



# Next Generation New Build

Promoting higher speed broadband in new build  
housing developments

## Consultation

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## Section 1

# Executive summary

## New build fibre networks are the first step in next generation access

- 1.1 The move to next generation access networks is one of the most fundamental changes in telecommunications infrastructure since the introduction of competition. Consumers continue to benefit from the broadband services available across the current generation of copper and cable networks. Next generation access networks, discussed in our September 2007 consultation on Future Broadband<sup>1</sup>, offer further opportunities for new services and business models.
- 1.2 Since our September consultation we have seen several announcements of investment in next generation access: Virgin Media, upgrading its cable network; H2O, using sewers to deploy fibre links in small cities; and BT in Ebbsfleet, a new build property development. Ebbsfleet may be the first deployment of fibre in new build but we know there are others planned. Government targets indicate there should be 3 million new properties by 2020 at a rate of approximately 240,000 per year<sup>2</sup> and Openreach has suggested it may deploy fibre to developments greater than 1,000 homes.
- 1.3 New build fibre deployments are an opportunity for providers to trial new services, understand consumer needs and improve their service offer accordingly. We want to encourage these deployments and one important way in which we can do so is by clarifying the regulatory environment. Our Future Broadband consultation set out our strategic approach to next generation access in general. This consultation sets out our proposals for next generation access in new build developments, in order to:
- ensure efficient and timely investment is open to different providers;
  - help providers successfully deliver services, particularly through clear standards;
  - promote competition and protect consumers; and
  - ensure equitable regulatory treatment of providers.

## Ofcom's approach to next generation access in new build housing

- 1.4 Ofcom's approach focuses on enabling providers to invest and compete because we believe competition is the best way of ensuring that the benefits of next generation access are passed on to customers. This view is supported by the UK's experience in current generation broadband: in 2002 UK broadband penetration stood at 7%, and six years later penetration has reached 57%<sup>3</sup>, driven in part by fierce competition from local loop unbundling operators (LLUOs).
- 1.5 This competition is due to investments by a number of market players within the regulatory environment put in place by Ofcom following our Telecommunications

<sup>1</sup> <http://www.ofcom.org.uk/consult/condocs/nga/>

<sup>2</sup> From a base of 165,000 per annum in 2006

<sup>3</sup> The percentage of UK households with a broadband connection according to Ofcom's Communications Tracking Survey, Q4 '07.

Strategic Review<sup>4</sup> (TSR) in 2005. The review came to two main conclusions: firstly that today's wireline access networks are not replicable or open to multiple investors (contestable); and secondly that the deepest point where it is possible to promote effective and sustainable competition is the local loop.

- 1.6 New build networks are different. There are opportunities for investment to be contestable at the point of deployment. However, once new build developments are complete, wireline communication networks may display the same characteristics of an enduring economic bottleneck as does the existing copper access network. There are therefore two ways in which competition can be promoted:
- a) contestable investment at the point of deployment;
  - b) in areas where market power develops, the application of appropriate regulatory obligations including wholesale access remedies.
- 1.7 As well as promoting competition we want to give providers the regulatory clarity they need. These two aims are interlinked: the regulatory environment in new build will be determined by the competitive conditions in place.

### **Promoting contestability in new build deployments**

- 1.8 Ofcom wants investment in new build next generation access (NGA) to be contestable. This is likely to result in more competition and greater benefits to consumers.
- 1.9 Contestability is easiest to achieve when networks are being built: the incremental cost of building two access networks in parallel may not substantially differ from building only one. Even if two networks are not deployed at the same time, laying spare duct could reduce barriers to entry for new wireline access networks after the development is finished. The investment would continue to be contestable.
- 1.10 However contestability is not the same as competition. Even with contestable investment opportunities, there may be other factors which prevent the development of a competitive market and necessitate regulatory intervention to protect the interests of consumers.

### **Promoting competition following deployment**

- 1.11 If there were a number of fibre networks serving individual homes then there might be sufficient infrastructure competition to ensure a competitive market. As a result there might be little need for regulation promoting access to networks to ensure the benefits of competition are available to consumers.
- 1.12 However, if there is only one access network, wholesale access to that network might be required to promote competition in services to consumers. In many cases the infrastructure owner might choose to provide access on commercial terms: in our conversations with investors, many are keen to attract as many service providers as possible to their network and propose 'open access' models to give end-customers the greatest possible choice. They know that if customers can choose from lots of different service providers, they will value the network more.

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<sup>4</sup> [http://www.ofcom.org.uk/consult/condocs/statement\\_tsr/](http://www.ofcom.org.uk/consult/condocs/statement_tsr/)

## Regulatory obligations on new build NGA providers to promote competition

- 1.13 Ofcom would prefer not to impose new regulation on new build network providers, especially given the probable small size of the developments. However, where a competitive market does not develop, it may be necessary to impose ‘*ex ante*’ regulation. Ex-ante regulation is imposed only after conducting a thorough market review and a finding of significant market power in the relevant economic market, which may be defined by geographical boundaries as well as by services.
- 1.14 The form of regulatory intervention would need to be considered on the facts of specific cases. However, it could look like the regulatory environment in Kingston upon Hull, a relatively small area with a dominant provider which is regulated accordingly. In the case of new build, wholesale infrastructure access may be possible through access to passive products, for example unbundling or duct access. If infrastructure access is not appropriate due to technical or other issues, we would be likely to require a form of active line access (ALA). ALA products retain as much as possible of the innovation potential inherent in passive forms of line access, in contrast to existing bitstream services. Their characteristics were discussed in our September consultation and are the subject of ongoing engagement with industry<sup>5</sup>.
- 1.15 The prospect of regulatory obligations following the contestable investment in new build NGA might be considered a disincentive to investment. This should not be the case. The demand for existing telephony and broadband services is known and it is no more risky to provide these services in new build areas than elsewhere: regulation based on the model applying elsewhere should not discourage investments to deliver these services in new build. The situation for the new services that fibre can deliver is different: here there is significant demand risk. Initially then, we will focus our regulatory approach on ensuring that consumers have access to existing regulated services at existing prices. Network operators will benefit from much greater discretion in pricing the new fibre services. We believe this approach gives the right signals for efficient investment while protecting customers. In our publication on Future Broadband later this year, we will further consider the issue of pricing.

## Standards are key to any commercial access model

- 1.16 In today’s access networks, ISPs, and others providing services such as broadband to UK customers, are accustomed to the current range of wholesale access products, often developed in response to regulatory obligations. These include wholesale line rental (WLR), carrier pre-selection (CPS) and local loop unbundling (LLU). Service providers have invested in understanding how to order, manage and sell these products and would have to adapt their internal systems and processes to take advantage of new wholesale products.
- 1.17 While they may be eager to do this for a new market of many millions of customers, a market of a few thousand homes, or even less, is unlikely to justify the investment. New build developments vary in size from a few homes to ten or twenty thousand: all are relatively small and ‘local’ in comparison with the established national network of 26 million homes. This fragmentation may be compounded by different investors making different technology choices, resulting in a patchwork of new build network technologies.
- 1.18 There are two ways to address this issue of wholesale demand. The first is to reduce the investment required by service providers to use the new wholesale products.

<sup>5</sup> See <http://www.ofcom.org.uk/consult/condocs/nga/ethernetala/>

This can be achieved by reducing their cost or by minimising the difference between the new products and the old ones; for example, by replicating some or all of the features of the existing products. The second way is to increase the size of the addressable market beyond the number of houses in any one development. This would be possible if different housing developments could be served by the same wholesale access product.

- 1.19 Both of these responses would be supported by the development of common standards. Standardisation makes it easier for service providers to deliver service across different housing developments. Standardisation also helps to reduce the costs of network deployment: standardised network equipment is cheaper.
- 1.20 Given the critical role of standards in making access to new build developments commercially attractive, Ofcom believes it would be highly desirable for an appropriate industry body to take on the challenge of standardising wholesale access and seeks views as to which body would be most suitable. We strongly believe that the industry is better placed to set standards than the regulator but we also seek views as to what action Ofcom should take if the appropriate standards fail to materialise.

### **Protecting consumers from potential harm**

- 1.21 Next generation access offers new possibilities for service innovation. It may also potentially weaken some of the existing protection for consumers.
- 1.22 In copper networks, the line is powered from the exchange so that it continues to be active if there is a power cut in the home, enabling ongoing access to emergency services. In general, fibre networks do not support line power, so the line will fail if the consumer premises power fails. Our recent statement on Emergency Access for VoIP Networks<sup>6</sup> set out certain requirements on publicly available telephony service (PATS) providers; for new build we propose that the relevant General Condition can be interpreted as being met through the provision of a battery backup facility. This facility will provide power to the consumer's terminal equipment in the event that the domestic power supply is unavailable and therefore maintain continued access to emergency services.
- 1.23 Existing consumer protection provisions continue to apply including the Universal Service Obligation (USO), which ensures access to basic voice telephony services at uniform prices across the UK. The USO currently applies to BT and KCOM in Kingston.

### **Existing obligations to promote competition**

- 1.24 BT (and KCOM in Hull) is subject to regulatory obligations as a result of findings of significant market power (SMP) in a number of markets. These obligations have resulted in wholesale access products such as WLR which enables communications providers to control the voice part of the line and CPS which allows consumers to choose which communications providers handle their voice calls. CPS and WLR have been very successful in promoting competition; for example over three hundred service providers deliver services using BT's CPS product.
- 1.25 As we outlined in our Future Broadband consultation, next generation access services are likely to fall within existing market definitions for wholesale local and

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<sup>6</sup> <http://www.ofcom.org.uk/consult/condocs/voip/voipstatement/>

wholesale broadband access, at least initially. If there is no competition in these markets following deployment, and if BT (or KCOM in Hull) is the only network operator, then the regulatory obligations it currently faces are well placed to address competitive concerns. We believe it would be premature to remove the existing obligations in advance of deployment. If a competitive market arises we can deregulate accordingly.

1.26 The LLU obligation currently applies to a 'metallic path' only: copper. In fibre new build there is no copper network and therefore copper unbundling is not possible. We believe it would not be proportionate to require a copper network to be built out solely in order to enable copper unbundling in new build fibre areas. This increases the importance of the other wholesale access products which are available.

1.27 While wholesale access products such as CPS and WLR help promote competitive provision of retail services they also largely define those services. They do not enable communications providers to innovate in the way that an active line access product would. The right type of ALA product could also meet some of the existing regulatory obligations, such as the control of voice calls currently provided by WLR. However this might not be enough to attract communications providers if it did not also replicate the exact functionality of the existing product. It makes sense for the new services to offer communications providers and consumers user experiences as close as possible to those of existing products; in this consultation Ofcom seeks views as to the extent to which it is also necessary to replicate existing functionality. The relevant obligations and our proposals are summarised below:

- **Passive access:** *Wholesale local access (WLA) market:* Local loop unbundling is an obligation to address SMP in this market. Where fibre is rolled out as part of a new build development we propose that the LLU obligation is not to be read as requiring the installation of a parallel copper network.
- **Broadband access:** *Wholesale broadband access (WBA) market:* The competitive state of the products upon which WBA services are based would drive the need for regulation. If these upstream products are not in a competitive market, we would want to ensure a suitable WBA product was made available, which could, for example, be based on an ALA-type product.
- **Voice access:** *Wholesale exchange line services markets and call origination market:* A number of obligations are in place to address SMP in these markets, including wholesale line rental (WLR), carrier pre-selection (CPS) and indirect access (IA). The obligation continues to apply in all cases. Ofcom seeks views as to whether, in each case, the obligation must be met by the replication of the existing wholesale products or whether it is possible to meet it in an alternative way, for example by the provision of an ALA-type product.

### There may be other ways to promote competition

1.28 One of the major barriers to fibre rollout is the cost of the civil infrastructure. The proposals for the revised European Framework strengthen the references to duct access as a remedy and many other national regulatory authorities are consulting on duct access. Ofcom recognises the many challenges involved in securely sharing the duct network, but believes they may be more easily overcome in new build. We have conducted a review of international best practice in telecoms infrastructure sharing and the results are included in this consultation. We seek views on the feasibility and attractiveness of duct sharing in new build.



## This consultation

- 1.29 This consultation aims to clarify the regulatory environment that will exist for next generation access network deployments in new build developments, so that potential investors in this market can make informed decisions. We strongly encourage all industry players to work together to develop appropriate standards to ensure the commercial success of wholesale access in new build, and will actively monitor progress in this area. Additionally:

BT (and KCOM in Hull) must continue to meet existing regulatory obligations for existing products. It is proposed that the LLU obligation is not be read as requiring the roll out of a parallel copper network in new build areas. Fibre based products should offer communications providers and consumers user experiences which are as close as possible to those of existing copper based products. Pricing of existing products should be similar in both copper and fibre deployments.

Other potential new build NGA providers should make the investment in a way that enables competition through wholesale access products which support innovation as well as meeting existing requirements.

- 1.30 We have emphasised the significance of new build next generation access deployments in paving the way for the next generation of communications services to meet the needs of citizens and consumers. Ofcom believes it is important that as wide a range of stakeholders as possible, including communications providers, housing developers and local authorities, actively participate in this debate and share their views. To this end we have a number of specific questions for consideration:

*Question 1: What can Ofcom do to encourage timely standards development for new build NGA wholesale access products and interfaces? Which industry body is best placed to undertake the standardisation of these products and interfaces? What action should Ofcom take if these standards fail to materialise?*

*Question 2: Do you agree with Ofcom's approach to promoting competition and consumer choice in new build fibre access deployments?*

*Question 3: Do you*

*(a) believe that the existing obligations must be met by replicating the existing copper products, or that an alternative approach could be satisfactory? What are the implications of replicating existing products on fibre?*

*(b): agree that SMP holders rolling out fibre do not need to roll out a copper network in parallel solely to meet their LLU obligation?*

*(c): agree with Ofcom's approach in relation to WBA and new build areas?*

*(d): believe that the WLR obligation must be met by replicating the existing copper product, or that an alternative approach based on an ALA type product would be satisfactory?*

*(e): believe that the CPS obligation must be met by replicating the existing copper product or that an alternative approach based on an ALA type product would be satisfactory?*

*(f): believe that the IA obligation must be met by replicating the existing copper product or that an alternative approach based on an ALA type product would be satisfactory?*

*(g): agree with our proposal to interpret GC 3.1 (c) as being met through the provision and use of a battery backup facility to maintain uninterrupted access to emergency services in new build developments?*

*Question 4: Do you think access to the duct network, including non telecoms duct, is a potentially feasible means of promoting competition in new build? If so what types of commercial and operational models could successfully support such access arrangements in the UK?*

## Section 2

# Background and context

## Introduction

- 2.1 In Ofcom's September 2007 consultation '*Future Broadband - Policy approach to next generation access*'<sup>7</sup>, we discussed the current level of competition in broadband supply and proposed options for incentivising investment and promoting competition in the next generation of access networks that are required to deliver substantially higher broadband speeds. We recognised that in the UK the first examples of next generation access ('NGA') networks were likely to be deployed as part of new housing developments and described one such prospective deployment - Ebbsfleet - in some detail. These early deployments are to be welcomed as they will bring with them the opportunity to observe the benefits of new, faster, broadband services. Although advances in technology are allowing increasing bandwidths to be delivered over current generation networks, the continuing development of high speed services, for example broadband-delivered high definition video, may mean that these networks will be unable to meet future demand. New build deployments will provide an important opportunity for communications providers ('CPs') and those deploying infrastructure to pilot new technologies, as well as business and operational models. To ensure that these deployments are as successful as possible, we believe it is important to provide clarity as to the regulatory environment.
- 2.2 While our September 2007 consultation set out broad proposals for a strategic approach to NGA, stakeholders in new build deployments would benefit from more detailed proposals regarding the regulation of these new networks in the short and medium term. We therefore undertook to consult specifically on regulatory approaches to new build. This consultation considers the requirements of new build developments, the challenges for regulation, and recommends specific proposals which are intended to promote efficient investment in new build next generation services while helping to ensure that the benefits of these new services are passed on to consumers. In this section we define what we mean by new build, why it is important and what is in the scope of the consultation.

## What is next generation access?

- 2.3 Since our Telecommunications Strategic Review<sup>8</sup> (TSR) in 2005, we have seen significant evolution in broadband services based on the existing infrastructure and this evolution is far from complete. As described in our Future Broadband consultation, the desire for operators to offer ever faster speeds, and for customers to purchase them, shows no sign of slowing. New high speed services, such as high definition video, will place increasing demands on current networks. We are already seeing some upgrades to current cable networks, and they continue to offer the opportunity to deliver very high bandwidths to end customers. There is also no doubt that upgrades to copper based broadband networks will continue, enabling the delivery of faster broadband speeds to consumers. However, there is likely to be a point beyond which today's access networks will no longer be able to fulfil consumers' increasing speed and coverage requirements. NGA networks are designed to overcome these limitations. Typically, for wireline access networks, NGA

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<sup>7</sup> <http://www.ofcom.org.uk/consult/condocs/nga/>

<sup>8</sup> [http://www.ofcom.org.uk/consult/condocs/statement\\_tsr/](http://www.ofcom.org.uk/consult/condocs/statement_tsr/)

will involve the installation of fibre cables for at least part of the route between the exchange and the home as discussed below.

- 2.4 Next generation access is an important subject for Ofcom. There is increasing evidence that current generation broadband services are contributing to both social and economic welfare. NGA network deployments may in time offer further scope for development, innovation and economic gain. They could facilitate the development of new products and services that in turn may further drive competitiveness and productivity. These prospects have made NGA a topic of increasing debate in the past 12 months. In other countries, such as France and the United States, deployment of NGA has started: as set out in our Future Broadband consultation, there are a number of reasons why current generation broadband may continue to meet the needs of consumers in the UK for longer than in other countries. Nevertheless, there is general consensus that at some point current generation access networks will run out of steam. Therefore the deployment of NGA networks has the potential to be very good for consumers. We are keen to see investment take place at the right time and in an efficient manner and to remove any unnecessary regulatory barriers which might delay this investment. One important part of achieving this is to clearly set out the practical options for the regulation of these new networks in the context of a consistent policy framework. This is the aim of our ongoing workstream on Future Broadband which later this year, should result in a further publication commenting on the consultation and exploring new issues.

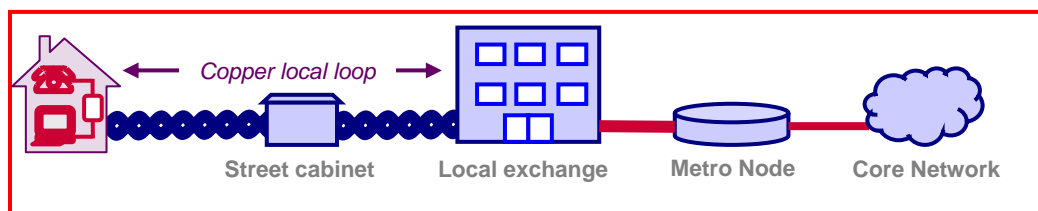
### **New build deployment**

- 2.5 In 2006, the UK government announced a target of 2 million new build homes by 2016: a revised target of 3 million new homes by 2020 was announced in 2007. Today, it is estimated that around 246,000 new residential and business premises are being built each year. New build housing will therefore account for up to 8% of the total housing stock by 2016. These new build developments will vary considerably in scale from a few units in one street to new villages and even perhaps towns. Where developments are in existing urban areas, existing utility infrastructure is likely to be used: these are often referred to as brownfield deployments. Where there is no existing utility infrastructure then new infrastructure – ducting and trenching for example – will need to be laid. In these cases, new telecoms infrastructure will be deployed. For the purposes of this consultation, new build deployment refers to the deployment of new telecoms infrastructure generally, though not exclusively, for the purposes of new housing developments and in areas where no infrastructure yet exists?
- 2.6 New build deployment (or ‘new build’) is important because the costs to lay fibre are much less here than elsewhere. This is because all the ‘utility’ infrastructure – telecoms, gas, water, electricity etc – must be rolled out at the same time and the costs of digging and trenching – up to 80% of estimated fibre rollout costs – are reduced and shared between many services. Therefore the incremental cost of fibre is dramatically reduced. In fact, once the costs of digging are no longer a factor, fibre may be cheaper than copper in some circumstances and one of the key economic barriers to NGA deployment will be removed or significantly decreased. From informal conversations with housing developers we understand that they are increasingly looking to fibre deployment in order to ‘future proof’ their communications infrastructure.
- 2.7 The deployment of fibre in new build may take place in different ways. Traditionally, telecoms infrastructure has been owned by BT and the cable companies, but this may change for new build. Sometimes the housing developer will lay the basic duct

infrastructure and then look to a network operator or technology partner to lay the fibre and run the network. In other deployments, the developer may choose to lay the duct and build and operate the fibre network themselves. This is likely to result in electronic communication services being provided by new entrants to the market who may not be familiar with the existing regulatory framework. The business models may also differ with investment being recouped through wholesale service provision, or in charges directly levied against the householder. These new business models will give rise to different commercial incentives and drivers compared to the incumbent's deployment of copper over many years.

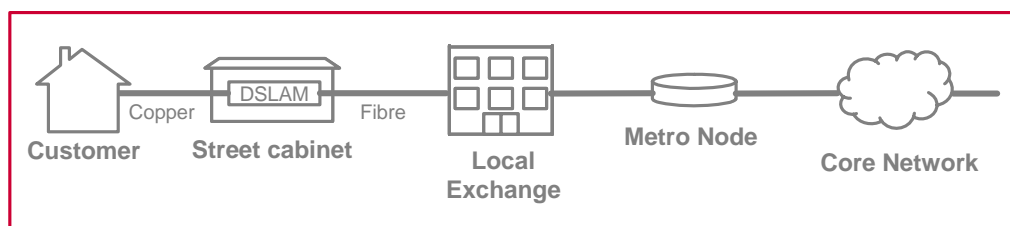
### Difference between new build and existing telecoms infrastructure

2.8 Existing telecoms infrastructure is almost exclusively based on copper lines from the exchange to cabinets and on to the home: there is a direct and in general dedicated connection between each home and the exchange as illustrated in Figure 1 below. At the exchange, the traffic on these copper lines is aggregated onto shared backhaul and routed around the network. The copper lines to the home also carry electrical power, enabling traditional telephones to operate without the need for a separate power supply.



**Figure 1: Typical current infrastructure**

2.9 Where operators wish to use as much as possible of the existing infrastructure while delivering substantially higher bandwidth services, this can be achieved through the deployment of fibre to the cabinet ('FTTC'), while retaining the copper 'sub-loop', as illustrated in Figure 2. We are seeing FTTC deployments in the US as well as Germany and Holland.



**Figure 2: Fibre-to-the-cabinet (FTTC)**

2.10 In a FTTC next generation access deployment, active electronics are installed within the street cabinet, which is connected to the exchange with a fibre link. The existing copper sub-loop from the cabinet to the subscriber premises is retained. This shorter portion of copper loop, compared to exchange-based Digital Subscriber Line ('DSL') broadband, allows higher bandwidths to end customers. Depending on deployment choices, speeds of up to 100Mbit/s can be achieved. However, as with other copper based DSL deployments, actual performance will vary according to the length and quality of the copper loop being used.

2.11 Current generation cable networks use a similar architecture to this for the delivery of broadband and TV services. However, rather than using individual pairs of twisted

copper wire and DSL to connect to each house, they use a shared co-axial arrangement.

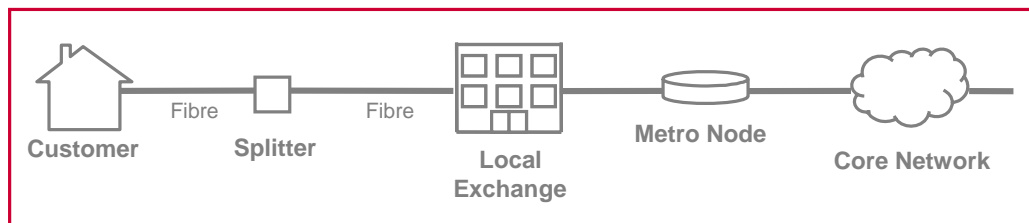
2.12 In new build deployments there is no pre-existing copper, so fibre may be deployed all the way to the home. These deployments may be based on different technologies and architectures: these are described in overview in the next section. What they have in common is the use of fibre optic cable to carry the voice and/or data traffic between the home and the exchange or another point of aggregation. The most significant differences between fibre optic cable and copper are summarised in Table 1 below.

Characteristic	Copper	Fibre optics
<b>Capacity</b>	The capacity of copper depends on the modulation employed and the length of the line, typically the upper limit is between 8 and 24 Mbit/s, and more for sub-loops. It decreases as line length increases.	The capacity of fibre optics depends on the modulation and architecture employed but ranges from 10Mbit/s to virtually unlimited
<b>Impact of distance</b>	The bandwidth performance of copper decays significantly with distance	Fibre optics delivers consistent bandwidth up to 20km and potentially beyond
<b>Line powering</b>	Copper supports line powering easily	Line powering is generally considered impractical over fibre

**Table 1: Difference between fibre optic and copper technology**

**Different technologies and architectures used in FTTH deployments**

2.13 Fibre-to-the-Home ('FTTH') deployments involve the complete replacement of copper loops with fibre all the way to the customer's premises as shown in outline in Figure 3 below.



**Figure 3: Fibre-to-the-home (FTTH)**

2.14 There are a number of technologies to deliver FTTH, but the most basic distinction is between point-to-point technologies and shared infrastructure technologies. The most prevalent shared infrastructure technology is a passive optical network (PON):

- In a PON a single fibre from the exchange serves multiple customers, by having its capacity divided or 'split' (typically to 32 customers in current systems), into to separate fibres for the final drop. Sharing the capacity equally (which can be up to 2.5Gbit/s for a 'Gigabit PON' (GPON) system), each customer will receive around 80Mbit/s; however much higher peak speeds can be achieved.
- In point-to-point ('PtP') fibre each consumer has a dedicated fibre connection from the exchange to their premises. This architecture allows virtually limitless access speeds to be offered.

- 2.15 Across Europe and the world both shared and PtP deployments are underway, although in general most incumbents are choosing to deploy variants of PON networks, such as GPON, while new entrants may be more likely to deploy PtP fibre. The choice between infrastructure based on PtP or PON has significant consequences for the number of fibres that need to be laid: PON requires significantly fewer fibres than to an equivalent PtP fibre roll-out. In its recent consultation on Ebbsfleet, BT Group outlined its view that PON architecture is a more cost effective technology for new build deployments, mainly because of the significant savings in fibre and associated space and power in the exchange. Its intention is therefore to deploy PON-based FTTH networks to new build developments. Elsewhere, some investors continue to consider the options provided by PtP fibre. The technology options for FTTH deployments are considered in more detail in Annex 6.
- 2.16 Technology selection raises implications for regulation, both in terms of the promotion of competition and for existing regulation: for example, it is more difficult to unbundle a PON architecture than a PtP architecture. Investors in new build require clarity on regulatory requirements to assess whether their technology choice enables them to meet their obligations. As we outlined in our consultation on Future Broadband, we do not believe it is Ofcom's role to recommend any one technology architecture over another. However, we do feel it is important that the selection of technology should be an issue for broad industry discussion and debate in advance of deployment, and we welcome Openreach's intention to consult on its choice of technology choice and the implications.

### **Industry activity**

- 2.17 As indicated we believe this is the right time to consult on new build because of the extent of proposed new build activity, including Ebbsfleet, Wembley City and Titanic Docks.
- 2.18 Openreach has indicated that it is considering the option of deploying fibre infrastructure to new build sites which are of a suitable size and location. It is currently reviewing the selection criteria which might apply. Openreach currently provides new network infrastructure to approximately 20,000 new homes per month, and has indicated that a large proportion of such developments may be suitable for fibre deployment. Housing developments take place over a long life cycle; for example, Ebbsfleet is expected to be rolled out over ten years. It is therefore likely that many developers will actively consider fibre to the home deployments.

### **This consultation**

- 2.19 In the next section of this consultation we set out our regulatory approach and principles as relevant to NGA generally and new build specifically. We then go on to consider in some detail the extent of consumer choice in new build developments and how this can be optimised. In Section 5, we consider how existing regulation may need to evolve in order to continue promoting competition and we propose specific policy options where regulation may need to change or be superseded. Finally, we describe the next steps and related work.
- 2.20 NGA and some related services are the subject of a number of on-going consultations both by Ofcom and by others within the industry, such as Openreach. Our new build consultation is limited in scope to those issues directly raised by new build:



- new build and legacy regulation; and
- options for the promotion of competition in new build.

2.21 As set out in our September consultation, more general issues raised by NGA will be considered as part of the relevant market reviews on the basis of the strategy and principles developed as part of the Future Broadband consultation. Relevant market reviews and consultations include:

- wholesale broadband access market review;
- wholesale local access market review;
- business connectivity market review; and
- regulation of VoIP services: access to emergency services.

2.22 In November 2006, Ofcom issued guidance on new build<sup>9</sup>. Since then we have made further progress in understanding the requirements of new build developers. This consultation does not supersede the guidance but should complement it.

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<sup>9</sup> <http://www.ofcom.org.uk/telecoms/ioi/orp/fibreaccess/>



## Section 3

# Ofcom's regulatory approach

## Ofcom's primary duty is to further consumer and citizen interests

3.1 Ofcom's principal duties are set out in section 3(1) of the Communications Act 2003:

- 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.

3.2 In addition, we have a number of statutory duties and powers relevant to NGA deployments. Amongst other things, Ofcom:

- is required to secure the availability throughout the UK of a wide range of electronic communications services<sup>10</sup>;
- must have regard to the desirability of encouraging investment and innovation in relevant markets<sup>11</sup>; and
- must have regard to the desirability of encouraging the availability and use of high speed data transfer services throughout the United Kingdom<sup>12</sup>.

## We believe our Future Broadband principles apply to new build

3.3 In our Future Broadband consultation, we outlined our proposed approach to enabling the conditions for efficient investment in NGA networks. This approach is based on our duties and the regulatory principles outlined in our Strategic Review of Telecoms adapted to reflect the differing characteristics of NGA investments compared to current generation access networks. We believe these principles apply equally to new build roll out of fibre access networks:

- contestability*: an investment is contestable when it can be made by more than one potential investor. We think that timely and efficient investment is more likely to be achieved if the investment is contestable, allowing any operator who considers there to be a business case for deploying next generation access infrastructure, to invest as soon as they wish. We believe new build next generation access is potentially contestable and are already seeing announcements of deployment from providers including, but not limited to, BT;
- maximising the potential for *innovation*: we believe that scope for innovation and differentiation is essential for competition in next generation access, and that infrastructure ownership enables maximum innovation; where this is not practical, other forms of access should give as much control of the underlying infrastructure as possible to maximise the potential for innovation;
- equivalence*: strong competition in current generation broadband has been helped by ensuring that all operators are able to buy exactly the same wholesale

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<sup>10</sup> Communications Act 2003, Section 3(2)(b)

<sup>11</sup> Communications Act 2003, Section 3(4)(d)

<sup>12</sup> Communications Act 2003, Section 3(4)(e)

products, with the same processes and at the same price, as operators with SMP. We propose to apply this principle to NGA, supported by approaches such as functional separation, which are essential to reduce incentives for anti-competitive behaviour while retaining incentives for efficient investment. If the new build telecoms infrastructure becomes a bottleneck asset – ie one that cannot be replicated - then access to that asset should be provided on equivalent terms between competing providers and the asset owner's downstream divisions;

- iv) *reflecting risk* in returns: we recognise that anyone who makes investments in NGA is likely to face significant commercial risks. Any regulation of a bottleneck asset should reflect the risks the investor faced at the point of investment in order to provide appropriate incentives for investment in the first place. This could be achieved through approaches including anchor product regulation and risk-adjusted return; and
- v) *regulatory certainty*: the regulatory regime should be clear and in place for a reasonable period of time to allow investors the clarity that they need to invest with confidence.

### Competition is a key enabler of consumer benefit

- 3.4 Our experience with current generation broadband has shown that competition is one of the most significant ways in which the benefits of service and price innovation can be passed on to customers. In 2002 UK broadband penetration stood at 7%. Six years later penetration has reached 57%<sup>13</sup> driven, in part, by fierce competition between local loop unbundlers such as Carphone Warehouse and Sky. In our Wholesale Broadband Market Review<sup>14</sup> we identified geographic areas where we now believe there is effective competition in broadband delivery.
- 3.5 As a regulator one of Ofcom's key objectives is to enable a market which is effectively competitive; this minimises the need for regulatory intervention and helps ensure the benefits of competition are passed on to consumers. Whether there is effective competition is usually assessed in a market review. The first step in such a market review is the definition of the relevant market, both in terms of services and geographical areas. As we outlined in our Future Broadband consultation, next generation access services are likely to fall within existing market definitions for wholesale local and wholesale broadband access, until such time as we see compelling evidence that there is a break in the chain of substitution between existing broadband services and those available only over next generation access. Below we discuss how a new build market might be defined in relation to geographic areas keeping in mind the distinction between competition and contestability.
- 3.6 Competition is effective if customers have an actual choice between competing suppliers. This is different from the idea of contestability, where there may be only one player and the prospect of investment by another player is thought to act as a constraint on its behaviour: it is less likely to raise prices if it suspects this will lead to entry into the market by another operator. The constraining effect of potential entry is in large part determined by how easy that entry would be, and so how responsive entrants would be to high prices set by the incumbent. Clearly this threat is less credible if market entry requires digging up the streets, for example. However, if sub-ducting is laid at the time the development is built, for example, the cost of

<sup>13</sup> The percentage of UK households with a broadband connection according to Ofcom's Communications Tracking Survey, Q4 '07.

<sup>14</sup> <http://www.ofcom.org.uk/consult/condocs/wbamr07/>

another player laying new fibre may be relatively low and the threat of market entry more real. It is for this reason that Ofcom seeks to encourage contestability.

- 3.7 The existence of duct on its own is unlikely to be sufficient to make potential entry so likely that the constraining effects of that potential entry would be equivalent to the constraints under effective competition. There may be other barriers to market entry - customer equipment for example - which mean that entry would not take place, and the incumbent's behaviour would be far from fully constrained. There is therefore a difference between the likely constraining effect of a degree of contestability and that under effective competition. Nevertheless there are potential benefits from making new entry as feasible as possible, both from the possibility of actual entry and its constraining effect even if it remains only potential.
- 3.8 It could be argued that removing one of the greatest barrier to deployment – civil works – makes market entry so likely that we can regard the market as being so contestable that the actions of any single supplier are as constrained as they would be by effective competition. This might lead to the conclusion that the regulator should not intervene, but allow the market to correct any short term concerns. Ofcom recognises this point but we feel that our duty to protect consumer interests means that we cannot base our policy proposals solely on such an argument.
- 3.9 Ofcom encourages contestability in new build deployments and the laying of spare duct or requiring ongoing duct access is a good way to achieve this. However, it would be wrong to conclude that the existence of duct capacity of itself will make the market fully contestable or will allow the constraining effects of competition to be replicated through the threat of competitive entry. There may be other factors which prevent the development of a competitive market and require regulatory intervention.

### Geographic markets in new build

- 3.10 In November 2007, Ofcom published a consultation following our review of the wholesale broadband access market in which we proposed to define sub-national markets on the basis of identifying geographic areas where similar competitive conditions apply. This approach was later endorsed by the European Commission. In this section we consider the relevance of geographic markets to new build without prejudice to any future market reviews, should one be initiated. Our aim is to offer further guidance on how the current regulatory framework might potentially apply in new build.
- 3.11 The new communications infrastructure in an area of new build might be installed by BT or by another communications provider. In either case, as part of the overall process of assessing regulatory requirements, the question arises as to whether the new build area should be considered to be a separate geographic market or to be part of a broader, perhaps national, market.
- 3.12 In the case of new build conducted by BT, a technology neutral approach to the question would suggest that, where the products are in the same market, the new build area should be regarded as part of the national market within which BT operates. Universal Service requirements might lead to basic voice and data services being subject to a pricing constraint that was common across the existing national market and the new build area. The only differences between the new build area and other areas would be the of timing of the build and the technology used. This seems to suggest a national market which included the new build area could be defined.

- 3.13 If, however, our market analysis led to the identification of a local market and BT, or any other operator, as the sole infrastructure provider, was found to have 100% of the customer connections, there would be a presumption that the relevant operator was a dominant provider in this market. If, as a result of such analysis, an operator was found to have SMP in a local market, it would be Ofcom's duty to consider the imposition of appropriate remedies. It is likely that it would be appropriate to apply the same or a very similar approach to remedies in the local new build area as is applied to BT's existing access network in the rest of the country.
- 3.14 One possible scenario could be a number of infrastructure owners who each operate only in one new build area. Each of these areas might be regarded as local markets. However, it is also possible that the relevant market could be regional in nature because of a common pricing constraint between the area in question and other existing or new build areas. For example, a cable operator might construct the network in the new build area and then adopt a uniform pricing policy with respect to that area or a CP might roll out infrastructure in a number of separate new build areas and operate a common approach across these areas. Both would create a regional market consisting of a patchwork of areas connected by a common pricing constraint.
- 3.15 Under many potential scenarios, it is likely that the operator of the new build network would have 100% share of the relevant market, and so may be presumed to have SMP. As set out in Section 4 of this consultation, Ofcom believes that it is desirable for consumers in new build areas to be able to enjoy the same choice and variety of services as consumers elsewhere, as far as is reasonably possible. Under the regulatory framework where SMP is found, Ofcom would have the power to impose appropriate remedies on a local network operator in order to help to achieve that objective. However, it is possible that this would constitute an excessively complicated and burdensome approach to regulation, given that there could be a large number of small operators who had SMP in very limited geographic areas. Furthermore, it is possible that the dominant provider in a new build area might be willing to follow the spirit of existing remedies. If this were so, there might be no need to impose formal regulation on the dominant provider, as an informal approach could be sufficient to secure the necessary customer benefits and to promote competition. However, the dominant provider might be otherwise minded and Ofcom wishes to make clear that we would not regard the lack of wholesale access products in a new build area as an acceptable situation. If this turned out to be the case, Ofcom would have to consider the use of its formal powers under the regulatory framework and the Communications Act. Ofcom also reserves the option of using its powers under the Competition Act to address the situation.

#### Approach to existing regulatory obligations

- 3.16 As stated previously, Ofcom wishes to see new build investment open to as many players as possible, and considers regulatory clarity and equitable treatment an important part of achieving this. Ofcom also wishes to see consumers continue to benefit from the competitive provision of services. BT and KCOM may consider that their existing regulatory obligations place them at a disadvantage in comparison to new investors who have no such obligations at the point of deployment. After consideration Ofcom has come to the conclusion that it would not be appropriate to remove the existing regulatory obligations. This is for two main reasons.
- 3.17 The first reason is one of principle. The aim of these obligations is to enable a competitive market downstream of the obligation. It is possible that the relevant upstream inputs may be provided competitively, either through multiple networks or

open access to a single network. If this is the case we can deregulate accordingly. If a competitive market does not develop the existing obligations are designed to address this lack of competition and we have seen that they are well placed to do so. The obligations have resulted in products such as wholesale line rental (WLR), which enables CPs to control the voice part of the line, and carrier pre-selection (CPS) which allows consumers to choose which CP handles their voice calls. CPS and WLR have been very successful in promoting competition; for example, over three hundred service providers deliver services using BT's CPS product. Rather than expose consumers to an absence of competition in order to re-impose the existing regulatory framework, it makes sense to leave it in place.

- 3.18 The second reason is practical. Removing the existing regulatory obligations would require a market review resulting in a finding of no SMP. A market review before deployment had taken place would not show any change in the market conditions. A market review after deployment has taken place would put BT (and KCOM in Hull) in a similar position to other infrastructure investors, who may be subject to market review following deployment.
- 3.19 It is, therefore, our view that in relation to new build the existing obligations should remain in place. It is up to BT (and KCOM in Hull) to set out how it proposes to meet its obligations in new build areas. In general such obligations include the requirement to supply a certain type of product but do not specify how the product should be implemented. Sometimes they do include a functional specification – for example for CPS – which seeks to be technology neutral. Ofcom is keen to avoid the replication of existing products in new technology to meet regulatory obligations if they can be better met in alternative ways. However it is desirable that the new fibre based products offer the same consumer and CP experience as the existing copper based products. This would make it easier for consumers and CPs to migrate from the copper products to the fibre ones.
- 3.20 There is a trade off between the costs of replicating and maintaining legacy products in new build next generation access and the costs of communications providers and potentially end customers adapting to new products. In Section 5 we consider this in more detail and seek views on the extent to which replication of the existing regulated products is necessary to meet the existing regulatory obligations.

## Section 4

# Promoting consumer choice

## NGA will bring real benefits to consumers

- 4.1 Next generation access networks bring improved functionality to consumers including:
- higher peak bandwidth;
  - higher sustained bandwidth;
  - greater symmetry of upstream and downstream capacity; and
  - assured quality of service.
- 4.2 This means that, alongside existing services, NGA consumers should be able to access a wide range of new services as they are developed. Some of these are expected to be higher speed versions of today's services, such as high definition television on demand. However, it is widely expected that innovative new services will be developed to take advantage of the capabilities of the networks. These services are much harder to predict, but there are many exciting possibilities in areas including entertainment, education and health care. All this brings the potential for excellent outcomes for consumers. Indeed, this promise of cutting edge new services is part of the reason why housing developers are keen to have NGA networks available to their new homes.
- 4.3 Ofcom will seek to ensure choice for all consumers of next generation access services. However, we believe that those living in new build areas need particular attention. For a number of reasons, there is a risk they will have less choice in their service provider and, as a result, the range, quality and competitiveness of the services may be lower. Ofcom has a duty to do all we can to guard against this outcome.
- 4.4 The availability of choice is directly related to the level of competition in the market. In this section we consider how infrastructure and service based competition may arise, and the implications for the consumer of each.

## Promoting competition in infrastructure ownership

- 4.5 As set out in Section 3, Ofcom's approach to next generation access is based on a number of principles, one of which is the promotion of contestability. By this we mean that the investment in NGA should be open to as many different potential investors as possible. We believe that the investment in new build next generation access is potentially contestable. As described in more detail in Section 6, the barriers to investment are lower than for more general NGA investment: the incremental cost of laying fibre at the time of build is similar to, or even less than that for copper. New build investment also attracts a wider range of investors than more general NGA, some from outside the existing telecoms value chain. We may see investment from water and energy companies, leveraging their experience in deploying utility infrastructure; property developers, with track records in serving new build housing; new entrants, who see an investment opportunity; service providers with an existing market base who may wish to own and control more of the service

infrastructure and existing infrastructure owners who already own and operate large networks.

- 4.6 Ofcom is keen to encourage contestability because, as discussed previously, we believe this may make competition more likely. To achieve this, we want to clarify the regulatory environment that investors will face following deployment and in particular the likely level of regulation. In this section and the next we set out how different investors should face similar levels of regulation if the competitive situations are the same, for example if there are similar levels of market power.
- 4.7 Whilst the development is being built and the trenches are open there is very little cost differential between one network provider laying fibre or duct and two or more network providers laying fibre or duct. The incremental cost is the ducting material or the fibre itself and this is generally a small or even insignificant part of overall costs. This means that there could be more than one fibre network to each house in the development and therefore competition at the infrastructure level. During the development roll-out, the housing developer may choose to lay extra duct so that new providers can easily pull through fibre after completion. In Section 6 we discuss other ways in which the barriers to infrastructure ownership may be reduced through duct and trench sharing. These measures would encourage the deployment of competing infrastructure.
- 4.8 There are also other options for the later deployment of access networks. For example, the use of aerial fibre drops would lower barriers to entry. Wireless access networks may be deployed. Operators could seek to use alternative wayleaves, for example sewers. Or operators with code powers could choose to implement parallel networks where they see a clear commercial case – for example high potential revenues or reduced costs of deployment.
- 4.9 There are therefore a number of ways by which competition in infrastructure provision can be encouraged. However just as contestability is not the same thing as competition (see Section 3), encouraging infrastructure competition is not the same as ensuring infrastructure competition. Consider the case of copper unbundling: LLU is available throughout the UK to enable competition in downstream markets. In certain geographic areas we believe LLU has been taken up in sufficient quantities to bring about a competitive market downstream, a position set out in our WBA review and subsequently endorsed by the European Commission. We do not, however, see a competitive downstream market on a nationwide basis. Ofcom believes that the key test for effective competition is not simply the availability of the remedy but the level of choice customers face in the services on offer to them.

### **Promoting competition in service provision**

- 4.10 If there is only one NGA network in a development then the result may not be very different from the existing copper network, where competitive access to the network is required to enable competition. In many cases the infrastructure owner may choose to provide access on commercial terms. In our conversations with potential investors they are often keen to attract as many service providers as possible to their network and propose 'open access' models to give end-customers the greatest possible choice. They know that this will increase the value of the network to customers and that otherwise potential home owners may complain that they cannot purchase the range of services to which they are accustomed. For example the South Yorkshire Digital Region project proposes that all service providers will have access to core and access services at published rates. In other areas, H20 are also proposing an open access model.

## Standards help promote services in new build

- 4.11 The potential issue of localised services is of particular concern in new build areas because the access technology could be different from most other areas. While new build developments may vary in size from a few homes to ten or twenty thousand, in comparison with the established national copper-based network of 26 million homes they remain small and localised. The national network is by and large based on one technology, copper. In new build we may see a patchwork of different technologies as different investors choose the technology they prefer. In these circumstances Ofcom seeks to maintain the level of competition in telecoms service provision which benefits consumers today. The question we must address is how potential service providers will view these small localised markets.
- 4.12 Currently, service providers deliver services to their existing customers across the copper network using a range of wholesale access products, often developed in response to regulatory obligations. These include, for example, carrier pre selection (CPS) wholesale line rental (WLR) and local loop unbundling (LLU). Service providers have invested in understanding these products, how to order and manage them and sell them on to their own customers. Ordering, managing and selling a new product requires the service provider to invest in adapting their internal systems and processes, depending on how different the new product is in comparison to those already in use. While they may be eager to do this for a new market of many millions of customers, a market of a few thousand homes, or even smaller, is unlikely to justify the investment. Therefore we believe a key barrier to service provision in new build is likely to be the investment required by existing service providers to deliver service.
- 4.13 There are two ways to address this. The first is to reduce the amount of investment required by minimising the difference between the new products and the old ones. This could be done by replicating some or all of the features of the existing product, as we discuss later in Section 6. The second way is to increase the size of the addressable market beyond the number of houses in any one development. This would be possible if different housing developments offered similar access products.
- 4.14 In our consultation on Future Broadband, we considered the case for a new high quality low level wholesale Ethernet access product; we refer to this as Active Line Access (ALA). Our main objective in proposing this type of product is to promote innovation because ALA would be designed to maximise the extent to which CPs could control the underlying infrastructure. However an additional, and equally important, advantage of standardising the wholesale access to different developments around an ALA type product is that this approach would reduce the burden on CPs when seeking to access new housing developments. Ofcom is currently engaging with infrastructure owners and CPs to help determine what an ALA-type product should look like.
- 4.15 As well as promoting service provision, a significant advantage of standards is that they can help reduce the costs of network deployment by the infrastructure owners because standardised network equipment is cheaper. This is very important as we do not want customers in new build areas to face higher prices than customers elsewhere in the UK.
- 4.16 Ofcom therefore sees the development of appropriate standards for products and interfaces as a key factor in the commercial attractiveness of new build wholesale access products and the range of retail products available to consumers. Ofcom believes that industry is best placed to deliver such standards. As a regulator we



believe we should remain technologically neutral as far as possible. For these reasons we would strongly encourage the appropriate industry body to take on the role of developing the right standards. We recognise the challenges of timely standards development in this global market and therefore seek industry views as to what action Ofcom can take to encourage standards development by the appropriate body. We also seek views on what action Ofcom should take if the appropriate standards fail to materialise.

*Question 1: What can Ofcom do to encourage timely standards development for new build NGA wholesale access products and interfaces? Which industry body is best placed to undertake the standardisation of these products and interfaces? What action should Ofcom take if these standards fail to materialise?*

### Regulatory obligations on new build developers to promote competition

- 4.17 Ofcom has a bias against intervention and would prefer, if appropriate, not to impose new regulation, especially given the likely small size of new build developments. However, our regulatory duties and principles clearly set out the case for intervention where competitive conditions do not promote consumer benefit. In these circumstances we would be likely to consider intervention in order to require the provision of network access of some kind.
- 4.18 The form of intervention would depend on the specifics of the case in question. As set out in Section 3, our preference is for access at the passive level. In new build, this is might be access to the ducts or fibre unbundling. In this consultation we seek views on the feasibility of duct access. As regards fibre unbundling, we recognise that there are some technologies for which this may be difficult in the short and medium term, for example Gigabit Passive Optical Networks (GPON). Where infrastructure access is not feasible we would be likely to require an ALA-type product.
- 4.19 The prospect of regulatory obligations following the contestable investment in new build NGA might be considered a disincentive to investment. This should not be the case. Investment in copper access networks in new build developments has continued under the current regulatory environment and there is known demand for existing telephony and broadband services. Regulation may discourage inefficient investment which is dependent on monopoly returns but it should not discourage investments in new build with sound business cases. Investment in fibre technology, rather than copper technology, may offer some additional risk but potential providers will consider that risk in relation to the potential revenues resulting from the new services that cannot be delivered over copper.
- 4.20 It is important to note that Ofcom recognises that there is significant demand risk with regard to new services. Previously we have stated that in any regulated pricing of these new services we would seek to reflect the risk at the time of deployment. In our Future Broadband consultation we discussed ways of reflecting risk, including anchor pricing and risk adjusted returns, and looked for stakeholder views. Our engagement with stakeholders since then has shown significant uncertainty with regard to the best and most practical way of reflecting risk. As a result we cannot yet give regulatory certainty as to how risk will be reflected for next generation access services.
- 4.21 However, we can clarify our approach to existing or legacy services. Our principle of technology neutrality where possible would suggest that price-regulated operators should not charge more for delivering the same service over a different technology, as such an approach would not incentivise efficient technology choice. Equally,

consumers should not have to pay more for a technology choice which they cannot influence or avoid, as is largely the case for new build home owners. For these reasons, Ofcom will initially focus our regulatory approach on ensuring that consumers have access to existing regulated services at existing prices. Network operators will benefit from much greater discretion in pricing the new fibre services. We believe this approach gives the right signals for efficient investment whilst protecting customers. In our statement on Future Broadband, due for publication later this year, we will consider the issue of pricing further.

### Competition and consumer choice

- 4.22 In practice, consumer choice results from a range of competing suppliers offering a range of services which consumers are willing to purchase. The measures described in this section are designed to promote competitive supply of next generation access services in new build whilst not unduly intervening in, or prescribing the actions of, market players. Ofcom seeks views stakeholders' views on this overall approach.

*Question 2: Do you agree with Ofcom's approach to promoting competition and consumer choice in new build fibre access deployments?*

## Section 5

# How will today's regulation apply?

### Our preferred approach to existing regulation

- 5.1 As set out in Section 3, the existing regulatory obligations apply to new build. As well as the obligations put in place on BT (and KCOM in Hull) as a result of market reviews, there are also obligations resulting from the Universal Service Directive and the General Conditions. In this section we clarify as far as possible the implications of existing regulation for new build developments. In determining our approach, we have considered two important but not always complementary objectives. The first flows from our desire to encourage competition and consumer choice by minimising the barriers to entry for service provision in new build developments. With this in mind, it makes sense that as far as possible, any products provided in new build deployments to meet existing SMP obligations should be capable of being used by CPs in the same way as those available today. To minimise consumer disruption they should also be capable of offering similar user experiences to consumers.
- 5.2 The second important objective in determining our approach is our aim of encouraging investment in new build fibre developments so that consumers can benefit from the innovative new services that they support. To do this we want to minimise the legacy burden on new build network investors and encourage new wholesale offerings which can allow CPs to innovate in the services they deliver to end customers.
- 5.3 Having reviewed all the existing obligations it is our view that it is possible to meet both these objectives by maintaining the existing obligations and the existing flexibility in how they are met. In this section we consider what that means for each obligation and seek views on our assessment. As we have indicated already, it is likely that these or similar regulatory obligations could be placed on other new build providers in the absence of competition. This section is therefore relevant to all prospective investors.

### Existing regulatory obligations

- 5.4 The current regulatory environment can be roughly divided in four types of regulation:
- BT and KCOM (formerly Kingston Communications), the designated universal service providers are subject to certain universal service obligations (USO);
  - BT is subject to a set of Undertakings under the Enterprise Act 2002 given to Ofcom in lieu of a reference of certain markets to the Competition Commission;
  - SMP conditions apply to BT and unless specified otherwise, also apply to KCOM for the Hull area, in relation to a finding of SMP in relevant markets;
  - General Conditions apply to providers of Electronic Communications Services (ECS) or Electronic Communications Networks (ECN).

### Universal Service Obligation

- 5.5 Universal service obligations are intended to ensure that basic fixed line services are available at an affordable price to all citizens and consumers across the UK. The

main scope of the USO is defined by the Universal Services Directive<sup>15</sup> (USD). The Secretary of State for Trade and Industry (now the Secretary of State at the Department of Business, Enterprise and Regulatory Reform) specified the extent to which universal services must be provided throughout the UK in the Universal Service Order ('the Order')<sup>16</sup>. Currently, Ofcom designates BT (and KCOM in Hull) to provide specific universal services, all of which have to be offered at uniform prices across the UK, and consequently in all new build areas.

- 5.6 In the statement and further consultation on our Review of the Universal Service Obligation published in March 2006<sup>17</sup>, we emphasised that the USO is an obligation on BT with respect to customers not a right of BT to require developers to build out copper access. We said:

“BT does not have a right to require developers to build out copper as part of new housing projects in order to fulfil its USO but BT has to meet reasonable requests if made by customers on these developments.”

### Undertakings given to Ofcom by BT<sup>18</sup>

- 5.7 On 22<sup>nd</sup> September 2005, BT Group plc offered and Ofcom accepted a set of undertakings ('the Undertakings') pursuant to Section 154 of the Enterprise Act 2002 in lieu of a reference of certain markets to the Competition Commission. The acceptance of the Undertakings was aimed at addressing Ofcom's competition concerns in these markets through, *inter alia*, the implementation of what has been termed "Equality of Access" for all CPs.
- 5.8 One outcome of the Undertakings was the establishment of Openreach, an operationally separate unit of BT with responsibility for BT's access network and responsibility for the provision of access network services to all CPs on an Equality of Access basis.
- 5.9 Equality of Access consists of two concepts:
- Operational separation, which includes the creation of a separate division within BT referred to as "AS" in the Undertakings and now operating under its brand name Openreach. The Undertakings specify the terms and implementation of this separation.
  - Equivalence of Inputs (EOI) to products for CPs, which means that products and services provided by Openreach must be available to all CPs, including BT lines of business, on the same timescales, terms and conditions (including price and service levels) and by means of the same systems and processes.
- 5.10 In Northern Ireland the Undertakings have special provisions. There is no requirement there on BT to operate a separate Openreach organisation. However, BT has to offer Openreach's products in Northern Ireland. It is therefore the case that Openreach's products are available throughout the UK.

<sup>15</sup> Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and user's rights relating to electronic communications networks and services (Universal Service Directive)

<sup>16</sup> The Electronic Communications (Universal Service) Order 2003 (SI 2003 No 1904), see:

<http://www.opsi.gov.uk/SI/si2003/20031904.htm>

<sup>17</sup> <http://www.ofcom.org.uk/consult/condocs/uso/>

<sup>18</sup> This section does not apply to KCOM

## Obligations on providers found to have SMP

- 5.11 Where a CP is found to have SMP, Ofcom has the power to impose certain remedies in order to foster competition. These remedies may include a requirement to provide network access, at economic bottlenecks, to other CPs. This “ex-ante” regulation is only imposed after conducting a market review in accordance with the European regulatory framework and the relevant sections of the Communications Act 2003. The process for market reviews is:
- i) to define the relevant economic market(s) in relation to relevant products and geography;
  - ii) to assess competition in each defined market, in particular to assess whether any CP - individually or jointly with others - has SMP in the defined markets; and,
  - iii) to consider the imposition of appropriate *ex-ante* regulatory remedies for CPs found to have SMP.

## Our proposed approach to existing SMP regulatory remedies

- 5.12 The following sections discuss how existing regulatory remedies currently apply, how they are affected by changes in technology and where appropriate our thoughts on how they might be implemented in the new build environment. As discussed previously, Ofcom is actively engaging with CPs, including BT, regarding the definition of a potential low level high quality Wholesale Ethernet access product for next generation access networks, ALA. In our engagement it has been proposed that an ALA-type wholesale access product could meet some or all of the existing obligations.
- 5.13 While wholesale access products such as CPS and WLR help promote competitive provision of services they also largely define the service on offer. Communications providers may have some control over the billing interface and may be able to choose from a suite of product features but CPS and WLR do not enable CPs to innovate in the way that a more basic product would. In principle, an ALA-type product would allow more of the value of a service to be captured within the CP. Whilst recognising that it is for BT to set out how it intends to meet its obligations, Ofcom seeks initial views from our stakeholders as to the advantages or otherwise of an ALA-type product in comparison to the replication of existing copper products in meeting existing obligations.

*Question 3a: Do you believe that the existing obligations must be met by replicating the existing copper products, or that an alternative approach could be satisfactory? What are the implications of replicating existing products on fibre?*

## Wholesale local access

- 5.14 Local loop unbundling (LLU) is a remedy to a finding of SMP in the wholesale local access market, which provides CPs with access to the local loop connection between the consumer and a local exchange. CPs can partly or wholly lease the access line from the dominant provider in order to provide the attached consumer with voice and/or data services.
- 5.15 The aim of LLU is to stimulate competition in downstream markets which are based on local loop connections, e.g. voice and broadband access. LLU is considered to be

an important remedy as it allows competing providers to innovate and differentiate their product offerings, thereby bringing greater benefits to citizens and consumers.

- 5.16 As discussed in Section 2, there are two basic fibre access network architectures: PtP and PON. While it would be possible to physically unbundle a PtP network, it is far more challenging for PON, where for part of the network a single fibre connection is shared between all of the attached consumers. Openreach has declared that GPON is its proposed technology and H20 have also said they will use it. It therefore appears likely, for the moment at least, that GPON will be extensively deployed in the UK, particularly in residential areas.
- 5.17 In addition to the limitations for fibre unbundling indicated above, the obligation to provide LLU, introduced through our wholesale local access (WLA) market review in 2004<sup>19</sup>, sets out both "full unbundled access to the local loop" and "shared access to the local loop" in terms relating to "Metallic Path Facilities", i.e. a pair of twisted metal wires. In new build developments where fibre is deployed there are likely to be no twisted metallic pairs through which LLU could be provided. Ofcom could consider interpreting the existing obligation as requiring the parallel roll-out of copper even where fibre is being rolled out. This would enable copper local loop unbundling in new build areas.
- 5.18 However, to do so would have cost implications. Deploying the copper network and then maintaining two networks and their supporting management systems in the new build area would incur incremental costs. We have not conducted a full cost benefit analysis, but our current thinking is that these costs would be significant. It would also impose a technology choice upon BT. The benefits would be limited to any incremental consumer benefit resulting from the availability of LLU as opposed to the wholesale access products which will be available across the fibre network. We currently have no evidence that these would be significant. For these reasons, we do not propose to require the SMP holder to provide a twisted metallic path ('copper') solely for the purpose of meeting the LLU obligation, where it provides a fibre access connection in its place.

*Question 3b: Do you agree that SMP holders rolling out fibre do not need to roll out a copper network in parallel solely to meet their LLU obligation?*

- 5.19 Given the potential it provides for innovation and product differentiation we consider access to the passive infrastructure (which we call Passive Line Access or PLA) important in the promotion of competition. Therefore, we may put forward PLA remedies in future market reviews. This approach is in line with the recently published revised Commission Recommendation on relevant markets susceptible to *ex-ante* regulation, which removes reference to twisted metallic pairs in relation to shared and fully unbundled access. It would allow for an unbundling of point-to-point fibre and in the case of GPON sub-loop unbundling. In Section 6, we lay out other ways in which passive access may be provided: for example through duct access and/or dark fibre (including fibre unbundling).

## Wholesale Broadband Access

- 5.20 The Wholesale Broadband Access (WBA) market is one of the markets identified by the Commission in its revised recommendation as being susceptible to *ex-ante* regulation. As such, Ofcom is required to periodically review this market to ensure that *ex-ante* regulation is appropriate given the prevailing competitive conditions.

<sup>19</sup> <http://www.ofcom.org.uk/consult/condocs/rwlam/>

Ofcom recently consulted on a new set of proposals for WBA and proposed the identification of distinct geographic markets, for one of which ('Market 3') we proposed to remove regulation. This approach was subsequently endorsed by the European Commission.

- 5.21 Clearly, a future new build development would not have existed at the time when this market was reviewed and therefore it would not have been directly included in that assessment. This raises the question about what *ex-ante* regulation, if any, should apply to the new build development.
- 5.22 Whilst it may be considered that we should re-review this market following each new build, the proposals for the WBA markets clearly set out that the question of whether or not *ex-ante* regulation is required in each given area depends largely on the competitive state of access to the upstream inputs, upon which the WBA services are based. If there is competitive access to the upstream inputs and these are providing a real constraint then it is unlikely that *ex-ante* regulation would be required. However, absent such competitive access we would want to ensure that a suitable WBA service is made available on fair and reasonable terms.

*Question 3c: Do you agree with Ofcom's approach in relation to WBA and new build areas?*

### Wholesale line rental

- 5.23 In 2003, we carried out a review of the fixed narrowband wholesale exchange line, call origination, conveyance and transit markets<sup>20</sup> ('the narrowband review'). Following the designation of BT (and KCOM for the Hull area) to have SMP in the wholesale exchange line markets detailed below, we imposed remedies upon BT and KCOM:
- Wholesale residential analogue exchange line services;
  - Wholesale residential ISDN2 exchange line services;
  - Wholesale business analogue exchange line services;
  - Wholesale business ISDN2 exchange line services;
  - Wholesale ISDN30 exchange line services.
- 5.24 Wholesale line rental is a service through which a CP effectively leases an exchange line from BT, including the termination at the local exchange switch through which calls are switched or routed. This service provides CPs with the ability to decide how best to route a consumer's calls. The CP owns the billing relationship with the consumer and can provide a single bill for all the communication services offered over the exchange line. The objective of WLR is to address SMP in residential and business exchange line markets and enable CPs to compete in retail voice services without the need to build out an access network to the consumer.
- 5.25 As an outcome of the narrowband review BT was required to specify a fit for purpose analogue WLR product. For the implementation of Integrated Service Digital Networks (ISDN) WLR products, Ofcom issued a Direction, setting out a "Wholesale ISDN Line Rental Functional Specification", as Annex E to the narrowband review.

<sup>20</sup> [http://www.ofcom.org.uk/consult/condocs/narrowband\\_mkt\\_rvw/nwe/](http://www.ofcom.org.uk/consult/condocs/narrowband_mkt_rvw/nwe/)



Both BT's specification for analogue WLR and that contained in the functional specification are defined in terms of a PSTN implementation.

- 5.26 BT provides a range of WLR products to meet its WLR obligations (Condition AA10) and it is for BT to determine how best to meet these obligations in new build. However, Ofcom does invite views as to the extent to which the new build fibre product should replicate the existing WLR products associated processes and other features and equally the extent to which the obligation could be met by an ALA-type product. Whatever product BT offers to meet its obligations, it has to provide WLR on an equivalence of input basis to all CPs, including other BT lines of business in accordance with the Undertakings.
- 5.27 Since the introduction of the ISDN WLR Functional Specification the Undertakings have been adopted and there might be an argument for not imposing the Functional Specifications where new product development is required: Ofcom has the power under SMP condition AA10.2 to consent to a provision of ISDN WLR not in accordance with the Functional Specification. However, it is not clear that new product development is required for ISDN WLR. Ofcom feels it is appropriate to exercise caution in changing an existing requirement, especially one which is the basis for a flourishing retail service. Therefore, we are currently not proposing to issue such consent.

*Question 3d: Do you believe that the WLR obligation must be met by replicating the existing copper product, or that an alternative approach based on an ALA-type product would be satisfactory?*

## Call origination market remedies

- 5.28 The narrowband review found BT (and KCOM in the Hull area) to have SMP in the market for call origination. All references to BT in the following discussion apply equally to KCOM. As a result of a finding of SMP, Oftel (Ofcom's predecessor) imposed, amongst other things, two particular remedies to promote competition: CPS and Indirect Access (IA).

### Carrier Pre-selection

- 5.29 CPS is a remedy that allows consumers of a publicly available telephone service provided by BT to select an alternative provider for the origination of specified call types by designation in advance, i.e. without the need to dial a prefix. For example the consumer can choose that all international calls are routed by the selected CP. A consumer can, at any time, override CPS through the use of a prefix code through prior agreement with its main communications provider.
- 5.30 The obligation to provide CPS flows from the Universal Service Directive and is imposed by Condition AA8 of the narrowband review. Under this Condition, BT must offer on request CPS which is defined in the relevant notification as:

*"a facility which allows a Subscriber to whom a Publicly Available Telephone Service is provided by means of a Public Telephone Network to select which Pre-selected Provider of such Service provided wholly or partly by means of that Network is the Pre-selected Provider he wishes to use to carry his calls by designating in advance the selection that is to apply on every occasion when*



*there has been no selection of Provider by use of a Telephone Number."*

- 5.31 The objective of CPS is to promote competition in the call origination market by allowing consumers of BT telephone services to choose other communications providers. As with the WLR obligation discussed above, it is for BT to determine how best to meet its CPS obligation in the new build environment. We believe that the existing functional specification can be met by fibre technology and are aware that CPS continues to be a popular service. We are not therefore proposing to change the Carrier Pre-selection Functional Specification but do invite views on the extent to which it must be met by the replication of the existing product and features in fibre and equally the extent to which an ALA-type product might meet the obligation.

*Question 3e: Do you believe that the CPS obligation must be met by replicating the existing copper product or that an alternative approach based on an ALA type product would be satisfactory?*

### Indirect Access

- 5.32 IA provides a remedy to a finding of SMP in the call origination market similar to that provided by CPS. Indirect access enables consumers of a publicly available telephone service provided by BT to select an alternative CP for the purposes of routing individual calls by use of a telephone number on each separate occasion, i.e. through the addition of a prefix to the called party's telephone number. The dialled prefix determines the alternative CP used to route the call. IA is a service that continues to be valued by many consumers. Indirect access is defined in the relevant notification as:

*"a facility which allows a Subscriber to whom a Publicly Available Telephone Service is provided by means of a Public Telephone Network to select which such Service provided wholly or partly by means of that Network is the service he wishes to use by the use of a Telephone Number on each separate occasion on which a selection is made."*

- 5.33 As with CPS, the objective of IA is to stimulate competition in the call origination market by allowing a consumer of a publicly available telephone service, provided by BT, to choose an alternative CP. There is no functional specification for IA, as exists for CPS, and BT has the ability to define its own implementation. We seek views as to the extent to which the IA obligation must be met by the replication of the existing product and features in fibre and, equally, the extent to which an ALA-type product might meet the obligation.

*Question 3f: Do you believe that the IA obligation must be met by replicating the existing copper product or that an alternative approach based on an ALA type product would be satisfactory?*

## Measures for consumer protection

### Emergency access from the main telephone service

#### Introduction and Background

- 5.34 In new build fibre access networks voice telephony is likely to be provided using Voice over IP (VoIP) technology. VoIP technology can deliver new and innovative services like video calling and conference calling, in addition to traditional services like call waiting, voice mail, call forwarding and call barring. This means that VoIP brings additional benefits of increased competition and consumer choice.
- 5.35 The capabilities of VoIP telephone services may differ from those of traditional telephone services. In particular, the existing copper access provides line powering to the home but fibre access does not. As a result the consumer's terminal equipment (e.g. VoIP phone, handset adaptor, home gateway or personal computer) must be powered from the domestic power supply. In the event of a failure in this supply, the consumer's terminal equipment may no longer be operational and access to emergency services would not be available.
- 5.36 The details of the relevant regulatory environment are set out in Annex 5. To date, there has usually been the opportunity to access a broadband connection and a switched telephone line in the same home, giving citizens and consumers the opportunity to choose to retain a powered line. However, in the case of homes with a new build fibre access network only, that choice will not be available.

#### Ensuring continuity of power supply

- 5.37 As set out in General Condition 3.1 providers of Publicly Available Telephone Services at fixed locations are required to:
- “take all reasonably practicable steps to maintain, to the greatest extent possible: [...] (c) uninterrupted access to Emergency Organisations[...]”.
- 5.38 In the previous consultations on VoIP regulation, Ofcom has considered that requiring line powering for VoIP services is not a “reasonably practical” solution, as required by General Condition 3 “because of the power demands of the terminal equipment and the characteristics of the access technology typically used (for example, ADSL)” (the 2004 Consultation, paragraph 6.27). We were of the view that the appropriate solution was to require providers to give consumer information on the reliance of VoIP services on a power supply. It was thought that would enable consumers to make an informed choice about whether to retain a traditional service connected to the switched telephone service, which would have line powering. Importantly, those consultations were conducted in the context of a switched telephone network being available alongside broadband.
- 5.39 However, in new build developments served solely by fibre access networks, a VoIP service and fibre access will provide the sole telephony service, removing the consumer's ability to choose to retain a traditional phone line with line powering. In determining our policy here, we take account of the desirability of regulating in a way that does not favour one technology over another or one means of providing technology over another<sup>21</sup>; the desirability of encouraging investment and innovation

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<sup>21</sup> Section 4(6) of the Communications Act 2003 provides:

in relevant markets and the availability and use of high speed data transfer services. With regard to accessing emergency services, we also take into consideration the vulnerability of children and others whose circumstances mean they need special protection; the needs of persons with disabilities, the elderly and those on low incomes; and the desirability of preventing crime and disorder<sup>22</sup>.

- 5.40 To mitigate risk to citizens and consumers in the context of new build fibre access networks, in this consultation we propose, that where a VoIP service categorised as PATS is provided in a new build environment, we interpret the requirements of GC 3.1 (c) to be met through the provision of a secure uninterrupted battery backup facility. This battery backup facility would be required to power the consumer's terminal equipment, any network termination at the consumer's premises and any adapter device that is used to support their VoIP services with a traditional telephone in the event of a failure in the domestic supply. In our view, the provision of battery backup is consistent with doing all that is reasonably practical to ensure uninterrupted access. If adopted, we would amend the Guidelines and the Code of Practice to reflect this policy. A draft of the new guidelines (with marked up amendments) is included as Annex 5.

*Question 3g: Do you agree with our proposal to interpret GC 3.1 (c) as being met through the provision and use of a battery backup facility to maintain uninterrupted access to emergency services in new build developments?*

## Other Openreach specific issues

### Openreach IRS Product

- 5.41 It is becoming common practice for property developers to place restrictive covenants on property owners to prevent the installation of external aerials on individual dwellings; additionally, some properties are situated in areas of poor broadcast reception. To address either/or both of these circumstances, some new build property developers are seeking to serve homes with broadcast entertainment services from a centralised aerial or satellite dish location. It is to this end that Openreach has developed its Integrated Reception System (IRS).
- 5.42 Openreach's IRS product provides for the point-to-multipoint unidirectional distribution of satellite TV, terrestrial TV and DAB radio signals from a central reception point to individual dwellings. IRS uses fibre optic technology with the same topology as a PON. The deployment of IRS is planned for use in the Ebbsfleet fibre-to-the-premises pilot project and will operate over fibres laid in parallel to those of the GPON deployment that supports telecommunication services. It is expected that IRS will be supplied by Openreach for deployment on a much wider basis in the future. The system architecture is illustrated in Figure 4 below.

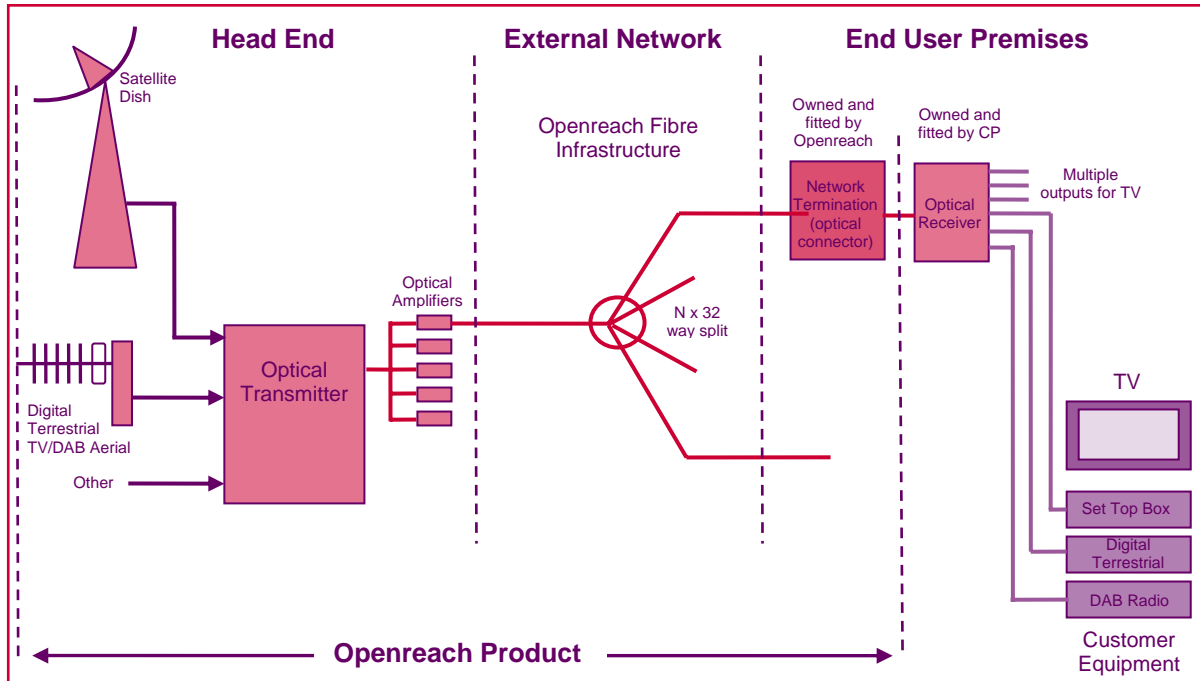
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The fourth Community requirement is a requirement to take account of the desirability of Ofcom's carrying out their functions in a manner which, so far as practicable, does not favour—

(a) one form of electronic communications network, electronic communications service or associated facility; or

(b) one means of providing or making available such a network, service or facility, over another.

<sup>22</sup> Section 4 of the Communications Act 2003.



**Figure 4: Openreach IRS Architecture**

- 5.43 IRS conveys signals input at the head-end to the consumer's premises where they are presented to the end-user using standard antenna connectors. To the consumer the system is transparent and the signal appears as if it had been directly received by the relevant antenna. The consumer can use without restriction whatever reception equipment they would normally use with more traditional methods of reception, e.g. set-top box, DAB radio or digital TV receiver. IRS could be regarded as a "fibre aerial".
- 5.44 At Ebbsfleet, Sky is the only pay TV retailer offering a service over IRS. The current system as designed and deployed receives the Sky signal from the UK targeted satellites at 28 degrees east, plus terrestrial TV and DAB radio signals. The IRS system is limited in bandwidth to that used for the reception of the Sky service, but does also support the conveyance of Freesat services contained within the same bandwidth. The IRS system is capable of receiving signals from other satellite pay TV retailers provided via other satellites - dependent upon the positioning of the satellite receiving dish - within the bandwidth limitation of the system; to this extent IRS is an open platform.
- 5.45 The current IRS system does not support the conveyance of other specified pay TV retailers services, such as those of cable operators and those satellite services operating within a different bandwidth to that of Sky. It is our expectation that, if other pay TV retailers express a commitment to use the IRS platform, Openreach will carry out the further development necessary to support the services of these retailers and offer them access to the system on fair, reasonable and non-discriminatory commercial terms.

## Section 6

# Future options to promote competition

## Passive infrastructure access as a future driver for competition

- 6.1 In our Future Broadband consultation, we outlined our view that NGA may reduce the gap between active and passive competition when compared to current generation access. This view was based on the relative static costs of passive based competition, for example sub-loop unbundling, being potentially higher, and the relative benefits in terms of the potential for innovation between passive inputs and active inputs, being lower. ALA-type products offer a greater potential for innovation for NGA deployments than exists for the active inputs in current generation access networks.
- 6.2 The potential for innovation delivered by an ALA product very much depends on the flexibility of the wholesale product provided by the network operator. Although our principle of equivalence of input ensures that the same active inputs are available to all CPs on a common basis, providing the same scope of innovation to all players in the market, this does not ensure innovation to the fullest extent possible with passive inputs. Active inputs do offer inherent benefits such as the need for less manual intervention and a lower risk of upstream market fragmentation, and therefore maybe be attractive to some players in the market. However, it is our view that passive inputs provide greater opportunity for innovation and competition. In this section we explore possible passive inputs, which could complement active remedies that maybe available and seek views on the feasibility and attractiveness of duct access and sharing.

## Passive infrastructure access framework

- 6.3 Ofcom's objective is to further the debate on passive infrastructure access in new build, to help assess demand, viability and possible implementation as a means of promoting competition in new build deployments. To facilitate the debate, we propose a framework for passive infrastructure access.

### What is passive infrastructure access?

- 6.4 Passive access refers to wholesale products based on direct access to the physical infrastructure elements of the access network, but not including any form of active electronics. Examples include access to the duct network, poles, unbundled copper loops or dark fibre. In new build there are predominantly three passive access options for consideration: trench, duct and dark fibre.

### International case studies

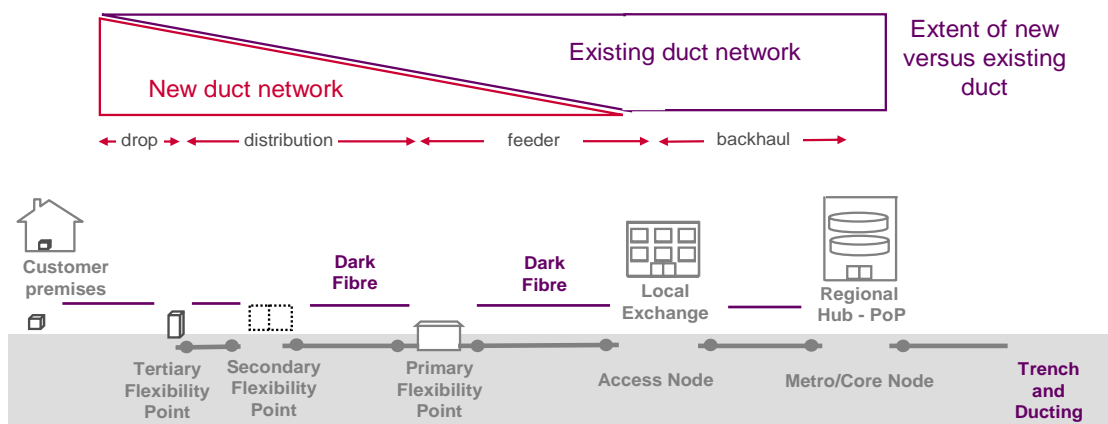
- 6.5 As part our review of passive infrastructure we commissioned an international study to investigate examples and practical challenges of duct access and where relevant other passive infrastructure (i.e. fibre, poles and trenches) provision in a number of countries. The study provides examples of duct access and sharing from Australia, Canada, France, Italy, Japan, Portugal, Sweden and USA, and is summarised in Annex 8. It would seem to suggest that duct access and sharing may be a valuable tool for promoting competition in certain circumstances.

## Passive infrastructure in access network deployments

6.6 Telecoms infrastructure consists of interconnected active and passive elements that support the delivery of telecommunication services. The passive elements include the duct network (trenches, ducts, manholes and joints), poles, street pedestals and cabinets, exchange offices, dark fibre and metallic path facilities. The extent and scale of passive infrastructure, including the duct network, that will be deployed in a new build site will depend on a number of factors including:

- the size and density of the new development;
- the terrain and local policy; eg building regulations and covenants;
- any plans to serve a larger customer base in the future;
- practical limits for the use of the available spare capacity in any existing passive infrastructure.

6.7 The topology of these new build fibre access networks may vary from deployment to deployment and may not mirror existing legacy deployments. A generic representation illustrating the potential extent to which the passive infrastructure may be deployed in new build developments is shown in Figure 5 below.



**Figure 5: Passive infrastructure and elements in the network**

6.8 The generic architecture shown has the following sections:

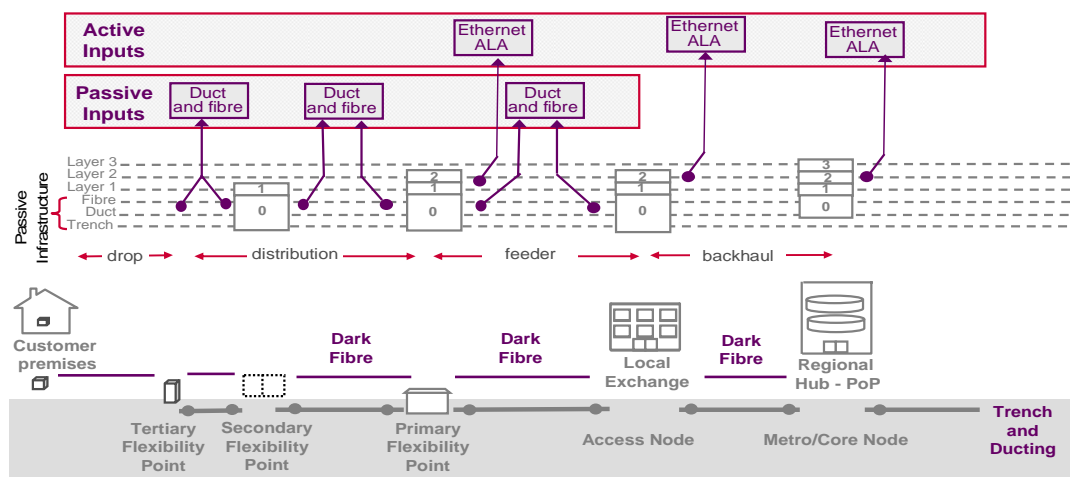
- Feeder: from the local exchange to the first flexibility point; referred to in the diagram as the primary flexibility point;
- Distribution: from the primary flexibility point to the final flexibility point; referred to in Figure 5 as the tertiary flexibility point. The distribution section may also include an optional secondary flexibility point;
- Drop – from the tertiary flexibility point to the customer premises.

6.9 In reality different combinations of flexibility points may be present or absent depending on the deployment, and in some cases there may be additional flexibility points.

- 6.10 In order to promote a common language for the debate and identify the locations at which infrastructure access and sharing i.e. duct and fibre access could be feasible, we propose the terminology appended in Annex 10.

Options for locations of passive infrastructure access

- 6.11 Fibre and duct access for NGA in new build sites could take place at different flexibility points and at the local exchange as identified in Figure 6 below.






**Figure 6: Location for passive access**

- 6.12 The practical challenges of passive infrastructure access/sharing is more complex and therefore less probable for certain sections of existing networks than for the new build case, where the potential for access/sharing may be considered during network deployment. Ofcom has considered the feasibility of passive access at different points in the network based on previous Ofcom investigations and industry engagement. A summary of our assessment is shown in the first part of Table 2 below. Passive access is unproven in the UK except in the feeder part of the network. In most other sections it would appear less probable, but we welcome views on this assessment.
- 6.13 The second part of Table 2 looks at the feasibility of passive access in new build networks. Industry engagement and our international survey suggest that there is an opportunity for the development of commercial and operational arrangements that could enable passive infrastructure in new build fibre access networks, and we give more detail on this below. Again we welcome views on this analysis.

			Passive Network Section		
			DROP	DISTRIBUTION	FEEDER
Existing	Fibre Cable	P2P			
		PON			
	Micro Duct				
	Sub Duct				
	Main Duct				
	Trench				
New/Build	Fibre Cable	P2P			
		PON			
	Micro Duct				
	Sub Duct				
	Main Duct				
	Trench				

**Feasibility and Opportunity for Sharing**

 Less Probable     
  More Probable     
  Commercially Proven

**Table 2: Opportunity to share and access passive infrastructure**

**Duct access and sharing**

6.14 One of the key barriers to investment in fibre NGA networks is the cost associated with deploying the passive infrastructure. This is made up mainly of telecom ducts, usually placed underground in trenches, which facilitate the installation and later replacement and addition of cable. Around 70 - 80% of network deployment costs can be incurred in civil works: the digging and closure of trenches and the laying of new ducting and fibre. The incremental cost of laying cable in installed duct is much lower than the cost of digging trenches and laying new ducts. It therefore could make good business sense to install spare duct at the build phase to accommodate future needs. This approach also supports the option to lease excess duct capacity if desirable. We believe this type of duct sharing has the potential to reduce the barriers to entry and encourages competition.

6.15 Duct access can take different forms:

- access to existing telecommunication duct and duct network;
- access to existing alternative duct and non-telecommunication duct network such as used by utilities like water, gas and sewer and owned by local authorities; and
- sharing of new duct and duct network starting at the build phase – be it telecommunication or utility duct.

6.16 The scope of duct access in new build is predominantly the third form: sharing of new duct and duct network at the build phase.

The current regulatory environment

6.17 Although Ofcom has powers under the Communications Act 2003 to impose access-related conditions for the sharing of infrastructure including duct we have, so far, chosen not to exercise these powers. When our predecessor, Oftel, investigated duct



access in 2002<sup>23</sup>, it identified significant practical barriers for sharing existing duct, including:

- no commercial demand for access to CP's duct and pole networks;
- health and safety concerns;
- risk of damage to existing cables during the rollout of cables in a shared duct;
- the availability and knowledge of spare capacity, duct location and routing;
- the lack of clarity regarding the imposition of business rates;
- code powers; and
- property rights.

6.18 As a result, Ofcom has not to date imposed any obligation for duct sharing. It should be noted that any new provider applying to Ofcom for Electronic Communications Code powers must show a willingness to share infrastructure should that be requested and should it be practical.

6.19 In Ofcom's Future Broadband consultation access to existing duct was considered as having limited practicability due to a number of reasons explained in the next section. However, access to new duct was identified as being more promising and an appropriate passive remedy to promote competition in new build deployments.

#### Duct access as an enabler for competition

6.20 Of all the passive options that are being considered, duct access is the most basic, offering the potential for competitive innovation at the deepest level of infrastructure. It allows a competing operator to choose the type of cable and the technology over which services are delivered. In the case of new build competing CPs could also have the flexibility to innovate at the duct level, for example in the specification and layout of ducts. The increased flexibility at the infrastructure level provides greater scope for innovation.

6.21 While a number of practical challenges exist in accessing existing ducts, these challenges diminish or may completely disappear when the network is built from scratch using new duct. With the existing access network duct infrastructure the extent, quality and accuracy of records for ducts such as start and end points, routing and splits, dimensions and spare capacity vary by owner, area and section of the duct network. In new build, there is an opportunity for better documentation of the duct infrastructure.

6.22 Another issue is the variability in specification, spare capacity and quality of existing duct and duct network, which may render it unsuitable for sharing. For example, the chambers and joints in which the existing ducts start, end and split may not have sufficient space and flexibility to allow multiple CPs to operate – lay new cable, house equipment and splices. With new build, the opportunity exists to design a fit-for-purpose sharable duct network and lay spare capacity that supports multiple CPs from the outset and with a view to meeting future demand.

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<sup>23</sup> [http://www.ofcom.org.uk/static/archive/Oftel/publications/ind\\_guidelines/duct0602.htm](http://www.ofcom.org.uk/static/archive/Oftel/publications/ind_guidelines/duct0602.htm)

## Mechanisms and arrangements for supporting duct access

- 6.23 In terms of regulatory mechanisms, Ofcom concurs with the European Regulators Group (ERG) opinion regarding mandating access to new duct<sup>24</sup>. The ERG recommended that the EC clarify and strengthen legal powers of the NRAs stemming from Article 12 of the Access Directive<sup>25</sup>, where this is practical and justified, for example at the build phase.
- 6.24 Through informal engagement with stakeholders and the international case study (contained in Annex 7), we have identified the following operational models for duct access:
- joint/shared duct network planning and access;
  - unrestricted access to one or many other CPs;
  - managed access to one or many other CPs; and
  - no access – infrastructure ‘owner’ undertakes all access on behalf of others.
- 6.25 We believe there could be an opportunity in the UK for the emergence of commercial models supporting duct access in new build. Some models identified by the international case studies demonstrate how the cost of investment and operation can be successfully recovered including:
- shared investment at the time of dig;
  - expression of interest/option purchase at time of dig followed by duct purchase/lease;
  - duct lease/purchase after dig; and
  - sharing or outsourcing of operational costs.
- 6.26 Recent developments have demonstrated the emerging use of alternative duct and non-telecom duct infrastructure. For example, H2O Networks have recently announced proposals to use sewers where feasible, in selected towns in the UK starting with Dundee, Bournemouth and Northampton, to save costs in deploying fibre to individual homes. In addition, the international case studies present examples where non-telecom duct infrastructure have been successfully used for deploying fibre access networks. Based on this evidence, it would appear that access to non-telecom duct infrastructure such as sewers could be a feasible means of promoting competition.

*Question 4: Do you think access to the duct network, including non telecoms duct, is a potentially feasible means of promoting competition in new build? If so what types of commercial and operational models could successfully support such access arrangements in the UK?*

<sup>24</sup> [http://www.erg.eu.int/doc/publications/erg07\\_16rev2\\_opinion\\_on\\_nga.pdf](http://www.erg.eu.int/doc/publications/erg07_16rev2_opinion_on_nga.pdf)

<sup>25</sup> Directive 2002/19/EC of the European Parliament and of the Council, of 7th March 2002 on access to and interconnection of, electronic communications networks and associated facilities (Access Directives)

## Dark fibre

### Dark fibre as a potential remedy to SMP

- 6.27 Dark fibre is fibre installed in ducts, but not in use, i.e. not actively transmitting a communications signal. Access to dark fibre would allow one CP to use the fibre of another as an input to their downstream wholesale and retail products. Such an input would allow a greater potential for innovation than provided through active inputs alone as the CP would have complete control of the transmission technology and services.
- 6.28 In the local access infrastructure, dark fibre access could potentially form a remedy in different sets of markets:
- those collectively categorised as business connectivity services (retail leased lines, wholesale symmetric broadband origination);
  - the wholesale local access market; and/or
  - possibly a separate dark fibre market.

### Ofcom's current position on dark fibre as a remedy in business connectivity services

- 6.29 We raised the potential of access to dark fibre in the access network as a remedy in business connectivity services markets in our BCMR consultation published in January 2008<sup>26</sup>. It should be noted that the focus of the BCMR is on the provision of dark fibre in the access network for wholesale business connectivity markets rather than for residential broadband services. Our intention in the BCMR consultation was to canvass opinion on the arguments for and against exploring the access to dark fibre as an SMP remedy more fully, as a means of promoting more effective competition in downstream leased line markets.
- 6.30 The BCMR consultation cited the following three reasons for considering dark fibre in the access as a potential remedy to significant market power (SMP) in the business connectivity services markets:
- i) a more radical option is required than currently exists to remedy a lack of competition in some leased lines markets;
  - ii) dark fibre is a remedy at the deepest level of infrastructure, which is in line with the principles of the TSR that deep infrastructure competition provides the greatest opportunity for innovation; and
  - iii) communication providers have argued that access to dark fibre would enable them to compete on price, quality of service and service innovation.
- 6.31 In the BCMR consultation, we expressed the view that dark fibre falls within the definition of an electronic communications network, and therefore Ofcom's powers under the Communications Act 2003 apply. We recognised that where dark fibre could be used for the provision of wholesale terminating segments and in the access network, separate markets might need to be considered. We noted that any market review undertaken in these markets would be complex and would have to align with existing regulation and our regulatory principles.

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<sup>26</sup> <http://www.ofcom.org.uk/consult/condocs/bcmr/>

- 6.32 In order to determine if dark fibre could be imposed as a remedy in the business connectivity markets, it would likely be necessary to carry out a market review of the market for dark fibre access and find SMP in that market. Further, in deciding whether dark fibre is a suitable remedy following a market review, it would likely be necessary to consider the benefits to consumers in terms of improved competition and market development against the cost of implementation, and the impact on business connectivity and other downstream markets.
- 6.33 In the BCMR consultation, we asked stakeholders whether we should investigate further the case for undertaking a review of the relevant markets in relation to dark fibre in the access for business connectivity services. We also asked what the pros and cons are of requiring an undertaking designated to have SMP in a given market to make dark fibre in the access available to other CPs. The BCMR consultation closed on 27<sup>th</sup> March 2008. Depending on the responses to the questions posed in the consultation, we may consider the case for the provision of dark fibre in the access for business connectivity services markets, including where services in these markets are provided in new build developments.

### The European position is evolving

- 6.34 The current regulatory framework does not explicitly refer to dark fibre as a remedy. Article 12 of the Access Directive allows NRAs to impose obligations on CPs having SMP to meet reasonable requests for access to network elements and associated facilities, including unbundled access to local loops.
- 6.35 The Commission's revised Recommendations on relevant markets published in December 2007<sup>27</sup>, removed any technology constraints on unbundled access. The applicable market in the revised recommendation is: Market 4 - wholesale (physical) network infrastructure access (including shared or fully unbundled access) at a fixed location.

### Precedents for dark fibre access are being set elsewhere in Europe

- 6.36 Access to dark fibre in the access network is under consideration in a number of countries where the EC regulatory framework applies and precedents are now being set. Of particular interest is a recent ruling affecting Deutsche Telecom in Germany<sup>28</sup>.
- 6.37 In June 2007, the German Federal Network Agency obliged Deutsche Telecom to grant access to the 'last mile' of the passive infrastructure of its VDSL network, including not only its duct network, but where duct capacity was not available access to dark fibre. Deutsche Telecom filed an application for temporary relief from enforcement of this regulatory order with the Cologne Administrative Court. In its assessment the Cologne Administrative Court concluded that the obligation should remain in effect, with the minor modification that Deutsche Telecom is not required to disclose information on ways of gaining access to its ducts and dark fibre until a summary review of the issue and associated legal aspects has been completed.

<sup>27</sup> [http://ec.europa.eu/information\\_society/policy/ecomm/doc/library/proposals/rec\\_markets\\_en.pdf](http://ec.europa.eu/information_society/policy/ecomm/doc/library/proposals/rec_markets_en.pdf)

<sup>28</sup> [http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/germany/adopted\\_measures/de20070646&vm=detailed&sb=Title](http://circa.europa.eu/Public/irc/infso/ecctf/library?l=/germany/adopted_measures/de20070646&vm=detailed&sb=Title)

## Section 7

# Next steps and related work

- 7.1 The ongoing deployment of new build NGA networks generates much interest and raises many issues for consideration, many of which we have covered in this consultation. As a result, we are keen to hear the views of a wide range of stakeholders on the issues raised in this consultation and other issues that may arise as the debate progresses.
- 7.2 This consultation, which is specific to issues arising from new build deployments, forms part of the much wider industry-wide debate on NGA. Ofcom has sought to take forward this debate with the publication of our consultation on Future Broadband which closed in December 2007. The Future Broadband consultation laid out our proposals for a strategic approach to the regulation of NGA in the wider context.
- 7.3 Later in 2008, we intend to publish a follow-up document to our Future Broadband consultation, which will lay out our approach to and application of our principles for next generation access. That document will take account of responses we received to that consultation and other forms of engagement that we have undertaken with our stakeholders.
- 7.4 We are continuing a targeted programme of engagement with a wide range of stakeholders, both in relation to NGA in the wider context and new build specifically. This programme of engagements includes:
- technical discussions to consider the practical issues with developing a suitable active line access product. These will be held on bi-lateral, and, in the form of seminars, on multi-lateral basis. The objectives of these discussions will be to encourage industry standardisation of a set of features for such a product.
  - technical and regulatory workshops on our proposed approach to ensuring returns that adequately reflect the risk on investments in new build and on a wider basis NGA deployments
  - national and regional meetings to consider particular issues arising from NGA for particular geographic areas and the relationship to potential future digital divide.
- 7.5 At the same time other organisations are considering the implications of next generation access. Over the next few months we expect to see the Broadband Stakeholder Group publish its reports on the framework for assessing the economic and social value of NGA and a consultation from the European Commission on a draft Recommendation on NGA. BERR has also announced an independent review of NGA. Ofcom will monitor and provide input to these publications as appropriate.
- 7.6 This new build consultation will close on 25<sup>th</sup> June 2008 after which we will take full consideration of the responses with a view to publishing a statement outlining our policy and regulatory approach for new build deployments of next generation access in summer of 2008.

## Annex 1

# Responding to this consultation

## How to respond

- A1.1 Ofcom invites written views and comments on the issues raised in this document, to be made **by 5pm on 25<sup>th</sup> June 2008**.
- A1.2 Ofcom strongly prefers to receive responses using the online web form at <http://www.ofcom.org.uk/consult/condocs/newbuild/howtorespond/form>, 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 (see Annex 3), to indicate whether or not there are confidentiality issues. This response coversheet is incorporated into the online web form questionnaire.
- A1.3 For larger consultation responses - particularly those with supporting charts, tables or other data - please email [chinyelu.onwurah@ofcom.org.uk](mailto:chinyelu.onwurah@ofcom.org.uk) attaching your response in Microsoft Word format, together with a consultation response coversheet.
- A1.4 Responses may alternatively be posted or faxed to the address below, marked with the title of the consultation.
- Chinyelu Onwurah  
 Floor 2  
 Dept: Strategy and Market Developments  
 Riverside House  
 2A Southwark Bridge Road  
 London SE1 9HA
- Fax: 020 7981 3333
- A1.5 Note that we do not need a hard copy in addition to an electronic version. Ofcom will acknowledge receipt of responses if they are submitted using the online web form but not otherwise.
- A1.6 It would be helpful if your response could include direct answers to the questions asked in this document, which are listed together at Annex 4. It would also help if you can explain why you hold your views.

## Further information

- A1.7 If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Chinyelu Onwurah on 020 7981 3000.

## Confidentiality

- A1.8 We believe it is important for everyone interested in an issue to see the views expressed by consultation respondents. We will therefore usually publish all responses on our website, [www.ofcom.org.uk](http://www.ofcom.org.uk), ideally on receipt (when respondents confirm on their response coversheet that this is acceptable).

- A1.9 All comments will be treated as non-confidential unless respondents specify that part or all of the response is confidential and should not be disclosed. Please place any confidential parts of a response in a separate annex so that non-confidential parts may be published along with the respondent's identity.
- A1.10 Ofcom reserves its power to disclose any information it receives where this is required to facilitate the carrying out of its statutory functions.
- A1.11 Please also note that copyright and all other intellectual property in responses will be assumed to be licensed to Ofcom to use in order to meet its legal requirements. Ofcom's approach on intellectual property rights is explained further on its website at <http://www.ofcom.org.uk/about/accoun/disclaimer/>

### Next steps

- A1.12 Following the end of the consultation period, Ofcom intends to publish a statement in June 2006.
- A1.13 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](http://www.ofcom.org.uk/static/subscribe/select_list.htm)

### Ofcom's consultation processes

- A1.14 Ofcom seeks to ensure that responding to a consultation is easy as possible. For more information please see our consultation principles in Annex 2.
- A1.15 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](mailto:consult@ofcom.org.uk) . We would particularly welcome thoughts on how Ofcom could more effectively seek the views of those groups or individuals, such as small businesses or particular types of residential consumers, who are less likely to give their opinions through a formal consultation.
- A1.16 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](mailto:vicki.nash@ofcom.org.uk)



## Annex 2

# Ofcom's consultation principles

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

### Before the consultation

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

### During the consultation

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

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

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

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

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

### After the consultation

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



## Annex 3

# Consultation response cover sheet

- A3.1 In the interests of transparency, we will publish all consultation responses in full on our website, [www.ofcom.org.uk](http://www.ofcom.org.uk), unless a respondent specifies that all or part of their response is confidential. We will also refer to the contents of a response when explaining our decision, without disclosing the specific information that you wish to remain confidential.
- A3.2 We have produced a coversheet for responses (see below) and would be very grateful if you could send one with your response (this is incorporated into the online web form if you respond in this way). This will speed up our processing of responses, and help to maintain confidentiality by allowing you to state very clearly what you don't want to be published. We will keep your completed coversheets confidential.
- A3.3 The quality of consultation can be enhanced by publishing responses before the consultation period closes. In particular, this can help those individuals and organisations with limited resources or familiarity with the issues to respond in a more informed way. Therefore Ofcom would encourage respondents to complete their coversheet in a way that allows Ofcom to publish their responses upon receipt, rather than waiting until the consultation period has ended.
- A3.4 We strongly prefer to receive responses via the online web form which incorporates the coversheet. If you are responding via email, post or fax you can download an electronic copy of this coversheet in Word or RTF format from the 'Consultations' section of our website at [www.ofcom.org.uk/consult/](http://www.ofcom.org.uk/consult/).
- A3.5 Please put any confidential parts of your response in a separate annex to your response, so that they are clearly identified. 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 coversheet 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**

What do you want Ofcom to keep confidential?

Nothing	<input type="checkbox"/>	Name/contact details/job title	<input type="checkbox"/>
Whole response	<input type="checkbox"/>	Organisation	<input type="checkbox"/>
Part of the response	<input type="checkbox"/>	If there is no separate annex, which parts?	

**DECLARATION**

I confirm that the correspondence supplied with this cover sheet is a formal consultation response. It can be published in full on Ofcom’s website, unless otherwise specified on this cover sheet, and I authorise Ofcom to make use of the information in this response to meet its legal requirements. 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 question

A4.1 The following list the consultation question contained within this document:

*Question 1: What can Ofcom do to encourage timely standards development for new build NGA wholesale access products and interfaces? Which industry body is best placed to undertake the standardisation of these products and interfaces? What action should Ofcom take if these standards fail to materialise?*

*Question 2: Do you agree with Ofcom's approach to promoting competition and consumer choice in new build fibre access deployments?*

*Question 3: Do you*

*(a) believe that the existing obligations must be met by replicating the existing copper products, or that an alternative approach could be satisfactory? What are the implications of replicating existing products on fibre?*

*(b): Do you agree that SMP holders rolling out fibre do not need to roll out a copper network in parallel solely to meet their LLU obligation?*

*(c): Do you agree with Ofcom's approach in relation to WBA and new build areas?*

*(d) Do you believe that the WLR obligation must be met by replicating the existing copper product, or that an alternative approach based on an ALA-type product would be satisfactory?*

*(e): Do you believe that the CPS obligation must be met by replicating the existing copper product or that an alternative approach based on an ALA type product would be satisfactory?*

*(f): Do you believe that the IA obligation must be met by replicating the existing copper product or that an alternative approach based on an ALA type product would be satisfactory?*

*(g): Do you agree with our proposal to interpret GC 3.1 (c) as being met through the provision and use of a battery backup facility to maintain uninterrupted access to emergency services in new build developments?*

*Question 4: Do you think access to the duct network, including non telecoms duct, is a potentially feasible means of promoting competition in new build? If so what types of commercial and operational models could successfully support such access arrangements in the UK?*

## Annex 5

# Proposed Modification of the Guidelines on the application of PATS obligations to VoIP service providers

Ofcom proposes to modify the Guidelines on the application of PATS obligations to VoIP service providers as set out below (the added text in paragraphs A5.73 and A5.73a has been underlined and highlighted in yellow for ease of reference):

### A. Introduction

#### Purpose

- A5.1 These guidelines set out Ofcom’s approach to applying certain requirements or obligations, which may be applicable to VoIP service providers<sup>29</sup> under either General Condition (“**GC**”<sup>30</sup>) 3 or GC 4. In particular, these guidelines:
- seek to provide clarity on the meaning of some of the legal concepts used in relevant GCs applicable to providers of ‘Publicly Available Telephone Services’ (“**PATS**”), so as to inform stakeholders of Ofcom’s general view on them; and
  - describe factors that Ofcom would consider in the application of said requirements or obligations in GCs 3 and 4.
- A5.2 These guidelines are primarily intended to illustrate how Ofcom would investigate potential contraventions of the requirements or obligations in GCs 3 and 4 when taking enforcement action. Normally, Ofcom would do so by giving a contravention notice under section 94 of the Communications Act 2003 (the “**Act**”). In such a notice, Ofcom would set out its determination that there are reasonable grounds for believing that a person is contravening, or has contravened, a condition set under section 45 of the Act, such as GCs 3 and 4.

<sup>29</sup> The term ‘VoIP provider’ is used throughout these guidelines in a broad sense covering services provided in the UK using the Voice over Internet Protocol (“VoIP”), including (without limitation) here Voice over the public Internet, Voice over broadband (including managed and unmanaged services), Voice over Unlicensed Wireless Access, Voice over licensed wireless including pre WiMax based services; that term also includes voice services described as ‘new voice services’ (or ‘NVS’) in Ofcom’s consultation document entitled *New Voice Services: A consultation and interim guidance* on 6 September 2004: see [http://www.ofcom.org.uk/consult/condocs/new\\_voice/aneu\\_voice/?a=87101](http://www.ofcom.org.uk/consult/condocs/new_voice/aneu_voice/?a=87101).

<sup>30</sup> The majority of the general conditions of entitlement (or “GCs”) is, at present, set out in a Notification setting general conditions (taking effect from 25 July 2003) under section 48(1) of the Communications Act 2003, which Notification is dated 22 July 2003 by the Director General of Telecommunications, whose regulatory functions have since 29 December 2003 been transferred to Ofcom: see

[http://www.ofcom.org.uk/static/archive/oftel/publications/eu\\_directives/2003/cond\\_final0703.pdf](http://www.ofcom.org.uk/static/archive/oftel/publications/eu_directives/2003/cond_final0703.pdf).

Certain GCs have been more recently amended by Ofcom, and a consolidated version of the GCs as at 19 December 2006 (including annotations) can be accessed at:

[http://www.ofcom.org.uk/telecoms/loi/g\\_a\\_regime/gce/cvogc.pdf](http://www.ofcom.org.uk/telecoms/loi/g_a_regime/gce/cvogc.pdf)

- A5.3 Persons given a contravention notice would have the opportunity to make representations, to comply with the condition in question and to remedy any consequences of the breach, before any further action would be taken in the event of non-compliance, such as the imposition of a penalty of up to 10% of the provider's relevant turnover<sup>31</sup>. Further action that Ofcom could take includes the giving of an enforcement notification under section 95 of the Act, the giving of directions suspending service provision and the giving of its consent to persons affected by the contravention in question for the bringing of civil proceedings under section 104 of the Act.
- A5.4 Ofcom may also take these guidelines into account when it is requested to resolve a dispute referred to it under and in accordance with section 185 of the Act. However, whether or not it would be appropriate (and, if so, the extent) for Ofcom to take them into account on a dispute reference in a particular case is a matter that Ofcom would need to consider on a case-by-case basis.

## Role and Status

- A5.5 Guidelines have the benefit of contributing to effective regulation by improving transparency and understanding. In particular, they are aimed at encouraging compliance by explaining obligations imposed, thereby ensuring that relevant providers understand their obligations and enabling potential customers to identify contraventions. Guidelines also assist to frame an effective complaint, or an effective defence, in the event that a provider is suspected of contravening a condition.
- A5.6 One of Ofcom's regulatory principles is that Ofcom will regulate in a transparent manner<sup>32</sup>. Guidelines are an important means to achieving this principle and to increasing understanding of Ofcom's policy objectives and approach to regulation.
- A5.7 Ofcom would normally expect to follow these guidelines should it investigate any potential contravention of a relevant GC discussed in these guidelines. If Ofcom decides to depart from these guidelines, it will set out its reasons for doing so. These guidelines may also be subject to revision from time to time.
- A5.8 That said, whether or not (and, if so, how) a particular matter is regulated will usually turn on the specific facts in each case. Stakeholders (and, in particular, those persons providing certain services) should seek their own independent advice on specific matters taking into account the facts in question to answer specific questions on their legal obligations. Ofcom cannot, as a matter of law, fetter its discretion as to any future decision. Accordingly, although these guidelines set out the approach Ofcom would expect to take, they do not have binding legal effect; each case would be considered on its own merits.

## Scope and Relevance

- A5.9 The key aspects of the scope and relevance of these guidelines are as follows:
- These guidelines will be of interest mainly to providers of PATS that are (potentially) subject to requirements and obligations set out in relevant GCs. However, they may also be of interests to end-users, subscribers or consumers

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<sup>31</sup> Further details on the criteria that Ofcom would take into account in setting the amount of any penalty can be found in Ofcom's Penalty Guidelines, see: <http://www.ofcom.org.uk/about/accoun/pg/penguid.pdf>.

<sup>32</sup> Statutory duties and regulatory principles, <http://www.ofcom.org.uk/about/sdrp/>.

of PATS, or other stakeholders who are interested in the effectiveness of PATS regulation within communications markets.

- Certain aspects of GC 3 and GC 4 relate to the provision of a ‘Public Telephone Network’<sup>33</sup> (“PTN”). These guidelines are not intended to provide guidance on requirements or obligations relating to such provision.
- These guidelines do not cover Ofcom's approach to investigating potential contraventions of the consumer information requirements in respect of VoIP services which are the subject of a separate code.
- These guidelines should be read in the light of, and in conjunction with, the final statement entitled *Regulation of VoIP Services* accompanying the publication of these guidelines.

A5.10 The remainder of these guidelines is structured as follows:

- Section B sets out the regulatory framework relevant contextually to these guidelines;
- Section C discusses the meaning of terms and legal concepts that are relevant to determining the application of the relevant requirements or obligations;
- Section D deals with requirements or obligations in respect of network integrity (GC 3) and guidance on issues related to network performance and reliability for VoIP service providers; and
- Section E deals with requirements or obligations concerning the provision of location information to emergency services (GC 4) and their application to VoIP service providers.

## B. Relevant Regulatory Framework

A5.11 In 2002, a package of European Community directives was adopted to establish a harmonised framework for the regulation of electronic communications services (“ECSs”), electronic communications networks (“ECNs”), associated facilities and associated services. These directives entered into force on 24 April 2004 and member states were required to apply their domestic law transposing the directives from 25 July 2003.

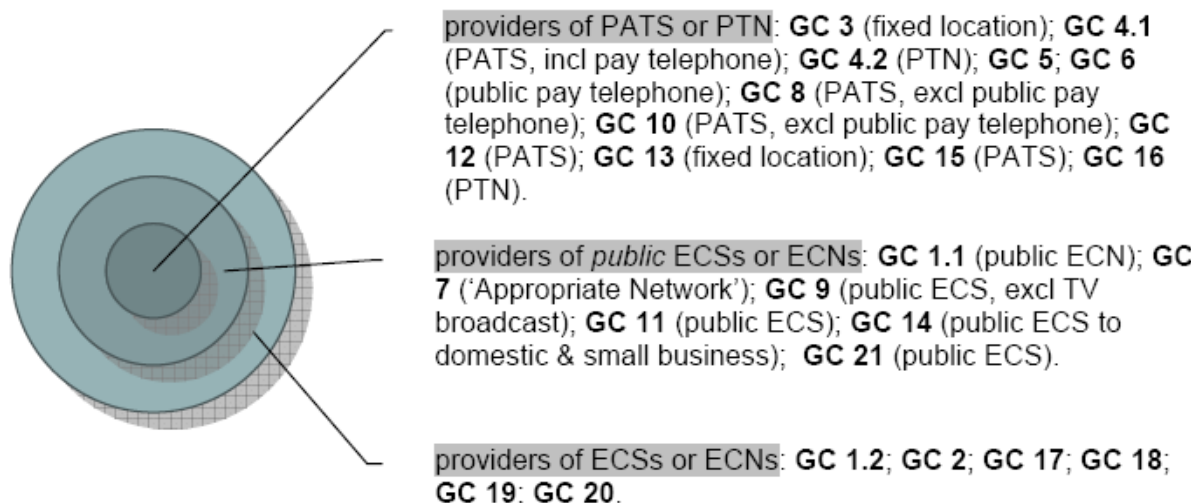
A5.12 That harmonised framework also established certain rights of end-users and corresponding obligations on undertakings providing publicly available ECSs and ECNs. Such regulation derives mainly (but not exclusively) from certain provisions in the Universal Service Directive<sup>34</sup> (“USD”). In particular, the USD requires, in effect, that in the UK Ofcom ensures that certain matters (such as network integrity, emergency calls and planning, metering and billing, number portability) are

<sup>33</sup> See paragraph 1 in Part 1 of the Schedule to the Notification dated 22 July 2003 by the Director General of Telecommunications, referred to above, which defines PTN as meaning “an Electronic Communications Network which is used to provide (PATS) it supports the transfer between Network Termination Points of speech communications, and also other forms of communication, such as facsimile and data;”.

<sup>34</sup> Directive 2002/22/EC of the European Parliament and of the Council of 7 March 2002 on universal service and users’ rights relating to electronic communications networks and services.

regulated to protect the interests and rights of end-users (or, as the case may be, 'subscribers') of ECSs.

- A5.13 As a result of these Community obligations, Ofcom imposed domestic regulation in the form of the GCs which took effect from 25 July 2003. One of the effects of that harmonised framework is that the provision of all ECSs and ECNs is generally authorised and the system of explicit decisions or any other administrative acts (such as licences) by national regulatory authorities prior to being allowed to provide ECSs and ECNs has been abolished.
- A5.14 Therefore, in the UK, the (previous) licensing regime under the Telecommunications Act 1984 has been replaced by the so-called General Authorisation regime. Thus, everyone is 'generally authorised' to provide ECSs and ECNs in the UK. However, the General Authorisation is (among other things) subject to the GCs<sup>35</sup>. In other words, all providers of ECSs and ECNs can enter the market as they wish, although they have to comply with any obligations imposed on them.
- A5.15 Importantly, it is to be emphasised that the GCs apply to anyone who is providing an ECS or ECN, or a particular description of an ECN or ECS (such as PTN or PATS, respectively), specified in the GC in question. Therefore, it is the responsibility of each and every provider to ensure compliance with its GC obligations upon such provision as no individual notification will be given to it by Ofcom that certain obligations apply to it. Failure to comply with such obligations is subject to enforcement action by Ofcom under the procedures mentioned above. Accordingly, a provider must consider whether it falls within the definition of a "Communications Provider", which term is defined separately for each and every GC.
- A5.16 In very broad terms, the main types of network or service provider and the GCs that they are subject to are illustrated in the figure below.



<sup>35</sup> Individual providers may be subject to additional obligations, such as SMP conditions (imposed as a result of a finding of Significant Market Power), access related conditions or conditions imposed as a consequence of a provider being designated as a universal service provider. Any provider which is subject to these additional conditions will have been notified individually when the conditions were imposed. Such additional obligations are not relevant as such to matters covered by these guidelines.



## Figure 2: Types of Provider and the GCs

### C. Meaning of Terms and Legal Concepts

#### Publicly Available Telephone Service (PATS)

A5.17 As shown in Figure 2 above, the majority of GCs are applicable to providers of PATS (or PTN). That term is generally defined<sup>36</sup> for the purposes of the GCs as follows:

“Publicly Available Telephone Service” means a service available to the public for originating and receiving national and international calls and access to Emergency Organisations through a number or numbers in a national or international telephone numbering plan, and in addition may, where relevant, include one or more of the following services: the provision of operator assistance services, Directory Enquiry Facilities, Directories, provision of Public Pay Telephones, provision of service under special terms, provision of specific facilities for End-Users with disabilities or with special social needs and/or the provision of non-geographic services;

A5.18 This definition corresponds to same term as defined in the USD<sup>37</sup>, which provides:

“publicly available telephone service” means a service available to the public for originating and receiving national and international calls and access to emergency services through a number or numbers in a national or international telephone numbering plan, and in addition may, where relevant, include one or more of the following services: the provision of operator assistance, directory enquiry services, directories, provision of public pay phones, provision of service under special terms, provision of special facilities for customers with disabilities or with special social needs and/or the provision of non-geographic services;

A5.19 This means that a service constitutes PATS if, and only if, it meets all of the following gating criteria:

- ‘a service available to the public’;
- ‘for originating and receiving national and international calls and’;
- ‘access to emergency services’;
- ‘through a number or numbers in a national or international telephone numbering plan’.

A5.20 In other words, Ofcom considers that:

- where a VoIP service does not meet *all* of the abovementioned gating criteria, it is not a PATS; and

<sup>36</sup> See paragraph 1 in Part 1 of the Schedule to the Notification dated 22 July 2003 by the Director General of Telecommunications, referred to above.

<sup>37</sup> See Article 2(c) of the USD.



- where a VoIP service does meet *all* of these criteria, it automatically becomes a PATS.

## Electronic Communications Service (ECS)

A5.21 As seen from the above gating criteria, it is necessary to consider what is meant by a publicly available service. The meaning of the public availability of a service is a matter considered below. As regards the term 'service' in the definition of PATS, Ofcom takes the view that it is to be taken as a reference to an ECS. In support of such interpretation, Ofcom considers that it is relevant to take into account the harmonisation aims of the USD, which are set out in Article 1 of the USD. In particular, Article 1(1) provides that:

1. Within the framework of Directive 2002/21/EC (Framework Directive), this Directive concerns the provision of electronic communications networks and services to end-users. The aim is to ensure the availability throughout the Community of good quality publicly available services through effective competition and choice and to deal with circumstances in which the needs of end-users are not satisfactorily met by the market.

A5.22 In other words, that provision makes it clear that, whilst the USD concerns provision of ECSs, the harmonisation aim is to ensure the availability throughout the Community of good quality 'publicly available services'. Ofcom therefore takes that reference to (publicly available) services as a service, to start with, falling within the ECS definition. However, for such a service to constitute PATS (i.e. a publicly available service of a 'good quality'), it must not only be publicly available but also satisfy the remaining above-mentioned gating criteria.

A5.23 The term ECS is defined in Article 2(c) of the Framework Directive<sup>38</sup> as follows:

(c) "electronic communications service" means a service normally provided for remuneration which consists wholly or mainly in the conveyance of signals on electronic communications networks, including telecommunications services and transmission services in networks used for broadcasting, but exclude services providing, or exercising editorial control over, content transmitted using electronic communications networks and services; it does not include information society services, as defined in Article 1 of Directive 98/34/EC, which do not consist wholly or mainly in the conveyance of signals on electronic communications networks;

A5.24 That ECS definition has, in turn, been transposed in section 32(2) of the Act by the following definition<sup>39</sup>:

(2) In this Act "electronic communications service" means a service consisting in, or having as its principal feature, the conveyance by means of an electronic communications network of signals, except in so far as it is a content service.

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<sup>38</sup> Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services.

<sup>39</sup> This definition is, in Ofcom's view, relevant in this context because of the 'interpretation clause' in paragraph 2 in Part 1 of the Schedule to the Notification dated 22 July 2003 by the Director General of Telecommunications, referred to above.

A5.25 Therefore, in considering whether a particular service (such as a VoIP service) is an ECS, Ofcom would normally consider the factual and technical aspects of such a service in the light of a number of questions, including the ones set out below.

ECS: Is the service conveying a “signal”?

A5.26 To answer this question, section 32(8) of the Act provides that references to the conveyance of signals include references to the transmission or routing of signals or of parts of signals and to the broadcasting of signals for general reception.

A5.27 In turn, the term “signal” is defined in section 32(10) of the Act as including:

- a) anything comprising speech, music, sounds, visual images or communications or data of any description; and
- b) signals serving for the impartation of anything between persons, between a person and a thing or between things, or for the actuation or control of apparatus.

A5.28 If the answer to that question is answered in the affirmative, the next question would normally be:

ECS: Is that conveyance by means of an ECN?

A5.29 Section 32(1) of the Act defines ECN as meaning:

- a) a transmission system for the conveyance, by the use of electrical, magnetic or electro-magnetic energy, of signals of any description; and
- b) such of the following as are used, by the person providing the system and in association with it, for the conveyance of the signals—
  - i) apparatus comprised in the system;
  - ii) apparatus used for the switching or routing of the signals; and
  - iii) software and stored data.

A5.30 Section 32(6) of the Act provides that the reference to a transmission system includes a reference to a transmission system consisting of no more than a transmitter used for the conveyance of signals. As regards software and stored data, section 32(9) provides that the cases in which software and stored data are to be taken as being used for a particular purpose include cases in which they (a) have been installed or stored in order to be used for that purpose; and (b) are available to be so used.

A5.31 Having established that the conveyance of signals in question is by means of an ECN, the next question is:

ECS: Does the service consist in, or have as its principal feature, such conveyance?

A5.32 The answer to this question is entirely dependant on the facts in each case.

ECS: Is the service (or part of it) a “content service”?

A5.33 Section 32(7) defines a “content service” as:

“means so much of any service as consists in one or both of the following—

(a) the provision of material with a view to its being comprised in signals conveyed by means of an electronic communications network;

(b) the exercise of editorial control over the contents of signals conveyed by means of a such a network.”

A5.34 To the extent to which the service in question is a ‘content service’<sup>40</sup> (or part of such a service), it is not an ECS and, as seen above, it cannot therefore constitute a PATS. On the other hand, if it (or part of it) is not a content service (and provided that all of the above-mentioned questions are answered in the affirmative), then it would constitute an ECS.

A5.35 However, for an ECS to constitute a PATS, one would still need to consider whether that service is provided so as to be available for use by members of the public. Even so, whilst such a service would be a public ECS for the purposes of the Act, one still needs to consider whether the remaining gating criteria apply to the service in question.

A5.36 However, before turning to the issue of public availability of a service, it is to be noted that, as seen from Figure 2 above, a number of GCs apply to providers of either publicly available ECSs or ECNs or simply ECSs or ECNs. An example of the latter is GC 17 which deals with the allocation, adoption and use of telephone numbers. It is the case, at present, that only a provider of ECS or ECN can apply to Ofcom for an allocation or reservation of appropriate telephone numbers.

A5.37 In certain cases, questions may also arise as to which person is actually providing<sup>41</sup> the ECS in question for regulatory purposes. In this regard, it is to be noted that, in particular, section 32(4)(b) provides that:

references, where one or more persons [*e.g. a sales agent*] are employed or engaged to provide the network or service under the direction or control of another person [*e.g. a telecommunications company, Telco X*], to the person [*e.g. a retail customer*] by whom an electronic communications network or an electronic communications service is provided are confined to references to that other person [*here, Telco X*];

A5.38 Taking this example, whether or not a sales agent is ‘employed or engaged’ to provide the ECS in question to the retail customer ‘under the direction or control’ of Telco X is a matter that will turn on the factual circumstances of each case, taking into account the contractual relationships between the respective parties.

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<sup>40</sup> As seen above, the definition of ECS in the Framework Directive makes it clear that information society services other than those that consist wholly or mainly in the conveyance of signals on electronic communications networks are not ECSs. It may therefore be appropriate to consider whether a service would fall within the meaning of an information society service defined in Article 1 of Directive 98/34/EC (as amended by Directive 98/48/EC) on a case-by-case basis to assist the interpretation of an ECS.

<sup>41</sup> That is to say, making available, supplying or furnishing for use. Section 405(1) of the Act provides that the word “provide” (and cognate expressions) in relation to an ECN, ECS or associated facility, is to be construed in accordance with section 32(4) of the Act.

## Public Availability

- A5.39 As discussed above, the public availability of a service is a prerequisite to constitute a PATS. However, the USD does not provide any clarification as to what it means by a service being available to members of the public. In most cases, Ofcom suspects that this issue will not be a difficult one to determine on the facts. However, Ofcom considers that it might be of assistance to set out, in broad terms, how it would approach this issue in this context.
- A5.40 In Ofcom's view, a publicly available service is one that is available to anyone who is both willing to pay for it and to abide by the applicable terms and conditions. The provider will not have imposed an upper limit on the class of potential customers other than those that arise from technical or capacity constraints. A publicly available service is distinguishable from a bespoke service restricted to a limited group of individual and identifiable customers.
- A5.41 The number of customers to whom the service in question is provided may not necessarily indicate on its own whether it is publicly available or not. For instance, a service with only one customer would be considered a service that is available to members of the public, if other customers would not be prevented from taking up the service but have not chosen to take the service up. This situation would exclude the case where a service is not being made available in good faith, for example by being deliberately overpriced or because the terms and conditions are framed so as to be generally unacceptable. In contrast, a service may not be available to members of the public even though it has several customers – e.g. in the case of a landlord providing services to tenants on a single set of served premises.
- A5.42 Services do not have to be nationally available to be available to members of the public. Indeed, there are a number of providers within the UK limited to a regional customer base and such services are considered to be available to the public. It is also to be understood that the term 'members of the public' requires a broad interpretation – it is not to be read as residential or small business customers. A service that because of its scale, such as a virtual private network service, is only likely to attract corporate customers is still considered to be available to members of the public.
- A5.43 The reason the example of the landlord-tenant service is not available to members of the public is not because it is geographically restricted. Rather, it is because admittance to the set of potential customers is not generally open to anyone. Instead, it depends on the existence of a prior relationship between provider and customer. A more extreme example of a service that is not available to members of the public while being provided for remuneration is the provision of a payphone service within the confines of a prison.
- A5.44 Another example of a service not being made genuinely available to members of the public is where it is primarily targeted at members of the provider's Group (i.e. parent and subsidiary undertakings). Ofcom is minded to consider that, where a provider earns a substantial proportion of its revenue from members of its Group, the services it provides are not genuinely publicly available. A substantial proportion of revenues may be in the order of 80 per cent of the revenues generated by the relevant service, but this percentage is only broadly indicative. However, where it is possible, by means of a physical or logical separation, to partition a network into discrete units, one of which provides services to members of the provider's Group and one of which provides services to members of the public, the part that provides services to members of the public will be regarded as publicly available.

- A5.45 Ofcom recognises that there may be ambiguous cases where it will not be immediately apparent whether or not a given service is available to members of the public. In such cases, the way in which the service is marketed may be indicative.

### **Originating and Receiving Calls**

- A5.46 As seen from the PATS definition above, a publicly available service must be one for originating and receiving national and international calls to constitute PATS. In other words, it must be a two-way service.

### **Numbers in a national or international telephone numbering plan**

- A5.47 As stated above, the origination and receiving of national and international calls and access to emergency services must be through a number or numbers in a national or international telephone numbering plan.

### **Access to Emergency Services/Organisations**

- A5.48 As mentioned above, a further gating criterion in the PATS definition is that it must be a service for 999 access (or, as the definition of PATS for the purposes of the GCs refers to the latter, Emergency Organisations<sup>42</sup>).
- A5.49 In this context, it is to be noted that Ofcom takes the view that any type of 999 access would suffice to satisfy this gating criterion. In other words, such access does not need to meet any achieve any particular degree (or quality) of access in order to constitute 999 access for the purposes of being a PATS.
- A5.50 However, where a service does offer such access (and the remaining gating criteria is met) so that it constitutes a PATS, it is equally to be noted that a provider of such a service is required under GC 3 to take all reasonably practicable steps to maintain, to the greatest extent possible, uninterrupted access to emergency services as part of any PATS offered at a 'fixed location'. The meaning of the latter term is considered below.

### **Fixed Location**

- A5.51 Certain requirements or obligations in GC 3 are limited to those persons providing PATS at a 'fixed locations'. This is because Article 23 of the USD provides:

Member States shall take all necessary steps to ensure the integrity of the public telephone network at fixed locations and, in the event of catastrophic network breakdown or in cases of force majeure, the availability of the public telephone network and publicly available telephone services at fixed locations. Member States shall ensure that undertakings providing publicly available telephone services at fixed locations take all reasonable steps to ensure uninterrupted access to emergency services.

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<sup>42</sup> See paragraph 1 in Part 1 of the Schedule to the Notification dated 22 July 2003 by the Director General of Telecommunications, referred to above, which defines the term 'Emergency Organisation' as meaning "in respect of any locality: (a) the relevant public police, fire, ambulance and coastguard services for that locality; and (b) any other organisation, as directed from time to time by Ofcom as providing a vital service relating to the safety of life in emergencies;".

- A5.52 The package of directives adopted in 2002 makes a general distinction between services provided at fixed locations and those provided to non-fixed locations. A clear example of a fixed location would be the place where a provider has contracted to provide a service through the public switched telephone network (or PSTN) connection at an end-user's residence at a geographic address. This could be contrasted with the 'non-fixed location' case where a provider contracts with the end-user to provide services to a mobile phone (or other itinerant equipment), irrespective of the precise location where end-user normally accesses these services.
- A5.53 In its consultation document of June 2004<sup>43</sup>, the European Commission considers the 'nomadic' nature of certain VoIP services in the context of the network integrity requirements in the above-mentioned Article 23. In particular, the Commission recognises that certain users of VoIP services could connect their terminal at any suitable access point, such as a Wi-Fi hotspot or Internet café, and are not limited to a fixed location. Its view is that the term 'fixed location' refers to the location at which a connection is provided. The Commission then implies that, whilst a provider of PATS at a fixed location will normally provide the service at a contractually agreed location, nomadic use would not constitute the provision of PATS 'at a fixed location'. It concludes that the Article 23 requirements will apply only when the service is used at the fixed 'home' location.
- A5.54 Ofcom recognises that a nomadic service poses particular issues since the PATS provider may have little or no visibility or control over the infrastructure when it is used away from the main location and may not therefore be able to provide consistent quality of service. For instance, if a VoIP service is used within an Internet café's Wi-Fi hotspot (Unlicensed Mobile Access), which use frequencies which are uncoordinated and, as such, it cannot be guaranteed to be free from interference from an adjacent access point. In the 2004 consultation<sup>44</sup>, Ofcom proposed that it would interpret the meaning of a 'fixed location' consistently with the Commission's view. At this time, Ofcom remains of this view. However, Ofcom anticipates that this approach may become less sustainable in the future.
- A5.55 That example shows that, whilst the term 'fixed location' is not defined in the directives as such, the legislative intention was that the term would be interpreted according to its natural and ordinary meaning. Generally understood dictionary meanings make it clear that the noun 'location' refers to the action or process of locating or a particular place or position, whereas the adjective 'fixed' means fastened securely in position or predetermined or inflexibly held. In other words, if a service is provided at a contractually agreed location which is fixed in its nature (for example the end user's residential home or business), then this would, in Ofcom's view, constitute a service provided at a fixed location. There might be nothing to prevent a user technically from connecting to the service from another location (such as a Wi-Fi hotspot or Internet café). However, Ofcom considers that the network integrity requirements in Article 23 of the USD (as transposed in GC 3) would not be relevant when the service is used in these other locations. This would

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<sup>43</sup> See the document entitled Information and consultation paper on the regulatory treatment of Voice over Internet Protocol (VoIP) under the EU regulatory framework;  
[http://europa.eu.int/information\\_society/policy/ecomms/doc/info\\_centre/commiss\\_serv\\_doc/406\\_14\\_voip\\_consult\\_paper\\_v2\\_1.pdf](http://europa.eu.int/information_society/policy/ecomms/doc/info_centre/commiss_serv_doc/406_14_voip_consult_paper_v2_1.pdf)

<sup>44</sup> See consultation document entitled New Voice Services: A consultation and interim guidance, published on 6 September 2004:  
[http://www.ofcom.org.uk/consult/condocs/new\\_voice/aneu\\_voice/?a=87101](http://www.ofcom.org.uk/consult/condocs/new_voice/aneu_voice/?a=87101)

equally apply to other obligations which have been imposed on communications providers of a certain service at a fixed location, such as GC 13.

## **D. Network integrity requirements (GC 3)**

A5.56 In lights of the terms and concepts considered in section C. above, Ofcom turns below to issues related to network integrity and reliability so that it is clear to VoIP service providers what type of matters Ofcom is likely to take into account in investigating any potential breach of GC 3, such as certain steps that they could take in order to comply with the requirements in question.

### **The terms of GC 3**

A5.57 It is appropriate first to set out the terms of GC 3, which provides:

#### **3. PROPER AND EFFECTIVE FUNCTIONING OF THE NETWORK**

3.1 The Communications Provider shall take all reasonably practicable steps to maintain, to the greatest extent possible:

(a) the proper and effective functioning of the Public Telephone Network provided by it at fixed locations at all times, and

(b) in the event of catastrophic network breakdown or in cases of force majeure the availability of the Public Telephone Network and Publicly Available Telephone Services provided by it at fixed locations, and

(c) uninterrupted access to Emergency Organisations as part of any Publicly Available Telephone Services offered at fixed locations.

3.2 The Communications Provider shall ensure that any restrictions imposed by it on access to and use of a Public Telephone Network provided by it at a fixed location on the grounds of ensuring compliance with paragraph 3.1 above are proportionate, non-discriminatory and based on objective criteria identified in advance.

3.3 For the purposes of this Condition, "Communications Provider" means a person who provides a Public Telephone Network at a fixed location and/or provides Publicly Available Telephone Services at a fixed location.

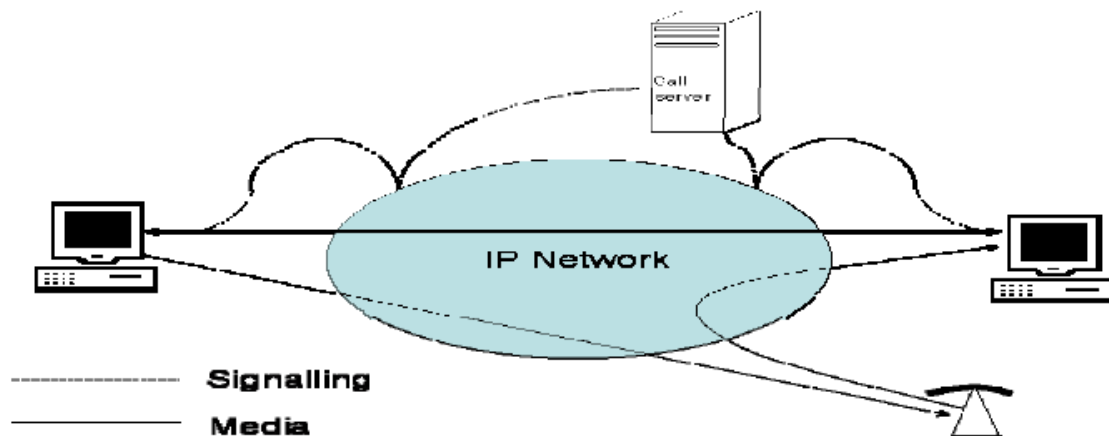
### **Persons to whom GC 3 applies**

A5.58 It is clear on the face of this GC that it only applies to PTNs (parts GC 3.1(a) and 3.1(b)) and PATS ( parts GC 3.1(b) and 3.1(c)), both provided at fixed locations. In this context, it is to be noted that these guidelines deal only with Ofcom's views as regards to the application to PATS providers, and not PTNs.

A5.59 As regards to the requirements relating to PATS, they are twofold. Namely, a person who provides PATS at a fixed location must take all reasonably practicable steps to maintain to the greatest extent possible:

- the availability of such PATS if there is catastrophic network breakdown or in cases of force majeure; and

- uninterrupted access to emergency organisations as part of such PATS.



**Figure 3: VoIP Applications and Signalling**

A5.60 As is clear from Figure 3 above, the reliability and performance of a VoIP service is dependant potentially on a number of elements. Typically, VoIP traffic includes signalling and media data which may take diverse routes through an IP network.

### Relevant considerations

A5.61 For a VoIP service running over an xDSL access network, the key elements that will affect reliability are likely to be:

- consumer premise equipment ('CPE') (e.g. PC/software and/or adaptor);
- local access (e.g. copper loop);
- broadband access network (e.g. DSLAM, ATM and IP network);
- core IP network and Internet peering arrangements - several models exist for this, including the use of direct peering, transit or inter exchange peering and the use of public Internet exchanges;
- service and application layers (e.g. home subscriber server, call server and media gateways);
- interconnection into other networks for the purposes of call termination (e.g. the extent of interconnect agreements with other providers including transit operators).

A5.62 For other broadband networks (such as cable modem, Wi-Fi or WiMax), different elements would be relevant in the local access and broadband access layers.

A5.63 A provider who does control all aspects of the network from end-to-end may be able to provide a high level of network integrity through controlling quality of service and prioritising traffic.

A5.64 In respect of the service/application and IP network layers, there are a number of steps that a VoIP service provider (including those offering nomadic services) could take in respect of the elements they do control. Possible measures include:



- engineering the VoIP service to minimise latency and specifying minimum requirements for use of the service such as bandwidth and contention ratios;
- marking the VoIP traffic for priority (QoS) in an IP network in accordance with an agreed DiffServ or IntServ class of service<sup>45</sup> scheme. This can then be used between interconnected IPv4 networks and may be maintained both in IP headers (precedence bits) and interconnected MPLS networks (EXP bits);
- designing their networks to minimise routing hops, providing sufficient redundancy including call servers, gateways and network capacity, to deal with any throughput issues during re-routing or congestion;
- proactively managing any customer premise equipment to dynamically alter the properties, such as packet and or window size, to maximize throughput for voice traffic in response to observed network performance;
- implementing deep packet inspection to identify and prioritise voice traffic in those parts of the network in which it has control;
- implementing home subscriber server, gateways and call servers close to significant sources and sinks of traffic to other networks;
- in the case of an xDSL service, using the associated PSTN line (which is provided with the DSL service) for 999 access. This would ensure that in the event of power cut/failure or broadband service outage, all 999 calls would be routed to the associated PSTN line, by use of software or control in the CPE/broadband adaptor.

A5.65 Ofcom is not suggesting that any of these specific measures should be regarded as mandatory in order to demonstrate compliance with GC 3. Indeed, these guidelines are intended to provide certain general assistance as to how Ofcom might assess compliance, bearing always in mind more generally that:

- the word “reasonably” imports an objective test, but the onus is on the relevant communications provider to establish that “all reasonably practicable steps to maintain, to the greatest extent possible” have been taken to secure compliance with the applicable obligations in GC 3; and
- while “reasonably practicable” is in isolation a somewhat less strict standard as compared to simply what is “practicable”, the relevant communications must show that not only that *all* such steps have been taken but also that they have so been taken “to the greatest extent possible”.

A5.66 We do, however, consider that all communications providers providing 999 access can reasonably be expected to carry out a formal risk assessment for that service. Such a formal assessment is expected to include:

- producing a model of the network elements used to provide that service;
- defining a set of performance parameters which characterise the end to end performance of that service (e.g.MTBF);

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<sup>45</sup> <http://www.inf.ufsc.br/~mario/QoSIBM>

- identifying which of the elements are most likely to fail, or suffer from degraded performance, and what the consequence would be for the performance parameters;
- determining which elements are critical in relation to the end-to-end service performance, and what risk mitigation strategy might reasonably be adopted in relation to those elements; and
- determining and implementing a risk mitigation strategy that might reasonably be adopted in relation to those critical elements.

- A5.67 In some cases, there are likely to be elements of the end-to-end network that VoIP service providers do not directly control. For example, they may rely on a different broadband provider (xDSL, cable modem, licensed wireless or UMA) to provide access to their VoIP services. Since reliability of the service provided over the network depends on the integrity of the underlying access and interconnected networks, this could present problems for VoIP service providers in complying with their obligations under GC 3.
- A5.68 In the 2004 consultation, Ofcom raised the issue of how a VoIP service provider who does not control the underlying network may ensure network integrity. Most respondents were of the opinion that service level agreements (“**SLAs**”) between VoIP service providers and infrastructure providers were an effective way of ensuring network integrity and reliability. Ofcom is of the view that such agreements may help improve network integrity.
- A5.69 Therefore, in investigating any potential breaches of GC 3 by VoIP service providers, Ofcom would consider what SLAs on quality and reliability VoIP service providers have entered into with their respective providers of underlying network services. For example, where a broadband access is provided by a different provider, then it may be appropriate that the commercial agreements between the VoIP service provider and broadband access provider would include agreement on the priority mechanisms employed to ensure that any agreed marking or classification of traffic is maintained. Ofcom may expect that such SLAs make provision for service classes and characteristics for VoIP traffic.
- A5.70 Nomadic use presents particular challenges in respect of ensuring network integrity since the user may use a wide range of access networks and so putting in place SLAs may present greater difficulties.
- A5.71 Another consideration that Ofcom will examine in an investigation would be any provisions to ensure continuity of service in the case of a power outage at the customer premise. In the case of a PSTN service, continuity of service is ensured through line powering which provides power from the exchange.
- A5.72 The provision of VoIP services (particularly when provided over existing xDSL, cable modem, licensed wireless and UMA) involves the use of Customer Premise Equipment (“**CPE**”) which is not powered by the broadband service or network termination point or equipment. In the 2004 consultation, Ofcom asked whether line powering was appropriate for VoIP services (question 23). It was not considered a viable option by any respondent. In light of this, Ofcom would not currently expect a VoIP service provider to provide line powering to VoIP CPE.
- A5.73 In the absence of line powering, there are other options to ensure continuity of service in the case of a power outage at customer premises (such as the use of

battery back-up or uninterrupted power supply (“UPS”). Ofcom’s view is that, unless otherwise stated in paragraph A1.73a below, the decision to provide battery backup for CPE should be left to the VoIP service provider, who may provide such a facility as part of a service offering.

**A5.73a** Where, with regards to new build fibre access networks, as described in Ofcom’s [consultation document of 16 April 2008], the only voice telephony service provided to end-users is one using VoIP technology, the VoIP service provider is expected to meet the requirements of its obligations under GC3 through the provision and use of a secure uninterrupted battery backup facility. This battery backup facility would be required to power the end-user’s terminal equipment, any network termination at the end-user’s premises and any adapter device that is used to support the VoIP services with a traditional telephone in the event of a failure in the domestic supply.

A5.74 However, it is worth noting in respect to network termination equipment:

- in the US, at least one cable operator provides a cable modem with battery backup which ensures the service is still available as a result of local power outages;
- some VoIP service providers focussing on the business market carry out comprehensive audits when providing IP voice services (such as a review of power requirements including battery and UPS options when specifying solutions for business critical purposes);
- cable operators in the US advise customers on UPS options for their network terminating equipment.

## **E. Emergency Calls (GC 4)**

A5.75 We now turn to the separate obligations contained in GC 4.

### **The terms of GC 4**

A5.76 GC 4 provides:

#### **4. EMERGENCY CALL NUMBERS**

4.1 The Communications Provider shall ensure that any End-User can access Emergency Organisations by using the emergency call numbers “112” and “999” at no charge and, in the case of a Pay Telephone, without having to use coins or cards.

4.2 The Communications Provider shall, to the extent technically feasible, make Caller Location Information for all calls to the emergency call numbers “112” and “999” available to the Emergency Organisations handling those calls.

4.3 For the purposes of this Condition,

(a) “Caller Location Information” means any data or information processed in an Electronic Communications Network indicating the geographic position of the terminal equipment of a person initiating a call;

(b) “Communications Provider” means:

(i) in paragraph 4.1, a person who provides Publicly Available Telephone Services, or provides access to such Publicly Available Telephone Services by means of a Pay Telephone;

(ii) in paragraph 4.2, a person who provides a Public Telephone Network;

(c) “Pay Telephone” means a telephone for the use of which the means of payment may include coins and/or credit/debit cards and/or pre-payment cards, including cards for use with dialling codes. For the avoidance of any doubt, references to a Pay Telephone include references to a Public Pay Telephone.

### **Persons to whom GC 4 applies**

A5.77 As this GC makes it plain, only GC 4.1 applies to PATS providers (who, in the context of VoIP services, are the focus of these guidelines), whereas GC 4.2 applies to PTN providers. The former obligation is simply one requiring a PATS provider to ensure that any end-user can access the emergency organisations by using the emergency call numbers “112” and “999” at no charge.

### **Relevant considerations**

A5.78 Ofcom considers that it might be helpful to indicate to those providers of VoIP services that constitute PATS what they may need to agree with providers of PTNs to help them meet their GC 4.2 obligations.

A5.79 GC 4 implements the USD requirement that public telephone networks make caller location information available to emergency authorities, to the extent technically feasible, for all calls to 999/112. GC 4 defines this caller location information as indicating the geographic position of the terminal equipment of a person initiating an emergency call. Emergency location information is important to the emergency services. Location information is used to dispatch relevant emergency assistance and aids in crime prevention and detection.

A5.80 In the PSTN, a fixed network termination point is matched with a callers’ geographic location which can be identified from the CLI present in signalling system number 7, even when CLI is withheld by the caller. However, for a VoIP service providing location information is not as simple especially for nomadic services.

A5.81 It is possible for a VoIP service provided over a xDSL, cable modem or Wi-Fi broadband connection to provide its location or location of its associated broadband access network termination point in a number of ways, as outlined below. This information could then be passed directly to the emergency operator service. Some options on how this could be provided are discussed below.

A5.82 The simplest approach is for the emergency operator (the operator who receives the 999/112 call in the first instance), to request location information when the call is received. They could be prompted to do this in the case of a 999 call by use of a flag that highlights that the call is from a VoIP service.

A5.83 A second broad approach is for the user to input location details prior to using the VoIP service. This information could then be matched against the E.164 number

when a call is received by the emergency operator. For this approach to be effective location information would need to be obtained from the VoIP user prior to calls being made and this information would need to be populated in the emergency operator database and matched against the E.164 number received. In addition the E.164 number could be flagged as being from a VoIP service which could prompt the emergency operator to confirm the location with the caller.

- A5.84 Where a service is used in a nomadic manner (i.e. there are multiple locations that the VoIP service is being used from) then the user would need to input location information at each new location they are at. This could be facilitated by the VoIP service provider requesting their customer to periodically update the location at which they are using the service, or for the VoIP service provider to monitor the customer's IP address and request revised location information when the IP address changes.
- A5.85 A third approach is to use the IP network and IP addressing to provide location information. Location based solutions are used in the commercial world in particular with respect to control of TV content rights and ecommerce. The BBC uses software which locates an IP address down to city/country level in the UK. They use this to be able to restrict access to certain content rights (e.g. where the rights are for UK only) and users are only allowed to view the content if their source IP address matches part of the IP address range assigned to UK. In the US similar software and topology information is used to stop baseball matches being shown 'live' to internet subscribers living near baseball grounds with granularity achieved down to zip code level.
- A5.86 The granularity of such a solution could reach the targets required by emergency services but only if ISPs collaborate in providing IP address and topology information to a central database. It would be of interest to understand how granular can location be made based on IP v4 addressing. Ofcom understands that such a solution would be constrained by the use of private addressing and NAT. However, it is likely that that future NGN deployment will largely use IPv6 so that a higher level of granularity could be achieved. Standards work to provide location in IP network is ongoing, NICC has a working group looking at providing location in IP networks, as indeed has ETSI and the IETF, eCall proposals from the EC propose a minimum data set, including location, should be provided to support the emergency services across Europe.
- A5.87 Another approach could be to incorporate GPS/A-GPS or other GNSS (such as Galileo) receivers in the broadband adaptors which provide connectivity for the voice service. It is worth noting however, that GPS receivers suffer from the limitation that indoor coverage is problematic, not many users would attach an external antenna and CPE cost would increase.
- A5.88 Another alternative would be for all 999 calls to be made from a PSTN line in the case where a PSTN line remains in place. This could be done by using intelligence in a broadband adaptor (when using xDSL service) to force all 999 calls to PSTN line. This solution enables the continued provision of location to the emergency services based on the PSTN network termination point and associated service location.

## Annex 6

# 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). 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.
- A6.2 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](http://www.ofcom.org.uk/consult/policy_making/guidelines.pdf)
- A6.3 This consultation covers both general policy questions where we are looking for stakeholder views on possible approaches, such as the feasibility of duct access, and more specific policy proposals, such as the requirement to provide battery backup. For the general policy questions a detailed analysis of the costs and benefits is not appropriate at this stage and this impact assessment focuses on the high level impact.

## The citizen and/or consumer interest

- A6.4 The deployment of next generation access networks has far reaching implications for citizens and consumers, and for the UK economy as a whole. The first deployment of these networks is occurring now in new build housing developments, where the incremental cost of rolling out network infrastructure is significantly lower than for existing locations.
- A6.5 New build next generation access networks have the potential to bring significant benefits to consumers in the innovative range of high speed applications and services they enable. As a result, the timely and efficient deployment of new build next generation access networks is of considerable importance.
- A6.6 The deployment of new build next generation networks provides an invaluable opportunity for service providers to trial new services and business models enabling them to better understand the needs of consumers and refine their service offerings accordingly.
- A6.7 Our policy proposals in this consultation are aimed at protecting the interests of citizens and consumers through the promotion of competition and innovation. We seek to do this through existing regulation where it applies in the case of new build next generation access networks.

A6.8 Additionally, new build next generation access networks will most likely be provided through optical fibre technology to the consumer's home. In current generation access networks, a copper local loop connection provides power to the consumer's telephone, such that in the event of a failure in the domestic power source telephone access to emergency services is maintained. Where telecommunication services are provided over new build fibre access networks, there is no provision of power to the consumer's telephone via the access network and therefore it is powered from the domestic power source. As a result of a failure in the domestic power source access to emergency services may no longer be available. In addition to our role safe-guarding the consumer interest through competition, consumer safety is a prime consideration. Therefore, in this consultation we make proposals for ensuring continued access to emergency services is maintained where a consumer is served by a new build fibre access network.

### Ofcom's policy objective

A6.9 Our policy objectives for new build next generation access are fully aligned with our objectives for next generation access as a whole as outlined in our Future Broadband consultation. These objectives flow from our statutory duties and powers, and where relevant we must have due regard to the following:

- securing throughout the UK 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 UK.

A6.10 The proposals put forward in this consultation are aimed at meeting the following high level Future Broadband objectives to apply in our approach to new build next generation access deployments to ensure that:

- the UK witnesses timely and efficient wide scale, market led investment in new build 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 new build next generation access services that facilitates service and business model innovation and experimentation, and that allows service differentiation based on wholesale inputs.

A6.11 Our success in achieving the policy objectives contained in this consultation will be measured in part by the role that new build deployments play in the overall timely and efficient investment in next generation access in the UK. As with the criteria outlined in the Future Broadband consultation, a successful outcome for new build deployments in the UK will see:

- operators investing in new build next generation access networks as soon as it is economically efficient for them to do so, and regardless of what other operators are 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 deployments; and
- that diverse and innovative competition continues to deliver the consumer benefits we see with current generation access.

A6.12 The detail of our proposals for meeting existing regulation are contained in section 5 of this consultation and future opportunities for promoting competition in section 6. We will publish our conclusions to the outcome of this consultation taking into full consideration the responses we receive in a statement that will provide detail of the regulation that will apply to new build fibre access networks.

## Impact of specific proposals

### Wholesale local access

- A6.13 We propose that Openreach is not required to deploy copper in parallel to fibre in new build deployments solely for the provision of an LLU remedy in the wholesale local access market. We believe that it would be neither proportionate nor technology neutral to impose such a requirement and therefore have not carried out a detailed cost assessment. However we recognise that the main cost of requiring copper rollout at the time of deployment would be in the additional ducting required; the copper pair per home and the additional operational costs of maintaining two networks. The digging and trenching costs would be required for the laying of fibre and other new build infrastructure and would therefore be shared.
- A6.14 The benefits to consumers of a parallel copper access network, which could be unbundled, would depend on the ability of fit for purpose fibre-based wholesale access products to deliver the services currently enjoyed by consumers at similar prices. We believe our initial approach to pricing, which seeks to ensure prices for legacy regulated products are the same as on copper, should mean that the benefit of a parallel copper network would be low.

### Wholesale line rental and carrier pre-selection

- A6.15 As discussed in the body of this consultation, the existing WLR and CPS obligations continue to apply and it is for BT (and KCOM in Hull) to set out how it intends to meet them. We propose that the products offered over fibre should allow for the same or very similar customer and CP interfaces. Whatever approach BT follow, they will incur the costs of developing a fit for purpose product, some of which will be passed on to CPs in the wholesale price and subsequently consumers in the retail price of their voice services.
- A6.16 In addition, CPs may incur incremental development costs, and the greater the differences between existing products and the fibre based ones, the greater these costs are likely to be. These costs include systems and processes for ordering and production of these products and any internal product development costs to build appropriate retail products from these inputs.
- A6.17 CPs may consider that these development costs do not provide a good basis for investment in the short term due to a limited customer base. This situation may improve in the medium to long term as the addressable customer base increases.

This situation could lead to an absence of competition and innovation, which could impact consumers in terms of prices and the diversity of products available.

## **Emergency Access**

- A6.18 We propose that GC3.1 (c) can be interpreted as being met by provision of a battery backup facility to ensure continued access to emergency services in the event of a domestic power outage. The provider of the consumer's publicly available telephone service should ensure the facility is available.
- A6.19 The absence of a battery backup facility would leave consumers without access to emergency services in the event of a domestic power outage which is potentially life threatening and we consider this requirement essential in protecting consumers.
- A6.20 The provision of a battery backup facility involves costs for the provider which are estimated at between £10 and £50 per home for customer premises equipment, depending on the level of back up provision provided. These estimates are not based on significant volumes and should fall with time. They are also dependent on the extent of battery backup facility provided. Ofcom is not making specific proposals for the operation and maintenance of battery backup in order to reduce the potential burden on relevant operators.
- A6.21 As we believe that leaving consumers without emergency access is not a viable alternative, the costs must be considered to the cost of providing separate access to emergency services or alternative ways of meeting GC 3.1 (c). One such alternative could be the provision of a metallic power feed from the serving exchange to each consumer's premises and the additional location and installation of power sources at the exchange. We believe these costs would be in excess of those for providing a battery backup facility.

## Annex 7

# The different FTTH technologies

A7.1 This section describes the main types of FTTH technologies – Point to point fibre (PtP); Multiplexed Optical Fibre Networks (MOFN); Passive Optical Networks (PON); and the approach to fibre implementation known as ‘open access’.

### Point to Point Fibre

A7.2 Point-to-point optical fibre networks are similar to copper access networks in that they provide a dedicated transmission path - in this case one or two optical fibres - from the local exchange to a customer site. The optical fibres are contained in multi-fibre cables. Lengths of fibre are ‘spliced’ – that is to say joined together - at underground flexibility points located in manholes and inspection chambers in order to provide an end-to-end connection. In the BT network point-to-point fibre is used to provide leased lines with bandwidths of 2 Mbit/s and above to business customers. The termination at the customer site is in an Optical Termination Unit ('OTU') and a multiplexer that provides the delivered bandwidth in the format specified by the customer.

A7.3 The maximum bandwidth that point-to-point fibre networks can deliver is dependent upon the transmission systems used to transport the data traffic. The BT Megastream range of retail optical fibre data leased lines offer bandwidths from 2 Mbit/s to 155 Mbit/s up to a radial distance of 25km, using Synchronous Digital Hierarchy ('SDH') transmission systems. In reality, optical fibre has the capability of delivering very large bandwidths of 10 Gbit/s or more, and when dense wave division multiplexing ('DWDM') is implemented, bandwidth capacity is almost unlimited. We are now seeing an evolving ranging of Ethernet products offered over PtP fibre, such as 1G Ethernet and 10G Ethernet.

### Multiplexed Optical Fibre Networks

A7.4 Like point-to-point, a multiplexed optical fibre network shares many characteristics with the copper distribution network. ‘Fat pipes’ are provided to the street cabinets and a multiplexer is then used to provide the appropriate bandwidth to the end-user down individual fibre drops. The major feature of multiplexed optical fibre networks is the requirement for active electronics at the street cabinet and associated power feed and management which significantly increases costs.

A7.5 Multiplexed optical fibre networks can deliver in excess of 100Mbit/s to end-users up to 40 kilometres cable distance, further than both point-to-point and Passive Optical Networks ('PONs') because the multiplexer acts as a regeneration facility. This increased distance means that fibre can be long lined from further back in the network and fewer exchanges are required.

### Passive Optical Networks

A7.6 In PONs a number of end-users share the same fibre from the exchange. This fibre is ‘split’ at the street cabinet into 16, 32 or 64 independent fibres each of which carries the same light signal. Splitters may serve more than 64 end-users in the future but this will reduce the bandwidth available to the end-user, where existing technologies are deployed. Splitters are passive devices; therefore there is no need for active electronics at the street cabinet greatly reducing operational costs. Fibre

sharing also reduces the number of fibres that need to be managed at the exchange, reducing space and power requirements. Because of these characteristics many incumbents, including BT, argue that PON technologies are the most cost effective way to deploy Fibre-to-the Home. However, PONs do have disadvantages: the bandwidth available to the end-user is less than with point-to-point architectures and it is also more difficult to provide competitive access to the underlying infrastructure.

A7.7 PON standards are many and varied; the three leading PON technologies are Broadband PON ('BPON'), Gigabit PON ('GPON') and Ethernet PON ('EPON'). While the standards for all three have been ratified, there is some debate as to their actual stability. BPON and EPON have been tested in the field, the latter particularly in Korea and Japan. Verizon and Bell South are currently deploying GPON in the US and BT is trialling and piloting GPON.

A7.8 The main difference between EPON and GPON is in their architectural approach: GPON provides two Layer 2 encapsulation modes: ATM and/or a proprietary encapsulation known as GPON Encapsulation Method. EPON employs a single Layer 2 encapsulation method that uses Ethernet to carry data, voice, and video. All the three technologies are capable of supporting services such as Triple Play (telephony, high speed data and television). The table below summarises key characteristics:

	<b>BPON</b>	<b>GPON</b>	<b>EPON</b>
Standards	ITU G.983	ITU G.984	IEEE 802.3ah
Standard Status	Ratified	Ratified	Ratified
Maximum Bandwidth Downstream	1.25 Gbit/s	2.5 Gbit/s	1 Gbit/s
Maximum Bandwidth Upstream	622 Mbit/s	2.5 Gbit/s	1 Gbit/s
Maximum Split Ratio	1:32	1:128	1:16
Downstream bandwidth at Max split	40M	20M	60M
Transmission	ATM	ATM, Ethernet	Ethernet
Distance	Up to 20 Km	Up to 20 Km	Up to 20 Km
Examples	In use by Verizon	Planned by BT	In use by NTT

A7.9 PONs use time division techniques to share the bandwidth in both up and downstream directions. PONs originated before the widespread application of WDM technologies in the core and backhaul of optical fibre networks. DWDM in the access would greatly increase available bandwidth per end-user and this has been trialled in Korea but is yet to be incorporated into standards and widespread deployment is still some time away. Both EPON and GPON standards bodies are currently discussing Next Generation PON ('NGPON') which is likely to support DWDM as well as significantly increasing the maximum distance the PONs can cover, perhaps up to 100km. Long Range PONs ('LRPONs') would enable operators to greatly reduce the number of exchanges in the networks, offering further cost savings.

## Open Access

- A7.10 Open Access ('OA') is not a technology as such but an approach to fibre implementation. In general, it refers to networks which are available for access (to all) on reasonable terms. It is an umbrella term which can be used to mean free internet access or network neutrality, there being no recognised definition of who should have 'open access' or at what level (e.g. infrastructure or bitstream level). As promoted by some vendors OA refers to the separation of the network from service provision. In this model, which has been extensively implemented in Scandinavia and to a lesser extent elsewhere, CPs access underlying network features through standard interfaces which allow them to provision and deliver the services their end customers choose to purchase from them. It is worth noting that Equivalence of Input is a form of Open Access.
- A7.11 Open Access may promote competition at different points in the network. In some implementations a limited set of services (up to 30) is defined in advance by the network owner. This reduces the capability of the CP to innovate or differentiate itself. If the implementation is vendor specific there is the possibility of further limitations to innovation capability with, additionally, the potential of a sole-supplier bottleneck. The ability of these networks to interconnect with themselves and with others may determine their attractiveness to CPs and the choice consumers face. Other implementations may support open access to the duct or dark fibre, enabling providers to compete in all aspects of service provision.

## Annex 8

# International case studies on duct access

A8.1 There are significant concerns as to the feasibility of duct access both in new build and existing networks. Ofcom wished to learn whether the practical difficulties of which we are aware have been overcome in other countries. To this end we undertook a study to identify international examples and draw from the experience of cases where access to passive infrastructure elements (i.e. fibre, poles and trenches) is successful. As part of the survey regulators, CPs and incumbent operators were studied. Our initial analysis of the case studies would suggest that duct access may be feasible. We have summarised the case studies below.

## Canada

A8.2 In Canada, the sharing of existing duct and poles has been an established national practice for over 40 years. The practice of duct sharing was actively encouraged by local government policy as a way to avoid the digging of separate trenches when cable access networks started being deployed in the 1960's. The principles and tariffs for sharing duct are regulated by the Canadian Radio-Television and Telecommunications Commission ('CRTC') - the Canadian telecom regulator - and apply to all operators who own duct: incumbents, cable network providers and new entrants. The CRTC believes that the current duct sharing regulation provides an equitable arrangement for all operators and keeps the cost of renting duct down. The CRTC is not aware of significant technical and security problems arising out of the sharing arrangements. However, Bell Canada, the incumbent in Ontario and Quebec, has the view that the current regulated tariffs for duct rental do not incentivise the duct owner to install spare ducts, as the tariffs barely cover the cost of maintenance.

A8.3 In parallel to national duct access regulation, a number of local authority-led and commercial initiatives exist in Canada that promote duct sharing. For example in Montreal, Commission des Services Electriques de Montreal ('CSEM')<sup>46</sup>, which is a co-operative agency established in 1910 by the city of Montreal consisting of communication providers, utilities, civil engineering companies, building consortia and planning authorities has been given the mandate to build, operate and manage the underground space in the city including the duct network. CSEM has the role of standardising construction, consolidating demand from various sources – telecom, gas, the city authorities, etc - to build duct capacity and engineer extra capacity for renting and reselling. The rate for renting duct is calculated using a formula<sup>47</sup> taking into account cumulative capital investment, interest rates and amortisation. The initiative has resulted in a good supply of duct, competitive rates and minimal disruption resulting from civil works. Another initiative that started in 1994 in Montreal called the Centre for Expertise and Research on Infrastructures in Urban areas ('CERIU')<sup>48</sup> aims to increase collaboration and foster the optimisation of urban infrastructure in Quebec including ducts for new build. It is in the process of defining an infrastructure sharing framework where interested parties (usually CPs and utilities) are invited to collaborate and agree on the overall design and standards used in deploying the passive infrastructure in new developments. The passive infrastructure which includes trenches and ducts is built by a single company

<sup>46</sup> <http://www.csem.qc.ca/Files/CadreStrategique2005.pdf>

<sup>47</sup> Rent per meter = cumulated investment + interest / length with an amortisation over 20 years

<sup>48</sup> [http://www.ceriu.qc.ca/en/ceriu\\_home/](http://www.ceriu.qc.ca/en/ceriu_home/)

according to the specification mandated by the interested parties committed to the development. Apart from Montreal where CSEM owns and operates all underground infrastructures, once the passive infrastructure has been deployed, the committed parties own and operate the passive infrastructure. The initiative should lead to savings in construction and maintenance as well speed up the process for deploying passive infrastructure in new developments. One drawback to the framework is that once the infrastructure is installed it does not enable subsequent access to duct space to new interested parties.

## France

- A8.4 In France, the sharing of duct is not a new concept as a number of commercial offerings and public policy led initiatives exist for point to point duct sharing. For example, France Telecom ('FT') operates and manages the sharing of point-to-point passive infrastructure on behalf of local bodies serving business parks. Moreover FT has been providing duct access on a commercial basis for over a decade on a case by case basis where municipalities have refused to grants rights of ways. In the City of Paris, the 1,120-mile sewer passive infrastructure has been made available by the Mayor of Paris to operators who would like to lay duct for deploying fibre networks at nominal rates.
- A8.5 Over the last few years ARCEP, the French regulator, has been pro-actively auditing the quality and availability of FT duct for access and sharing. ARCEP has recently conducted two separate public consultations where it proposed duct as one of the key input remedies for NGA. FT has agreed to provide duct geo-location information to its competitors in order for the competitor to survey the duct quality and spare capacity. However, in return the competitor must share the results of the survey with FT and access to the spare duct is subject to FT authorisation. FT is currently in negotiations with the main competing operators in developing a fit for purpose wholesale duct access offering, with ARCEP acting as the arbitrator. The first version of the FT duct access offering was privately communicated to the main competing operators in December 2007, however it is expected that a number of negotiation rounds will be required for FT and the main operators to reach final agreement on pricing and the operational aspects of the offering. According to ARCEP FT will publish a revised offer next summer.

## Portugal

- A8.6 In Portugal the ducts owned by the incumbent, Portugal Telecom Comunicacoes ('PTC'), are available for sharing as stipulated by law drawn up while PTC was being privatised in 2001 and which came into effect in 2004. As a result the Portuguese telecom regulator ANACOM did not have to argue the case for the feasibility of duct sharing but only had to use its powers to oblige PTC to publish a reference offer for duct sharing. The offering referred to as ORAC (Reference Conduit Access Offer) was initially published in 2004 but did not meet all the obligations. Only after PTC revised the offering and ANACOM was satisfied that the revised offering fulfilled the spirit and terms of the law, fostering the use of PTC's ducts by competitive operators, was it enforced in 2006.
- A8.7 ORAC is a well-defined framework for duct sharing that in principle should foster the usage of incumbent duct. The framework specifies all the key operational aspects and processes for enabling duct sharing: application, pricing parameters, information availability, co-ordination procedures, accreditation, service level agreements, and the parameters for assessing feasibility. The framework is equally applied to new build with the additional requirement that in new build, PTC has to



invite all interested parties if they would like to jointly share the cost of investing in the new build duct and hence the benefit arising from owning the duct.

- A8.8 ORAC works well in principle however it has a number of limitations. The application process is slow – the paper based system has only just been upgraded to e-paper and does not scale adequately, for wide scale deployment of NGA networks. Moreover the service connection duct, (also known as building entry duct) which is generally managed by PTC but owned by the building owner, is not within the scope of ORAC. In addition information on ducts is not always up to date which is usually addressed by using accredited sub-contractors who have local knowledge of the duct network. Finally access to ducts sometimes requires co-ordination with the local council which operates on different timescales to PTC.

## Australia

- A8.9 In Australia duct access and sharing is a relatively new concept that started in the 1990's. Competing operators can gain access to existing duct for backhaul and in the access network up to the last drop either from utilities via commercial offerings or from other licensed operators via a condition in carrier licensing regulation. Licensed carriers are mandated to provide access to physical facilities they own including duct to competitors for the carriage of competing telecom services and deployment of competing facilities. Telstra, the incumbent operator offers wholesale access to its network of ducts, tunnels, manholes and pits at costs that are negotiated with the regulator, the Australian Communication and Media Authority (ACMA). Although the regulated offering for duct specifies a lower cost for duct than the typical utility commercial offering (AUS \$ 7/metre in the commercial offer versus AUS \$ 11/metre in the regulated offer), competitors like OPTUS view the regulated offering from Telstra as process intensive and complicated with high overhead charges to process orders and enable duct access and sharing. In contrast access to duct from power utilities is relatively straight forward, although a separate cable chamber or manhole has to be sometimes built to provide access to the infrastructure and accommodate equipment and splicing. New duct sharing agreements with utilities have been drawn up to include secondary chambers. According to alternative operators sharing of duct over short distances (less than 250-300 metres) costs more than own build unless it occurs in dense urban and metropolitan areas.
- A8.10 In parts of Western Australia and some urban areas e.g. Melbourne trench sharing is viewed as a viable commercial option, particularly for new build, where the developer builds trenches as per agreed specifications and co-ordinates the sharing of the trench between services including telecom services delivered over fibre. For example VicUrban, a state developer, is employing trench sharing at an ongoing project called Aurora, a 8000 home development, in outer Melbourne.

## Italy

- A8.11 The availability of ducts for sharing is the key reason why FTTH has been deployed relatively rapidly and earlier in Italy than other European countries. Fastweb for example has used the ducts from utilities and from Telecom Italia's non-operational cable Socrate infrastructure to deploy fibre to approximately two million homes. The Socrate infrastructure was constructed by Telecom Italia in the 1990's for delivering multimedia services in a joint venture with Sky Italia but the project ran into trouble and was abandoned in 1998. As of 1997, the Socrate infrastructure which was dimensioned to accommodate a fibre-coax network passed more than 1.5 million homes which made it particularly suitable for deploying a fibre access network.



When Telecom Italia's acquisition of TV channel 'La 7' resulted in an anti-trust ruling in 2001, it was obliged to open up the Socrate infrastructure to third parties. In regions and cities where the Socrate infrastructure is absent local authorities have developed policies for duct and trench sharing.

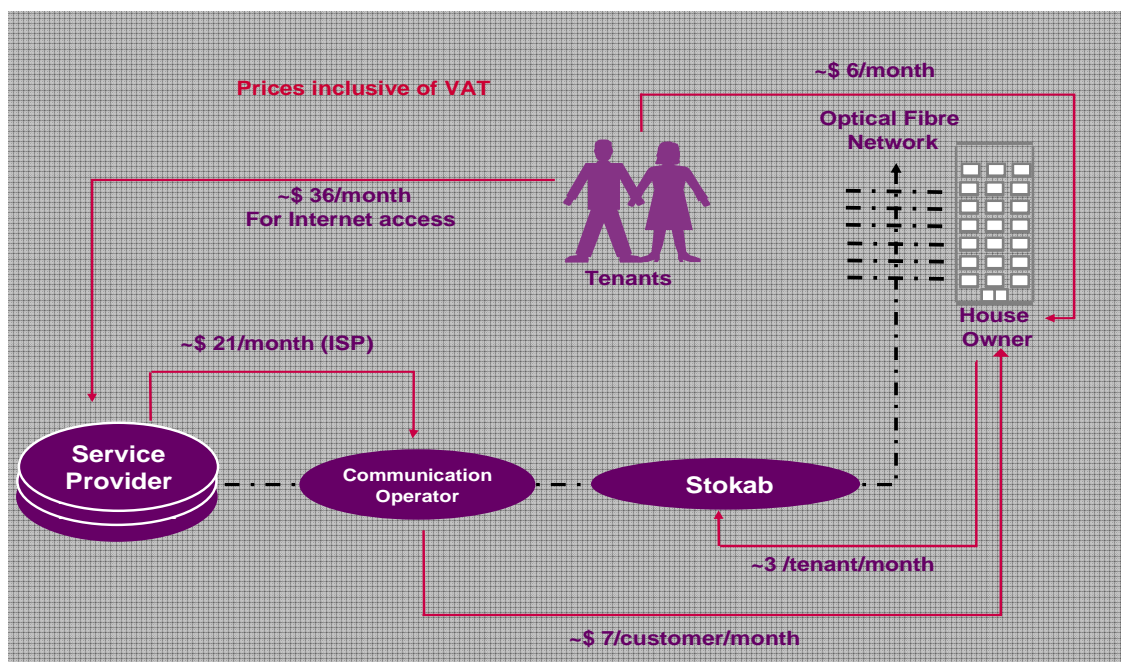
- A8.12 Telecom Italia's published duct access offering is priced over a number of dimensions: by duct volume and sub-ducts, dependent on the availability of duct in the city/region; and by section of the passive network i.e. differential pricing for primary (the combination of backhaul and feeder sections) and secondary (the combination of distribution and drop sections) network infrastructure. Although the pricing and procedures for gaining access to duct from Telecom Italia is fair and relatively proportionate the scarcity of duct in the secondary network and lack of space in the service connection duct and in the cable chambers to install splices makes it challenging to deploy fibre all the way to the home. The limited Socrate network footprint constrains the utility of Telecom Italia duct access offering to less than 2 million homes.
- A8.13 In May 2007 AGCOM the Italian regulator launched a major public consultation to address Telecom Italia's unfair advantage, as the owner of the passive telecom infrastructure, to potentially be able to rapidly deploy NGA. As part of the consultation AGCOM is considering mandating Telecom Italia to share its ducts and passive infrastructure to remedy the situation. Although Telecom Italia has shown signs of co-operating with AGCOM on sharing its ducts, acknowledging that sharing infrastructure is essential to facilitate FTTx<sup>49</sup> rollouts, it proposes that duct sharing should be a symmetric requirement. AGCOM is due to decide on its position on duct sharing in 2008.

## Sweden

- A8.14 In Sweden city-owned passive network companies such as Stokab in Stockholm promote an 'open access passive network' model. In Sweden there are 155 city network companies (stadsnets) like Stokab, of which 90% are fully or partially owned by the city or municipal authority. Stokab, which is owned by the City of Stockholm, has developed and expanded the Stockholm passive network having been granted access to the city underground infrastructure. The network consists of rings that each serve a block (a rectangular area in the city surrounded by streets and containing several buildings), interconnected by Stokab's metro backbone network. Each ring consists of a duct system (multiple sub-ducts or micro-ducts) that starts and ends at an "area node" located at the basement of a designated city block building where all the fibres from the block are terminated. From the area node Stokab has installed a duct system through the basement of buildings within the block to form a ring. Each building connected by the duct ring is a potential 'connection node' from where Stokab can bi-directionally branch a micro duct from the multi-duct ring. Stokab operates the passive network and leases dark fibre to any interested party at cost based rates. The Stokab network is used by more than 90 operators including the incumbent TeliaSonera. Stokab is not involved in providing services over its dark fibre network nor is it involved in laying ducts and cables within buildings. The Stokab model has enabled every block in Stockholm to be connected by dark fibre.
- A8.15 In Sweden a large proportion of the housing stock is owned by housing companies owned by the municipalities. In Stockholm, where almost 50% of the housing stock is Multiple Dwelling Units (MDU), the housing companies have played a significant

<sup>49</sup> Last mile of connection to specific locations using fibre optic cable e.g. Fibre to the Home (FTTH)

role in increasing access to the Stokab open access metro backbone network. For example Familje Bostader (FB), which is the largest housing company owned by the City of Stockholm, has deployed fibre to each tenant apartment and negotiated with Stokab to link all its MDUs to the Stokab network. The diagram below illustrates the various business models and financial relationships between the various players involved in providing services over the open access Stokab network.



Source: Stokab/IDATE

## USA

A8.16 The USA has had regulatory framework in place for access to poles and ducts since 1978 when congress authorized the Federal Communications Commission ('FCC') to ensure that poles, ducts, conduits and rights-of ways<sup>50</sup> controlled by utilities (i.e. local exchange carriers or any other public utilities, except the railway, which are not federal government or State property) are made available to cable TV carriers on 'just and reasonable' rates, terms and conditions. In 1996 congress expanded the group of beneficiaries to include telecommunication service carriers but excluded incumbent local exchange carriers in order to promote local competition in the telecom sector. In the implementation of the expanded framework the FCC adopted two specific rate formulae to establish maximum rates in the event of a disputes between parties involved; the formula that produced lower rates was applied to cable carriers and the formula producing higher rates to telecom carriers. In 1998 the framework was further expanded to include cable Internet carriers and wireless carriers and the formulae further simplified. The framework does not apply to the joint use arrangements between ILECs and utilities. The study identified three types of commercial joint arrangements between ILECs and utilities in the USA: joint ownership, joint use and licensing or managed access. Recently the FCC has proposed changes to the framework to reflect increasing inter-modal competition in the sector i.e. between cable and telecom carriers.

<sup>50</sup> Poles, ducts, conduits and rights of way are collectively referred to as pole attachments in section 224 of the Telecom Act which covers the framework

A8.17 In practice a number of state utility commissions have pre-empted the FCC jurisdiction by certifying that they regulate the rates, terms and conditions of 'pole attachments'. In addition, it is evident from a number of previous court cases that utilities may deny access for reasons such as safety, reliability, insufficient capacity and engineering rules, although the utility has the ultimate burden for providing proof if a complaint is filed. There is a significant demand for duct access according to Verizon and the framework provides certain rights and protection to the parties involved.

## Japan

A8.18 In Japan there are two regulated regimes that co-exist for sharing infrastructure: asymmetric regulation on ducts and other passive facilities owned by the incumbent, NTT East, in accordance to the 'obligatory section'; and symmetric regulation on ducts, cable tunnels and other passive facilities that applies to assets of NTT East and other operators for which there is no specific plan of use, under the 'general section'. Both sections specify similar processes and procedures to enable access, sharing and joint use. Sharing of facilities such as ducts, manholes and poles is a common practice and has been successful in reducing the cost of deploying broadband infrastructure in Japan.

## Annex 9

# Terminology for physical infrastructure access and sharing

The following provides a guide to the terminology proposed for furthering the discussion of physical infrastructure access and sharing.

**Cable trench** – a long narrow excavation or channel used in which duct and/or cable is laid.

**Duct** – a closed passage for housing and protecting cables and conductors. There are three types of ducts:

- **Main or primary duct** – large duct which may contain factory installed sub-ducts or micro-ducts.
- **Sub-duct** – smaller duct than the main duct used mainly to partition and improve the utilisation of main ducts, and protect individual cables. Typically 3-4 sub-ducts are drawn inside a section of primary duct enabling cables to be drawn in later while protecting cables in-situ. Telecom sub-ducts are usually coloured red or yellow. Sub-duct may contain factory installed micro-ducts.
- **Micro duct** – micro-duct is a recent innovation and is the smallest type of duct. Micro-ducts are either factory or field installed into standard size duct prior to the installation of micro-cables. Micro-duct has to be chosen to be compatible with the cable being used and the fibre count required.

**Cable chambers** - part of the underground system structure used as flexibility points for accessing cables and physical joints in the passive network. Cable chambers facilitate placement, connection, and maintenance of cables and associated equipment. Cable chambers can refer to manholes, footway boxes, joint boxes, hand holes, and pull holes.

**Cable joint box** - an underground chamber that contains the joints between two lengths of fibre optic cable.

**Cable** - an assembly of one or more cable units (e.g. copper pairs, copper quads, coaxial tubes, fibres) in an overall sheath. Cables can be either pre-installed or blown into ducts, sub-ducts or micro-ducts. Some cables can also be directly buried. Micro-cables designed primarily to be installed inside specified micro-ducts are a recent innovation.

**Fibre** – specially manufactured glass strands, used for the transmission of optical signal, that are installed inside cables.

**Customer premises distribution frame** - a point of demarcation usually sited outside a property where the network operator terminates and connects external grade cables to internal grade cables. The customer premises distribution frame could also be located inside a building or property in a communication or utility service room. Sometimes known as an intermediate distribution frame.

**Cabinet** - street furniture for housing cables and/or equipment providing an appropriate degree of protection against external influences and/or end-user contact.

## Annex 10

# Glossary

**Access network:** An Electronic Communications Network running from the end-user's premise to a Local Access Node and supporting the provision of access based services. It is sometimes referred to as the local loop or last mile.

**ADSL (Asymmetric Digital Subscriber Line):** A digital technology that allows the use of a standard telephone line to provide high speed data communications. Allows higher speeds in one direction (towards the customer) than the other.

**ADSL1:** The first generation of ADSL, capable of data speeds of up to 8Mbit/s towards the customer and up to 640kbit/s from the customer.

**ADSL2/ADSL2+:** Improved versions of ADSL, offering high speeds, especially on shorter telephone lines. In the case of ADSL2+, up to 24Mb/s can be delivered towards the customer.

**ALA (Active Line Access):** A type of next generation access wholesale access product, described in Ofcom's September consultation 'Future Broadband'.

**AM (Amplitude Modulation):** Type of modulation produced by varying the strength of a radio signal. This type of modulation is used by broadcasters in three frequency bands: medium frequency (MF, also known as medium wave: MW); low frequency (LF, also known as long wave: LW), and high frequency (HF, also known as short wave: SW). The term AM is often used to refer to the medium frequency band

**ATM (Asynchronous Transfer Mode):** Broadband transmission technology which provides the backbone for many of the world's telecommunications network. ATM breaks information flows into small fixed-length cells of 53 bytes. Cells of any type of traffic " voice, multimedia, data or video " can be interspersed with each other. ATM operates at speeds of 25, 155 and 622 Mbps.

**BCMR:** Business Connectivity Market Review

**Bit-rates:** The rate at which digital information is carried within a specified communication channel.

**Bitstream:** A wholesale service providing conveyance of data traffic, typically ATM or IP, from an end user's premise to a point of interconnection made available by the incumbent to a competitive provider.

**Communications Act:** The Communications Act 2003, which came into force in July 2003.

**Contention ratio:** An indication of the number of customers who share the capacity available in an ISP's broadband network. Figures of 50:1 for residential broadband connections and 20:1 for business are typical).

**Co-regulation:** The sharing of regulation between a statutory body (e.g. Ofcom) and its licensees.

**CPE (Customer Premises Equipment):** Any network- or communication service-related equipment located at a customer site

**CPs:** Communication Providers

**CPS (Carrier Pre-selection):** The facility offered to customers which allows them to opt for certain defined classes of call to be carried by an operator that has been selected in advance and has a contract with the customer. CPS does not require the customer to dial a routing prefix or use a dialler box.

**Dark Fibre:** Optical fibre that has been laid, but is not lit by its owner; may be available on a wholesale basis to another Network Operator to light with its own electronics

**DCMS:** Department for Culture, Media and Sport

**Downlink speed:** Also downlink or download. Rate of data transmission from a network operator's access node to a customer, typically measured in Megabits per second.

**DSL (Digital Subscriber Line):** A family of technologies generally referred to as DSL, or xDSL, capable of transforming ordinary phone lines (also known as 'twisted copper pairs') into high-speed digital lines, capable of supporting advanced services such as fast Internet access and video-on-demand. ADSL, HDSL (High data rate Digital Subscriber Line) and VDSL (Very high data rate Digital Subscriber Line) are all variants of xDSL).

**DSLAM (Digital Subscriber Line Access Multiplexor):** Apparatus used to terminate DSL enabled local loops, which comprises a bank of DSL modems and a multiplexer which combines many local loops into one data path.

**EC:** European Commission

**ERG:** European Regulators Group

**Ethernet:** A family of networking technologies standardised by the IEEE defining data transport and networking at Layer 2 over a range of physical media. Originally designed for Local Area Networks, now also being seen in carrier networks and Next Generation Access

**Ex ante regulation:** Regulatory intervention aimed at addressing anti competitive behaviour before it happens.

**Ex poste regulation:** Regulatory intervention aimed at addressing anti competitive behaviour after it happens.

**FM (Frequency Modulation):**Type of modulation produced by varying the frequency of a radio carrier in response to the signal to be transmitted. This is the type of modulation used by broadcasters in part of the VHF (Very High Frequency) band, known as VHF Band 2

**FTTC (Fibre-to-the-cabinet):** An access network architecture in which the optical fibre extends from the access node to the street cabinet. The street cabinet is usually located only a few hundred metres from the subscriber premises. The remaining segment of the access network from the cabinet to the customer is usually a copper pair but could use another technology, such as wireless.

**FTTH (Fibre-to-the-Home):** An access network architecture in which the optical fibre extends from the access node to the end user's living or office space.

**FTTB (Fibre-to-the-Building):** An access network architecture in which the optical fibre extends from the access node to the building. The network operator generally serves

individual customers over in-building copper cabling from a central Ethernet switch or DSLAM in the building.

**FTTx (Fibre-to-the-x):** A general term for any network architecture that involves fibre in the local loop

**GC:** General Conditions of Entitlement

**Generic Ethernet Access (GEA):** An FTTH wholesale product proposed by BT.

**GPON:** Gigabit Passive Optical Network. A fibre access technology based on shared fibre.

**High Definition Television (HDTV):** A technology that provides viewers with better quality, high-resolution pictures.

**Headline connection speed:** The theoretical maximum data speed that can be achieved by a given broadband. A number of factors, such as the quality and length of the physical line from the exchange to the customer, mean that a given customer

**IA (Indirect Access):** Where a customer's call is routed and billed through operator's network even though the call originated from the network of another operator. Also a wholesale product from BT.

**IEEE:** Institute of Electrical and Electronics Engineers

**Interconnection:** The linking of one Public Electronic Communications Network to another for the purpose of enabling the persons using one of them to be able (a) to communicate with users of the other one; (b) to make use of services provided by means of the other one (whether by the provider of that network or by another person).

**Internet:** A global network of networks, using a common set of standards (e.g. the Internet Protocol), accessed by users with a computer via a service provider.

**IP (Internet Protocol):** The packet data protocol used for routing and carriage of messages across the Internet and similar networks.

**IPTV (Internet Protocol Television):** The term used for television and/or video signals that are delivered to subscribers or viewers using Internet Protocol (IP), the technology that is also used to access the Internet. Typically used in the context of streamed linear and on demand content, but also sometimes for downloaded video clips.

**ISDN (Integrated Services Digital Networks):** A standard developed to cover a range of voice, data, and image services intended to provide end-to-end, simultaneous handling of voice and data on a single link and network.

**ISP (Internet Service Provider):** A company that provides access to the internet.

**ITU:** International Telecommunications Union

**LAN (Local area network):** A network for communication between computers covering a local area, like a home or an office.

**Leased Line:** A transmission facility which is leased by an end user from a public carrier, and which is dedicated to that user's traffic.

**LLU (Local Loop Unbundling):** LLU is the process where the incumbent operators (in the UK it is BT and Kingston Communications) make their local network (the lines that run from customers premises to the telephone exchange) available to other communications providers. The process requires the competitor to deploy its own equipment in the incumbent's local exchange and to establish a backhaul connection between this equipment and its core network.

**Local Loop:** The access network connection between the customer's premises and the local PSTN exchange, usually a loop comprised of two copper wires.

**Multiplex:** A device that sends multiple signals or streams of information on a carrier at the same time in the form of a single, complex signal. The separate signals are then recovered at the receiving end.

**Narrowband:** A service or connection providing data speeds up to 128kbit/s, such as via an analogue telephone line, or via ISD.

**NGN (Next generation core networks):** Internet Protocol based core networks which can support a variety of existing and new services, typically replacing multiple, single service legacy networks

**NGA (Next generation access networks):** Broadband access networks that connect the end-user to the core network capable of with a bandwidth quantity and quality significantly in excess of current levels (a benchmark of 20Mbit/s or more is often used).

**NRA:** National Regulatory Authority

**OECD:** Organisation for Economic Cooperation and Development.

**OTA (Office of the Telecoms Adjudicator):** The Telecommunications Adjudicator has been established to facilitate swift implementation of the processes necessary to enable competitors to gain access to BT's local loop on an equivalent basis to that enjoyed by BT's own businesses.

**Of tel:** Office of Telecommunications, whose functions transferred to Ofcom on 29th December 2003.

**PATS:** Publicly Available Telephone Service

**Peaktime:** The period during which: a radio station broadcasts its breakfast show and, on weekdays only, also its afternoon drive-time show; a television station broadcasts its early- and mid-evening schedule, typically used by Ofcom to refer to the period between 18:00 and 22:30 each day (including weekends)

**PECS:** Public Electronic Communication Service

**Peer to peer distribution:** The process of directly transferring information, services or products between users or devices that operate on the same hierarchical level.

**PLA:** Passive Line Access. A type of wholesale infrastructure access, described in Ofcom's Future Broadband consultation.

**PSTN:** Public Switched Telephony Network. Traditionally, voice services have been traditionally delivered over the PSTN.



**SDSL (Symmetric Digital Subscriber Line):** A variant of DSL which, unlike ADSL, offers the same data speeds in both directions.

**Service bundling (or multi-play):** A marketing term describing the packaging together of different communications services by organisations that traditionally only offered one or two of those services.

**Service provider:** A provider of electronic communications services to third parties whether over its own network or otherwise.

**SME:** Small to medium sized enterprise. A company with fewer than 250 employees.

**Streaming content:** Audio or video files sent in compressed form over the internet and consumed by the user as they arrive. Streaming is different to downloading, where content is saved on the user's hard disk before the user accesses it.

**Sub-loop unbundling:** A variant of LLU where a competitive operator takes control of only a portion of a customer's local loop, allowing them to install their equipment closer to the customer and potentially offer higher speed services. In Sub-loop unbundling, the point of handover is commonly the Primary Connection Point (PCP) or street cabinet.

**Telecommunications, or telecoms:** Conveyance over distance of speech, music and other sounds, visual images or signals by electric, magnetic or electro-magnetic means.

**Transmitter:** A device which amplifies an electrical signal at a frequency to be converted, by means of an aerial, into an electromagnetic wave (or radio wave). The term is commonly used to include other, attached devices, which impose a more simple signal onto the frequency, which is then sent as a radio wave. The term is sometimes also used to include the cable and aerial system referred to above, and indeed the whole electrical, electronic and physical system at the site of the transmitter.

**TV over DSL/TV over Broadband:** A technology that allows viewers to access TV content – either in a linear programme schedule, or on-demand – using Internet Protocol via broadband services, either on a PC or (via a set-top box) on a TV set.

**VDSL (Very high bit rate DSL)** This is currently the fastest version of DSL and can transmit very high data rates on short reaches of the local loop.

**VoB (Voice over Broadband):** A technology that allows users to send calls using Internet Protocol and a broadband service.

**VoD (Video on Demand):** A service or technology that enables TV viewers to watch programmes or films whenever they choose to, not restricted by a linear schedule. Also Near Video on Demand (NVoD), a service based on a linear schedule that is regularly repeated on multiple channels, usually at 15-minute intervals, so that viewers are never more than 15 minutes away from the start of the next transmission.

**VoIP (Voice over Internet Protocol).** A technology that allows users to send calls using Internet Protocol, using either the public Internet or private IP networks.

**WAN (Wide area network):** A network allowing the interconnection and intercommunication of a group of computers over a long distance.

**Wifi:** Short range wireless technologies using any type of 802.11 standard such as 802.11b or 802.11a. These technologies allow an over-the-air connection between a wireless client and a base station, or between two wireless clients.

**WiMAX:** A wireless metropolitan area network (MAN) technology, based on the 802.16 standard. Available for both fixed and mobile data applications.

**WLR (Wholesale Line Rental):** A regulatory instrument requiring the operator of local access lines to make this service available to competing providers at a wholesale price.