With duct installed, it may be possible to install additional or alternative cables in the ducts without requiring additional digging, greatly reducing incremental costs. A competitive operator buying duct access as an input to deploying their own network, would obtain the right to install their own cables in the dominant operator's existing ducts.

A8.5 Of all the passive options considered here, this is the most basic, and therefore potentially the most flexible of inputs. The competing operator can choose the type of cable to install (e.g. copper pairs, coaxial copper, optical fibre) and then has complete choice of the technology they deploy to deliver signals across this

infrastructure. Regardless of the choices made by the duct owner, the competitor could choose, for example, xDSL, DOCSIS (cable modem standards), point to point fibre, or passive optical networks, subject only to any architectural constraints imposed by the layout of the ducts themselves. This high level of flexibility leads to the greatest opportunity for innovation among all the competition options.

A8.6 An obvious drawback comes from the need for the competitor to deploy so much of their own infrastructure; it is the most expensive option. It also involves the greatest duplication of assets between the networks of the operator with significant market power and their competitor or competitors.

A8.7 Alongside the economic challenges, there are a number of practical issues that would need to be addressed for duct access to be viable. In the case of a next generation access network built from scratch using all new ducts, the practical problems may be trivial. Being new, such a duct network is likely to be in good condition, be well documented and have vacant space within it. Indeed, it may make the deployment of a new duct network more economically viable if it is specifically designed to support multiple operators from the outset.

A8.8 Most of the practical problems of duct access are related to the sharing of an existing network, such as that owned by BT. Such duct networks have been built gradually, to specifications which have varied over the years. The first major issue is that there may not even be continuous duct all the way to the customer. Even where ducts are present, they may be in poor condition, or already full of cables, both of which could make them unsuitable for sharing.

A8.9 Another concern is the extent and accuracy with which information about the ducts is recorded. To be useful to a competitor, detailed and accurate information is required such as start and end points, routing, dimensions and spare capacity. Another consideration is the chambers in which the ducts start and end, and whether these have sufficient capacity and flexibility to allow connections to be made to more than one operator’s equipment.

A8.10 The flexibility of duct access could lead to significant benefits for competition, if the practical problems could be overcome. However, there appears to be very little interest in any form of access network duct sharing amongst UK operators, indicating that the problems are perceived to be too large to work around at present. Even in countries where existing duct networks may be better suited to sharing, such as France, it is not seen as viable for the whole country.

A8.11 Duct access could potentially occur at two locations in the access network – the street cabinet and the local exchange. The specific issues associated with each are considered below.

Street cabinet duct access

A8.12 At this location, the competitive operator would gain access to the duct running between the customer and the street cabinet. The lack of contiguous duct is most likely to be an issue in this part of the network, at least for an FTTC deployment reusing the existing infrastructure. In some cases, cables may have been directly buried in the earth or, alternatively, the use of overhead cable routing is common, at least for part of the connection. Dealing which such inconsistency would greatly increase deployment costs, possibly to the point where it would be more efficient to ignore the patchy existing duct, and start again from scratch.

A8.13 These customer-cabinet duct quality issues may become less of a problem in the case of an FTTH network. Because no UK operator currently has fibre extensively deployed between end customers and street cabinets, this would need to be deployed before a dominant FTTH network could into existence. One possibility is that in the course of this deployment the operator would need to improve the quality of the duct network to the point where it would be far more attractive to a potential sharer. An alternative, negative, outcome is that the deployment of fibre exhausts the only spare capacity in an otherwise high quality customer-cabinet duct network, resulting in competitive duct sharing becoming impossible. Another possibility, again unhelpful for potential competitors, is that the dominant operator uses one of the emerging "direct bury" technologies to remove the need for duct in this leg of the network and reduce their costs. Finally, in some countries, for example Japan, much of the fibre in this final leg to buildings has been routed overhead, although with UK planning restrictions, a buried solution, whether ducted or direct, seems most likely.

A8.14 If high quality, sharable, duct does exist all the way to the customer, the street cabinet is the closest location to the customer at which a competitor could access it. This maximises the operator's flexibility in how the rest of network, namely the backhaul spanning from the cabinet to their core network, is structured and the technologies it uses. They may choose to use wireless rather than optical fibre for example, or arrange the aggregation of traffic from multiple cabinets to offer more control of quality of service.

Local exchange duct access

A8.15 Here the competitor would gain access to the duct between the street cabinet and the exchange. This section of duct is more likely to be contiguous, in good serviceable condition and accurately documented than the customer-street cabinet leg. The operator may chose to use the customer-street cabinet leg also, in which case they would of course suffer from its potential problems as outlined above.

A8.16 Compared with accessing duct at the street cabinet, this option would reduce the flexibility for the competitor between the cabinet and the exchange somewhat – they would be forced to use a wired technology compatible with the duct layout and running via the duct owner's local exchanges. They could still deploy different technology to the duct owner though, for example, using optical fibre end to end, allowing them to offer an FTTH service even if the duct owner chooses FTTC.

Passive inputs – unbundling

A8.17 Unbundling implies that control of the physical connection to an individual customer is removed from the "bundle" belonging to the dominant operator and passed to a competitor. Exactly what form this physical connection takes will vary depending on the choice of technology (e.g. FTTC vs. FTTH) and the location at which the hand over occurs. Today, the complete copper connection, or local loop, from the customer to the exchange is used for LLU competition.

A8.18 Gaining direct access to the physical customer connections gives a competitor the option to use a different transmission technology from the dominant operator. An example with current exchange based copper unbundling is LLU operators installing ADSL2+ DSLAMs while BT is using less advanced ADSL.

A8.19 As a competitor using unbundling reuses the dominant operator's cables, this option does not require as much investment as the duct access option considered

previously. However, a large scale unbundling deployment will still be an expensive undertaking.

A8.20 Most unbundling options have complications relating to the migration of customers between competing operators. This usually requires rejumpering; an engineer visits the unbundling location and physically disconnects the migrating customer's connection from their current operator's equipment and transfers it to the new one. This is a time consuming and expensive operation which makes running a successful business based on unbundling more difficult. It allow introduces a potential inequality between the access network owner, who will typically connect all customer lines to their equipment as the new network is built, and the competitor, who faces a cost and time delay penalty for rejumpering each time they win a customer. It is possible that automated equipment could be used to remove, or at least reduce, the need for manual rejumpering. However, such equipment is not commonly used at present and may give rise to economic and operational problems of its own. In the longer term it does have the potential to positively impact the viability of unbundling.

A8.21 Unbundling in next generation access could occur at several different locations in the network:

- copper line at the cabinet (or sub-loop unbundling);
- fibre at the cabinet (or fibre unbundling);
- fibre at the exchange (or fibre unbundling); and
- wavelength at the exchange (or wavelength unbundling)

Copper line at the cabinet (or sub-loop unbundling)

A8.22 This option, which is relevant in an FTTC deployment, is similar to today's LLU arrangements, except that the competitor takes over the copper lines to the end customer's premise at the street cabinet, rather than the exchange. The name 'sub-loop unbundling' is commonly used to indicate that only part of the traditionally unbundled line is used.

A8.23 Compared to LLU, it is unlikely that sub-loop unbundling will be economically viable for as high a proportion of the population, due to the greater number of locations at which the connections are passed to the competitor and at which they therefore have to deploy equipment. As an indication of the scale of the investment, consider the case of serving 100% of the market with LLU, which would involve deploying equipment into all of BT's 6,500 exchanges. To achieve the same with a sub-loop unbundling product, around 80,000 cabinets would need to be equipped. While for any given coverage footprint, sub-loop unbundling will require equipment in more locations than LLU, each piece of equipment serves far fewer customers and can therefore be cheaper. As sub loop unbundling, and the technology supporting it, becomes more widespread, costs will reduce, potentially increasing the areas in which it is economically viable.

A8.24 There are practical issues to consider alongside the economic ones, most of which are related to the constraints of the cabinets. Even for a standalone operator deploying an FTTC network, housing the required transmission and backhaul equipment in the existing street cabinets is problematic because they are small and often quite full. This problem becomes much worse when multiple operators need to

be supported. For operators upgrading current copper networks to FTTC, the usual assumption is that the existing cabinet will not be suitable and so will need to be replaced with, or supplemented by, a new one. To support multiple operators with their increased cabling and equipment requirements, larger or more numerous cabinets would be required. Apart from the expense involved, there is an environmental impact in the proliferation of street cabinets, which may cause problems with planning authorities.

A8.25 Like the cabinets typically used in cable TV networks, FTTC cabinets would require an electrical supply and likely some form of external ventilation. This would make them more expensive and complex compared to the simple versions used in most PSTN-based networks like BT's.

A8.26 Another limitation of cabinet-based copper unbundling is that a competitor using it will not have complete freedom in the transmission equipment they choose. Firstly, as the sub-loop is cooper they will of course be limited to technology applicable to this type of medium and today this is likely to mean an xDSL variant. A less obvious constraint is imposed by the Access Network Frequency Plan (ANFP) which specifies the characteristics of the signals that can be used at various points in the copper access network, with the objective of minimising interference between services. This places limits on the technology that can be used by a cabinet unbundler, hence limiting their scope for innovation. These limitations apply to the owner of the copper network as well, and within these the competitor will still have the ability to innovate by making different choices.

Fibre at the cabinet (or fibre unbundling)

A8.27 This option is essentially the FTTH version of sub-loop unbundling, with a fibre, rather than copper, connection made available at the cabinet. Physical fibre unbundling at the cabinet is only possible with some fibre architectures, for example point to point fibre.

A8.28 Most major operators in Europe do not favour point to point, and most are likely to opt for a gigabit passive optical network (GPON) architecture instead. GPONs consist of a single fibre connection from the exchange out to a device called a 'splitter' which divides the signal on the fibre between a number of end customers, typically 32. A separate fibre connects between the splitter and each end customer. These final customer fibres can be unbundled at the splitter location, but this may not be at the cabinet. Each splitter serves far less customers than a typical cabinet, and is likely to be placed as close as possible to the group of customers it serves, to minimise the length of the expensive individual customer fibres. In this scenario, unbundling at the cabinet would become impossible.

A8.29 Unbundling at the splitter, while possible in theory, is unlikely to be viable in practice. Firstly, as the number of customers available at each splitter is so small, if they are spread between multiple competing operators, the resulting fragmentation may leave each deployment economically unviable. Secondly, the practical problems associated with space and planning constraints of sharing street cabinets are likely to be magnified at the smaller and more numerous splitter locations.

Fibre at the exchange (or fibre unbundling)

A8.30 This option would only be applicable to FTTH architectures such as point-to-point, which has individual fibre connections running from the customer to the local exchange. It would not be possible for the more likely PON based deployments.

Wavelength at the exchange (or wavelength unbundling)

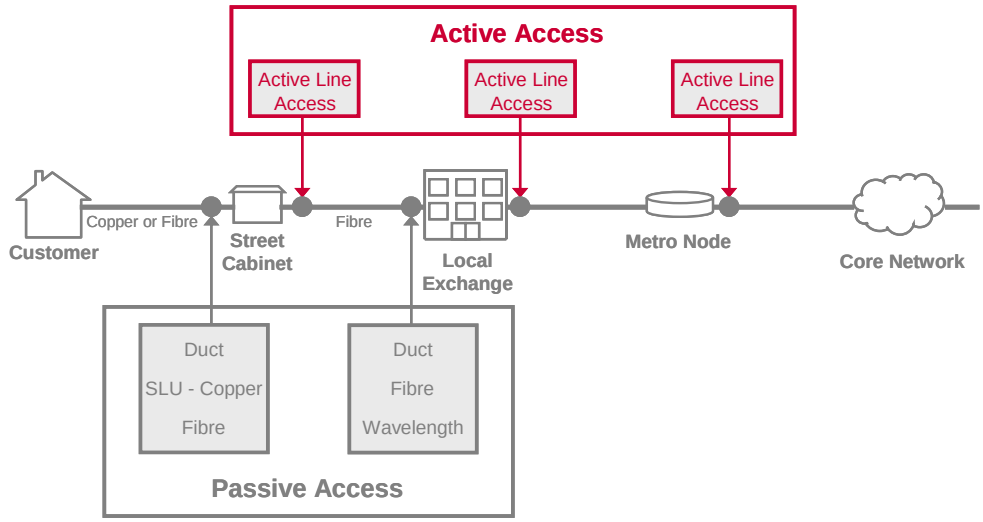
A8.31 Some PON systems deliver a different wavelength, or 'colour', of optical signal to each end customer. Wavelength unbundling makes this available to a competitive operator at the exchange.

A8.32 Wavelength unbundling is not strictly a passive input product, in that it offers the competitor access to an optical signal transmitted over the fibre, rather than the physical fibre itself. This places some constraints on the technology that can be used by the competitor. However, like true passive access, it does offer a means of gaining direct access to a customer, even in architectures such as PONs which cannot readily be physically unbundled. Achieving this though, requires use of technology which is very expensive and typically used in core networks, not in access networks. Therefore it seems unlikely that it will form the basis of next generation access competition, at least initially.

Active inputs – active line access

A8.33 Active input implies that the access network infrastructure owner has installed equipment to transmit signals across their cables, and makes the data signal, or 'bitstream', from this equipment available to their competitors. IPStream is an example of a current generation broadband active line access product.

Figure A13: Active input based competition – active line access



Source: *Ofcom*

A8.34 The general advantages and drawbacks of active line access inputs compared to the various passive options have been described in Section 6. The remaining issues are concerned with where the product is made available. In general, the closer to the customer that the competitor picks up the active line access product, the more of the backhaul and core network comes under their ownership or at least control. This may increase their costs, but also increases their scope for innovation. Taking active line access at the cabinet, for example, would allow a competitive operator building their own backhaul network to install sufficient capacity to ensure an uncontended service could be offered to all customers, an option which may not be available to an exchange-based competitor.

A8.35 An operator taking an active line access product from the network owner at a location close to the customer may choose to rent the backhaul connections between this point and their core network, rather than building their own. In this case, some of the innovation potential may be lost, depending on the flexibility and pricing of the backhaul products available in the market.

A8.36 There are three main locations where active inputs could be offered:

- active line access at the cabinet;
- active line access at the exchange; and
- active line access at the metro or core node.

Active line access at the cabinet

A8.37 In this option, the competitive operator would obtain access to the bitstream signal emerging from the transmission equipment housed in the cabinet. This option is only valid for a FTTC deployment, as the most likely FTTH options would not have any equipment at the cabinets capable of generating a bitstream. Today, the FTTC transmission technology is likely to a form of DSL, for example VDSL2. On top of this, the dominant operator will also add technology to allow the management of traffic from multiple customer connections and multiple services with differing quality requirements. As discussed previously, it seems beneficial that the functionality included in such technology is as minimal as possible, while still allowing the flexibility for innovative services to be created.

A8.38 If the competitive operator taking active line access at the cabinet chooses to build their own backhaul network, they would need to install their own backhaul transmission equipment in the cabinets. Therefore they would encounter many of the costs and practical problems of sub-loop unbundling-based competitor, but would not gain as much scope to innovate, because they rely on more of the access network owner's technology choices. It is possible that passive line access at the cabinet (sub-loop unbundling), or active line access at the exchange would form more rational options and the role for active line access at cabinets may therefore be limited.

Active line access at the exchange

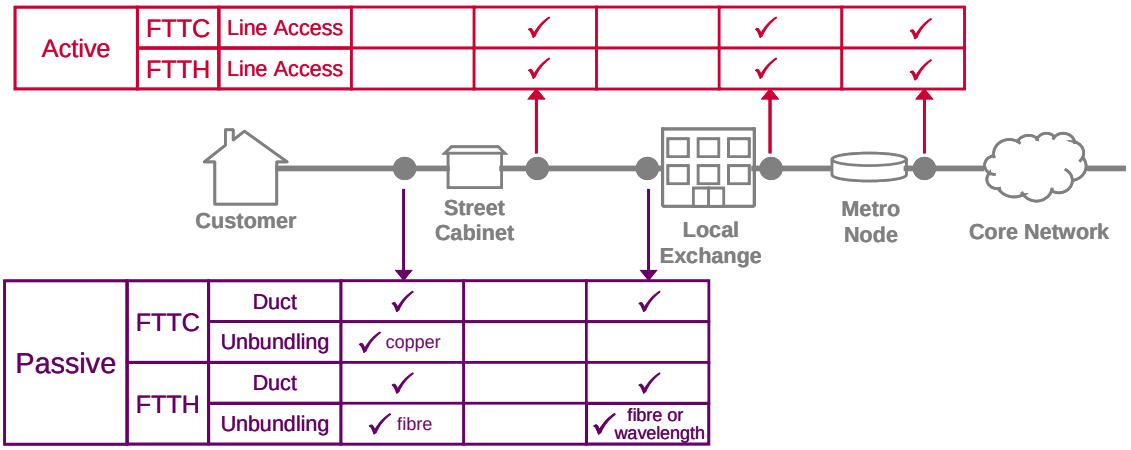
A8.39 An active input product made available at the exchange, after the incoming streams from different end customers have been combined. At the expense of some loss of cabinet-exchange backhaul flexibility, this option would significantly reduce the cost of active access compared to the cabinet-based option and may prove more viable.

Active line access at metro or core node

A8.40 An active input product in which the traffic from all the competitor's customers is combined and made available at small number of locations. The access network owner provides the majority of the competitor's traffic aggregation and backhaul with this option, minimising the competitor's need to deploy infrastructure of their own, but limiting the opportunity for service differentiation based on these parameters. For such a product to still allow meaningful innovation and differentiation at a service level, it is important that it is as flexible as possible. An example might be the ability to offer a wide range of services each requiring

different quality of service parameters, with the service set varying by customer type.

Figure A14: Summary of competition options by location



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