

Wholesale pricing for next generation access networks

A new approach

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1 Executive Summary

There is little doubt that the introduction of next generation access ('NGA') networks is changing the economics of fixed telecoms service provision. And, whilst the prospect of faster broadband and new services is to be welcomed, there is a risk that the effectiveness of competition in this sector will be weakened by the change in cost structure. This paper argues for a new approach to wholesale pricing for network access services to ensure that competition continues to be as effective as possible, and to extend the benefits of competition to the widest range of consumers.

In order to create the best chance of having effective competition over the widest possible area, and the greatest scope for innovative competition, we argue that NGA bitstream¹ services must meet two criteria:

- they must allow Communications Providers (CPs)² to control the technical characteristics of network services; *and*
- the recurring per line charges should form a relatively small proportion of the total charges to a CP.

Pricing in this manner effectively shifts the bitstream service further upstream, and means that CPs will be able to compete more effectively. It is therefore unlikely that incumbents will introduce such pricing voluntarily. Regulatory pressure will therefore be needed to ensure that this form of pricing is made available.

Competition will often stimulate innovation. It can be the driving force to encourage the evolution of services to meet the diverse needs of consumers. However, this process is predicated on the ability of competitors to create new services to offer to consumers. This is a well-rehearsed argument in the world of telecoms regulation. It forms one of the principle justifications for local loop unbundling remedies, and for the primacy of physical unbundling remedies to access NGA networks. Equally, it underpins the need for NGA bitstream services to replicate the technical control characteristics of physical unbundling.

The argument we set out in this paper rests on the idea that innovative service differentiation is a function of both technical characteristics *and* price. Fixed telecoms services are increasingly sold in bundles, and in this environment competitive differentiation relates to the manner in which a bundle is priced almost as much as the substance of the constituent services.

Therefore, not only do competitors require the ability to specify technical characteristics, they also need to be able to adopt a range of different retail tariffs. This implies a need for relatively low per-line marginal costs³. This cost structure exists for incumbents and other operators who own access network infrastructure,

¹ We will use 'bitstream access' as a generic / collective term to refer to both wholesale broadband access services which include shared (and aggregated) backhaul *and* so-called active access services which tend not to include aggregated backhaul.

² For simplicity, we refer to downstream competitors of the incumbent as CPs throughout the paper.

³ That is, the change in costs associated with selling a fixed-line service to a new customer.

and to a lesser degree for LLU operators. In contrast, it does not tend to exist for competitors using bitstream. This has certainly contributed to the fact that competition based on bitstream has been less effective than LLU. Across the EU, almost three times as many competitor broadband lines are provided using LLU compared to bitstream⁴.

1.1 *The need for bitstream access to NGA networks*

In discussions about wholesale access to NGA networks, regulators have indicated a preference for physical unbundling (or passive access) remedies. Wherever they are viable, we agree that such remedies provide the most robust platform for competition. However, there are always regions in which population density dictates that passive access is uneconomic, and the introduction of NGA networks will tend to increase the number of areas in which this is the case.

The following table summarises the economic feasibility and the technical and practical feasibility of passive access under different NGA network architectures relative to LLU over the current copper network.











Architecture / technology	Economic feasibility	Technical and/or practical feasibility
Current gen copper		
FTTC		
FTTH: GPON		
FTTH: P2P fibre		
FTTH: WDM-PON		

Table 1.1: feasibility of passive access under various network architectures

FTTH networks based on point to point fibre have similar characteristics to the current generation network, and therefore would be suitable for unbundling. In contrast, there is little prospect of wide scale adoption of physical unbundling of (or passive access to) FTTC and GPON networks. WDM-PON networks appear to offer considerable potential for highly efficient forms of access which provide excellent levels of technical control. However, this technology is still in the early stages of development, and so cannot currently be relied upon to provide the foundation for competition in the fixed telecoms sector.

⁴ Based on the most recent ECTA broadband scorecard (September 2009), there were 11.4 million broadband lines provided using bitstream or resale, but 30.9 million provided using LLU. See <http://www.ectaportal.com/en/REPORTS/Broadband-Scorecards/Broadband-Scorecard-2009/>.

In the long term, one of these technologies may start to dominate, but for the foreseeable future a range of different architectures are likely to exist - including substantial areas where the network is yet to be upgraded. This diversity, in conjunction with the costs of passive access, will lead to a growing demand for bitstream services. If competition is to be effective *throughout* national markets, and not just in pockets where passive access is viable, then bitstream services will need to create much greater scope for competitive differentiation than they have in the past. The *structure*, and not just the level, of bitstream prices will play a critical role in determining whether such differentiation will be economically viable.

1.2 The importance of price structure

The structure of a wholesale access tariff is often the most significant determinant of the cost structure for CPs. Changes in this tariff structure can therefore have a significant impact on a CP's competitiveness. This effect is distinct from the impact of the (average) *level* of wholesale charges.

Competition based on LLU has tended to be more effective than that based on bitstream. It has allowed CPs to create new products, and to offer genuinely new pricing and service bundles. This ability stems from the fact that LLU gives CPs independent control over the technical characteristics of the access service. However, the ability to offer new pricing and service bundles is also a function of the cost structure of relatively low per line recurring charges which LLU generates for CPs. As a result, where CPs serve customers outside their LLU footprint, they often charge significantly more for very similar services⁵.

Changes to tariff structure alone can shift the location of a wholesale product in the value chain. Figure 1.1 below shows part of the fixed telecoms value chain. Starting at the left hand side, an operator who owns the network infrastructure end-to-end and self-provides all elements of the service will incur costs according to all the various raw inputs required (civil infrastructure, network equipment, staff costs, IT costs, etc). Many of these will be fixed with respect to the addition of a single new customer in the short run, although not necessarily fixed when considering the addition of large number of customers over a longer period of time.

As one moves to the right, and considers the business models of CPs entering the value chain further downstream, the inputs are less 'raw' having already been processed further upstream. These upstream inputs tend to be priced on a variable basis, and hence the cost structure for CPs operating at this level within the value chain has relatively less fixed, and more variable, cost. In the extreme, we have resale in which the cost structure generally mirrors the retail price structure, and hence is almost entirely variable.

⁵ See section 2.4 below for examples.

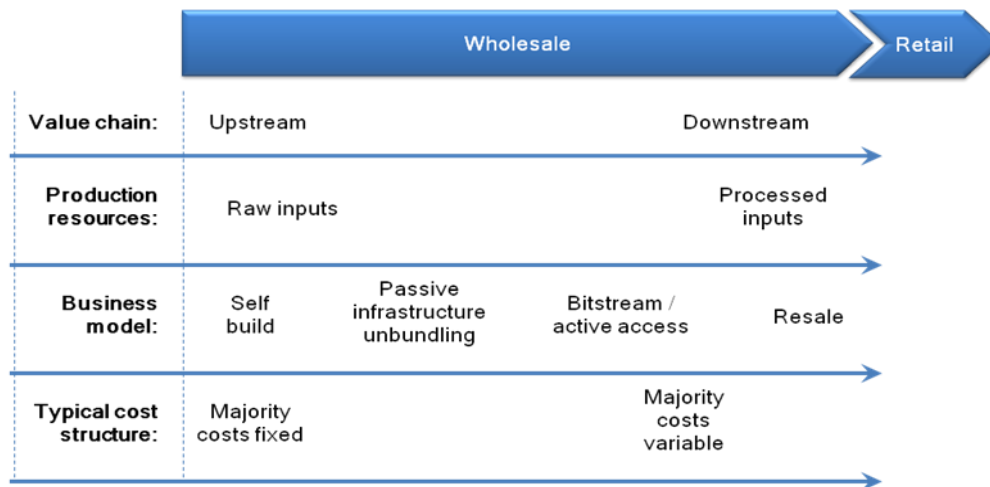


Figure 1.1: price and cost structure

The more that pricing reflects the cost structure of the underlying raw inputs, the further upstream that product will tend to lie. This effect is independent of the ability to control the manner in which the underlying inputs are used⁶.

Just as being further upstream adds to the ability to control retail product specification, it also adds to the ability to control retail prices. The reason for this is that there are very few business strategies which support pricing below marginal cost. Recurring per line charges are generally the most significant element of a CP's marginal costs. The level of these charges therefore sets an effective lower limit on the rental element of retail pricing. A relatively low per line recurring charge therefore creates greater scope for pricing innovations⁷.

This is important for a number of reasons. The willingness to pay for NGA-based services varies considerably across the population⁸, and will almost certainly change over time. Some consumers with niche demands are prepared to pay a premium today, but the majority appear to be happy to use current generation services⁹. As

⁶ If a CP also has control over how the raw inputs are used, then the CP is effectively self-providing these inputs. We note below that this amounts to co-investment.

⁷ This assumes some form of price discrimination - i.e. the lower price will not be made available to all customers, or on a permanent basis. If pricing is to be uniform over time and to all customers, then a profit maximising firm will only care about total average costs. The manner in which the costs are incurred is then only relevant to the extent that it affects total cost due to the time value of money.

⁸ Ofcom recently carried out some consumer research which included an estimate of the willingness to pay for higher speed broadband. They asked consumers how much they would be willing to pay to double their existing broadband speed. The results were a highly skewed distribution. Over half of respondents were either unwilling to pay any extra or were unsure. A very small number were prepared to pay considerably more than their current fee. See, in particular, Figure 3.12 in http://stakeholders.ofcom.org.uk/binaries/consultations/wla/annexes/consumer_research.pdf

⁹ For data on take-up of NGA-based services relative to availability, see chart on page 8 of "Super-fast broadband, Context and summary for Ofcom's consultations on the wholesale local access and wholesale broadband access markets". As the report notes (paras 2.21-2.22), the countries leading on roll-out and take-up of broadband tend to be those with significant government support for NGA networks. See, <http://stakeholders.ofcom.org.uk/binaries/consultations/wla/annexes/context.pdf>.

NGA-based services improve, and as consumer awareness of the benefits of these services increases, it is likely that more people will pay the premium.

Given these circumstances, it will be important for CPs to be able to offer basic access services at a relatively low price, and then ‘up-sell’ additional and enhanced services to customers. Without the stepping-stone of an attractively priced basic service, it will be difficult to generate the momentum needed to shift the new services from niche interest into the mainstream¹⁰. Equally, the fact that CPs can attract a wider audience to connect to the network is socially beneficial since this will help to bridge the so-called ‘digital divide’.

1.3 Virtual LLU pricing

In line with the principle of cost orientation, we propose a structure for NGA¹¹ bitstream pricing which approximates the use of resources required to produce the service. Our suggestion is that CPs using a bitstream service with this price structure would incur costs in roughly the same manner as an operator who uses LLU today. A CP would therefore pay for the following wholesale service elements independently:

- service enablement - to create the ability to serve customers in a particular geographic area - through a one-off set up charge and a semi-fixed fee which recurs every few years¹²;
- backhaul rental through a regular recurring charge per unit of backhaul per local exchange area served; and
- rental of customer access lines through a regular recurring charge.

We refer to the proposal as ‘virtual LLU pricing’. There are many parallels with the ‘virtual unbundling’ remedies being discussed by a number of National Regulatory Authorities (NRAs)¹³. These have focussed on the technical characteristics of bitstream services, and the ability of CPs to control the network. We fully support these proposals, but add requirements for a price structure which generates a relatively low marginal cost for the CP¹⁴. This would be simple to adopt, and would help to make competition more effective.

¹⁰ One of the reasons for this is network effects: it is important for networked services to reach as wide an audience as possible (including those relatively less willing to pay) since each additional subscriber increases the value of the service to all the existing subscribers.

¹¹ The proposal would apply equally well to bitstream based on the current generation network. However, we focus on NGA bitstream because it is likely to be the only viable option for CPs in many circumstances.

¹² The frequency of the charge would be determined by the asset life of the transmission and switching equipment used for the service. So, for example, it might be 5 years for active fibre equipment.

¹³ For further details see section 4.3.

¹⁴ In the context of our proposed pricing structure, technical control can be seen as the ability to use the various inputs in different proportions: for example, adopting a different ratio of backhaul bandwidth to lines served.

2 The importance of wholesale tariff structure

2.1 Introduction

Towerhouse Consulting LLP has been commissioned by Vodafone to consider the need for a new approach to wholesale pricing for access to NGA networks. The problem to be addressed is as follows:

- The economics of wholesale network access changes with the introduction of NGA. The result is that passive infrastructure access, equivalent to LLU, will not always provide a viable platform for competition. Therefore, competitors will increasingly need to rely on bitstream services. Unfortunately, to date, competition based on bitstream has been relatively ineffective with the most successful CPs (by market share) using LLU.
- LLU has allowed CPs to offer a much wider range of services, and packages of services, at attractive prices. Part of this is due to the ability to dictate the technical characteristics of the service. However, the flexibility to offer innovative retail tariffs, which has helped to drive the take-up of new services, stems from the fact that LLU creates a relatively low per line marginal cost for CPs.
- In contrast, bitstream pricing tends to be structured like retail services, with most of the cost to the CP coming in the form of a per line recurring charge. This restricts the range of profitable pricing strategies that a CP can adopt, and ultimately limits the effectiveness of competition based on bitstream.

The solution proposed in this paper is an obvious one: to change the structure of bitstream pricing to reduce per line recurring charges, and to introduce or increase other charges which do not vary directly with the number of lines to ensure the incumbent can recover its efficiently incurred costs.

2.1.1 Outline of the paper

The rest of this chapter discusses the importance of the structure of wholesale tariffs as distinct from the general, or average, price level. Then, in chapter 3, we introduce and assess two options for wholesale price structure which would create a lower marginal cost for CPs. The first is an arbitrary shift from recurring per line charges to a standing charge which recurs every few years and is chosen to ensure no change in revenue for the incumbent. This serves to illustrate the importance and influence of price structure as distinct from price level, and therefore to demonstrate the type of changes required in any practical solution.

The second option is a price structure which reflects the consumption of underlying resources, and can therefore be seen as an example of cost orientation. We concentrate on one specific example in which the underlying resources are those which would be used by a CP purchasing a physical unbundling solution such as LLU.

In the penultimate chapter we consider proposals by the European Commission and by a number of NRAs in relation to the issue of access to NGA networks. In particular, we ask whether the EC NGA Recommendation would permit our proposed

pricing structure. Finally, we offer some conclusions and recommendations for regulators considering wholesale access to NGA networks.

2.2 Cost structures through the fixed telecoms value chain

Per line charges generally represent a very large proportion of the total payment from the CP to the incumbent for wholesale access. In contrast, a CP incurs costs according to a variety of different drivers for the parts of the service which they self-provide.

Under self-provision, each input¹⁵ used has its own cost characteristics and its own relationship to the number of customers served. The following table describes the four possible relationships between the number of lines and the required volume of the input. It also defines three general cost categories according to these relationships: variable, semi-fixed and fixed.

Relationship	Description	Example	Cost category	Proportion of unbundling costs
One-to-one	An additional unit of the input is required for each additional line.	Access line to the customer	Variable	40% - 60%
Indirect - fixed proportions	An additional unit of the input is required after a certain number of lines, i.e. the input has a fixed capacity.	Active electronics	Semi-fixed	10% - 30%
Indirect - variable proportions	Additional units of the input are required as the number of lines increase, but the capacity of the input is variable - to be determined by a managerial choice.	Backhaul	Semi-fixed	
None	The volume of the input is essentially fixed relative to the number of lines served ¹⁶ .	Some overheads	Fixed ¹⁷	10% - 30%

Table 2.1: possible relationships between input volume and lines served

¹⁵ Inputs could be physical assets such as civil infrastructure, electronics, buildings, vehicles; non-physical assets such as software, licences; or human capital such as engineering, managerial input, customer support, etc.

¹⁶ Assuming at least one line is served.

¹⁷ Fixed cost does not imply a one-off cost. These may be costs which the CP incurs on a regular basis, but the size of the cost does depend on the number of lines served, i.e. it is fixed relative to the number of lines served.

The final column shows an estimated range for the proportion of costs incurred by a CP using physical unbundling. The figures are based on a study¹⁸ by WIK Consult of the costs of various NGA network architectures, and our analysis of the difference between retail prices and unbundling costs¹⁹. The fixed and semi-fixed costs are annualised and averaged across a volume of lines based on a CP with a market share of around 20%.

The proportion of variable costs would be much higher for a CP using a bitstream service for which pricing was predominantly based on per line charges. More generally, the greater the proportion of inputs that a CP self-provides, the lower the proportion of costs which are likely to be variable. Therefore, as a CP climbs the “ladder of investment” and builds out its own infrastructure closer to the end user premises, their cost structure changes from one that is predominantly variable to one that is predominantly fixed and semi-fixed. This trend is shown in figure 1.1 above.

It is clear, however, that this trend is driven largely by the choice of bitstream tariff structure. It is not inherent in the nature of the wholesale bitstream service or the underlying cost structure, and therefore can be changed relatively easily.

2.3 The importance of wholesale tariff structure

Wholesale tariff structure can have a significant impact on the ability of CPs to compete by restricting the range of profitable pricing strategies which they can adopt. The argument is simple:

¹⁸ http://www.vodafone.com/content/dam/vodafone/about/public_policy/position_papers/vodafone_report_final_wkconsult.pdf

¹⁹ At figure 3-12, the WIK report shows the modelled cost structure of a fibre unbundler with 20% market share within a less densely populated urban area. In this scenario, the fibre access charge represents 57% of total annualised costs for the CP. For bitstream access from the local exchange this rises to 65%. These figures are derived from detailed modelling of the costs of a greenfield build NGA network.

This leads to some of the highest costs, both proportionately and in absolute terms, in the access network. Therefore, we have also looked at the proportion of costs for LLU operators today. We have considered the UK market. We assume that the market is reasonably competitive in areas where LLU is viable, and therefore current retail prices provide a good approximation for total costs on a per line basis (including a return on capital, i.e. a profit margin). We consider bundles of broadband and telephony line rental, and ignore introductory discounts and special offers.

The (non-discounted) rental price per month for these services is around £20. For examples, see <http://www.broadbandchoices.co.uk>. Excluding VAT, CPs therefore receive revenue of around £16 per line per month which we assume to be an approximate total economic cost of providing the service. The costs for LLU MPF line rental are currently £89.10 per year (£7.43 per month). This works out as 46% of total costs.

For a final point of comparison, we consider CPs in the UK providing the same telephony and broadband package using wholesale access products from BT. They will most likely use IPStream and WLR (details and pricing available from www.btwholesale.com and www.openreach.co.uk respectively). The current price per line per month for these services is £6.43 and £8.49 respectively, giving a total of £14.82 per month. We should note that this is not directly comparable with the assumed £16 total cost since that was based only on areas where LLU is viable. IPStream and WLR offer national coverage. If we perform the same analysis of retail pricing but in rural areas we find that the market price is closer to £30 per month. Assuming this price is indicative of total economic cost (and we should be less confident in this assumption since the market is less effectively competitive in these areas), then the wholesale access charges represent somewhere over 60% of these costs.

- Selling at a price below marginal cost results in a loss of money on each sale. In general, therefore, a CP will not sell telecoms services with a monthly recurring charge below its recurring per line wholesale cost.
- If a CP finds that it is selling to some customers at a price below marginal cost, it will clearly try to reverse the situation. This could be by selling additional services, but by far the simplest, cheapest and most certain method will be to either raise the price or terminate the service to these customers.
- As a result, the recurring per line element of wholesale charges sets an effective lower limit on a CP's retail pricing.

On the assumption that wholesale access service prices match the simple rental-per-line structure of retail pricing, then CPs who enter the value further downstream and rely more heavily on the incumbent's infrastructure are restricted in the range of profitable pricing strategies they can adopt. The relatively high recurring per line charges that they face imply a relatively high minimum retail price level.

Despite the simplicity of this argument, there has been very little direct analysis of wholesale price structures by regulators. The reason is perhaps that upstream remedies, such as physical unbundling, tend to deliver the beneficial cost structure of low recurring per line charges as a by-product of the fact that CPs have to self-provide more network infrastructure. Therefore, because physical unbundling remedies currently provide the foundation for competition, there has been little imperative to understand the beneficial effects of changing wholesale pricing structure.

Alternatively, one might argue that as long as the average price a firm charges is above its average costs it will be profitable, and therefore it is the average cost and price level that is important. This is likely to be true in industries where average cost is roughly the same as marginal cost. However, for industries such as telecoms which incur significant fixed costs, then average cost²⁰ is usually²¹ higher than the marginal cost. In these circumstances, there are many profitable and sustainable strategies in which the firm would sell to some customers, some of the time, at a price below average cost. For example, telephony line rental has traditionally been priced below average cost, with higher margins on calls making up the shortfall in costs.

In contrast, there are very few circumstances in which selling below marginal cost will be rational:

- On the expectation that prices will rise. This may be the case when a product is first introduced, for example. In order to build market awareness, a firm might offer very significant introductory discounts.

²⁰ We should note that 'average cost' in the presence of fixed costs from durable assets implies an assumption about the length of time it will take to recover the cost of durable assets.

²¹ Short run marginal cost may spike temporarily, for example where the addition of one extra customer implies the need for increased backhaul capacity. However, once the capacity is installed, short run marginal cost will revert to its usual position below average cost.

- On the expectation that costs will fall. A firm may decide to sell at a loss to help build market share and thereby achieve economies of scale which drive reductions in marginal costs.
- In order to drive sales of a related product which has a profit margin greater than the loss on the sale of the first product. For example, printer and toner cartridges; razors and razor blades.
- As an anti-competitive practice. For example, a firm may wish to force a new competitor out of the market, or ward off threatened entry, by selling at a loss.

There are two points to note. First, all except the linked sales option are temporary strategies. Secondly, the strategies make most sense in the context of the sale of goods where there is a one-off transaction. Therefore, the total loss associated with a sale below marginal cost is a fixed, known quantity. In contrast, telecoms services are rented over a period of time. Under these circumstances, the total loss associated with an additional sale where the rental price is below the marginal recurring cost depends on the period of service. That is, selling below marginal recurring cost in telecoms creates an open ended financial liability.

Our proposal is to create a lower marginal cost for CPs by reducing per line recurring wholesale charges, but increasing other charges to compensate the incumbent for the loss of revenue (or to otherwise ensure that the incumbent can fully recover its efficiently incurred costs). It is easy to accept that a lower marginal cost generally creates more pricing flexibility, since it would usually be indicative of lower average total costs. However, in our proposal, the lower marginal cost is only achieved by incurring much high fixed and semi-fixed costs.

Therefore, in order to isolate the effects of changes in total average costs, we must consider two scenarios in which total average costs are the same, and so the reduction in marginal cost in one of the scenarios is exactly offset by higher fixed and semi-fixed costs.

Assuming total average costs are the same, it may seem reasonable to believe that the manner in which the costs are incurred is irrelevant as the level of marginal cost in each scenario will not affect the range of profitable pricing strategies for a CP. However, this is only true to the extent that total cost stays the same regardless of the commercial decisions taken by the CP. In reality, a CP's pricing decisions will affect total costs, and so cannot be ignored. For example, if a CP's chosen strategy calls for a price below marginal cost, then it can increase its profits easily by increasing price or withdrawing service.

Consider the following example: in a competitive market, a CP can sell a basic broadband service for €10 per month, and can offer a premium TV services as an optional extra for €5 per month. Given this pricing, it will achieve demand of 1 million broadband lines, and 100,000 of these customers will take up the TV service. We consider two cost scenarios shown in table 2.2 below.

	Scenario 1	Scenario 2
Marginal cost of broadband (per month)	€9.80	€10.20
Marginal cost of TV (per month)	€2	€2
Fixed costs (per month)	€400,000	€0
Profit given pricing of €10 and €5 (per month)	€100,000	€100,000

Table 2.2: two cost scenarios

Given the same pricing strategy of €10 for broadband and €5 for TV, a CP would achieve the same volume and would make the same profit under each scenario. However, it is easy to see that scenario 2 is implausible. Even if there is the prospect of profitability in the future through the sale of the high margin TV service, the CP is unlikely to sell the basic broadband service to 900,000 customers at a total loss of €180,000. A simple strategy for increasing profits would be to increase price to these customers, or to terminate their services. In reality, the ease and immediacy of this strategy is likely to outweigh the possibility of gaining higher profits in the future from up-selling the optional TV to the customer base.

The conclusion is that lower marginal costs create the opportunity to adopt a wider range of profitable pricing strategies - even when total costs remain the same. With this in mind, we should note that our proposed changes to the structure of bitstream tariffs are not equivalent to discounts. The objective of a discount scheme is to reduce total average costs. As we have just seen, there are benefits to having a lower marginal cost even if total average cost remains the same. However, we should also note that in moving to a price structure where CPs pay more upfront, there is a transfer of risk from incumbent to CP. As such, a discount may be justified to reflect the reduction in the incumbent's costs²². Discounts are discussed further in section 4.2 below in relation to the EC NGA Recommendation.

2.4 Retail price innovation and consumer benefits

Having established that a price structure which generates low marginal cost will create greater scope for innovative retail pricing, we next consider why this is important for competition and consumers. There are a number of reasons, but in essence these amount to the fact that greater flexibility over retail pricing will mean that the market can serve a greater proportion of potential demand. Willingness to pay for NGA based services is likely to vary widely across the population. Therefore, for any given price, there will be some customers who are prepared to pay a little more, and some who will not buy the service until the price falls.

²² i.e. to the extent that the incumbent's costs include an allowance for risk, these costs will reduce if some of that risk is transferred to a CP.

If a CP can structure its retail packages such that those willing to pay a little more do so, then they can also price slightly lower to attract currently unserved consumers whilst maintaining or increasing their profits. There are a number of strategies which would help achieve this aim, all used in the market today for current generation broadband, and involving some combination of price discrimination and product differentiation. Examples are introductory discounts, and bandwidth or download limits. Product differentiation such as download limits will, in many cases, make little difference to costs, but will allow the CP to vary prices for essentially the same service. For example, many customers would prefer to pay a little extra for a larger download limit than they really need for peace of mind. Therefore, two customers can make exactly the same use of the network, and so cause the same level of cost, but will pay a different price for the service.

The key is that each customer served generates a positive margin: even the low rental payments more than cover per line recurring wholesale charges. Each customer is therefore making a positive contribution to the recovery of the fixed and semi-fixed costs.

There is evidence of this effect from the market today. Where LLU operators offer services nationally, then they generally offer more competitive pricing and more comprehensive packages of services in areas where they can use their own network rather than the incumbent's²³. For example, the CP 'free' in France sells its basic broadband service for €29.99 per month in LLU and fibre areas, but €35.98 elsewhere²⁴. TalkTalk in the UK offers broadband packages outside its LLU footprint, but charges £15.32 per month extra.²⁵

The ability to adopt innovative price structures will be particularly important in the NGA world. We expect that a large number of NGA-based services will be sold as an addition or enhancement to a basic line rental service. This type of bundling already dominates current generation broadband markets. For example, in their most recent consumer research in the UK, Ofcom found that,

for many consumers, buying a bundle was a good route to trying out a new service for the first time. This indicates that bundling may well be a driver of take-up of broadband and pay-TV services.

²³ This is subject to the following caveat. Retail pricing and packages are of course influenced by a variety of factors. In terms of cost, LLU operators specifically target areas where the average total cost of provision is lower. Therefore, if retail prices are differentiated on a geographic basis, one would expect them to be higher outside LLU footprint areas.

²⁴ Current prices from www.free.fr

²⁵ See www.talktalk.co.uk for details. For more examples from the UK, see Annex 8 from Ofcom's "Review of the wholesale broadband access markets 2010". See <http://stakeholders.ofcom.org.uk/binaries/consultations/wba/summary/wbacondoc.pdf>.

[...] 45% of people with pay-TV did not have this service before subscribing to it within a bundle. Similarly, 40% of people with fixed broadband in a bundle did not have this service before.²⁶

Initially, when consumer awareness of NGA services is low, willingness to pay is likely to be low. However, in time, this will change. It is therefore important that CPs can attract customers to their network with relatively low priced basic or initial offers, and then be able to up-sell additional services in the future.

From a macroeconomic perspective, the effect of more connections to NGA networks is that there will be greater interest in developing services which require the additional functionality that these networks provide. In turn, more and better services will attract more consumers to the new networks. There is, accordingly, a positive feedback loop between the number of consumers connected to NGA networks and the development of new services. This is an example of a network effect: each additional connection adds to the value of all the existing connections to the network.

Finally, the ability to target parts of the demand curve which are not currently served clearly helps to bridge the digital divide. Ensuring that there is a low threshold to join the network is perhaps the most important tool in tackling this policy issue.

²⁶ Page 62, *The Communications Market 2010*, Ofcom. Available from <http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr10/?a=0>

3 Options for achieving lower marginal cost

This chapter explores two options for achieving a lower marginal per line cost for CPs: an arbitrary change in price structure which keeps revenue constant for the incumbent; and a pricing model which replicates the cost structure faced by CPs using LLU. A comprehensive assessment of alternative pricing structures is beyond the scope of this paper. Therefore, our conclusions are directional rather than absolute: we believe that the proposals made would be an improvement, but even better options may well exist.

3.1 *'Pure' virtual pricing*

We begin by considering a simple bitstream service provided by an incumbent consisting of access, backhaul and all the relevant associated facilities to ensure end-to-end connectivity between a point of handover²⁷ to the CP and the customer premises. This section considers the impact of a reduction in the recurring per line charge for the service, whilst maintaining total revenue for the incumbent by increasing other wholesale charges.

We assess the following two price structure scenarios under the assumption that volumes are growing constantly.

- a. high-per-line-charge: in this scenario, all the incumbent's revenue comes from a recurring per line charge; and
- b. low-per-line-charge: in this scenario the per line charge is lower, and the shortfall in revenue is made up through a semi-fixed charge which recurs every 5 years.

For any given volume, moving from the high- to the low-per-line-charge scenario implies a loss of revenue for the incumbent. This difference in revenue gets larger as volume increases. Therefore, we need to know the volume of lines in order to calculate the semi-fixed charges and ensure that revenue remains the same under the two scenarios.

Figure 3.1 below shows the incumbent's revenue profile under the two scenarios. We have assumed constant growth in the volume of lines. The size of the semi-fixed charge is set to ensure that total cumulative revenue is the same under each scenario after every 5 years.

²⁷ The location of the point of handover is not important to the present discussion - it could be close to the customer premises or in the core network.

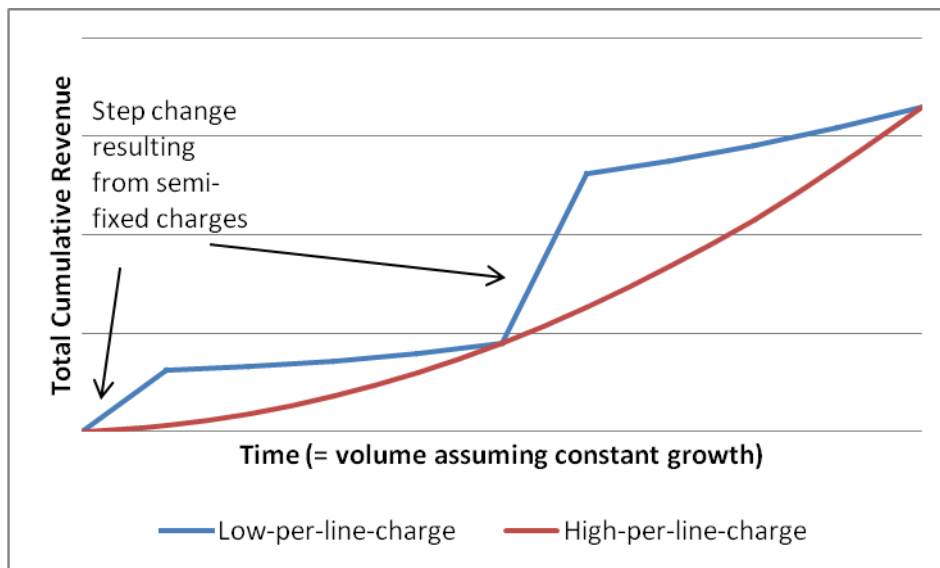


Figure 3.1: cumulative incumbent revenue under low- and high-per-line-charge scenarios

Under high-per-line-charges, the incumbent's revenue is dictated entirely by the number of lines sold. Under the alternative scenario, the revenue profile changes, but by assumption the cumulative amount of revenue collected by the incumbent is the same. The only difference is that CPs pay, and the incumbent receives, a lump sum²⁸ on a periodic basis. Therefore, the total revenue received by the incumbent shifts from the smooth function of volume (shown in red) to a lumpy function of volume and time (shown in blue).

We now consider the impact of moving from the high- to the low-per-line-charge scenario for the CP and for the incumbent.

3.1.1 Impact on the CP

At first glance, the CP appears to be worse off under the low-per-line-charge scenario. At every moment before the end of each 5 year period they have paid more in total to the incumbent. In particular, they have been required to pay a significant amount of money upfront. As such, there is a transfer of risk from the incumbent to the CP²⁹.

However, the CP benefits from a lower per line marginal cost, and can therefore adopt a much wider range of profitable pricing strategies. This increases the scope for competition on the basis of innovation and differentiation. In particular, it opens a potentially vital business strategy of attracting a large customer base through a relatively low line rental, and then 'up-selling' higher margin services³⁰.

²⁸ This size of the lump sum depends on the forecast volume. In the example shown we have assumed constant growth in the volume of lines, and therefore the lump sum increases.

²⁹ We need to be careful about assessing risk and uncertainty using our current model since we have implicitly assumed perfect foresight in order to assure ourselves of revenue equivalence at the end of each 5 year period.

³⁰ For further discussion, see section 2.4.

The upfront costs associated with the change in price structure may be seen as a barrier to entry by creating economies of scale, and will therefore prevent some CPs from competing. To some extent this is true, but as we have seen, there is a reward associated with incurring the increased upfront costs and risks. This is very similar to the issues faced by a CP considering moving up the “ladder of investment”.³¹

There are two other points to note in relation to this argument. First, one can make the upfront costs less of a hurdle by ensuring that the relevant charges are sufficiently granular. For example, if the bitstream service offered access on a regional basis, a CP could choose to build up to full national coverage gradually, and therefore would not have to incur all the upfront costs in one go. This would mirror the approach taken by LLU operators in building their networks.

Secondly, given that the effect of the change in price structure is to shift the bitstream service further upstream, it would enable the creation of a secondary wholesale bitstream or resale market. Therefore, if there is demand from smaller scale CPs, the market should create additional downstream wholesale services which can be priced on a traditional per line basis.

3.1.2 Impact on incumbent

The revenue profile for the incumbent is shifted such that money is received sooner. Therefore, holding everything else constant, this reduces the risk associated with recovering the costs of providing the service. However, we must accept that in reality, everything else would not stay constant.

Perhaps the most significant impact on the incumbent would be that, as noted above, the new price structure would enable CPs to offer a wider range of retail tariffs. In other words, it would make CPs more effective competitors by giving them greater independence to choose a retail tariff which does not match the bitstream pricing.

From this perspective, the incumbent has some control over a CPs retail pricing under the high-per-line-charge scenario. In effect, the higher the recurring per line charge (as a proportion of total bitstream charges), the less scope there is for a CP to adopt different pricing, and therefore the greater the level of influence of the bitstream charges on retail pricing. In moving to the low-per-line-charge scenario, the incumbent loses some of this control.

A second issue for the incumbent is cost recovery. In the low-per-line-charge scenario, the incumbent's revenue becomes less sensitive to the volume of lines, but much more sensitive to the number of CPs. Small changes in the number of CPs can cause very large changes in revenue. Therefore, the potential variability of the incumbent's revenue increases.

Similarly, given that there is uncertainty over the future volume of lines, one cannot dimension fixed and semi-fixed charges to guarantee revenue equivalence. If a CP sells a smaller number of lines than expected, then the average revenue per line for the incumbent will be higher than the high cost scenario; but if the CP sells more than

³¹ This is not surprising since we have proposed the change in price structure in order to better match the cost structure of the underlying network assets.

expected, then average revenue per line will be lower. This is shown in the figure 3.2 below.

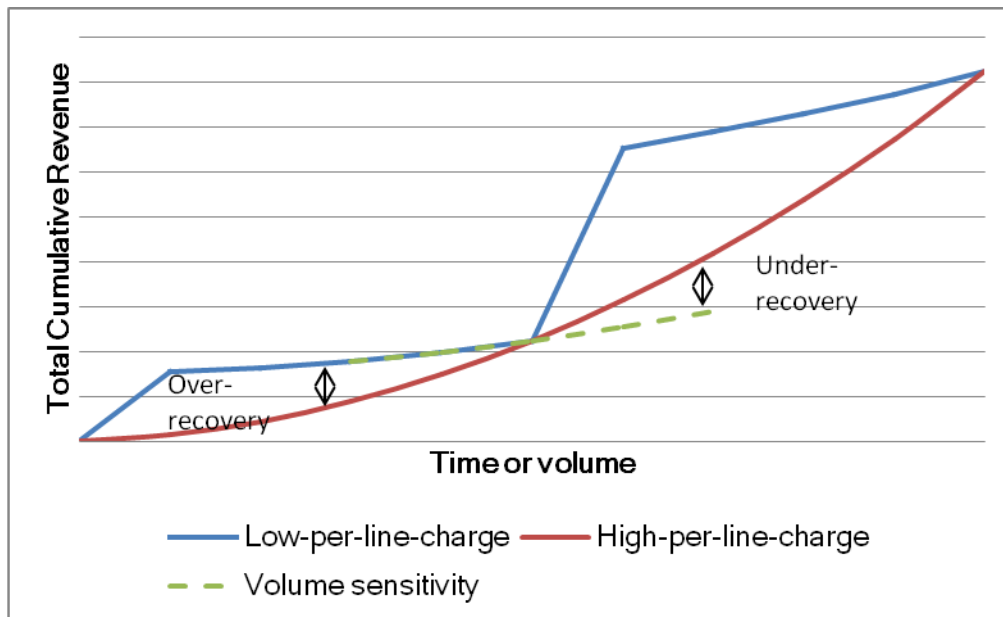


Figure 3.2: over- and under-recovery of revenue relative to the high recurring charge scenario

Risks of over- and under-recovery are an unavoidable feature of the telecoms industry given the largely fixed nature of costs. A variety of volume and timing assumptions are required whenever fixed costs are recovered through simple per line recurring charges. These volume forecasts concern not only the number of customer lines to be served in the future, but the relative amounts of all the various inputs required to produce the service. If any of these volume forecasts turn out to be wrong, then revenue will not match cost. These complexities and uncertainties are intrinsic to the process of setting regulated prices: the regulator must try to verify all these costing assumptions to ensure that future revenues do match costs.

One of the advantages of moving away from a price structure in which most costs are recovered through per line charges is that it reduces the sensitivity of cost recovery to the volume of lines. In a sense, the low-per-line-charge scenario is an example of greater cost orientation in pricing - to have a structure for the prices which more closely matches the manner in which underlying costs are incurred. This idea of pricing to match resource use is explored further in the following section. From the perspective of cost recovery, it can mean that the risks of under- and over-recovery are reduced.

3.1.3 Impact on competition and investment

A final point to note is that the increased competitive intensity associated with the change in price structure may be seen as damaging to long term investment prospects. In the sense that CPs gain access to lower marginal costs without investing more in physical assets, it may appear as if they are less committed to the long term prospects for the market. The counter argument is that although CPs are

not investing in their own physical assets, they are making a similar financial commitment through the upfront payments. In a very real sense, the CPs are investing in the physical assets of the incumbent³².

Equally, to the extent that upfront payments represent underlying costs (which is the basis of the option discussed in the following section), the risks of short-termism are no different from those based on competition via unbundling today. Ultimately, a CP must recover its fixed costs to be profitable. The more significant the fixed (and semi-fixed) costs, the greater the risks to a CP of an average price level closer to marginal costs. As a result, we believe that the proposed increases to charges to compensate for lost revenue will tend to offset the risks of short-termism: a very low marginal cost will only be achieved if the CP invests a very significant amount upfront.

3.2 Pricing to match resource use

In this section we consider how a change in wholesale price structure to deliver lower marginal costs to CPs can be justified on the basis of matching the use (and cost) of resources³³. As discussed in the previous chapter, the production of a fixed telecoms service requires a range of different inputs. With bitstream services, many of these inputs are preassembled, and their respective costs are recovered through a simple per line charge. The alternative we now explore is for a CP to pay for some of the underlying inputs separately, and according to the manner in which they are used.

3.2.1 A model of virtual LLU pricing

In matching wholesale prices to underlying costs, we must decide on the level of granularity of the costs. That is, how far up the value chain should we look to determine cost structure? The closer we get to the raw, unprocessed inputs, the higher will be the proportion of fixed costs. Given the relative success of copper LLU, we believe that a good starting point is to consider the cost structure faced by an LLU operator. Therefore, we first define a stylised model of the costs incurred by a CP using LLU assuming they rent backhaul capacity from the incumbent or a third party. We consider only the most significant drivers of cost:

- line rental and connection;
- one off costs associated with enabling the provision of service from an exchange - DSLAM capex and installation, backhaul installation and one-off collocation costs;
- recurring costs driven by the number of exchanges enabled - backhaul rental (also driven by choice of backhaul bandwidth), space and power rental; and
- common recurring costs (i.e. driven by the provision of service *per se*) - operating and maintenance, systems interface costs, overheads.

Ultimately, we want to generate a price structure for NGA bitstream which creates the same cost structure for a CP as that of a copper LLU operator today. Clearly, the

³² See section 3.2.2 on the relationship between the proposed change in pricing structure and co-investment.

³³ As previously noted, this can be seen as an argument for genuinely cost oriented pricing, i.e. pricing which genuinely reflects the cost of resources used in the production of the service.

network components will be different for NGA bitstream, but if we abstract sufficiently, NGA and the current generation network share the same cost drivers for components which perform the same function. This is shown in figure 3.3 below, which applies these LLU costs categories to a generic network architecture. The passive access element could be a physical fibre, a combination of dedicated fibre and wavelength (as in GPON), or the copper sub-loop in the case of FTTC. The location of the aggregation point can therefore vary depending on network architecture.

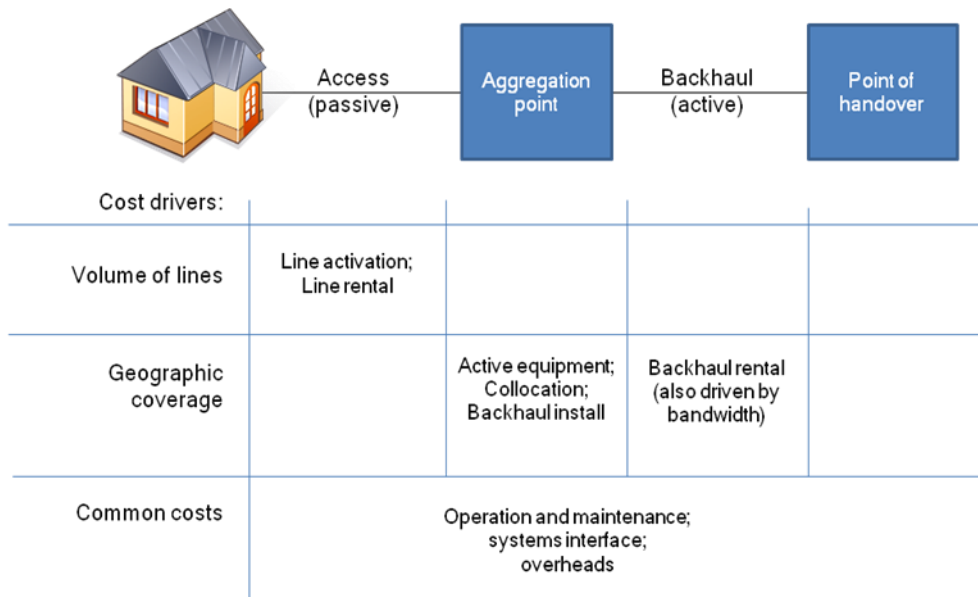


Figure 3.3: cost drivers in bitstream access provision

With these broad categories of cost in mind, we can now map the costs to a specific price structure for bitstream. Pricing will consist of a combination of fixed and recurring charges relating to the number of aggregation areas served, the amount of backhaul bandwidth (per aggregation area), and the number of lines served. Common costs will need to be recovered through a mark-up to these prices. In the interest of achieving a lower marginal cost for the CP, and matching the underlying cost structure, we would suggest that such mark-ups are not applied to the recurring per line charges.

Under our proposal, a CP would pay separately for all the items listed in table 3.1 below. As a result, the line rental element of the bitstream charge would be a much smaller percentage of the total, resulting in a relatively lower marginal cost to the CP. Equally, since the incumbent receives revenue in a manner which more closely reflects the way in which costs are incurred, the risk of under-recovery should be reduced. In essence, there is a transfer of risk from the incumbent to the CP, which may help to justify NGA investments.

	Per line	Per aggregation area served	Bandwidth per aggregation area
Fixed	Connection	Installation	<i>None</i>
Semi-fixed	<i>None</i>	Active equipment capex	<i>None</i>
Recurring	Line rental	Power and colo; maintenance and repair	Backhaul

Table 3.1: elements of the proposed charging structure

A final point to note is that, thus far, we have not assumed that the CP actually controls the relative proportions in which the underlying inputs are used. They merely pay for them on a different basis. In order to generate control over technical characteristics, and therefore to create new services, it is vital that CPs are able to use the inputs in different proportions. The most obvious example is backhaul: in order to deliver services requiring greater reliability, such as voice services or video streaming, it is important that the CP be able to allocate additional backhaul bandwidth per customer line.

3.2.2 Relationship to co-investment

The idea explored in the previous section is that pricing should reflect the manner in which underlying costs are incurred. In the extreme, pricing could mirror this cost structure precisely: where there are fixed costs for the incumbent, a CP pays a one-off upfront fee; wherever the incumbent installs extra equipment, the CP pays a share of the costs; etc. This amounts to the idea of co-investment which has been discussed by a number of NRAs and was referred to in the recent EC recommendation on NGA networks³⁴.

Co-investment transfers a significant proportion of the risk associated with investing in NGA from the incumbent to the CP. As a result, the CP ought to benefit from a marginal cost which is similar to that incurred by the incumbent.

We can show the full range of options for wholesale price structure on the value chain chart introduced in chapter 1. The furthest upstream option is co-investment where the price structure matches the very high proportion of fixed costs associated with physical network infrastructure investment. Moving downstream, an increasing proportion of costs are distributed as depreciation charges and recovered through recurring wholesale per line charges. As the proportion of cost recovered through per line charges increases, the scope to offer differentiated retail pricing reduces. Ultimately, a CP is simply reselling an identical product at a very similar price, but under a different brand.

³⁴Commission Recommendation of 20 September 2010 on regulated access to Next Generation Access Networks, **2010/572/EU**.

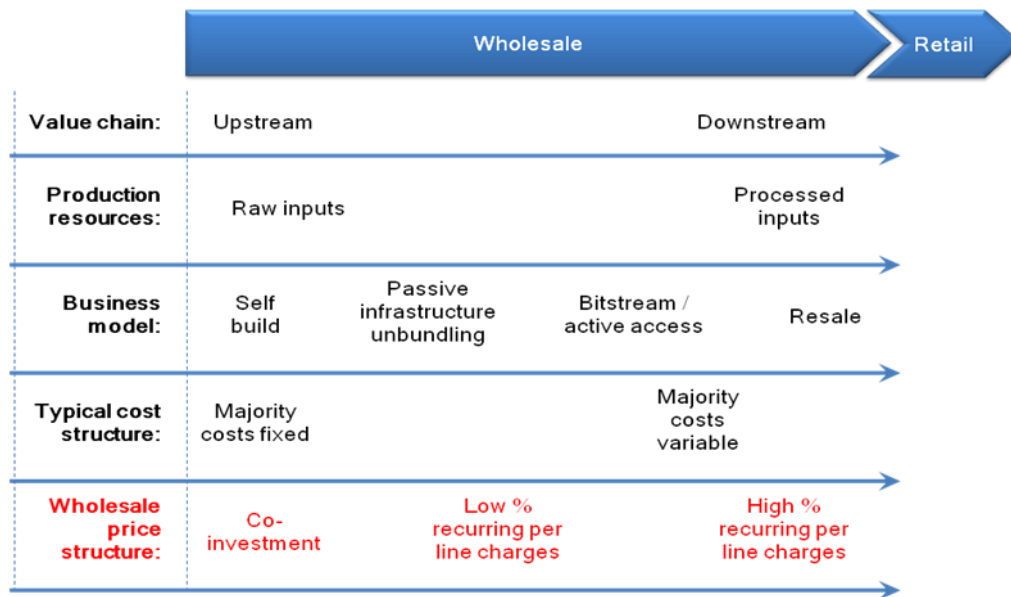


Figure 3.4: wholesale price structure and the fixed telecoms value chain

4 The debate so far

This chapter provides a brief overview of the proposed regulatory solutions to the issue of wholesale access to NGA networks. Throughout this paper we have assumed that investment in NGA will take place to some degree, and have focussed on the issue of access to these new networks. In addition to this issue, regulators have also been concerned with the incentives to invest in building NGA networks.

It has become clear from these discussions that there is a trade-off between promoting investment in NGA networks and promoting competition through regulated access to the networks. This trade-off creates uncertainty over the future course of regulation. In particular, proposals to create an environment more conducive to investment are taken to mean that competition will become weaker. Therefore regulators have been keen to stress that they will continue to support competition.

We believe that our proposal for a different structure for bitstream pricing can help to balance the trade-off, and therefore help to reduce regulatory uncertainty, by creating additional options for wholesale access. Pricing structure is more flexible than product design and the location of physical points of access. This makes it possible to create additional rungs on the ladder of investment. This helps to create options which both support effective competition *and* maintain (or even improve) incumbent incentives to invest. Therefore, we position our proposal as an addition to, rather than replacement of, the existing NRA proposals.

In the following section we provide a review of the economics of access to various different types of NGA network. In light of this, we consider the EC NGA recommendation, and then discuss some of the proposals from NRAs for virtual unbundling services.

4.1 *The economics of NGA access*

At the conceptual level, there are four basic designs for NGA networks:

1. Fibre to the cabinet
2. GPON - fibre to the home
3. WDM PON - fibre to the home
4. Point to point fibre to the home

Table 1.1 in the executive summary shows the economic and technical feasibility of physical unbundling under these network architectures relative to LLU. Under FTTC and GPON, the physical location where a CP would need to connect to the network in order to unbundle passive network components lies very close to the customer premises. The economics of access in these circumstances are roughly equivalent to unbundling exchanges in sparsely populated areas in current generation networks: costs are high relative to the number of potential customers, and therefore duplication of infrastructure by a number of competing CPs is not financially viable. Therefore, under these network architectures, it is likely that bitstream products will be required to support competition in many areas.

WDM PON technology holds out the prospect of wavelength unbundling. Wavelengths represent uncontended bandwidth, and provide a good approximation to (and for many uses, indistinguishable from) a physical fibre connection. Wavelengths can, in theory, be 'unbundled'. That is, a single wavelength representing pure uncontended bandwidth to a single customer can be handed over to a CP, leaving the CP to specify the services running over the connection almost without constraint.³⁵

However, the technology is still in its infancy with standards yet to be agreed. It is therefore likely to be some time before it becomes a genuine option for real world deployment.

From the perspective of a CP currently using LLU, point to point FTTH provides the closest equivalent to the current network architecture and the possibility of a smooth transition to the new network. Point-to-point fibres are likely to terminate at, or in the vicinity of, the local exchange, and can be unbundled in a manner equivalent to the copper network.

Without doubt, the option of fully unbundling point to point fibre is likely to deliver the most robust forms of competition. It would generate least disruption to the business model of established competitors, and it delivers perhaps the greatest scope/opportunity to engineer competing services to the desired specification. As shown in the recent WIK-Consult study³⁶, P2P FTTH networks do not necessarily cost significantly more to build than PON networks.

However, from a practical perspective, few incumbents are actually planning to build P2P FTTH networks for the residential sector. Even those planning to use this technology will not deploy it everywhere. Our conclusion is that under almost all realistic NGA roll-out scenarios there will be significant demand for bitstream services to support competition.

To date, bitstream services have had little success in enabling effective competition. As a result, regulators have adopted one, or both, of two positions:

- that regulation should intervene to help improve the business case for physical unbundling; and/or
- that bitstream services should be improved to allow CPs to compete more effectively by ensuring that bitstream shares the technical characteristics of passive infrastructure access.

The EC recommendation, considered in the following section, sits very much in the former category; and the virtual unbundling proposals from the Austrian, Danish and

³⁵ Furthermore, since the wavelength can be transmitted without material degradation of signal considerable distances (and with appropriate regeneration, can be transmitted for vast distances), WDM creates the possibility of genuinely 'virtual' physical unbundling - that is, the CP would gain access to the network in a manner that was functionally very similar to physical unbundling, but be able to do so remotely. The physical proximity of the CP to the customer would have no bearing on the functionality of the access connection.

³⁶ *Op. cit.*

UK NRAs in the latter. Our proposal can be seen as an extension of the second position to cover pricing: bitstream pricing should ensure that CPs face a structure of costs as-if they were using physical unbundling.

4.2 European Commission Recommendation on NGA networks

The recent recommendation focuses heavily on passive infrastructure access as the optimal solution. It requires that NRAs consider requirements to mandate access to³⁷:

- a. Underlying civil infrastructure such as duct and poles;
- b. The terminating segment in the case of FTTH;
- c. The entire fibre loop in the case of P2P FTTH; and
- d. The copper sub-loop (in FTTN/FTTC deployments).

In addition, the recommendation suggests that, if permissible under national laws, the SMP operator should be required to deploy multiple fibre lines in the terminating segment and additional duct capacity to cater for demand from other operators³⁸.

The recommendation implies that active access remedies are relevant only to market 5 - that for wholesale broadband access. Here, the EC notes the need for wholesale products to reflect the full range of capabilities of the NGA network in order to allow CPs to compete effectively. We interpret this to mean that such wholesale products (which we have referred to as bitstream services) should allow a CP to control the technical characteristics of the service, such as the bandwidth allocated per user.

Annex 1 of the recommendation provides detail of how cost orientation should be implemented for the pricing of both passive and active access products. This concentrates on the issue of the appropriate allowance to make for investment risk. The recommendation is that a risk premium should be added to the cost of capital to take account of a variety of factors which contribute to the uncertainty of investment in NGA networks.

The final part of the annex deals with price discounts based on term or volume commitments. The conclusions are that such schemes are acceptable to the extent that the discount reflects *only* the reduction in the average cost per line which results from a transfer of risk from the incumbent investor to the CP³⁹.

We conclude that there is nothing in the EC recommendation to prevent the adoption of the pricing model proposed in this paper. In fact, given that this form of pricing implies a greater proportion of upfront payments, it would have a similar effect to a volume/term commitment scheme, and therefore could result in a reduction in the risk of the incumbent's investment. As such, and in accordance with Annex 1 of the Recommendation, this may justify a discount (i.e. a reduction in the *average* price level). However, it is important to stress that our proposal does not equate to a discount scheme.

³⁷ For more detail, see paras 13-30.

³⁸ Paras 16 and 21.

³⁹ Sections 7 and 8 of Annex 1.

4.3 Virtual unbundling

Three NRAs, in Austria, Denmark and UK, have now either proposed or implemented wholesale access remedies which are virtual versions of physical unbundling. The basic premise is that physical unbundling provides the greatest level of control for CPs, but that a significant degree of control could be provided using active access products. Therefore, in areas where physical unbundling is not economically viable, the incumbent should introduce 'virtual unbundling' services which try to replicate the levels of control that a CP would have achieved if they were physically unbundling. Our analysis focuses on the first of these proposals: Ofcom's analysis of the UK wholesale local access market⁴⁰.

Ofcom concluded that in many areas passive infrastructure access was unlikely to support effective competition. As a result, Ofcom considered in some detail what an active wholesale access service would need to look like in order to support effective competition given the current market conditions in the UK.

Ofcom concluded that, given BT's roll-out plans and the current deployment of network infrastructure by LLU operators, that competition in the UK would be best served by a virtual unbundling product⁴¹. They therefore defined a conceptual service, referred to as VULA (Virtual Unbundled Local Access)⁴². VULA is designed to replicate the control that LLU operators have over technical characteristics of the service, and therefore to match the scope to compete that LLU has created for CPs. In this regard, Ofcom note that,

the most effective way to support the development of downstream competition would be to provide significant scope for alternative providers to innovate and differentiate in how they package and deliver services.⁴³

⁴⁰ See <http://stakeholders.ofcom.org.uk/consultations/wla/>

⁴¹ In the statement to the Review of the wholesale local access market, October 2010, Ofcom writes (para 1.26):

At this point, we consider that VULA is likely to be the main basis for NGA competition over BT's network, to supplement the continuing effectiveness of LLU, over at least the next four years. Our economic analysis suggests that VULA is very likely to be the most cost-effective NGA remedy and the remedy most likely to emulate the level of competition currently delivered by LLU.

⁴² This is first discussed in the consultation to the Review of the wholesale local access market, March 2010. <http://stakeholders.ofcom.org.uk/binaries/consultations/wla/summary/wlacondoc.pdf>

At paragraph 1.19 Ofcom states that:

The intention is that VULA would provide access to the NGA network in a way that is similar to how LLU provides access on the CGA network. However, rather than providing a physical line, VULA would provide a virtual connection that gives OCPs a dedicated link to their customers and substantial control.

⁴³ Para 8.10, statement to the review of the wholesale local access market

In order to generate this scope to innovate, Ofcom describe a number of characteristics that a VULA service should have⁴⁴:

- a. Local access - the point of interconnection should be physically close to the end user premises.
- b. Service agnostic - the access should not be specific to any service - it should simply provide access to bandwidth.
- c. Control over access in terms of QoS - it should allow CPs to control the way in which packets are prioritised and therefore allow CPs to offer services which require different levels of QoS.
- d. Uncontended between subscriber and point of handover - despite being provided over shared infrastructure, the bandwidth should be uncontended.
- e. Control of CPE - the CP should be able to specify the equipment used in customer premises.

Broadly speaking, there is consensus around the fact that a wholesale service with these characteristics would create enough control to allow a CP to differentiate its services from a technical perspective. In the Austrian version of virtual unbundling, there is an additional requirement that CPs should be able to create multicast services.

In terms of VULA pricing, Ofcom concluded that BT should be allowed to price as they see fit given the early stage of development of the market, and because the price would be constrained indirectly by competition from both NGA services from Virgin Media and current generation access services⁴⁵. As a result, they did not consider the structure of VULA pricing in any detail⁴⁶.

The question we now address is whether the pricing a VULA service is likely to deliver a low marginal cost per line to CPs. We expect that it would, but only to the extent that the 'local' requirement ensures that the service covers only a small amount of infrastructure (from the aggregation point to the customer premises in the terms of figure 3.3 in the previous chapter). Equally, given that this is perhaps the most expensive part of the network and the part which is the focus of NGA investment, there may still be a considerable rise in the per line element of charging relative to LLU on the copper network.

For this reason, it is important to note that the change in pricing structure that we argue for is not dependent on bitstream services being provided 'locally'. Part of the

⁴⁴ For further details, see, for example, paras 7.231-7.248 in the consultation to the Review of the wholesale local access market.

⁴⁵ However, Ofcom did note that BT would still be subject to *ex post* Competition Law regulation, and they did impose a requirement that VULA prices (and other terms and conditions) be fair and reasonable.

⁴⁶ They do note, however, in the market review consultation, that they believed it would be appropriate for BT to test a number of different price structures such as tiered pricing whereby different quality levels or bandwidths are priced at different levels. See, for example, paras 7.252-7.253, *op. cit.*

purpose of this paper is to explain that the choice of pricing *structure* for bitstream services can be made independent of the underlying network. Therefore, we believe that a bitstream service could have all of the requirements listed above without being provided locally, but would then need to be priced with an appropriately low per line recurring charge. The local requirement is likely to create an effective ceiling on the per line element of charges, but this perhaps does not go far enough to create a low marginal cost for CPs, and ensure effective competition.

5 Conclusions and recommendations

Price regulation of wholesale access serves three potentially conflicting purposes:

- a. to protect against the abuse of monopoly power through excessive pricing;
- b. to promote competition; and
- c. to encourage investment.⁴⁷

In practice, regulated prices are usually set at some measure of average total cost. Assuming these costs are 'efficiently incurred', pricing at this level will ensure that the incumbent cannot make excessive returns, and efficient downstream competitors should be able to run financially viable operations. This covers objectives a and b, and c to the extent that it refers to investment in downstream markets. There is potentially a trade-off between the achievement of these objectives and encouraging investment within the regulated market. If it is difficult to achieve 'efficiency', then it will be difficult to make a return on investment. Hence, one can argue for slightly higher prices in order to fulfil objective c.

In light of this trade-off, it is difficult to make an unambiguous case for any particular pricing model. Therefore, we set the following criteria to enable an objective assessment of our proposed alternative wholesale pricing structure, but acknowledge that to some extent our recommendations reflect a judgement as to the relative merits of promoting competition and investment.

The two most important criteria are:

- **Cost recovery:** the regulated incumbent should be allowed to recover all relevant costs which have been efficiently incurred (and *only* costs which have been efficiently incurred). Costs should include a reasonable return on the capital employed, and where appropriate this should be adjusted to account for the risk associated with the relevant investment.
- **Effective competition:** the pricing of the wholesale access service should enable CPs to compete effectively (with the downstream operations of the incumbent). Effective competition implies the ability to create and deliver new services with pricing which attracts customers.

⁴⁷ These three objectives are derived from Article 13 of the Access Directive (2002/19/EC) which concerns a NRA's remit to impose price controls. It states that price controls may be needed where market conditions indicate that lack of competition might allow an operator "to sustain prices at an excessively high level, or apply a price squeeze, to the detriment of end-users." It also notes the importance of investment, stating that NRAs "shall take into account the investment made by the operator and allow him a reasonable rate of return on adequate capital employed, taking into account the risks involved." It goes on to require that any price regulation "serves to promote efficiency and sustainable competition and maximise consumer benefits."

In addition to these two key criteria, it would be beneficial (but not essential) if pricing were to have the following attributes.

- Risk sharing: there are potential benefits in allowing CPs to share in the risk of investment in NGA networks - both in terms of promoting competition and investment.
- Technology/network architecture neutral: there are likely to be a variety of different technologies and network designs in operation for the foreseeable future (including the current generation network). It is therefore important that future wholesale products and their pricing be applicable to a wide range of these different networks.
- Indifferent to demographics: in an ideal world, a wholesale access product and its pricing would be sufficiently flexible to allow a CP to use it to serve an entire country - despite the wide variations in local conditions.

We assess the proposed price structure against these criteria in the sections below.

5.1 Cost recovery and risk sharing

In moving away from revenue which is almost entirely dictated by the volume of lines to revenue which is a function of a range of different volumes (such as the number of CPs, the amount of backhaul used, amount of equipment installed, etc), expected revenues become more sensitive to changes in volume. At first, this appears to represent an increase in risk for the incumbent. However, assuming pricing can be tied more closely to underlying costs, the risks to cost recovery may actually reduce. In essence, there is a transfer of (retail) demand risk from the incumbent to the CP⁴⁸, as the incumbent is able to pass through some of its fixed costs as they are incurred rather than having to wait until retail demand materialises.

In addition, to the extent that bitstream services are offered (and priced) on a geographically disaggregated basis, the volumes which drive revenues will tend to be larger. This will tend to reduce the sensitivity of total revenue and cost recovery to discrepancies between expected and actual volume. For example, if CPs paid a fee to enable the provision of service on an exchange by exchange basis (for example, to cover costs for access transmission/switching equipment), this would clearly create much more granularity in revenues relative to a fee to enable services nationally.

Therefore, with suitably designed prices, it should be possible to ensure that cost recovery for the incumbent is at least as effective as it is under traditional bitstream pricing.

⁴⁸ As we have noted, in the extreme, if prices fully match cost structure then we have something equivalent to co-investment. This clearly involves a significant transfer of risk.

5.2 Effective competition

There is often little scope for meaningful differentiation of basic access services in telecoms, and therefore innovation is more likely to be driven by the bundle of services offered to the consumer and the pricing of this bundle. Therefore, the *structure* of prices of the various elements of the bundle takes on extra significance, and the ability to change this structure becomes an important aspect of innovation.

The main argument that we put forward in this paper is that the per line recurring wholesale charges set an effective lower limit on retail pricing. Therefore, to enable innovative retail pricing, which has been a key feature of LLU based competition, bitstream pricing should be structured to match the relatively low recurring per line charges faced by LLU operators today. This implies increasing, or introducing, charges which do not relate to the number of lines served.

It could be argued that there is a risk that the increased upfront charges will act as a barrier to entry and therefore curtail competition. Whilst it is undoubtedly true that higher upfront payments will create economies of scale, and imply greater risks for CPs, this is merely a reflection of the structure of underlying costs. Paying higher fees upfront simply mirrors the risks associated with investment in physical network infrastructure. In the case of our proposed pricing structure, the benefit to the CP of making this financial commitment is access to a lower marginal cost, and the ability to compete more effectively.

In effect, the change in pricing structure moves the wholesale product further upstream. As such, another counter to the risk of reduced competition is that it would allow CPs to create wholesale products which sit further downstream and are priced on a per line basis.

Finally, the flexibility over the size of the shift to upfront fees means that it is possible to fill gaps in the ladder of investment where the network architecture implies a big jump from one rung to the next. For example, the investment required for sub-loop or GPON unbundling is often prohibitive, whereas traditionally priced bitstream services generally leave little scope for competition. An alternative priced bitstream service may still require considerable upfront investment, but the level can be adjusted to ensure competitive entry is viable.

5.3 Network and demographic indifference

One of the advantages of bitstream is that it can be neutral to the underlying design of the network in a way which is not possible for physical access remedies. At least in terms of the presentation of the service to the CP, bitstream does not have to vary between different access network architectures. It may be that pricing ought to change to reflect the differences in the underlying network, but as we have shown above, the idea of paying for different network elements according to the incumbent's cost drivers is a general one. It applies regardless of the design of the network, and therefore it should always be possible to design a price structure which results in low recurring per line charges to CPs.

Equally, it is possible to change the design of the bitstream service to ensure that it is viable across a wider range of demographics than has traditionally been the case. One of the key determinants of financial viability of an access method is the cost of backhaul. In densely populated areas, it will be possible for CPs to purchase dedicated backhaul capacity. Whereas in other areas, shared backhaul bandwidth will be the only option. There is no reason why a suitably designed bitstream service should not offer both options; and crucially, that the shared backhaul offer be priced on a similar basis (for example, rental per amount of bandwidth per exchange) to dedicated backhaul.

5.4 Recommendations

We believe that the pricing proposal outlined in this paper would help to ensure that bitstream services can be used to support truly effective competition over NGA networks. However, the threat of increased, or more effective, competition is likely to mean that incumbents do not choose to offer this form of pricing voluntarily. Therefore, we recommend that NRAs include pricing structure as part of the assessment of cost orientation requirements for bitstream services. Ultimately, we believe that where passive access remedies are not viable, NRAs should mandate bitstream access with a price structure that delivers low marginal cost to CPs.

We view this as the sole regulatory remedy required in these areas in the access/broadband value chain. That is, no further remedies would be required downstream. Demand for wholesale access services priced on a traditional per line basis would be served by CPs using the regulated bitstream service. This is analogous to areas where competition based on passive remedies is effective and therefore regulated bitstream access is no longer required.

It should be noted that the proposal is compatible with a retail minus approach to price regulation. However, retail minus tends to imply a wholesale tariff structure which maps onto that found in retail markets - i.e. precisely what we are trying to move away from. It is important to remember that retail minus is simply a method of setting the price *level*, with the 'minus' chosen to reflect the costs of efficient downstream operations. Although it is much simpler, and therefore more transparent, to use retail minus in the context of a wholesale tariff structure which matches the retail price, it is not necessary.

Similarly, one potential concern with the proposed approach is that it would create additional complexity for regulatory bodies trying to prevent margin squeeze since a simple comparison with retail prices is no longer possible. Such simple tests are certainly not possible for the majority of today's upstream remedies such as LLU, and our proposal is ultimately to make bitstream pricing look more like that of an upstream remedy. From this perspective, the design and application margin squeeze tests will be no more difficult than they are today.

In conclusion, we believe that the best chance of having effective competition over the widest possible area, and the greatest scope for innovative competition, will be delivered by requiring bitstream services which meet the following two criteria:

- they must allow CPs to control the technical characteristics of network services; and
- the recurring per line charges should form a relatively small proportion of the total charges to a CP.