



Regulatory challenges posed by next generation access networks

Public discussion document

Publication date: 23 November 2006

Contents

Section		Page
1	Executive summary	1
2	Introduction	5
3	Definition of next generation access and the challenge for regulation	10
4	Wholesale access to next generation access networks	21
5	Implications for existing regulation	36
6	Next steps	38

Section 1

Executive summary

- 1.1 Investment in next generation access (NGA) networks continues to gather pace internationally, with announced deployments from both operators and public sector organisations. Ofcom considers now is the appropriate time to revisit the issues raised by next generation access investments. These investments are distinct from next generation core networks which focus on replacing multiple legacy core networks with a single IP-based network.
- 1.2 In considering the appropriate regulatory regime for next generation access (including options for no regulatory intervention) there are many important and complex issues to be addressed. This document is not a formal consultation document seeking views on alternative proposals. Instead, this paper seeks to outline the issues and prompt discussion of them.
- 1.3 Recently, the UK has displayed a good outcome with respect to the availability, take-up of and bandwidths supported by current generation broadband networks. At the same time, the UK is not witnessing the same level of investment in next generation access networks as displayed in some countries like the US, Japan, Korea and the Netherlands. We believe this is mainly due to the specific characteristics of the UK, particularly: a copper access network capable of supporting higher bandwidths over DSL; a mature pay TV market which influences the potential for IPTV business models; less competition in end-to-end infrastructure provision; and a focus in the UK on core next generation network upgrades at this time.
- 1.4 Some stakeholders consider the availability of higher speed access infrastructure as critical for the UK. These stakeholders consider there would be powerful benefits from the deployment of next generation access in the UK through development of new services, increased productivity and competitiveness, and to society, for example through greater access to information and public services. However, many commercial communications providers consider that the case for investment in next generation access infrastructure continues to be weak in the UK, or that the need for future network upgrades is likely to arise at a later time in the UK than for some other countries.
- 1.5 However, despite the lack of announced deployments, Ofcom considers that it is important that we start to provide clarity on the regulatory regime for next generation access networks in a timely manner, so that any lack of regulatory clarity is not a contributory factor in the timing of future investments.
- 1.6 In considering regulatory approaches to next generation access, it is important to define what these services comprise. Ofcom prefers a broad definition of next generation access, which covers a number of technologies that can be used to deliver next generation access services, including both wired and wireless solutions. However, we consider that wireline network deployments may provide greater regulatory challenges following the migration to next generation access networks.
- 1.7 As we discussed within the Strategic Review of Telecoms, wireline access networks have historically been an enduring economic bottleneck – it is critical to the approach to regulation to establish whether this will be the case in the future. This depends on:
 - the extent of wireless network rollout;

- the substitutability of fixed and wireless services; and
 - the prospects for competition in provision of wireline next generation access, particularly through the use of alternative wayleaves, including sewers or utility ducting, to reduce the cost of wireline network deployment.
- 1.8 It may be that the deployment of wireless access technologies will provide a competitive alternative to wireline next generation access deployments. This could result in increased infrastructure competition for next generation access. We are interested in stakeholders' views on the prospects for such wireless technologies. However, this paper seeks to explore the implications from a regulatory perspective if widespread deployment of new wireless technologies did not emerge.
- 1.9 Regulators are most concerned with issues arising from enduring economic bottlenecks, where the economies of scale and scope within communications networks and the advantages of incumbency may limit market entry by new communications providers. Given the barriers to contestability that are inherent in wireline network deployments, it is likely that deployments of wireline next generation access infrastructure may represent an enduring economic bottleneck at least in some parts of the UK. As a result, we focus this discussion paper on the challenges to regulation arising from wireline next generation access deployments.
- 1.10 In this paper we consider the policy issues that may arise from the emergence of new, or reinforcement of existing, enduring economic bottlenecks as a result of a step-change in access network investment associated with next generation access deployment. There are two main policy challenges posed by next generation access:
- the challenge for ex ante regulation to balancing the dual aims of both promoting competition and ensuring efficient investment incentives are not distorted; and
 - the challenges for wider public policy relating to social benefits that may be derived from next generation access deployments, and the issue of social inclusion and the digital divide. Whilst we outline these public policy questions briefly, we do not consider them in detail here: given the progress of next generation access deployments to date, it may be premature to try to answer these questions.
- 1.11 Prior to adopting any ex ante regulatory policy, Ofcom is required to conduct a thorough market review under the EU Framework Directive. Such a market review would require Ofcom to define the relevant market for next generation access services. Ex ante regulation is not applied to infrastructure, but to the services delivered over that infrastructure. Next generation access deployments could be used to deliver a range of services, including: existing services; higher quality versions of existing services; and new services that are unique to next generation access networks. This discussion paper does not include a formal market definition as, at this time, it is not clear what services that would be provided over next generation access networks might constitute a separate market. Instead, it focuses on the principles of regulation that may be applied to next generation access networks that are enduring economic bottlenecks.
- 1.12 Faced with the deployment of new bottleneck assets, one of the key decisions for regulators is the most appropriate regulatory policy to adopt. At the highest level, this is a choice between forbearance versus the promotion of downstream competition through mandated access. Forbearance may be a suitable approach to regulating next generation access investments where there are significant prospects for wide

scale, competing access infrastructure deployments which will provide a competitive constraint to the potential for incumbent operators leveraging any position of market power. Ofcom considers that, given the UK's market structure and characteristics, the prospect for wide scale competitive access infrastructure is relatively low. Forbearance is therefore not likely to be an appropriate policy for the UK.

- 1.13 As discussed in the Strategic Review of Telecoms, we consider that promotion of competition through equality of access is the most appropriate approach to assets that are enduring economic bottlenecks. Ofcom continues to favour this approach with respect to next generation access investments, but with returns that are reflective of the level of risk at the time of investment. These new infrastructure investments may display a number of unique characteristics that mean the current approach to regulation is not appropriate. For example, historically, current generation local access network investments have faced low demand uncertainty and were considered a sunk cost for bottleneck asset owners – this may not be the case for next generation access investments.
- 1.14 It is not the role of Ofcom to provide operators with incentives to make particular investments. Rather, we should endeavour to ensure that the incentives for efficient investment are not distorted, particularly as a result of disproportionate regulation. In determining the most appropriate approach to regulation for investment in any risky bottleneck asset, and its implications on incentives, it is important to reflect adequately the level of risk incurred at the time of investment.
- 1.15 The level in the network where regulatory remedies may be applied to next generation access networks may differ substantially from the current copper local access network. Therefore, one key consideration for any next generation access regulatory policy is the correct level in the network to mandate access to promote downstream competition. This will, in part, depend on technology choices made by industry. The levels may vary for different technology deployments, but could include: access to ducts; unbundling options, including sub-loop or fibre unbundling; or access to a wholesale bitstream product.
- 1.16 Deployment of next generation access infrastructure is likely to have an impact on current regulation, including the wholesale products currently defined by regulation. Ofcom must consider the appropriate level of, and period for, support for legacy wholesale products as operators move to using next generation access networks. In determining the appropriate level and timescales for the support of legacy regulatory products, it is important to consider the full costs and benefits of both continued support versus removal of these products.
- 1.17 It is not the role of the regulator to protect investments made by competitive communications providers against market risks. These risks may include the emergence of new technology developments, such as next generation access that superseded operators' current market propositions. However, it is appropriate for Ofcom to consider the interests of existing competitive operators in ensuring the continued availability of and terms for current wholesale inputs to their products, during the lifetime of the assets in which they have invested. We also need to ensure that a suitable migration path for existing infrastructure investments is allowed for following the deployment of new technologies.
- 1.18 In order to progress the debate on next generation access, Ofcom is interested in stakeholders' views and opinions. Whilst we are not conducting a formal consultation process at this time, we are keen to receive any views in writing, and to use these to promote further public discussion of the issues. We also intend to organise a number

of seminars in early 2007 to meet with stakeholders and discuss the challenges and issues posed by next generation access.

Section 2

Introduction

- 2.1 On many measures, the broadband market in the UK has been a real success story in recent years. Over 99% of people are now connected to broadband-enabled exchanges: this is among the highest broadband availability in the world, and higher than Japan, Korea and the US. Broadband penetration rates continue to grow, with 43% of households taking broadband services in March 2006. The UK now has the second highest broadband penetration amongst G7 nations. At the same time, bandwidths are continuing to increase, with the majority of operators now offering services of up to 8Mbps, and in some instances up to 24Mbps.
- 2.2 The UK is also witnessing a continuing increase in the level of competition in retail broadband service provision and an acceleration in the number of unbundled lines, which has now exceeded 1 million lines, up from 210,000 at the end of 2005.
- 2.3 This competition in broadband service provision has resulted in significant consumer benefits, including:
- increased choice, with a wide range of broadband ISPs offering services in the market
 - significantly reduced prices, with the typical price for a 1Mbps broadband connection falling from £30 in 2004 to £15 per month in 2005¹;
 - launch of discounted bundled product propositions of fixed telephony, multi-channel TV and broadband access, offering customers further cost savings; and
 - a high degree of innovation in terms of new services launched, such as video on demand over IPTV.
- 2.4 However, in other countries, investment in next generation access networks continues to gather pace, with announced deployments from both operators and public sector organisations. Such investments include Deutsche Telekom's fibre to the cabinet deployment, Illiad's proposed fibre to the home deployment in French metropolitan areas, AT&T and Verizon's investments in higher speed broadband access networks in the US, and NTT's deployment of fibre to the home in Japan. Next generation access investments of a similar scale have not yet been announced in the UK.
- 2.5 It is important to note the difference between next generation access upgrades and next generation core network deployments. BT's investment in its 21st Century Network (21CN) and other such investments by other operators in the UK are examples of investments in core next generation networks (NGNs). These investments focus on replacing multiple legacy core networks with a single IP-based network for the provision of all services.
- 2.6 This paper does not consider core NGNs, only deployment of next generation infrastructure in the access network. However, the deployment of either next generation access or next generation core networks can influence a companies' strategy in relation to the other. For example, following the deployment of a next

¹ The Communications Market 2006

generation core network, operators may be able to secure further cost savings from deploying an all Internet Protocol network deeper into the access network.

- 2.7 Some stakeholders including public sector organisations, equipment manufacturers, content providers, and certain public interest and consumer groups, consider the availability of higher speed access infrastructure as critical. These stakeholders consider there would be powerful benefits from the deployment of next generation access in the UK. They consider that these benefits would accrue to the economy as a whole, through development of new services, increased productivity and competitiveness; and to society, through the creation of new social networks and greater access to information and public services.
- 2.8 However, many commercial communications providers consider that the case for investment in next generation access infrastructure continues to be weak in the UK. They are also of the opinion that whilst next generation access upgrades are on their roadmap for future network upgrades, the UK is likely to require these upgrades at a later time than some other countries.
- 2.9 The various international deployments of next generation access infrastructure have been led by a number of factors, including competitive pressure (often between cable operators and copper-based incumbents), political influences or government support, and the ability to offer IPTV-based entertainment services. Market conditions are of course different in different countries. There may be good reasons why the efficient timing for the deployment of next generation access in the UK is later than in some countries:
- the topology of UK copper access networks may mean that DSL-based services (including LLU-based services) can be used to deliver higher bandwidths than in some other countries, and may therefore have a longer remaining life;
 - UK planning regulations require wireline networks to be laid underground in many places, rather than on poles. The UK also has a relatively low proportion of people living in blocks of flats. Both of these factors can make it considerably more expensive to deploy next generation access infrastructure than in some countries;
 - one rationale for next generation access investment is the opportunity to address new revenue streams, specifically in the delivery of pay TV services. However, the UK has one of the most developed multi-channel and pay TV industries in the world, with 70% of homes receiving multi-channel services and 44% pay TV services in Q1 2006. This is likely to weaken the business case for communications providers to invest in higher speed broadband access networks; and
 - an alternative strategy to next generation access upgrades is to focus investment on next generation core networks, seeking to achieve cost savings and enable the delivery of new products and services. UK operators are global leaders in these developments.
- 2.10 The deployment of next generation access networks poses new challenges for regulators. Previous access networks had been in place for so many years that any risks associated with their deployment had long since been amortised. Because these access networks were competitive bottlenecks, most regulators required their owners to provide other operators with access to them at cost-based prices. But new access networks are different: there is a risk associated with them, that demand from

businesses and consumers may not materialise as expected. Therefore if regulators imposed cost-based access with a standard rate of return that did not take into account the level of risk in an investment, there would be little incentive on operators to make the investment. If the demand didn't materialise, they would have to bear the loss; if demand did materialise, regulation may prevent them from benefiting.

2.11 There have been a number of different regulatory approaches adopted in different countries to address this situation. These have included:

- the FCC in the US determined regulatory forbearance to be the most appropriate approach following the deployment of deeper fibre by incumbent telcos and given the competitive position of cable in this market. In this situation, once incumbent operators upgraded their access network to next generation access, they would no longer be obliged to offer access to it to other operators;
- in Germany there has been a debate about the appropriateness of time-limited forbearance from regulation for Deutsche Telekom's fibre to the cabinet investment;
- in the Netherlands, OPTA is currently consulting on the regulatory implications of KPN's announced deployment of fibre to the cabinet, including a range of potential conditions to be applied to the phasing out of current exchange-based unbundled local loop products; and
- there has been an ongoing debate on regulatory holidays and emerging markets within the European Framework Review.

2.12 Ofcom considers it is now an appropriate time to consider what regulatory approach may be most suitable for the UK. In considering the regulatory approach to adopt with respect to next generation access infrastructure investment, Ofcom must have regard to its statutory duties as defined in the Communications Act 2003.

2.13 Ofcom has a number of statutory duties and powers relevant to next generation access deployments. 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.

2.14 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 services²;
- the desirability of encouraging investment and innovation in relevant markets³; and
- the desirability of encouraging the availability and use of high speed data transfer services throughout the United Kingdom⁴.

2.15 One of Ofcom's first pieces of work was a Strategic Review of Telecoms⁵, with the aim of establishing how we would address these duties in our approach to telecoms

² Communications Act 2003, Section 3(2)(a)

³ Communications Act 2003, Section 3(2)(d)

⁴ Communications Act 2003, Section 3(2)(e)

regulation. As a result of this review, Ofcom committed to the following principles in its approach to regulation:

1. promote competition at the deepest levels of infrastructure where it will be effective and sustainable;
2. focus regulation to deliver equality of access beyond those levels;
3. as soon as competitive conditions allow, withdraw from regulation at other levels;
4. promote a favourable climate for efficient and timely investment and stimulate innovation, in particular by ensuring a consistent and transparent regulatory approach;
5. accommodate varying regulatory solutions for different products and where appropriate, different geographies;
6. create scope for market entry that could, over time, remove economic bottlenecks; and
7. 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.

- 2.16 This discussion document discusses how Ofcom should apply these principles to next generation access network investments. In particular, it is important to note that the fourth of these principles relates to the promotion of *efficient* investment, as opposed simply to incentivising investment. Some countries have used regulatory and public policy to provide operators with specific incentives to invest in next generation access infrastructure. This is because of the perceived benefits for the economy and society that this investment may generate. Our duties reflect the fact that Ofcom is not best placed to decide the appropriate timing of such investments – commercial operators are. Ofcom's aim should therefore be to ensure that regulation does not distort the incentives for timely and efficient investment, whenever that may be.
- 2.17 In an environment of demand uncertainty for new services, and in the face of potentially significant capital expenditures by communications providers, it is particularly important that any lack of regulatory clarity is not a contributory factor in the timing of future investments. To date, industry and stakeholders have expressed limited interest in wide-scale deployment of next generation access infrastructure, and any uncertainty over the regulation that would apply to next generation access investments has not been a barrier to deployment. We believe, however, it is important that regulatory uncertainty does not distort efficient investment decisions in the future.
- 2.18 We are therefore publishing this discussion document to help structure a debate in the UK about the appropriate regulatory approaches to next generation access investments. This document is not a formal consultation document proposing particular approaches but rather seeking general views on the issues relating to next generation access. A formal consultation would not be appropriate given the level of uncertainty in areas such as the applications and services that may be delivered over next generation access networks, and on the technology choices that will be made.

⁵ http://www.ofcom.org.uk/static/telecoms_review/index.htm

2.19 Ofcom is seeking to encourage public debate on the issues raised by the deployment of next generation access networks. In order to further this discussion, we invite comment from stakeholders on the issues raised in this paper. As part of this debate, Ofcom intends to engage stakeholders in a series of events in early 2007 to further the understanding of the issues raised by next generation access.

2.20 The remainder of this paper is divided into four sections:

- definition of next generation access and the challenge for regulation;
- wholesale access to next generation access networks;
- implications for existing regulatory policy; and
- next steps.

Section 3

Definition of next generation access and the challenge for regulation

- 3.1 In assessing the potential approaches that Ofcom might adopt towards next generation access infrastructure deployments, it is useful to start by outlining exactly what we mean by next generation access infrastructure, and what the regulatory issues are that we need to address. In this section we discuss six issues:
- what next generation access infrastructure is;
 - what technologies can be used to deliver it;
 - the prospects for future enduring economic bottlenecks;
 - next generation access services and economic markets;
 - challenges to regulation posed by next generation access; and
 - challenges to public policy posed by next generation access.

Definition of next generation access

- 3.2 Defining what does and does not constitute next generation access is difficult in advance of the emergence of new applications and services that utilise the new infrastructure. Most definitions currently use a combination of minimum bandwidth and service characteristics such as symmetry or quality of service. For example, some definitions consider 20Mbps or more as the point which would define what a next generation access network would need to provide. This is on the basis that 20Mbps may be sufficient to support services (such as simultaneous multiple HDTV feeds using MPEG4, broadband internet and voice services) that cannot be delivered by existing broadband technologies to the majority of customers.
- 3.3 A more general definition that can be applied is one which describes next generation access 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. The advantage of using a relatively general description like this is that, until next generation access infrastructure is deployed and next generation access-specific applications and services are launched, a firm definition of next generation access may be difficult to arrive at. Any formal market definition for what does and does not constitute next generation access will depend on the network capability and services deployed. At this time, Ofcom considers this general definition to be more appropriate in order to progress the debate on next generation access.

Technologies to deliver next generation access services

- 3.4 Next generation access deployments are often assumed to refer to the roll-out of fibre deeper in the access network (for example, fibre-to-the-cabinet or fibre-to-the-

home). However, next generation access services could be delivered by a number of technologies, including fibre deployments, cable, terrestrial fixed or mobile wireless services, satellite or further upgrades to existing copper-based access networks. There are likely to be a number of alternative options for deployment of next generation access infrastructure by incumbent telecoms operators, competitive operators and new entrants.

- 3.5 There are various forms of fibre deployment that could be undertaken, either by copper access network owners to upgrade their networks, or by new entrants. These include laying fibre to street cabinets, and using DSL technology from the cabinet to the customer; point-to-point networks where a single fibre goes to each customer; and passive optical networks, where customers typically share the bandwidth on the access fibre.
- 3.6 Cable networks in the UK already have fibre deployed relatively deeply into the access network, and a number of technology upgrades are available which offer opportunities for increased bandwidth. Within the UK, digital cable covers 45% of premises. Whilst there may be limited appetite for further cable rollout within the UK at this time, those areas that are cabled may present a real opportunity for future delivery of next generation access services with relatively lower levels of investment than for copper-based access networks.
- 3.7 Terrestrial wireless services offer the opportunity to deploy competing access infrastructure in both cable and non-cable areas. However, they may offer different service characteristics to wireline services in terms of coverage, contention, symmetry and service speeds. Whilst suitable for high burst bandwidths, these networks may be less suitable to deliver sustained high bandwidth connections for many users. Wireless service deployments are constrained by spectrum availability. However, if they have suitable spectrum the economics of their deployment is often relatively scalable, meaning that they have lower economic barriers to entry as compared to new wireline deployments.
- 3.8 Ofcom's spectrum policy aims to address spectrum constraints as much as possible. This is partly through releasing more spectrum to the market as it becomes available. More broadly, Ofcom's spectrum management policy is to allow market forces to prevail wherever this is judged to be in the best interests of the citizen-consumer. The key mechanisms Ofcom will use to achieve this are:
 - trading of spectrum between users so that they can buy, sell, aggregate and disaggregate spectrum holdings; and
 - liberalisation of spectrum use, so that increasingly users can change the technology or type of use that they make of the spectrum they hold.

The prospects for future enduring economic bottlenecks

- 3.9 Of key interest to regulators are the implications of enduring economic bottlenecks on the competitive environment. By this, we mean those parts of a network where not only does one or more operator have significant market power (SMP), but where effective, sustainable competition is unlikely to emerge in the medium term as a result of difficulties for competitors to replicate access infrastructure.
- 3.10 The problem of enduring economic bottlenecks is that the economies of scale and sunk costs of telecoms networks, especially for wireline access networks, are particularly hard for new entrants to overcome. Yet if new entrants do not build their

own fixed access or backhaul networks, they are reliant instead on the owner of bottleneck assets to provide wholesale access to its network.

- 3.11 In the Telecoms Strategic Review, we established that there would be a need for some form of continuing regulation of current generation local access networks because of these enduring economic bottlenecks. As a result, we established the need for genuine equality of access to wholesale products that offered access to this bottleneck.
- 3.12 This conclusion applied to the case of copper-based local access networks, where network investment costs were sunk and demand risk for services provided was very low however. This is not necessarily the same for next generation access deployments. The extent of enduring economic bottlenecks may also change with next generation access networks, as a result of changing network economics.
- 3.13 The right approach to regulating next generation access depends upon how contestable the investment is (in other words, who has the opportunity to make the investment), and once in place, whether next generation access infrastructure is likely to display the characteristics of an enduring economic bottleneck.
- 3.14 An enduring economic bottleneck may arise as a result of new infrastructure deployment by either an existing incumbent operator or by a new entrant. However, 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 an incumbent operator; and
 - the importance of scale economies in wireline communications services.
- 3.15 Barriers to contestability may be mitigated by the deployment of competing access infrastructures. The degree to which these deployments may mitigate barriers to contestability will depend on:
- the scale of the investment;
 - the economic viability of competing alternative access infrastructures; and
 - the availability of alternative wayleaves for wireline deployments.
- 3.16 To date, many alternative access infrastructure deployments have been focussed on specific geographic locations and lack the economies of scale that national deployments may benefit from. Ofcom is therefore interested in stakeholders' opinions on the likelihood of wide-scale competitive next generation access infrastructure deployments as compared to niche or regional deployments.
- 3.17 Once wireline investments are in place, the extent to which they are likely to be an enduring economic bottleneck depends partly on the extent to which other networks are able to compete with them. For example, both wireless and wireline technologies can offer bandwidths significantly in excess of today's broadband speeds. Yet, as we discuss above, the different characteristics of these networks may make them suitable for different services. For example, capacity constraints may mean that wireless networks will be less suitable for sustained high bandwidth applications, such as High Definition TV on demand. Ofcom is therefore interested in stakeholders'

opinions on the likely substitutability of services that may be delivered using different next generation access technologies.

- 3.18 Operators may also be able to deploy competing wireline local access networks by using alternative wayleaves. In principle, the civil costs of building a competing wireline next generation access network could be substantially avoided by operators using alternative duct networks, including existing utilities. Ducting and trenches used by electricity, gas, water, sewers, and drainage networks could be employed in the roll-out of wireline next generation access infrastructure.
- 3.19 The use of electricity distribution networks for deployment of FTTH solutions appears to be increasing in a number of international markets. In part this is being driven by the strategies of electricity distribution companies seeking to gain access to new revenue streams. For the remaining utilities, the use of alternative wayleaves for the deployment of next generation access services may be more suited to build-out in regions or localities that have specific architectures or needs, rather than a nation-wide deployment. Iliad's announced deployment of fibre to the home using municipally owned duct and sewers in Paris is a good example of a localised deployment using alternative wayleaves where available.
- 3.20 Ofcom is interested in stakeholders' opinions on the viability of using alternative wayleaves to deploy competing next generation access networks in the UK, both nationally and regionally. We think it is likely that use of alternative wayleaves may enable competitive infrastructure deployment to be cost competitive in some areas and to some customers, but the prospects for widespread deployment of competitive wireline next generation access networks using alternative wayleaves may be limited.

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- 3.21 Given the prospects for contestable investment by new entrants, it is likely that future wireline next generation access infrastructure deployments will display the characteristics in future of enduring economic bottleneck, at least for some parts of a wireline access network and in some areas of the country. This paper goes on to consider the policy issues that may arise if next generation access deployments are future enduring economic bottlenecks.

Next generation access services and economic markets

- 3.22 Next generation access network deployments may be used to deliver three different types of retail product: existing services; higher quality versions of existing services; and new services that are unique to next generation access networks. Ex ante regulation is not applied to telecoms network infrastructure, but rather to those services that are delivered over that infrastructure. The regulatory approach to the services delivered over an next generation access network could therefore vary depending upon the type of service:
- **Existing services.** Next generation access infrastructure deployments could be used to deliver the same retail products as current generation broadband access networks (for example, as defined in the Wholesale Broadband Access market review⁶). In that case, whilst the wholesale product underpinning the retail product would be based on a different technology, the retail product for customers would not change significantly. Therefore, it could be argued that the

⁶ <http://www.ofcom.org.uk/consult/condocs/wbamr/>

next generation access based wholesale products would be defined as being in the same market as today's wholesale products.

- **Higher quality versions of existing services.** A next generation access network may be used to deliver the better quality versions of existing retail products that are currently being supplied over existing networks. An example of this may be where a consumer is able in future to purchase a 50Mbps broadband internet access retail product which is underpinned by a next generation access wholesale product. The appropriate treatment of higher quality services delivered over next generation access infrastructure depends on the extent to which the different products are substitutes for one another. There may be a chain of substitutability; for example, pricing of a 5Mbps broadband service may be constrained by 2Mbps services, and 2Mbps services may be constrained by 1Mbps services etc. Where higher quality versions of existing products continue to be substitutable for current services, it could also be argued that next generation access services were in the same market as today's wholesale products.
- **New services, unique to next generation access.** Deployments of next generation access networks may be used to deliver new, innovative services that cannot be supported by current generation access networks and are not substitutable for today's services. In this case, it could be argued that these wholesale products were within a different market to today's products. If next generation access products were in a different market, the regulatory approach to them may need to vary from the regulation applied to current generation access networks.

3.23 In order to assess whether the services being provided over next generation access networks were substitutes for current broadband services, and therefore part of the same market and liable to existing regulatory remedies, Ofcom may need to conduct a market review.

3.24 Also, in considering the relevant market for next generation access, we will need to take account of the existing relevant economic markets, including the wholesale local access market and the wholesale broadband access market:

- **Wholesale local access**⁷ – this market is 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. 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.
- **Wholesale broadband access**⁸ – 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. The launch and take-up of next generation access

⁷ <http://www.ofcom.org.uk/consult/condocs/rwlam/statement/>

⁸ <http://www.ofcom.org.uk/consult/condocs/wbamr/>

services may increase the take-up and usage of higher speed applications. If it transpires that new higher speed applications are developed and increasingly taken up by end consumers, it may be necessary for Ofcom to consider further its definition of broadband internet access services in future market reviews.

However, until such a time, higher speed broadband services are considered to be included within the scope of the wholesale broadband access market.

- 3.25 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 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. 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.
- 3.26 As part of this paper, we consider 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.
- 3.27 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. This paper considers the policy issues that may arise if one or more next generation access operators were to be found to have significant market power.

The challenges for regulation

- 3.28 If next generation access network deployments were to constitute an enduring economic bottleneck, this then poses a regulatory conundrum. To date, in order to protect competition in the presence of enduring economic bottlenecks, regulators have generally mandated access to these assets on cost-based terms with a cost of capital reflective of the lower level of risk associated with these assets. However, if this standard approach to access regulation were to be adopted for future next generation access infrastructure, the returns available to the communications provider considering deploying the bottleneck assets may be reduced such that there may not be a commercial case for making the investment in the first place.
- 3.29 This problem arises as the application of mandated access at regulated prices would limit the returns available to investors, whilst the risk of losses remains unlimited. This asymmetry may distort incentives to invest in next generation access. On the other hand, if other operators were not offered mandated access to bottleneck next generation access infrastructure, the bottleneck asset owner could expect to earn higher returns, possibly secured through monopoly rents, perhaps at the retail level. This approach would seriously harm competition and therefore would represent a significant cost to consumers.

- 3.30 Large-scale investment in LLU-based services has now commenced in the UK, resulting in increased competition in the provision of broadband services alongside longer-established service provider-based competition. It is important that we ensure that the progress achieved recently in increasing broadband market competition, particularly through the provision of LLU-based services, is not undermined through future market foreclosure as a result of technology developments, regulatory uncertainty, inappropriate regulation or a lack of appropriate regulation. At the same time, we need to ensure that regulation balances the promotion of competition and ensures the existence of conditions that provide incentives for efficient investment.
- 3.31 Ofcom remains committed to the principles we identified in the Telecoms Strategic Review, notably the promotion of competition at the deepest level of infrastructure where it will be effective and sustainable. We believe the appropriateness of these principles will continue following the deployment of next generation access networks.
- 3.32 We consider it may be premature to propose specific regulatory remedies relating to next generation access infrastructure at this time. We will consider detailed remedies at a later stage through the normal process of market reviews, as the clarity on the potential and technology choices for next generation access deployments increases. Instead, this paper seeks to explore the following question:

“Where wireline next generation access upgrades are likely to become enduring economic bottlenecks, what should Ofcom’s approach be to ensure an environment that allows incentives for efficient investment whilst promoting competition in the provision of wholesale and retail services?”

- 3.33 It is not the role of the regulator to provide operators with incentives to make particular investments. Regulators are in a poor position to judge the appropriate time for investments to be made. Rather, Ofcom needs to ensure that the incentives for investment in next generation access infrastructure are not inefficiently distorted, particularly as a result of disproportionate regulation.
- 3.34 The problem is that the business case for deploying next generation access is very complex, and therefore the range of regulation that affects these incentives is quite broad. In principle, operators’ incentives to invest in next generation access infrastructure are influenced by the ways in which they seek to monetise these investments. These include:
- in the retail market, consumers may pay more because they value the services such access may provide or allow e.g. faster access and any content or applications. Similarly in the wholesale market, the price of next generation access products may be higher. This increase in revenue per customer, either at the wholesale or retail level, provides one incentive for investment;
 - offering next generation access products may increase an operator’s market share at both the retail and the wholesale level. Obviously the extent to which market share increases in this way depends upon whether other operators have access to next generation access investment, through regulated wholesale products;
 - the investment could cost-in only as a result of a lower level of operating costs for a fibre access network compared to a copper access network. This might be because a fibre network could do away with the need for exchange buildings; the fibre could go all the way from the premises to the metro node. Alternatively, the

fibre deployment may offer lower operating and maintenance costs than a legacy copper access network; and

- an operator may try partly to recoup its investment through new business models, including quality of service charging mechanisms. This additional revenue could be sought from application or content providers, by charging for higher speed or quality delivery of their applications to customers.

3.35 The promotion of competition, and ensuring efficient investment incentives are not distorted, imply two main regulatory issues. We consider these issues Sections 4 and 5:

- whether regulation should mandate access to next generation access networks which are enduring economic bottlenecks in order to continue to promote competition, and if so, on what terms; and
- the implications of next generation access deployments on existing regulation.

The challenges for public policy

3.36 The challenges for public policy relating to next generation access can be divided into two main areas:

- identification and realisation of external social benefits arising from next generation access deployments; and
- the emergence of a digital divide in next generation access availability.

Social benefits and next generation access

3.37 Current generation broadband has been shown to bring very significant benefits to consumers and businesses that are able to access it. For example, it can lead to productivity gains as businesses make use of electronic supply chains and can market themselves on the web, and it can allow employees to work more flexibly at home. Consumers can access online public services and be a part of new, online societies.

3.38 Some stakeholders consider that the availability of higher speed access infrastructure is critical to the UK to further the benefits to the economy and to society. Their concern is that public policy may be required to ensure the availability of next generation access if the market does not deliver these services in a timely manner.

3.39 Public policy intervention may be warranted where there are positive externalities associated with next generation access: that is, where the public benefits to society of its provision substantially exceed the private benefits accruing to its supplier. Where there are benefits to society which are not externalities, for example private benefits from usage of next generation access services, the argument for public policy intervention is much less clear, as these additional benefits could be expected to be met by commercial deployments of NGA.

3.40 It is therefore important, in considering the arguments for and against public policy intervention in next generation access, that evidence is provided on the source and scale of the social benefits that may accrue as a result of these networks. This is necessary in order to assess fully the costs and benefits of public policy in next

generation access. To date, there has been little compelling evidence suggesting that the availability of next generation access networks would result in incremental increases in social benefit beyond what is delivered by current generation broadband services. For example, the majority of the applications and services generally proposed for next generation access are entertainment services that may result in limited incremental social benefit.

- 3.41 Absent any evidence for significant social benefits, public policy intervention in the provision of next generation access may result in incentives for inefficient deployment of next generation access networks. As a result of such intervention, operators may see a business case for deployment even though there may not be significant consumer demand for the services delivered over next generation access networks.
- 3.42 It is not for Ofcom to determine when or how public policy is employed with respect to next generation access deployment. However, the wider social implications are a key feature of the debate on next generation access. Therefore, Ofcom is interested in stakeholders' opinions on how and where the deployment of next generation access infrastructure may result in significant social benefits. For example, to further this debate, it would be useful to understand the applications and services that could be enabled by next generation access that would result in incremental consumer and citizen benefit beyond what is delivered by current generation broadband access networks.

Digital divide in next generation access provision

- 3.43 Given the economics of wireline next generation access deployments, it is likely that the deployment of next generation access infrastructure will be undertaken on a regional basis, starting with the most densely populated areas. Coverage may be expanded into other areas incrementally as:
- demand uncertainty reduces following the launch and take-up of next generation access products and services; and
 - the cost economics of next generation access deployments improve, for example as a result of scale economies in the manufacture of equipment.
- 3.44 Whilst such regional developments may pose some challenges for ex ante regulatory policy, for example in the definition and application of geographic markets, it is not Ofcom's role to determine the most appropriate deployment strategy or coverage of next generation access deployments. These are decisions that the market will need to make.
- 3.45 However, such regional deployments may lead to much greater challenges for wider public policy. This is because, given the cost economics of next generation access, it is likely that the reach of these networks will fall short of the current generation broadband deployments, and therefore short of near-ubiquitous availability.
- 3.46 This raises a number of issues related to the 'digital divide', in terms of:
- the net benefits consumers derive from availability of higher bandwidth broadband services; and
 - the minimum level of service citizens should have a right of access to.

- 3.47 In considering the situation with regards to the availability of broadband services, including next generation access, legitimate questions will be raised about whether the existing scope of Universal Service Obligations (USO) should be extended from narrowband services. Changes to the scope of USO are matters for Government and the European Commission and are therefore outside Ofcom's remit.
- 3.48 However, Ofcom nevertheless has a direct interest in encouraging the availability of affordable quality broadband services in rural areas. This issue is being considered by Ofcom as part of our digital inclusion work, which will look specifically at understanding the market, technological options available for rural broadband supply, incentives on providers, the importance of service for social inclusion and the role of Ofcom and other public bodies. Next generation access networks are an extension of this issue, which highlights the prospect for significant variances across the country not just in physical availability, but also in the bandwidths available to consumers.
- 3.49 Ofcom therefore is interested in stakeholders' opinions on the likely reach of next generation access services.

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- 3.50 It may be that the socially optimal outcomes with respect to social benefits or coverage of next generation access may not be achieved by commercial deployments of next generation access. In this situation, society would need to consider the issues that arise for citizens. Ofcom would do well to adopt a forward looking perspective on these issues, as opposed to waiting for them to emerge. However, we feel it would be premature to consider in detail the issue of social benefit or digital divide in next generation access in this document at this time, given:
- uncertainty on what next generation access services may be offered and the net benefits to society that may arise from widespread availability of higher bandwidths services;
 - uncertainty on the coverage of market-led deployments of next generation access.
- 3.51 One mechanism to address variances between the socially optimal outcome and market-led deployments access networks is through public intervention in infrastructure investment. Examples of this include the Regional Development Authorities' recent investments to enable broadband services in those local telecoms exchanges considered by the market to be uneconomic. Well-targeted public sector schemes can result in significant benefits to consumers, businesses and regional economies, with limited damage to competition between broadband suppliers. However, poorly targeted schemes have the potential to result in considerable harm, especially where public interventions risk distorting commercial companies' incentives for efficient investment.
- 3.52 Ofcom intends to publish a paper, in conjunction with the DTI, aimed at those public sector organisations considering intervention in the provision of higher speed broadband networks, including RDAs, devolved authorities and local authorities. This paper will seek to set out the main considerations when assessing if public intervention in this area is desirable and proportionate.

Scope of this discussion paper

3.53 The regulatory approach that should be adopted in the presence of enduring economic bottlenecks or significant market power held by one or more operators is of key interest to regulators. In order to progress the debate on regulation and next generation access, this paper considers what may be the most appropriate regulatory approaches in the situation that:

- new products and services emerge that are unique to next generation access deployments;
- wireline next generation access network deployments are made that are enduring economic bottlenecks;
- alternative access networks do not provide significant price constraints to the services delivered over the bottleneck wireline next generation access network; and
- one or more operators emerge with significant market power in the provision of wireline next generation access infrastructure.

3.54 We are not presuming that these outcomes will occur. Rather, these are a number of hypotheses made in order to frame the debate on appropriate regulatory approaches for next generation access. The remainder of this paper is written on the basis of these hypotheses.

Section 4

Wholesale access to next generation access networks

- 4.1 Much of the debate about the regulation of next generation access focuses on whether other operators should be allowed mandated access to this infrastructure, and if so on what terms. Around the world, regulators have taken very different approaches. For example, as we discussed above, the US has adopted a policy of explicit regulatory forbearance; in Germany the debate has been about a 'regulatory holiday', or time-limited forbearance. These different approaches reflect in part the differing prospects for competition based on end-to-end infrastructure in different countries.
- 4.2 At heart, this issue is about the answers to two questions:
- How can Ofcom ensure that efficient incentives for investment in next generation access infrastructure are not distorted, either by existing regulation, regulatory uncertainty or anti-competitive behaviour?
 - How can Ofcom ensure the continued promotion of competition once next generation access networks are in place? What risks, or opportunities, does next generation access pose for the level of competition?
- 4.3 There may be a degree of tension between these two questions: approaches that promote competition may reduce or distort operators' incentives to invest in next generation access infrastructure; whilst allowing higher returns for operators' investments in next generation access through regulatory forbearance could reduce competition.
- 4.4 In this section, we discuss these questions in three stages:
- **Forbearance or equality of access.** Should operators whose next generation access networks are likely to be enduring economic bottlenecks be required to provide wholesale access to other operators on the basis of equality of access, or should regulation explicitly forbear from such a requirement, at least for a period of time?
 - **Efficient investment incentives.** Were Ofcom to require equality of access to next generation access networks which are enduring economic bottlenecks, how can the investment's level of risk be reflected in the returns that owners of these networks earn in order to preserve efficient investment incentives?
 - **Promotion of competition at the deepest level.** Again, were Ofcom to require equality of access to next generation access networks which are enduring economic bottlenecks, how should Ofcom adhere to the principle established in the Telecoms Review of promoting competition at the deepest point in the network at which it is likely to be effective and sustainable?

Forbearance or equality of access

- 4.5 The choice of forbearance or equality of access is at the heart of the debate about regulating next generation access. Either regulation should require owners of next generation access networks which are enduring economic bottlenecks to provide access to that infrastructure, or it should not.
- 4.6 Forbearance is the explicit removal of any regulatory requirement for owners of next generation access networks to provide such access. 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 German regulation of VDSL services.

Permanent forbearance

- 4.7 Permanent forbearance has an important advantage. Investments in next generation access are risky; they may be profitable, or they may not. As we explain in the previous section, open access regulation at regulated prices may have the effect of capping the positive returns of the investment, but leaving investors fully exposed should the investment be unsuccessful. As a result, investment could be inefficiently reduced. Permanent forbearance avoids this distortion.
- 4.8 It is important that we should include explicit ex ante forbearance as a consideration as the issue continues to be debated within the European Framework Review by operators, regulators and governments.
- 4.9 The main disadvantage of permanent forbearance is that it may be that the only competition in future next generation access services is between operators who own their own infrastructure, reaching all the way to the customer. This is because there may be no wholesale products for other operators to purchase. In the USA, the regulator has taken the decision that the number of providers of end-to-end broadband access services is such that future levels of competition will be sufficient. In markets such as the US where there is such end-to-end competition in access infrastructure, a permanent forbearance approach has been associated with a rapid roll-out of next generation access services.
- 4.10 However, there are a number of factors that are likely to prevent the emergence of effective and sustainable wide-scale end-to-end local access infrastructure competition in the UK. Cable networks only cover 45% of UK households, whilst the cost of replicating a wide-scale wireline local access network in the UK may be much higher than the cost of upgrading existing copper or cable networks. This may mean such deployments are unattractive to new entrants and may not be able to compete effectively. This could result in any wireline next generation access deployments by new entrants being restricted to a small number of commercially viable areas or customers, limiting the competitive effect of these deployments.
- 4.11 In such a situation, with limited prospects for sufficient end-to-end competition in next generation access, forbearance from ex ante regulation could seriously distort the market:

- forbearance in the absence of prospects for effective competition could result in operators being able to increase expected returns from next generation access investment to monopoly levels.
- forbearance on a new technology deployment could result in inefficiently rapid investment, with operators making investments in order to move away from the regulatory remedies applied to current technologies;
- forbearance from regulating a specific technology, such as fibre, could result in inefficient selection of next generation access solutions by operators; and
- absent prospects for widespread effective competition in end-to-end infrastructure, choosing to forbear from ex ante regulation would be likely to result in a rapid decline in competition at other points in the telecoms value chain. It may be likely that benefits to consumers from such competition, in terms of choice, lower prices and rapid innovation going forward, would be lost.

Time limited forbearance

4.12 Time-limited forbearance is where a regulator commits to forbear from requiring access to next generation access networks which are enduring economic bottlenecks for a defined period of time; say a three to five year period covered by a market review. The aim of such a policy would be to deliver incentives to prospective owners of the future bottleneck by offering them monopoly rents for a period of time, after which regulation would step back in to protect competition.

4.13 However, such a policy may result in increased uncertainty for next generation access investments. 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.

4.14 In addition, the impact on competition could be expected to extend far beyond the period of forbearance. If some next generation access services were effectively a replacement for today's broadband services, competitors would be severely damaged by an inability to offer such services over several years. It could take very many years after the period of forbearance for competitors to return to the position that they hold in the market today. This risk may be compounded by the time and cost required for a vertically integrated owner of an enduring economic bottleneck retrospectively to develop a wholesale product to offer on the basis of equality of access.

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4.15 Forbearance may only be appropriate in markets where there is the prospect of widespread effective end-to-end infrastructure competition in next generation access services. Were Ofcom to believe that the deployment of widespread competing end-to-end next generation access infrastructures was likely in the UK, and that their roll-out would be sufficient to deliver effective and sustainable wide-scale competition, a policy of explicit time-limited forbearance from ex ante regulation of next generation access for the period of a market review might be appropriate.

4.16 At this time however, the prospects for effective and sustainable local access infrastructure-based competition in next generation access services suggests to

Ofcom that regulatory forbearance would be inappropriate for the UK. It would risk badly distorting the market, and severely damage the prospects for competition, with negative impacts for consumer benefits for a very long time to come.

Equality of access

- 4.17 In the absence of strong prospects for widespread, effective end-to-end competition in wireline next generation access, prospects for future competition rely on other operators having access to the bottleneck next generation access infrastructure. Central to the Telecoms Strategic Review and the Undertakings made by BT to Ofcom was the principle of equality of access. This included the principle of equivalence: that when owners of bottleneck infrastructure provided access to other operators, they should offer exactly the same wholesale products, on exactly the same terms, as they used for their own downstream divisions.
- 4.18 There are two challenges to a regulatory approach to next generation access based on equality of access. The first is to ensure that efficient investment incentives to deploy a new access infrastructure are not distorted by the regulatory environment. Of key importance here is the need for incentives that promote **efficient** investment, as opposed to any investment regardless of efficiency.
- 4.19 Where regulation prevents a bottleneck asset owner from leveraging market power into higher returns downstream, resulting in the bottleneck asset owner deciding not to deploy next generation access, efficient investment incentives have **not** been distorted. In this case, the incentive to invest is based on the ability to leverage market power in the bottleneck asset into a downstream market. If the business case for this investment relied upon such leveraging of market power into downstream markets by the bottleneck asset owner, it would not be an efficient investment. However, efficient investment incentives **would** be distorted by regulation if, in the face of demand uncertainty, regulation does not take into account the level of risk incurred at the point of investment, for example in the access terms set under any equality of access approach.
- 4.20 The second challenge is to establish the level in the network at which network access should be promoted by the regulator. As we outlined in the Telecoms Review, there are substantial benefits from competition based on infrastructure rather than just having resellers selling the same pre-defined product. However, we recognised that, for some types of network, in some geographies and for some customer densities, it may not be economically feasible for competitors to roll out infrastructure all the way to the customer. Therefore, we said that we would instead promote competition at the deepest level where it was likely to be effective and sustainable. The question is what that point is for next generation access networks. As we discussed in the Telecoms Review, it may be appropriate for regulation to promote competition at different levels of the value chain for different geographies. The impacts of network type, geography and customer densities are likely to be even more pronounced for next generation access deployments than they are for existing local access infrastructure.
- 4.21 We consider the challenges of efficient investment incentives and promotion of competition in turn in the next two sections.

Efficient investment incentives

- 4.22 One of the main challenges for regulation is how to ensure that potential investors in next generation access networks that constitute enduring economic bottlenecks can

be confident that they will be allowed to earn a level of return that adequately reflects the degree of risk they faced at the time of making the investment.

- 4.23 Equivalence implies that vertically integrated operators will not be able to leverage their control of bottleneck assets in order to earn higher returns in other points in the value chain, for example at the retail level. Therefore it is particularly important that they can expect to earn appropriate returns from the price that they charge their vertically integrated retail division and other operators for access to their next generation access network.
- 4.24 As discussed in Section 3, next generation access networks may be used to support all the different types of access products that are available today. In addition, they may be able to support a higher quality of existing products, as well as offering the possibility of supporting new and innovative products that may require very high speeds or symmetric bandwidth. Each of these circumstances is likely to require different approaches to the pricing of any regulatory remedies that may be applied. Demand for existing services and higher quality versions of existing services is likely to be much more predictable than demand for entirely new services, and it may be appropriate for this to be reflected in any mechanisms chosen to calculate the price of regulated access.
- 4.25 There are two main considerations of relevance for the application of equality of access for next generation access investments:
- the most appropriate pricing mechanism; and
 - approaches to modifying traditional pricing mechanisms to reflect the investment risk at the time of deployment.
- 4.26 We also briefly consider below a third issue that may affect the incentives for investment; that is, the issue of 'network neutrality'.

Pricing mechanisms

- 4.27 The traditional regulatory pricing mechanisms that could be applied to next generation access deployments include:
- a. access obligations but with no regulatory determined prices;
 - b. retail minus pricing;
 - c. cost plus a mark-up for common costs;
 - d. cost plus with an activity-specific cost of capital;
 - e. returns adjusted for a symmetric 'fair bet'; and
 - f. cost plus with additional rewards for making risky investments.

a. Access obligations

- 4.28 Under this approach, the owner of bottleneck assets would be obliged to supply, on a non-discriminatory basis, access to those bottleneck assets to third parties. The access terms may be agreed on a commercial basis between the parties or set by the bottleneck asset owner. Under an equality of access approach, the bottleneck

asset owner would be obliged to provide wholesale access to all operators including its own vertically integrated downstream retail operations at the same rate. This approach presents the opportunity for limited regulatory intervention, or need to determine prices for the wholesale inputs to next generation access products. This makes its implementation easier than some other regulatory approaches. It also allows the market to set the most appropriate price for access, taking into account the market's own assessment of the riskiness of the investment.

- 4.29 However, this approach may also offer incentives for a vertically integrated bottleneck asset owner to undertake a number of activities to distort competition, including extracting monopoly rents from its access network, cross subsidise its downstream retail services or margin squeeze competitors using access to its next generation access network as an input to a downstream retail product. The ability to act on these incentives is constrained by ex post competition law.
- 4.30 This approach would not require Ofcom to determine the level of risk in the investment – this would be left to the market. However, in the event of any disputes being raised on access terms, Ofcom may be required to undertake a margin squeeze test. This may make this approach little different to the following approach of retail minus pricing – it may simply result in ex post price regulation as a result of disputes as opposed to ex ante price regulation of services. If this were likely, it may be more suitable to determine prices ex ante in order to limit the risk that the bottleneck asset owner gains a competitive advantage, for example significant market share, before the conclusion of any margin squeeze assessment. This may be of greater significance in fast growing markets.

b. Retail minus pricing

- 4.31 This pricing approach would not set the absolute level of the charges, but instead require that a sufficient margin exists between the price of each regulated wholesale access product and the relevant downstream price to allow the necessary additional costs of providing the downstream product to be covered. Therefore, wholesale product prices may be set by the regulated firm provided that there is sufficient margin between the prices for its wholesale product and those downstream products that use the wholesale product as an input. These downstream products may be retail services, or may be another downstream wholesale product. This 'margin' between the two products' prices is required so that other competitive operators reliant on the provision of the bottleneck asset owners' wholesale product can compete in downstream service provision. A retail minus pricing obligation would need to be coupled with an obligation to supply and a non discrimination obligation in order for it to be effective.
- 4.32 A retail minus approach is generally used in two sets of circumstances: where market power is not entrenched and effective competition is likely to develop; or where the market is new and innovative and there could be a risk of deterring investment.
- 4.33 In the former case, retail minus may be preferred to a cost-based approach to pricing because, as competition grows stronger, competition would ensure that charges reflect costs. Relying on competition to avoid excessive charging by operators with significant market power, where possible, is preferable to a regulator's assessment of cost-based charges.
- 4.34 In the case of a new and innovative market, retail minus might be preferable to a cost-based approach because it is difficult to assess correctly the reasonable return on capital that should be included in cost-based charges. If charges were based on

the regulator's estimate of costs, there is a risk that they may not provide a sufficient return for innovative and risky investments and that this may adversely affect incentives to invest and innovate, thereby slowing the development of competition.

- 4.35 The application of a retail minus approach necessarily incorporates a test for the calculation of the margin squeeze. The margin squeeze calculation can be quite complex, especially in situations where a single wholesale product is an input in to multiple retail products. For example, it would need to be determined whether the margin squeeze test must be passed on all retail products.
- 4.36 This approach is one of the least likely to distort efficient investment incentives as it does not cap the level of return that the bottleneck asset owner can make on next generation access investments. However, the complexity surrounding tests for margin squeeze, and the possible need to resolve these at service commencement, in order to prevent any near term advantage to the bottleneck asset owner from margin squeezing competitors, will necessarily complicate this approach.

c. Cost plus a mark-up for common costs

- 4.37 Charges for regulated services can also be set so as to reflect long run incremental costs. This approach consists of setting the charges on a cost-oriented basis, where the costs included in the charges are:
- the forward-looking long run incremental costs efficiently and necessarily incurred by the regulated firm to provide the service to which the charge refers;
 - an appropriate mark-up to allow the recovery of common costs ; and
 - a reasonable return on the capital employed.
- 4.38 Ideally, charges would be set in a way which encourages buyers to take account of the resource costs of their purchasing decisions. The charges that prevail in a competitive market have this feature. In a regulated environment, cost plus based charges are the ones that most accurately reflect the resources consumed by the provision of services and, thus, correspond more closely to the charges that would occur in a fully competitive market. Cost plus based charges also encourage efficient entry at the network level because they reflect replacement costs, which are the costs that would be faced by a new entrant.
- 4.39 Cost plus charges, however, are generally not appropriate when the market is new and innovative, as it would be difficult for the regulator to assess the appropriate return to allow on capital employed and to forecast the correct utilisation factor of the assets. Setting incorrect charges, particularly if they are set too low, may deter efficient investment decisions and slow down the development of competition.
- 4.40 The application of cost plus pricing does include an estimate of the risk involved in an investment through the reasonable return on capital employed. Traditionally the cost of capital used has been assessed at the company level based on the overall risk in an operator's business. However, this may not be appropriate for specific investments that have a different risk profile, including next generation access deployments.

d. Cost plus with an activity-specific cost of capital

- 4.41 This is similar to a traditional cost plus approach where wholesale charges are set by the regulator. However, 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. This approach may be justified if there is a particular investment has either a higher or lower degree of systematic risk than the overall business.
- 4.42 Ofcom has used this approach in the past in other contexts, notably in determining the cost of BT's copper local access network. In that case, using the project-specific risks of copper access networks, which are lower than the overall company weighted average cost of capital, resulted in the application of an activity specific cost of capital to reflect the different risk profile of this type of investment.
- 4.43 One of the concerns that companies may have in investing in bottleneck assets with a high degree of risk is that the regulator will not allow a reasonable return on these investments. Applying a project-specific cost of capital allows the bottleneck asset firm to earn higher returns for specific services being offered over next generation access investments proportionate to the risk that is being incurred. However, this is only appropriate if the systematic risk associated with the investment is higher than the overall risk for other investments. It is not clear at this time that next generation access investments will display higher degrees of systematic risk than other investments.
- 4.44 Next generation access investments are likely to be subject to a high degree of uncertainty at the time of deployment around whether they will be successful or not. However, it is important to note that the project-specific cost of capital should take into account the level of risk at the point of deployment. It may not be appropriate to apply the same risk factor to a project which is deployed over a number of years. For example on early investments where there is a higher degree of demand uncertainty and therefore greater risk, it may be appropriate to allow higher returns. However, this should not be reflected in the activity cost of capital, which is associated with systematic risk, but rather in the issue of a 'fair bet' and the timing of investments. We explore these issues further below.
- 4.45 In order to be successful, this approach would require a robust analysis for calculating the differential risks of different activities. Given the effort required to achieve this, and the relative degree of subjectivity surrounding activity-based risk assessment, it may only be appropriate for those activities where the systematic risks are quite significant.

e. Returns adjusted for a symmetric 'fair bet'

- 4.46 This approach would seek to adjust for the asymmetric risk a firm may bear when faced with regulation of services based on risky investments. 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. If the demand outcome was favourable then it may make significant returns and if it was unfavourable it may make significant losses.
- 4.47 A straight-forward application of the standard cost plus pricing approach may have negative incentives to invest since it 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 – thus the firm does not get a ‘fair bet’.

- 4.48 One way in which to achieve a symmetric ‘fair bet’ for investments in next generation access, with access terms set on a cost plus basis, would be for two principles to be satisfied. First, the price should be set to earn a reasonable return on the basis of the expected cash flows from the investment at the time of deployment. Second, in the event that the outcome of the investment diverged from the expected returns given the regulatory determined price for access, the treatment of the good and bad outcomes should be symmetric, so that the risk of bearing unexpected losses is matched by the prospect of keeping unexpected profits.
- 4.49 In general, symmetric treatment of good and bad outcomes is achieved in regulation by allowing a glide path from higher/lower actual outcomes towards the expected returns. In the case of higher than expected returns, the regulator could define a glide path for the operator’s returns to tend toward the originally expected level. This glide path allows the investing company to be able to keep a proportion of the higher returns for longer, as opposed to witnessing them all being regulated away immediately through a one-off adjustment. In the case of lower than expected returns, the regulator may need to allow revisions to the access terms for the product, for example price increases, so expected returns tend towards the level originally expected in the presence of regulation.
- 4.50 However, it is difficult to achieve a symmetric treatment of outcomes in the scenario where no demand materialises - in other words the complete failure of the investment. This is because the lack of demand means that it is not possible to offer a glide path back to the expected level of returns by increasing the regulated price.
- 4.51 Not only is this asymmetry of treatment, in itself, an area of concern, but this asymmetry also has an effect on the overall value of the expected returns (taking into account future regulatory treatment) from this investment which is lower than it would otherwise be. This suggests that the regulated price may generate lower returns than the project’s cost of capital.
- 4.52 One way of compensating for the asymmetry is to allow an upward adjustment to the regulated price to reflect the reduction in the expected returns due to the asymmetric treatment. Whilst this does not correct for the asymmetry it may be able to compensate for the asymmetric treatment such that the investor faces a ‘fair bet’ when undertaking the investment.
- 4.53 We are interested in stakeholders’ views on how regulatory policy may be used to take account of symmetric fair bets, and on the possible approach discussed above.

f. Cost plus with additional rewards for making risky investments

- 4.54 This is an approach based on a different view of how investment and innovation occurs. It is a concept developed by the economist Joseph Schumpeter where investment and innovation is focused on the role of the entrepreneur in forcing ‘creative destruction’, in which old ways of doing things are destroyed and replaced by the new, across markets and industries. In this view, monopolies and large profits are seen as necessary phenomena to provide the incentives to drive innovation by entrepreneurs. This approach would suggest that, in order to make the investment in next generation access networks, firms would need to earn a return in excess of one that adequately reflects the risk involved – i.e. an additional reward over and above the risk reflective return.

- 4.55 Ofcom does not normally take this view when determining policy. Our approach to regulation is more firmly grounded in the view that it is competitive markets that deliver optimal and efficient outcomes. This underlies Ofcom's general approach to access networks, which favours an equality of access approach where upstream bottlenecks have been identified and promotion of downstream.

Efficient timing of investment and real options

- 4.56 A real option is the right, but not the obligation, to undertake some business decision, typically the option to make a capital investment. One example of a real option particularly relevant to next generation access is the 'waiting to invest' option. In this case, a firm can make the decision to invest now but it faces uncertainty about a large number of possible outcomes. Or it can make the decision to invest later when certain outcomes have been eliminated and therefore there is greater certainty about possible outcomes. The difference between the expected value of the pay-off from investing now and investing later is the option value from 'waiting to invest'.
- 4.57 The application of real options in assessing the cost of capital would be as a substitute, as opposed to additional, to other approaches. Using real options to determine the appropriate cost of capital may make allowances for the same factors that are either explicitly or implicitly included in other approaches to setting regulated prices. Real options however are a more sophisticated approach.
- 4.58 However, the sophistication of this approach has implications for the degree of complexity in assessing real options. For example, the level of information required to measure the value of real options accurately is very high. This is the case for incremental investments in current products and services, but becomes even more important for large, one-off investments in new infrastructure, products or services. For example, valuing real options requires information on the volatility and variances in a number of key factors that influence investment returns, including demand, costs and risk. For existing services, it may be possible to analyse empirical evidence on these variances to form a view of future returns. However, no such information may be available for one-off investments in entirely new products and services.
- 4.59 The complexity associated with real options is further compounded by the fact that options can be created as well as destroyed following any investment decision. For example, an investment in next generation access may create an option to deploy a particular new product or service in the future that was not envisioned at the time of network deployment and that could not be delivered over current generation local access networks. The value of these options created may therefore need to be factored into any assessment of the real options.
- 4.60 With respect to next generation access, real options may be useful as they include considerations of the timing of investments. As we discuss below, the implications for risk on the timing of next generation access investment is of key importance. Real options reflect the implications of investment timing in a more sophisticated way than other approaches, which are more binary in nature: either a project is viable or it is not – there may be no consideration of how a project's viability may vary over time.
- 4.61 Ofcom considered the use of real options in regulatory policy within its 'Approach to risk in the assessment of the cost of capital' statement in August 2005⁹. Within this statement, we proposed to assess the value of real options on a case-by-case basis. Before using a real options approach to regulation, there are a number of criteria that

⁹ http://www.ofcom.org.uk/consult/condocs/cost_capital2/statement/

determine the appropriateness of this approach. These include: demand uncertainty; inability of operators to pilot or trial the services; absence of first mover advantage; and the genuine value associated for operators in adopting a 'waiting and see' approach.

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- 4.62 The various approaches listed above could be applied to the regulation of bottleneck next generation access networks for a long time to come. This brings about two further complications, as time goes on.
- 4.63 The first is that prospective owners of bottleneck next generation access networks need to be confident that they will be allowed to earn risk-reflective returns for much of the life of the asset. The problem is that, at some point in the future, it may be hard to recall that deploying these assets was ever risky at all. The temptation therefore will be for future regulators to return to regulating assets using a cost-based approach assuming lower levels of risk and hence a lower cost of capital. If operators anticipate that this might happen, this will affect their incentive to invest. So regulators need some way of making contingent commitments; for example, committing themselves to regulating the asset in a particular way so long as the operator is found to have significant market power. Under the European framework, however, it is hard to make such contingent commitments. This is in part because the findings of one market review cannot bind the findings of a subsequent one.
- 4.64 The second complication is that the level of risk associated with an investment in next generation access is likely to change as successive tranches of investment are made. As the uncertainty around new services diminishes, so the average expected returns from that investment will increase, as there is less risk of the investment failing. Therefore, in order to maintain the same level of return on these later tranches of investment as was achieved for initial investments, a lower blended average access price may be more appropriate to ensure the same level of return from these assets.

Investment incentives and net neutrality

- 4.65 One way that operators may plan to monetise investments in next generation access is through offering content providers different levels of quality of service to deliver their applications to consumers. This issue continues to be discussed within the US and Europe as part of the net neutrality debate. For example, if a service provider wished to provide a high definition TV on demand service, the access provider might charge the high definition TV application provider a premium for offering to guarantee the quality of service with which subscribers received that service.
- 4.66 This could make a substantial difference to the business case for such infrastructure investments. In this regard, next generation access is an example of a two-sided market. Just as magazines charge both advertisers and subscribers, next generation access providers may plan to secure payments from both consumers and application providers.
- 4.67 Were regulation introduced in Europe which restricted service providers from acting in this way, it could affect their incentives for investing in next generation access networks. This issue is currently being considered in the context of the Review of the European Regulatory Framework.

- 4.68 This issue is still being debated in Europe. But it is important in the context of next generation access: as regulation in this area evolves, this could have significant implications for operators' incentives. Regulation that prevented these strategies could remove a potential source of revenue and return for next generation access networks.

Promotion of competition at the deepest level

- 4.69 The second main challenge with a regulatory approach based on equality of access is to determine the level in the network at which third party access to bottleneck assets could be promoted.
- 4.70 In the Strategic Review of Telecoms, Ofcom established the principle that regulation should be focused on promoting competition at the deepest level in the network (i.e. closest to the customer) where competition was likely to be effective and sustainable. This was because we considered that competition based on infrastructure was much more conducive to competitive innovation than competition based only on service provision. One example of this effect is Ofcom's policy and approach to local loop unbundling, which has resulted recently in improvements in the level of competition in broadband services, and benefited customers in terms of new services, increased choice and reduced prices.
- 4.71 At its most effective, this principle can lead to a 'ladder of investment', where competitive operators build sufficient scale interconnecting at one point in the network which allows them to invest in infrastructure closer to the customer. For example, potential benefits arising from competitive differentiation of services may drive local loop unbundling operators with sufficient scale to invest in infrastructure beyond the exchange, including in next generation access investments. French local loop unbundling operator Iliad recently announced such an investment in fibre to the home in Paris and other dense metropolitan areas where it has more than 15% share of the current broadband access market. Such investments will increase the level of competition, and as a result may further increase consumers' choice, reduce prices, and increase innovation.
- 4.72 This principle of promoting competition at the deepest level in the network where it is likely to be effective and sustainable could be applied to next generation access networks, where they are likely to be enduring economic bottlenecks. However, the level in the network where regulatory remedies could be applied to next generation access networks may differ substantially from the current copper-based generation broadband access network. The options available are also likely to be dependent on technology choices made by industry, and it may vary for different customers, or in different geographies.
- 4.73 There are a number of factors relevant to determining the point in the network at which equality of access remedies might apply. They include:
- **Where access is technically feasible.** For example, it may not be possible to unbundle some fibre deployments based on passive optical networks (PONs) in the same way as copper local access networks. Because of their architecture, it may be possible to have remedies at the bitstream or wavelength level, but possibly not at the level of physical infrastructure such as dark fibre.
 - **Where access is likely to be practical.** For example, it may be technically feasible for rival fibre-to-the-cabinet networks to access unbundled sub-loops at the cabinet. However, it may be practically unfeasible to have multiple, rival

cabinets or footway boxes because of a lack of space on the pavement; or it may be practically unfeasible for engineers to rejoiner customers at the cabinet level whenever they change supplier.

- **Where access is likely to be economic.** Even if it is technically and practically feasible for rivals to interconnect at a certain point in the network, it may not be economically viable for them to do so. For example, it may be that the minimum efficient scale required to support rival electronics in street cabinets precludes effective competition at this level.
- **Where access is likely to lead to competitive innovation.** The reason for aiming for competition as deep as possible in the network is to maximise the scope for competitive innovation. Yet there are certain assets which are deep in the network but where the potential for innovation is very limited. These may include ducts and dark fibre, for example. It may be wasteful duplication to encourage rival operators to invest in such assets, with little gain in terms of greater potential for competitive innovation, especially if equality of access is implemented.

4.74 Using this framework, it is possible to consider a wide range of points in the network at which equality of access remedies could be applied. It should be noted that the available options to promote competition at different points in a next generation access network may vary depending on the specific technology deployed. We explore four of these options further below:

- a) access to bottleneck asset owners' physical plant, including duct and poles;
- b) sub loop unbundling / co-location of equipment at the cabinet;
- c) fibre unbundling at the exchange; and
- d) access to a wholesale bitstream product with either local or metro-node interconnection.

Ducts and poles

4.75 One of the key potential constraints to the deployment of next generation access infrastructure is the cost associated with wireline network deployment. Around 70% of deployment costs are can be incurred in civil works – the digging of trenches and laying of new ducting and fibre.

4.76 Sharing the physical plant of bottleneck asset owners' local access networks, including ducting and poles, would significantly reduce the cost of deploying wireline solutions by competitive operators. This may especially be the case in rural areas or areas where new civil works would be complex, such as in dense urban areas. If duct and pole sharing were to prove feasible in the delivery of a mass market next generation access network, it might provide the opportunity to significantly reduce total cost of deployment for competitive next generation access networks.

4.77 Sharing of telecoms physical infrastructure by third parties to deploy competitive access networks was reviewed by Ofcom on several occasions, with the last assessment in 2002¹⁰. Ofcom concluded that formal intervention to require duct and

¹⁰ http://www.ofcom.org.uk/static/archive/ofcom/publications/ind_guidelines/duct0602.pdf

pole sharing was not required, on the basis that there was little demonstrated demand from operators for such an intervention, and that any formal intervention would present substantial practical difficulties.

- 4.78 It may now be appropriate to revisit duct sharing with particular attention paid to next generation access services. Ofcom is interested in stakeholders' views on the level of demand from communications providers and practicality of local access network duct sharing in the deployment of a next generation access network.

Sub loop unbundling at the cabinet

- 4.79 Should a fibre-to-the-cabinet topography be chosen, competitive operators may have the opportunity to move active electronics from the exchange in local loop unbundling to the cabinet to unbundle the sub-loop.
- 4.80 Competition at this level in the network would represent a move up the ladder of investment for competitive operators; access network competition would move closer to the customer. This option would also preserve the scope for product innovation in the market by allowing competitors choice in their technology deployments.
- 4.81 However, sub loop unbundling may face economic and practical limitations:
- the economics of sub-loop unbundling are uncertain. The minimum efficient scale, in terms of share of lines that a competitive operator may need to achieve within a particular cabinet to cover fixed investment costs and achieve sustainable competition, may be materially higher than the share of lines required for sustainable local loop unbundling competition; and
 - sub-loop unbundling faces practical constraints also, including the availability of space and electricity supply at the cabinet for multiple sets of electronics.

Fibre unbundling at the exchange

- 4.82 One technical option for next generation access would be the deployment of fibre from the exchange to the customer premises. In this situation, competitive operators may seek to move from an unbundled copper product to an unbundled fibre product, retaining the same level of infrastructure investment and positioning in the network architecture whilst benefiting from the increased bandwidth available over a fibre local access network.
- 4.83 However, the technology and topology chosen to implement fibre in the access network may severely limit the practicality or cost of unbundling fibre at the exchange:
- where point-to-point fibre technology is chosen, it may be possible to unbundle the local loop in a manner very similar to that used today for copper;
 - if a shared infrastructure topology, such as Passive Optical Networks, is chosen, it is no longer possible easily to associate a single physical element of connectivity with a particular end user. In this situation options for unbundling become more challenging. For example, it may be possible to associate wavelengths with end users to achieve a form of unbundling. However the wavelength division multiplexing (WDM) technology required to support this form of unbundling is relatively untested for use in the access network and may be both complex and expensive to implement.

- 4.84 Options based on any form of unbundling at the exchange may be further limited by the approach a bottleneck asset owner may take to next generation access deployment. Next generation access deployments by incumbent telcos may not allow for simple migration from copper-based unbundling to next generation access unbundling. For example, the commercial case for deployment of next generation access for some operators may be based in part on the availability of cost savings. To achieve these cost savings, some operators are considering the removal of exchanges following next generation access deployment in order to reduce cost. The rationale for deployment of next generation access networks and the available cost savings may be further complicated if the operator has deployed a next generation core network. For example, this may further increase the cost savings from deploying an all Internet Protocol network deeper into the access network and removing exchange locations. This is the approach currently being considered by KPN in the Netherlands.

Access to wholesale bitstream products

- 4.85 The provision of regulated wholesale bitstream access in downstream broadband origination markets is another option for the focus of future regulation. This may be the case where future next generation access upgrades meant that effective competition deeper in the network than such bitstream access provides was not viable. The benefit of promoting competition at this level is the relative lack of complexity in wholesale product definition. However, this option would imply competition in the network moving away from the customer towards service provider-based competition. This could risk reduced prospects for innovation in next generation access services, because it would mean that competitive operators did not have control over the technology and solutions deployed in the access network. These decisions would be made by the bottleneck asset owner.

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- 4.86 In addition to these four levels, there are many others at which remedies could be applied. Some may be suitable with some next generation access technologies, others unsuitable. The impact of different technologies on the competitive landscape means that, whilst Ofcom continues to take account of the desirability of regulating in a technology neutral manner, we are keenly interested in the technologies that all types of operator wish to deploy as they move to next generation access networks. These technology choices may have material impacts on the available and preferred approaches to promoting competition at the deepest level in the network. If today's competitive operators are not anticipating deploying their own networks that connect all the way to the customer, we are keen to understand where in a bottleneck asset owner's network they would prefer to interconnect.

Section 5

Implications for existing regulation

- 5.1 The previous chapter discussed whether regulation should require competitors to have access to next generation access networks which are enduring economic bottlenecks, and if so on what terms. However, the deployment of next generation access infrastructure may also have a number of implications for existing regulation, including the wholesale local access and wholesale broadband access markets, as discussed in Section 3.
- 5.2 The Undertakings given to Ofcom by BT¹¹ 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, it must (except in certain specific circumstances) also provide it to other communications providers on an equivalence of inputs basis.
- 5.3 In addition, Ofcom must consider the appropriate level of support for current wholesale products as operators move to next generation networks. This issue was considered by Ofcom in its consultation and statement on Next Generation Networks with respect to a number of current regulated wholesale products. This issue will arise again with the deployment of next generation access networks.

Support for legacy wholesale products

- 5.4 BT is currently required to offer a range of wholesale access products under the ex ante framework. For example, in the broadband value chain these include sub-loop unbundling (though this is not currently being widely used), local loop unbundling, bitstream access and access at the IP layer.
- 5.5 Some of the access network upgrade technologies that a local access network owner might choose to deploy would make it difficult or expensive to offer such products in future. For example, it may be much more expensive to roll out fibre-to-the-cabinet and provide DSL from the cabinet, if a proportion of lines continued to require a copper connection from the exchange to support LLU.
- 5.6 In addition, some of the rationale for investing in next generation access networks might be to reduce the on-going operational cost of the copper local access network. Once in place, fibre access networks can be cheaper to run than copper ones. For example, fibre deployments could run all the way from customers' premises to a metro node, eliminating the need for local exchanges. But many of these cost savings would only be achievable by stripping out the copper access network entirely, and not running the two access networks in parallel.
- 5.7 This is the situation that has arisen in the Netherlands, where KPN is proposing to deploy fibre-to-the-cabinet to 28,000 street cabinets. By locating equipment in these cabinets, KPN will then be able to remove active electronics at the exchange, leading to cost savings.

¹¹ http://www.ofcom.org.uk/consult/condocs/statement_tsr/

- 5.8 In this situation, OPTA has published a consultation outlining the potential conditions that may apply to KPN in its rollout of a fibre-to-the-cabinet network. These include:
- limitations on the timescales for KPN to phase out of existing unbundling products, varying by exchange location; and
 - a requirement to continue to support requests for unbundling at the exchange for those areas where fibre-to-the-cabinet has not been deployed.
- 5.9 The decisions that Ofcom takes about the need to support today's wholesale access products could therefore affect both the bottleneck asset 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.
- 5.10 Ofcom remains committed to the principles we outlined in the Telecoms Strategic Review, specifically our focus to promote competition at the deepest levels of infrastructure where it is likely to be effective and sustainable. Our commitment to this approach has resulted in competitive communications providers investing in products, services and infrastructure on the basis that the wholesale products on which they based their investments would remain available for some time to come.
- 5.11 Ofcom's role is not to protect these 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. Competitive operators have made and are making significant investment in communications infrastructure on the expectation that currently available regulated wholesale products will be available for a reasonable period of time, for example LLU products. Ofcom remains committed to the supply of these wholesale products as set out in its Wholesale Local Access market review, carried out in 2004¹². Ofcom is keenly aware of the impact that upgrades to existing bottleneck assets and an associated removal of current wholesale access products may pose to current competitive communications providers.
- 5.12 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 would 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. 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 would be fundamental.
- 5.13 We are keen to hear stakeholders' views on these issues. Our initial inclination is that the benefits of strong competition are such that it is essential that wholesale products which use the copper access network should be available to competing operators for a considerable time to come. However, so long as timing and migration processes are sufficiently transparent, well signalled and certain, it may be appropriate to outline well-defined dates at which obligations to supply certain wholesale products may no longer be required.

¹² <http://www.ofcom.org.uk/consult/condocs/rwlam/statement/>

Section 6

Next steps

6.1 Ofcom is interested to discuss further the issues raised in this document, and any thoughts or concerns that any interested party has relating to next generation access. This discussion document is addressed to all organisations and individuals who have an interest in the telecoms industry in the UK. This includes, among others:

- businesses participating in the telecoms sector, including infrastructure-based operators and service providers, and manufacturers of telecoms equipment;
- other organisations with a commercial or employment interest in the sector, including content and application providers, content aggregators or trades unions;
- consumers of telecoms services, either as businesses or as individuals, and organisations representing consumers;
- individuals or organisations concerned with the impact of telecoms on particular groups of citizens, or on the economy as a whole; and
- Government departments, Regional Development Agencies and Devolved Governments.

6.2 As we have discussed throughout this document, there are a number of specific areas where we are interested in the views of all stakeholders, including:

- the likelihood of wide scale competitive next generation access infrastructure deployments;
- the likelihood of alternative wayleaves or infrastructure deployment reducing the bottleneck in local network access for next generation access services;
- the viability of using alternative wayleaves to deploy competing next generation access networks in the UK, both nationally and regionally,
- the likely substitutability of services between different next generation access technologies;
- how and where the deployment of next generation access infrastructure may result in significant social benefits: what applications and services enabled by next generation access may result in incremental consumer and citizen benefit beyond what is delivered by current generation broadband access networks;
- the likely reach of next generation access services, and the sources of any costs to society that may arise from regional deployments of higher speed access services;
- how regulatory policy may be used to take account of symmetric fair bets with respect to next generation access investments;

- the level of demand from communications providers and practicality of local access network duct sharing in the deployment of a next generation access network;
- the technologies that all types of operator wish to deploy as they move to next generation access networks;
- where in a next generation access network competitive operators would prefer to interconnect given their own plans for further investment and network upgrades; and
- the appropriate approach to future support and potential migrations for legacy wholesale products following the deployment of next generation access networks.

6.3 In order to understand further the issues relating to next generation access for industry and the wider stakeholder community, Ofcom intends to meet with key stakeholders to discuss their opinions and thoughts on next generation access in early 2007. Ofcom will also organise a number of stakeholder seminars to discuss next generation access related issues further.

6.4 Whilst this document is not a formal consultation, Ofcom invites written views and comments on the issues and questions raised in this document. We hope to use these views to promote further public discussion of the issues and, where possible, publish these responses on Ofcom's website. If you have any comments or questions about this public discussion document or wish to discuss any of the issues raised, please contact Clive Carter (clive.carter@ofcom.org.uk) on 020 7981 3541. In addition, more information can be found on Ofcom's website: www.ofcom.org.uk/.