

Regulating next-generation fixed access to telecommunications services

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Abstract

This paper considers a central issue in telecommunications regulation. What rules, if any, should regulators put in place to provide incentives for timely and efficient investment in NGA while, at the same time, preventing monopoly abuse – either by taking monopoly rents from end users or harming downstream competition? We focus on the regulatory environment in the EU in attempting to answer this question. But the proposals we make are equally relevant to the rest of the developed world.

There is a range of both active and passive remedies which regulators might use. We argue that, while passive remedies are important in enabling infrastructure-based competition, active (bitstream) remedies will be important for preserving competition in the supply of retail, NGA-based, products. In particular bitstream offers access seekers a way of reaching customers nation-wide at the same time as the national fixed incumbent for a relatively modest investment¹; This is especially important when competing for the revenues of multi-sited businesses.

*To regulate bitstream products effectively regulators might specify the price regulation principles which would apply to operators found to have significant market power (SMP) in NGA supply **in advance** of any market definition and SMP assessment. To enable timely and efficient investment in NGA regulators should allow access providers to provide distinct NGA-based bitstream products to meet the needs of different segments of the end-user market and to then charge for these products at the wholesale level so as to reflect their value to end users rather than their costs. But regulators also need to put in place competitive safeguards. These might require access providers with SMP to supply all access seekers, including its own downstream retail business, on equivalent supply conditions and prevent them from exerting a price squeeze on access seekers. Access providers with SMP should also provide a price regulated bitstream product to replace unbundled local loops.*

Transition measures are also important in moving from competition based on copper access to competition based on NGA access. Here we argue that regulators should:

¹ Especially if a standard interface to bitstream products has been developed

- *Remove obligations on access providers to offer legacy wholesale products at greenfield sites where they want to supply FTTH*
- *Not require access providers to compensate local loop unbundlers for any shortening of economic asset lives as a result of closure of the copper access networks but give reasonable minimum notice of such closures so as to allow an orderly transition to competition in an NGA world*
- *Allow incumbent fixed operators to shut down their copper networks.*

1 Introduction

In this paper we review demand for NGA and its likely impact on the way ICT services are delivered to both businesses and consumers. We then look at the current patterns of investment in NGA before considering the key regulatory issues which arise with the rollout of NGA. As part of this analysis we also assess the extent to which the European Commission's draft Recommendation on regulation of NGA addresses these issues.

2 Demand for NGA

End user demand

Demand for high-speed access to networks has grown exponentially over the past three decades.² At the end of the 1970s, 1.2 kbit/s. was considered to be a high speed. Today, the same business site probably accesses a wide area network at 2 Mbit/s or 10 Mbit/s. Figure 1 illustrates. It plots what the authors judged to be a "high-speed connection" at a given point in time at two year intervals from 1990 to 2006 on a log scale and then provides straight-line extrapolations of this trend forward to 2018. According to this plot demand for bandwidth has grown exponentially since 1990 and, on current trends, might reach 100 Mbit/s or more by 2015.

The trend of Figure 1 to higher speeds is currently driven by four main factors:

- A desire to run existing Internet applications faster. Higher speed broadband would lead to significant time savings on use of existing applications which could be of substantial economic value. Improving broadband speeds to NGA levels example might, if it cut the time users spend on existing Internet applications by 3%, be worth around €4 billion pa to the UK or €24 billion pa to the EU³.
- Growth in use of Web 2.0 services such as software-as-a-service, online back-up, and content sharing. To function effectively these applications often require higher reliability, greater consistency of speeds, and higher upload speeds than copper networks can deliver
- Development of "within premises" wireless networks, which allow multiple users to share a broadband connection together with growth in the number and variety of devices that can access the Internet, including games consoles, laptops, handheld devices and, in future, TVs. The

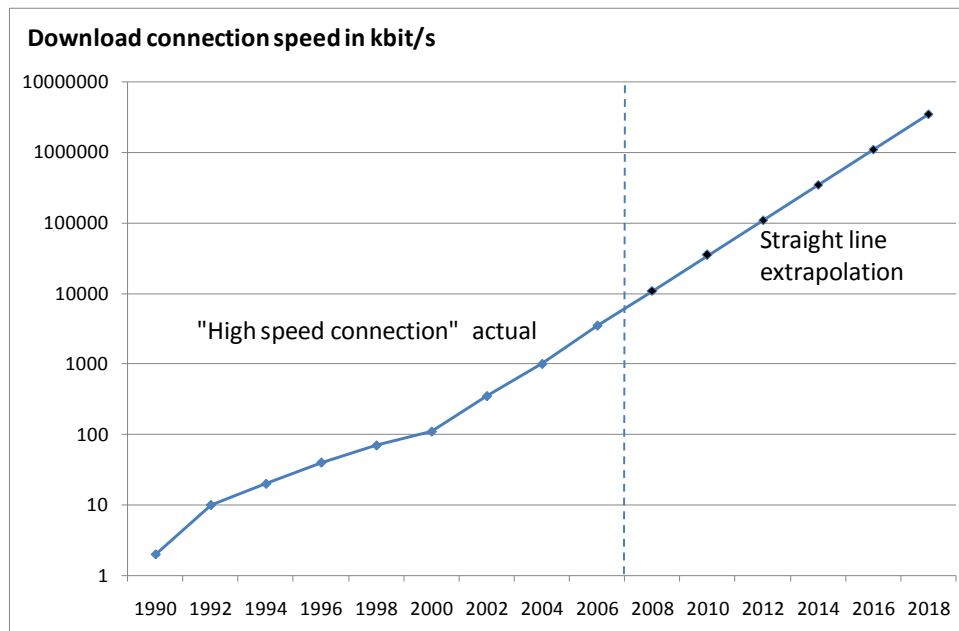
² This is sometimes referred to as Nielsen's Law which says that end user bandwidth requirements grow by 50% each year

³ *A framework for evaluating the value of next-generation broadband*, Broadband Stakeholder Group and Plum Consulting, June 2008

bandwidth required for such applications is now growing as high definition formats for video content become rapidly more popular.

- Growth in streamed video applications which require low error rates to avoid break-up of the stream, alongside a requirement for symmetric speed to support two-way applications such as video calling and collaboration.

Figure 1: Growth in demand for bandwidth



Source: FTTH World Market and Technology Forecast, 2006-2011, Heavy Reading

Willingness to pay for higher bandwidth

It is not yet clear to what extent end-users, and especially consumers, are willing to pay for the higher bandwidth services. But it is clear that there is some willingness to pay.

In the US, where operators are free to set what market prices they like for fixed NGA, there is now growing evidence that a significant proportion of end-users are willing to pay extra for FTTH-based NGA. For example, Figure 2 shows the variety of price points at which end-users can buy broadband access from Verizon. At the same time Verizon reports substantial demand for the higher speed services with these price premiums. Demand for its fibre broadband services (FiOS) grew from one million in December 2007 to 2.5 million 12 months later⁴, while the 20 Mbit/s downstream packages proved the most popular, at least in the New York area⁵. HSBC also reports a strong demand for premium NGA services. According to the bank:

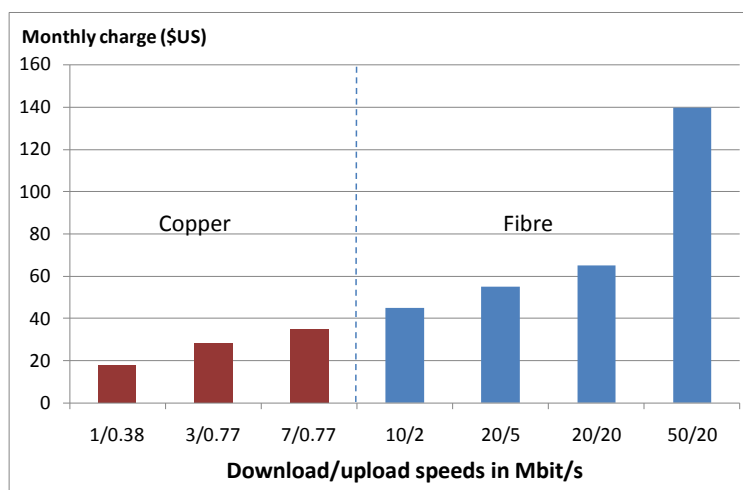
“In areas where Verizon’s FiOS and NTT’s B-FLET⁶ services are available, we estimate that around 40% of broadband customers choose the NGA product”⁷.

⁴ See for example <http://investor.verizon.com/financial/quarterly/vz/4Q2008/4Q08Bulletin.pdf>

⁵ Gizmodo. “Next up for Verizon FiOS: Invading Manhattan, Japan-Like Uber-Bandwidth. <http://gizmodo.com/tag/verizon-fios/>

⁶ A fibre-based access product in Japan

Figure 2: The price points for Verizon's FiOS services



Source: Verizon website

2 Supply of NGA

The roles of fixed and cellular mobile broadband

Both fixed and mobile networks have a role to play in meeting this need for increasing bandwidth and it would be wrong to consider the regulation of fixed next-generation access in isolation from cellular mobile developments.

In particular we are now seeing the rollout of mobile broadband networks, especially in the USA and Australia. In the US for example AT&T and Verizon, having spent \$16 billion at auction on UHF spectrum, are aggressively rolling out LTE technologies in a race to capture the market for mobile broadband services. Such technologies will offer maximum speeds close to those of VDSL, albeit on a shared basis across all users in a cell.

The speed with which mobile operators in the EU make similar investments is largely dependent on the resolution of issues surrounding the licensing of spectrum. In particular there are questions as to how the 15 year licences for existing 2G spectrum will be renewed as they run out over the next few years and how 900 MHz spectrum will be re-farmed so as to allow HSPA and LTE technologies to be deployed to enable cost-efficient in-building and rural coverage? These issues are outside the scope of this paper.

It is unlikely that cellular mobile networks will offer a full substitute for next-generation fibre access in terms of speed and reliability without major investment in a substantially higher density of base stations, so as to enable much greater spectrum re-use. This may happen in the long term. But, for the next few years analysts typically predict that fixed IP traffic (a good measure of demand for broadband) will greatly exceed mobile IP traffic as illustrated in Figure 3.

⁷ *Age of Enlightenment*, HSBC Global Research, September 2008

Figure 3 Fixed and mobile IP traffic in Western Europe

Traffic in Western Europe (Petabytes per month)	2006	2009	2012
Mobile IP traffic	1	28	357
Total IP traffic	886	3591	10882

Source: Cisco Visual Networking Index, 2007 to 2012, Cisco, June 2008

Nevertheless there are good reasons to believe that mobile broadband networks will offer significant competitive constraints on the supply conditions of fixed retail NGA-based services - constraints which regulators will need to take into account in regulating fixed NGA. Competition between suppliers using fixed fibre access networks and those using mobile broadband networks for the telecommunications spend of those at the margins of this group⁸ could provide a substantial constraint on the behaviour of the former. At the same time LTE will provide an adequate substitute for fixed NGA for a significant minority of end-users. Already HSPA based services offer strong competition to DSL and cable. In Austria, Spain and Sweden, for example, mobile broadband services were cheaper than their fixed equivalents at the end of 2007, and, in Austria, mobile broadband accounted for 64% of broadband additions in the previous 18 months⁹. We might expect similar substitution of fixed NGA by LTE in the medium to long term.

As well as providing competition to fixed NGA, the rollout of mobile broadband will almost certainly stimulate investment in fixed NGA. Given their requirements for fibre backhaul to build the dense network of cells required for high-speed mobile broadband, mobile operators are important wholesale customers for NGA. We might also see fixed and mobile operators making joint investment in fibre rollout. Regulators will need to consider what, if any, constraints they might wish to impose on such joint ventures.

In summary we expect mobile broadband to offer both a partial substitute for fixed broadband and a complement which could stimulate demand in the longer term. With these considerations in mind we focus in the rest of this paper on fixed NGA and its regulation.

The limits of the copper network

The copper network is limited in its ability to meet this need for greater bandwidth. Use of the most advanced ADSL technologies with exchange-based copper loops may offer up to 24 Mbit/s download speeds for a small minority. But for the 10% of the population with the longest loops it might offer only 3 Mbit/s or less¹⁰. This has led telecommunications operators to consider investment in fibre based fixed access networks. Such investment might take one of several forms:

⁸ And for the spend of households which are considering joining this group

⁹ *Telecommunication services - introducing the new threat: broadband substitution*, Morgan Stanley, November 2007

¹⁰ *A framework for evaluating the value of next-generation broadband*, Broadband Stakeholder Group and Plum Consulting, June 2008

The types of fixed NGA

There is a choice of NGA technologies. A fixed incumbent operator might consider fibre to the cabinet or node (FTTN) or fibre to the building or home (FTTH). With **FTTN** the access provider replaces the copper between the MDF and the cabinet with fibre. It then locates VDSL (or ADSL) modems at the cabinet to provide high-speed broadband to the end-user. This technology offers download speeds of up to 100 Mbit/s on very short copper loops. In practice the length of the copper loops means median speeds of around 20 Mbit/s downstream and up to 5 Mbit/s upstream in typical Member States.

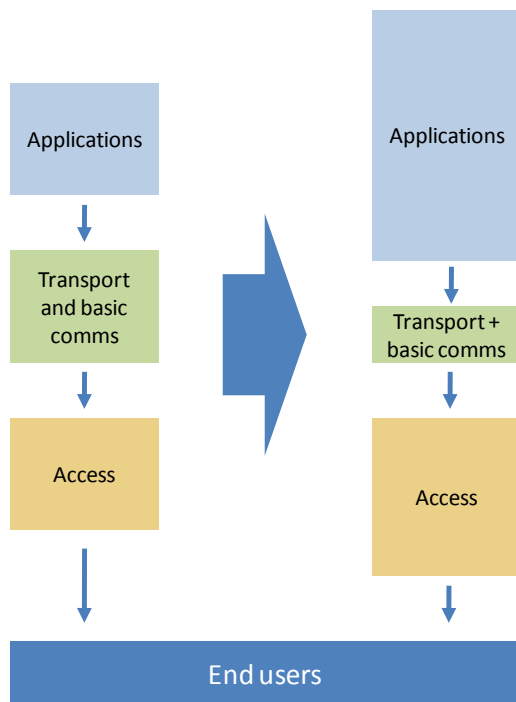
With **FTTH** the access provider runs fibre all the way from the network to the end-user. At the network end the fibre terminates for cross connection to the core network on an optical distribution frame (ODF). FTTH offers download speeds of 70 Mbit/s or more with current technologies, and almost unlimited bandwidth in the long term with wave division multiplexing upgrades. It also offers a wide range of configurations including symmetric high-speed broadband for which there is strong demand from businesses and growing demand from consumers

Cable operators are also beginning to deploy DOCSIS 2.0 and 3.0 in their hybrid fibre/coaxial networks. DOCSIS 2.0 typically offers an end user download speeds of 20 Mbit/s, and DOCSIS 3.0 offers speeds of 100 Mbit/s or more - depending on the level of contention between customers for shared capacity.

3 The changing nature of competition

In considering how best to regulate fixed NGA, we also need to consider how competition in the delivery of communications services based on NGA might develop. This is particularly important given that we are now seeing some fundamental changes in the way in which communication based services are delivered to both businesses and consumers. Figure 4 illustrates.

Figure 4: The changing nature of the value chains for communications services



First we are seeing a shift in the value-added by communications services away from the basic services at the transport layer to services at the application layer. This is reflected in a fall in revenues to communications providers from basic voice telephony and a growth in the use of Internet-based services of many kinds. These include web hosting, web browsing, e-mail, data back-up, and a wide range of entertainment and information-based services. The shift may strengthen as operators roll out next generation core networks. Instead of functionality being embedded in circuit switches, network intelligence moves to soft-switches and application servers at the network's edge. These changes makes it much easier for service providers to develop and deploy new services, and increases the opportunity for application service providers to innovate, since these service providers are less constrained by limitations in the functionality of network switches.

Secondly we are seeing a big growth in the value-add delivered at the applications layer. For example we observe a shift from broadcast-based entertainment to Internet-based entertainment, the development of new applications such as social networking, and rapid expansion in cloud computing. The move to Internet-based computing services, with recent major investments by global companies such as Google, Microsoft, Amazon and IBM, offers the promise of lower cost and more flexible computing for businesses of all sizes, with the potential for significant productivity increases. But cloud computing depends upon NGA broadband speeds, consistency and quality of service to realise its full potential.

Finally the access network is becoming more central to the business of communications providers. Consumers have expressed a preference¹¹ for business models in which they purchased devices and software to use with Web-based services rather than business models in which they buy a vertically

¹¹ For example through the current rapid take up of the i-Phone and the applications and content which its users buy from the Apple store

integrated stack of access, basic communications and application services from a single player. The days of the walled garden appear to be over - end users want to be able to choose their applications from the Internet rather than have their access network or communications provider choose for them. At the same time the access network is an essential link in the value chain of Figure 4 There should be a substantial willingness to pay for this link by end users, if they are to access the growing range of networked applications at suitable broadband speeds.

These changes mean that the nature of competition is shifting. The prime benefit is no longer to stimulate cost efficiency and innovation at the transport layer, but to stimulate innovation at the application and content layers. Such a shift in the competitive process changes what a service provider might want from regulated NGA access. For example a service provider with a set of innovative application services might in future put emphasis on nationwide or EU-wide access to its customers via relatively few standardised points of interconnect and/or low-cost and speedy processes for customers who want to change service provider.

It would be wrong for an regulator to engineer NGA regulation to produce such outcomes. But it is important that any NGA regulation which is put in place does not hinder these new forms of competition.

4 The choice of NGA technology

The choice between FTTH and FTTN is a difficult one for operators to make. FTTN offers a significantly lower cost option than FTTH. According to a recent study for the UK's Broadband Stakeholder Group¹² the cost of rolling out FTTN to the first 80% of the UK population¹³ is £400 per connection compared with £1500 per connection for FTTH. It can also be rolled out much more quickly. Nationwide FTTN rollout might take 3 to 5 years compared with 10 to 15 years for FTTH.

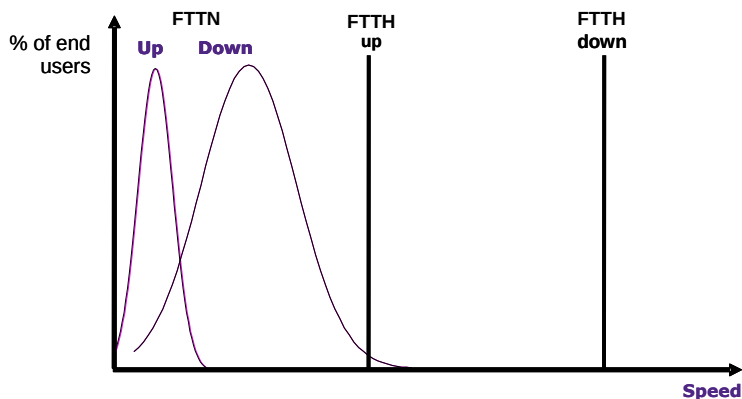
But FTTH also has significant advantages. There are substantial savings in operating costs which are not available with FTTN. In the US for example Verizon reports 80% savings on operating costs from the rollout of its FTTH access network¹⁴. FTTH offers guaranteed speeds to all subscribers whereas FTTN offers speeds which are very sensitive to the length of the copper sub-loop as Figure 5 illustrates. And FTTH offers speeds which is significantly higher than those of FTTN. It is therefore more future proof. Critics of FTTN also point to the trends of Figure 1 and argue that it will fail to meet latent demand for bandwidth demand by 2012. So it will have a short economic life while generating substantial sunk cost in terms of capital expenditure on VDSL cabinets.

Figure 5: The distribution of bandwidth for the end user - FTTN vs FTTH

¹² *The costs of deploying fibre based next generation broadband infrastructure*, Broadband Stakeholder Group, July 2008

¹³ According to this study the cost per connection for the remaining 20% is much higher at £800 for FTTN and £3000 for FTTH

¹⁴ Verizon have said they expect to realize savings of about \$1 billion in annual, ongoing operating expenses by 2010, when Verizon expects to pass 18 million homes with fibre and have 6-7 million FiOS customers (Verizon have a fixed line residential customer base of around 30 million). This implies an operating cost saving of \$143-\$166 per customer annually or around 80% of relevant operating costs



Source: *A framework for evaluating the value of next-generation broadband*, Broadband Stakeholder Group and Plum Consulting, June 2008

Within FTTH, there is a choice to be made between point-to-point fibre, with a dedicated fibre for each end-user, and GPON, where 32 or 64 end-users share the split ends of a single fibre. Thus far, fixed incumbent operators which are considering FTTH roll-out have nearly all indicated that they prefer GPON. In contrast, most local government-funded networks have used point-to-point fibre.

5 Investment so far in NGA

Given the high cost of NGA investments¹⁵ and the uncertainty over willingness to pay, EU incumbent operators have so far found it difficult to get their boards to commit to large-scale NGA deployment. Indeed it is noticeable that the bulk of NGA investment across the EU has so far been made by a mix of local authorities, utilities and AltNets

Undoubtedly lack of regulatory clarity and certainty has also contributed to this lack of investment by incumbent fixed operators. There is a lack of clarity both about price regulation of NGA investments in areas where the access provider is judged to have SMP and about regulation for transitional arrangements to preserve legacy products based on the copper network. (Some regulators have offered clarity by proposing to regulate in the same way as for legacy products. This is not a helpful approach).

The Netherlands offers a good example of regulation holding up investment. KPN announced its intention to roll out an All-IP network with next-generation access nearly two and a half years ago - largely in response to fierce competition from cable operators. KPN is still discussing with its regulator the conditions under which it will provide others with access to its NGA. It has yet to make any significant investments.

6 The central issue of NGA regulation

There is one central issue facing regulators as they decide how best to regulate NGA:

¹⁵ It might cost €5 billion to fibre the first 80% of a country with a population of 20 million using FTTN or €20 billion using FTTH

What rules, if any, should regulators put in place to provide incentives for timely and efficient investment in NGA while, at the same time, preventing monopoly abuse – either by taking monopoly rents from end users or harming downstream competition?

Answering this question requires a regulator to balance two considerations:

On the one hand how does a regulator ensure timely and efficient investment¹⁶? The simple approach is to leave NGA investment unregulated as the authorities do in the USA. One problem with this approach is that it could allow incumbent fixed operators to re-monopolise markets¹⁷. NGA leads to the replacement of the copper access network, either partially or fully, with fibre. This undermines the current business models of many AltNets. Without any NGA access obligations, access seekers must then accept whatever supply conditions the access provider offers and, given that the access provider normally competes with the access seeker in retail markets, the access provider has strong incentives to offer supply conditions which weaken competition

On the other hand how does a regulator ensure vigorous innovation and competition at the retail level? A simple approach here is to maximise competition by applying the same legacy access obligations as it has applied to the copper network. Access seekers would then be able to rent NGA connections from the access provider at cost base prices. The problem with this approach, as we explain below, is that it severely weakens the business case for investing in NGA and hence leads to delayed investment.

The cost of delay, beyond the point at which it is rational to invest is likely to be considerable. For example till Ezell et al¹⁸ suggest that the benefits of moving to next-generation broadband in the US are likely to include a \$50 billion pa reduction in commuting costs and an additional \$50 billion per annum in economic benefits from improved services for the elderly and disabled. They also point to major but unquantified benefits from cloud computing, collaboration and improved education services.

7 Key considerations in developing NGA regulation

There are a number of important factors which regulators will need to assess when developing NGA regulation if they are to address properly the central problem set out above. In particular:

- What range of remedies is available for regulators to impose on NGA access providers with SMP so as to enable competition?
- To what extent can regulators rely on duct sharing and other passive remedies?
- How should regulators regulate bitstream products to enable timely and efficient investment?
- What is wrong with unbundled fibre as a remedy?

¹⁶ See *A framework for evaluating the value of next-generation broadband*, Broadband Stakeholder Group and Plum Consulting, June 2008 for a discussion on what constitutes timely and efficient investment

ie when the net present value of expected incremental revenues exceeds the net present value of expected incremental costs in an unregulated market

¹⁷ The US approach might also lead to over investment as a way for access providers to escape legacy regulation. But US authorities, perhaps aware of this problem, removed obligations to supply unbundled local loops at the same time as their rulings on fibre access.

¹⁸ Ezell S, Atkinson R, Castro D, and Ou G, *The need for speed: the importance of next generation broadband networks*, The Information Technology and Innovation Foundation, March 2009, <http://www.itif.org/index.php?id=231>

- What measures are required to enable an effective transition from legacy to NGA wholesale products?

We consider these questions in turn in the remainder of this paper.

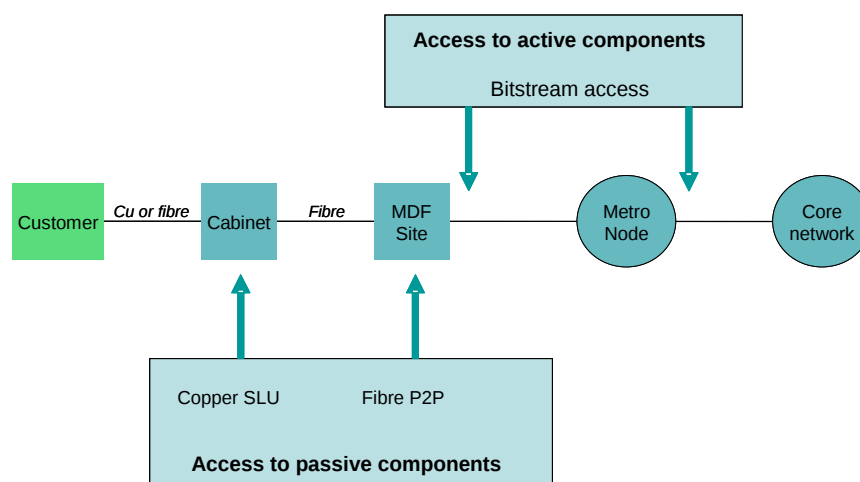
8 The range of possible regulatory remedies

A regulator might consider that retail competition in the supply of NGA-based products is sufficient¹⁹. But in most regions of most member states this is unlikely to be the case. The regulator may then consider imposing some combination of passive and active remedies on an access provider with SMP. **Passive remedies** allow access seekers to rent components of the access provider's network. There are three main types of passive remedy:

- Access to ducts. Such access reduces the costs of the access seeker by up to 80% by eliminating the need for expensive civil engineering
- Access to copper sub loops (plus associated backhaul and cabinet collocation services) where an incumbent access provider has rolled out FTTN
- Access to unbundled fibre - in a similar fashion to that now used with copper loop unbundling - where an incumbent access provider has rolled out FTTH

Active remedies usually involve the access provider in offering a range of bitstream products to access seekers on regulated supply conditions. Figure 6 shows the range of likely point of interconnection with the main active and passive remedies.

Figure 6: The main active and passive remedies (excluding duct sharing)



9 The effectiveness of passive remedies

In its Draft Recommendation on NGA regulation, the European Commission has put considerable emphasis on the deployment of passive remedies like duct sharing, sub-loop unbundling, and optical

¹⁹ For example if there is competitive supply from a fixed incumbent, a CATV operator, an alternative network operator using the ducts of a utility, and indirect competition from mobile broadband

loop unbundling. Yet there are strong arguments which suggested that all of these remedies will be attractive to access seekers in only limited circumstances.

First let us consider **duct sharing**. The authorities in France, one of the main proponents of duct access, estimate that such access might enable access seekers to build rival NGA networks for up to 30% of the French population. This leaves 70% of the country where this remedy is not viable. And the recent rollout of competitive NGA networks in Paris suggest that even this estimate of 30% might be too high. There is a race to fibre Paris. But rivals have so far tended to avoid head-to-head conflict by laying fibre only in those streets where they are the first supplier. There are good commercial reasons for such behaviour. The return on investment from two operators laying fibre in the same street is very much lower than that enjoyed by a single supplier.

If, as this initial evidence suggests, we end up with a patchwork of local monopolies in the supply of NGA, then duct sharing remedies will not be sufficient on their own. In this scenario the bulk of the population will be required to take NGA-based services from the single vertically integrated operator which fibred their street, and there will be substantial competition problems at the retail level

Studies by Analysys on prospects in the Netherlands²⁰ and Ireland²¹ suggest that **sub loop unbundling** (SLU) is only likely to be viable in very restricted circumstances. The basic problem is that SLU requires the access seeker to collocate equipment and to build out or rent backhaul to its network at locations which typically serve 400 customers with copper loops. Yet local loop unbundling, which incurs similar collocation and backhaul costs, is typically viable only at MDF sites with 10,000 or more copper loops.

Fibre loop unbundling is possible when point-to-point architectures are used but not when GPON is deployed. Yet most incumbent operators have expressed a strong preference for GPON. And even where an operator deploys point to point fibre (as KPN proposes to do in the Netherlands) there are strong arguments to suggest that regulated access to unbundled fibre will lead to delayed investment and weaker competition. We set out these arguments in Section 12.

In combination these arguments point to the conclusion that bitstream will be an important regulatory remedy for preserving competition in the supply of retail NGA-based products.

10 Regulating bitstream NGA

If bitstream remedies are of central importance in establishing retail competition in an NGA world, then what obligations should a regulator impose on an access provider of bitstream with SMP? Such regulation needs to take account of six main factors:

- The need for regulatory clarity and certainty. We discuss this issue below
- The need to allow the access provider to differentiate between the bitstream products it offers and to charge prices which reflect the value of these products to end users rather than their cost. Again we elaborate below
- The need to establish appropriate safeguards against re-monopolisation of markets. This point is also discussed below

²⁰ *Business case for sub loop unbundling in the Netherlands*, Analysys for OPTA, 2006

²¹ *The business case for sub loop unbundling in Dublin*, Analysys for ComReg, December 2007

- The need for access providers to offer NGA products with standardised interfaces to the networks of access seekers. This lowers the costs of access seekers offering nationwide, or EU wide, services²²
- The need for experimentation. NGA access providers face substantial demand and technology uncertainties. There is therefore a need for them to experiment with the products offered and the prices charged, so as to discover those products and prices which maximise demand.
- The need to ensure that universal service obligations are met. Does the price of basic voice line access remain affordable for end users who want only voice telephony in an area where NGA is rolled out on a replacement basis? This is essentially a matter of preserving universal service requirements.

The need for regulatory clarity and credibility

Lack of clarity over how they will be (price) regulated when they have SMP in NGA supply is deterring fixed incumbents from investing in NGA. They do not have much confidence if they are told they can invest, but that there will then be a market review and only then will remedies be considered. NGA investors are also concerned about credible commitment by the regulator. Potential investors do not simply consider what a regulator says it will do, but factor in what they expect it to do over time.

In combination these concerns can lead to an investment hold-up problem in which regulators do not commit to regulation before there is investment and the investors are not prepared to invest until there is regulatory commitment. Given this analysis, regulators may wish to consider whether they should set out the price regulation principles which would apply to operators found to have SMP in NGA supply *in advance* of any market definition and SMP assessment.

They may also wish to consider how to make statements about future regulation more credible – in other words, how to increase their incentives not to renege on commitments, perhaps by raising the reputational stakes of doing so. The current regulatory framework is not helpful in this respect. The requirement to conduct market reviews every two to three years, in which there is a fundamental reappraisal of SMP status and remedies, makes it difficult for regulators to enter into commitments which might need to span a decade to achieve efficient and timely investment. To address this issue the European Commission has proposed in its Draft Recommendation on NGA regulation²³ that “A consistent regulatory approach should apply over successive review periods to any access remedies and price obligations placed on SMP-operators as a result of reviews of markets 4 or 5”

It is of course relatively easy for a regulator to offer a high level of regulatory clarity if it disregards outcomes. One regulator for example has stated that it will regulate NGA products at cost base prices. This offers great clarity to potential access providers. But it is unlikely to promote efficient investment. Nor does it help the long-term credibility of the regulator if the regulator is required to relax its price regulation rules when no investment is forthcoming.

When it comes to bitstream access the Draft Recommendation proposes that “[existing] access remedies....should be maintained for existing services and chain substitutes” but that “inappropriate wholesale obligations should not be imposed where... a service provided over NGA networks

²² Access providers which roll out of mix of FTTH and FTTN might offer a standard interface to the bitstream products of technologies. Openreach has proposed such an approach in the UK

²³ Draft Commission Recommendation on regulated access to Next Generation Access Networks (NGA), DG Info Soc, October 2008

constitutes a newly emerging retail market". These proposals raise two problems. There is considerable uncertainty over what constitutes "a newly emerging retail market" where "inappropriate wholesale obligations" should not be imposed. More seriously there is a competition issue. In effect the Draft Recommendation seems to be saying that SMP access providers do not need to offer access to wholesale NGA products which are required for "newly emerging retail markets". Yet it is precisely such markets where access seekers are most likely to require NGA access if they are to compete effectively with the access provider's own downstream business.

The need for value-based pricing

We argue below that, in order to achieve timely and efficient investment in NGA, access providers should be allowed to provide distinct NGA-based bitstream products to meet the needs of different segments of the end-user market and to then charge for these products at the wholesale level so as to reflect their value to end users rather than their costs.

In other words we argue that the cost based approach, which has worked well when regulating access to legacy products, where the investment is already largely sunk, is not appropriate when regulating NGA-based products, where very substantial new investment is required.

To see why we reach this conclusion, let us consider the situation set out in Box 1 and examine what happens if access provider A is required to charge access seekers B and C a cost based price of two units pa.

Box 1 A simplified market situation against which to test investment incentives

Monopoly access provider A plans to roll out an NGA network nation-wide so is to completely replace its copper network²⁴ and then to offer NGA-based bitstream products to access seekers B and C

Access seeker B is owned by access provider A and is subject to universal service obligations.

There are three groups of end users of equal size:

- Group 1 seeks simple voice telephony for which it is willing to pay 1 unit of revenue pa
- Group 2 wants basic broadband at copper DSL speeds for which it is willing to pay 2 units of revenue pa;
- Group 3 wants high-speed broadband and is willing to pay 4 units of revenue pa for it.

A plans to offer three distinct products to meet these needs.

The annualised cost of providing each of these product is 2 units pa²⁵.

In this case:

- A recovers its costs. So initially we might conclude that it will make the NGA investments required
- B might initially plan to offer services to the market at prices equal to their willingness to pay²⁶. If B then got equal penetration of the three end user groups it would generate an average revenue per customer of 2.33 units pa²⁷ and generate a small profit

²⁴ This replacement strategy for NGA is likely to offer a lower unit costs than an overlay strategy in the long term

²⁵ In practice the costs of the products will vary - but not by much. The big cost is in rolling out the fibre and/or cabinets close to the customer. This cost varies little across the three bitstream products

²⁶ With a mark-up for retail costs and value-added services which we exclude in this example for simplicity

- This pricing strategy might be a good one if there were a monopoly on retail service provision. But in a competitive market with cost based pricing of wholesale inputs, B can simply offer Group 3 high-speed broadband services at (say) 2.5 units pa. This would undercut B by 1.5 units²⁸ and make C a profit of 0.5 units²⁹ pa per customer
- If C were to capture all of Group 3 this would leave B with an average revenue per customer of 1.5 units per annum³⁰ but with costs of two units per annum. So its initial pricing strategy is not sustainable
- To respond to this competitive threat and make a profit B must raise its prices to Group 1 and drop its prices to Group 3. The end point of this process is one in which the price to all three end user groups is close to the average willingness to pay of 2.33 units per annum. In other words competition prevents the access seekers from price differentiating on NGA access to end users. If they do so they create substantial arbitrage opportunities for others
- From an end-user perspective this outcome is far from acceptable. Group 1, which is willing and used to paying one unit pa for simple voice telephony, is now required to pay close to 2.33 units pa. Such an outcome is, almost certainly, politically unsustainable
- The alternative is for neither B nor C to serve such customers. But this means that B, which is subject to universal service obligations, is in breach of these obligations.

This analysis suggests three possible outcome from imposing cost based prices on B - to raise voice telephony prices for those wanting basic voice telephony by 100% or more and risk seeing such customers migrate to cellular mobile alternatives **or**; to generate net losses for the owner of A and B **or**; to put B in breach of its universal service obligations. None of these outcomes is attractive to the owners of A and B who would delay authorising NGA investments until demand conditions had changed to a situation in which a much higher proportion of customers were willing to pay the higher prices of high speed broadband.

These problems disappear if we allow access provider A to set the prices for its three bitstream products based on their value rather than their costs. A might set the wholesale prices of the three products at 1, 2 and 4 units pa respectively. This allows it to make a profit, while access seekers B and C pass through these access prices to end users at zero profit and compete on the value-added services which they offer. A continues to take the risk on the investment. But now, if it gets the bitstream products and prices right, it has an opportunity to make an economic profit as well.

The need for competitive safeguards

Allowing SMP access provider's freedom to price discriminate between distinct bitstream products is important for timely and efficient investment in NGA. But allowing the access provider complete freedom to price NGA bitstream products as it wishes is unlikely to lead to vigorous competition at the retail level. We suggest that three safeguards are needed.

The access provider should be required to supply all access seekers (including its own downstream retail business) on equivalent supply conditions - both in terms of price and non-price terms.

²⁷ $(1+2+4)/3$

²⁸ 4 less 2.5

²⁹ 2.5 less 2

³⁰ $(1+2)/2$

The access provider should be prevented from exerting a price squeeze on access seekers - for example by setting the price of its wholesale bitstream products high relative to the equivalent retail prices charged by its downstream business.

Finally there is a need to impose conditions so as to enable an orderly transition for access seekers from copper-based wholesale broadband products to NGA-based bitstream products. For example the access provider might offer a bitstream replacement for an unbundled local loop at the median speed possible with an unbundled local loop, and at the ULL price plus the cost of the access functionality currently added by the local loop unbundler.

This third constraint also serves another purpose. It provides an anchor product which constrains the prices which the access provider can charge for high-speed NGA bitstream³¹. If it sets these prices too high end users would revert to basic broadband services. As a result the revenues from high speed NGA bitstream, which justify the NGA investment in the first place, would disappear.

11 Is fibre unbundling an effective remedy?

In analysing rollout of FTTH, the European Commission's Draft Recommendation proposes that regulators should consider duct sharing as the best remedy, access to unbundled fibre loops as the second best remedy, and bitstream as third best. In this way member states can establish the right regulatory incentives to maximise infrastructure base competition between NGA suppliers.

We are not entirely convinced by this argument. In particular we are concerned that, in three important respects, requiring access to unbundled fibre³² is inferior to bitstream access in promoting the twin objectives of timely and efficient investment and vigorous retail competition. Moreover, if the retail market for fixed communications services changes, as anticipated in Section 3, then we can expect the advantages of bitstream over fibre unbundling to grow with time.

First an NGA access provider is more likely to invest in a timely and efficient way if it is required to provide bitstream access than if it is required to supply passive fibre. The argument is as follows. The cost of supplying NGA to end-users is largely independent of the bandwidth provided, while the price which each end-user is willing to pay varies considerably (from €12 to €60 per month, according to evidence from the US). Bitstream access allows the access provider to price differentiate so as to match different products to different willingness to pay. This significantly improves the business case for investment, as discussed above. By contrast, an obligation to supply passive fibre is unlikely, in practice, to allow the access provider to price differentiate. There is only one product, passive fibre, which is likely to be sold at a single (cost oriented) price,³³ to which the access seeker can add electronics to provide a range of access products to end-users. In this case, it is the access seeker who extracts the economic surplus through price differentiation rather than the investing access provider. This makes the case for investment by the access provider significantly less favourable. It might be possible to overcome this objection through the use of long-term contracts between the access provider and the access seeker. But such an approach is untested and uncertain.

³¹ For further discussion of the concept of anchor product pricing see Brian Williamson. July 2007. *New regulatory approaches to next generation access*

³² Such a remedy is technically possible when an access provider deploys point to point fibre but not when it deploys GPON fibre

³³ It is difficult to see how the access provider could charge different prices for the same product depending upon how the access seeker then subsequently used it.

Secondly bitstream generates end user switching costs which are significantly lower than those associated with fibre unbundling. Bitstream allows for “zero touch” end-user reconfigurations. This makes for fast, low cost switching and should provide end-users with a reliable transfer service. Fibre unbundling requires the access provider to reconfigure the fibre at the optical distribution frame in a similar way to copper loop unbundling.

Finally bitstream offers superior geographical reach to access seekers. Bitstream allows a service provider to reach all end-users on the access provider's NGA network from only a few points of interconnection. By contrast, nationwide reach with fibre unbundling requires the access seeker to collocate at all the optical distribution frames³⁴ in the access provider's network.

Taken together these arguments suggest that it might make sense for a regulator to require bitstream remedies, regulated along the lines suggested in Section 10, from the start. Passive remedies such as duct sharing might then be put in place, as demand from access seekers dictates. Such an approach has a number of advantages over one in which passive remedies are deployed first and active remedies deployed only when passive remedies fail. In particular bitstream products give access seekers a way of reaching customers nation-wide at the same time as the national fixed incumbent for a relatively modest investment³⁵. This is especially important when competing for the revenues of multi-sited businesses. Being able to offer broadband access to such customers at only a proportion of its sites, a likely outcome with passive remedies, substantially weakens competition in the business markets³⁶.

12 Transition measures

There is general agreement that it does not make economic sense for the fixed incumbent to continue to run both copper and fibre access networks in parallel forever. At the same time, a speedy transition, while minimising costs, might also significantly weaken competition. Regulators therefore need to establish transition rules which balance these two conflicting requirements. Moreover, regulators need to establish these rules now. The cost of transition is an important factor in shaping NGA investment plans for fixed incumbent operators. Rules therefore need to be set in advance in four key areas if we are to see timely and efficient investment.

First a regulator will need to consider what obligations to impose on investors providing FTTH in greenfield sites. Here, it makes economic sense for regulators to remove immediately obligations on the access providers to supply legacy products - a point recognised in the Commission's Draft Recommendation. At the same time, regulators will need to require access providers to supply NGA-based products which offer adequate substitutes and to ensure that basic universal service rights are preserved.

Secondly a regulator will need to decide the conditions for pricing legacy wholesale products during the transition period. Economic analysis suggests that it should be the end-users of the legacy copper-based services rather than the end-users of the new NGA-based service who should bear these costs. This incentivises end users and service providers to switch to NGA-based products more quickly, and helps minimise the additional costs of migration without damaging competition overall.

³⁴ Of which there might be several thousands.

³⁵ Especially if a standard interface to bitstream products has been developed

³⁶ *The Economic Benefits from Providing Businesses with Competitive Electronic Communications Services*, BT, July 2007

regulators might, for example, allow prices for wholesale legacy products to rise to reflect rising unit costs as the volume of use of legacy products falls.

Thirdly decisions need to be taken about the regulations which should govern the phasing out of local loop unbundling. This shortens the economic lives of the assets of the local loop unbundlers. We suggest that local loop unbundlers should not be compensated for the shortening of these asset lives by access providers. To do so would delay NGA investment by access providers and lead to economic losses.

But we also suggest that access seekers should be given reasonable minimum notice of such a change so as to preserve competition to the fixed incumbent. The notice period might be some combination of the time required for an efficient operator to adopt an NGA business model.³⁷ and the time required for an efficient access seeker to migrate its customer base to this new model. So as not to weaken competition, it is important to give access seekers the opportunity to hold on to the customer base in which they have made a substantial investment in terms of customer acquisition costs. But if they want economically efficient outcomes regulators should not put the onus on the access provider to negotiate notice periods with the access seekers. This leads to asymmetric bargaining positions in which the access seeker gets what it wants simply refusing to reach any agreement. To produce outcomes which are in the public interest then the regulator will need to determine notice periods, perhaps using the standards set out above.

In addition access seekers should be offered bitstream NGA products which are adequate substitutes for local loop unbundling. This would probably mean products for both the consumer and business markets running at similar speeds to those achieved using unbundled local loops, and priced so as to result in a similar cost of ownership. It is important to note that this requirement could delay NGA roll-out if the price of the copper loops is currently set below cost, as it is in some Member States.

Finally member state governments and regulators need to provide incumbent fixed operators with the powers necessary to shut down their copper networks. In the long-term, it makes sense to shut down the copper network and to supply everyone using fibre access. Such an approach would lead to substantially greater savings in operating costs than one in which copper and fibre are run side-by-side. But a copper replacement strategy, rather than a fibre overlay, raises some important issues which may require action by Member State governments, as well as by regulators. This might include the need to allow for short discontinuities in service in some areas, as copper is replaced by fibre in certain duct sections; for the phasing out of minor services which are uneconomic to deliver over fibre³⁸; and for access to people's homes to install optical network terminators so as to connect them to the end-user's power supply and to check that the fibre service works properly. This is not problematic when someone orders a new fibre-based service, but it can be if they simply want to continue to use their existing service. Without such powers, a replacement roll-out strategy for FTTH is not an option which the fixed incumbent can consider. The economic losses from the absence of such an option could be substantial.³⁹

³⁷ For example, time to develop its own wholesale line rental replacement product.

³⁸ This might include certain ISDN and telemetry services

³⁹ For more discussion on these points see Williamson and Marks. June 2008. "A framework for evaluating the value of next generation broadband." A report for the Broadband Stakeholder Group.