OFFICE OF COMMUNICATIONS

Delivering super-fast broadband in the UK

Setting the right policy framework

Consultation

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Section 1

Executive summary

1.1 Broadband has been one of the most significant developments in communications technologies in recent years. The move from dial-up internet access to broadband services has had a phenomenal impact on consumers, citizens and businesses. Take-up has reached 58% of homes in less than eight years. Broadband has fundamentally changed how people work, communicate, access information and consume media services.

1.2 The desire for operators to offer ever faster services, and for customers to use the applications or services this speed supports, shows no sign of reducing. We are now on the cusp of a new and potentially more fundamental development – the move to 'super-fast' or very high speed broadband. These services will deliver significant improvement to users' broadband experience through higher bandwidths, a better balance between downloading and uploading speeds, and more reliable, higher quality services.

1.3 But delivering these new services will require investment either in new physical infrastructure or in new technologies – 'next generation access'. A number of existing and new communications providers have already announced their investment intentions for such networks, including BT and Virgin Media.

1.4 This document updates the thinking behind our consultation "Future Broadband – Policy Approach to Next Generation Access" published in September 2007 in light of these developments and the responses we received. It focuses on how we can both encourage investment and promote competition in these new networks. This document complements the other recent publications we have seen on this topic, including the Caio review and the European Commission's Recommendation on Next Generation Access.

What will next generation access mean for consumers?

1.5 For consumers, super-fast broadband will support new services and ways of communicating. Examples of these new services might include: reliable high definition video; two-way video communications; simultaneous usage of broadband services by different householders; social inclusion for disabled people through new ways of communicating; and new ways to access public service content and information, including health and education information.

1.6 For business customers new networks make high bandwidth connections that offer greater upload speeds affordable for small businesses. They can change working practices and businesses' costs by making home working a more viable and interactive activity.

1.7 To make sure consumers and business benefit truly from super-fast broadband, we must learn the lessons from today's broadband experience. In the early days of broadband, limited competition meant there was little choice, high prices and low take-up. Consumers were not aware what broadband could do for them, and once they had subscribed, could not easily switch provider.

1.8 For super-fast broadband to be a success, consumers must be aware of the services on offer, with suitable information to choose between alternatives. They must also be

able to exercise choice by being able to move from one service provider to another. This will require good quality migration processes for consumers moving to next generation access networks, back from them, or between different operators' networks.

Vision for the future – a mixture of technologies supporting new services

1.9 Our stakeholders – communications providers, industry groups, and consumer and business bodies – tell us they increasingly believe that super-fast broadband will bring real benefits and opportunities. However, the evidence to support this is still emerging, even in those countries where these networks have already been built. This means that there is still a lot of uncertainty as to exactly who will want to use super-fast broadband, for what services, and how and where new access networks to deliver these services will be built.

1.10 In practice, the supply of super-fast broadband will be based on a range of different technologies, including fibre, satellite, cable, fixed wireless and mobile wireless. Each technology has its own benefits and costs. The best placed technology will vary depending on factors such as location, customer density, usage and demand for mobility. We believe that technology choice is best left to the market.

1.11 Ofcom's focus is on furthering the interests of consumers and citizens. We think the delivery of these new networks is desirable, and will help to deliver both consumer and citizen benefits. We want to promote private sector led investment in the right technology at the right time, based on a competitive environment, and supported by the right regulatory framework. It is through such competition and regulation that the consumer and citizen interests can be best met.

How can and should regulation contribute to the future?

1.12 Regulation must support investment by the private sector, while at the same time promoting competition wherever there are potential barriers to competitive delivery of services. This is especially true for fixed next generation access networks that are likely to display the characteristics of enduring economic bottlenecks. Our stakeholders have told us that the most valuable ways regulation can support private sector investment is to:

- provide a clear, consistent and transparent regulatory regime;
- ensure any regulation takes account of the uncertainty and risk in investment;
- provide flexibility in trialling and piloting to help develop and test new technologies, commercial relationships and services;
- support experimentation by all organisations on how to deploy or run these services, including new entrants, the public sector and community broadband projects; and
- reduce barriers to entry wherever possible. Our strategy of spectrum release, liberalisation and trading is a key area in achieving this aim, enabling the market to launch new wireless services when the time is right, including those that may compete in the delivering of next generation access services.

1.13 Regulatory certainty is key: we will aim to deliver this certainty by committing to ensuring our decisions are clear, timely and consistent over the longer term. We will

also seek ways to ensure such certainty and consistency is reflected within the EU Framework where ever possible.

1.14 On promoting competition, we do not think that the move to new, next generation access networks means we need to fundamentally change our current regulatory approach. We continue to believe that competition at the deepest level that is effective and sustainable, supported by equivalence of access, is the right approach. What might change is what this means in practice. How to deliver on this objective in the future is one of the key areas for decision in setting the regulatory regime.

There are three main incentives for investment that regulation could affect

1.15 Regulatory policy can enhance the incentives for investment. There are three main incentives for investment that can be affected by regulation to varying degrees. They are:

- the degree of competition and contestable investment, which will drive investment and innovation;
- the potential for cost efficiencies or cost reduction; and
- the opportunity for service and infrastructure providers to increase revenues, either from new services or new commercial relationships.

Ensuring competition remains key to our approach

1.16 The experience of current broadband shows that competition brings the most benefits in terms of consumer outcomes, investment and efficiency. Where there are substantial barriers to entry, it is therefore desirable to promote competition through regulation.

1.17 In the future, it remains likely that effective competition will depend on regulation, at least in some locations. As with today's broadband market, promoting competition may require regulated access for third parties to the networks and products of operators with market power.

1.18 One of the key questions for industry and Ofcom is what form any wholesale products should take. In our last consultation, we identified two types of wholesale product: 'passive' products, relying on access to physical network elements, like copper, fibre, or duct; and 'active' products relying on access to the electronic equipment that is connected to the physical infrastructure.

1.19 Active and passive products both have different strengths. Active products may result in lower costs, but can limit product and price innovation and differentiation to competing providers. Passive products on the other hand offer much more opportunity for differentiation, but suffer from the risk of duplicative investment and fragmentation, increasing the cost of competition.

1.20 We believe that passive products offer the most desirable means to promote of competition where economically sustainable. However, in practice we are likely to need a mix of active and passive inputs initially, allowing scope for technical and economic experimentation. As is the case today with current broadband, both may be required into the future. However, the distinction may not be as simple as a choice between active and passive products. In reality, both active and passive products can take a number of forms, each with subtly different characteristics.

1.21 Openreach's consultation on its proposed next generation active product, Generic Ethernet Access, is the first move from industry to explore the potential of future wholesale access products. We look forward to the outcomes of this discussion and consultation. Our final regulatory decisions will be heavily influenced by the outcome of these industry discussions.

1.22 Responses to our previous consultation, stakeholder discussions and third party analysis all suggest that widespread use of some options for passive access may be uneconomic on a mass scale. This is because of the potential for higher costs and smaller scale at each location than today.

1.23 However, passive access could take many forms, based on different network deployments or commercial models. Some of these may improve the underlying economics making these products more attractive. We think that industry needs an opportunity to explore such options, and to look at innovative ways of making competition based on passive access work economically and practically.

1.24 We are particularly interested in how joint investments or risk sharing may be able to improve the economic case for passive access. This is where more than one party shares part or all of the investment cost. For example, operators might co-invest in some shared parts of the network, while still investing in some pieces of the network individually.

1.25 Joint investment has benefits both for existing network owners and alternative network operators. It can help existing network owners to share, and reduce, the risk associated with upgrading to next generation access. Also, drawing on more than one organisation's financial resource may allow a wider, and potentially faster, rollout. For alternative network operators, joint investment allows a greater degree of control of the underlying network, offering more opportunities for innovation and differentiation in products and prices.

1.26 However, co-ordination and effective management of joint investment approaches can be difficult. We are keen to understand the benefits and potential risks arising from different models of joint investment, or other new commercial models like up front payments or guaranteed demand in return for lower ongoing prices. These actions all have the potential to improve the case for investment and the end result for customers. However, it remains fundamentally important to us that any new commercial relationships are not discriminatory or anti-competitive.

1.27 Duct access is another passive product that is receiving significant interest across Europe. We are undertaking a survey of BT's ducts, with the aim of publishing results before the end of the year. At the same time, we welcome thoughts on how far duct and pole access is a necessary part of any future regulatory regime and what interest there is in using these products. This complements the recommendations from the recent Caio review, which considered how greater use of new poles and co-ordination of street works could reduce the cost to build these new networks.

Prices for wholesale products should reflect risk and promote competition

1.28 One key element in securing investment and promoting competition is regulated pricing. We have previously expressed our belief that risky investments should be allowed to earn returns that reflect the level of risk faced when the investment is made. We recognise the risks of investing in next generation access will initially be higher than those associated with today's access networks. There is still a large amount of uncertainty on both the demand for the very high bandwidth services as

well as the technologies that can be used to deliver them. This uncertainty may diminish over time as demand becomes clearer and technologies better understood. However, while the uncertainty remains, so does the risk.

1.29 Pricing mechanisms need to reflect this level of risk, while allowing investors the freedom to experiment and try combinations of new services and prices. At the same time, we must ensure that consumers are protected from excessive pricing.

1.30 We are keen to understand views on an approach to wholesale pricing that:

- allows network operators freedom to set the price of active products. This may be a suitable approach where there are indirect retail price constraints, for example from today's broadband services or services offered over other access networks to limit the risk of excessive pricing. Such an approach allows the market to find the right price for these services; and

- applies more traditional approaches based on costs for wholesale passive products, but with suitable considerations for the risk incurred in any investment. This approach has the advantage of promoting efficient use of these products, while reflecting the risks associated with investment.

1.31 Such a pricing approach is based on the current state of market development, and the relative immaturity of super-fast broadband services. If the current situation were to change any pricing approach put in place would need to be reviewed. One example would be where the closure of current access networks results in a change to the overall market structure and reduced indirect pricing constraints.

1.32 Simply preventing excessive pricing is not enough on its own to ensure a good consumer outcome. To really benefit from new services, consumers must also have effective choice, for example choice of retail supplier. We see it as a very positive development that investors including BT and new build fibre providers are already proposing wholesale products that will support such choice.

As take-up increases, there will be a desire to transition from old to new networks

1.33 Next generation access networks will eventually replace the current broadband networks. Old and new networks may operate in parallel for a time, but there will be strong business reasons to move to a single, modern access network as super-fast broadband services become mass market. For current network owners, effective transition is likely to be one of the keys to the long term success of these new investments. New networks offer the chance to increase efficiency and reduce operating costs for network operators after transition.

1.34 Moving from existing to new access networks poses some difficult challenges to existing competitors, regulation and the consumer. Any transition may result in fundamental changes to the regulated wholesale products or the features they support. It is not our role to protect communications providers from the impact of technology change. However, we would not wish any transition to prejudice the competitiveness of the market or result in a poor consumer experience during change over.

1.35 When transition becomes an issue will depend upon the take-up of super-fast broadband services and the potential cost savings from transition. If these services are a success, the need for transition could reasonably be expected to arise within

the next two to five years. When it does, we will need to work with our stakeholders to understand the implications and define a clear process to enable transition. The right time for transition depends on a number of potential triggers, including: the take-up of super-fast broadband services; the availability of good quality access products on the new network; a clear plan and process discussed with industry; and suitable bulk migration processes.

1.36 We believe that any transition to new access networks needs to be carefully managed, with clear consultation, notification and migration periods. We are interested in stakeholders' views on how this might work in practice, including the triggers, timescales and geographic phasing.

Policy can help create an environment in which new commercial models can flourish

1.37 The third incentive for launching super-fast broadband services is to generate new revenues. This may be even more important now than it was for current broadband services given the larger cost of investment in new access networks. New revenues could come from new applications and services, consumers being willing to pay more for access, or new commercial models.

1.38 The introduction of new business models can be controversial, but may be very important in the delivery of new access networks. Regulation can have a role, for example in helping to increase consumer confidence in new services. One example is improving consumers' perception of behavioural advertising. We are interested in views on where else Ofcom can assist in new commercial developments.

What role for the public sector in delivering super-fast broadband?

1.39 At the start of current generation broadband, people thought that the market may only deploy services to around 60% of UK homes. In the end, it significantly exceeded this. However, some modest public sector intervention was still required to deliver broadband to the current 99% availability.

1.40 We agree with the conclusions of the Caio review that the private sector should play a principal role in investing to deliver super-fast broadband. However, there is uncertainty on how far the private sector will go – it depends on the demand, take-up and cost of these new networks. It is highly unlikely that the private sector will deliver truly national coverage: current plans are for 40 to 50%, the Broadband Stakeholder Group (BSG) believes it could reach two thirds of the UK. This uncertainty makes it difficult to predict what role the public sector should play at this point.

1.41 How far super-fast broadband may add to both wider social and economic value also remains uncertain at the moment, though evidence on will emerge over time. If there are substantial benefits from widespread availability of new access networks, and the private sector will not deliver this availability, there will be a case for an enhanced role for the public sector.

1.42 We believe that, in this period of uncertainty on the demand, usage and reach of next generation access networks, it is best for the public sector to adopt a partnership approach with the private sector to delivering super-fast broadband services. Specifically, it should seek to:

- focus near term attention on those geographic areas that can already be identified as remaining under-served in the future;

- facilitating market-led investment at community level; and
- co-ordinate its activity across the UK.

Today we published our statement on new build fibre

1.43 Many of the issues in this document relate to next generation access networks built in parallel to today's access networks or upgrades to existing networks. But developments are already underway in some areas, with developers and communications providers installing fibre to new build premises. We published our statement on the regulatory regime for fibre in new build developments in parallel with this consultation[1]. This document sets out clear positions on the delivery of existing regulatory obligations and products, universal service and uninterrupted access to emergency services.

Framework for action

1.44 The wider debate on next generation access will continue to develop in the coming months. We have already started to engage with industry in this debate through the industry round-table held on 2 September 2008. This consultation seeks to provide clear leadership and proposals for how to progress this debate.

1.45 We have set out a number of proposals in this document for how regulation can set the right environment for investment. We will:

- provide flexibility in trialling and piloting of next generation access networks and support new ways to deliver investment, for example though the use of sewers;
- provide clarity and consistency on the pricing mechanisms that may be most appropriate for next generation access in the near term, as well as outlining approaches to estimate what a risk reflective rate of return may be;
- work with industry to develop a fit-for-purpose product set, including passive and active remedies, depending on demand. We strongly favour a policy of supporting a range of investment models to promote competition in next generation access;
- work with industry bodies to ensure that all next generation access remedies can be bought and managed as easily as possible, with suitable purchasing, provisioning and migration processes;
- promote standardised technical requirements for wholesale active line access products, working with communications providers, standards bodies such as the Broadband Forum and other European regulators. We are publishing a draft of these requirements alongside this document;
- consult on specific proposals for a wholesale duct access product, subject to the outputs of our initial duct survey and receiving clear declarations of interest to this consultation in duct access from communications providers
- support transition to new networks when this issue arises, while at the same time preserving competition;

[1] http://www.ofcom.org.uk/consult/condocs/newbuild/statement/

- encourage constructive debate between players at different stages in the value chain in order to ensure, wherever possible, the timely rolling out of new and innovative services; and

- build on the guidance on best-practice intervention that we have already set out in order to encourage effective public sector intervention in rural locations where the market seems less likely to invest.

1.46 We will progress these actions and the positions outlined above in the coming months through a range of activities which continue the debate with the full range of our stakeholders.

Section 2

Super-fast broadband services will soon be a reality for the UK

The next generation access debate is gaining pace and investment plans are firming up

2.1 Since we published our last consultation on the future of broadband in September 2007, we have seen growing interest in next generation access, with both private and public sector stakeholders announcing investment plans. The recently published review of next generation broadband led by Francesco Caio for UK Government[2], together with the contributions from the Broadband Stakeholders Group[3] and a draft Recommendation from the European Commission[4] are driving the public policy debate.

2.2 In November 2007, Virgin Media announced plans to upgrade two thirds of its cable network to the DOCSIS 3 standard, offering speeds of up to 50Mbps to nine million premises by the end of 2008.

2.3 BT announced its pilot of fibre-to-the-home (FTTH) services for newly-built homes in Ebbsfleet, Kent in January 2008. The first customers moved into premises in September 2008, and the aim is to offer FTTH to all 10,000 homes that are being built. On 15 July 2008 BT announced plans to invest £1.5bn to upgrade the broadband services that seven to ten million homes could receive by 2012. These plans will deliver a mix of fibre-to-the-cabinet (FTTC) covering six to seven million homes plus FTTH deployments including new build areas. The majority of this deployment is scheduled to take place in 2011/12. In August 2008, Openreach issued a consultation on the wholesale access product it plans to offer over these networks.

2.4 There are other smaller scale projects are underway, involving both private and public investors: H2O Networks Ltd[5] has announced plans to build fibre networks in Bournemouth from September 2008 and Dundee from January 2009, utilising municipal sewers, with “six to ten” additional projects to follow. The Digital Region project in South Yorkshire[6] has announced its preferred bidder for the rollout of their planned fibre-to-the-cabinet services, offering broadband speeds of up to 25Mbit/s to approximately 600,000 premises.

2.5 As a result of these developments, the next generation access debate is moving out of the realm of possibilities and principles, and into a discussion of concrete plans and deployments. We believe that in order to ensure that next generation access delivers the greatest possible benefit to UK consumers and businesses, all players in this market need to start jointly setting the course now.

[2] http://www.berr.gov.uk/files/file47788.pdf
[3] http://www.broadbanduk.org/index.php?option=com_content&task=view&id=66&Itemid=43
[4] http://ec.europa.eu/information_society/policy/ecomm/doc/library/public_consult/nga/dr_recomm_nga.pdf
[5] http://www.h2onetworksdarkfibre.com/
[6] http://www.digitalregion.co.uk/

2.6 It is important to recognise that the current plans and developments are generally in their early phases, and even when completed will still leave much of the country without next generation access. Both Virgin and BT's currently announced upgrades will cover less than 50% of the population, and it is likely their footprints will overlap considerably. Beyond this, most activity is highly localised in nature, often focussing on specific city areas or developments. The prospects for national deployment still appear a long way off. It will be important to consider potential approaches for increasing coverage at the appropriate time.

What is super-fast broadband, and how does it link to next generation access?

2.7 There is no simple, agreed definition of what super-fast broadband is. Some people consider it to relate to specific technologies. Others relate it to certain minimum bandwidths that can be supported. In practice, it is likely to be both. We consider these developments to cover both new services and new networks. They will:

- result in a significant improvement in the broadband experience for end users, through combinations of: higher bandwidths; more equal upstream and downstream bandwidths; and more reliable, higher quality services – super-fast broadband; and
- require investment either in new physical infrastructure or in new access network technologies – next generation access.

2.8 Super-fast broadband is delivered by new technologies – so called next generation access technologies. While it is the delivery of better quality, super-fast broadband services that will bring consumer and business benefits, it is the move to new access networks that may pose the greatest challenges for regulation.

2.9 This is a relatively loose definition. In practice, super-fast broadband and next generation access could involve:

- laying fibre to existing telecoms street cabinets, offering end customers the prospect of higher upstream and downstream bandwidths as a result. For BT's deployment of FTTC, this might mean bandwidths for end customers up to 40Mbps downstream and 15Mbps upstream[7]. While these are not assured bandwidths, they represent a significant increase over the top speeds currently available through ADSL and ADSL2+, which stand at 8 and 24Mbps downstream respectively;
- upgrading the current cable network with new network technologies and new customer equipment in the home, without the need for laying any new connections. For Virgin Media customers, super-fast broadband will mean speeds of up to 50Mbps downstream, against their current maximum of 20Mbps;
- offering fixed or mobile wireless services using 3G LTE and WiMAX technologies, bringing higher bandwidths to customers in remote and rural locations and the ability to carry these services with them. Depending on how they are configured, both may be able to deliver headline speeds in excess of 50Mbps downstream and 20Mbps upstream; or
- connecting new build homes with fibre connections that could offer significantly better quality broadband service than today. Customers could choose between a

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http://www.openreach.co.uk/orpg/products/nga/downloads/FTTC%20Product%20Proposal%20Iss%201-0.pdf

range of options, from a guaranteed 10Mbps downstream and 2Mbps upstream, all the way up to services that offer peak speeds of 100Mbps or more.

This consultation aims to progress the debate on next generation access

2.10 One of our key objectives is to create an environment that facilitates investment, supports competition, but first and foremost brings benefits to consumers and citizens. It is imperative for us that regulation does not become an impediment to investment.

2.11 In order for us to be effective in this role, we believe that now is the right time to move from high-level policy principles to much more detail on regulatory and operational issues. In some cases, our views on the detailed issues are more fully formed, and we seek feedback on them through this document. In other cases, it is still too early for such detail; in these cases we have set out firm plans to address the outstanding issues and provide maximum regulatory certainty as quickly as possible.

2.12 At the same time, we believe there is a need to progress the debate on the role for the public sector in delivering next generation access. This needs to consider issues about the potential focus and timing of any public sector schemes.

2.13 This document gives more detail on our general principles for regulating future next generation access deployments. We are seeking views from our stakeholders on the issues explored, including how potential regulatory approaches may affect both the incentive to invest and the promotion of competition. While this document seeks to provide clarity on how we think regulation should react to these deployments, we cannot presuppose the outcome of any full market review. The imposition of any new or modified regulatory obligations, on the basis of the above general principles and considerations resulting from this consultation, will require further procedural steps such as a market review or amendments to the Undertakings.

This consultation builds on our previous consultations and related work

2.14 We have previously consulted on next generation access in November 2006 and September 2007. Within these documents we outlined our statutory duties and the principles by which we would seek to regulate next generation access in the future.

2.15 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. The Act gives Ofcom a number of further statutory duties and powers relevant to next generation access deployments. In meeting those duties, Ofcom:

- is required to secure the availability throughout the UK of a wide range of electronic communications services;
- must have regard, where relevant, to the desirability of encouraging investment and innovation in relevant markets; and
- must have regard, where relevant, to the desirability of encouraging the availability and use of high speed data transfer services throughout the United Kingdom.

2.16 Our aim is to create a framework that strikes a balance between securing investment and promoting competition in telecoms for the benefit of citizens and consumers. In

our September 2007 consultation we outlined five principles in order to achieve this aim, which were generally supported by respondents:

- **contestability:** we aim to create the conditions that allow any operator who considers that there is a business case for deploying next generation access infrastructure to invest, as soon as they wish;
- **maximising potential for innovation:** we believe that the scope for innovation and differentiation is essential for competition in next generation access;
- **equivalence:** strong competition in current generation broadband has been helped by ensuring that all operators are able to buy exactly the same wholesale products at the same price as operators with market power. We propose to apply this principle to next generation access;
- **reflecting risk in returns:** anyone who makes investments in next generation access is likely to face significant commercial risks. Regulation should reflect these risks in order to provide appropriate incentives for investment;
- **regulatory certainty:** it is also important that the regulatory regime we adopt is clear and in place for a reasonable period of time, to allow investors the clarity that they need to invest with confidence.

2.17 These principles are embodied in all of the more detailed issues explored in this document. The principles of contestability, innovation and equivalence underpin all of our thinking on prospective wholesale access products in a next generation environment. Our discussion of pricing approaches is a practical application of our belief in recognising the actual level of risk incurred in any investment in new networks. Outlining a framework for transition from copper to fibre access networks is a specific example of providing greater regulatory certainty and clarity to support both investment decisions and existing business models.

We are also publishing our statement on new build fibre

2.18 This consultation forms the centre piece of our thinking on next generation access today. However, it needs to be read and considered in conjunction with other, specific debates, in particular our statement on new build fibre.

2.19 Some of the first practical applications of next generation access in the UK will be fibre to the home connections to new build developments, either by existing communications providers or companies that are new to this market. These fibre deployments raise a number of very specific challenges for the existing regulatory environment as they are likely to exist without any parallel copper access network. In this way they are quite different to some of the other mass market overlay network deployments we have seen announced in the past year.

2.20 These differences raise a number of specific questions from both existing operators, including those with significant market power, and new entrants. We have therefore addressed these issues specifically in our New Build Statement. A summary of the key issues and guidance covered in the new build statement can be found in section 10. The full statement is available on Ofcom's website[8]:

[8] http://www.ofcom.org.uk/consult/condocs/newbuild/statement/

Next generation access is not only an issue for Ofcom

We welcome the contribution from the Caio Review

2.21 The Caio Review, which focuses on how to promote the development of next generation access in the UK, was published on 12 September 2008. We worked closely with the review team as they developed their recommendations. We welcome the review's conclusions, especially on those areas that could facilitate next generation access deployment but that are outside of Ofcom's remit, for example street works or more flexibility in the use of aerial fibre.

2.22 We are seeking to address the review's recommendations for regulation within this consultation and our engagement with stakeholders. Specifically, we are addressing issues relating to regulatory certainty, indicating potential future market definitions, development of suitable wholesale access products and outlining a clear approach to future transition from copper to fibre networks.

2.23 Of particular note are the review's comments on the role for sharing and collaborative investment. We explore these issues in section 6. We also note the recommendations on the application of existing regulatory requirements and universal service, both of which have been covered in our New Build Statement published today.

We also welcome the draft Recommendation on Next Generation Access from the European Commission

2.24 Shortly before the publication of this document, the European Commission issued a draft Recommendation for consultation on the future regulatory treatment of next generation access across the European Union. Such Recommendations form part of the EU regulatory framework, and although they are not binding on individual regulators such as Ofcom, they are something we have take close account of when we determine appropriate regulatory rules for this country.

2.25 The draft Recommendation, which builds on an earlier Common Position of the European Regulators' Group to which Ofcom contributed, touches upon many of the same issues that form part of this document, and draws many of the same conclusions, including the need for:

- future regulatory remedies which guarantee effective competition;
- a mix of regulatory remedies to achieve this, including both passive and active solutions;
- greater regulatory certainty for next generation access investment, and for investment risk to be properly assessed in setting regulated prices; and
- a clear path to transition as and when the existing copper network is replaced with fibre.

2.26 We will examine this Commission's draft Recommendation carefully and expect to work closely with Commission as their consultation and this elicit informed responses from stakeholders on a number of matters.

It is imperative that we work closely with stakeholders over the coming months

2.27 The introduction of next generation access will mean a step change for all stakeholders in the broadband market. Ultimately, it may lead to a transition away from networks that have served consumers and citizens and been used by businesses to deliver services for decades.

2.28 The questions that have to be resolved in this context are therefore far reaching and complex. On some, Ofcom will need to take the lead, on others industry will be better positioned to work out an effective and efficient solution. In many instances, we will need input from consumer representatives and local government and to co-ordinate our work with central government and the European Commission.

2.29 We will closely engage with stakeholders over the next months to catalyse the agreement of a common way forward and ensure active involvement of the interested parties to allow a timely resolution of the questions at hand. Throughout the consultation period we will seek to meet with stakeholders directly, through a series of one-on-one conversations and round-table meetings.

2.30 We are also keen to promote debate and hear the views of consumers. To this end, we have set up a blog in order to encourage questions and contributions from the general public, accessible via http://comment.ofcom.org.uk/superfastbb/. We also welcome comments on the interactive executive summary on our website: http://comment.ofcom.org.uk/bbsummary/.

The remainder of this document outlines our current thinking in more detail

2.31 The remainder of this document discusses the wider context of next generation access networks and outlines some of the key regulatory challenges.

2.32 In terms of the wider context, Section 3 looks at what next generation access will mean for consumers and businesses. Section 4 outlines Ofcom's vision for the future of next generation access in terms of competitive trends and technology options and goes on to detail what role regulation has in delivering this vision.

2.33 In terms of regulatory issues, Section 5 considers the role of regulatory policy in influencing incentives for investment, including competition, cost reduction from transition, and new revenues. Section 6 reiterates the importance of competition and looks at options to deliver it. Section 7 looks at pricing approaches to deliver effective competition and investment. Section 8 outlines a prospective framework for the treatment of any future transition from copper to fibre access networks. Section 9 considers revenue generation and the role of regulation in this context.

2.34 Finally, we consider developments associated with next generation access. Section 10 summarises our new build fibre statement. Section 11 provides thoughts on the role of the public sector in next generation access.

2.35 Section 12 summarises the specific questions on which we are seeking views and additional evidence and outlines our proposed framework for action.

Section 3

What will super-fast broadband mean for consumers and businesses?

3.1 At this early stage in the development of next generation access, our primary focus is necessarily on technical issues and the potential impact on the wholesale market for the supply of telecommunications access service in the future. Our stakeholders have publicly stated that the deployment of new super-fast broadband will depend on a clear and well defined regulatory environment. As a result, much of this document, and our previous consultations on the topic, are focussed on specialised regulatory issues. However, it is important to stress that it is the consumer and citizen interest that underpins our approach to next generation access and our work in this area.

3.2 We think that the deployment of next generation access has the potential to lead to significant benefits for consumers, both individuals and businesses, and for citizens. It also creates the potential for new risks and harm which we need to be aware of and respond to as they emerge in the future, as we do with other telecommunications issues.

Potential consumer benefits from super-fast broadband

3.3 Current generation broadband has brought massive change to the range of services and methods consumers can use to communicate. It was difficult to predict that the introduction of broadband would make common place activities such as:

- downloading music rather than buying it on CDs;
- sharing amateur video clips reaching millions of people around the world;
- having high quality video conferences with friends and relatives overseas;
- listening to thousands of local radio stations from all over the world;
- on-demand access to previously broadcast TV and radio programmes; and
- working from home, while still maintaining access to office computer networks.

3.4 We believe a similar scale of change will be enabled by next generation access and super-fast broadband. However, it is hard to predict exactly what form this will take. None of the responses to our previous consultation gave firm evidence of particular products that might drive demand for next generation access. At the same time, it is clear that the new networks have the potential to facilitate the improvement of all aspects of broadband technology. We think that this will in turn create the opportunity for the market to develop new and exciting services.

3.5 There are a number of more commonly cited examples of new services that can be delivered over super-fast broadband and next generation access. Next generation access networks have the capacity and speed to deliver high definition content. This may allow direct competition with services previously only available on other platforms, such as viewing movies on Blu-ray disc, and also the development of entirely new services.

3.6 A second commonly cited example is two-way video communications. A study on the value of next generation access commissioned by the BSG[9] and referred to also by a recent document from the Ofcom Consumer Panel[10], explains how high quality video conferencing can lead to various types of benefits being achieved, such as more effective remote working leading to the reduction in carbon emissions, by reducing commuting.

3.7 Next generation access has the potential to bring real benefits to citizens too. It can improve the capacity and strength of the underlying infrastructure that communications services are delivered over, as well as the reach of broadband services. The benefits of super-fast broadband can also encompass wider social aspects. For example, two-way video can improve social inclusion by allowing better ways to communicate for disabled people; other new applications could enhance community support for isolated individuals; greater and more efficient information flows have the potential to improve citizens' democratic participation. Health and education are also often cited as key topics for which access to richer information consumer and citizen would have significant social benefits.

Potential business benefits from super-fast broadband

3.8 Applications enabled by super-fast broadband can also have significant benefits for business customers. For small businesses, it can bring within reach the high speed and symmetric connections generally only available to large businesses today. Next generation access technologies will certainly bring higher speeds, and most are also capable of offering more symmetry, i.e. a closer match between up and download speeds, than today's broadband. These improvements bring with them the potential for greater productivity, new efficiencies and the ability to explore new markets and products.

3.9 While already benefiting from high quality connections at their main sites, bigger businesses also have much to gain from the potential of next generation access to reduce the costs and extend the reach of high bandwidth connections. This will allow existing and new satellite offices to be connected at a higher speed than is currently possible or affordable. It may also enable new working practises that may further reduce the need for employees to commute and occupy expensive office space.

3.10 Evidence of potential business user demand for next generation access services was provided by a February 2008 Communications Managers' Association (CMA) survey of its members[11]. The CMA's members, mostly larger companies with dedicated communications managers who tend to have high levels of spend on communications, expected that these new services could bring: increased bandwidth, speed and quality; improved applications, communications and services; and deliver efficiency benefits to businesses. The survey results suggest that new business demand for next generation access would come from a mix of enabling businesses to do the same things better and providing them with access to new services.

Care will be needed to maximise the benefits and reduce the risks

3.11 Next generation access is not a solution to all the possible concerns related to current broadband. On a technical level, the overall consumer experience is dependant on many factors, and upgrading the access network will not improve

[9] http://www.broadbanduk.org/component/option,com_docman/task,doc_view/gid,1009/Itemid,63/
[10] http://www.ofcomconsumerpanel.org.uk/news/documents/K5.pdf
[11] http://www.thecma.com/index.cfm?s=10&dir=814312

aspects of the services limited by constraints elsewhere. One example is the concerns people have about the difference between the headline speeds of broadband services and the actual speeds they experience.

3.12 An upgrade to next generation access should greatly increase the headline speeds offered by broadband service providers. However, the extent to which the customer experience will match this depends on several factors. For some next generation access technologies, the speeds that a given customer's line can achieve will still vary depending on how far the customer is located from the operator's equipment, similar to ADSL delivered broadband today. For other technologies, the peak speed that can be achieved will be the same for all customers regardless of where they live, but the overall capacity of the access network is shared between its users, in a similar way to existing cable networks. This means that at busy times, the speed delivered to a given customer may be limited by congestion on the access network.

3.13 Beyond the access network itself, there are similar capacity sharing effects, which next generation access technology cannot improve. Much of the slow-down users experience when using today's broadband at different times are a result of limited capacity further back in their service provider's network, or the internet itself. This situation will only be improved by investment in those parts of the network; absent this investment, next generation access could actually make things worse by increasing the demand on existing capacity.

3.14 To address this issue, in June 2008, Ofcom and the internet industry drew up a voluntary code of practice[12] which requires ISPs to provide consumers with information and advice on the maximum broadband speed they can expect to achieve in practice. Under the code, ISPs are also required to inform consumers about how they manage traffic on their network. ISPs representing over 90% of the UK's broadband consumers have signed the code. Ofcom is also undertaking a research programme to investigate what speeds and quality of service consumers actually obtain in practice from leading ISPs.

3.15 These measures should help inform consumers about the true speed and quality of their broadband services. They will also make it easier for consumers who value better quality broadband services to identify these in the marketplace, thereby encouraging further investment from operators. The Caio review has identified the need for similar measures in relation to super-fast broadband services, so it is likely they will continue to be important in the future.

3.16 The new networks will also not necessarily be the solution to the coverage limitations of broadband. Areas that are technically or economically difficult to serve with current networks are likely to remain so. In these cases, there may be a greater role for the public sector to address some of these issues. This is discussed in Section 11.

3.17 As with most new technologies and market changes, next generation access has the potential of new risks and harm to consumers and citizens. Based on our experience of consumer and citizen issues with current broadband technology we can identify some key likely areas of risk. These include migration, information disclosure (for example on speeds) and access issues. As the market implements and the new networks and services we will address these issues if necessary.

[12] http://www.ofcom.org.uk/telecoms/ioi/copbb/copbb

Migrations processes will be key to ensuring the success of next generation access

3.18 The success of next generation access will in a large part be dependent on the existence of effective migrations processes. Where switching is not easy, consumers are less likely to want to switch, and this is likely to diminish the effectiveness of competition and limit the benefits that consumers would otherwise have received. For competition to be effective in delivering benefits to consumers, it is vital that consumers are able to engage effectively, consider available options and migrate seamlessly between service providers or products regardless of the nature of the migration process or the underlying technology.

3.19 Experience from current generation broadband has shown how important it is to have effective and robust customer migration processes in place. These have been one of the single largest areas of concern and consumer detriment as broadband take-up grew. Ofcom therefore considers that it is essential that the development of effective migrations processes is afforded an important priority in discussions around next generation access from an early stage. This will include a wide range of different migration types, including: between current generation and next generation networks, including migrations back from next generation access to today's broadband networks; between super-fast broadband service providers on the same platform; and between platforms, e.g. copper and cable access networks.

Consultation questions

Question1 - Is there further evidence available on the applications and services or consumer benefits that may be supported by next generation access?

Question 2 - Who should lead on defining and implementing a process for migrations to and from next generation access networks? What roles should industry, Ofcom and other bodies play?

Section 4

Our vision for the future and the role regulation should play

4.1 Outlining a vision for the future of next generation access is challenging. As we have already indicated, there is considerable uncertainty about the products and services that will be supported. However, it is important to recognise that uncertainty existed prior to the deployment of today's broadband networks. What happened in practice was that consumers and businesses began to use communications services, including the internet, in a multitude of new ways that were not previously anticipated.

4.2 Next generation access networks are likely to be similar. They will have the capability to support a huge range of new applications, business models and market entrants which are hard to predict. Despite this, it is worth considering what a good outcome would be – a vision for the future – and what role regulation should play in this.

There will not be 'one' type of next generation access network

4.3 There is no single model of next generation access network deployment. Just as we've seen with today's broadband services, it is likely that there will be a mix of technologies and networks deployed in different locations depending on customer demand and the characteristics of each location. For example, we might witness:

- FTTH deployments to new build developments. Where no previous telecoms infrastructure exists, a number of developers are installing fibre rather than copper as this involves little additional cost;
- FTTC deployments to more dense urban areas where the economics of next generation access networks are more favourable. FTTC may also be used to extend the reach of broadband services to those who cannot get good quality broadband connections at present due to technical restrictions such as the length of their phone line. FTTC networks will continue to have lower potential maximum speeds than FTTH[13], but are cheaper to implement to most existing buildings;
- upgrades to the existing cable network to offer much higher broadband speeds without the need for substantial new physical infrastructure. The extension of cable networks into currently non-cabled areas in the UK is unlikely;
- use of fixed wireless services, taking advantage of the increasing availability of spectrum, including the upcoming Digital Dividend spectrum, and of the reducing cost of fixed wireless equipment. How well wireless will be able to deliver the very highest bandwidths compared to wired technologies remains to be seen; and
- increasing bandwidths offered over mobile connections, following the release of more spectrum and technology improvements. We are already seeing with 3G dongles that some customers do not see the need for a fixed connection for broadband services. The move to even faster mobile technologies like WiMAX and 3G LTE may continue this trend for next generation access. However, the physical limitations and shared architecture of mobile networks may limit their ability to deliver the very highest bandwidths.

[13] Peak speeds for FTTC range from 30 to 50Mbps downstream and 5 to 20Mbps upstream or up to 13Mbps symmetric. FTTH deployments generally offer symmetric data rates of 50 to 100Mbps, but some are already considering 1Gbps – the potential for future developments are practically limitless

4.4 In practice, next generation access in the UK is likely to comprise a mixture of all of these options, and more. It is by combining them that the market will best serve the needs of customers, drawing on the benefits of each. This mirrors the situation in the USA where there is already a mix of FTTH, FTTC, cable, wireless and exchange based copper services all co-existing in different areas, provided by a range of communications providers.

Technology and deployment techniques not traditionally associated with broadband will be increasingly important

4.5 Much of the technology specific discussion in this document is focussed on the regulatory issues raised by changes to the existing networks used to deliver fixed broadband. These changes are most likely to be based on FTTC and FTTH deployment. However, for next generation access networks, alternative technologies and deployment options will also have an important role to play.

4.6 The significance of wireless networks in delivering both current and new super-fast broadband services in the future is one reason for Ofcom's continued focus on spectrum release and liberalisation. These both seek to reduce barriers to entry and facilitate investment in new access networks and services for the benefits of consumers.

4.7 For wired networks, using existing non-telecoms passive infrastructure can reduce the need for dedicated trenching and ducting which is a large proportion of typical deployment cost. Alternative wayleaves, as they are known, can therefore make fixed deployments quicker and cheaper and may be particularly attractive to players without existing telecoms infrastructure. In the UK, H2O are using the sewers in Bournemouth and other cities to deliver fibre to the home. Across Europe, there are a number of cities where existing wayleaves are being used to deploy telecoms access networks, including Paris and Vienna.

4.8 The Caio review recommends looking at ways to address barriers to alternative ducting methods, including use of other utilities' networks and encouraging industry to adopt new techniques for coordinated installations. We support these recommendations: anything that can reduce the cost of deployment will increase the prospects for both existing and new communications providers investing in next generation access.

4.9 Ofcom is keen that any opportunities for lowering deployment costs are exploited as fully as possible. For example, we have discussed the use of sewers with Ofwat, the HSE and Water UK and we are agreed that in principle there is no reason why the sewer network should not play a part in the deployment of fibre. We will continue to work with these organisations to reduce the barriers to fibre deployment. Whilst it is unlikely to be practical to deploy fibre in the last few meters of the sewer system, it could play an important role in the deployment of backhaul fibre. We are also in talks with Ofgem to explore areas of overlap between the telecoms and energy infrastructure.

Next generation access developments should not be considered in isolation

4.10 Next generation access deployments will not be the only major change within the fixed telecoms industry. Also of huge importance to the sector, consumers and the regulator is the move to next generation core networks. In the UK to date, next generation core and access network upgrades have been considered separately. When deployed however, the reality is that they will be inseparable.

4.11 If successful, next generation access deployments may drive substantial growth in overall bandwidth usage, resulting in increasing demands on the backhaul capacity used to connect them to the core. New services may also require much lower bandwidth unit costs, if they are to be affordable for consumers. The deployment of new backhaul technology which can increase capacity and decrease cost will therefore be key to the success of mass market next generation access deployment. Both BT and Virgin have acknowledged this as a key dependency for their own access network upgrades.

4.12 At the same time, the move to next generation core networks will result in a change to the overall access network product set. This is a debate that industry is already engaging in. As new next generation access products are released, like Generic Ethernet Access, these will need to be considered in that context.

The future demand for next generation access remains uncertain

4.13 It is not clear how or where next generation access technology will be taken up. The potential success of any new technology is always hotly debated, and predictions are often wrong. In the past, 2G mobile services demonstrated phenomenal take-up amongst customers. However, 3G and mobile data services have taken longer than was originally anticipated to achieve mass market penetration.

4.14 The take-up of broadband by consumers and businesses is particularly interesting, reaching 58% penetration in only eight years. This matches the performance of digital TV, and exceeds the performance of not only mobile phones but also consumer electronics like colour TVs, VCRs, CDs and DVDs, all of which took between 10 and 17 years to achieve similar levels of penetration.

4.15 The take-up of next generation access will depend on a many factors, including:

- the benefits consumers see from new applications and services;
- the balance of importance customers place on fixed services, bandwidth, mobility, ubiquity and so on;
- the extent to which a wider value chain of content, applications and services develops, which strengthen the consumer appeal of super-fast broadband; and
- the level of competition – experience with mobile and current generation broadband suggests that competition is key to stimulating innovation and growth.

Visions for the future depend on your perspective

4.16 Different groups will have perspectives on what next generation access should and will deliver. It is useful for Ofcom to understand what different stakeholder groups would consider a good outcome.

4.17 For residential customers, next generation access may provide a better means to do things which they already do on today's network – for example, offering a more reliable connection to basic email and web-browsing, or reducing the problems of network congestion which slow down certain applications today. In the longer term though, consumers are likely to benefit from new products and services which can only be delivered over next generation access, including bandwidth-hungry content and audio-visual services

4.18 Business customers may be concerned with availability, resilience and quality of service – particularly given that loss of connections can mean loss of business. There

is also scope for businesses to use super-fast broadband services to improve their productivity, for example making greater use of online sales and purchasing systems, or more widely adopting cost-saving strategies such as teleworking.

4.19 In reality, many customers will have little interest in the underlying technology. Next generation access may simply be a way of continuing to improve the quality of broadband connections, internet access, and allowing new services to be offered.

4.20 Organisations from across the wider value chain will also see these networks as offering new opportunities to deliver content, services and applications:

- small scale new entrants may be attracted by the continuation and improvement of existing broadband business models, offering the ability to address a wide audience with relatively low cost business models;
- existing content companies are likely to be most interested in the new applications and services they can develop to complement, or in some cases replace, their existing distribution mechanisms;
- service providers and aggregators may focus on new business models and service distribution strategies;
- public sector organisations may utilise the capabilities of these new networks to explore new ways of addressing citizens and delivering public services to individuals; and
- network operators may use these new networks, and the services that they support, to develop new revenue streams and new commercial relationships with other players in the value chain.

4.21 The examples above demonstrate that next generation access, like broadband before it, could mean a host of different things to a host of different individuals and organisations.

The regulatory vision for the future

4.22 Ofcom's aim with respect to next generation access is to meet our statutory duties to further the interests of citizens and consumers, including businesses. These interests are likely to be best met by the timely deployment of these new networks and the resulting continued innovation in services, combined with the right safeguards for effective competition.

4.23 Ofcom's role is to try and ensure that the conditions are right for the market to be able to deliver the maximum benefit to consumers. Therefore, our vision is for widespread availability of high speed access networks led by private sector investment. This is the best way to secure efficient investment in the right technology, in the right places, at the right time. We continue to favour approaches that leave as much discretion in investment decisions to the private sector and limit any regulatory barriers. We do not believe it is right for the regulator to pick one single technology to promote or even indicate a preference between technology options. Rather, we believe it is more efficient for the market to choose the most appropriate solution to deliver higher speed broadband services based on the specific circumstances. This is another rationale behind our policy of releasing spectrum to the market as soon as it becomes available, and facilitating spectrum liberalisation and trading.

4.24 We do not currently see a need for mechanisms to secure widespread availability beyond that which investment from the private sector will achieve. As higher speed broadband services start to become part of life within the UK, the case for society to

secure widespread availability will grow, just as we are seeing with today's broadband networks. Before any such decision is taken – and it would be a matter for Government, rather than Ofcom - there will need to be clear evidence of detriment, unmet demand from consumers, and clear indications that the market is unlikely to address this.

4.25 However, as the coverage of these new networks grows we will need to monitor continually for such evidence. This is also the recommendation of the recently completed review for the Government conducted by Francesco Caio. In previous consultations some stakeholder have also warned that waiting for a long period of time before addressing specific issues in certain areas of the UK may not be the most efficient way forwards. In such cases, there may be a greater role for earlier, targeted public intervention. We discuss potential roles for the public sector in section 11.

4.26 In the nearer term, we continue to believe that the best way to secure ongoing benefits for consumers and citizens, in particular through services and price innovation, is through a competitive environment. This is why our regulatory approaches in a next generation access world continue to focus on the promotion of effective and sustainable competition.

The role for regulation in a next generation access world

4.27 Some of the network technologies discussed present lower barriers to entry than others. Given the release and potential trading of radio spectrum, investment in wireless networks may be more contestable than for fixed access networks. To date, a competitive environment in fixed access networks has required regulatory intervention to deliver wholesale access. This is because they are characterised by high barriers to entry and significant sunk costs. This makes competition in the provision of access networks themselves unlikely, and if there is to be scope for competition in markets downstream of local access, some form of regulated wholesale access must be secured. The economics of deploying infrastructure for backhaul are similar in some ways to those of the access network. As a result, there is a risk that this too will constitute an enduring economic bottleneck and therefore require some form of regulatory intervention to allow scope for effective competition.

4.28 Issues of market power, resulting in limited scope for competition can apply to any deployments by either an existing incumbent operator or a new entrant. However, operators with existing fixed access networks may be able to reuse these assets to reduce next generation access deployment costs, raising greater barriers for new entrants. The move to new access network technologies does not necessarily change the characteristics of fixed access and the bottlenecks it can present. In fact, the more capital intensive nature of next generation access could actually increase barriers to entry. However, a change to the underlying network technology and topology employed in next generation access is likely to result in changes to the specifics of how, when and where to regulate access.

4.29 There may be scenarios where fixed access networks are not enduring economic bottlenecks given the presence of alternative technologies that can deliver substitute services. As we discussed above, prospects for competition may be presented by other wired or wireless technologies, or use of alternative wayleaves to reduce the cost of deployment by competing operators. We are keen to support any developments of competing end to end infrastructure - these present a real opportunity for ongoing effective competition. However, as we outline in annex 8, it appears likely that many of these developments are more likely to either address

specific niches or be complementary to, rather than substitutes for, very high bandwidth fixed access networks.

4.30 Therefore, in the presence of an enduring economic bottleneck in fixed access, delivering competition will require some form of regulatory intervention. The first step in defining any regulatory approach is to define the market and assess market power. Any resulting intervention must always be mindful of the implications on the incentives to invest initially by the owner of a bottleneck asset. Both of these aims need to be carefully balanced in setting any regulatory environment.

It is important to provide regulatory certainty

4.31 Speaking to our stakeholders, it is clear that regulation has a role to play in delivering efficient investment in these new networks. There are a number of things that our stakeholders have identified as being of most value to support the investment case for next generation access. These include:

- providing regulatory certainty through a clear, consistent and transparent regulatory regime;
- ensure any regulation takes account of the uncertainty and risk in investment;
- provide flexibility in trialling and piloting to help develop and test new technologies, commercial relationships and services; and
- support experimentation by organisations including new entrants, the public sector and community broadband projects.

4.32 Of these, the clearest message from our previous consultations and stakeholder discussions is the need for greater regulatory certainty. It is because of this that we included it in our five principles for regulation in a next generation access world. We need to ensure our decisions, and the processes underlying them, are clear, transparent and timely. We also need to ensure that, for a given competitive environment, and over a period of time, our decisions are consistent.

4.33 Of course, complete regulatory certainty is not achievable. In particular, under the European Framework and UK legislation, we are required to undertake market reviews at frequent intervals, and each must be conducted on its merits according to a strictly-defined legal process. However, our aim is to provide longer term clarity on how the regulatory environment will apply and evolve, in order to support long term investments in next generation access. In practice, this requires us to behave in a consistent manner between market reviews where the competitive environment has not changed materially.

4.34 In its recent recommendation, the European Commission indicated its firm belief that there is a need for longer term legal and regulatory certainty for investors in next generation access. We agree with this position - regulatory certainty is a prerequisite for companies to effectively assess and undertake such investment. We will work with the Commission to ensure that the application of EU rules, including the Commission's supervision of future market reviews, complement our efforts to secure greater regulatory certainty here in the UK.

Our vision remains one of markets based on equivalence

4.35 Strong competition in current generation broadband has been helped by ensuring that other operators are able to buy the same wholesale products, using the same processes and at the same price, as the downstream divisions of network operators with market power – a regulatory approach we have termed 'equivalence' following our strategic review of telecommunications[14]. Equivalence is an essential mechanism to reduce incentives for anti-competitive behaviour while retaining incentives for efficient investment. As we outlined in our previous consultations on this topic, we propose to apply this principle to next generation access.

4.36 However, the principle of equivalence may need to be adapted to take into account the realities of next generation access. Equivalence in its current form was developed to address competition problems relating to existing copper networks. These networks constitute an enduring economic bottleneck and are characterised by high levels of sunk costs and high demand certainty. Access network owners have already recouped their initial investment in these networks during the period of state owned monopoly. In this environment, the correct approach to promoting competition was to mandate access on equivalent terms for all parties.

4.37 Discussion with our stakeholders has highlighted how important flexibility in some elements of any next generation access products or pricing may be to making the investment case viable. For example:

- not all customers will want to receive the same end service. Some may want high quality premium services while others may prefer lower cost, best efforts services. Such variations may require flexible or different wholesale products;
- there may be significant variation in consumers' willingness to pay. This may also suggest the need for more variation in retail prices, supported by more flexible products, including greater flexibility and variation in underlying wholesale prices;
- there may be substantial economies of scale in the new networks that suggest volume purchases of connections could attract volume discounts; and
- some investors may be interested in entering into risk sharing and joint investment models to secure deployment and ongoing access on favourable terms in return for up front capital commitments.

4.38 Many of these issues are new, and arise as a result of the significant uncertainty on demand and commercial models that characterises next generation access. In such an environment, a simplistic application of equivalence may increase the challenges for would be investors.

4.39 However, the original need for equivalence as a tool to address anti-competitive price and non-price discrimination will remain wherever these new investments constitute enduring economic bottlenecks. How the principle may need to be adapted will be influenced by the reality of next generation access deployments, and the experience and feedback of industry. Whatever adjustments are found necessary to the detailed application of equivalence, we believe this overarching principle should remain.

Market definitions and next generation access

4.40 In considering the question of market definition it is important to bear in mind that market definition is not an end in itself but a means to an end – it is the identification

[14] http://www.ofcom.org.uk/static/telecoms_review/final_statement.htm

of a set of products and a geographic area, allowing an assessment of whether ex-ante regulation is required to promote competition and deliver consumer benefits.

Wholesale access market definition from first principles

4.41 In considering the question of market definition and whether there is a need to intervene in the provision of next generation access products, it is beneficial to consider the question of market definition from first principles rather than seeing how next generation access may fit into current existing market definitions.

4.42 Market definition is an exercise in identifying relevant competitive constraints that may apply to products and services. In undertaking market definition exercises in various market reviews, we have identified a number of potential competitive constraints: these form our principles in determining the boundaries of relevant markets. From experience, the relevant competitive constraints are: demand-side substitution; supply-side substitution; cluster markets, where goods are bought and sold collectively; a common pricing constraint, and homogenous competitive conditions. In order to conduct a robust market definition exercise in relation to new products and services, it is necessary to consider how far each constraint may apply to the new products and services. In each case, it is necessary to consider the constraints on the product first, and then to consider the way in which constraints vary by geography.

4.43 Our starting point is less about which market we might believe the high speed services sit in, and more about identification of the competitive constraints and how they work in terms of the services, prices and choice that will be made available to consumers.

4.44 It may be that existing access products present some form of competitive constraints on pricing for next generation access services. If next generation high speed services are in the same market as existing services, on the grounds of demand-side substitution (probably including any chain of substitution), the supplier of those services may be constrained by the availability of existing services.

4.45 However, regardless of whether there is a separate market defined for higher speed broadband products (i.e. whether they are constrained by lower speed services or not) the key question is whether there is sufficient choice of high speed provider for consumers. While the availability of existing products would constrain prices and avoid obvious consumer detriment, this constraint does not actually go as far as allowing consumers a choice of high speed service supplier. A limited, or no, choice in supplier may also limit the level of innovation in the delivery of these new services.

Existing market definitions in fixed broadband

4.46 The markets identified in the Wholesale Local Access market review (concluded in 2004) were defined using technology neutral principles but with the boundary of the market defined in a technology-specific manner i.e. it includes local access networks that utilise copper or cable in the local loop or sub-loop but explicitly excludes local access networks utilising wireless or fibre technologies or which support services to mobile devices. Fibre-based access was determined to not constrain the pricing of loop-based and cable-based local access as its costs of deployment and hence price meant it was considered an economic substitute.

4.47 The Wholesale Broadband Access market review was concluded in May 2008. This is also defined in a technology-neutral way. However, in that market review we

defined the market boundary without reference to specific technologies[15]. In addition, the Wholesale Broadband Access market definition does not specify an upper bandwidth limit. This was on the basis that when the market was defined there was insufficient evidence to suggest that services with speeds higher than are currently available would fall into a separate economic market, i.e. there is no observable break in the chain of substitution between retail asymmetric broadband internet access services available today[16].

The structure of relevant economic markets may change over time

4.48 We outlined in our previous next generation access documents that, given current evidence it may be likely that next generation access based services will fall into future market definitions for market 4 (wholesale local access) and the current market definition for market 5 (wholesale broadband access). There might be a good argument for a chain of substitution at the retail level between various speeds of broadband, not least because an operator with a fibre network could, and might be expected to, offer not just super-fast broadband but also a full range of lower speed packages in competition with copper-based networks. In the absence of empirical evidence suggesting current generation access services are not a substitute for next generation access services, the appropriate approach might be to adopt a broad market definition initially which included both current generation services and next generation services.

4.49 However, this conclusion will need to be tested with consumers as and when next generation access services are launched in the UK. There may be new services that can only be supported over next generation access which are not substitutable either for current broadband services or services offered over other distribution platforms, e.g. satellite. This can be assessed by empirical analysis to inform whether there is a break in the chain of substitution at certain speeds/services. In this circumstance, these new services may constitute a new market.

4.50 There is no evidence available yet that would allow such a detailed analysis. Anecdotally, many of the applications and services that next generation access may be used to deliver can be supported to some degree by upper-end current broadband products. This position is consistent with the European Regulators' Group's Common Position on next generation access and the Commission's recently published draft Recommendation on next generation access. It is also the view expressed to Ofcom by BT in response to our previous consultation.

4.51 As a result, we continue to believe that next generation access services should be treated on the basis of the current market reviews and significant market power findings. However, it is vitally important for Ofcom to assess any changes to the competitive conditions that may flow from the deployment and take-up of next generation access services. This will lead to the question of what is the most appropriate form of regulation to promote competition and deliver consumer choice in a next generation access world. We set out our thinking on this below. As next generation access networks are built we will need to consider these questions on a

[15] The market definition is "asymmetric broadband access and any backhaul as necessary to allow interconnection with other Communications Providers which provides an always on capability, allows both voice and data services to be used simultaneously and provides data at speeds greater than a dial-up connection. This market includes both business and residential customers."

[16] This means that, although direct substitution between the fastest and the slowest speed broadband services may be limited, there is sufficient substitution between adjacent packages (for example, the fastest and the next fastest) for all speeds greater than dial-up to be subject to a common pricing constraint.

case by case basis in light of the regulatory framework and in accordance with the procedures under the Communications Act.

Next generation access and BT's Undertakings

4.52 On 22 September 2005 British Telecommunications plc ("BT") offered, and Ofcom accepted, a set of undertakings (the "Undertakings") pursuant to section 154 of the Enterprise Act 2002 in lieu of reference of certain markets to the Competition Commission. The Undertakings were designed to deliver equality of access through the creation of Openreach and the application of the principle of equivalence of inputs. The Undertakings included certain commitments from BT in relation to its delivery of Next Generation Networks in order to encourage the development future competition. However, no provisions were included in the Undertakings to deal with next generation access as it was accepted that there were many important and complex issues to be addressed before it would be possible to set out the appropriate regulatory approach. [17]

4.53 As the discussion on next generation access develops it will be necessary to establish the appropriate regulatory framework. The Undertakings are likely to form an essential part of this framework. Once the next generation access policy has become clearer, it will be necessary to consider how it could impact the Undertakings. A number of issues will need to be considered including the following:

- whether it will be appropriate for Openreach, as opposed to another part of BT, to provide active electronics for the delivery of next generation access wholesale products;
- how the information sharing restrictions in the Undertakings will impact next generation access product development; and
- how the Undertakings might need to evolve to take into account the networks, products and services that will be delivered in a next generation access world.

4.54 Ofcom is not seeking to consult on how next generation access might impact the Undertakings at this stage. A consultation will be held to discuss this at the appropriate time. However, Ofcom would welcome initial stakeholder views, on the potential impact that next generation access could have on the Undertakings.

Consultation questions

Question 3- What role is there for Ofcom in the ongoing debate on next generation access versus industry's role in progressing this debate through multi-lateral and bi-lateral discussion?

Question 4 - How far does current regulation, including market definitions, equivalence and the BT's Undertakings, need to evolve as result of next generation access deployment?

[17] See Section 6 of the Final Statements on the Strategic Review of Telecommunications, and undertakings in lieu of a reference under the Enterprise Act 2002 dated 22 September 2005 http://www.ofcom.org.uk/consult/condocs/statement_tsr/

Section 5

Regulatory policy can influence incentives for investment

5.1 The two key challenges facing Ofcom on next generation access investment continue to be the same: how to secure efficient and timely investment in next generation access while at the same time continuing to promote effective competition.

5.2 Some may argue that these challenges cannot both be met at the same time. This argument is based on the idea that investors will be less willing to deliver next generation access infrastructure if early, strong competition means they would earn less from providing next generation access services. Ofcom has a different view. We believe that by following the principles for regulation that we set out in section 2, we can promote competition both when the next generation access networks are being built and afterwards when services are being delivered, and that we can do this without deterring network investment.

5.3 The development of next generation access networks is a historic change and we believe that regulatory policy decisions should support this change. Part of how we propose to do this is to take a principled but pragmatic approach to the regulation of next generation access. However, we must consider how private sector decisions to invest can be influenced by Ofcom's actions and decisions on how to regulate next generation access. It is vital that the regulatory framework for next generation access is considered at the start, both so that networks are designed in ways that promote competition for the long-term benefit of citizens and consumers but also provide the right incentives for investment. However, the framework will necessarily evolve as we learn lessons from these new deployments.

5.4 We have identified three key factors that directly influence the incentives to invest in next generation access networks. These are threat of competition, potential for cost reduction and efficiencies, and potential for additional revenue generation. In practice it is likely that a combination of these three factors will drive investment.

Competition is one of the key drivers for investment

5.5 For potential investors in next generation access infrastructure, a credible risk of a competitor making the investment before them may act as an incentive to invest. Investment in this case is driven by a desire to prevent a loss of customers, and revenues, to competitors in the form of new market entrants or existing competitors.

5.6 The threat of competition does not have to come from a competitor using the same technology. For example, in next generation access the incentive to invest may be increased where there is strong cable competition, or significant competition for TV services from a range of potential platforms.

5.7 The regulatory policy decisions made by Ofcom have significant potential to influence the prospects both for market entry and for subsequent competition, and with this the incentives to invest. Central to our regulatory approach is promoting options for contestable investment wherever this is efficient and sustainable and leads to longer-term competition. However, the regulatory model to deliver competition and contestability in next generation access may not look the same as the current world. This is explored in more detail in Section 6.

5.8 It is important to note that this is not a decision solely for Ofcom. Choosing the right regulatory approaches to promoting contestability and competition while incentivising investment must be done in collaboration with industry. In order to truly deliver competition, we need to understand how far industry will have a clear demand for specific types of products, as well as considering their impact on planned investments.

New access networks offer opportunities for cost reduction and efficiencies

5.9 One of the key drivers for investment will be the benefits arising from a move to a new, more reliable access network. The potential cost saving from the deployment of next generation access could arise from a number of sources, including:

- **operational expenditure savings** – existing networks have generally evolved over decades to keep up with the changing distribution and service demands of customers. Many of their elements are therefore very old and expensive to maintain. New networks, designed from scratch around the current population distribution and modern technologies may be much cheaper to operate;
- **opportunities for one-off cash benefits** – network infrastructure components that become irrelevant following a transition to next generation access could be monetised to some extent. A typical example is the sale of real estate properties hosting local exchanges; and
- **avoiding wholesale access product costs:** for communications providers who currently buy access products from third parties, deploying their own infrastructure can reduce recurring outgoings.

5.10 In order to achieve these cost savings in the first place, the cost associated with deploying a new network have to be incurred. Many innovative approaches are being taken to limit these deployment costs. For example, to minimise the costs associated with installing new cables, many solutions involve reusing as many assets from the existing network as possible. This may involve the installation of fibre cables into existing ducts, or allowing the in-place replacement of the copper cores of existing cables with optical fibres.

5.11 In practice, the ability to reuse assets to reduce deployment costs, and to realise potential cost savings after the network is built, depend on a number of factors:

- **transition from old to new networks** - to realise the cost savings, for example, operators must be able to avoid the costs of today's networks. This can only be achieved if the old access network is no longer supported, or if customers are migrated to the new network to close the old one. The ability to realise cost savings during the period of network build is less certain due to complexities in actual transition and the timescales involved;
- **the reach of next generation access** - the more of the existing copper access network that remains in service, the lower the potential for overall cost reductions; and
- **the type of next generation access technology used** - a 'mixed economy' approach to next generation access deployment, utilising different technologies depending on location, and drawing on the existing copper network, might limit the portions of the copper access network available for closure. In addition, there may be further operational costs involved in managing multiple access networks.

5.12 Expected cost reductions that have been expressed publicly vary substantially, ranging from 21% in Germany to up to 90% in Japan. BT have not cited cost saving as a specific driver for making the recently-announced upgrades to its network. BT's upgrade is based on overlaying its existing network with fibre-to-the-cabinet (FTTC), using GPON-based backhaul from the cabinet to the exchange. VDSL based super-fast broadband services will be offered over the existing copper sub-loop. In this deployment, BT retains the full copper local access infrastructure and runs it in parallel with FTTC for voice and ADSL services for the time being.

5.13 It seems likely that in any next generation access deployment there will come a point when it is more economically efficient to switch off the old network. We believe that the regulatory environment should support such transitions when the time is right, while continuing to ensure there is a competitive environment. The potential commercial timing of any transition remains uncertain – it will depend on the take-up of services using the new networks and the scope for cost reduction and efficiency from transition. As a result, it is not possible to be specific on issues such as the timing of particular transition milestones. However, we think it is important to consult on our thinking on the triggers for transition and how transition might occur. This should help investors and potential investors gauge the extent to which cost savings can be realised. This is discussed in more detail in Section 8.

There are also opportunities to increase revenues through new services

5.14 New access networks provide opportunities to deliver new services which may generate additional revenue and lead to changes in the industry's current value chains.

5.15 Different operators are likely to have different perspectives on the potential revenue opportunities from next generation access investments depending on who they are:

- **new entrant** – an organisation looking to target new telecoms markets may consider investing in an access network to facilitate this. All the revenue they earn from the network is additional, but making such a large investment to enter a new market is risky;

- **existing player without their own network** – a wholesale customer may wish to build its own network, not only to save cost but also to generate additional revenue. A next generation access network may allow it to offer innovative new services, or to take a larger slice of existing value chains. As well as increasing revenue, this approach may also increase market share; or

- **existing network owner** –the new network may enable the delivery of new services on which consumers and businesses place more value and are therefore willing to pay more for.

5.16 There are various ways in which these opportunities to generate additional revenue can be realised, such as usage charging based on capacity or quality of service delivered, higher access charges, premium content and new advertising models. The last two in particular may represent a significant shift in the role in the value chain that the network operator has traditionally fulfilled.

5.17 In general, we are keen to promote innovative new revenue models to assist operators in making the case for next generation access deployment. However, there may be few opportunities for Ofcom to directly support the emergence of new business models through regulation. This is explored further in Section 9.

Section 6

Competition remains key to delivering the benefits of next generation access

6.1 Our approach to regulating current generation broadband networks relies on effective and sustainable competition to deliver consumer and business benefits. As we outlined in Section 4, it may be that there are better prospects for market led competition as a result of new technology and deployment options. However, there remains a substantial risk that this area will continue to be characterised by the presence of enduring economic bottlenecks given the costs involved in fixed deployments and the limitations of other technologies. This is why we may continue to need regulation in the future.

6.2 This section considers how different wholesale products may best enable effective competition. We believe that, like today, a mixture of passive and active products will continue to be appropriate in the future. This section outlines our current thinking and would inform future market reviews, but does not presuppose the outcome of any current or future market review.

6.3 Active inputs do not deliver the same potential for product and price differentiation as passives, but they are cheaper for competitors to use, at least initially. They are likely to act as an important option everywhere, and in some areas will be the only economically viable means of introducing competition. It is important that they therefore offer competitors as much innovation potential as possible, and developments in this area are very promising.

6.4 Despite the vital role that effective active products will play, our preference is still for passives because of the greater scope for competition that they offer. However, the economics mean that successful widespread deployments using existing passive products, such as the current form of sub-loop unbundling, may be harder to achieve. However, history suggests that the business case can improve over time, and changes to the structure of the products and new business models like joint investment have the potential to improve the viability of these products in the shorter term.

A mix of passive and active wholesale products will be required to deliver effective competition

6.5 In our previous consultation on this topic, we introduced two main types of potential wholesale remedy: passive and active. These are described below.

Figure 1: Passive and Active remedies to support competition

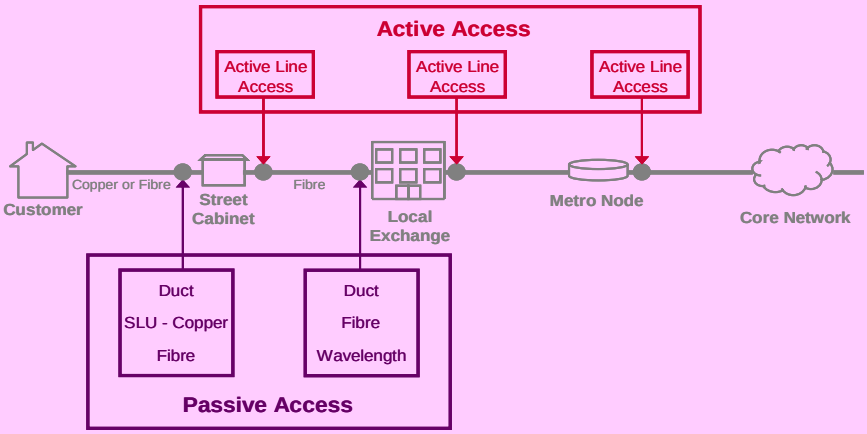
Passive wholesale access products

Input products offering direct access to the underlying passive infrastructure of the network to the customer, such as copper and fibre cables. The point at which an operator purchasing these products needs to interface with them is relatively close to the customer because the length of this "last mile" connection is usually quite short. The operator needs to install its own active electronics to send signals across the infrastructure at this point.

Active wholesale access products

For these products, also commonly known as bitstream, the owner of the infrastructure owns and manages the active electronics and from here the wholesale inputs are made available to others. The bitstream signals delivered by the active electronics can readily be transported across the infrastructure owner's backhaul and core networks, allowing the potential for a wide choice of interface points at local or central locations.

Examples of passive and active products for FTTC and FTTH deployments



There are advantages and disadvantages with either type of product

6.6 Active products represent the least expensive way for a competitor to enter the market. Initial investment can be much lower than for passive products. Another advantage is that a single type of active input product can be used to address customers served by different access technologies, for example copper or fibre. Passive products tend to be technology specific. Compared with passive products, the use of active products by competitors also minimises duplicative investment and allows the bottleneck asset owner to achieve the maximum scale economy, reducing the costs of competition.

6.7 However, passive products offer a competitor some decisive benefits over active products:

- passive products leave many more technology choices in the hands of competing operators, maximising scope for the development of innovative products;

- they leave much more of the control of the service delivered to end customers with the competing operator, minimising their reliance on the bottleneck asset owner;

- after the initial investments are made, ongoing costs for passive input products tend to be lower than for active, allowing more flexibility in retail pricing; and

- passive products offer greater choice on investment timing. Active inputs only become available after the bottleneck asset owner has invested. Passive inputs can be used before, at the same time as, or after such an investment.

6.8 Overall, active products minimise the investment necessary to deliver competition, while passive products allow the greatest chance for ongoing dynamic competition. This is because they offer the greatest scope for product and price innovation and differentiation.

6.9 We made clear in our Strategic Review of Telecommunications that our preference is for competition at the deepest point that is effective and sustainable because of the dynamic benefits they create. This generally means a preference towards passive access to any bottleneck assets, made available as close as possible to the customer. In practice, today we see competitors in broadband using a mix of inputs to deliver broadband. In some areas multiple physical networks have been deployed. In others, competitors rely on the passive local loop unbundling (LLU) product, and in yet others we see competition based only on active bitstream products.

6.10 The principle of promoting effective and sustainable competition is equally valid with next generation access networks. It is likely that the 'depth' of competition feasible in any given location will be different from today. Where possible, we would like to see competition based on passive products. However, due to the differing characteristics of passive and actives, we believe we will continue to a see a mix of these product types, with some areas served by competition based on active inputs only and others using passives as well. This mix will change as the market develops, and it remains too early to guess the exact role of each type of product.

6.11 Below we consider active and passive products in more detail.

Active wholesale products

6.12 Active wholesale products have a number of advantages, particularly in relation to the cost of market entry. This means they will continue to have a central role in delivering next generation access competition. The economics of active products mean that they result in a lower cost from introducing competition compared to passive products. Active products are therefore the most likely input product to be a viable across the widest possible area of future next generation access footprints.

6.13 However, these products have disadvantages compared with competition based on passive products. They offer less opportunity for product and price innovation and differentiation. For example, active products mean most communications providers will have the same underlying cost structure, largely based on variable costs. These disadvantages were one reason for the extensive adoption of LLU by competitors.

Developments in technology may reduce some of the current disadvantages of active products

6.14 The limitations today's active products impose on product innovation could be addressed as a result of technology developments. Since raising this topic in our previous consultation, we have continued to work with industry to explore how the potential of new technologies can be realised in practical future active products.

6.15 Two factors lead to potential improvements in the competitive characteristics of active products in the future. The first is the increasing automation of service maintenance and support through Next Generation Operational Support Systems (NGOSS).The second is the rise of Ethernet as a ubiquitous transport in backhaul and core networks – generally termed Carrier Ethernet. Active products benefit from adopting a common interface technology as this gives independence from the underlying infrastructure and economies of scale across different deployments. Ethernet is the obvious choice for such an interface because it is a 'raw', relatively simple protocol, which can be used to transparently carry a range of higher level services.

6.16 These two factors mean that it may be possible to transfer more control of the underlying infrastructure with active access products. At its most basic it is possible to imagine a very 'raw' Ethernet active bitstream product which gives access to the capabilities of the physical, passive, layer whilst simply adding the minimum functionality necessary for the support of competition. Ofcom refers to the set of technical requirements that could deliver this type of active access as Ethernet 'Active Line Access' (ALA). We have been actively discussing these with industry since our last consultation.

6.17 As a result, we have identified a number of characteristics necessary for future active products, captured in our Ethernet ALA technical requirements[18]. These characteristics are:

- security;
- quality of service;
- support for multicast;
- a wide range of consumer premises equipment; and
- flexible aggregation and interconnect.

6.18 Ofcom commissioned consultants to survey commercially available Ethernet access products to assess the current state of the market and to inform the need for Ofcom engagement to promote the development of active products[19]. The survey found that the competitive characteristics we identified were available in commercial products to a lesser or greater extent.

6.19 Defining these characteristics provides an overarching framework to capturing the requirements of wide range of possible active products. They are not meant to form a product description in their own right. In practice, specific products will be developed

[18] http://www.ofcom.org.uk/telecoms/discussnga/eala/eal/
[19] http://www.ofcom.org.uk/telecoms/discussnga/eala/eas/

to meet differing commercial or regulatory objectives, and not all characteristics will be relevant in all cases. Annex 9 describes these characteristics in more detail. .

Practical development of active next generation access products is starting in the UK

6.20 Openreach is currently developing its own active access product – Generic Ethernet Access. It intends that GEA will be the basis for wholesale access to its next generation access network. Openreach published a consultation on its proposed GEA pilot product for FTTC deployment areas on 21 August 2008. This builds on its consultation and engagement with industry on GEA for FTTH developments.

6.21 In its response[20] to the Ofcom New Build consultation, Openreach characterised GEA as its version of active line access. Openreach's proposed GEA products for FTTC deployments displays many of the characteristics that have been identified as important for next generation active products. Inevitably there are some gaps between these early products and the technical requirements of active line access. At the moment, some of the most significant are:

- the different GEA versions offer hard wired interfaces supporting one or two communications providers. This will limit the ability of consumers to purchase a range of innovative new services from different providers, a facility which has proved important in some international next generation access deployments. A product meeting the active line access requirements is likely to need considerably more flexibility than this;

- the support for multicast is limited. This is a technology that allows for lower cost distribution of video content to larger numbers of customers over communications networks. For some active products, especially those offering relatively centralised interconnection, this may greatly increase the cost of delivering some services, such as internet television; and

- the support for different levels of quality of service is limited. This may constrain the range of services that can be cost effectively delivered.

6.22 The most appropriate channel for industry to influence Openreach's product development is as customers, submitting statements of requirements and responding to Openreach's consultations. The active line access technical requirements do not replace these consultations, but complement them, based on extensive and detailed engagement with industry. We encourage Openreach to continue to consider these technical requirements when developing its active wholesale products.

6.23 We welcome Openreach's consultation and urge all stakeholders to provide feedback on the plans for the product. This will help Openreach to develop its GEA product to offer meet the needs of its customers. In particular, we look forward to seeing a development roadmap for GEA in due course, indicating how this product will develop over time and meet the requirements of Openreach's customers, expressed both in response to the Openreach's consultation Ofcom's work on active line access technical requirements.

[20] http://www.ofcom.org.uk/consult/condocs/newbuild/responses/BTGroup.pdf

Standardisation is important for future active products

6.24 It is important that industry players work together to define future active access products. They are better placed than any regulator to do this. But it is also the case that these products need to offer standardised interfaces because of the risk of technology isolation and delivery of common services, including universal service, across the UK.

6.25 The risk of technology isolation is higher in next generation access then in current access networks. In the future we may see more, smaller networks than we have today as different players deploy networks in new build developments, for example. These could be based on a range of possible technologies including FTTC, GPON FTTH and point to point FTTH. Service providers may not be able to offer their services to all networks across the UK if they need to adapt their internal processes and systems to work with many different technologies and interfaces products. This is particularly an issue when different network may only give access to a small number of consumers. Common standards will alleviate this problem.

6.26 Standardised interfaces will also reduce the cost for the delivery of universal service. They will help the current USO operators deliver their obligations across different technologies. This is explored in more detail in our New Build Statement[21]. In the context of our New Build consultation, BT and other infrastructure providers have indicated their support for standardisation of wholesale products.

6.27 Ofcom can play a role in promoting standards, working with industry to help bring about standardisation. Such standardisation must not be limited to the UK: the economics of super-fast broadband require European if not global standardisation. This is because of the global nature of telecoms equipment supply, as well as the need for consistency to realise the benefits of a single European market. Given the European telecoms regulatory framework, all European countries face similar challenges and many are looking at active products to address them. We are therefore working with other national regulatory authorities and standardisation bodies to promote a global approach. In addition, NICC, the Broadband Forum, and the ITU have all expressed a desire to be involved in progressing active wholesale product standards.

6.28 Our engagement on the technical requirements and the industry roundtable we held on 2 September have also highlighted the importance of the operational processes and systems supporting wholesale access. These are closely linked to issues on products and in some ways are as, or more, important. Annex 9 gives some suggestions for requirements in this area.

Passive wholesale products for FTTC

6.29 In contrast to active products, passive products tend to be specific to the infrastructure they are used to gain access to. From current announcements it appears that the majority of next generation access deployment in the UK is likely to be based on FTTC, at least in the medium term. This will be complemented by smaller scale FTTH deployments, especially in new build areas and new apartment buildings. This section considers two products which may therefore be key to delivering effective competition: sub-loop unbundling (SLU); and duct access.

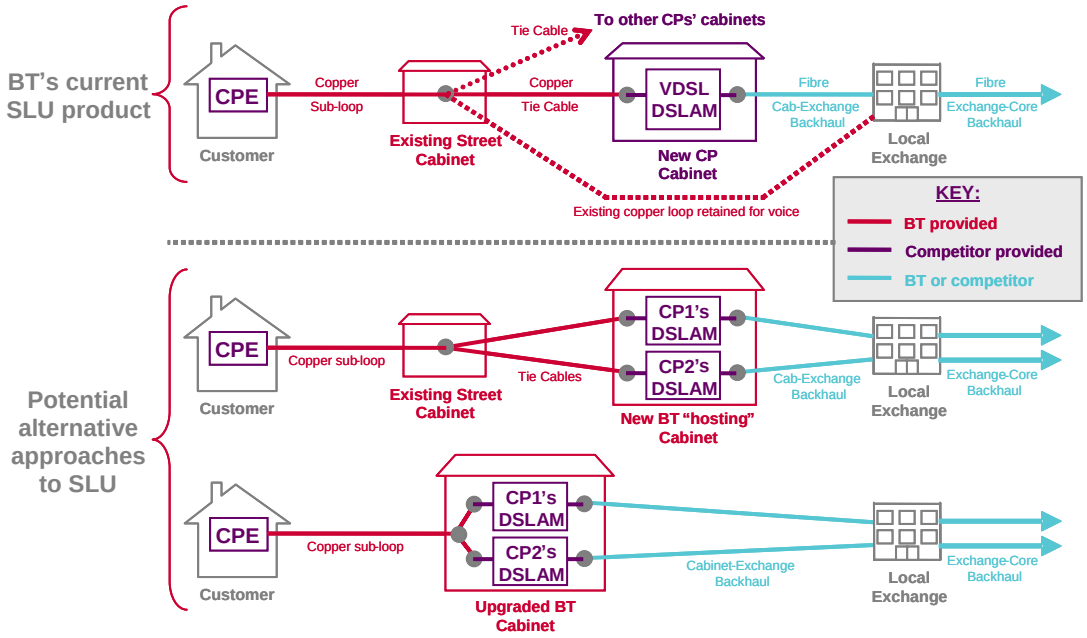
[21] http://www.ofcom.org.uk/consult/condocs/newbuild/statement/

Sub-loop unbundling products are available and have been improved

6.30 Sub-loop unbundling is already a regulated wholesale access product[22], although no-one has used it commercially to date. In its recent draft Recommendation, the European Commission confirms that it regards it essential that a reference sub-loop unbundling product is maintained. It is important therefore for us to consider the prospects for effective deployment of sub-loop unbundling.

6.31 The product currently offered by BT is being trialled in London and is set to form the basis of the South Yorkshire Digital Regions project[23]. Since our last publication, the Office of the Telecoms Adjudicator (OTA) has been working with industry to improve the products and processes offered by BT for sub-loop unbundling. This has involved revising existing processes for the Plan, Build and Operate stages of the product, resulting in significant improvements. However, practical and economic challenges remain for this product.

Figure 2: The basic elements of sub-loop unbundling using BT's current product, and possible alternative arrangements



There may be operational issues with sub-loop unbundling

6.32 There are a number of remaining practical issues with current sub-loop unbundling products that may raise barriers to large scale adoption. For example, operators need to decide which cabinets they wish to unbundle to serve their target customers. However, data on cabinet locations and the customers they serve is less readily available than the exchange data used for LLU. Industry, working with BT, is likely to be able to find solutions to most practical problems as sub-loop products are trialled and deployed more widely. Similar issues have been encountered throughout the life of LLU, and using mechanisms such as the OTA, they have mostly been resolved. This does mean that reaching a sub-loop unbundling product suitable for volume deployment will inevitably be an iterative process.

[22] http://www.ofcom.org.uk/consult/condocs/rwlam/rwlam_state/rwlam2.pdf
[23] http://www.digitalregion.co.uk/

6.33 Alongside the issues associated with the current products and processes, there are also practical challenges that are not directly linked to regulation. For example, it may be difficult to obtain suitable sites and planning permission to place additional cabinets, especially for multiple operators' deployments. When installed, mains power is required at these new cabinets and arranging this can be expensive and take many months.

6.34 Beyond what might be considered as day-to-day practical issues common to any complex new product, there are some larger operational issues associated with current sub-loop products. Chief among these is the lack of integration into standard automated ordering systems such as the Equivalence Management Platform (EMP) or a product specific service provider gateway. There are also a number of ancillary products that potential purchasers of sub-loop unbundling have expressed interest in but that are not currently available. This includes equipment hostelling and suitable fibre backhaul products from the cabinet to a competitor's network.

Sub-loop unbundling may also face challenging economics

6.35 Whilst passive wholesale inputs such as sub-loop unbundling offer operators opportunities to develop distinctive new services, they will only invest in them if they see a clear route to making a suitable return. However, various public of the economics of sub-loop unbundling approaches have raised questions on the economic viability of this product, at least for certain locations. Studies include those by Analysys Mason on the economics of different options for competition in FTTC networks in the Netherlands[24] and Dublin[25], as well as a recently published ECTA study[26].

6.36 The study from ECTA shows the viability of competitive entry using passive inputs and FTTC varies significantly between the countries studied (Germany, France, Italy, Portugal, Spain, Sweden). This study estimated the market share required to deliver a positive business case for an alternative investor using varieties of sub-loop unbundling. This varied by country, and by geography type. For example under one scenario, the minimum market share of all communications customers for a competitor using sub-loop unbundling in 'less urban areas' (covering 5 million homes) was 31%.

6.37 This is based on an assumption of the competitor sharing 80% of the costs of its ducting i.e. sourcing the ducting it requires from existing sources (e.g. duct access, use of sewers etc). As the assumption on the level of sharing falls to 20%, the market share required increases to 37%. This shows the importance of models that reutilise existing assets or share investment in new assets.

6.38 To understand the economics of sub-loop unbundling in more detail, Ofcom has undertaken its own high level assessment of the costs. While the results depend on many factors specific to any given communication provider, some scenarios suggest break even may require the provider to supply around a third of all lines connected to a typical cabinet. In the UK, the largest cabinets are around three times the size of the average, which means they should be able to support the required level of penetration for a given operator to be profitable. However, there are very few

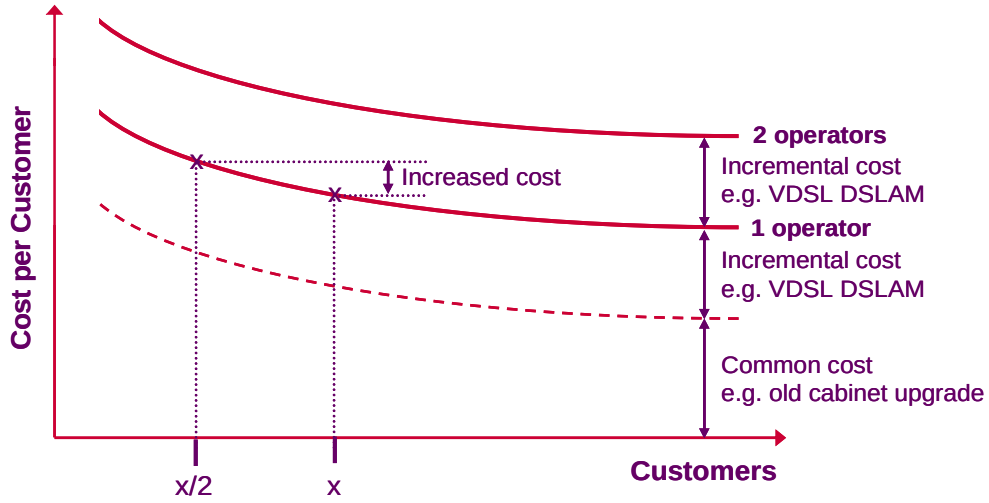
[24] http://www.opta.nl/download/Analysys+Final+Report%2Epdf
[25] http://www.comreg.ie/_fileupload/publications/ComReg0810a.pdf
[26] The Economics of Next Generation Access, WIK-Consult GmbH for European Competitive Telecommunication Association,
http://www.ectaportal.com/en/upload/ECTA%20NGA_masterfile_2008_09_15_V1.zip

cabinets of such a size, and the relatively even distribution of large and small cabinet sizes across any given area means that such 'cherry picking' may be difficult in practice. This is contrast with local loop unbundling, where larger exchanges tend to be clustered together in areas of higher population density.

6.39 The economic challenges for multiple operators using passive remedies to access the same cabinet arise from two main causes, illustrated in Figure 3:

- fragmentation: the sharing of the customer base across multiple operators results in less customers per operator, unless the overall size of the market increases sufficiently to compensate. This reduces economies of scale and pushes operators up the cost curve; and
- duplication of investment: the level of incremental cost resulting from investments in multiple versions of the same assets, such as electronics or new cabinets, shifting cost curves upwards.

Figure 3: Illustrative cost curves showing the results of fragmentation and the duplication of investment



There are opportunities to improve the investment case for sub-loop unbundling

6.40 Developments in technology and the volume driven reduction of equipment cost over time are both important factors which have improved the economic case for unbundling in the past. Both may apply equally to new passive products.

6.41 A shorter term improvement may come from new business models that reduce the level of duplicative investment required by current sub-loop unbundling products. Both the ECTA study and the Caio review point out the economic benefits of sharing assets and infrastructure. There are a number of options for the economics of passive products could be improved:

- joint investment models where, at the time of deployment, all communications providers interested in investing in a cabinet contribute to the shared assets required to upgrade to FTTC (new ducting, backhaul connections etc, cabinet upgrade etc). Each service provider only duplicates investment in its own active electronics;

- there could be a bidding phase before the upgrade is undertaken. All the operators willing to invest in the upgrade would then be then catered for. It would also be possible to include space for a certain number of additional "late comers" in this approach;

- perform the initial upgrade on the assumption that more than one operator will eventually wish to install its own electronics. The exact number of operators catered for could vary depending on the likely economic attractiveness of unbundling the cabinet;

- the upgrade could be undertaken to cater for just the first operator who wishes to deploy. If other operators decide at a later date that they also wish to use the same cabinet, then they would need to pay all additional costs incurred in retro fitting them;

- as above, but late arrivals also pay back the first operator for a share of its investment in the initial upgrade costs for items which have benefit to all. Examples might include the initial cabinet survey and remedial uplift work. This approach would strengthen the advantage of getting in first and further offset risks of competitors entering, but leaves options open for later entry.

6.42 The lower section of Figure 2 on options for sub-loop unbundling indicates how alternative technical arrangements for sub-loop unbundling which might be appropriate in these cases for reducing cost. For example, they would remove the current requirement for each unbundling operator to install their own street cabinet and pay for separate tie cables to connect them. Instead, all operators' equipment is hosted in a single new cabinet or an upgrade or replacement to the original copper cabinet.

6.43 While helping to reduce cost, these models do raise some potential new concerns. For example, in some cases the operator making an initial upgrade to FTTC takes on the risk of allowing additional space for competitors which may either remain unused or be over-subscribed. However, joint investment and risk sharing might minimise such concerns, while still allowing reductions in duplicative investment.

6.44 To be successful, any joint investment needs to be attractive for all parties involved:

- for the bottleneck asset owner, joint investment offers the chance to reduce the cost of covering a given number of homes. This reduces its overall exposure to risk. Alternatively, it can reach more homes with the same level investment. Another benefit, particularly important in light of the uncertainty over compelling new applications for next generation access networks, is the potential for partners with complementary retail offerings to accelerate customer take-up and grow the size of the overall market; and

- for service providers investing looking to use passive products, the benefit is the scope for product and price innovation. At the same time, these players can reduce their own investment and risk compared. By careful choice of which assets to replicate, they can retain key technology choices and control of their end customers without duplicating common components unnecessarily. Also, by making upfront investments, albeit at lower levels than required for standalone sub-loop unbundling, they can change the underlying cost economics, with less focus on variable costs, allowing them greater pricing flexibility. Taken together, these benefits maximise the opportunity for retail product differentiation while controlling investment and risk.

6.45 The co-ordination and effective management of joint investment can be challenging. However there are examples of such arrangements working successfully, like the CERIU shared infrastructure deployment in Montreal[27], and recent radio access network sharing agreements in mobile. Even where commercial and practical challenges can be overcome, there will still duplication of some costs and reductions in scale economy. Operating costs, including customer migration costs, may continue to be substantial and unavoidable without some form of active switching equipment in cabinets. However, when combined with the improved scope for innovation and differentiation in products and prices, such joint investment models may improve the case for passive based competition.

6.46 We believe the best outcome will be delivered by interested industry players exploring opportunities commercially and establishing whether there are arrangements under which the challenges can be addressed. Indeed, both privately and at our recent round-table event, many communications providers have expressed the view that they would welcome the opportunity to explore commercial arrangements for the deployment of the new networks. However, while commercial agreement on passive products and joint investment are preferable, if there is significant demand for passive products that remains unserved by the market, we will consider alternatives.

6.47 We want to ensure that any proposals for joint investment meet with our dual aims of securing investment while promoting competition. We have outlined above the benefits for network build of joint investment approaches. However, any such agreements must also promote effective competition that delivers benefits to consumers. In practice, joint investments involving a communications provider with market power would likely need to be undertaken on a non-discriminatory basis. More-over, any joint investments must have regard to general competition law and in particular to the provisions on agreements between competitors. If such discussions result in complaints or disputes, we will consider how to respond based on the circumstances. If they ultimately fail, we will need to work with industry to understand the barriers and whether they can be reasonably addressed.

Duct access may be an important input for those considering sub-loop unbundling investment to improve the economics

6.48 The cost associated with deploying passive infrastructure is one of the key barriers to investment in next generation access networks. The Broadband Stakeholder Group's recent report[28] looked at the costs of this fibre infrastructure in the case of FTTC and estimated that it accounts for 42% of total deployment costs. Options for significantly reducing deployment cost could therefore encourage potential players to invest. The Caio review recently made recommendations on mechanisms that could be employed to reduce the cost of deployment, including co-ordination of street works and trenching.

6.49 While street works and trenching are outside Ofcom's remit, another option for reducing the cost of deployment is making use of existing communications duct. It is for this reason that we are seeing duct access encouraged or mandated by regulators across Europe. The recent draft Recommendation of the European Commission places considerable emphasis on the importance of duct access partly because (it argues) this can create the conditions for the deepest possible

[27] Next Generation New Build – http://www.ofcom.org.uk.consult/condocs/newbuild/condoc.pdf
[28] "The costs of deploying fibre-based next-generation broadband infrastructure" - http://www.broadbanduk.org/component/option,com_docman/task,doc_view/gid,1036/Itemid,63/

deployment of competing infrastructure in the network. However, it acknowledges that replicating infrastructure using duct access may not be economically feasible in all geographies or national markets.

6.50 In addition to the question of economic feasibility, there are also important questions about technical and operational practicability of duct access. In the UK, Oftel looked at duct access in 2002. It concluded that there were significant operational issues associated with duct access which might render it infeasible in the UK. It also found there was limited demand for such a product from communications providers. We included this topic in our 2007 consultation in the general discussion of possible passive remedies. We received very few expressions of interest at that time.

6.51 In the light of the strong push for duct access in the draft EC Recommendation, and the apparently successful deployment of duct access in some areas of other EU countries, it is important that we assess once again whether there is a viable market for duct access products, as evidenced by expressions of interest from communications providers.

A survey of ducts is in progress and detailed expressions of interest in duct access are sought

6.52 In recognition of the high costs of new ducting, and the increased level of interest in duct access in some other European countries, Ofcom is undertaking an initial sample survey of BT's duct. This began in July 2008 and aims to provide information on the feasibility of duct access. It is similar to a survey undertaken by the French regulator Arcep in 2007, which contributed to France's policy of promoting competition through duct access. The survey will indicate the level of potentially usable capacity in BT's ducts and how this compares with other counties, in particular with France We aim to share the results of the survey towards the end of this year. .

6.53 Mandating duct access would be a significant regulatory development. Ofcom will continue to examine the practicality of duct access, but to support such a development would also require evidence of demand from communications providers. Ofcom therefore asks communications providers to indicate what kind of duct access would be of interest to them, and on what scale.

6.54 It is important to distinguish between new build duct access and existing duct access as the practicalities and likely availability are quite different. In the case of new build, the incremental cost of including spare duct is minimal; some operators consider it best practise to over provision at this point. Nevertheless, as set out in the New Build statement, Ofcom considers that the imposition of any regulatory obligation to allow for the sharing of duct in new build would need to be based on the identification of market power as well as clear evidence of market demand and operational feasibility.

6.55 Depending on the outcome of our initial survey work and the expressions of interest we receive, we plan to work with industry and BT to develop duct access as appropriate. With currently little stated interest in the UK, it would be difficult to justify the expense of developing a usable duct access product, even if the survey suggests it would be feasible in a significant proportion of areas. With stronger demand the survey results will become critical. However, given the limited sample size it will still not be possible to predict duct availability in any given area.

Passive access will allow contestability in some areas, especially in conjunction with public subsidy

6.56 Joint investment implies that all players interested in passive-based next generation access networks will invest in a given area at the same time. If such models emerge, the scope for contestable investment is small; it is less likely that any operator will be able to afford the upgrade on their own. In the past, we have stressed that contestability is one of the most important benefits of passive access. However, the consensus view on how challenging sub-loop unbundling economics are, suggests that purely commercial investment pre-empting upgrade by the bottleneck asset owner is less likely.

6.57 The availability of what might be called traditional, or standalone, sub-loop unbundling is still very important for cases where a potential unbundler has a different economic or commercial case for investment. A good example is the Digital Region project in South Yorkshire, which is using the current sub-loop unbundling products from BT as the basis of deployment to around 500,000 houses. Combined with public funding, sub-loop unbundling gives them the option of deploying in advance of BT. Without access to sub-loop unbundling, the project would not be possible in its current form. It is also important to allow operators to respond to any future improvements in the underlying economics.

Despite the challenges, if passive line access products can be made to work, they offer the greatest scope for competition

6.58 We do not underestimate the size of the challenges ahead for different forms of sub-loop unbundling, or the investment of time and money required overcoming them. However, our view remains that the potential benefits to competitive operators and ultimately consumers are so large that we cannot preclude this investment opportunity. This is particularly important in light of the potential for technology developments to make the investment case more attractive in the future.

6.59 At this stage, sub-loop unbundling certainly looks viable in less of the country than LLU. However, the technology, its deployment and in particular the business models that could be employed, are at such an early stage it would be premature to rule it out as a result. Original estimates how far that LLU investments would reach have been significantly exceed by current deployments. VDSL technology, on which sub-loop unbundling is likely to rely, is at a far less advanced stage than LLU ADSL technology was when the original LLU predictions were made. The potential for future cost reductions may therefore be even greater now.

6.60 We are interested in understanding how far there is, or may be, demand from communications providers for some form of sub-loop unbundling. The responses we will receive to this consultation will shape how we develop the different wholesale remedies outlined here.

Passive wholesale products for FTTH

6.61 While FTTC is likely to be the predominant technology used to upgrade the existing copper access network, there will be deployments of FTTH. This will include fibre to multi-dwelling units, small businesses and new build developments. Even when considering just fibre to the home deployments, differences in possible architectures, such as passive optical networks (PON) and point-to-point (P2P) mean that different passive remedies need to be considered. This section considers:

- duct and pole access; and
- fibre and wavelength unbundling.

The uncertainty over ducts access remains but it may have an important role for FTTH

6.62 Duct access has been discussed in detail above, and the comments there apply to its use for FTTH. The amount of new cabling infrastructure that needs to be installed in FTTH is much greater than FTTC and accounts for a high proportion of the overall deployment costs. As a result, the benefits of potential cost savings offered by duct access could be much bigger. Because building new ducts would increase a competitor's costs so significantly, access to any existing duct could increase the opportunity for contestability in FTTH deployment.

6.63 Offsetting this potential is the fact that the ability to re-use or share existing duct to tends to reduce as the network moves towards the end customer's premises. In many cases the final part of the existing copper cable run is either directly buried, or is installed over ground using telegraph poles and aerial 'drops'. Where there is no existing duct, or no space, new ducting may be required, increasing the cost of deployment.

Access to poles for overhead infrastructure

6.64 In its initiatives to create momentum behind next generation access deployments, the Caio review recommended relaxing constraints on the use of overhead fibre cabling. This would potentially reduce costs of fibre deployment from £1,200 per home passed to £400[29]. How far communications providers are allowed to build new overhead cabling is an issue that is outside Ofcom's remit. However, access to and use of existing overhead poles is something that could fall within the remit of sector specific regulation.

6.65 We are interested in hearing views on the viability of sharing existing overhead plant, such as poles, and the benefits this may bring in reducing deployment cost. While accounting for a relatively small proportion of the overall distance that an access network needs to span, the final drop, which is often done overhead, accounts for a disproportionate amount of the cost. This is because this part of the network is generally shared between the fewest customers and so its construction costs cannot be spread as widely as other parts of the access infrastructure.

6.66 We believe that overall, the impact of sharing overhead plant on cost reduction is likely to be more modest than duct access solutions, which are relevant for more portions of the network. Also, it is only likely to be of interest for operators interested in deploying FTTH, or other technologies that require complete replacement of the copper loop. There are practical concerns unique to this type of sharing, such as the wind loading consideration for existing poles and operational problems with installing fibre overhead. However, if there is a strong interest expressed by stakeholders, this is an area we will explore further.

[29] http://www.berr.gov.uk/files/file47788.pdf

Fibre and wavelength unbundling

6.67 In our previous consultation, we discussed other potential passive products applicable to FTTH. These were fibre unbundling at the cabinet, splitter or exchange, and wavelength unbundling.

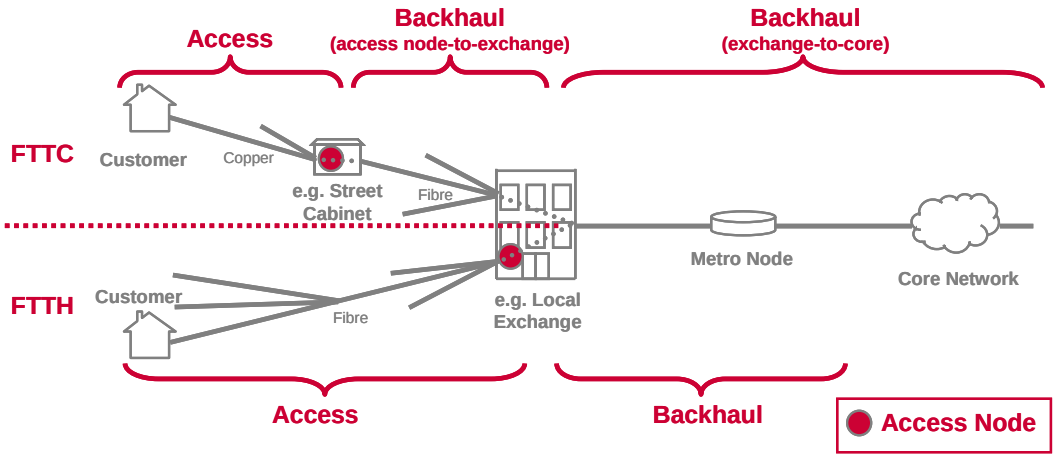
6.68 Internationally, fibre unbundling is being considered in the Netherlands in response to KPN's announced deployment of point to point fibre. However, while FTTH activity in the UK has increased in the last 12 months, the extent of current and planned coverage for these networks remains limited. BT's PON-based plans for new build housing represent the majority of published plans. However, BT has not yet provided details on the exact reach of these deployments.

6.69 Given the focus on PON deployments, wavelength unbundling may be the most promising future passive remedy outside of duct access. Practical wavelength unbundling in access networks remains likely to be some way off, although developments in the last 12 months suggest that this technology is progressing more quickly than expected. We will continue to monitor developments closely to assess the role it could play in promoting competition once the technology is demonstrated to be technically and economically viable.

A dynamic backhaul products market is key to the successful development of next generation access

6.70 Backhaul is the term used to describe connections from the access network to core communications networks. While backhaul is not part of the access network it is required for the effective delivery of higher bandwidth services. Many of the problems popularly thought to be caused by today's access network, such as broadband speeds and contention issues, are more likely to relate to issues with backhaul capacity. Different next generation access networks use different forms of backhaul, as shown in Figure 4, but all will require significant upgrades in capacity to support the new super-fast broadband services.

Figure 4: The role of backhaul with typical access technologies



6.71 Current generation broadband services for consumers rely upon contended, or shared, bandwidth in the backhaul network. This means that as usage increases congestion in the backhaul may occur. Backhaul congestion can be one of the main reasons why the maximum speed of a given broadband connection often differs from the effective achieved speed, especially in busy periods. The increasing usage of applications requiring the constant provision of large bandwidths, such video

services, increases the risks of congestion. Deployment, take-up and usage of next generation broadband services will highlight this further.

6.72 Incentives to invest in greater backhaul capacity can be influenced by the presence of regulatory measures ensuring contestability. In this respect, duct access, where feasible, has a strong potential to reduce the barrier to entry in the market of backhaul provision. By using duct access, communications providers could reduce the costs of own-built infrastructure for backhaul links, which would provide greater flexibility in the provision of services to end users based on other passive inputs like sub-loop unbundling. Alternatively, where no single operator has sufficient incentives to undertake the investment for backhaul upgrades, or in cases in which re-use of existing ducts is not viable, communications providers could decide to co-invest in new civil infrastructure.

6.73 The market for backhaul products for current generation broadband is highly concentrated at the infrastructure level. Our conversations with purchasers of current LLU products suggest that the own-built option is chosen by just a few operators in a limited number of locations; in most cases unbundlers tend to buy raw bandwidth from players that have a large scale backhaul infrastructure at their disposal, like Openreach and Virgin Media.

6.74 The likelihood of increasing economies of scale in backhaul may mean that next generation access causes the backhaul products market to concentrate further. Even though market mechanisms are likely to provide the necessary incentives for investing in greater backhaul capacity, we will continue considering this issue alongside those around incentives for investment and promotion of competition in access networks.

Proposed Ofcom actions

6.75 We will continue to develop the mix of regulatory remedies that will support different modes of competition to benefit customers. This has a number of important elements:

- high-level-clarity on how obligations will be introduced for each of the remedies, including duct access, and the relationship between new and current regulatory products;
- supporting industry in developing detailed product design, processes and systems for the network access. We will work with industry bodies to ensure that all next generation access products can be bought and managed as easily as possible;
- suitable backhaul products and capacity, while not specifically part of the access network, are key to supporting any effective broadband network. In the future, a combination of new Ethernet products and use of existing duct space may play a role in ensuing there is suitable backhaul capacity and competition to support effective broadband networks.

Consultation questions

Question 5 - How important are passive products such as forms of sub-loop unbundling and duct access? Can the economics of these products support the promotion of effective and sustainable competition at this level? Which passive products should Ofcom pursue?

Question 6 - What are the characteristics of high quality, fit for purpose active wholesale products? How far can active products with these characteristics support effective and sustainable competition?

Question 7 - Are there other options for promoting competition through regulated access that have not been considered here?

Question 8 - How far may options for joint investment provide greater opportunities for competition based on passive inputs? Are there lessons that can be learned from similar ventures in other industries? What are the risks and advantages of such approaches?

Question 9 - What should be the respective roles of Ofcom and industry in defining and implementing product standards?

Section 7

Key to delivering effective competition and investment is pricing

7.1 Pricing of wholesale next generation access-based services is crucial to the success of these networks. Pricing will affect both the incentives to invest, the success of competition, and consumer demand for the services. Regulatory price setting is one of the remedies available to address market power. However, when determining whether price setting is appropriate, the likely effect on investment incentives, competition and consumers needs to be considered.

7.2 Our preference is to regulate at the wholesale level, either for active or passive products, seeking to promote downstream competition in retail services. Only where wholesale regulation was likely to be ineffective or remedies in place insufficient may retail price regulation be considered. This is the approach we have adopted for current generation broadband services.

7.3 Detailed regulatory price setting can only be undertaken when more details emerge on the scope of investment and range of services that being demanded. However, there are some general principles of which Ofcom's approach needs to take account.

7.4 In this section we outline some general principles relating to pricing and discuss the importance of achieving consumer choice as well as ensuring price levels are appropriate. The aim is to elicit the views of our stakeholders on appropriate approaches to pricing where there is market power. However, while this outlines our current thinking and would inform future market reviews, it does not presuppose the outcome of any market review.

7.5 In summary, at this stage we do not consider it appropriate for the regulator to set the prices for the new services. We are however keen to promote consumer choice and therefore where there are limited next generation access network operators we would want to ensure that wholesale services are made available.

Some general pricing principles

7.6 If there was multiple, competing, next generation access networks then consumers should be adequately protected by this competition and accordingly it would be unnecessary for the regulator to intervene and set prices. However, as it is possible that such an outcome will not materialise, it is sensible to consider what the regulatory approach to pricing should be, if required.

7.7 When considering the appropriateness of regulatory approaches it is useful to assess them against some general pricing principles we believe are appropriate for these new services. These principles build on our previous consultations on next generation access and the responses we received. These principles are:

- pricing and rates of return must reflect the level of risk faced when investments are made;
- pricing approaches should take into account the level of demand uncertainty;

- flexibility in pricing is desirable, allowing experimentation, increased investment and greater take-up;
- pricing approaches need to reflect the underlying characteristics of products;
- regulation should consider the impact on investment incentives from the relative prices of different products;
- the costs of new investments should be recovered from the services that they support; and
- investment risk can be addressed by more than just pricing approaches.

Pricing approaches must reflect investment risk and minimise uncertainty

7.8 Investment in next generation access networks is associated with uncertainty. The cost of investing in next generation access is likely to be significant. Yet at the same time, demand for the services next generation access networks may deliver is not yet clear.

7.9 To some extent investors may be able to initially test demand for new products and services in some areas before rolling out to other areas. However, demand for super-fast broadband is heavily dependent on the content and services that can be offered over it, which will take time and a sizeable market to develop. This means that initial testing, whilst useful, may not accurately estimate future demand

7.10 To ensure that incentives to investment are not undermined, regulation needs to take into account the associated risk. Where the risk is high, the investor should be given the scope to earn higher returns. We do not consider that it would be appropriate to allow higher returns on products which are available today, as demand for these is clearer and therefore there is less risk associated with providing them.

7.11 If the regulator elects to set prices then the associated risk would need to be reflected in the regulated price. High risk investments would therefore result in higher regulated prices. Of course, the risk associated with any investment is likely to reduce as the market develops and consumer demand and willingness to pay become clearer, which implies that the appropriate level for any regulated prices would also reduce.

7.12 Despite the likely change in risk over time, it is important for Ofcom to commit to consistent pricing approaches and indicate their likely duration in order to provide as much clarity as possible on our view of appropriate returns and hence ease of investment decisions. Charge controls, for instance, are typically put into place for periods of up to four years. We are interested in views from stakeholders on how long in general any pricing approach with respect to next generation access should apply. Any specific proposals in relation to pricing would need to be reviewed through the proper regulatory processes, such as a result of the outcomes of a market review in the light of changes to the overall market.

Pricing approaches should take into account the level of demand uncertainty

7.13 Where regulatory price setting is appropriate, we would need to forecast costs and revenues in order to estimate future returns on investment. Where demand is uncertain, forecasting future revenues becomes more difficult and this increases the risk of setting prices too low or too high. If we were to set prices too low, we risk

stifling efficient investment. Conversely, if we were to set prices too high, we risk stifling consumer demand.

7.14 The regulatory costs and risks involved in setting prices under these conditions suggests that it is might not appropriate to set prices across all wholesale products. This suggests there can be benefits in approaches where the market sets prices, especially in the earlier stages of market development when there is substantial uncertainty on demand. This also allows a degree of flexibility in price setting.

Flexible pricing can increase investment and take-up

7.15 The current uncertainty around new services may mean that an investor's strategy includes offering introductory prices in order to simulate demand and to test consumers' willingness to pay. One example in next generation access elsewhere is Verizon's early development of its FiOS service which has been characterised by such price trialling. Allowing flexibility in the prices that can be charged for the new services is therefore likely to be beneficial as it can reduce investment risk.

Pricing approaches need to reflect the underlying characteristics of products

7.16 It is important to consider the underlying characteristics of the products when assessing the most effective pricing approach. Where products cannot be differentiated, but require risky investment, there are two possible approaches:

- allowing higher mandated prices. This requires forecasts of costs and revenues, which is likely to be difficult given uncertain demand; or
- allowing the asset owner to set its own prices. This option carries the risk of excessive prices which may hinder competition and reduce the potential benefits of next generation access to consumers. Many alternative operators responding to our previous consultation were concerned about potential margin squeeze in case of full flexible price setting.

7.17 In our previous consultation document we explored the following options for regulating certain next generation access products:

- allowing higher mandated wholesale prices;
- allowing the asset owner to set its own prices; and
- anchor product pricing.

7.18 We consider that of the options outlined, the anchor product pricing approach has significant advantages. Where feasible, is likely to be the most efficient pricing approach for risky next generation access products. Its main advantages are:

- it provides incentives to invest by allowing higher returns on new products (likely to be higher speed broadband);
- it minimises the risk of detriment by ensuring that products equivalent to those available today are offered at equivalent prices;
- the ability to charge excessive prices is limited because the anchor product's price constrains the prices of all other products offered;
- it allows flexibility in pricing, enabling investors to trial different price points and change price to maximise take-up; and

- it carries less regulatory cost and risk compared with the option where the regulator sets the absolute prices.

What is anchor product pricing?

- Anchor product pricing is an alternative approach to setting mandated prices or allowing the network operator complete freedom to set all prices. The approach involves specifying one or more wholesale products for which the price would be set by Ofcom – the anchor. Prices of other, non-anchor products could be set freely by the asset owner.
- Any anchor product would be similar to products widely available and demanded today. Consumers who wanted to would still be able to buy today's product at today's prices. Others could choose to take a different service for a different price. It is likely that non-anchor products would generally be higher bandwidth products that are not widely available today.
- Prices for anchor and non-anchor products would not necessarily be cost-based. Prices of non-anchor products would be set by the operator while anchor products could be set on the basis of existing products' prices.
- Although the network operator would be free to set prices for non-anchor products, it is expected that the price of the anchor product would act as a constraint and ensure that prices were not set excessively. In addition, the operator would be required to provide all products on an equivalent basis.
- Anchor product pricing has the advantage of creating incentives for efficient investment (by allowing higher prices on higher bandwidth products) while ensuring that consumers of products currently available today are not adversely affected.
- More details are available in our last consultation document.

7.19 The disadvantage of anchor product pricing is that it is based on the network operator being able to offer differentiated products. This allows different prices to be set and higher returns to be made on the highest quality products. This makes this approach particularly suitable for active products.

7.20 However, some products are risky but cannot be differentiated by speed and quality, for example, access to passive products like new ducts or dark fibre. In both cases, the network operator would be unable to distinguish between providers using the passive product for different qualities of broadband service and therefore all would have to be charges the same price.

7.21 On balance, in this situation, we believe that the best trade-off between creating the right incentives for efficient investment and ensuring that consumers benefit from next generation access investment is to set higher mandated prices that take account of an estimate of the risk incurred in investment.

Regulation should consider the impact on investment incentives from the relative prices of different products

7.22 The relative prices of different wholesale products have a significant impact on investment incentives. This includes both new and existing access products. To some extent, products will be substitutes for each other: downstream providers are

likely to be able to use different combinations of products to provide super-fast broadband services to end-users. The choice of products will be influenced by their relative prices as well as any additional costs involved in their use.

7.23 As a result, it is important for any pricing approach to consider how the relative prices of different access products will affect the incentives for investment and the promotion of competition. In some cases, arbitrage opportunities may arise, for example, a provider might be able to under-cut the asset owner's prices on certain products by purchasing and re-selling a combination of other wholesale products. If relative prices are not set carefully, the investment case for some products may be undermined.

The costs of next generation access should not be spread across all products

7.24 Investment in next generation access networks is desirable in so far as they support the delivery of new services to end customers, as it is these end services that generate increased benefits. However, it is likely to be inefficient to secure investment in next generation access by allowing its cost to be spread across all products including existing services. Such an approach would negatively affect consumers who do not value the new services by forcing them to pay higher prices. In effect, those consumers who do not value next generation access investment would be subsidising those consumers who do.

Investment risk can be addressed by more than just pricing approaches

7.25 There are alternative ways of reducing the risk faced by for next generation access network investors, such as establishing commercial agreements with upstream network providers and downstream service providers. Such an investor may, for example, be able to use financial incentives to attract content developers, which would encourage higher consumer take-up of new services. A next generation access investor could also share the risk of next generation access deployments with other communications providers. Options for this would include joint investment, or pre-investment agreements to purchase a certain minimum volume.

7.26 We are very keen to support any new commercial models that can increase the incentives to invest while delivering a competitive environment. However, any such agreements involving communications providers with market power would only be appropriate if contracts are tendered on a fair and non-discriminatory basis. For other providers, such commercial models would need to have regard to general competition law and in particular to the provisions on agreements between competitors.

Comments are sought on one particular option for pricing

7.27 The way next generation access products are priced is likely to evolve over time. As uncertainty and risk reduce as the market evolves, the most effective approach to pricing is likely to change. As a result, we have outlined here a near term approach to the pricing of access products while the market is in the early stages of development.

7.28 At this stage in market development, a pricing approach that will allow the market to trial and experiment with next generation access deployments is desirable. As outlined above, at times of significant uncertainty, regulatory price setting may be difficult and undesirable given the risk of setting the wrong price. Allowing greater pricing freedom, especially for new products, will allow the market to work out what the optimal pricing should be in the initial phase of market development in order to

generate the take-up of services necessary for the recovery of next generation access investments.

7.29 In practice, one approach to the pricing of wholesale access to these new networks would be to:

- provide greater pricing freedom for new bitstream products like Generic Ethernet Access; and
- focus on a more traditional pricing approach, based on cost orientation, for upstream network access products.

7.30 This approach is based on the following situation:

- at this stage, there are likely to be far greater direct pricing constraints on (downstream) active products than upstream (passive) products;
- there is demand uncertainty over new products. This means that investment in products to provide new services is risky. For active products this is particularly a big issue, as the network operator invests ahead of demand from downstream providers; and
- our strategy is to focus regulation as far upstream as possible in order to promote downstream competition.

7.31 The imposition of any regulatory pricing approach would be dependent on conducting the appropriate market review, or adjusting existing regulation such as the Undertakings. The purpose of this section is to seek views on the appropriateness of one specific potential approach to future pricing regulation where that is necessary.

Option for pricing of active products

7.32 In an overlay scenario the next generation access network and any services delivered over it will be incremental to the existing products and services. Therefore, consumers will have access to both existing products (and prices) and any next generation products.

7.33 In a scenario where the current generation access network is replaced by a next generation access network, those regulatory obligations that are not technology specific will continue to apply irrespective of the underlying network technology. Therefore, in this scenario we would expect existing products and services to be made available at the same prices as today, as far as this is appropriate and proportionate. Provision of existing products and services can increase the likelihood of downstream service providers using the new access networks.

7.34 However, as we have outlined in our New Build Statement, we recognise that it may be impractical and/or unnecessary to fully replicate existing services and therefore we intend to adopt a pragmatic approach to the product specification in such a scenario. In this situation our aim would be to ensure similar services as today are made available at similar prices. We continue to believe that new products and services should be supplied using the same processes as today's products as far as possible to ensure the usage of these new networks by downstream service providers.

7.35 In both situations of network transition and new build next generation access, the aim of ensuring that consumers continue to have access to similar services as today at similar prices would therefore be satisfied.

7.36 In general, we are of the view that introducing price regulation (whether on a cost-oriented basis or not) for new active bitstream services at this stage of next generation access development may be disproportionate. While a final decision on this position would depend on the outcomes of a market review, the reasoning for initial thinking is as follows:

- to the extent that the services are genuinely new, with untested demand, the whole risk would be borne by the network operator. This is because, unlike passive products, active bitstream products are priced on a per end user basis. Given the large upfront fixed costs to build the new access network, prices are therefore highly dependent on the anticipated number of users. Under very uncertain demand conditions, forecasting costs and revenues is likely to be very difficult. Setting prices for new active services therefore carries significant regulatory cost and risk if demand varies from that forecast. It may result in stifling efficient investment if prices are set too low or reducing the potential consumer benefits if prices are set too high;
- allowing pricing freedom may carry a risk of high prices. However, if these services are more like an extension to the current range of services then the price for these services will be constrained by the price of the existing services supported over the copper access network. This may be either because existing products are sufficient substitutes for the new products, or through a chain of substitution;
- further constraints may exist from the retail prices of services delivered over an operator's next generation access network may be constrained by the prices of services provided over another next generation access network. For instance, the prices of services that would be offered by BT and Virgin Media can potentially constrain each other given the potential footprint of the two networks may be quite closely matched;
- in addition, the availability of the 'raw' network elements on a cost orientated basis will also act to constrain the pricing behaviour of any next generation access network operator for bitstream products as these products provide an alternative means to deliver services to end customers; and
- the imposition of price regulation at this level could undermine incentives to invest further upstream which would be contrary to our strategy to promote competition at the deepest level.

7.37 Our aim is to allow operators to experiment with pricing and demand for new services but at the same time will ensure that consumers are adequately protected though the availability of similar services as today at similar prices.

7.38 We believe that it will be important to remain aware of potential margin squeeze issues. Given the proposed freedom on both access and retail pricing for upstream active products, margin squeeze can be caused either by a "too high" access charge, or by a "too low" retail price, or both. The important point is that margin squeeze is an issue of relative as opposed to absolute prices. The issue is whether the relative upstream and downstream prices allow a sufficient margin for competitive supply of the downstream service. Compared with the previous regime of regulated access, this new regime will increase the set of strategies for margin squeeze, creating new challenges.

7.39 We are, however, fully aware of these risks and will remain vigilant. We would be very likely to analyse a margin squeeze issue by assessing whether an equally efficient downstream operator would earn at least a normal profit when paying the active access price set by the network operator. In the case of next generation access, it may be that an efficient operator's strategy would be to price low early on to increase take-up and therefore attract content and service developers, which would further increase demand.

7.40 In practice there are likely to be some difficulties in distinguishing between attempts to margin squeeze from a genuine strategy to price low in the retail market in the short-term to increase take-up. A potentially contentious issue in assessing margin squeeze will be if a hypothetical anti-competitive practice has affected the efficiency of the retail arm of the network operator. For example, if increased take-up resulting from low retail prices reduces unit costs.

7.41 Furthermore, our proposed pricing freedom for active upstream products would be revisited should a market review reveal anti-competitive issues or should a complaint from a competitor establish that a deliberate margin squeeze occurred.

7.42 However, we note that an alternative potential strategy to take advantage of the beneficial effects of building take-up early on is for the network owner to price access services at a low price to encourage take-up at the wholesale level. The success of this strategy would, however, depend on the access owner's commitment not to increase the access charges too much once there is 'enough' take-up. Otherwise, the optimal strategy for the retailers purchasing access would simply be to set high retail prices and pocket the high margin (they have much less incentives than the network owner in developing scale, having invested nothing in the next generation access network). This approach may be limited if the network owner also offers retail services: it may set lower retail prices, constraining the retail prices charged by others.

Pricing of passive products

7.43 Our overarching strategy is to promote competition at the deepest level, where it is efficient and sustainable. In the past we have concluded that access and backhaul networks are enduring economic bottlenecks and this has lead us to impose some of the most stringent regulation in these areas, for example local loop unbundling and Ethernet backhaul. By giving communication providers access to these 'raw' network elements, on regulated terms, they are able to build their own competing networks and are able to innovate in the design and construction – which in turn will determine the products and services that can be supported.

7.44 Sub-loop unbundling is an explicit requirement on BT in the Wholesale Local Access market and needs to be provided on a cost-orientated basis. Further, backhaul (the link between a communication provider's local loop unbundling co-location facility and its core network) is also an explicit requirement on BT from the Business Connectivity (leased lines) market and this to need to be provided on a cost-orientated basis. However, as we discussed in Section 6, uncertainty remains on the final form that any passive access remedies could take.

7.45 At the current stage of next generation access development we see no reason to adopt a different approach to any pricing of passive access. As we have outlined above, there may be difficulties in adopting anchor product or flexible pricing approaches for passive products that cannot be differentiated. This can make these approaches less appropriate for passive access. This can suggest the need for a

more traditional type of pricing approach. However, investment in some passive elements of next generation access upgrades is likely to be risky, and this risk should be considered in any regulatory approach.

7.46 Therefore we believe that our initial focus should be on the 'raw' network elements which are upstream to next generation access networks, for example sub-loops and backhaul from the cabinet to the exchange. In all cases, we would need to ensure that there was a suitable consideration for the level of risk incurred at the point of investment in setting any prices under this approach.

7.47 Providing more detail on pricing approaches for passive products will depend on the form these products take. Industry is moving ahead with discussions on the form and design of active products, allowing a more detailed discussion on pricing. However, until there is clarity on the types of passive products in demand, it is more appropriate to remain at the level of principle when considering wholesale passive access pricing.

What could trigger a review of such an approach?

7.48 As the market begins to settle down it may that the approach set out above needs to be reconsidered and revised. There are a number of developments that may suggest that a reassessment is necessary, for instance:

- evidence that shows that the constraint provided by the upstream 'raw' network elements is ineffective;
- evidence that the price of new products supplied by a network operator are not sufficiently constrained by existing products or by new products from another network operator, accompanied by increasing demand for the new products; or
- developments that undermine the effect of indirect retail price constraints. There could be a number of factors that may mean these constraints are not sufficient to prevent excessive pricing. For example, removal of the copper local access network supporting existing broadband services. Alternatively, changes to Access Network Frequency Plan, maximising the performance of FTTC based broadband services but reducing the quality of exchange based broadband services.

7.49 This position would need to be assessed on the basis of evidence of substitution, and we will be able to do this better once services have launched.

Ensuring consumer choice is of fundamental importance

7.50 This section has so far considered how pricing options that can incentivise efficient investment while at the same time supporting competition. Effective competition, and the consumer choice that it brings, is not only supported by pricing approaches though. Even where the risk of excessive pricing as a result of market power has been reduced, for example through indirect retail price constraints, we need to ensure that consumers continue to benefit from effective choice.

7.51 The presence of pricing constraints does not ensure that consumers would be able to choose between service providers. Rather, combined with a margin rule, it ensures that they will not be overcharged for these services. Any lack of choice may limit the potential benefits from innovation and differentiation in super-fast broadband services that consumers can receive.

7.52 Therefore, where there is no effective competition or upstream remedies resulting in choice at the retail level, we would mandate access to wholesale products that would support choice at the retail level.

7.53 The availability of wholesale next generation access services will not only promote consumer choice, but also has the potential to expand the market for retail super-fast broadband based services by increasing the routes to market. This could, therefore, assist in making next generation access a success which in turn de-risks the investment.

7.54 Many investors in network infrastructure have already announced their intention to offer wholesale products that support retail consumer choice, including Openreach which is currently consulting on its own wholesale access product. We welcome all such announcements, and encourage all providers to consider the benefits of offering wholesale access to next generation access services to downstream communications providers.

Stakeholder consultation will be key on the issue of pricing

7.55 The proposal above is just one way in which pricing could be approached for the near term. It is very much early thinking from us – this is a complex area where we are looking to balance the incentives to invest and the promotion of competition while considering a number of different product types and varieties. In practice, defining an approach to pricing, and setting price levels where necessary, will require close engagement and consultation with communications providers. This will need to be undertaken in conjunction with Openreach's proposed deployment and trial services for its proposed investment in next generation access: our approach must take into account the reality of current investment. We therefore welcome all comments that our stakeholders have to the issues described above.

7.56 In future, we may need to provide clear pricing approaches and levels for planned next generation access investments. The outcome will depend in part on the wholesale products that are put in place, and will link closely to the feedback we have on demand from industry for specific types of wholesale access products and responses to this consultation. However, we are interested in stakeholders' views on the near term approach outlined above.

Consultation questions

Question 10 - How far do stakeholders consider the pricing approach outlined here of pricing flexibility for active products and cost orientation plus considerations for risk is appropriate at this stage of market development?

Question 11 - Will indirect constraints allow for an approach based on more price flexibility for active products? How will such an approach affect the incentives of different operators to invest and deliver super-fast broadband services to end customers?

Question 12 - What period of time would be appropriate for such an approach to ensure a balance between the need for longer term regulatory certainty with the inherent demand and supply side uncertainty in super-fast broadband and next generation access?

Question 13 - What are the key factors that could make a review of any pricing approach necessary?

Section 8

Eventually there will be a transition from copper to fibre

8.1 We have discussed a range of different reasons why operators may choose to invest in next generation access. In practice, a profitable business case may rely on a number of these factors. If the operator considering investment already owns an existing access network, one of the relevant considerations may be operational cost saving and other efficiencies.

There are a number of potential drivers for switching off old networks

8.2 Estimates of the size of potential cost savings are limited at the moment. However, some information is becoming available, notably from KPN and Verizon, who have both stated that they consider shutting down their old networks fundamental to their business case:

- on operational cost reductions, KPN has announced staff reductions of 3,000 to 3,500 as a result of access network upgrades (12.5% of its total workforce). Overall potential savings per annum are estimated to be £312m;
- on failure rates and operational cost reductions, Verizon has reported an 80% reduction in failure rates for its fibre access network. Overall, its FTTH strategy is estimated to account for annual operational savings of £86 per line per annum, eventually rising to around £117; and
- on the sale of property such as local exchanges, for those operators who have not sold these assets (BT already has), they present an opportunity to offset the capital costs of network deployment. KPN estimates this benefit at around £780m for its all IP network deployment.

8.3 BT has not cited cost savings as a significant driver for its planned deployment. Even where operational cost saving isn't a major driver in the case for making the initial investment, continuing to operate both networks in the long term will increase the operator's costs. Most obviously, until the old network is switched off, two networks, instead of one, are being operated and maintained. As the technology in the original network becomes older and obsolete, maintaining it will become more expensive and eventually spares may simply be unavailable. Another issue is that as customers move from the old network to the new one, the fixed costs of maintaining the old network are spread across fewer customers. Eventually these effects are likely to mean that it is uneconomic to maintain the old network. Indeed, in its response to our previous consultation, BT expressed the view that there "must be no continuing requirement to maintain a copper network alongside new fibre".

8.4 Another driver may be that, depending on the next generation technology being used, parts of the existing network and its infrastructure can be reused to save the capital costs of deployment. This reuse could include the lowest levels of the infrastructure, such as holes, ducts and buildings, through to assets like cables or even electronics. It may be that switching off some or all of the old network more rapidly will allow more cost saving reuse to take place.

8.5 Finally, there may be technical reasons why it is desirable to switch the existing network off. This is most likely in the case of new access networks which reuse

infrastructure from the existing network, such as an FTTC network which uses some of the same copper cables as existing exchange-based ADSL. Here, the potential interference between the ADSL and VDSL signals limits the power that can be used for the new network and hence the data rates it can achieve. Switching off the old network, and with it ADSL, will allow the new network to deliver its full potential.

8.6 Taken together, these factors mean it is likely that switching off their existing network will be an important part of the investment case for an operator considering a network upgrade. Like other elements of a potential investment case for next generation access over which regulation may have an influence, we are keen to do all we can to ensure unnecessary barriers are removed.

We have a duty to protect consumers during transition

8.7 However, we need to balance the objective of promoting widespread deployment of new networks, with our other duties to protect consumer interests. The removal of a network used by larger numbers of businesses and consumers will always carry the risk of consumer harm. Specific examples of potential consumer detriment include:

- **Forced migration** – it may be that an operator sees a case to switch off the legacy network while some customers are still relying on it. No matter how attractive the services on the new network, it is likely that some customers will never choose to switch voluntarily. These customers may include some of the more vulnerable and less technology aware;
- **Removal of existing retail products** – as we have seen with the migration to next generation core networks, some customers rely on features of the existing networks that can't easily be replicated on the new ones. This may include specific technical characteristics that business customers take advantage of, or simply the ability to dial 999 when the power fails. It is unlikely to be appropriate, or even technically possible, to insist all services are replicated identically on the new networks, so careful planning to minimise any harm will be important; and
- **Impact on competition** – much of the current competition relies on wholesale products running over the existing networks. As we have discussed elsewhere, we believe competition is essential in delivering good consumer outcomes, and this will remain true for next generation access. However, it is inappropriate to attempt to force all existing wholesale remedy products to be offered over the new networks: it may disproportionately expensive or perhaps even technically impossible to do so. Although the make up of competition may therefore change substantially between the current and new networks, it is important that the transition process allows for effective competition to be maintained at all times.

8.8 The remainder of this section outlines our view of how transition might occur and the safeguards we would seek at various points in the process. It isn't possible to be definitive yet on some of these points, as we are long way from seeing what form next generation access networks will take in practice. However, we feel it is valuable to outline the principles we will use when considering any concrete proposals for transition.

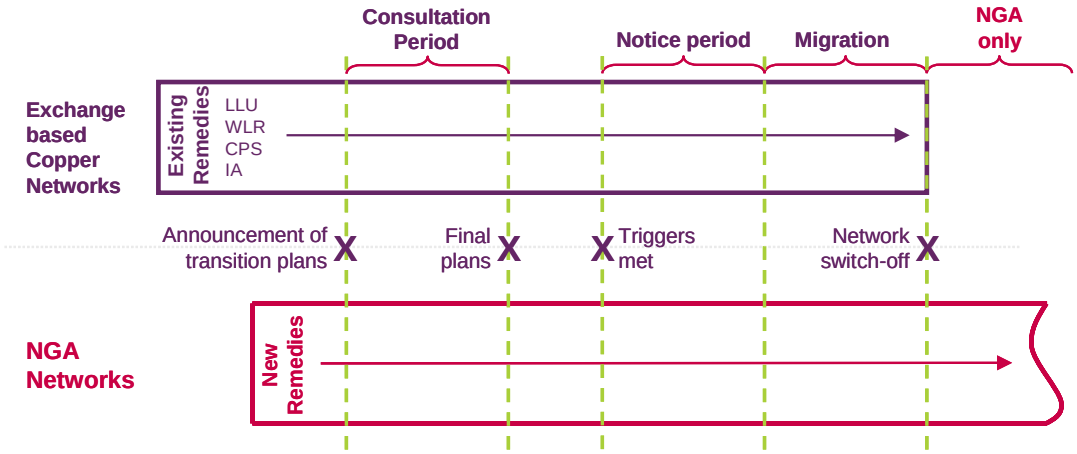
A model for transition

8.9 Below is a simple model of a process for how transition might occur, showing the main stages which we feel will be important. The key principles it captures are:

- all affected stakeholders should have an opportunity to comment on the network owner's transition plans before they are finalised;

- the transition process in any given area should not start until certain pre-conditions, or triggers are met; and
- when the process is triggered, there will be a set minimum notice period to ensure affected stakeholders have time to react as required.

Figure 5: Proposed model for transition between current and next generation access



Transition would start with stakeholder consultation

8.10 We anticipate that a next generation access network would already be deployed, at least in some areas, before its operator would bring forward firm plans to switch off their existing network. However, if the case for building the new network was particularly sensitive to the transition timing or process, they may wish to reach agreement before deployment starts. Whatever the relative timing, we believe a meaningful consultation with all affected stakeholders is important.

8.11 Any consultation on transition could include:

- the triggers to start the transition process;
- the notice period between the announcement of transition in a particular area and the start of the work;
- the detailed migration process and timing by which customers will be moved from the old to the new network, including communication and engineering issues; and
- plans to deal with any technical or operational issues during the transition.

There could be a number of triggers for the transition process

8.12 With a final, published transition process plan in place, we believe a number of preconditions will need to be in place before it can be triggered in any given area. Examples might include:

- The network owner's wishes – depending on internal strategies, operational considerations, etc., there may be good reasons why network owners actually wish to keep operating the old network alongside the new for an extended period;
- Time period – it may be appropriate to establish a minimum time period from when the next generation access network was deployed before transition could start. This would be particularly important to other operators who use existing wholesale products, to allow them time to develop and implement alternative strategies, including stopping any further investment in current networks at the appropriate time;

- Take up – it may be appropriate to wait until at least a certain percentage of customers have moved over to the new network;
- Competition – it is important that effective competition is in place before transition can begin. This may need to be judged on both a local level and on a national basis. It may be that the presence of several small local competitors may not reliably indicate the establishment of sustainable competition. Many of the problems with historical wholesale remedies, for example, have only become apparent when large scale competitors have used them in volume; and
- Consumer protection measures – there will need to be arrangements in place to ensure consumers are adequately protected during the transition. These might include acceptable plans for continued access to the emergency services, and basic products being available on the new network at acceptable prices. These issues are particularly important because consumers remaining on the old network will not have a choice – they will be forced to migrate. In many areas of the country there is to be an alternative network available if they aren't happy with the new one.

8.13 The exact blend of these potential triggers and the thresholds we would associate with them can only be established as the exact form of the new networks, and the wholesale products they offer, become clear.

8.14 In practice, the timing of any transition remains unclear, but it could reasonably be expected to arise in a two to five year period as the roll-out of next generation access networks accelerates, and their implications become better understood by industry.

The triggers are likely to be met in different regions at different times

8.15 Roll-out of next generation access networks is unlikely to be national for a substantial period of time; we expect to see phased geographic deployment. It would not be appropriate to insist that the entire deployment was finished before any transition could begin. This would mean that the old network might need to be maintained for very long periods in the initial areas, possibly long after most customers had migrated from it, which would be inefficient. On the other hand, it would be equally inappropriate to assume all areas were ready to have the old network switched off just because the first area was. Therefore, while the consultation on the overall transition process may be done on a national basis, we believe the notice period and migration itself is likely to occur region by region, when the triggers for each region have been reached.

Notice and transition periods will follow consultation

8.16 When the operator has expressed the desire to remove the old network in a given area, and the trigger conditions are met, we believe that there should be a period of notice before the operational and technical work commences. During this period, a range of communications would be needed, carefully targeted at different groups of affected stakeholders, to ensure that nobody is surprised when the existing network is switched off and that everyone has had time to make whatever arrangements they feel appropriate.

8.17 Following the notice period, the detailed work of migrating the remaining customers onto the new network and switching off the old one can begin. The duration of this phase will largely be determined by technical and operational considerations. As with similar migrations, such as the upgrade from analogue to digital PSTN, or the move

to BT's 21CN, the process will need to ensure minimum service interruption for customers.

The nature of competition may change following transition

8.18 Ensuring that competition continues after transition does not imply that it will continue in exactly the same form, or indeed necessarily involve the same competitors. In some cases, it may be appropriate for wholesale products flowing from remedies on the new network will look identical to existing ones. However, there will be other cases where this is not efficient or even technically possible. Overall, it is likely that the wholesale products available following transition will look different from today. We also think the business models of competitors using these products may need to change quite significantly. The types of services that will be consumed and the flow of revenues across the value chain will evolve.

8.19 Operators whose business models are based on consuming regulated wholesale products connected to the current access network need to plan for this future. We note that many operators have stated publicly that they are already doing this. While we expect the current networks and products to be with us for years to come, the sooner this future planning is started the better.

Proposed Ofcom actions

8.20 We will work to ensure that the market is not constrained in identifying new and innovative approaches to transition from current to next generation access networks when the time is right. We will balance this with the need to protect consumers. To this end, we have outlined a framework for transition to next generation access networks that we will develop further based on stakeholder feedback, ensuring that we address potential regulatory barriers to transition.

Consultation questions

Question 14 - How far can the generic model for transition outlined here deliver both incentives to invest in next generation access while ensuring existing competition is not undermined?

Question 15 - What triggers would be appropriate for the commencement of any transition process?

Question 16 - Once triggers or circumstances for transition are achieved, what would be an appropriate period for the various phases of transition (consultation, notice period, transition)?

Question 17 - Over what geographic area should any process of transition be managed, for example region by region or nationally?

Section 9

Regulation can play a smaller role in increasing revenues

9.1 For investment to happen, a potential investor needs to believe that the benefits generated from upgraded access infrastructure outweigh the costs of deploying it. One of the ways to achieve this is to try to generate additional revenues from the new infrastructure by adopting new commercial models. We support such new commercial models. However, what we can do to support them in practical terms is quite limited.

9.2 Establishing an explicit link between additional revenues and incentives to invest in next generation access is difficult. The potential additional revenues generated from new commercial models may be used to build an investment case for next generation access or just as an opportunity to increase the revenues generated from current generation services. If those revenues are then invested in network capacity, it is likely that they would be invested in the backhaul network to relieve the capacity pressure there, rather than in the upgrade of the access network.

The industry is actively developing new commercial models

9.3 In current generation broadband networks, the main commercial model used by service providers involves consumers paying flat rate charges for access to the internet and, with this, access to the content available on this platform. Where service providers do not own their own infrastructure, they in turn pay the infrastructure owner or network operator for wholesale products so they can use the network to deliver services to customers. At the same time content providers or aggregators pay internet transmission providers to transmit their content to the network operator in the local access network. This system has been successful in driving the market for current generation broadband.

9.4 Internet service providers have traditionally charged end customers for network access depending on the speed (i.e. bandwidth) they receive and/or the amount of capacity they are allowed to use (i.e. download limits). Until recently, most UK service providers priced at flat rates with unlimited downloads, and generally discriminated prices based on headline speeds. Where service providers did set download limits the enforcement of these usage restrictions was not always strict or consistent.

9.5 However, revenue growth from increased broadband take-up is now likely to reduce as the number of new subscribers slows. At the same time, with increased customer usage of network capacities, the current pricing approaches are changing. Some service providers are showing greater flexibility and diversity in their price differentiation. In addition, across all service providers, the focus on controlling customer usage of capacity is increasing, mainly by ‘fair use’ policies. Some use traffic management to support their fair usage policies, by ‘throttling’ the bandwidth of extremely heavy users during peak times of use (afternoons/evenings). The number of users affected by these policies in practice is, however, limited. For example, Virgin Media reports that less than 5% of its customer base are heavy users.

9.6 There are a variety of ways to seek more revenue from next generation access services, although the degree to which each of these might be used in practice is unclear.

9.7 Some providers are already exploring options to charge customers more for higher bandwidths, with mixed success. In the US, some of Verizon's customers have demonstrated a willingness to pay a premium for fibre access services. Verizon has recently launched its 50Mbps service across its footprint, retailing at between $90 and $140 per month. However, this is not the case in some other markets. For example, in Singapore, StarHub has a 100Mbps broadband cable service at £45 per month, but its most popular broadband services are its 8Mbps and 12Mbps packages, priced respectively at £22 and £30 per month. Also, Illiad's announcement of its entry level 50Mbps fibre access based services in metropolitan areas was priced at the same rate as its DSL based services – £23 per month.

9.8 Directly linking the price customers pay to the capacity they use is another route to increase revenues. A key issue could be consumer uncertainty about capacity usage, both for specific services - which could deter innovation - and for total usage. Some US companies have experimented with this by charging those customers exceeding their monthly cap on a pay-as-you-go basis. Premiums to access specific bandwidth hungry services are also an option.

9.9 Quality of service charging is often discussed with regards to new access networks, for example discriminating prices based on the guaranteed minimum speed that users will receive. A challenge with this approach is marketing it in a way that is simple for consumers to understand. Also, charges would not relate to usage, so this model may not help alleviate the pressure on the backhaul and access networks. It could however be combined with usage allowances.

9.10 Increasing end users' access charges is another option, either increasing the price of line rental or the price of services in general. Prices could be raised for all customers taking fixed telecoms service or just those taking broadband services. This would be a decision of the network operator. Price rises may not necessarily be passed on to end customers, as they could be absorbed by the service provider. A key issue is by how much could the prices for customers be increased before they seek substitutes such as mobile services or chose not to take a particular service altogether.

9.11 Many next generation access business models are based on the incremental revenue available from delivering premium content to users. According to research by Analysys Mason, UK consumers are estimated to have spent over £3.9 billion pounds on pay TV services in 2007. The vast majority of this expenditure (£2.9 billion) was on premium subscriptions. These figures show that there is clearly an appetite for premium content. Forecasts also suggest that in future the fastest growing market segment delivering this content is expected to be IPTV.

9.12 A variation on the sale of premium content is bundling premium content into the overall broadband proposition. This has been pursued in some other markets and in several cases has been central to the investment case for next generation access. However, in the UK, using the broadband network to provide premium content is not new, so there is less scope for extra revenues. Consumer willingness to pay will be constrained by the content that they already have available over other platforms. BT Vision, Tiscali and Virgin already use their access networks to deliver content to customers. Also, relative to other countries, there has been limited success in attracting IPTV subscribers in the UK.

9.13 Finally, new advertising revenues are often seen as a key new revenue stream. Advertising over the internet is a rapidly expanding market. In 2007, £2.8 billion were spent on internet advertising – an increase of 40% year on year. The proportion of advertising money spent on the internet as a percentage of total advertising spend has grown from 3.1% in 2003 to 16.7% in 2007. Further, whilst while the overall real expenditure on advertising is expected to increase marginally over the next two years, the share that the internet takes of this market is forecast to increase significantly. The market is also seeing new forms of advertising that are well suited to broadband networks, including behavioural advertising.

Alternative revenue opportunities from a new value chain

9.14 Traditionally, the focus of network services providers, for the purposes of revenue generation, was on end consumers. However, the transition to next generation access creates a potential opportunity for a re-assessment of business models. In particular, the increase in bandwidth makes the delivery of potentially high value content, such as video games and films, over broadband more attractive to content providers. This potential for content creators to develop new forms of content, as well as new ways of delivering pre-existing forms of content, means that any consideration of the investment case for next generation should consider the potential revenue available to network operators from the delivery of these value added services.

9.15 Digital distribution describes the practice of delivering digital information and content over the online platforms. The increased capability of next generation access infrastructure, over current infrastructure, offers content creators the opportunity to re-evaluate their value chain models. Traditionally, commercial content creators would be expected to engage with a complex mix of publishers, distributors, aggregators, marketers and retailers.

9.16 Digital distribution over next generation access networks could enable the content creator to re-engineer (or re-intermediate) the value chain, taking on the roles usually fulfilled by others in the value chain. Lessons from today's models of online distribution would suggest that content creators are potentially able to exert a much greater influence over their value chain, in part due to their ability to bypass more traditional stages which they deem to add insufficient value. For example, not all content creators require publishers to reach end consumers. A topical example would be the recent Radiohead release of *In Rainbows* online before it was available on physical product. Digital distribution also offers content creators the ability to access consumers across a much larger base, including potentially a global market. A further benefit is the ability to provide a much larger range of product offering, including back catalogues, which traditional retail models cannot easily supply.

9.17 Where next generation access enables enhanced forms of engagement with content, for example multi-player gaming or higher speed HDTV downloads. The challenges for content providers and for network providers are how to extract the increased value generation from this from the end consumer and how to agree its fair division. It is not for Ofcom to take a position on either of those challenges in this document, but there is contextual value in considering some of the issues raised.

Revenue extraction

9.18 Current business models for the retailing of content over TV or online platforms are based largely on advertising or direct payment for specific content (either subscription or pay-per-view). Where additional consumer value is created by

enhanced consumer experience there may be scope for increasing in the revenues generated through each of those models. Increased penetration of highly valued services creates, naturally, a larger potential audience base for advertisers. Although audience fragmentation could serve as a constraint, improvements in advertising techniques, reflected in the ongoing development of targeted and behavioural advertising technologies, may yield increased returns for online content suppliers.

9.19 The economics of traditional pay TV is based upon the principle that payment can be extracted from consumers with a willingness to pay for particular content, premium films and sport in particular, using conditional access technologies. Conditional access technologies are typically binary technologies in that consumers pay a particular price or they are excluded from the service. There is no means by which the service provider is able to conveniently offer consumers a range of differentiated price offers such that they can extract more accurately a consumer's willingness to pay. It may be that, for some forms of content, particular consumers have a higher willingness to pay than the content supplier is charging. This represents lost revenue for the content supplier.

9.20 Advances in Digital Rights Management may potentially enable content owners to offer consumers a much richer array of price and product offers. Use of Digital Rights Management in theory enables content owners to create new distribution models which enhance economic welfare.

9.21 For example, film producers engage in a form of price discrimination by releasing their product via a series of windows, which segments consumers into discrete groups according to their willingness to pay. Digital Rights Management potentially enables film producers to replace the windows-based form of discrimination with discrimination based upon technology. Where Digital Rights Management enables film producers to make content available to consumers on specific platforms earlier than is possible under traditional models economic welfare may be increased. The distribution of any increased welfare between producers and consumers is an empirical matter and is not considered here. While it is almost certainly the case that much of the revenue generated via online consumption of content will represent a cannibalisation of pre-existing revenue streams, where next generation access supports new forms content or enables consumption of content in new ways then additional consumer value may be created.

Revenue division

9.22 Typically, network operators view end-users as their primary source of revenue. Where new value is created in the value chain, as a result of investment in next generation access, a fair distribution of this increased surplus between content providers and network operators would be efficient. This may come about via the adoption of a carriage fee-based model, whereby content producers are charged for the distribution of their content to end consumers. This is the model currently employed by pay TV operators, who charge individual channels a carriage fee. Additionally, fees are levied for the supply of complementary services, such as a service being displayed on an Electronic Programme Guide. It may be the case that such an approach would only be able to function in a market where network operators created a positive incentive for content owners, who currently pay only for their own access service, rather than a carriage fee as such. For example, it is conceivable that network providers would offer quality of service guarantees to content producers in return for a carriage fee. Such a contractual relationship could include content protection, download speed guarantees or customer service commitments.

9.23 There are indications that this model may become acceptable to content providers. The BBC reportedly hopes to trial a system from content delivery network provider Velocix that would place about 200 servers on the networks of UK ISPs in order to make the iPlayer less costly for both parties to support. Under Velocix's model, the content provider typically pays the vendor a fee for each video downloaded, part of which is passed to the ISP whose network the video travelled over. A successful trial and implementation of this model may encourage wider take up of this commercial model.

9.24 A significant challenge with this two-sided market approach is that, it may require the service providers to discriminate against some content in favour of other. This goes against the principle of net neutrality, which is based on non-discrimination of different forms of internet traffic carried across network. However, it is possible to use a model based on two different tiers or pipes that would allow this to work effectively. One pipe follows a net neutral approach in which content and applications are transmitted based on a best effort approach. The other pipe is quality of service controlled and carriage of content and applications over it are charged. Content and applications whose transmission is charged for would be transmitted over the latter. Content providers can move freely between the two pipes depending on whether they pay a carriage fee or not (or other commercial agreements).

9.25 There are risks and challenges associated with a carriage fee approach for both consumers and content providers. Consumers would need to have access to clear and transparent information about how their usage is affected. They would need to be provided with detailed information about the carriage deals and traffic policies, to ensure that they are able to access the content they want. Having to pay for carriage will significantly affect margins. Further, it may reduce incentives to innovate and introduce new potentially bandwidth hungry services, as the prospect of having to pay for carriage of these may undermine any potential business case.

How can Ofcom support industry in these developments?

9.26 All of the options outlined provide valuable potential additional sources of revenues for network or service provider. While the majority of these options will require market-led implementation, we believe that we can nevertheless play an important supporting role.

9.27 We will aim to provide as much clarity as possible about whether we see any regulatory or legal impediments with new business models, as issues emerge. We have previously taken a similar approach around net neutrality.

9.28 We propose to encourage the adoption of different models by contributing to the development of best practice guidelines or codes of conduct. These would be intended to give consumers transparent and accessible information so they can understand new commercial models and make informed decisions when choosing between service providers. We are already exploring the development of a best practice approach around targeted advertising, and could expand this to other areas. For example, clear consumer understanding will be needed of:

- the capacity they are using (for capacity-based charging models);
- the level of service they are signing up for (for quality of service-based models); and
- content services that may be blocked by service providers (where carriage fees are charged to content providers).

9.29 One example of this activity is in behavioural advertising. This refers to a range of techniques that will enable service providers to select and place adverts on sites visited by an individual user based upon the users previous online activities. These techniques should not be confused with contextual advertising, whereby adverts are related to the contents of the web page on which they are appearing.

9.30 Behavioural advertising offers ISPs an opportunity to develop a new source of revenue. However, there appear to be a number of potential obstacles to its further deployment. Firstly, consumers are concerned about how behaviours are tracked, the forms of information being gathered on their online activities and the how this information is used. Secondly, consumers are increasingly aware of the value of using information on their activities and are keen to better understand the exchange that takes place – are better services or new products being provided in exchange for consent being granted for the collection of usage data?

9.31 Whilst the latter issue is clearly not a matter for Ofcom, we have been involved in constructive discussions with the Information Commissioner's Office (ICO), the UK's lead authority on privacy matters, and with industry stakeholders on the former.

9.32 Customers will also feel more comfortable with new business models if they are more able to readily switch service providers if they are not satisfied. As already mentioned, we must therefore also ensure that appropriate switching processes are available for customers as new business models are introduced.

Consultation questions

Question 18 - What actions, if any, should, Ofcom undertake to support new revenue models from next generation access?

Section 10

New build fibre policy

10.1 So far, many of the issues we have discussed are specific to overlay next generation access network investments. However, there is a very different type of investment that is already occurring – FTTH to new build homes. These developments are different both because of the underlying technology, and because there is no existing copper local access network present. In many ways, it is the lack of copper in new build fibre deployments that drives the key regulatory issues we address in our new build statement, published at the same time as this consultation and accessible here: http://www.ofcom.org.uk/consult/condocs/newbuild/statement/.

10.2 However, as we outline in section 8, we expect that over time, as overlay networks transition from copper to fibre, the situation we see in new build fibre today is likely to become more commonplace and seen elsewhere. Without copper in the network regulatory remedies used or required may be different to the ones used in an overlay next generation access network.

10.3 New build fibre deployments will be the first practical application of next generation access networks in the UK. They are likely to provide an opportunity to try out new products and services both at a wholesale and retail level on a smaller scale, ahead of wider rollouts of overlay next generation access networks as announced by Virgin and BT. They also provide new players with the opportunity to enter the market for fixed telecoms networks and services.

10.4 In the new build statement, we outline our overall regulatory approach for new build fibre deployments, as well as our approach to wholesale access, the replication of existing regulatory products and uninterrupted access to the emergency services. Details can be found in the statement but we provide an overview of our positions below.

Regulatory approach

10.5 The central aim of our regulatory approach to new build fibre deployments is to promote competition, which in turn provides consumers with the benefits of choice. We want to avoid a situation in which a consumer in a new build development with fibre has access to the service and products of only a single communications provider. In order to achieve this we want to promote competition in both infrastructure ownership and service provision, by ensuring that appropriate wholesale access products are made available.

10.6 For new build fibre deployments, if it is apparent that there is only one telecoms access network, we would expect the operator of that network to provide access to it on a fair, reasonable and non-discriminatory basis through fit for purpose wholesale access products. Our approach applies equally to all new build developments and operators.

Wholesale access

10.7 In order to ensure contestability and competition in new build fibre deployments, we expect that both active and passive wholesale access products have a role to play in new build fibre.

10.8 We would expect new build fibre infrastructure providers to install spare capacity in their ducts, and use sub-ducting. This will ensure that there is capacity to support duct sharing in the future, should that prove necessary for effective competition. We will consider duct access in new build in conjunction with duct access in existing networks as part of a broader strategy of competition based on ducts.

10.9 We would expect operators to consider the provision of standardised Active Line Access-based products to support effective competition between service providers.

Replication of existing regulatory products

10.10 Currently, BT and KCOM (in the Hull area) have been found to hold a position of significant market power (SMP) in certain markets and accordingly regulatory obligations have been placed on them. In fulfilling these regulatory obligations BT and KCOM are offering a number of 'regulatory' products. However, in a new build fibre network we recognise that it may be impractical and/or unnecessary to exactly replicate these existing regulatory products. Therefore we prefer to adopt a pragmatic approach to the wholesale products that are used to fulfil any regulatory obligations or expectations.

Uninterrupted access to the emergency services

10.11 Ofcom's interpretation of General Condition 3.1(c) is that the access network needs to be capable of supporting uninterrupted access to voice services in the event of a loss of power in the consumer premise. In a 'copper' access network this requirement is fulfilled by providing power down the telephone line. However, there are currently no commercially available technologies to support line powering in a fibre access network and therefore in order to fulfil this requirement it is likely that backup power supplies will need to be installed in the consumer premise.

10.12 We would expect Public Telephone Network (PTN) providers to initially supply the relevant customer premise equipment with a backup power supply. As per our VoIP guidelines[30], Publicly Available Telephony Service (PATS) providers do not always have control of the underlying network infrastructure and therefore may be unable to ensure network integrity and service reliability. We would therefore expect these providers to take all reasonable steps, such as coming to service level agreements with network providers in order to comply with the General Condition.

10.13 The decision about the exact length of time a backup power supply should last is for PATS and PTN providers to determine. However, to provide an indication of what level of time we would consider practicable and reasonable, we support the emerging consensus among new build fibre providers that are generally initially opting for backup lasting four hours. This is also in line with the options followed internationally.

[30] http://www.ofcom.org.uk/consult/condocs/voip/voipstatement/voipstatement.pdf

Section 11

What role can the public sector play in next generation access deployment

11.1 As we have outlined, our preference for the initial deployment of next generation access networks is private sector led. However, some respondents to our first phase consultation felt that Ofcom's analysis left too much responsibility for exercising leadership to the private sector, with an insufficient role foreseen for public authorities, including central government, devolved administrations, Regional Development Agencies (RDAs) and local authorities. In practice, we have always seen a significant role being played by a variety of agencies in next generation access deployment, but in this section we consider the arguments for a rebalancing of the roles of the public and private sector.

Role of the public sector in next generation access investment

11.2 The balance between public and private sector activity is of course a matter of considerable debate and sometimes controversy in many sectors of the economy. Ofcom's duties, which include the need to secure widespread availability of new networks and are expressed in terms of securing outcomes for both citizens and consumers, implicitly recognise that there may be limitations on what the market can deliver. This is why, for instance, the UK has a long-standing commitment to a 'mixed economy' model of public service broadcasting. Given the economic importance of next generation access deployment, we believe it is important to take the widest possible view of the range of instruments which could be deployed to secure it.

11.3 Ultimately any decision that the state should directly support next generation access deployment, such as through expenditure of public money, would be a matter for the Government, not Ofcom. We would expect the Government to give careful consideration to any proposals to ensure that these did not substitute for private investment which would happen anyway; that public money would be used efficiently; and that EU state aid concerns would be fully addressed. The starting point for any analysis would be likely to be whether there was self-evidently a market failure leading to under-investment. Given that the general picture on worldwide deployments of new access networks is of very early stage deployments in most countries, it would need to consider whether the UK telecommunications market demonstrates a general unwillingness to make large investments in new technology.

11.4 Since privatisation, BT has completed a series of major investment programmes (including exchange digitalisation, the deployment of ISDN, ATM and ADSL technologies), and the UK has also seen extensive competitive deployment of new mobile and fixed telecommunications networks, including five national mobile communications networks. On the face of it, the evidence is that the predominantly private market structure which has evolved since 1984 has actually been rather successful in channelling large investments into the UK telecoms sector.

11.5 However, it can still be asked whether next generation access is likely to either not be delivered, delivered too late, or in insufficient scale from the point of view of the UK as a whole. Here it is useful to distinguish between the 'private value' of an investment to businesses contemplating it, compared with the 'public value' to society as a whole. By private value, we mean the value recoupable by the investor, in the

form of increased returns from products and services made available as a result of the investment. By public value, we mean wider societal benefits from the investment that cannot be recouped fully (if at all) by the party making the investment. Such public value might accrue, for instance, if there were positive externalities from the deployment of the technology such as a reduction in congestion as a result of the new technology leading to a major increase in teleworking. If there is a large gap between that wider public value of an investment, and the recoupable private value, then it might be necessary for the state to intervene to secure the investment.

Figure 6: The prospects for economic and social value

The Broadband Stakeholders Group (BSG) published a report by consultants Plum in June 2008, which set out a framework for considering the value of next generation access. In developing this assessment, they considered a wide range of costs and benefits that might occur under different deployment scenarios. The benefits were divided into 3 categories:

- **Private:** benefits which are valued directly by individuals and companies and can be expressed in monetary terms;
- **Wider economic:** other economic benefits to society, which may not be recognised and therefore valued by individual consumers or businesses; and
- **Wider social:** other impacts on society, on which it may not be possible to put a direct monetary value, but are nonetheless positive.

Actual estimates on these potential benefits remain difficult to determine, and will require ongoing study as these new networks are deployed internationally.

Private benefits	Wider economic benefits	Wider social benefits
• Time savings doing existing tasks more efficiently; • Benefits from doing more of the things people currently use broadband for. Key was better support for 2-way services; and • Benefits from doing completely new things, not possible today. The hardest to predict and therefore value, but high definition video services and cloud computing are given as examples.	• Reductions in travel leading to lower greenhouse gas emissions; • Potential of the new networks to partially replicate the benefits of people and businesses existing in close physical proximity, without need for larger cities; • Increased competition in the economy through more trading of services. It may also help the better matching of people with available jobs; and • Increasing the UK's economic resilience to changes such as oil price increases by allowing new substitution and policy options.	• Better educated citizens, leading to example to better understanding of health issues and therefore wider social benefits; • A more informed democracy and greater freedom of expression; • Increased cultural understanding; • Social resilience, for example in managing a pandemic; and • Improved access and inclusion for those with disabilities.

Source: Broadband Stakeholders Group

11.6 As shown in Figure 6, the BSG noted that wider public value might be generated from next generation access in a number of areas[31]. But the BSG analysis was cautious on the scale of these claimed public benefits. It suggested that most of the value which could be identified from next generation access was properly

[31] http://www.broadbanduk.org/content/view/245/

characterised as private rather than public. It noted that there was no reason to believe that benefits to the UK in a wider sense, for instance improvements in business productivity and in the delivery of public services, could not be 'internalised' as private benefits, given that investors could sell connectivity to users looking to improve their productivity.

11.7 Overall therefore, the BSG report conforms to our view a well-regulated market ought to be able to capture most of the economic value generate by next generation access deployment. Taking this together with the generally sound record of the UK telecoms market in generating investment, we conclude that the case for a major shift in policy emphasis towards public sector investment is not justified at this time; primary responsibility should continue to rest with the private sector.

The case for public intervention in under-served geographic areas

11.8 Nonetheless, the generally positive story in the UK concerning willingness to invest in telecommunications might mask some important differences in terms of willingness to invest in specific regions or types of geography, and hence some examples of more localised market failures.

11.9 Securing near universal delivery of telecoms services has usually necessitated some form of intervention. The public sector played a significant role in the deployment of first generation broadband infrastructure in the early part of this decade, partly because of concerns that the market alone might create a significant digital divide between urban and rural areas and between metropolitan areas and outlying regions. This intervention took the form of a variety of schemes, ranging from small-scale community wireless broadband initiatives, to more ambitious schemes such as the Broadband for Scotland project, which subsidised the upgrading of some 399 exchanges to provide ADSL in remote and rural parts of Scotland, and the tender process for 512kbps services throughout Northern Ireland.

11.10 Such schemes played an important part in securing the widest possible availability of first generation broadband services. However, BT's exchange upgrade programme did render some community wireless and satellite broadband schemes obsolete, although some argue not before they had increased the pressure on BT to make the upgrade. This highlights the importance both of taking a realistic view of how extensively the market will deploy a technology and the likely timing of it doing so.

11.11 We believe that there will be a continued role for public sector interventions, including local authority and RDA-led schemes, to ensure the widest possible availability of next generation access. Such interventions could be on the demand side, for example aggregating consumer and public sector demand for higher bandwidth access, or on the supply side in terms of public funding for the delivery of next generation access networks.

11.12 A case can be made for intervention in areas that remain unserved by first generation broadband. While it is the case that the majority of BT exchanges are ADSL enabled, there remains a small minority of households that cannot receive broadband. There are two broad reasons for this. The first is the continued use of line sharing technology in the access network which is incompatible with broadband, and must be removed to enable service. The second is high electrical line loss due principally to long copper lines. For some households long copper lines mean they cannot receive broadband at all. However, there is also anecdotal evidence that a more substantial number of customers can receive broadband but only at a speed or stability which is markedly inferior to that experienced by those on shorter copper lines. In practice,

intervention to assist such consumers might be less straightforward than action to upgrade exchange areas (for instance): the affected consumers may be dotted throughout a region rather than clustered in particular locations.

11.13 Deploying fibre infrastructure deeper into the network can improve the quality and reach of broadband to eliminate not-spots and to raise quality for those consumers experiencing generally inferior service today. The first stage of any such intervention would be to map the scale of the 'not spot' and poor quality problem, about which there is considerable anecdotal evidence but little quantitative analysis. Ofcom is one of a number of bodies currently considering how such research could be usefully conducted to develop this evidence base. We also note that BT, in its recent announcement of planned next generation access investment, has indicated a willingness to discuss with Regional Development Agencies and local authorities where particular demand for super-fast broadband services might exist.

11.14 It will be harder to make the case for prospective market failure in delivering next generation access across wider geographic areas ahead of the large-scale market deployment of next generation access across the UK as a whole. In particular, public authorities will need to obtain approval that use of public money does not amount to impermissible State Aid. But it is worth noting that an ambitious next generation access scheme in South Yorkshire has received approval, the approval decision being based in part on the particular economic conditions of that region. It is quite possible that other English regions and/or the devolved administrations in the Nations may bring forward similar proposals in the future.

Facilitating market-led investment at community level

11.15 There are some other initiatives which local authorities can usefully take in order to encourage the widest possible deployment of next generation access. Where public authorities including the highways authorities) are undertaking new infrastructure schemes, there could be a strong case for putting in place duct infrastructure that could be made available to private firms wishing to build next generation access networks in that area. This is a fairly common practice in continental Europe, but we are aware of few such schemes here in the UK. In addition, for local authorities in planning permission negotiations with developers, there may be a case for seeking commitments to include next generation access infrastructure (whether in the form of ducts, dark or lit fibre). We understand that Local Authorities already have the necessary powers to secure such commitments.

Co-ordination of public sector activity

11.16 Whilst Ofcom believes public interventions can play an important and welcome part in stimulating next generation access deployment, there may need to be some basic co-ordination of efforts to ensure that schemes provide best value to citizens and consumers. In particular, there is a risk that publicly-funded schemes are designed to very different specifications in terms of the level of vertical integration of the operation – they may simply provide civil works, or dark fibre, or lit fibre or active line access. Ofcom recognises that this specification may need to vary depending on the nature of the 'market failure' problem being addressed. However, it would clearly be preferable to develop schemes which deliver maximum scope for competition in services and applications, and in infrastructure which can be economically replicated.

11.17 Similarly, there may be scope to develop best practice where public bodies put next generation access schemes out to tender. There has been some interesting experimentation in first generation broadband schemes on so-called 'reverse

auctions', where private sector participants tender to provide service at the lowest possible level of public subsidy, and it might be beneficial to develop a common approach to the design of such auctions. It is also important to ensure that tender processes create scope for a large enough number of private sector bodies to bid to create genuine competitive pressure to deliver value for money.

11.18 We would anticipate a high level of devolved responsibility for scheme design and delivery, and, given that their nature and extent may vary significantly depending on local needs, they may be administered by different types of public body. We believe it will be important for there to be some mechanism by which different administering bodies can come together to exchange best practice on scheme design and management, and to develop (as far as is possible) common standards for wholesale access. The Government should consider what mechanisms it may want to put in place to ensure such co-ordination.

A partnership approach to next generation access deployment

11.19 In practice, partnerships will need to be formed between a wide variety of bodies to ensure that next generation access deployment takes place effectively. The private sector will need to work closely and effectively with various public sector agencies to identify and service communities' needs. Central government will need to play an important role to ensure appropriate co-ordination of efforts, value for money, and effective procurement. Industry bodies such as the BSG and the Communications Managers Association can play a very significant role in providing a voice to consumers and industry users of broadband, and to provide the evidence that there is real, unmet demand for services for which consumers and users would be willing to pay. Ofcom is keen to work closely with all these bodies to ensure that collective efforts to stimulate the next generation access market take place in as effective a way as possible.

Consultation questions

Question 19 - What role should public sector intervention have in delivering next generation access?

Section 12

A proposed framework for action

12.1 This document seeks to provide clarity about and elicit responses on the regulatory questions that this journey raises. But, as with all new developments, much remains uncertain. The wider debate on next generation access will continue to develop in the coming months. Here we seek to provide clear proposals on how this debate can be moved forwards by all involved parties through a concerted range of actions and activities.

12.2 We have outlined a number of specific questions within this consultation and we welcome all comments and feedback on them. These are summarised in Annex 4. The answers to these will necessarily affect our focus for the near term.

12.3 Overall, this framework for action has been divided into:

- areas of focus for regulation in delivering on the aims of securing investment and promoting competition; and
- areas where other stakeholders can act to facilitate the development of next generation access in the UK.

Ofcom's focus for the coming months

12.4 This consultation is only one element of the broader work load that Ofcom will need to undertake following the recent developments in next generation access. One example is our New Build Fibre statement, which considers issues specific to these nearer term deployments. Some actions will be influenced by the answers we receive to the questions included above and the issues raised at Ofcom's recent round-table discussion with communications providers on this topic. Still more actions will flow from the implementation of the Caio review recommendations.

12.5 We have summarised the key next steps for the coming months in Figure 7**Error! Reference source not found.**. We welcome thoughts and comments on these actions.

a. Addressing demand uncertainty

12.6 Despite recent deployment announcements, significant uncertainty about retail and wholesale demand for next generation access networks remains. Communications providers and other players are seeking to mitigate potential risk through a number of means, including new commercial relationships.

12.7 Ofcom will pursue other approaches to reducing demand side risk. We will continue to encourage constructive engagement between players at different stages in the value chain in order to ensure the timely rolling out of new and innovative networks and services. This may include new commercial relationships between operators with market power and other communications providers, or joint investment in infrastructure. We will look to support and facilitate any such relationships that are non-discriminatory and in the end consumers' interest.

Figure 7: Proposed Ofcom areas for focus

Addressing demand uncertainty	Build and transition	Existing regulation	Next generation access specific policy	Consumer policy	Wider policy issues
• Promoting co-operation amongst wider value chain to realise potential benefits of NGA • Facilitating discussion on joint investment models • Seeking input from business and consumer groups on requirements that can be met by NGA • Facilitating open discussion on new commercial models to support NGA deployment • Contributing any forum for cross industry working • Developing our view on best methods of rewarding risky investments	• Reducing barriers to entry and cost of deployment, for example through use of alternative wayleaves, aerial fibre • Enabling experimentation in methods to deliver NGA by a wide range of parties • Providing flexibility in trialling and piloting new network technologies and solutions • Completing duct access study and gain understanding of demand • Defining principles, triggers and timing for any transition from copper to fibre access networks	• Ensuring existing and developing regulation is consistent with proposed NGA deployments • Linking new wholesale remedies to existing wholesale products and those in development as a result of 21CN • Continuing timely release of spectrum in a technology neutral way	• Understanding the level of demonstrable demand for new wholesale products • Ensuring fit for purpose wholesale products, supported by suitable processes and ancillary products • Supporting standardisation of new wholesale products • Determining appropriate pricing models and prices, including issues related to rate of return • Ensuring equivalence and the Undertakings support and address issues posed by NGA deployment	• Ensuring effective migration processes and procedures are developed at the time of network build • Continuing to promote transparency on product information and specifications as NGA services are launched • Addressing the practicalities of delivering the current USO over NGA networks	• Engaging with Government, on public sector schemes to deliver NGA to more outlying areas • Working with Government to develop an evaluation programme to assess the UK's progress towards NGA

12.8 Despite these efforts, some level of residual uncertainty and risk will be unavoidable. In these conditions, it is essential that operators are able to make a fair return on successful investments. We will work with industry to ensure our pricing approach balances this need with the requirement for competition as part of our work on next generation access policy.

b. Build and transition

12.9 As the UK moves into a period of next generation access deployment, it is important that regulation supports the build of these new networks. To achieve this, we will provide flexibility in trialling and piloting of next generation access services. We will engage with industry in the coming months to understand other areas where such flexibility may be desirable.

12.10 We will also develop our framework for the transition from copper to fibre access networks with a view to maximising consumer and industry benefits whilst not undermining the current overall competitive position. As larger developments become a reality, we will provide more detail on the timing of transition.

12.11 We also want to support new and innovative ways of deploying next generation access infrastructure, and experimentation by various parties. New, lower cost mechanisms for deploying fixed line infrastructure have already been identified by the Caio review as a key recommendation to the government. We have been engaging with other utility regulators and companies to assess the potential for using alternative wayleaves to deploy next generation access. We will continue this engagement, seeking to publish guidelines and best practice recommendations as appropriate.

12.12 We will continue with our initial duct access survey and will publish the results by the end of the year. Depending on these results and the level of demand, we will work with industry to facilitate the appropriate access products.

c. Existing regulation

12.13 We have already started to consider the potential implications of next generation access deployment in our current and emerging regulatory policy. As we move into a period of network deployment we shall consider the issues that new next generation access networks may bring for our market reviews, including the financial framework and narrowband market reviews. We must also take into account the implications of next generation access deployment on the development and launch of new regulated products, for example those resulting from BT's investment in its 21CN.

12.14 As the Caio review outlined, our programme of continued spectrum release and reform of regulations is likely to play a vital role in the overall delivery of broadband and next generation broadband services.

d. Next generation access competition and regulation

12.15 Ensuring clear regulation and a competitive environment for next generation access will continue to be key in the future. This document is another stage in our ongoing task of providing clarity and consistency on regulatory approaches to next generation access. At the same time, we continue to believe that regulatory stability and consistency will remain as important as clarity.

12.16 As we have outlined again in this document, we strongly favour a policy of supporting a range of investment models to promote competition in next generation access, including both passive and active remedies. Our preference is for passive products where they are viable. However, providing the right level of support for specific wholesale products will depend on the level of demand and appetite for investment within industry. Beyond answers to our consultation questions on this topic, we will continue bilateral and multilateral dialogue with stakeholders to understand the level of demand and commitment to different potential products, including duct access, sub-loop unbundling and active line access.

12.17 With demonstrable expressions of demand for specific product types, we will ensure the timely delivery of a fit-for-purpose product set with associated prices and inter-operator processes. For example, where sufficient demand exists, we may:

- consult on specific proposals for a wholesale duct access product and processes by Spring 2009; and

- commence the process of industrialising sub-loop unbundling, including product design, ancillary services in support of sub-loop unbundling, product prices and the associated product processes.

12.18 Given the fact that active line remedies will have a role to play at least in some areas of the UK, we will work to promote standardised wholesale active line access technical requirements (within two years), working with communications providers, standards bodies such as the Broadband Forum and other European regulators. Our starting point will be the draft requirements which we have published alongside this document, and any comments we receive about them: and

12.19 Effective operational processes are essential for the success of any product so we will work with industry bodies to ensure that all next generation access remedies can be bought and managed as easily as possible.

e. Consumer policy

12.20 It is important that, as next generation access networks, products and processes are developed that the needs of consumers are built into them. The launch of new networks, products and processes gives an ideal opportunity to address some of the consumer issues that arose in current generation broadband. These include the processes for customer migration from one service provider to another and transparency on the services offered, for example on actual bandwidth delivered.

f. Wider policy issues

12.21 One of the key outcomes from the Caio review was a need to monitor and compare the development of next generation access in the UK to our international peers. We support this and believe that the aim of this monitoring will be to assess if and when additional action is required with respect to next generation access through regulatory or wider public policy or government intervention. We will therefore work with government in developing an evaluation programme to assess the UK's progress towards next generation access.

12.22 As outlined in Section 11 and referred to in the Caio review, there is likely to be a role for public sector organisations in delivering next generation access networks to certain locations in the UK. To support these developments, we will build on the guidance on best-practice intervention that we have already given in order to

encourage effective public sector intervention to meet the needs of people and businesses in rural locations where the market seems less likely to invest.

Stakeholder engagement

12.23 Ofcom will progress its own actions outlined above in the coming months. These will be developed through a range of activities to continue the debate with the full range of our stakeholders. For example, following recent round-table discussions with new build fibre providers and wider communications providers, we plan to engage in ongoing and regular dialogue with industry. These sessions will consider the key operational requirements from next generation access technologies, the regulatory environment and wholesale product sets that will drive the UK forwards. We welcome views on how best to progress these debates in a transparent and effective way.

Delivery of next generation access will require collaboration across many parties

12.24 Delivering next generation access in the UK is not something that only Ofcom has a role in. Arguably, industry may have a greater role: it will be making many of these investments in new technologies to deliver new services, just as it did for current generation broadband.

12.25 There are a number of roles and activities that this wider range of stakeholders may need to be undertaken by others in order to ensure the efficient delivery of next generation access networks. These are in addition to the specific actions for Ofcom, summarised in Figure 8 below. These cover those actions that can be undertaken by:

- consumer, business and trade bodies
- the communications industry
- Central and local government
- Non-communications organisations; and
- the European Commission

Figure 8: Potential actions for other players

Consumer, business and trade bodies	Industry	Government	European Commission
• Educate consumers on broadband and super-fast broadband benefits • Caputring and expressing service needs from businesses • Evidence or expressions of expected demand for new online content and services supported by super-fast broadband • Contributing evidence to the debate on potential economic and social benefits from super-fast broadband	• Exploring methods to reduce the cost of network deployment, including alternative wayleaves and poles • Developing new wholesale access products • Agreeing commercial models and terms for new wholesale access products • Exploring demand for different forms of wholesale access • Agree the basis for industrialised products and processes • Promoting collaboration and new commercial models between communications providers and across the value chain • Develop mass market migration processes to and from next generation access networks	• Considering and implementing the recommendations of the Caio Review as appropriate • Benchmarking UK progress against international peers, with support from Ofcom and industry • Providing guidance on best practice public intervention • Ensuring interventions and public policy is targeted to areas that the market is least likely to serve	• Supporting regulatory certainty in the application of the European Regulatory Framework • Contributing to developing best practice in next generation access regulation including approaches to access, pricing, returns on investment, and the scope for contingent commitments • Guidance on addressing inclusions issues, including the evolution of the USO

12.26 Ofcom welcomes engagement by any of these parties on issues that help to take forward the next generation access agenda. We look forward to progressing and contributing to the Caio review recommendations. We also look forward to the European Commission's Recommendation on next generation access, and will review our own proposed actions in the light of this recommendation to ensure we are consistent with the broader European approach.

Consultation Questions

Question 20 - Are these the right actions for Ofcom and other stakeholders to be undertaking at this time? What other actions need to be taken or co-ordinated by Ofcom?

Annex 1

Responding to this consultation

How to respond

A2.1 Ofcom invites written views and comments on the issues raised in this document, to be made **by 5pm on 2 December 2008**.

A2.2 Ofcom strongly prefers to receive responses using the online web form at http://www.ofcom.org.uk/consult/condocs/nga_future_broadband/howtorespond/ngaform, as this helps us to process the responses quickly and efficiently. We would also be grateful if you could assist us by completing a response cover sheet (see Annex 3), to indicate whether or not there are confidentiality issues. This response coversheet is incorporated into the online web form questionnaire.

A2.3 For larger consultation responses - particularly those with supporting charts, tables or other data - please email clive.carter@ofcom.org.uk attaching your response in Microsoft Word format, together with a consultation response coversheet.

A2.4 Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.

Clive Carter
Riverside House
2A Southwark Bridge Road
London SE1 9HA

Fax: 020 7981 3706

A2.5 Note that we do not need a hard copy in addition to an electronic version. Ofcom will acknowledge receipt of responses if they are submitted using the online web form but not otherwise.

A2.6 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together at Annex 4. It would also help if you can explain why you hold your views and how Ofcom's proposals would impact on you.

Further information

A2.7 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Clive Carter on clive.carter@ofcom.org.uk.

Confidentiality

A2.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, www.ofcom.org.uk, ideally on receipt. If you think your response should be kept confidential, can you please specify what part or whether all of your response should be kept confidential, and specify why. Please also place such parts in a separate annex.

A2.9 If someone asks us to keep part or all of a response confidential, we will treat this request seriously and will try to respect this. But sometimes we will need to publish all responses, including those that are marked as confidential, in order to meet legal obligations.

A2.10 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use. Ofcom's approach on intellectual property rights is explained further on its website at http://www.ofcom.org.uk/about/accoun/disclaimer/

Next steps

A2.11 Please note that you can register to receive free mail Updates alerting you to the publications of relevant Ofcom documents. For more details please see: http://www.ofcom.org.uk/static/subscribe/select_list.htm

Ofcom's consultation processes

A2.12 Ofcom seeks to ensure that responding to a consultation is easy as possible. For more information please see our consultation principles in Annex 2.

A2.13 If you have any comments or suggestions on how Ofcom conducts its consultations, please call our consultation helpdesk on 020 7981 3003 or e-mail us at consult@ofcom.org.uk . We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.

A2.14 If you would like to discuss these issues or Ofcom's consultation processes more generally you can alternatively contact Vicki Nash, Director Scotland, who is Ofcom's consultation champion:

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

Tel: 0141 229 7401
Fax: 0141 229 7433

Email vicki.nash@ofcom.org.uk

Annex 2

Ofcom's consultation principles

A3.1 Ofcom has published the following seven principles that it will follow for each public written consultation:

Before the consultation

A3.2 Where possible, we will hold informal talks with people and organisations before announcing a big consultation to find out whether we are thinking in the right direction. If we do not have enough time to do this, we will hold an open meeting to explain our proposals shortly after announcing the consultation.

During the consultation

A3.3 We will be clear about who we are consulting, why, on what questions and for how long.

A3.4 We will make the consultation document as short and simple as possible with a summary of no more than two pages. We will try to make it as easy as possible to give us a written response. If the consultation is complicated, we may provide a shortened Plain English Guide for smaller organisations or individuals who would otherwise not be able to spare the time to share their views.

A3.5 We will consult for up to 10 weeks depending on the potential impact of our proposals.

A3.6 A person within Ofcom will be in charge of making sure we follow our own guidelines and reach out to the largest number of people and organisations interested in the outcome of our decisions. Ofcom's 'Consultation Champion' will also be the main person to contact with views on the way we run our consultations.

A3.7 If we are not able to follow one of these principles, we will explain why.

After the consultation

A3.8 We think it is important for everyone interested in an issue to see the views of others during a consultation. We would usually publish all the responses we have received on our website. In our statement, we will give reasons for our decisions and will give an account of how the views of those concerned helped shape those decisions.

Annex 3

Consultation response cover sheet

A4.1 In the interests of transparency and good regulatory practice, we will publish all consultation responses in full on our website, www.ofcom.org.uk.

A4.2 We have produced a coversheet for responses (see below) and would be very grateful if you could send one with your response (this is incorporated into the online web form if you respond in this way). This will speed up our processing of responses, and help to maintain confidentiality where appropriate.

A4.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore Ofcom would encourage respondents to complete their coversheet in a way that allows Ofcom to publish their responses upon receipt, rather than waiting until the consultation period has ended.

A4.4 We strongly prefer to receive responses via the online web form which incorporates the coversheet. If you are responding via email, post or fax you can download an electronic copy of this coversheet in Word or RTF format from the 'Consultations' section of our website at www.ofcom.org.uk/consult/.

A4.5 Please put any parts of your response you consider should be kept confidential in a separate annex to your response and include your reasons why this part of your response should not be published. This can include information such as your personal background and experience. If you want your name, address, other contact details, or job title to remain confidential, please provide them in your cover sheet only, so that we don't have to edit your response.

Cover sheet for response to an Ofcom consultation

BASIC DETAILS

Consultation title:

To (Ofcom contact):

Name of respondent:

Representing (self or organisation/s):

Address (if not received by email):

CONFIDENTIALITY

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

Nothing ☐

Whole response ☐

Part of the response ☐

Name/contact details/job title ☐

Organisation ☐

If there is no separate annex, which parts?

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

DECLARATION

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

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

Name

Signed (if hard copy)

Annex 4

Consultation questions

What will super-fast broadband mean for consumers and businesses?

Question1 - Is there further evidence available on the applications and services or consumer benefits that may be supported by next generation access?

Question 2 - Who should lead on defining and implementing a process for migrations to and from next generation access networks? What roles should industry, Ofcom and other bodies play?

Our vision for the future and the regulation should play

Question 3- What role is there for Ofcom in the ongoing debate on next generation access versus industry's role in progressing this debate through multi-lateral and bi-lateral discussion?

Question 4 - How far does current regulation, including market definitions, equivalence and the BT's Undertakings, need to evolve as result of next generation access deployment?

Competition remains key to delivering the benefits of next generation access

Question 5 - How important are passive products such as forms of sub-loop unbundling and duct access? Can the economics of these products support the promotion of effective and sustainable competition at this level? Which passive products should Ofcom pursue?

Question 6 - What are the characteristics of high quality, fit for purpose active wholesale products? How far can active products with these characteristics support effective and sustainable competition?

Question 7 - Are there other options for promoting competition through regulated access that have not been considered here?

Question 8 - How far may options for joint investment provide greater opportunities for competition based on passive inputs? Are there lessons that can be learned from similar ventures in other industries? What are the risks and advantages of such approaches?

Question 9 - What should be the respective roles of Ofcom and industry in defining and implementing product standards?

Key to delivering effective competition and investment is pricing

Question 10 - How far do stakeholders consider the pricing approach outlined here of pricing flexibility for active products and cost orientation plus considerations for risk is appropriate at this stage of market development?

Question 11 - Will indirect constraints allow for an approach based on more price flexibility for active products? How will such an approach affect the incentives of different operators to invest and deliver super-fast broadband services to end customers?

Question 12 - What period of time would be appropriate for such an approach to ensure a balance between the need for longer term regulatory certainty with the inherent demand and supply side uncertainty in super-fast broadband and next generation access?

Question 13 - What are the key factors that could make a review of any pricing approach necessary?

Eventually there will be a transition from copper to fibre

Question 14 - How far can the generic model for transition outlined here deliver both incentives to invest in next generation access while ensuring existing competition is not undermined?

Question 15 - What triggers would be appropriate for the commencement of any transition process?

Question 16 - Once triggers or circumstances for transition are achieved, what would be an appropriate period for the various phases of transition (consultation, notice period, transition)?

Question 17 - Over what geographic area should any process of transition be managed, for example region by region or nationally?

Regulation can play a smaller role in increasing revenues

Question 18 - What actions, if any, should, Ofcom undertake to support new revenue models from next generation access?

What role can the public sector play in next generation access deployment

Question 19 - What role should public sector intervention have in delivering next generation access?

A proposed framework for action

Question 20 - Are these the right actions for Ofcom and other stakeholders to be undertaking at this time? What other actions need to be taken or co-ordinated by Ofcom?

Annex 5

Impact Assessment

Introduction

A6.1 The analysis presented in this annex represents an impact assessment, as defined in section 7 of the Communications Act 2003 (the Act). Although the strategy outlined in this document will be consulted upon during the usual regulatory processes as they are implemented, we have set out an impact assessment here to give stakeholders an early indication of the options that are being considered.

A6.2 You should send any comments on this impact assessment to us by the closing date for this consultation. We will consider all comments before deciding whether to implement our proposals.

A6.3 Impact assessments provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice policy-making. This is reflected in section 7 of the Act, which means that generally we have to carry out impact assessments where our proposals would be likely to have a significant effect on businesses or the general public, or when there is a major change in Ofcom's activities. However, as a matter of policy Ofcom is committed to carrying out and publishing impact assessments in relation to the great majority of our policy decisions. For further information about our approach to impact assessments, see the guidelines, Better policy-making: Ofcom's approach to impact assessment, which are on our website: http://www.ofcom.org.uk/consult/policy_making/guidelines.pdf

The citizen and/or consumer interest

A6.4 Next generation access network investments are one of the largest changes to the communications sector, raising the potential for wide reaching implications for consumers, citizens and the economy. The communications networks that are deployed following these upgrades offer the potential to support a range of new applications and services that can be used for the benefit of both consumers and citizens. They may also support new applications and business processes that could result in significant benefits to the UK economy. As a result, the timely and efficient deployment of next generation access networks may be of fundamental importance.

A6.5 At the same time, following deployments of these networks, we need to ensure that there is effective and sustainable competition. This can result in significant consumer benefits, as witnessed in the current generation broadband access market, in terms of choice, innovation, and prices. Following their deployment, we need to consider how a competitive environment can be fostered in next generation access networks.

A6.6 Whilst there is limited evidence of the benefits of next generation access at present, this is to some extent a chicken and egg problem – the benefits may not become clear until new applications and services are used, but the development of these new services may depend on the deployment of the new networks. There is now considerable evidence of the benefits of current generation broadband, and it seems reasonable that the next generation will have an even greater role to play in the UK economy.

A6.7 Our proposed policy approach is designed to:

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

A6.8 This extends the approach we use for current generation access, with additional measures to deal with the need for timely and efficient investment and an effective transition from the current networks to the new. This approach has led to some of the best outcomes for consumers with respect to broadband in the UK of any major country in the world.

Ofcom's policy objective

A6.9 Ofcom's policy objectives for next generation access flow from a number of statutory duties and powers relevant to next generation access deployments. In meeting those duties, Ofcom must have regard where relevant, in particular, to:

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

A6.10 In order to assess the relative merits of different regulatory approaches to next generation access, it is important that we have an objective against which specific approaches can be measured.

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

A6.11 The success of Ofcom in achieving these policy objectives will in part be measured by the final outcome in terms of next generation access investments being made in a timely and efficient manner. A successful outcome will be for the UK to see:

- operators investing in next generation access networks as soon as it is economically efficient for them to do so, and regardless of what other operators of doing;

- that these networks are deployed in the most efficient way, using the most appropriate technology;

- that consumers of existing services are not disadvantaged as a result of the deployment; and

- that diverse and innovative competition continues to deliver the consumer benefits we see with current generation access.

Key factors in securing the policy objectives

A6.12 There are a number of key ways that regulation can support investment and promote competition in next generation access. These are considered in more detail in the body of the document, but include:

- Reflecting risk in the terms of regulatory policy, including pricing – without such considerations, it is unlikely that there will be timely and efficient investment in next generation access;

- Understanding the right balance between active and passive wholesale products in supporting effective and sustainable competition, assessed in section 6.

- Principles and options for the pricing of wholesale access products that will provide incentives for investment and delivery of new services to consumers, while still ensuring consumers benefit from the provision of competitive services. This is assessed in more detail in section 7.

- Facilitating a timely transition from copper to fibre networks, explored in more detail in section 8.

Annex 6

Summary of responses to the September 2007 consultation

Overall context and responses

A7.1 The responses to the September 2007 next generation access consultation Ofcom has received show a clear evolution in a number of stakeholders' thinking. When we published our first discussion document on the topic in November 2006, we received very little engagement. This time, we have received 58 responses from a range of different stakeholders.

A7.2 Of these, the communications providers and equipment vendors continue to constitute the bulk of the responses. However, we noticed increasing interest from a wide range of public sector organisations, including RDAs and devolved governments. Understandably, the various industry and public sector respondents have adopted positions consistent with their agendas.

A7.3 It is interesting to note that the September 2007 document generated more responses from interested individuals, mostly taking the position that next generation access is fundamental for UK consumers and the economy and should be delivered as soon as possible.

A7.4 Across the board, respondents considered that the time was now right to have this debate in the UK, and that there is a need for clear articulation of the regulatory environment that will apply to next generation access by Ofcom.

A7.5 However, there remain significant variations in the positions different stakeholders have with respect to next generation access, the role that Ofcom should have in this area, and the level of clarity that is required. Some called for significantly more detailed proposals for regulatory products and prices. Others called for statements of greater support for specific products. Others indicated that Ofcom should be more instructive in how it would apply our principles for regulation in a number of indicative scenarios.

A7.6 There are some areas of consensus emerging though:

- the majority of respondents felt that our principles contestability, innovation, equivalence, reflecting risk in access terms and regulatory certainty were the right principles;
- there is a substantial need for collaboration among players and across the value chain to ensure efficient and timely investment in these new networks;
- the demand for next generation access, and commercial models that would underpin private sector investment, remain unclear. No respondents were able to provide specific evidence of what the business case for investment would be, but there was an implicit belief that it would be needed at some time;
- we are likely to see a mixed economy of technologies in the medium to long term, rather than a single technology deployment to all areas. As a result, we need to consider a wide range of technologies that could deliver higher

bandwidth services, including wireless and broadband satellite services. We did address this issue in the consultation, but our focus remained on wireline next generation access as this may be the most likely to form an enduring economic bottleneck;

- on regulatory products, the majority of operators welcomed having both active and passive remedies, but some questioned the feasibility of competition based on passive inputs.

- on prices, few respondents offered detailed thoughts on how regulatory prices could work in practice. However, several commented that pricing structures should not be complex. Others, mainly alternative operators, raised concerns around the risk of margin squeeze in pricing models that allowed upstream providers greater flexibility in price setting; and

- while some stakeholders firmly believe that public sector involvement to secure earlier investment in these new networks is necessary and would be beneficial, no-one provided evidence on the potential sources of consumer, citizen or economic benefit from next generation access.

A7.7 On our principles, three received specific focus in responses: contestability, reflecting risk in access terms, and regulatory certainty. We address the responses on reflecting risk in returns and regulatory certainty below.

A7.8 On contestability, while it is welcomed as a principle, some operators raised questions on how achievable this principle would be without substantially greater commitment from Ofcom to support specific products e.g. by industrialising sub-loop unbundling and associated ancillary services (e.g. backhaul, co-location etc). For example, Tiscali highlighted that adequate backhaul is key to make competition viable. Thus highlighted the unequal tax treatment of different classes of telecoms operators under the current rating system as one of the barriers to contestability in infrastructure deployment.

Collaboration, cooperation and coordination

A7.9 Given the complexity of the development process of next generation access but also the complexity of the likely infrastructure, several respondents highlighted the importance of collaboration, cooperation and coordination in next generation access.

A7.10 BT stated that collaboration is key for next generation access. It suggests better coordination between regulators, government, planning authorities and RDAs to remove barriers to next generation access and enhance conditions, both nationally and locally, to encourage the market to develop. BT also sees a role for collaboration for players across the value chain in terms of making a common commitment to open wholesale access and a common commitment to open standards and platforms allowing downstream service, content and application providers and developers to engage on similar terms with all next generation access deployments. The BSG echoed these comments.

A7.11 Scottish and Southern Electricity suggested the addition of “promoting coordination of industry developments” to Ofcom’s principles for regulating next generation access. This is based on the belief that much needs to be coordinated in the development of an next generation access framework and that a formal governance arrangement is the best and most transparent way of achieving this.

Demand for next generation access

A7.12 Few stakeholders doubted the need for next generation access in the future, but the timing of these investments remained highly uncertain for most parties. For almost all respondents, the commercial case to support investments by the private sector was uncertain. A few responses (e.g. the Digital Region project) did claim that there was clear demand for higher bandwidth services, but this appears to be more of an issue of getting access to today's applications and content over current broadband connections than for the delivery of new applications or services.

A7.13 Most commercial respondents provided little, if any, detail of their views of demand for next generation access. Sky and O2 made no comment on the demand for next generation access. C&W considered 24Mbps to be suitable to meet most customer's needs in the short to medium term. Views on prospects of a society with multiple household communication connections and 'must have' bandwidth intensive consumer applications were shared, but for most communications providers this was not part of the immediate future. Tiscali suggests there is still some way to go to achieve full exploitation of network technologies that already exist and believe that the copper network may have more to offer. The BBC considered it could deliver its services to consumers over today's access networks for some years to come.

A7.14 From a business perspective, the CBI commented that businesses are still experimenting with how to exploit the opportunities broadband offers. The need for increased bandwidths is therefore less than the need for greater uniformity and integration of communications networks would be.

A7.15 At the same time, several respondents, largely those calling for immediate intervention believe demand for next generation access already exists and needs to be fulfilled as soon as possible. However, these respondents do not provide any concrete evidence supporting these statements. For example, Alcatel Lucent say UK competitiveness should be the main driver as 'continued on-going investment in new access technologies is essential for the future success of the UK economy ', although it offered no evidence to support this. Many other respondents referred to the need of the UK economy to remain competitive as a justification for investment but do not provide empirical support for this.

Other technologies

A7.16 Stakeholders with interest in wireless technologies commented that the consultation discounted wireless solutions in next generation access networks too easily. Arqiva highlighted that there was a growing demand for mobility for broadband and Hutchinson 3G highlighted that wireless networks may help to overcome the digital divide.

A7.17 There was some consensus that there may be a variety of different technologies deployed that create a complex environment that will be challenging to regulate. Ericsson highlighted that a regulatory frameworks needs to be sufficiently flexible to cater for multi-technology and multi-topology networks which are likely to be seen in practice.

Securing timely and efficient investment

A7.18 Respondents' consideration of when next generation access investment in the UK would be timely and efficient can largely be divided into two categories:

- those believing investment should occur as soon as possible so that the UK does not fall behind other countries both in a technological and economic sense; and

- those that believe investment should occur as and when commercial investors consider there is sufficient demand or other commercial rationales to support the business case. This is the position adopted by almost all communications providers, including BT.

A7.19 The former groups' viewpoint was more likely to support public sector intervention. The latter group was more likely to prefer a market-led approach to investment.

A7.20 Respondents in general agreed with the principles for regulation we outlined in the consultation. However, there was also an emerging consensus from many of the respondents that Ofcom needs to create greater regulatory certainty in order to create an environment that encourages timely and efficient investment. Although most respondents requested greater certainty, the majority did not specify for what aspects of our outlined approach they would like this. For those that did suggest areas where they would like more detail, the actual level of detail requested varied.

A7.21 For example, BT requested a clear statement about future policy relating to the commercial framework for investment, the co-existence of copper networks and the protection of legacy obligations, and the period over which the regulatory framework remains applicable. In comparison, Tiscali suggested Ofcom should provide clarity on regulatory factors that would affect any future investment in next generation access. The BSG specifically suggested Ofcom needs to provide certainty on pricing of wholesale products. Overall, the questions raised were mainly around how the proposed principles would be applied to specific developments and more details on the remedies that would apply in different cases.

A7.22 C&W offered a different opinion: it considered that the best way to send the right signals for companies to make efficient investment incentives would be to price services on a cost orientated basis from day one. This would reduce the risk of early prices being high and encouraging operators to make the decision to invest in own infrastructure in the short term when in the longer term prices may fall and undermine the case for own infrastructure ownership.

A7.23 CBI considered a wide range of models should be explored, such as regional partnerships between various demand-side and supply-side actors which might include public players. It considered Ofcom should ensure that these regional developments are consistent with a wider national framework.

Promoting competition

A7.24 Comments received on the more detailed proposals on regulatory approaches to wholesale products were mixed. Most respondents agreed with the need for a high quality, well designed active line access product, at least for some areas of the country. Feelings with respect to the need for passive line access were more varied.

Passive access

A7.25 Respondents did not consider passive access universally applicable across the UK.

A7.26 The main interest in passive access came from the current LLU operators, while the incumbent operators (BT and KCom) have reservations about this option.

A7.27 In terms of incumbents, BT claimed its Generic Ethernet Access product is almost as good as granting passive access. It considered a standard active access approach based on Ethernet access across all access networks would be better than passive access, highlighting that this approach would be more future proof and that it would support equivalence, which may not be possible with passive access in denser areas. KCom suggested that the UK may be a case where competition at the cabinet may be economically inefficient and unsustainable given the characteristics of the market environment.

A7.28 O2 supported the notion that investment may occur earlier with passive access. C&W stated it was keen to explore unbundled fibre specifically: this is consistent with its position in other consultations including the leased lines market review. C&W also considered that passive remedies will require issues with space and power, still unresolved from today, need to be considered to ensure next generation access investments are contestable. Sky welcomed the fact that Ofcom has tasked the OTA to work with industry to assess demand for sub-loop unbundling and work to ensure it is appropriately industrialised. For Tiscali, viability of sub-loop unbundling will depend on the availability of adequate backhaul products and whether or not sub-loop unbundling is to be an equivalence of input product sold by Openreach to downstream BT divisions.

A7.29 Several respondents, including Sky, compared sub-loop unbundling to the early days of LLU and warned that the problems that initially existed with LLU need to be avoided for sub-loop unbundling.

Active access

A7.30 The majority of respondents were in support of active access. Some respondents however called on Ofcom take a role in the development process to ensure that an active access product by Openreach is fit for purpose – namely of high quality and highly configurable.

A7.31 Alcatel Lucent expressed the belief that the current active line access definition offered by Openreach does not meet communication providers' requirements for service differentiation. This is also the position that C&W had, commenting that the current design of Generic Ethernet Access was some way away from C&W's vision of an active line access product

A7.32 C&W commented also that interconnection with active based products is likely to evolve over time, from centralised interconnection when volumes are smaller, to more local interconnection as volumes grow for those with exiting infrastructure. This may have implications for how the location of competition changes over time.

A7.33 Alcatel Lucent suggested that uncertainty on the prospects for innovation and differentiation from active line access products may be providing disincentives for investment at lower, passive levels. If the active line access product does deliver good prospects for innovation and differentiation, operators would prefer not to

invest in passive. However, at that time, they could not comment with precision on what active line access will deliver.

Pricing

No price setting but with obligations to supply

A7.34 While the opportunity offered by this option for greater flexibility in pricing at the most efficient level was welcomed by many, some alternative operators raised concerns that this approach would result in margin squeeze by a vertically integrated SMP operator – the SMP operator would seek to secure all profits in it upstream division.

Anchor product regulation

A7.35 There was widespread interest in anchor product regulation by respondents, but with this there were also requests for further details. Respondents considered the consultation's outline of anchor product regulation very complex and there were requests for Ofcom to explore and explain this option further in order to reduce the current uncertainty associated with it. However, several respondents counselled against adopting any pricing mechanism that was too complex, but rather preferred more simply understood and applied methods of pricing.

Reflecting risk

A7.36 Many respondents welcomed the principle of reflecting risk in access terms, and in allowing the market greater flexibility in price setting. However, many competitors remain significantly concerned about the risk of margin squeeze by vertically integrated operators with SMP in upstream services. Ex ante regulation was frequently mentioned as a potential remedy for this problem.

A7.37 C&W was one of the few respondents to take a different position. They argued the level of risk is influenced by timing and location. Evidence in the UK implies an incremental approach to investment will be adopted, with the potential of reducing risk. Trials and launches (such as those taking place in Ebbsfleet) could also be used to test commercial and technical issues.

Other

A7.38 Several respondents agreed that pricing will need to vary between the short and longer term, reflecting the different levels of certainty relating to costs and demand over this period. The views on how this may work in practice however varied. C&W claimed that initial pricing below cost followed by increases in price as deployment increases may work. BT meanwhile expressed belief that cost orientation is not practical as next generation access costs are uncertain in the long run and that short term costs may exceed prices until deployments achieve scale.

A7.39 C&W offered comments that pricing approaches based on EoI only (i.e. no price setting but an obligation to supply) may result in better quality products, but would not address the risk of downstream margin squeeze by BT to maximise overall group profits.

A7.40 The CBI commented that Ofcom has to consider the possibility of differentiated regulation across geographic regions or even specific roll-outs. Similarly, O2 believed remedies should take into account differences at the sub-national level.

A7.41 Alcatel Lucent placed a strong emphasis of a number of additional remedies, including duct and trench sharing to reduce deployment costs.

Transitioning from today's regulation

A7.42 LLU providers called for their LLU investment to date to be taken into account when transitioning from today's regulation. C&W in particular suggested that future remedies could be designed to make as much use of existing investment by LLU operators as possible, e.g. space, power, backhaul infrastructure etc.

A7.43 Meanwhile, BT stated explicitly that 'there must be no continuing requirement to maintain a copper network alongside new fibre'. BT believed that for FTTH, the cost of maintaining fibre and copper networks is likely to be restrictive.

Public sector intervention

A7.44 Respondents were in disagreement over the role of the public sector intervention in next generation access. Public sector bodies, RDAs, Ofcom's advisory committees and private individual respondents largely believed intervention is needed, albeit to varying degrees and at different points. Commercial organisations largely raised concern over creating artificial incentives for earlier investment in next generation access citing that this may distort competition and be detrimental in the long-term.

A7.45 Submissions by private individuals largely focussed on instances in which end-users raise concern that they will not be able to access services without intervention taking place. Public sector bodies further supported these views and also highlighted concerns about the UK economy falling behind as justifications for intervention.

A7.46 A joint submission by the RDAs question whether existing market-led model, regulating competition over what is an existing infrastructure, can effectively promote or indeed trigger investment in an entirely new infrastructure. In their view, as next generation access is a completely new access infrastructure, to provide a truly ubiquitous next generation access network a step-change in policy and regulation is required. If the market-led approach is maintained there is a risk that a good deal for the end-users is may be lost.

A7.47 Commercial organisations had views contrasting the above. For example, Sky believed that public intervention to promote next generation access investment carries with it several risks that potentially result in inefficient investments, and reduced consumer choice. C&W considered that artificially encouraging next generation access network rollout risks making the investment uncontestable, and entrenching existing SMP operators in the future. This will then require increasing micro management by the regulator.

A7.48 Many respondents, including commercial organisations, agreed that intervention by the public sector is appropriate where a market-led approach does not serve all parts of the country or all consumers, and there is a risk of a digital divide emerging. The BBC further qualified this point and suggested that intervention was appropriate where a digital divide is emerging and next generation access is proven to deliver significant social value.

A7.49 Suggestions for the type of interventions that may be taken were limited. Where they were made, suggestions varied largely. For example, the Communications Managers Association said BT should be encouraged to invest. Alcatel Lucent

meanwhile, suggested that co-investment models between communications providers and infrastructure based sectors could be used to lower the cost of passive infrastructure and be a viable option of facilitate investment. BT suggested that where funds are available and state aid rules permit authorities may wish to contribute to the construction of duct and access networks in specific locations.

Role and next steps for Ofcom

A7.50 The majority of respondents see Ofcom's role in next generation access as providing clarity and regulatory certainty. A number of commercial providers clearly stated that Ofcom should not get involved in determining when investment is timely or efficient, but that it has a role in providing an environment to make investment possible. Those respondents calling for public intervention saw our role in supporting any decisions made by government.

A7.51 Several respondents criticised Ofcom for a lack of certainty and conviction about demand for next generation access. On this basis there were calls for Ofcom to perform more research in this area.

A7.52 A number of respondents suggested that Ofcom undertake scenario analysis to develop the regulatory principles further. The BSG specifically suggest that Ofcom should consider potential scenarios in order to calibrate regulatory principles. The CBI suggests that Ofcom should improve its understanding of demand-side expectations and usage of next generation access by businesses and their customers to allow better modelling of different regulatory impact scenarios on next generation access investment.

Annex 7

Technology developments

Context

A8.1 This annex has the purpose of providing background on a series of recent technological advancement that may affect the next generation access investment case. While belonging to a large variety of technical fields, each of them they might have an impact on the economics, incentives or rationales of next generation access deployments.

A8.2 This is not intended to be an exhaustive or complete list, but has the purpose of keeping the ongoing debate on next generation access up-to-date with the latest technology developments.

Technology developments can improve the next generation access investment case

A8.3 Technological advancement can both have positive and negative contributions to the incentives to invest in next generation access. These can broadly be summarised under the following categories:

A8.4 On the positive side, technology developments can:

- Delivering more bandwidth per end-user, hence increasing value of prospective services delivered through new assets
- Increasing the functionality of potential next generation access networks, hence allowing wider ranges of services to be offered, and more revenue to be generated
- Reducing network deployment costs, hence reducing investment effort

A8.5 However, such developments can also Increase the pace of technological obsolescence, hence reducing prospective value of assets against upfront costs of investments.

A8.6 The continuous technology advancements experienced by the telecoms sector show that the balance between positive and negative factors has been historically in favour of the former. Even in the case of next generation broadband, technology developments can continue to improve business cases and potentially accelerate deployment.

Broadband technology advancements

WDM-PON

A8.7 Wave Division Multiplexing is a technology for increasing the capacity of fibre networks, which has been in use in the core network for a decade. A much more recent development is its application to access networks using Passive Optical Network technology, to enhance the bandwidth capabilities compared with using TDM techniques only, as in the case of EPON and GPON standards. WDM increases bandwidth by allowing a single fibre to carry multiple optical wavelengths,

each capable of carrying the same bandwidth that previously supported by the entire fibre. Up to 32 wavelengths can be supported by WDM-PON systems today. Trials of WDM implementations in the access network are underway in Korea. Commercial availability of WDM-PON equipment is premature, as the technology is still emerging. WDM-PON standards have not yet been defined, but Full Service Access Network (FSAN - the body which drove the GPON standard) aims to finalise them in 2010. WDM-PON is considered as a suitable candidate for future upgrades to GPON networks.

A8.8 The technology also opens technical possibilities related to unbundling of point-to-multipoint access networks. Unbundling of individual wavelengths, each assigned to a single customer, is technically possible, even though it involves a significant degree of engineering complexity. No one anywhere in the world has yet designed a regulatory access intervention based on WDM unbundling and such use is not a major driver of current standards development. As we outlined previously, wavelength unbundling can be an option for passive access to PON networks in which physical unbundling cannot take place. WDM-PON advancements suggest that WDM unbundling may be technically and economically viable in the near to medium term.

New broadband-over-cable technologies

DOCSIS 3.0

A8.9 DOCSIS 3.0 is a complex set of standards that encompass various aspects of broadband delivery over cable TV networks technologies. These include channel-bonding techniques. Using channel-bonding, operators can link multiple RF channels together to deliver higher bandwidths. According to the RF channels configuration of cable systems, channel bonding can be applied both to downstream and upstream bandwidth. The definition of the EuroDOCSIS 3.0 series of standards has been recently completed and at the end of 2007 CableLabs started awarding the first equipment certifications. EuroDOCSiS 3.0 allows cable operators to deliver up to 200Mbps of downstream bandwidth to end-users.

A8.10 During 2007, Virgin Media has conducted a pilot using pre-DOCSIS 3.0 equipment. In 2008 and 2009, the technology should be implemented to its whole cable network, thus allowing around 48% of UK households to access next generation access-like speeds. Virgin Media plans to start offering 50Mbps downstream broadband connections across its cable network footprint towards the end of 2008.

RF Over Glass

A8.11 While most cable TV networks are based on Hybrid Fibre-Coaxial (HFC) plants, equipment vendors are starting to develop technology solutions for cable networks purely based on fibre optics, that allow cable operators to maintain most of their networks based on the DOCSIS standards unchanged. Some of these solutions are being provisionally branded as RF Over Glass (RFOG); their implementation requires the substitution of the last portion of the cable network currently based on copper coaxial cables with fibre optics. The DOCSIS node (comparable to the street cabinet in telecoms networks deriving from the PTSN architecture) is then bypassed in favour of passive splitters. This would allow a significant increase in bandwidth available to each end customer. RFOG standardisation is still some way into the future and its primary application is most likely to be in greenfield sites.

Wireless broadband

A8.12 Mobile operators have escalated their mobile broadband offers based on HSPA during late 2007 and the first half of 2008. Although in the early stage of market development, mobile broadband has the prospect increasing competitive pressure on current generation fixed broadband services. Recent developments in wireless broadband standards will further increase the speeds that can be offered by mobile networks, bringing them closer to super-fast broadband territory.

A8.13 WIMAX (Worldwide Interoperability for Microwave Access) is a wireless technology with multiple variants – a static version suitable for fixed wireless access and wireless backhaul applications and a version with full mobility support. WIMAX networks based in the 802.16e standard (better known as mobile WIMAX) would be capable of providing data transfer rates up to 40Mbps under certain conditions. Commercial rollout of WIMAX has already been announced in a number of counties, for example the US by Sprint.

A8.14 In November 2007 the ITU decided to include WIMAX in the IMT-2000 family of standards. This decision increases global opportunities for WIMAX deployments, especially within spectrum bands traditionally identified for 3G expansions, like the 2.5-2.69GHz band. In the UK, WiMAX is currently being trialled by multiple service providers and several stakeholders have come forward as potential new entrants using WiMAX and the 2.6GHz band, which Ofcom plans to auction as soon as possible[32], to provide mobile broadband services.

A8.15 LTE (Long Term Evolution) is a technology similar to WiMAX from a performance point of view, but it is intended to provide a seamless upgrade to 4G services beyond today's 3G and GSM applications. The ability of using existing cellular sites makes LTE an obvious choice for mobile operators that have already invested in GSM and UMTS. However, as opposed to WIMAX, the standard definition for LTE has not yet been completed.

A8.16 The top winners of 700MHz spectrum in the US (Verizon and AT&T) have recently announced that LTE will be their 4G standard of choice. This has consequently put a significant pressure on vendors to develop suitable LTE equipment so that technology trials can start as early as possible. This pressure could mean that LTE network equipment may become available for commercial deployment in 2-3 years time. Future applications of LTE in the UK could be based on 3G spectrum bands or on the Digital Dividend, which will become available from late 2012.

A8.17 Some respondents to our September 2007 consultation expressed their concerns that Ofcom had discounted wireless technologies from the overall picture of next generation broadband. Ofcom is a technology neutral regulator and we do not consider appropriate for us to favour particular technologies over others. The reason why our consultations are centred on fibre-based deployments is that enduring economic bottlenecks are more likely to arise in fixed rather than wireless networks.

A8.18 In terms of performance, wired and wireless next generation broadband technologies differ significantly because of their underlying characteristics. Wireless and wired communications have different constraints due to basic physics laws. Wireless is by nature a contented medium and, at least in theory, more suitable to

[32] See our statement of 4 April 2008 available at http://www.ofcom.org.uk/consult/condocs/2ghzrules/statementim/

'burst' types of data transfers rather than to the provision of constant and continuous very large bandwidths. Wireless connections are generally asymmetric, too. Hence, those next generation access applications that will require constant access to symmetric bandwidth will probably work best on fibre.

A8.19 Wireless clearly offers advantages linked to nomadic and mobile use. As the computing capabilities of handsets and other portable devices increase, Next Generation Wireless Broadband is likely to gain ground. Most probably, a wide variety of next generation access applications will be developed, some of which will be designed for use at a fixed location, some for mobile, some for both. Different technologies could then be needed for different uses. While the top speeds offered by wireless technologies are likely to continue following those typical of wired and in particular fibre based connections, it is early days to assess whether future wireless broadband will predominantly constitute a substitute or a complement of future fixed broadband.

Satellite broadband

A8.20 Satellite internet services have traditionally offered performances similar to those of dial-up or basic broadband. Data links over satellite suffer the typical trade-offs of wireless systems (power limitations, contention) in a particular acute way, as satellite beams typically cover very large geographical areas. Recently developed spot beam systems use highly focussed multiple beams delivering greater bandwidths and efficiency. Eutelsat has announced the launch of a new Ka-band satellite using 80 spot beams in 2010. It will cover Europe and selected areas of the Middle East. Eutelsat estimates that this new system will cut costs of transmission from €25 to €3 per gigabyte, delivering to end-users broadband comparable to ADSL in terms of performance and costs.

A8.21 Despite these developments, satellite systems are unlikely to have next generation access-type of capabilities in the near to medium term. Ad-hoc systems with extremely focussed beams may be an exception, but will only be suitable for niche applications and not economically viable for mass market deployments. While the costs for satellite data delivery are falling, they are still significantly higher than those of wireless terrestrial systems of comparable performance. Satellite services could however prove useful in increasing broadband coverage into not-spots and very remote areas, especially as demand for higher bandwidths increases.

Extending the limitations of copper

A8.22 The speeds currently available in practice on telecoms copper-based connections in the UK can vary significantly according to a number of factors. Ofcom has recently launched a programme of independent research[33] aimed at providing clarity on the speeds that consumers across the UK can realistically achieve and the reasons determining the difference between advertised and real speeds. These factors are likely to include: copper loop length, copper line quality, in-house wiring issues, interference and cross-talk, backhaul contention and congestion.

A8.23 Various cost-effective approaches can be implemented to address some of these issues:

- Copper network improvements can be aimed at replacing poor joints or preventing / addressing water ingress.

[33] http://www.ofcom.org.uk/media/news/2008/06/nr_20080605

- Dynamic Spectrum Management (DSM) is a technique being researched by the DSL Forum that has the potential to reduce cross-talk.

- PC / router health-checks and faceplates replacements can address possible in-house network issues.

A8.24 All these solutions have the potential to marginally improve line speeds on the current network architecture. More substantial upgrades, such as the implementation of higher speed DSL standards (ADSL2+, VDSL, VDSL2) or reduction of backhaul contention can also improve significantly the performance of copper-based networks, bringing it closer to its theoretical limits.

A8.25 Ofcom has recently published a study on the theoretical limitations of copper[34]. The findings reach the conclusion that copper loops up to 2km long can sustain speeds of 50Mbps. Despite this result does not take into account all the possible constraints linked to a practical implementation, the study confirms that under certain conditions copper connections can deliver speeds significantly above those that are available with current generation broadband.

DSL bonding

A8.26 A different approach to overcome limitations of the delivery of broadband over copper is based on the principle of 'pairing' 2 or more copper pairs delivering a coherent signal to the same premise. Pairing techniques based on DSL transmissions are usually referred to as DSL bonding.

A8.27 Transmission techniques aimed at delivering Ethernet over bonded copper pairs have been used for some years to offer very high-speed broadband to business customers. These techniques can deliver bandwidths in the region of 40Mbps per customer. The high cost of consumer premises equipment has so far not allowed wider scale applications. Recently, cheaper equipment has been developed and some vendors are claiming that now copper bonding is economical enough to be applied in the residential market. The effective extent of applicability of this solution is mainly limited by the lack of consistent presence across telecoms networks or spare copper pairs.

A8.28 Bonded DSL rings (BDR) represent an alternative approach to DSL bonding. With BDR the network owner modifies the path of the DSL signals in the last portion of the access network by creating a ring encompassing various premises: where 2 copper pairs per home are present, copper pairs can be re-jumpered in the last distribution point by installing additional equipment, usually serving between 10 and 20 homes, so to create an architecture in which every home represents a node of a bi-directional ring.

A8.29 The ring is created by inserting additional equipment and re-jumpering copper pairs in the Distribution Point (DP), the aggregation point closest to the network edges usually serving between 10 and 20 premises. This results in DSL signals to run from premise to premise rather than in a tree-and-branch configuration. The technology relies on the presence and active use of two copper pairs per home, one running DSL signals into the home and the other to the next home. The CPE then acts both as a distributor of bandwidth from the ring to the home and as a bandwidth amplifier sending signal to the next node (premise) in the ring; this mitigates signals losses due to distance typical of DSL technologies. By using

[34] http://www.ofcom.org.uk/research/technology/research/emer_tech/copper/

VDSL2 a maximum of 400Mbps combined (both upstream and downstream) bandwidth can be achieved. Backhauling from the DP to a larger aggregation point (cabinet or exchange) can take place through copper bonding, where spare copper pairs are present.

Networks deployment and management techniques

Automatic Distribution Frames

A8.30 Metallic cross connects in local exchanges represent a bottleneck in current LLU processes. A request of broadband activation or switch between different providers requires a manual connection of the copper pair serving the relevant customer with the selected operator's DSLAM. Cabinet-based VDSL and sub-loop unbundling are subject to even greater challenges in this sense, as the cross-connection takes place in a higher number of more decentralised locations (around 90,000 cabinets as opposed to around 5,500 local exchanges). Automatic distribution frames (ADFs) have been developed to rationalise and automate cross-connection processes in local exchanges. Smaller versions of this type of equipment can in theory be fitted in street cabinets, too, but to date no operator has implemented this version of the system yet.

A8.31 The economics of FTTC and sub-loop unbundling are likely to be influenced by truck roll and cross-connection costs. The use of ADFs in cabinets has had no practical implementation to date, but at least in theory it has the potential to significantly reduce the complexity and costs connected to the activation of new VDSL customers and the switch between different sub-loop unbundling operators. This could substantially improve the case both for FTTC overlay deployments (allowing automatic switching for customers) and reduce the cost of competition in cabinets.

New ducting techniques

A8.32 A variety of technologies to overcome the challenges of traditional ducting are emerging.

- Slot trenching involves digging in a much less invasive and faster way compared with traditional trenching techniques. The smaller trenches obtained can be used for laying new small ducts, which can be then filled with fibre and pressurised by using Air Blown Fibre systems.

- Trenchless approaches to ducting can rely on robot boring techniques, which use automated impact moles to dig into muddy terrains

- Microducting techniques, some of which are marketed under the KableX brand, permit to substitute copper cables with fibre without affecting existing telecoms infrastructure elements such as ducts and trenches. It involves extracting copper from its jacket without digging; microducts are then inserted in place of the copper, creating a pathway for the installation of optical fibre without trenching or physically removing the existing cable. The first implementations of this technique took place in several North American pilots starting from November 2007.

A8.33 It is estimated that civil works costs account for about 50% to 70% of fibre deployment CAPEX. Traditional ducting, in particular, can cost as much as £100 per metre. The use of alternative approaches to civil works has therefore a high potential to reduce upfront costs of fibre deployments.

Fibre-optics management

A8.34 Despite having clear performance advantages, the installation of optical fibres poses additional engineering challenges when compared to copper. Fibre optic vendors have been recently developing products which simplify the laying and management of fibre cables. These products have the potential to reduce both upfront and running costs of fibre-based networks.

A8.35 A typical limitation of traditional optical fibres is the signal loss involved in bending. The ITU has developed standards to classify different types of Bend-capable fibres (BCFs). The use of BCFs decreases space requirements and improves network reliability in central offices and cabinets. More recently, vendors have pushed the capabilities of BCFs so to address problems of Multi-dwelling units installations; bend-resistant fibres can conform to corners and be automatically stapled in place.

A8.36 Other significant areas of development are those linked to splicing and termination of fibres. Various vendors have developed fusion-splice connectors: they allow to reap the benefits of fusion splicing - as opposed to mechanical splicing (more accuracy and minimal levels of signal loss) - and to avoid the complexity of the splicing process, through the use of standard connectors.

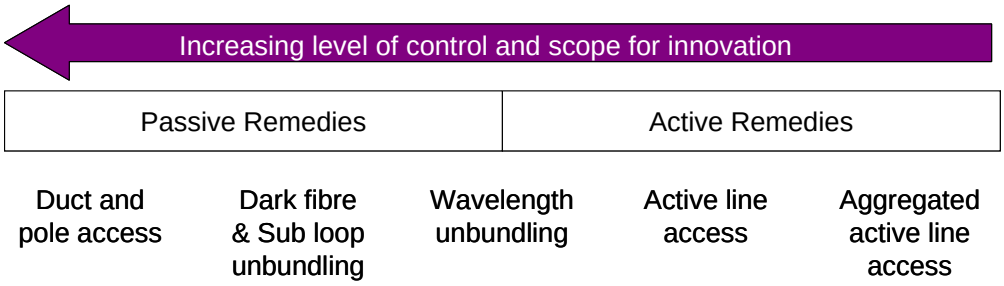
Annex 8

Ethernet active line access

Background

A9.1 As set out in Section 6 competition in next generation access is likely to take different forms depending on the local conditions and the state of market development. Passive access methods such as sub-loop unbundling and duct sharing, and active access methods such as bit-stream, may all have a role to play. A range of competitive options is shown in the diagram below.

Figure 9: Examples of active and passive remedies under consideration by Ofcom



A9.2 Ethernet Active Line Access (ALA) is our vision for a set of requirements for competitive active access in Next Generation Access. It will enable Communications Providers[35] (CPs) who do not own or control the underlying infrastructure to nevertheless offer competitive services through a wholesale bitstream product that is as close as possible to access at the physical layer. It is most likely to be attractive to communications providers where it is not practical for shared passive access to infrastructure. As far as possible, Ethernet ALA will offer communications providers a similar scope for innovation and control as they would have with direct access to the passive infrastructure. Therefore, the functionality of products based on Ethernet ALA should be as close as possible to the functionality of the underlying infrastructure.

A9.3 These requirements should form the basis for the development of active access products in the future. Infrastructure Providers may develop a range of products to meet these requirements; and any relevant obligations. It is worth noting that these are a set of minimum requirements which do not preclude additional functions which an ALA provider may wish to offer or other services that communications providers using ALA could request. As regulators, it is not our role to develop technology or products but we can facilitate standardisation. However, we cannot set standards but only encourage industry to engage in standardisation and to develop products based on these requirements.

A9.4 We set out five characteristics of active line access functionality which would support the delivery of competitive residential services. These characteristics are:

- Security, to ensure that data is carried safely over this network

[35] Communications Providers are companies who provide services to a customer's home, such as telephone and internet services and may own some parts of the network.

- Quality of Service, for prioritising traffic where appropriate in order, to provide an acceptable user experience to customers
- Multicast, for the economic distribution of audio-visual content
- Support for flexible Customer Premise Equipment (CPE), which may determine the consumer experience
- Flexible range of aggregation points, as the most economical point to aggregate traffic will vary between communications providers.

A9.5 These requirements were discussed in detail with industry at a number of workshops[36]. Attendees of these workshops included representatives of communications providers, infrastructure providers[37], vendors and other European regulators. There was overall consensus at these events that the five characteristics were the right requirements for a competitive and innovative wholesale product. However, there was also some debate over the level of functionality in a number of areas, in particular on multicast, the flexible support for CPE and the range of points of interconnection.

A9.6 Given agreement of these characteristics in principle, we have worked with industry to set out some detailed draft technical requirements for the functionality of Ethernet ALA. This annex gives an overview of these technical requirements. The more detailed draft requirements are available on our website[38], and are published for further discussion and feedback. Once consensus has formed, these technical requirements will be handed over to the appropriate standards bodies for the development of standards. These standards will help both providers and consumers or users of ALA[39] to create products and services that will support competition and deliver benefits to end users.

Choice of Ethernet

A9.7 Ethernet is simple, cheap and ubiquitous. As telecommunications companies invest in next generation networks, many are moving towards Ethernet as the technology for their IP based services. Therefore our assumption is that any active line access product will also use Ethernet technology.

A9.8 Due to its ubiquitous nature, there is already a highly competitive marketplace for equipment, and this will reduce the investment required. The Ethernet service interface is also universal, and can be used on many different types of physical media. It supports flexible bandwidths, therefore making services more flexible and scalable.

A9.9 The properties of Ethernet also support the characteristics of ALA. It is highly interoperable, making it easy for communication between different CPs using ALA and ALA providers. There are a wide range of existing standards which enables Ethernet to support other requirements of ALA, such as quality of service, security and service management.

[36] http://www.ofcom.org.uk/telecoms/discussnga/eala/ethernetala/
[37] Infrastructure Providers are companies who invest and own the physical network
[38] http://www.ofcom.org.uk/telecoms/discussnga/eala/eal/
[39] The requirements refer to infrastructure providers whose wholesale access products are compatible with ALA as ALA providers; and communications providers who consume or use ALA to deliver wholesale and retail products as ALA users.

Overview of Competitive Requirements

A9.10 As far as possible, we wish Ethernet ALA to be independent of the technology of the underlying infrastructure, so that it can be used as a wholesale bitstream product in any next generation access deployment regardless of the technology choices made by the ALA provider. A wholesale product at the lowest possible OSI layer enables communications providers using ALA to develop innovative services and products over this technology. ALA users will be responsible for ensuring that they have sufficient capacity to support the services which they are offering. A standardised Ethernet ALA product will reduce the risks of isolated islands of technology, where different wholesale products are offered by ALA providers. It also helps to enable USO[40] holders to fulfil their obligations to deliver services across infrastructure provided by other owners.

A9.11 Regulators should not lead in standardisation: our role is to help promote the debate within industry. Therefore, Ethernet ALA should be standardised by industry and through the appropriate forums. There is already relevant work taking place in standardisation forums such as the Broadband Forum, ITU[41], NICC and MEF[42].

A9.12 In the following section we overview the draft technical requirements of Ethernet ALA..

Five key technical requirements of Ethernet ALA

Security

A9.13 Ethernet ALA must support a basic level of transport security at the infrastructure layer, since transport streams from different ALA users will share the underlying infrastructure. Basic encryption is desirable, to ensure that content is only delivered to the requested destination. This is especially important where there is a shared architecture such as GPON. However ALA users will be responsible for further security of their transport streams at the link or service layer. The level of security at these layers can be determined by the ALA user.

A9.14 Examples of basic transport security include the following:

- the use of VLANs[43] to partition and isolate different transport streams, so that transport streams belonging to different ALA users are transported securely through the network; and

- transparent delivery of whatever security measures an ALA user wishes to use. This may include controlling access to a set of port IDs or IP addresses.

A9.15 The transport stream will identify both the ALA user and the customers. The separation of these streams at the ALA provider and user interface can be managed using stackable VLANs, as defined in IEEE 802.1ad (also known as Q-in-Q). Here, two VLAN tags are available for use to identify the ALA user and the end-customer. Further discussion is required to decide how these tags can be used in

[40] Universal Service Obligations
[41] International Telecommunication Union
[42] Metro Ethernet Forum
[43] Virtual Local Area Network

Ethernet ALA. It was thought that alternative protocols, such as PBT[44], MPLS[45] and VPLS[46] were less suitable to form the basis of Ethernet ALA.

Quality of Service

A9.16 The Ethernet ALA wholesale product should be enabled to transparently support different levels of Quality of Service. The infrastructure owner provides the physical network, but it is the ALA user's responsibility to manage the resources for different types of service streams. In doing so, ALA users can ensure that there is adequate bandwidth for the services they offer, both in the wholesale products they buy and within the capacity of the access network.

A9.17 ALA users will be responsible for labelling their customer's traffic streams with the designated priority tags, to allow time-critical traffic streams to be prioritised by the ALA provider. An ALA provider will therefore need visibility of the prioritisation so that packets can be forwarded according to their importance, when required.

A9.18 The Ethernet ALA bandwidth can be divided on a per-VLAN basis, to allow individual customers to join and migrate between different ALA services. In a shared infrastructure, such as a PON[47], there are different ways of sharing the bandwidth between customers and ALA users to deliver a Committed Information Rate (CIR) and Peak Information Rate (PIR). These options are discussed further in the draft technical requirements document.

A9.19 In the discussions at our Ethernet ALA workshops, it was largely agreed that quality of service can be managed by the ALA user through IEEE 802.1p. This standard specifies how priority to transport streams can be assigned. Ethernet packets are labelled with a 3-bit priority value (ranging from 0 to 7 with 7 being the highest priority) and traffic class is aligned to these values.

A9.20 There are a number of other existing standards for the support of quality of service in Ethernet for next generation access. These include the Broadband Forum's TR-101 and WT-156, and in the requirements set by the Home Gateway Initiative (HGI).

Multicast

A9.21 Multicast is a method of transmission which enables the efficient distribution of the same content to many users. In this way, bandwidth requirements in the backhaul are reduced, as communications providers only have to provide one multicast stream, which is then duplicated for all customers downstream. There are two ways in which multicast can be provided in Ethernet ALA, by the ALA user or provider:

- ALA user enabled multicast
    - The ALA user will install their own multicast server at the exchange and the multicast traffic will be transmitted from the ALA user's server to the Ethernet ALA handover point.

[44] Provider Backbone Transport
[45] Multi-protocol Label Switching
[46] Virtual Private LAN service
[47] Passive Optical Network

  - The ALA user may only have a few customers at each exchange, so it may be uneconomic to invest in multicast servers in all exchanges to provide multicast services to all customers.

- ALA provider enabled multicast
  - The multicast server at the exchange can be used by all communications providers serving customers at that exchange.
  - ALA users can deliver their multicast content to a single node for distribution to all exchanges.
  - ALA users manage their services at the multicast server.

A9.22 Communications providers have put forth an argument that unless an ALA provider provisions multicast, they will not be able to compete effectively. Therefore ALA provider enabled multicast should be a requirement in Ethernet ALA. ALA users could choose between using the ALA provider's multicast product and implementing their own version of multicast at a higher OSI layer. Current multicast standards only consider applications for a single communications provider. In Ethernet ALA, there will be multiple communications providers offering services on the same multicast infrastructure, therefore further discussion is required to decide how multicast will be implemented.

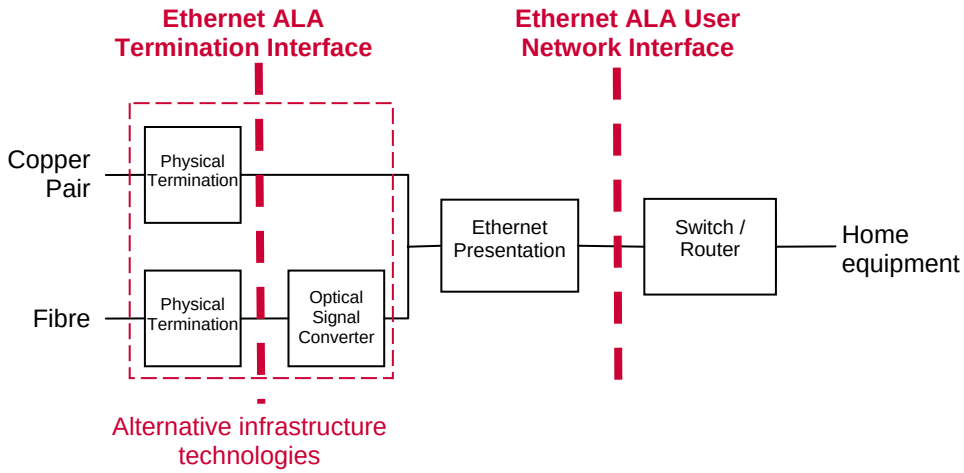
A9.23 Multicast is likely to be implemented in different ways, depending on the topology of the access network. As Ethernet ALA is infrastructure agnostic, the multicast interface between the ALA user and the ALA provider must be consistent, and therefore multicast cannot be implemented at the physical layer. Instead, the multicast handover should be available at the next lowest OSI layer to allow for maximum possible innovation. There is no requirement for encryption of multicast traffic at the infrastructure layer as ALA users can provide the security when required.

Support for Flexible Customer Premise Equipment

A9.24 In Ethernet ALA, we are focusing on the physical interface between the access network and the home network. However, in order to effectively support the competitive delivery of services to the home, the CPE should also support, or at the very least not prevent, the key characteristics of Ethernet ALA. For example, it must be aware of different Classes of Service, so that different types of content can be delivered reliably to the home.

A9.25 In the world of triple play services, customers may wish to source each service (such as voice, broadband or TV) from a different provider. Therefore the termination point within the home may be required to support services from a number of communications providers. The interface between Ethernet ALA and home equipment should be a common logical interface across all infrastructure types, such as a presentation of IEEE 802.1ad Ethernet (at the Ethernet ALA User Network Interface in Figure 10). This interface may occur between two pieces of equipment or inside an integrated box. A standard interface is preferred, so that home equipment from any vendor can operate in any Ethernet ALA home. For services from multiple ALA users, end customers can purchase an additional splitter. Alternatively, ALA users can provide additional CPE and gateways for installation by a customer, without an engineer visit.

Figure 10: Location of Ethernet ALA interfaces



A9.26 However, a standard Ethernet presentation in the home may restrict competition for the equipment which converts the data signal into Ethernet frames. Therefore it is anticipated that communications providers may wish to move the ALA interface further into the network, to the NTE (at the Ethernet ALA Termination Interface in Figure 1). There are technical challenges to overcome for access at this interface, as the equipment required for converting the incoming signal for Ethernet presentation will be installed by the ALA user or the end customer and this equipment will need to be interoperable with an ALA provider's NTE. As a result, this model may not be achievable until there are sufficient standards and proven interoperability between the equipment and the ALA provider's network.

A9.27 The Broadband Forum's standard TR-069 could be used for the remote management of the CPE. Standards for the support of Classes of Service have been discussed by HGI, ITU, the Broadband Forum and FSAN[48].

Flexible range of aggregation points

A9.28 There is no single most economic location for aggregation, therefore interconnection may take place at a number of handover points. ALA users could request physical and logical aggregation at reasonable points. Alternatively they can buy from a range of backhaul products to connect their networks to the handover locations on offer. ALA users can then choose the aggregation solution which is most economic for their network and migrate between these different aggregation locations as the transport demands of their network changes.

A9.29 Aggregation can take place at locations with active electronics, such as in the following equipment:

- cabinet;
- exchange;
- metro node; and
- core.

[48] Full Service Access Network

A9.30 With a flexible range of aggregation points, one ALA user can choose to connect locally at the exchange and use their own backhaul network. Alternatively, another ALA user can choose to buy an uncontended backhaul service to handover at a location closer to their network. Flexible aggregation also means that the ALA user can move the location of their interconnection. For example, as traffic demands change, an ALA user may wish to invest in its own backhaul network and move their interconnection point from a national aggregation point at the core network to a local aggregation point at the exchange.

A9.31 The ALA provider will be responsible for aggregation at the point of interconnection. This handover will take place via a standard NNI interface (such as a 1G or 10G Ethernet handover). Communications providers who require a smaller interface may request for a smaller handover provided by throttling this handover.

Additional Requirements

A9.32 Over the course of our workshops other issues were discussed which require agreement by the industry. These are not a part of the key characteristics of Ethernet ALA but are useful guidelines to the development of Ethernet ALA.

Systems and Processes

A9.33 The importance of systems and processes was emphasised, both for the day to day running of retail services and in migrations. As far as possible, there should be standardised interfaces and the systems and processes should be similar to those currently in use. Standardised modern systems, such as those based on XML[49], could be used in order to reduce the disruptions during migrations to next generation access services. ALA users would be able to order Ethernet ALA products easily, regardless of the differences between the infrastructure technologies used by different network owners. Some representatives of communications providers and infrastructure providers suggested that there should be a common system which would be accessible by all parties.

A9.34 These systems may also be required to support a number of different migration scenarios.

- The migration of an existing customer to a home served by next generation access on a new build site
- The migration of services between two different Ethernet ALA users
- In the case of an overlay network, migration from a next generation access service to a legacy service

Service Management

A9.35 There may be a need for a management platform in Ethernet ALA for communications providers to manage their VLAN, quality of service and other functionalities. An ALA user may wish to use these management functions to manage their product end to end with clear demarcation between the upstream and downstream providers, so that these transport paths can be tested independently.

[49] Extensible Markup Language

Current Standards

A9.36 There are already existing standards which could meet some of the requirements of Ethernet ALA. For example the implementation of quality of service in Ethernet has already been set out in IEEE 802.1p and the Broadband Forum are in the process of agreeing the technical standards for multicast, security and Quality of service on GPON in WT-156. Representatives from the MEF[50] and Broadband Forum[51] gave presentations at our Ethernet ALA workshops. The workshops were also attended by members of other standardisation groups.

A9.37 The IEEE and the Broadband Forum have other standards which may also be relevant to the development of Ethernet ALA. IEEE standardised Ethernet in IEEE 802.3 and additional requirements have been specified in IEEE 802.1. Existing Broadband Forum standards for equipment in DSL topology, such as TR-069 and TR-101 could also contribute to Ethernet ALA.

A9.38 Other standardisation bodies also have standards which could be used in Ethernet ALA. Global organisations such as ITU SG15 and MEF have internationally recognised standards, while ETSI and NICC can develop standards which could be used in Europe or the UK.

A9.39 ITU Study Group 15 is working on issues around optical systems for fibre access network (Q2) and customer access in xDSL deployments (Q4). Meanwhile the MEF are defining the network interfaces and different types of services on a metro Ethernet network. Within the home, the HGI are developing the requirements of a residential gateway to enable end to end delivery of services.

A9.40 As Ethernet ALA will be used for wholesale services in the UK, NICC, the UK interoperability standards body, could also be involved in the standardisation of ALA. Similarly, with its European focus, ETSI would also be an appropriate forum for standardisation. The European Commission have also indicated their support for a standardisation of wholesale access.

Next Steps

A9.41 Further discussion may be required on some of these characteristics and requirements for final agreement on the scope of Ethernet ALA. Thereafter the responsibility for the standardisation of Ethernet ALA will be given over to the industry and a standardisation forum.

[50] Metro Ethernet Forum
[51] At the time of the presentation, the organisation was called the DSL Forum. They changed their name to the Broadband Forum shortly after the June workshop.

Annex 9

Glossary

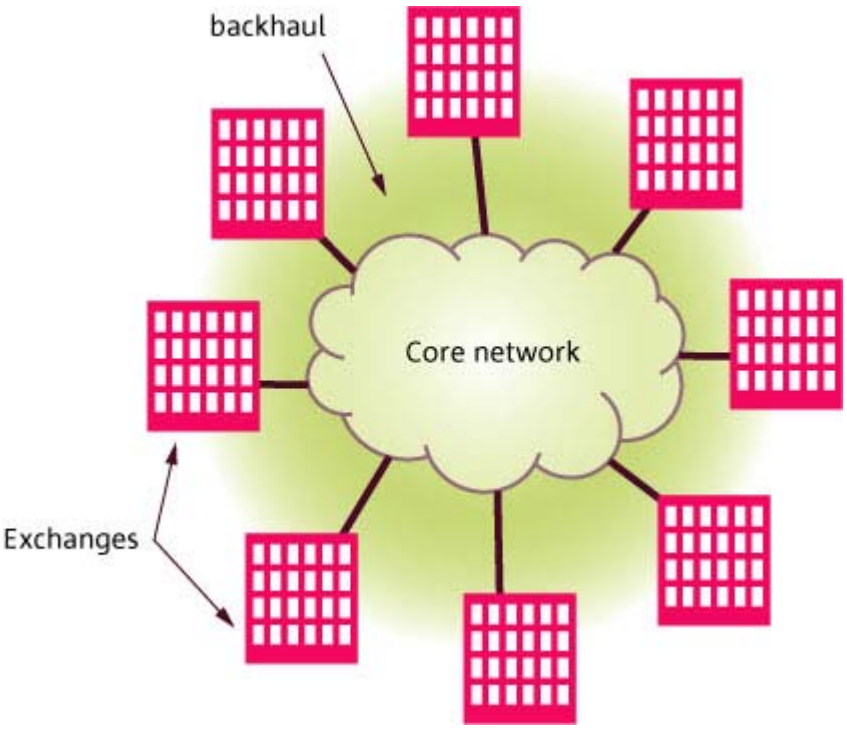
21CN: BT's upgrade of their core network (the backbone of the network).

Access network: The part of the network that connects directly to customers from the local telephone exchange.

Active Access: Wholesale access to the network infrastructure through electronic equipment.

ADSL (Asymmetric Digital Subscriber Line): A technology used for sending data quickly over a conventional copper telephone line. It is used in current internet services with download speeds up to 24Mbit/s.

Backhaul: The middle of the network, this is a high capacity line which links the core network with the access network.



Bandwidth: This is the measure of the how much data can be carried across a link in the network.

Broadband: An internet service which provides high speed access to the internet.

Business Connectivity Market Review: An Ofcom consultation published in January 2008, with a follow-up in July 2008, in which Ofcom set out a number of proposals in relation to the regulatory framework for retail leased lines or business lines in the UK.

Caio Review: An independent review of next generation broadband, led by former Cable and Wireless CEO Francesco Caio.

Communications Providers (CPs): Companies which provide telecommunications networks or services to a customer's home, such as telephone and internet services, and which usually own some infrastructure.

Core Network: The backbone of a communications network, which carries different services such as voice or data around the country.

DOCSIS 3 standard - Data Over Cable Service Interface Specification: The international standards for sending data over a cable network.

Ducts: Existing pipes which hold copper and fibre lines.

Duct Access: When service providers other than the owners of telecommunications ducts can access existing pipes to deliver connections to end customers. In practice, communications providers can pull their own cables through the existing pipes without needing to dig new trenches and lay new ducting.

Downstream/upstream competition and products: Describes the relative positions of different players, or their products, in the supply of broadband. The most 'upstream' provider is the one that sells the most basic product (for example copper or fibre access). Players who are 'downstream' of this are those that buy this basic product, add their own elements (for example their own electronic equipment to the end of copper links). These are often called wholesale providers. Further 'downstream' still are players who buy these 'wholesale' products, add their own branding, billing and customer services, and sell them on to customers. In practice, one company may do all three stages above, either explicitly or implicitly (for example Virgin Media or BT).

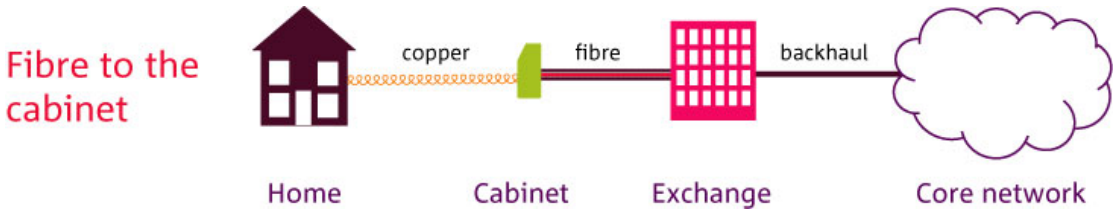
ERG: European Regulators Group of which Ofcom is a member.

Ethernet: A common technology which allows computers on a network to talk to each other.

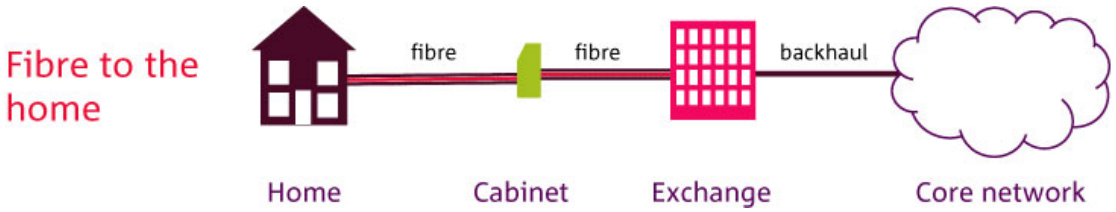
Exchange: A building which houses electronic equipment that connects telephone calls. Backhaul links from a content provider are terminated here to connect access links to end users.

Gigabit Passive Optical Network (GPON): A shared fibre network architecture that can be used for next generation access.

Fibre-to-the-cabinet (FTTC): An access network structure in which the optical fibre extends from the exchange to the cabinet. The street cabinet is usually located only a few hundred metres from the subscriber's premises. The remaining part of the access network from the cabinet to the customer is usually copper wire but could use another technology, such as wireless.

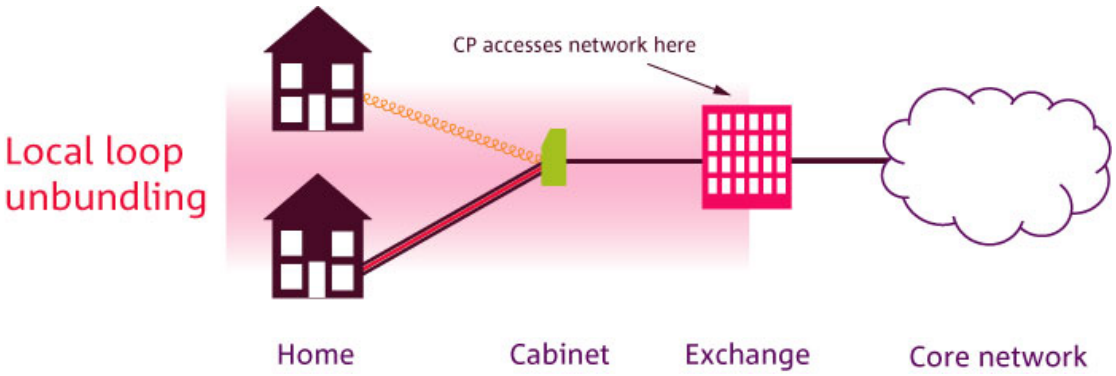


Fibre-to-the-home (FTTH): An access network structure in which the optical fibre runs from the local exchange to the end user's living or office space.



Integrated Services Digital Network (ISDN): A network which allows the digital transmission of voice and data over traditional copper lines.

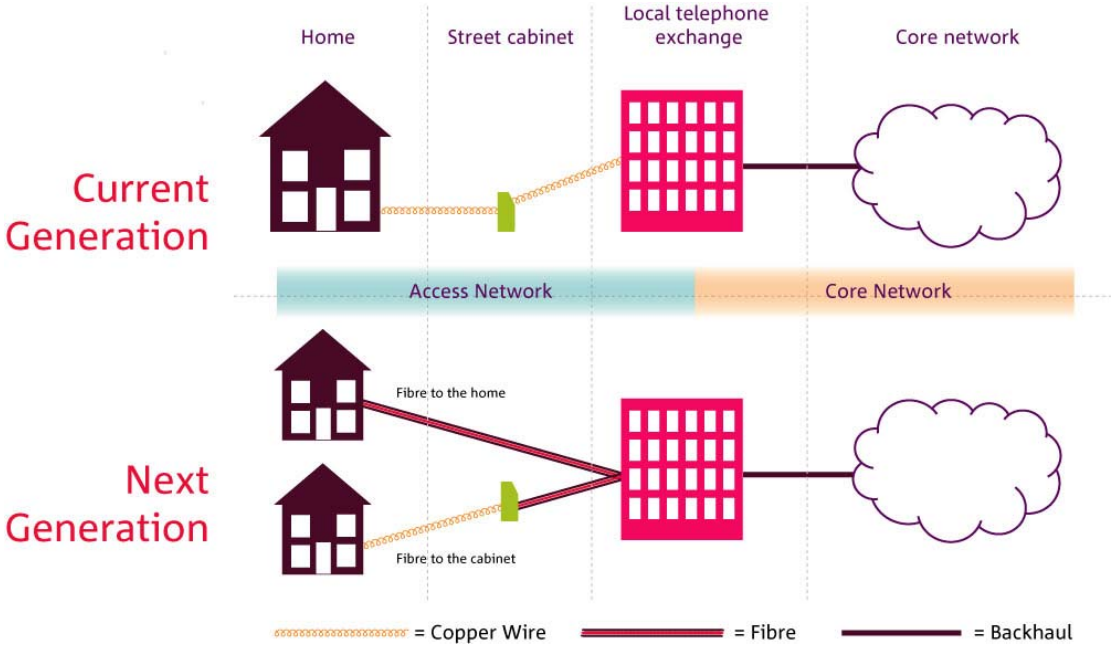
Local Loop Unbundling: When communication providers can gain access to the network by placing their own equipment at the exchange. Communications providers then take control of the line from the local exchange to the customer and the backhaul runs from the local exchange to their own core network.



Narrowband: A service which provides connections up to 56 kilobits per second (or 0.056 megabits per second). This is most commonly used for making phone calls over a copper wire, but was originally used for dial-up internet connections before broadband services took off.

Network neutrality: A way of processing data which does not differentiate between different bits of data when they move through the network, so that all traffic and all services (e.g. voice calls, web browsing, gaming etc) are given equal treatment.

Next Generation Access (next generation access): New or upgraded access networks that will allow substantial improvements in broadband speeds and quality of service compared to today's services. This can be based on a number of technologies including cable, fixed wireless and mobile. Most often used to refer to networks using fibre optic technology.



Next Generation Networks (NGN): An upgrade to the core or "backbone" part of the network to new technologies.

Not-spots: Areas where there is not sufficient broadband access.

NRAs: National Regulatory Authorities, such as Ofcom in the UK.

Openreach Financial Framework: An Ofcom consultation document published in May 2008 which reviews the prices that Openreach can charge other communications providers for its wholesale access products.

Passive Access: Wholesale access products based on direct access to the physical infrastructure of the network (e.g. copper, fibre, duct), without the need to connect to electronic equipment.

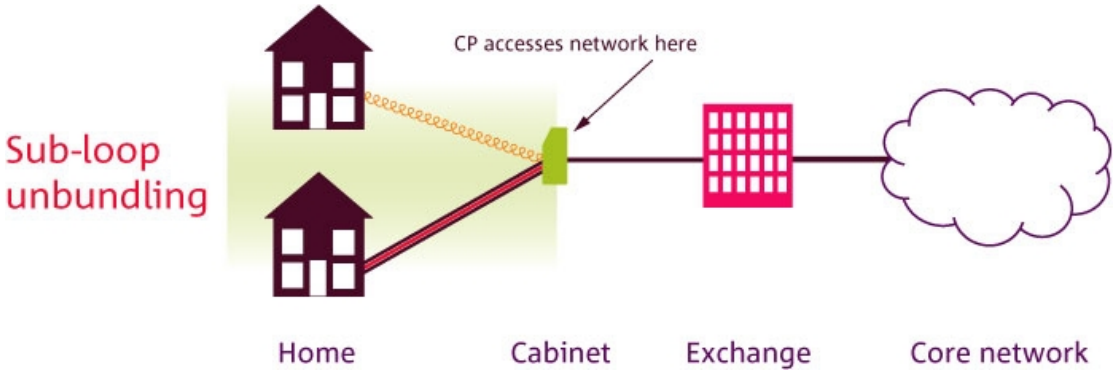
Regional Development Agencies (RDAs): Public bodies which aid regional development in English Government Office regions.

Service providers (SPs): Companies which provide services, such as telephone or internet services, to a customer's home or business.

Splitter: A piece of equipment used in fibre optic technology which splits a beam of light into many optical signals.

Street cabinet: A green box close to your house that connects your telephone line to the exchange.

Sub-loop unbundling: Like local loop unbundling (LLU), except that communications providers interconnect at a point between the exchange and the end user, usually at the cabinet.



Traffic shaping: When certain types of packets are given priority as they pass through the network, or when customers connection speed is managed to take account of the level of demand on the network. This is the opposite of net neutrality.

Universal Service Obligation (USO): BT, along with KCom in Hull, has a duty to provide a basic telephone and narrowband (or dial up) internet service to everyone in the UK.

Upstream/downstream competition and products: Describes the relative positions of different players, or their products, in the supply of broadband. The most 'upstream' provider is the one that sells the most basic product (for example copper or fibre access). Players who are 'downstream' of this are those that buy this basic product, add their own elements (for example their own electronic equipment to the end of copper links). These are often called wholesale providers. Further 'downstream' still are players who buy these 'wholesale' products, add their own branding, billing and customer services, and sell them on to customers. In practice, one company may do all three stages above, either explicitly or implicitly (for example Virgin Media or BT).

VDSL (Very high bitrate DSL): An upgrade to ADSL technology which allows for very fast internet access over copper lines. It is likely to be the technology which will be used in FTTC deployments.

WiFi: Short range wireless technologies that allow an over-the-air connection between a wireless device and a base station, or between two wireless devices. WiFi has a range of over 30 metres indoors, and around a kilometre outside.

WiMAX (the Worldwide Interoperability for Microwave access): A wireless technology, similar to WiFi, but with a longer range which can cover many kilometres. WiMax has been considered as a wireless alternative to fixed access connections to provide high speed access links instead of using copper to properties.