

Remedies for Broadband Services

Paper prepared for DG InfoSoc

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* The views expressed are those of the author alone.

This paper discusses and evaluates remedies for operators found to have significant market power in broadband services (taken here to be broadband wholesale access, unbundled local loops and leased lines) under the new European regulatory framework for electronic communications services. It is organised as follows, Section 1 describes the new regulatory framework. Section 2 discusses how the development of competition in broadband services might arise, identifies market failures likely to occur and then discusses how an optimal set of remedies might be found. Section 3 discusses remedies for wholesale broadband access; section 4 considers remedies for unbundled local loops; section 5 does the same for leased lines.

1. The new regulatory framework

The new regime, which passed into law in April 2002 and came into effect in July 2003, consists of a Framework Directive and four further Directives –on Access and Interconnection, Authorisation, Universal Service and Data Protection.

In summary, the new arrangements require NRAs to confirm or amend market definitions (from a list of relevant markets subject to *ex ante* regulation prepared by the Commission), to conduct market analyses and, where dominance is found, to impose *ex ante* remedies, normally from a list contained in the Directives. Markets not included in the list, and markets potentially subject to *ex ante* regulation but where no dominance is found, are subject solely to national or European competition law.

At one level, the new regime is a major step down the transition path between monopoly and the application of generic competition law. It operates across the range of ‘electronic communications services’, ignoring pre-convergence distinctions. It represents an ingenious attempt to lead the NRAs down the path of normalisation - allowing them, however, to proceed at their own speed (but within the uniform framework necessary for the internal market). Since the end state is one governed by competition law, the new regime moves away from the piecemeal approach of the previous (1998) regulatory package towards something more consistent with that law. However, competition law is to be applied (in certain markets) not in a responsive *ex post* fashion, but in a pre-emptive *ex ante* form. The new regime therefore relies on a

special implementation of the standard competition triple of: *market definition*, identifying *dominance*, and formulating *remedies*. We examine these in turn.

1.1. Market definition

In February 2003, the Commission has issued a Recommendation on relevant markets - defined in the manner of competition policy.¹ NRAs may depart from the Recommendation with the consent of the Commission. The Recommendation incorporates flexibility by allowing related 'technical services' to be aggregated within a market definition. Member States can also add or amend markets, using specified procedures. A consequence of the reliance of the proposed new regime on *ex ante* regulation is that it is necessary to adopt a forward-looking perspective on market definition.

1.2. Dominance

The new legislation adopts the classical 'dominance' as a threshold for intervention, under the name Significant Market Power (SMP). SMP can be exercised by a single firm, or collectively, or leveraged into a vertically related market.

In addition, Article 14 of the Framework Directive contained a prohibition on intervention in markets that are effectively competitive - implicitly defining markets where dominance is absent as effectively competitive. This is a change of fundamental deregulatory significance, and a major step along the route towards convergence with competition law.

Single firm and joint dominance are two of the three forms of dominance identified. Both are potentially of relevance in the broadband area – the latter where services are provided by a small number of platforms, for example ADSL and cable modems.

¹ Commission Recommendation of 11/02/2003 *On Relevant Product and Service Markets within the electronic communications sector subject to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services.*

Leveraged dominance is also potentially significant. The communications industry, like many industries, consists of a series of activities that can be performed either individually or by vertically integrated firms. There are well-established benign motives for firms to become vertically integrated. In particular, doing so may reduce production costs, by eliminating the costs of transactions between two separate firms.

However there are situations where a vertically integrated firm may find it advantageous to distort competition downstream as a means of bolstering its upstream market power, doing so using either price instruments such as a price squeeze or non-price instruments such as the supply of low quality inputs to competitors. This is a major issue in broadband markets.

1.3. Remedies

Under the Directives, NRAs have the power to impose obligations on firms found to enjoy SMP in a relevant market. Until recently, little attention was paid to the question of the action to be taken by an NRA in relation to a firm or firms judged to exercise SMP. While the circumstances in which intervention is required are set out in the Framework Directive, discussion of the nature of the regulatory response is largely confined to the Access Directive.² Putting on one side proposals relating to conditional access systems and other associated facilities, Articles 8 to 13 of the proposed Access Directive outline the NRA's options. Thus Article 8 (Imposition, Amendment or Withdrawal of Obligations) reads as follows:

“1: Where an operator is designated as having significant market power on a specific market ..., national regulatory authorities shall impose one or more of the obligations set out in Articles 9-13 of this Directive as appropriate.

.....

² Article 16 of the *Universal Service Directive* (Directive 2002/22/EC) also considers retail price control.

4: Obligations imposed in accordance with this Article shall be based on the nature of the problem identified, and shall be proportionate and justified in the light of the objectives laid down in Article 8 of the [Framework Directive]...”

1.4. The policy objectives

What are the policy objectives of the new framework, referred to above? In relation to competition, the objectives are:³

‘to promote competition in the provision of electronic communications networks, electronic communications services and associated facilities by *inter alia*:

- a) ensuring that users, including disabled users, derive maximum benefit in terms of price, choice and quality;
- b) ensuring that there is no distortion or restriction of competition in the electronic communications sector;
- c) encouraging efficient investment in infrastructure, and promoting innovation; and
- d) encouraging efficient use and ensuring the effective management of radio frequencies and numbering resources.’

I discuss below in more detail the possibility of conflicts between these objectives. It is sufficient here to note the potential conflict between benefiting users in the short term through low prices, which might best be achieved by regulating a single supplier, and encouraging longer-term investment and innovation, which may require competitive investments.

³ Article 8 of the *Framework Directive* (Directive 2002/19/EC).

2. Sources of market failure and optimal approach to remedies

2.1. *Forms of competition for the supply of broadband services*

Access to Broadband access can be provided using a variety of technologies. These include:

Services based on the copper loop. Digital subscriber line (DSL) technologies convert the standard twisted copper pair into a high speed digital line through the installation of a special modem both at the user's premises and at the network operator's switches. At the switch digital subscriber line access multiplexers (DSLAMs) separate the high speed data traffic, which is then directed, usually via ATM and IP networks, to an ISP.

For household and small businesses, asymmetric DSL (ADSL) is most common: most of the two-way band-width is directed to the downward direction; symmetric DSL (SDSL) provides symmetric capacity, which cannot be shared with voice. Many variants exist, differing in the capacity provided and the degree of contention they involve.

Cable modems. Cable modems and a switched network architecture can enable a cable television network to supply broadband services; like DSL they provide an always-on service, and (in the case of cable networks) simultaneous access to the Internet and cable television. As cable modems use networks which link groups of nearby subscribers, differentiation of service by individual household is problematic.

Fibre optic cable. Fibre optic technology offers speeds in excess of DSL technologies. Fibre optic cable is currently used chiefly for large volume users in the business sector. For other customers, fibre optic cable is usually rolled out to the feeder point and operators use traditional copper wire line, or an alternative such as coaxial cable, for the last few metres to the subscriber's premises.

Fixed wireless access. This involves line of sight transmission using technology such as Local Multipoint Distribution Services (LMDS). There is a trade off between bandwidth and distance from base stations.

Satellite. Satellite broadband services can fill the gap in deployment between other technologies, but investment costs are high for two-way services.

Nomadic wireless services. Local broadband service can be provided using unlicensed spectrum, often based upon technology standard 802.11b, and known as Wi-fi.

Mobile wireless. Third generation mobile services are potentially capable of providing broadband capacity – greater when the subscriber is not moving.

Power lines. The electrical power network can be used to deliver bandwidth of broadband dimensions both upstream and downstream.

Despite the multiplicity of possible technologies, for the purposes of the current review attention can be focussed on DSL and cable. Neither fixed wireless access nor satellite has attracted many customers. Fibre is confined to large businesses, and power lines are largely experimental. Wi-fi has attracted a great deal of attention, but its use is largely confined to ‘hotspots’ such as airports or other localised communities of interest. 3G mobile services are available in Italy and the UK, but are at the very start of their diffusion processes. In the UK in particular, they are being marketed primarily as a cheap source of voice calls. This picture is likely to change, of course, at subsequent reviews.

The relative weight of cable and DSL broadband customers varies from member state to Member State. Those without cable networks are effectively DSL monopolies. Where an incumbent operator owns, or has owned, cable networks (as in Germany), there is little competition. In other member states, competition between the two technologies is more vigorous (for details see Annex).

2.2. Characteristics of fixed networks

The discussion above had led to the conclusion that the chief platforms for broadband competition (where both are available) are the copper network and cable television. Each has the classic characteristics of fixed networks-

- economies of scale or of density, and
- economies of scope, where two or more services are provided over the same network.

Moreover the incumbent telecommunications operator has the advantages of being the historic monopolist, with an ubiquitous network, a well-known brand, knowledge of the customer base, and the benefit of customer inertia.

2.3. The pattern of entry into fixed network markets

In the supply of narrowband services, the last twenty years or so have seen efforts by competing operators to gain a foothold in infrastructure markets. This has typically pitted the historic operator with economies of scale and density against one or several competitors with low output levels and high unit costs, partially compensated for by access to new technologies and economies of scope not available to the incumbent. Entrants also seek to acquire regulatory assets, in the form of entry assistance through the regulatory process.

Where the regulatory or commercial framework does not require end-to-end competition, the natural strategy is for entrants, in their own particular circumstances, to employ a mixture of their own and the incumbent's assets. The feasibility of this policy will hinge on the regulator's policy towards access.

The three key regulatory interventions relate to where access is mandated, the price at which the incumbent's network services are available to entrants and the eligibility of

entrants of different types to purchase network services at wholesale prices.^{4 5} Wide eligibility means that entrants have access to network prices irrespective of their own level of investment in infrastructure, while under narrow eligibility only those undertaking significant infrastructure expenditures themselves have access to wholesale prices.

The choice of where access should be provided can range from a single point to the opportunity for entrants to unbundle network components wherever they choose. This decision will depend upon a balance among considerations of assisting entrants progressively to replicate assets as discussed below, the impact of unbundling on investment decisions taken by the incumbent and by entrants, and the transactions and regulatory costs of such unbundling.

Regulated prices for mandatory access are typically determined by reference to cost, normally defined by reference to the long-run incremental cost (LRIC) of the provision of the service by an efficient network operator. A price below this, for example, one based upon the historic costs of certain assets would clearly qualify as low. The relationship between price and cost need not be static over time. This might be achieved by regulatory *fiat* – through a decision by the regulator to publish a schedule of prices over time, or to adopt a pricing rule which would cause prices to change. It might also be achieved through an arrangement by which entrants had access to the incumbent's facilities at a regulated price for a specific period, and thereafter had to enter into commercial negotiations with the owner of the facility to gain access. This arrangement could generate the outcome that the facility owner might refuse to deal, thus making the price effectively infinite.

In order to investigate these options, it is helpful to introduce a further distinction between assets which, from the standpoint of the entrant, are easily replicable, or already replicated, and those which are difficult to replicate.

⁴M. Cave and I. Vogelsang, *How access pricing and entry interact*, available at http://users.wbs.warwick.ac.uk/cmur/publications/research_papers.htm

⁵ A further key issue -when it is mandated- is discussed below in relation to new investments.

In the case of traditional telecommunications service, it is difficult or even impossible for an entrant to replicate call termination. The entrant has to gain access to the callee in order to complete the call, and this may only be done via the incumbent's facility. In the case of call origination, replication will depend upon the nature of the entrant. Thus a cable operator with a pre-existing local network will find it easier to replicate the facilities upon which call origination is based than one without a network. This example also illustrates the way in which ease of replication depends upon technological development: the availability of a wireless local loop would clearly ease the replication of call origination assets.

Generally, the analysis leads to the not unexpected conclusion that the way to promote infrastructure competition is to make available easy and inexpensive access to the assets of the incumbent which are not replicable. At the outset this might include a large number of assets, which initially are complements to the entrant's investment, but with time become substitutes. The entrant passes progressively through several stages of infrastructure competition, as it ascends a 'ladder' of infrastructure construction.

By way of an example, consider the case of an operator whose strategy consists of targeting a mass market, involving considerable marketing and advertising expenditure, on the basis of – initially at least – a minimal investment in infrastructure. As its customer base increases, it makes further investments in switching and conveyance at the national level. It may even seek to connect some customers directly.

Similarly, entry into broadband services confronts an operator with a range of possible strategies, described more fully below. In keeping with the discussion above, it is therefore helpful to bear in mind that competition in broadband access markets is likely to be a dynamic process, involving migration of operators from one entry or access point to another.

2.4. *Market failure*

It is helpful to divide market failures into two categories – static or short-run, with given capital assets and technologies, and dynamic or long-run, where the market failure will likely relate to incentives to invest and innovate.

2.4.1. *Static market failure*

At the retail level, these include familiar practices, when applied by a dominant firm, such as excessive prices, predatory pricing, and bundling. Among the broadband markets in the Recommendation considered here, only leased lines have a retail component.

At the wholesale level market failure can find reflection in a variety of anti-competitive conduct by a dominant infrastructure operator. Examples are refusal to supply, excessive access prices and quality degradation. These are familiar in the economics and competition law literature and from regulatory practice.⁶ The Access and Interconnection Directive contains remedies designed to mandate access, control prices and counter deliberate quality degradation.

A further type of anti-competitive market failure (where practised by a dominant firm) is a margin squeeze. A vertically integrated firm may choose a combination of upstream and downstream prices which enables it to foreclose entry into the potentially competitive activity by denying its competitor an adequate margin to survive. This may be (but need not be) accompanied by charging an excessive price for the product under the firm's dominant control. The Framework Directive explicitly identifies leveraged dominance as a third form (in addition to single firm and joint dominance), thereby capturing the feature of a margin squeeze that the abuse may occur in a different market from the market where dominance is exercised.

⁶ On theories of efficient access pricing, and access abuses, see M. Armstrong 'The theory of access pricing', in M. Cave *et al.* (eds) *Handbook of Telecommunications Economics* and T. Randolph Beard, David L. Kaserman and John W. Mayo in 'Regulation, vertical integration and sabotage', *Journal of Industrial Economics*, 2001, pp 319-333.

This raises the question of motive. In a strictly static context, a firm with upstream market power would maximise its profits by seeking access to the most efficient downstream operator. However in a multi-period context, the integrated firm might anticipate the possibility, for example, that the retail competitor might choose, when it had collected an adequate numbers of customers, to integrate backwards into the upstream service or exercise countervailing bargaining power. This possible motive for a margin squeeze is discussed in Section 3 in the case of wholesale broadband access.

2.4.2 *Dynamic market failure (and regulatory failure)*

Section 1.4. above noted the problem of resolving tensions between consumers' short term interest in low prices and longer term interest in infrastructure competition. There are also complex interrelations between investment incentives for entrants and incumbents.

To discuss the former issue first, a very tight price control on broadband access or on leased lines will clearly deter entry by rivals into the provision of such services.⁷ Regulators must therefore implicitly apply a discounting process to make commensurate immediate customer benefit and enhanced competition and choice (and possibly lower prices) in a later period. Particular care must be taken to ensure, when a cost-oriented pricing remedy is adopted, that prices cover the cost of specific risks associated with the investment, as failure to do may stifle broadband investment by both incumbent and entrants.

A key issue determining the risk associated with broadband access investment is where returns will be recovered – in network charges or charges for the end-to-end services. For a firm contemplating a risky investment in broadband assets, the prospect of having to grant access to those assets at a low estimate of cost is clearly a deterrent to investment, unless the firm is confident of having an advantage – through its brand value, for example -in the retail market. With a more generous pricing

⁷ On the other hand, a tight price control on unbundled loops is unlikely to have similar effects since the incentive to duplicate is weaker, at least in member states without cable networks.

policy, investment by the incumbent may go ahead on the basis of gaining a return both on its own retail margin and from wholesale transactions.

In its policy statement on access regulation⁸, OFTEL took an uncompromising view (see below) of the timing of access to an SMP's new wholesale products based on new investment or innovation. By way of qualification, it argued that competitors might in some circumstances be required to share the risks in developing a wholesale product used to produce a service, the demand for which was uncertain; for example, competitors could commit to a level of demand. But on the question of whether mandatory access diminished incentives to innovate (in our terminology, led to a dynamic market failure), OFTEL asserted:

‘ 2.26: One circumstance where an SMP operator may argue that it should be permitted to refuse a request for a wholesale product is when the wholesale product has been developed to allow the SMP operator to launch an innovative retail product. In these circumstances, an SMP operator might argue that an obligation to supply the wholesale product to competitors would reduce its incentives to innovate.

2.27: Oftel considers that the SMP operator should be required to supply an equivalent wholesale product when introducing innovative retail services. Oftel does not consider that it is necessary for an SMP operator to be the sole exploiter of an innovation to benefit from that innovation. Furthermore because of the risk of leverage of market power from the wholesale market to the retail market, an operator with SMP should not be exempt from supplying wholesale products. Oftel considers that the incentives on a vertically integrated SMP operator to innovate are protected by allowing sufficiently generous terms (pricing of innovative products is discussed further in chapter three) in the supply of innovative wholesale products to other operators. ‘

In relation to remedies, however, OFTEL noted:

⁸ OFTEL, *Imposing Access Obligations under the new EU Directives*, September 2002

‘A.4.7: There are also strong arguments that, in recognition of the risk involved in introducing an innovative wholesale service, and to maintain incentives to innovate and invest, the maximum wholesale price should be set at retail minus. Retail minus consists in setting the maximum charge for a wholesale service equal to the retail price less the costs incurred by the retail activity of the SMP operator, or of its subsidiaries.’

At the opposite end of the spectrum, there are arguments that developers of new wholesale or network facilities should be entitled to an ‘access holiday’ –ie to unshared use for a period of years of those facilities for the purpose of making a retail offering. This is sometimes justified by analogy with arrangements for the protection of intellectual property, which explicitly create incentives to invest in its generation by offering the creator exclusive access to it for a specified period, despite the welfare cost of denying access to it by others when its marginal cost is normally zero.

In practice, NRAs are confronted with this problem not solely at the stage of remedies, but throughout the processes involved in the new arrangements. They provide various means of flexing such decisions at the stages of market definition, analysis and remedies. Newly emerging markets will not figure on a list of relevant markets; NRAs are enjoined to treat differently a high market share in a mature market and a high market share in an emerging market, where the first entrant may enjoy a temporary monopoly; finally, as OFTEL notes, different remedies – cost-oriented pricing and retail minus prices – generate different incentives for investment and innovation.

These decisions also have a bearing on investment incentives for operators other than the incumbent. In relation to innovative network investments in broadband, the latter is differently placed vis-à-vis competitors, than in the case of the legacy narrowband network. In the traditional network, the incumbent has a ubiquitous presence based on its historic monopoly. Competitors have options to replicate parts of it at dates of their choosing. They may need extra incentives to exercise those options. In relation to genuinely new investments on the other hand, incumbent and entrants could in principle be in the same position.

Does such symmetry apply, in relation to investments in broadband network services? In some member states there were delays, for example, in unbundling local loops, which gave the incumbent an advantage. The incumbent is also likely to have cost advantages over competitors making the same investments. The new assets may meet the needs of other services which the incumbent supplies, such as narrowband internet access, to a degree which does not apply to competitors. The incumbent also has better access to many potential customers for the new services. These and other differences in risk and return may lead to a higher required rate of profit for an investment for competitors. Imposing price controls on the SMP operator which are harsh may also stifle competitors' investments.

Attempts to put competitors on an even footing may be subject to challenge under the new regime. They may also require creating a *de facto* hierarchy amongst entrants, privileging one entrant over another rather than entrants over the incumbent. Several NRAs sought to bolster local facilities-based competitors by denying benefits to service providers, for example, by avoiding local carrier selection. Such policies may simply redistribute rather than enhance the competitive impetus against the incumbent.

Bringing these points together, it is clear that NRAs have to balance a number of conflicting considerations in deciding how to regulate access to broadband network assets. Put simply, they may first have to form a view of whether the SMP operator already stands in an asymmetrical position vis-à-vis other operators. This is vital because certain remedies, such as mandatory access at cost-oriented prices, will clearly exacerbate the asymmetry. The incumbent will have already made its investment, while entrants still have both 'make' and 'buy' options and may need to have the stimulus of a high 'buy' price to assume the risks of discretionary investment. If the NRA wants to prevent asymmetry developing or continuing, such remedies may be inappropriate.

A remedy is only lawful, however, where an SMP operator already exists so that the asymmetry assumption seems natural in relation to broadband assets. The NRA must then evaluate the scope for infrastructure competition in relation to different network

services. If it is very limited, then there is little point in adopting an access pricing policy designed to elicit competing investments – the costs of duplication would be too large. If it is large, then it may be worthwhile to price access in a way which gives other operators an incentive to install their own facilities, either immediately or in due course.

Finally, the NRA has to ensure that the SMP operator itself get an adequate reward for its investments. This can be achieved firstly by allowing an appropriate risk-adjusted cost of capital in setting cost-oriented prices, and secondly by forming a view as to whether the SMP operator's innovative investments can gain as good a return on network sales to competing downstream suppliers, as they can on retail sales. As the SMP resides in the wholesale product there are reasons for supposing that this will be the case. Moreover, if the NRA identifies the service in question as being potentially replicable, then it will be inclined to be generous in setting a high price to promote competitive investment. These considerations suggest that in relation to network services where replication is possible, it may be better to mandate access early but ensure that competitors have adequate incentives to invest by setting appropriate access prices.

2.5. The regulatory instruments available

This section offers a summary of the remedies listed in the Access and Interconnect Directive (Article 9-13) and the Universal Service Directive (Article 17). Each remedy is accompanied by a brief comment on its indications or advantages or contra-indications or adverse affects.

Obligation	Indication	Contra-indications or adverse effects
Transparency (Art 9 AID)	Technical information indispensable to successful interconnection	Price disclosure may ensure excessive/rigid prices
Non-discrimination (Art 10 AID)	Partial remedy against margin squeeze	Too broad a prohibition may reduce consumer welfare; conditions for discrimination may not exist
Separate accounting (Art 11 AID)	Potentially useful for persistent monopoly	Costly and not essential for many price squeeze investigation
Mandatory access (Art 12 AID)	Useful for dealing with persistent network monopoly	Reduces incentives to invest and innovate
Cost-oriented pricing (Art 13 AID)	Useful for dealing with persistent network monopoly	Reduces incentives to invest and innovate
Retail price control (Art 17 USD)	Can maintain distorted retail Price structure; possible Approach to consumer Protection issues (e.g. ignorance) May be consistent with use of global price cap	Widespread mandatory access by resellers an alternative

The discussion below focuses on mandatory access and cost-oriented pricing in relation to wholesale products, and on retail price control in the case of the minimum set of leased lines. However, it has to be recognised that the other remedies play a major role in controlling certain forms of behaviour by SMP operators, for example, to prevent degradation of the quality of access supplied to competitors. NRAs may need to impose non-discrimination conditions which are reflected in service level agreements (SLAs) between the access supplier and access seekers. It may be necessary when invoking a transparency remedy to require publication of key performance indicators (KPIs).

Additionally, the markets identified are explicitly stated in the Recommendation to include ancillary services. For example, in the case of unbundled loops, these will involve collocation facilities. These services will require detailed remedies on a case-by-case basis which are not considered here in detail. They are, however, indispensable to the effective functioning of the regime.

3. Wholesale Broadband Access

According to the Commission's Recommendation on Relevant Market,

“at the wholesale level, broadband access services include what is traditionally referred to as bitstream services. [Footnote: For the purpose of this Recommendation, bitstream is a service which depends in part on the PSTN and may include other networks such as the ATM network.] For now, the wholesale broadband access market is limited to bitstream services but defining the market in this way allows NRAs to take account of alternative infrastructures when and if they offer facilities equivalent to bitstream services.’⁹

As noted above the key ‘alternative infrastructure’ is currently provided by cable networks. For the purpose of market analysis, NRAs will therefore have to decide how to take account of cable operators’ supply, which may be entirely self-supplied but may also be provided to third parties.

For the purposes of this discussion of remedies, we assume the NRA finds that a firm (presumably, the historic monopolist) has SMP in wholesale broadband access. It then has to consider the range of possible remedies. This section focuses first on where access should be provided, then on the relative prices of the alternative access variants, and finally on the absolute level of prices. The related issue of unbundled loops (a separate market identified in the Recommendation as being eligible for *ex ante* regulation) is considered in Section 4.

⁹ *Op. Cit.* in footnote 1, p. 23

3.1. Bitstream Access Points

Figure 1 is a simplified representation of a range of wholesale broadband access points.

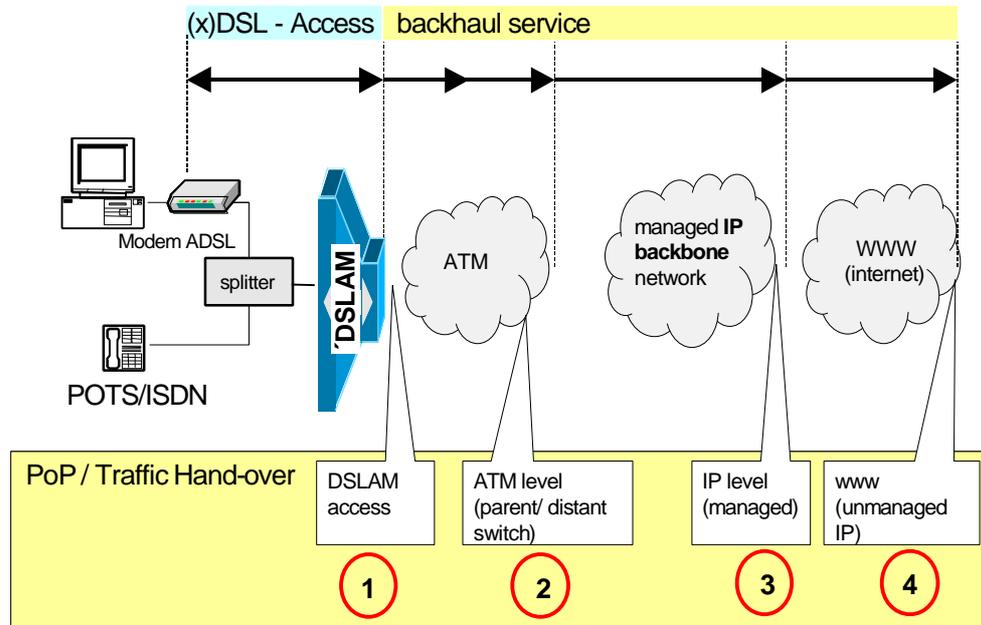


Figure 1: Bitstream Access Points (Source: RegTP)

In ascending order of the 'width' of wholesale broadband products, it is possible to distinguish:

- i. an unbundled loop or shared loop (not illustrated)
- ii. DSL access/DSLAM access
- iii. DSL access and ATM backhaul
- iv. DSL access and ATM broadband conveyance
- v. iv) plus access to the provider's managed IP level
- vi. v) plus internet backbone transport supplied by the provider – a wholesale broadband product
- vii. vi) plus auxiliary services, such as helplines – a pure rebadged/resale product

Member states will differ in the configuration of the SMP operator's network. Substitution possibilities exist at various places. An IP network can replace part of an ATM network. These options inevitably introduce some ambiguity or elasticity into

the definition of ‘bitstream’. Confining it to a tightly specified layer is unlikely to promote the objectives of the new regulatory framework.

The analysis above of the development of infrastructure competition on fixed networks suggested that a ‘ladder’ of access products creates – subject to pricing relativities mentioned below – the opportunity for competitors to invest in assets which take them progressively closer to the customer, and increasingly able to differentiate their service from that of the incumbent. Not all operators will wish to ascend to the top of the ladder. Depending on their business plans they will stop at various places. Some operators will segment their markets and may seek access at different points to service different groups of customers.

The identification of access points must also take account of technical and economic feasibility. The former is relatively straightforward. Economic feasibility relates to the transaction costs (widely interpreted) of additional points. Where access is made available to supply a small number of final customers, possibly in multiple locations, it might not be economically justifiable. This approach can in principle be enforced by requiring the access seeker to incur the costs of access. This does, however, ignore the fact that the benefits of competition accrue to all market participants, including those who do not change suppliers. Strict application of the principle that the access seeker must pay every cost may excessively constrain the entry points. It is also necessary to take account of the regulatory costs of multiple access points, noted below.

Balancing these considerations is a severe challenge to NRAs. In practice it may involve a consultation process with access seekers to establish where access is wanted. Competitors are likely to have different business models, and seek various access points. They will also have an interest in denying their rivals the access points they seek. The NRA is thus likely to have to pick its way through a range of proposals and counter-proposals in circumstances where, for reasons discussed below, the NRA’s intervention may have a significant effect on market outcomes.

3.2. *Relative prices of access products*

A key precondition for neutrality across different wholesale broadband products is satisfaction of a margin squeeze test. An operator practises a margin squeeze in a vertically integrated production process where the price difference or margin between two vertically related products, one more inclusive than the other, fails to cover the (incremental) cost of providing the 'wider' service. The classic case is a retail margin squeeze, where firm A sells a wholesale product to firm B, which competes in the retail market with firm A. If the difference between the wholesale and the retail price fails to cover retailing costs, firm B will be squeezed out of the retail market. It should be noted, however, that the margin squeeze approach can clearly be applied in other contexts than in relation to the retail margin.

This formulation begs many questions about the range of products over which the test should be conducted, the methodology for measuring costs, the firm whose costs are relevant to the test (firm A, firm B or some hypothetical efficient retailer) and the period over which costs should be calculated. These questions are dealt with in Commission Notices and other documents and European Court judgements. Some relevant issues have received little attention to date. These include in particular cases where there is considerable price differentiation or where a new product is coming to the market at a low 'entry price' – in which case it may be appropriate to apply the test over a number of years, on the basis of a credible business plan.

A prohibition of a margin squeeze thus lends itself to the task of ensuring that prices are set in a way designed to prevent the dominant firm from leveraging its market power from one stage of the production process into a neighbouring one. Applying it consistently over a range of broadband wholesale (and retail) products should avoid exclusionary behaviour of this kind.

Typically, such behaviour will be directed at discouraging competitors from making investments in IP or ATM networks which may threaten the dominance of the incumbent. We therefore expect a systematic tendency for more integrated products – wholesale broadband and products providing extensive access to IP networks – to be priced keenly, while 'narrower' products which provide fewer services will be expensive. Indeed, charges have been made in some jurisdiction, that the 'wider' product is actually cheaper than the 'narrower' one, although exact comparisons are

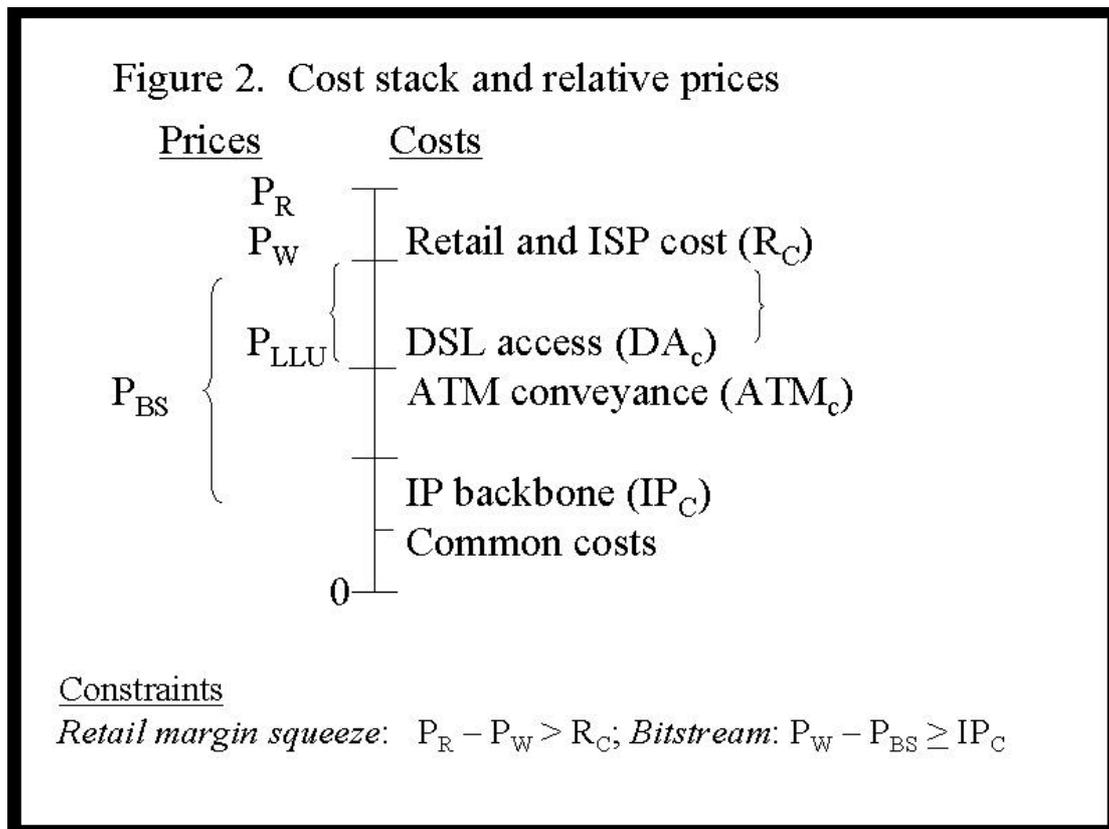
made more difficult by disaggregated charging structures – some products are sold on a ‘per customer’ basis, while other charges are based directly on the network elements used. Moving from one metric to the other requires assumptions about use.¹⁰

In relation to costs, there is a further key problem. In view of the expected growth in broadband demand, IP and ATM networks are typically dimensioned for future, not current output levels. As a result, calculating unit costs on the basis of today’s demand will produce high and misleading figures. The appropriate response is to estimate costs on the basis of a business plan which takes account of growth. This raises the problem that the NRA has to develop or approve the reasonableness of such a plan. Moreover, given economies of scale, a more ambitious plan will be associated with lower costs, a lower margin and hence the possibility of a lower relative price for the ‘wider’ product. Thus, an ambitious business plan for the wider product will affect the market outcome, as the small margin over the narrower product, justified by expected scale economies, will generate a high level of demand, thus making the prophecy in the business plan, self-fulfilling. In these circumstances, the NRA risks becoming an inadvertent market influence –either determining a high margin which promotes what may be inefficient entry, or accepting the incumbent’s optimistic cost projections and ensuring that its market power is maintained. More fundamentally, even if the NRA does have wholly accurate cost data, its prophecies may be self-fulfilling. That is, if it forecasts a high take-up, the required margin between the two adjacent services will be lower and take-up of the wider service will correspondingly be higher. If, on the other hand, it forecasts a low take-up and high unit costs, that forecast will be fulfilled too.

The application of the margin squeeze is illustrated in figure 2, which shows (on the left hand side), a variety of prices for wholesale broadband access, and (on the right hand side) a cost stack. The cost stack for wholesale broadband access begins with some common costs and then includes, successively, the incremental cost of the IP network, of ATM conveyance, and of DSL access, as shown in figure 1. These three

¹⁰ This issue arose in a broadband margin squeeze case before the ART in France: *Decision no 01-253 de l’Autorité de Régulation des Telecommunications en date du 2 Mai 2001 se prononçant sur un*

elements will comprise a wholesale broadband access product, to which retail costs are added to yield the full cost of a retail access product¹¹.



On the price side of the figure, a retail and wholesale price for wholesale broadband access are shown, together with the price of one version of bitstream. A margin squeeze test involves comparing the difference in price or margin between any two products with the incremental cost of the components in the ‘wider’ product.¹² In the figure the costs are implicitly those of the incumbent, but a case can be made for using the entrant’s costs. Figure 2 also notes two possible margin squeeze tests.

différend entre Liberty Surf télécom et France Télécom relatif aux conditions tarifaires de l’offre ADSL Connect ATM.

¹¹ In fact, in most member states this is bundled with the services of an ISP. It is assumed that these services have been stripped out from both costs and prices.

¹² The margin squeeze test described here compares the difference in price between any two services with the incremental cost associated with the ‘wider’ product. Two elaborations are necessary. First, the wider product may generate extra revenues as well as impose extra costs. If so, these extra revenues should be netted off the cost. An example is provided by a retail and a wholesale internet access product, where the former will not only impose extra retailing costs but may also generate extra revenue from advertising. Secondly, the price difference between two products must at least cover the incremental costs of the extra services in the wider product. If the number of such services is two (a and b) the incremental cost of (a + b) equals the incremental costs of (a) plus the incremental cost of (b), plus any costs common to (a + b). The margin squeeze tests thus cover both single service increments and increments of various combinations of services; the latter are sometimes known as combinatorial tests.

The figure is drawn to represent a situation in which the price and cost of the retail broadband service (including a return on capital and a share of common costs) are equalised. Yet price may be above or below cost- the latter case indicating that the SMP operator is selling, temporarily, at a loss. Whether this is a likely strategy depends in part upon the absolute level of access prices.

3.3. *Absolute prices of access products*

The previous discussion has dealt with restrictions on the relative prices of access products – seeking to create a level playing field among competitors with different levels of infrastructure. But the restrictions only create price floors based on incremental cost. Adding up all incremental costs will fail to make a contribution to common costs (either costs common to several access products, or costs common to broadband access and other services). Firms will seek, and be entitled, to recover these costs, and may also try to make additional profits. The tests will not prevent them from doing so because they only prescribe minimum and not maximum prices.

The existence of SMP (necessary to trigger any of the remedies) implies independent price-setting ability. One natural manifestation would be excessive prices – for example implemented by the SMP operator identifying the key ‘least replicable’ element in broadband access – for example bitstream – and extracting maximum profits from its position of dominance. In these circumstances, some form of price control may be appropriate – to sit alongside the various margin squeeze tests.

Two remedies in the Access Directive deal with controlling the price of access products. One is the imposition of cost oriented pricing. The other is mandatory access at reasonable prices, which is often construed as including retail minus prices – that is, prices for intermediate access components based on the retail price of the service minus the cost of services provided by the competitor rather than the access supplier. In one possible implementation, bitstream access would then be priced at the incumbent’s retail price minus retail costs, minus the cost avoided by the incumbent by not providing network elements supplied by the competitor, or the cost incurred by the entrant in doing so.

It is clear from the above description that implementation of either approach requires cost calculations –in the former case, the task of calculating the network elements provided to the access seekers, in the latter case the cost of the network elements provided by the competitors. Several difficulties arise in such calculations:

- where there are economies of scale – how to estimate output levels;
- where the market is at a development stage- over what period to project costs and how to allocate depreciation over time;
- where the investment involves specific risks- how to assess the cost of capital.

Whereas in discussions of fixed narrowband services, it is generally assumed that retail minus prices will exceed cost-oriented prices, in the case of relatively new broadband network investments, this may not be the case. Part of the reason relates to the possibly high cost of capital associated with the riskiness of the investment in question. A major part of it relates to the determination of the retail price for broadband services.

The problem is that incumbents may be pricing retail broadband access below cost, in order to develop the market or to acquire customers before rivals enter. The former motive will be present in many markets, while the latter may be more to do with the pursuit of first-mover advantages. If this is the situation, then retail minus prices may oblige the access supplier to hand the benefits of its market development to competitors (thus discouraging the investment) or to forgo some of the benefits of being a first-mover. In other words, retail minus pricing might cause the retail price of broadband to go up. This depends upon whether the access supplier expects predominantly to make its profits out of network services or from the retail margin. If the former, it may not care too much about whether it or a competitor to which it supplies with network services is the retailer. If the latter, it will not want to develop a retail market for its customers to benefit from, at the expense of its own network profits.

The issue here concerns the time path of returns. Is it safe for the SMP operator to provide broadband as a ‘loss leader’, recouping the costs of market development subsequently by earning above cost returns in the wholesale and retail markets? This depends on two considerations in particular: will competitors be able to evade paying above-cost prices for the services by replicating the assets, and will the regulatory system revert to cost-plus? As far as the former question is concerned, the SMP operator should be able to identify a service which it is hard or time-consuming to replicate. As far as the second question is concerned, the NRA may need to commit to maintain a retail minus approach into the future when retail-minus lies above cost-plus, to persuade the SMP operator to incur initial losses on broadband.

This consideration thus bears upon the issue of how to price the ‘anchor’ broadband access product –say bitstream- which may then provide a basis for setting a floor on the prices of other ‘wider’ products. As noted above, the theoretical and practical arguments in favour of cost-plus and retail-minus are finely balanced. Regulators may choose a path which takes them from the less informationally demanding retail minus approach, which may better reward risky investments, to cost plus at a later stage. In any event, it is important that NRAs gain as much information as they can about costs, at the earliest possible stage. This will require modelling of costs of broadband access using both the top-down and the bottom-up approaches. This process has already been started by some NRAs, and others would do well to follow, as trying to regulate wholesale broadband access is very difficult without an understanding of its cost drivers.

The discussion above suggests a package of remedies for wholesale broadband access: the determination of access points (possibly a restricted number, based on industry consultation); the use of the non-discrimination remedy to impose an *ex ante* market squeeze test in relation to the products identified; and the identification of a price, which might either be set by the regulator or chosen by the SMP operator, to anchor the price structure. To reiterate: this approach would only come into play where SMP had been found; and while it involves no regulation of retail broadband prices, the remedies chosen will be closely interlinked with price and competition variables in the retail market.

It is clear that this is no easy task. An NRA might limit its interventions to a small number of access points and be cautious with the margin squeeze tests, alive to the danger that it might make mistakes in both directions, by allowing unlawful behaviour and by sanctioning lawful behaviour.¹³

¹³ It is perhaps appropriate here to quote the words of William Baumol, even though he is writing not about *ex ante* regulation but the private application of competition law. “Rules that make it excessively easy to secure a conviction on charges of predation invite anti-competitive and rent-seeking litigation. Such rules tempt firms that cannot make it in the market place by virtue of superior products or greater efficiency and lower costs to seek success over their more efficient rivals in the courts instead. There they can hope to constrain the vigour of rivalrous acts by competitors and to transmogrify the character of their rivals from energetic enterprise, to timidity and hesitance.....” Quoted in Dennis L. Weisman, “The law and economics of price floors in regulated industries”, *Antitrust Bulletin*, Spring 2002, pp. 107-132.

4. Unbundled local loops

In relation to unbundled loops, the Recommendation observes that ‘the only reasonable widespread means of supplying the end user market (intermediate between dedicated wholesale capacity – leased lines – and dial-up Internet access) is over the local access network loops of the PSTN which have been enhanced to provide broadband access services. An operator using unbundled loops will not normally consider another form of wholesale broadband access service to be a substitute even if the service provided by the broadband service provider allowed the supply of all the same services that were provided over the unbundled loops’¹⁴ (p.24).

Unbundled loops are, of course, already subject to the Commission Recommendation of 25 May 2000 on unbundled access to the local loop, under which access is available at prices which follow the principle of cost orientation – closely similar to Article 13 of the Access and Interconnection Directive. Under the new framework, however, NRAs will have to take a fresh look at the appropriateness of this remedy.

In terms of our discussion in section 2.4 above of dynamic market and regulatory failure, the local loop in many member states falls into the category of a mature and ubiquitous technology which it is difficult to replicate. New investment is not required and the cost structure is well known –despite the complex valuation issues which arise and the associated disparity between forward-looking and historic costing methodologies. On this footing the risks associated with cost-oriented pricing in other contexts do not seem likely to eventuate. Accordingly, NRAs may continue with something close to the current regime as set out in the Recommendation on unbundled access to the local loop.

There is, however, a link between the pricing of the loop and the price of bitstream. This was not illustrated in figure 2 above, but clearly DSL access, illustrated there, combines access to the end user via the loop with access to DSLAMs etc. Oftel has conducted a margin squeeze analysis similar to those described in Section 3 above, in

¹⁴ *Op. cit.* in footnote 1, p.24

which it was alleged that the difference between the cost-oriented price of BT's unbundled loop and the price of its bitstream product was too small to cover the cost difference.¹⁵

As in other margin squeeze cases, fixing the margin hinges upon the extent of economies of scale in DSL access. A competitor renting unbundled loops will incur high costs in providing DSL access to end users if it is unable to benefit from economies of scale in the provision of the complementary investments required. These costs include the construction of collocation space and the installation of DSLAM equipment, the capacity of which is lumpy.

NRAs face a further issue in regulating local loops, that of setting prices for both the loop as a whole and of the high frequency component used in broadband application (the shared line). The problem here is that many of the costs are common between the low and high frequency components. Some NRAs have argued that in relation to customers not using broadband applications, the cost of access is adequately recovered by the operator in regulated line rental and call charges. It is therefore inappropriate to over-recover those costs by allowing the operator to charge above marginal cost for the shared line. This approach inevitably leads to a low regulated price for shared lines –although there may be significant one-off charges. Ideally, common cost allocation would be done through a Ramsey pricing process, where the relevant elasticities would be those for a mature service (narrowband access) and for a relatively new service (broadband access). Difficulties of estimation would complicate, but not rule out, such an exercise. If NRAs decide not to adopt the Ramsey approach they will have to make a decision based on maintaining appropriate price relativities across the range of wholesale products and their own assessment of the value of shared lines.

¹⁵ *Investigation by the Director General of Telecommunications to establish whether British Telecommunications plc has engaged in anti-competitive pricing in relation to its whole DSL products*, 28 March 2002.

5. Leased Lines

Leased lines fulfil a number of purposes, and can be divided into separate markets in a number of ways which will vary from member state to member state. They also overlap with other markets. As the Recommendation observes, ‘dedicated connections can be an alternative to unbundled local loops and vice versa in certain circumstances. Also dedicated trunk or long distance connections may be an alternative to long distance call conveyance’¹⁶.

There are also complicated links between wholesale and retail: ‘Dedicated capacity or leased lines may be required by end users to construct networks or link locations or be required by undertakings that in turn provide services to end users. Therefore it is possible to define retail and wholesale markets that are broadly parallel.’ (*Ibid.* p.28).

The reference here is to the fact that a line leased to a mobile telecommunications company, for example, for backhaul provides a point-to-point service virtually indistinguishable from an identical line leased to a company for the purpose of communications between two of its offices.

Formally, the wholesale/retail distinction is based in some member states on treating a telecommunications operator as purchaser differently from another customer. In others, the notion of a wholesale market does not yet exist. There is, however, an arguable economic basis for the difference in treatment. First, selling to other operators, or to oneself, does not involve the same retailing costs as selling to firms in general. Second, competitive conditions in the leasing of lines to operators are different from those in leasing of lines to other firms, to the extent that in the former case, but not the latter, supplier and customer are likely to be competing in downstream markets. If the conditions apply, and if both prices are regulated on a cost oriented basis, the price difference would reflect retail costs, which might, in practice, be a small part of the total. However, the question would then arise as to whether it was necessary to regulate at both levels, and whether wholesale regulation

¹⁶ *Op. cit.* in footnote 1, p. 27

might not suffice. This issue may arise at the next market review, but for the purposes of the current review, retail regulation of the minimum set is required.

At the retail level the Universal Service Directive refers at Article 18 to the need to maintain regulatory control over a minimum set of leased lines (up to 2Mbit/s) until the market in question has been shown to be effectively competitive. Annex VII sets out the required remedies of:

Non-discrimination: across customers and in the supply of leased lines for the operator's own services, or those of their subsidiaries or partners;

Cost-orientation, where appropriate: this also involves ensuring that firms with SMP have a suitable cost accounting system.

Transparency: requiring the availability of price technical, service quality and ordering information.

At the wholesale level the Recommendation notes that 'it is possible to distinguish separate markets, in particular between the terminating segments of a leased circuit (sometimes called local tails or local segments) and the trunk segments.' (p.28). It observes that the different member states have different network topologies – hence different dividing lines between tails and trunks. Finally, 'additional market segmentation is possible between high and low capacity leased lines'.

For all these reasons, NRAs are likely to come up with a varied set of market definitions. In its Consultation Document of 11 April 2003 'Review of retail leased lines, symmetric broadband origination and wholesale trunk segments,' OFTEL identifies markets for:

- retail low bandwidth leased lines
- retail high bandwidth leased lines
- retail very high bandwidth leased lines
- wholesale low bandwidth symmetric broadband origination
- wholesale high bandwidth symmetric broadband origination
- wholesale very high bandwidth symmetric broadband origination
- wholesale trunk segments.

Moreover, broadband origination services include terminating segments forming all or part of partial private circuit (PPCs) when supplied to another operator; LLU backhaul services and radio base station (RBS) backhaul services. BT disputes the inclusion of the latter two in its response of 20 June 2003 (pp. 26-7).

In relation first to remedies for trunk segments where SMP has been found currently as well as prospectively, the source of the problem is likely to be factors common to fixed networks, discussed in Section 2.2 above:

- the incumbent has a ubiquitous network
- entry may have occurred on trunk routes, but not on thin routes, leaving the incumbent a high market share overall
- economies of scale, combined with sunk costs, create barriers to entry.

Additionally, competitors may have difficulty in accessing capital markets.

In these circumstances, NRAs will have to balance the benefit to consumers of a cost-orientated pricing remedy with the potential loss of incentives for investment and innovation as a result of this form of price control. In relation to these two markets already considered (wholesale broadband access and unbundled loops), it is likely that trunk segments for leased lines would fall in an intermediate position in relation to the possible loss of incentives.

NRAs may wish to accompany cost orientation with a non-discrimination remedy to prevent the incumbent from benefiting from its vertical links with leased line tails or retail markets. They will also have to address the issue of whether prices should be geographically de-averaged.

In relation to leased line origination, NRAs are likely to find the position with respect to SMP varying with speed, where market power is lower in higher speed digital local segments. For example, OFTEL provisionally found BT to have SMP in the markets for low and high bandwidth but to have no SMP (and a market share of only 10%) in the market for very high bandwidth symmetric broadband origination.

As with trunks, NRAs, in choosing an appropriate pricing remedy, will have to balance short-term consumer benefits against incentives to invest and innovate. This might take the form of cost-oriented pricing as with LLUs, or the less draconian remedy of mandatory access on reasonable conditions, possibly accompanied, as in the discussion of broadband wholesale access, with margin squeeze conditions, (but subject to the important difference that while retail broadband services are not price-controlled, the minimum set of leased lines is subject to retail price control).

In relation to retail remedies, the starting point is to minimise the coverage of the remedy because

‘It is not necessary to expand the retail leased line categories to capacities beyond the minimum set since there must always be a presumption that an intervention at the wholesale level will be sufficient to address any problems that arise’ (*Recommendation*, p. 28)

As noted above, NRAs have to apply the remedies of non-discrimination and of transparency, but cost orientation is to be applied ‘where appropriate’. An NRA’s decision on this matter will be influenced by its view of the impact on the retail market of measures taken in the wholesale market. In the UK, OFTEL has provisionally concluded that cost-oriented pricing is required for the analogue leased lines up to 2Mbit/s and for digital leased lines up to 8Mbits/s (unless a voluntary price control scheme is introduced).

The focus of the discussion so far of leased line remedies has been entirely on price control. Yet, an Annex VII of the Universal Service Directive makes clear, transparency remedies are obligatory for the minimum set of retail leased lines, and available under the Access and Interconnection Directive for all wholesale markets. Accordingly a range of publication or pre-notification requirements may also be necessary, relating to a reference offer, pre-notification of changes in terms and conditions, quality of service information and requirements to publish technical information. Although such remedies are less susceptible to analysis, they are likely to have a major restraining influence on the exercise of market power.

Annex: the state of broadband competition, March 2003

	No of MDFs	MDF sites where OLOs installed eqpt	Number of OLOs placed colocation orders	Co-mingling mandated	Total incumbent copper subscriber lines	Incumbent DSL Lines	- of which retailed by incumbent or its ISP	%	- of which wholesale DSL lines resold by other operators/ ISPs	%	- of which provided to OLOs via DSL inter-connection	%	- Growth in retail, since end Dec 02	- Growth in wholesale (resold), since end Dec 02	Incumbent difference in total DSL lines to end Dec 02	% growth	OLO fully unbundled lines (broadband + voice)	- of which used for broadband	at
Austria	1,472	143	13		3,100,000	198,000	160,000	81%	38,000	19%		0%	16,000	7,000	24,000	14%	12,553	7,590	
Belgium	950	98	10	yes	4,705,854	550,000	465,000	85%	83,975	15%	1,025	0%	41,500	6,600	48,100	10%	2,530	2,530	
Denmark	1,200	200	23		2,695,996	249,033	245,956	99%	0	0%	3,077	1%	64,433	0	64,433	35%	46,367	46,028	
Finland	5,500	256	15		3,180,000	180,000	175,000	97%	5,000	3%		0%	63,000	3,000	66,000	58%	48,000	30,000	
France	12,000	174	9	yes	34,000,000	1,777,000	1,174,000	66%	603,000	34%		0%	187,000	190,000	377,000	27%	1,610	1,610	
Germany	7,900	2,000	52		49,400,000	3,400,000	3,400,000	100%	0	0%		0%	600,000	n/a	600,000	21%	785,000	240,000	
Greece	2,103	50	0		5,540,000	0	0	0%	0	0%		n/a	n/a	n/a	0	0%	170	0	
Ireland	1,100	40	2	yes	1,700,000	2,654	2,645	100%	9	0%		0%	931	9	940	55%	180	180	
Italy	11,300	517	31		27,194,000	927,000	805,000	87%	122,000	13%		0%	n/a	n/a	250,000	37%	124,500	56,000	
Luxembourg	66	10	14		315,000	6,562	6,562	100%	0	0%		0%	2,262	0	2,262	53%	296	260	
Netherlands	1,300	330	9	"yes"	8,309,314	391,436	313,149	80%	78,087	20%	200	0%	58,732	14,683	73,415	23%	26,743	26,743	
Portugal	1,900	14	4	yes	4,055,387	77,888	63,394	81%	14,494	19%		0%	n/a	n/a	n/a	0%	54	54	
Spain	6,836	135	7	yes	17,266,520	1,136,121	867,209	76%	155,439	14%	113,473	10%	n/a	n/a	178,917	19%	5,846	5,846	
Sweden	7,000	162	13		5,970,000	447,800	334,600	75%	106,200	24%	7,000	2%	20,600	9,200	29,800	7%	3,393	3,393	
UK	5,600	265	5-10	yes	28,500,000	810,000	410,000	51%	400,000	49%		0%	110,000	110,000	220,000	37%	2,780	2,780	
Total/Average					195,932,071	10,153,494	8,422,515	83%	1,606,204	124,775					1,934,867	24%	1,060,022	423,014	

DSL Figures from end of December 2002 - not directly comparable with the rest of the table
 Comparison done over 6 months - not directly comparable with the rest of the table

- n/a Not applicable in the specific case
- U Figure is unavailable
- LLU Local loop unbundling
- OLO Other licensed operator - i.e. alternative operators
- MDF Main distribution frame