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98-212

Access to bandwidth: Proposals for action

A consultation document issued by the Director General of Telecommunications

July 1999

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Summary

Information, and access to information, continues to be the key driver of growth and development of the information society and the knowledge driven economy.

For companies seeking to do business in the global marketplace, the quick, easy and inexpensive transfer

of information over the telecoms network is vital. It will also become increasingly important for individuals whether they are looking to buy the latest best seller, next year's summer holiday or conduct transactions with banks or the Government.

For larger businesses, high-speed transfer of data can be achieved by several means, often using broadband fibre optic cables installed by telecoms companies. But such cables are not economic for homes or smaller businesses.

More than 85 per cent of local access lines are supplied through BT's copper loops. At present this local loop can only deliver narrowband services such as basic telephony and data services (including ISDN2). This means that most homes and many smaller businesses have not yet been able to take full advantage of the information age, for example via high-speed Internet access.

In particular, by not having access to higher bandwidth services, small businesses are in danger of not being able to maximise their full business potential.

However, new technology, and in particular Digital Subscriber Loop (DSL) technology has made it possible to deliver higher bandwidth services over the local loop. This means that businesses and homes could receive higher bandwidth services and all the benefits that this would entail.

In December 1998 OFTEL issued the consultation document *Access to Bandwidth*, which looked at the action, OFTEL could take to encourage the supply of higher bandwidth services to SMEs and domestic consumers.

OFTEL received many responses from telecoms companies, businesses and consumers about its proposals. It was clear from the responses received that there is unmet demand in the SME sector for higher bandwidth services. It was also clear that demand for higher bandwidth services would develop in the domestic market.

Alternative telecoms supply routes to deliver higher bandwidth services, such as cable modems, are beginning to be used and OFTEL expects that there will be a range of supply routes in the medium term. However, until then, most users will be reliant on the supply of telecoms services over BT's local copper network.

BT has said that it expects to begin rolling out higher bandwidth services over its copper network within the next few months. When it does, there will be competition in the supply of higher bandwidth services, since BT is under a regulatory obligation to allow others to supply services over its network on the same basis as it allows its own businesses to supply such services.

Clearly OFTEL welcomes any such investment by BT that will dramatically improve the capacity of its network. However, given the growing importance of access to higher bandwidth services, OFTEL has concluded that it is not right simply to leave it to BT to provide these services as and when it felt it was in its commercial interest to do so.

OFTEL believes that it is in the national interest that other companies should have the opportunity to specify the type of higher bandwidth services to be run over the BT local loop and to make the necessary investments. They should not have to be simply the followers of BT.

For these reasons OFTEL has concluded that BT should be required to permit access to its local loops

OFTEL recognises that there are some real technical and commercial issues to be worked out by the industry. We propose that these issues be settled on the fastest possible timescale with a view to enabling access to BT's local loops by July 2001.

Comments are invited by 30 September on OFTEL's preliminary conclusions set out in this document. There will be a further period until 15 October for submission of comments on comments. Given the importance of this issue, OFTEL expects to take a final decision on the delivery of higher bandwidth

services over the local loop by end-October.

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Chapter 1

Introduction

1.1 This paper is the response to the consultations that have followed the publication of *Access to Bandwidth*, in December 1998. The paper looked at how best to provide – especially to residential customers and small businesses (SMEs) – new, higher bandwidth services (that is, those allowing transmission speeds in excess of those available via ISDN2). These include high speed Internet services, including educational and other information services, video on demand and interactive electronic commerce. These services are of fundamental importance to the development of the UK economy. They can be provided to consumers by a variety of delivery routes including cable, higher bandwidth radio (both fixed and mobile), satellite and DSL technologies over the fixed copper loop telephone network.

1.2 OFTEL's start point is that the ubiquity of the copper loop means that DSL technologies offer the most effective mechanism, over the next few years, to deliver widespread access to higher bandwidth services for residential and SME users. BT currently has a very strong market position in this sector; it supplies over 85% of the access lines to residential and SME users. The December document therefore examined the nature and extent of barriers to the provision of these services over BT's local loop; and sought views on the need for regulatory action by OFTEL to facilitate competition.

1.3 OFTEL also sought views on five possible sets of potential regulatory action that could be taken, if this were found to be justified (See Annex B). In Options 1 and 2, competing operators would 'lease' BT's local loop and perform the necessary technological upgrade to provide higher bandwidth capability. These options involve 'unbundling'.

1.4 In Options 3-5, BT would perform the necessary technological upgrade, and make available retail services to its own customers. BT would also need to provide wholesale products to other operators and service providers, enabling them to deliver services over the upgraded local loop to BT's end-users.

1.5 The consultation has provoked a widespread debate: more than 60 responses were received (a summary of the responses is in Annex A). Most respondents argued that action of some sort is needed to bring higher bandwidth services to residential and SME customers within a timescale and at prices which ensure that the UK does not lag behind its competitors, although not all were of this view. Although views differed on the form of action needed, by far the greater part of interest was focused on Options 2 and 4.

1.6 BT argued in their response that the deployment of Option 4 by the company would make unnecessary any further option. They have developed their case in further presentations to OFTEL. The arguments deployed by BT for Option 4 are very powerful. Since this consultation began, BT has developed plans to roll-out ADSL on a scale in the UK that would represent a massive leap forward in the provision of high bandwidth, and give the UK a basic framework that is in advance of any other country. BT will be announcing full details shortly. It will be an open network for service and other network operators. Whilst noting BT's view that its plan may have to be modified in the event of the introduction of Option 2 following this consultation, OFTEL welcomes fully this adoption of the principles of our Option 4.

1.7 OFTEL remains of the view that competition in the upgrade of the network is an essential complement to this roll-out by BT. For this reason, OFTEL believes there is a clear case for unbundling

the local loop on the lines of Option 2 and that regulatory action should be taken to carry this forward. This paper sets out our proposals. Existing regulatory provisions to ensure that competing operators and service providers have fair, non-discriminatory and timely access to BT's upgraded network would remain in place.

1.8 Option 2 would require a clear spectral management plan, defining power levels and frequency bands in which other operators' equipment is permitted to operate. Clear industry specified standards and open interfaces will be vital to success, as will be clarity over the operational support systems and process requirements. It is essential that this technical work should be properly prepared on a challenging but wholly realistic timescale. OFTEL is therefore proposing to set up a Focus Group of the Operator Policy Forum to develop guidelines for co-location and operational processes. Continuity of service and network security will be of paramount importance. Moreover it is also vital to develop appropriate commercial arrangements.

1.9 The work will be accompanied by an invitation to the NICC group on xDSL to continue its work and to develop a spectral management plan. As with all major network innovation, Option 2 services will need to be trialled; such trials would commence as soon as is practicable after the technical work described above. If OFTEL were to decide to proceed on this basis, in the light of responses to this consultation, a full implementation plan would be prepared, taking in all the stages and processes noted above. In OFTEL's view it is important that this work is completed in time for a trial to be initiated by no later than the end of Year 2000. Subject to a satisfactory outcome, Option 2 services would then be available from 1 July 2001. The timescale would require concentrated work by all sectors of the industry but we believe that it would be achievable.

1.10 This document expands on these preliminary conclusions and outlines the further analysis OFTEL proposes to undertake. OFTEL seeks views by 30 September 1999, and expects to announce a firm conclusion during October.

1.11 BT has told OFTEL they remain convinced that Option 4 alone with full access to service providers is the most effective route to deliver broadband Britain and are disappointed that OFTEL differs from this view. While BT reserves the right to maintain this position they will nevertheless work closely with OFTEL and the industry to develop the commercial, technical and operational arrangements necessary in respect of Option 2 should it be mandated following completion of the consultation process. This agreement means that regulatory uncertainty is removed from this key area of future communications infrastructure in the UK. Together with BT's plans for a wider scale ADSL roll-out this will ensure a smooth transition to a competitive broadband network which is vital to the development of the information age.

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Chapter 2

The importance of higher bandwidth services to the UK

2.1 Our conclusion that explicit regulatory action is required to ensure that the scope and timing of the upgrading of the local access network rests on our belief that this maximises consumer benefit. Underlying our approach is the fundamental goal of OFTEL: to secure for the telecommunications consumer the best possible choice, quality and value for money. The primary means to achieve this is by promoting competition. This applies to Access to Bandwidth as to other areas of our work. OFTEL will operate a regulatory framework to encourage investment and promote competition, both in the provision of higher bandwidth services and in access mechanisms for delivery of those services.

2.2 Higher bandwidth services are vital in building the UK's digital future, and in particular for the development of electronic commerce and other electronic services to users. OFTEL will play its part to ensure that, through facilitating the competitive provision of higher bandwidth services, the UK is well prepared to reap the benefits of e-commerce.

2.3 Higher bandwidth services enable more information to be delivered at higher speeds to the end user. And in many cases, higher bandwidth is essential if there is to be efficient interactivity between the services being provided and the consumer. New technology can change the way we work; how we communicate with friends, family, and businesses like banks and shops; how we relate to local and central government; how we organise our education; and how we spend our leisure time. Higher bandwidth enables the delivery of services such as high-speed Internet access and video-on-demand. It will facilitate the development of new multi-media services that make use of the greater technical capabilities.

2.4 Technological developments mean that unmetered tariffs or tariffs based on traffic volumes become a practical possibility, allowing an 'always on' connection to the Internet. This is possible because, while DSL uses the local access loop of the telephone network, it does not rely on switches within the PSTN and so does not tie up network resources in the same way as a dedicated connection over the PSTN. Instead, after passing over the local loop, traffic is directly routed through an Internet Protocol (IP) backbone to access Internet services. The nature of data networks such as IP is that capacity is only taken up when data is sent and received.

2.5 This capability will provide incentives for service providers to offer enhanced products and services to their customers, such as instant messaging. Unmetered tariffs also enable consumers to use the Internet in 'always on' mode without risk of unpredictable bills. It becomes as easy to look up a phone number on the Internet as it is to reach for a paper directory. Electronic services then become part of everyday life. The two factors of higher-bandwidth and always-on connectivity, coupled with appropriate services, will change usage of the Internet profoundly. This encourages e-commerce, and hence will help achieve the Government's objective of the UK becoming the best place in the world to do business electronically by 2002.

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Chapter 3

The case for regulatory action

3.1 OFTEL accepts that regulatory intervention should be undertaken only where there is a clear rationale. Regulation should not impose costs greater than the benefits it brings. It should not have the effect of diminishing incentives for investment, thereby delaying the offering of new services to consumers. Regulatory action should be confined to situations where, left to itself, the market will not deliver the best outcome for the consumer in both the short and long term.

3.2 In concluding that there is a clear case for regulatory action, OFTEL has looked at effective demand for higher bandwidth services. We have looked at barriers to competition in the supply of such services at both wholesale and retail level. We conclude that barriers do exist, and that SME customers in particular are not being supplied with services they wish to have and which could be supplied. This constitutes a rationale for regulatory intervention.

3.3 Our consultation has focussed primarily on the case for regulatory action in the provision of higher bandwidth services over BT's local loop. OFTEL expects that in due course there will be different competing delivery routes for higher bandwidth services. Cable modems are currently being trialled with

plans for roll-out before the end of 1999. Fixed radio access is currently available at lower bandwidth levels, and the Radiocommunications Agency has just consulted on further allocation of the fixed radio spectrum for higher bandwidth services. Licences for third generation mobile phones, which will deliver higher bandwidth services, are due to be granted early in 2000. Digital TV is already providing certain services to some residential customers.

3.4 But there are two main reasons to focus attention on barriers to provision over BT's local loop. First, it is unlikely that any of these competing delivery routes will (individually or collectively) provide scope for near-ubiquitous access in the near future. For example, cable networks at present pass only around 50% of UK homes, with 16% of homes taking service. For the next few years, BT's copper loops will therefore be the primary route for the delivery of higher bandwidth services to the mass-market. Demand from such consumers will not generally be able to be met by other routes. Second, BT has a very strong market position, supplying 85% of access lines.

Demand for higher bandwidth access

3.5 The market for higher bandwidth access is not uniform. To assess effective demand, we have looked separately at the market sectors that would be the likely targets of any DSL deployment. We have also considered the views of potential suppliers on whether access products exist to meet demands.

Residential sector

3.6 Our consultation suggests that growth in Internet traffic in the residential sector indicates that demand for advanced services is developing. It is difficult, in the absence of higher bandwidth supply, to judge whether there is demand for higher bandwidth that is *currently* not being met. But there is no doubt that the availability of higher bandwidth services will itself stimulate demand as it becomes clear what these services can deliver.

3.7 There is the potential for mass-market effective demand to develop within a reasonably short timescale. For the domestic user, higher bandwidth services will:

- speed up access to the Internet significantly, revolutionising access to information for leisure and educational purposes;
- make the emerging range of interactive services (home shopping, home banking, interactive games) even more attractive;
- enable the delivery of new services such as video-on-demand.

3.8 This potential is reflected in growth in technological products and services generally. Demand has tended to originate in niche or specialised interest groups and flowed through to the mass market. This has been true for penetration of personal computers and for use of the Internet. Currently, many people have access to high speed Internet access in the office and most universities provide access for their staff and students. This level of functionality will create significant residential demand. If the access capability is in place, competing service providers will innovate to differentiate their products. A proliferation of services will result, including interactive entertainment services, video on demand and e-commerce. On the basis of the evidence available and likely developments OFTEL believes that mass-market effective demand will emerge.

Smaller businesses

3.9 In the SME market and for smaller sites of larger businesses, there is demand for higher bandwidth access that is current and effective. Outside major conurbations, the customers for this service often have no alternative to BT's leased line products, which may be too expensive to meet the need of many small businesses.

3.10 For the small business, access to higher bandwidth services will increase their competitiveness by:

- making it easy to exchange large quantities of information instantaneously with colleagues and suppliers;
- enhancing the value of web pages as marketing tools, by speeding up access considerably;
- speeding up searches for information about products and services;
- making electronic commerce a much more user-friendly process.

Service providers and other operators

3.11 Independent service providers wishing to supply telecoms services or content over higher bandwidth infrastructure owned by network operators also have current, effective demand for higher bandwidth access. Existing services could be improved if provided over higher bandwidth access and new services developed, for areas in which they were confident there was a market. The consultation suggested that service providers would be willing and able to supply a wide range of services to residential consumers and SMEs including home banking, high speed Internet access and advanced entertainment services if higher bandwidth access were available to them. Their primary concern was to gain access to a large number of customers at the earliest possible opportunity. This could be achieved by Option 4. Many operators also indicated that they had current demand for access services, particularly to meet the needs of the SME market, but preferred access solutions that would give them some control over the technology used and enable them to provide an end-to-end service to customers. Unbundled products delivered through Option 2 would deliver this.

Provision of services

3.12 OFTEL has therefore considered the barriers to the competitive provision of services to meet this demand. As explained above, there was strong support from the consultation for the view that it is BT's local loop that will be the primary route to delivering higher bandwidth services to the residential and SME market for the foreseeable future. Many have argued that the ubiquity of BT's network and its strong market position are a barrier to the potential future competitive provision of higher bandwidth services across anything like the whole country.

Assessing the risks

3.13 In considering regulatory action to ensure potential demand can be met competitively, OFTEL has approached this by balancing the risks. The risks are first, if no action is taken now, the current demand might not be met on a fast timescale. Some roll out by BT of ADSL over some parts of its network without regulatory action could meet some of the SMEs' demand. But the pace and extent of roll out and the functionality would be in BT's hands. In other words, without regulatory action, the introduction of higher bandwidth services to SMEs throughout the UK might be delayed thus depriving customers of services they want and so damaging the UK's competitiveness.

3.14 Similar risks arise in the residential market. If the cable operators were to make available cable modems across their networks this would partially meet demand but widespread access across the country is some way off. Residential customers are even more dependent than SMEs on BT's local loop for delivery of higher bandwidth services. It seems likely that, without regulatory action, effective demand would emerge but would not be met until either BT chooses to roll out DSL across its network or other competing technologies (cable, radio) match BT's ubiquity.

3.15 On the other hand, OFTEL is conscious of the risk that regulatory intervention that sought to determine the extent and speed at which BT upgraded its network could distort investment decisions, perhaps resulting in uneconomic or stranded investments. Equally regulatory intervention should not deter investment in competing infrastructure – either different delivery routes or in competing local loop

infrastructures.

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Chapter 4

Pointers from the consultation

4.1 All this suggests is that there is clear potential demand in the residential market and already effective demand – currently unmet – in the SME sector. It is also the case that many residential and SME customers are dependent on BT's local loop and alternative delivery mechanisms are unlikely to provide an effective alternative, at least in the near future. OFTEL agrees that BT's strong position in the markets for residential and small businesses is a barrier to the potential future competitive provision of higher bandwidth services, and that regulatory action should be considered. On the basis of the consultation, OFTEL has sought a way forward which builds on the strengths of options 2 and 4 while avoid the weaknesses of either individually.

Option 2 (Partial baseband leased circuit)

As preferred.

4.2 Under Option 2 OFTEL would mandate a form of 'unbundling'. BT would be required to make its local copper loop available as a leased circuit to other operators. Operators would be able to upgrade the loop to provide higher bandwidth capacity by installing equipment at BT's local exchange and at the customer's premises. Operators would need to build out their networks to all the exchanges from which they intended to provide services (or hypothetically, but probably not much in practice, to lease BT lines). Further details and a diagram are at annex B.

4.3 This is consistent with our policy that competition is the best route to giving consumers the best possible deal in terms of choice, quality and value for money. It would:

give consumers, particularly the SME sector (since this is likely to be the initial focus of competing operators) a choice of provider of higher bandwidth access;

introduce competition into the technological upgrade of BT's local loop, thus stimulating innovation in effecting the upgrade;

allow competing operators to upgrade according to their own assessment of the effective demand for their service. Competitors would not have to wait for BT but would be able to set their own pace while bearing the investment risk themselves. The consultation revealed several operators keen to do this.

4.4 There are disadvantages:

on its own. Option 2 appears unlikely to deliver 'mass-market' roll-out to the residential market. It is expected that new operators would concentrate first on the SME market, moving later into the top end of residential users;

there are technical and practical issues that to be resolved including an appropriate Spectral Management Plan to obviate problems due to crosstalk induced interference between circuits in the same cable. The practical and operational details of equipment co-location would also need to be determined;

a consumer taking higher bandwidth services from a competing operator would need to take voice services from that operator as well. This might reduce choice but this difficulty could be overcome by splitting the bandwidth channels so that the voice channel was routed through BT's network and the

higher bandwidth channels were routed to a co-located competitor. This possibility is examined further in paragraph 6.3.

Option 4 (Permanent virtual circuit access)

4.5 Option 4 involves For BT to upgrading its network to enable its copper loops to be used to deliver higher bandwidth services. This could take place on a voluntary basis or it could be underpinned by an explicit regulatory requirement or timetable through which OFTEL would set out the extent of roll-out it considered necessary to meet any demand. In either case, as discussed in paragraph 4.7 below, BT would be required under its licence conditions to provide a wholesale interconnect product to other operators and a wholesale access product to service providers on fair and non-discriminatory terms.

4.6 Under Option 4, connection between the service provider and customer would not be through a discrete physical connection. Rather access would be provided through a virtual circuit, where the data from many customers is multiplexed together and the service provider recognises a logical connection between each customer and the data packets flowing on the circuit. Service providers would connect to BT's network at a single point to access all customers for whom higher bandwidth capability was available. Further details and a diagram of this option are at Annex B.

4.7 Any introduction of a higher bandwidth service will need to conform with existing obligations in BT's Licence and with OFTEL's guidelines on interconnection and interoperability. These include requirements that:

BT provide an appropriate wholesale (interconnect) service, which must be available on the same day as retail launch. Other operators would need to receive appropriate notice of interconnection arrangements so that they could launch services over the higher bandwidth connections at the same time as BT, if they so wished;

BT must make available any access product used by its own service provider to deliver value added services to competing service providers on non-discriminatory terms.

See paragraphs 15 to 21 of Annex C for further discussion.

4.8 There are many advantages in this option being available, in particular:

subject to take up, it could give a substantial proportion of UK residential and SME consumers access to higher bandwidth services within a short period of time;

to the extent that this option facilitates access to the mass market, it would be attractive to service providers and stimulate the supply of innovative services;

it would minimise the technical difficulties, particularly spectral management that may arise with the alternative model whereby other operators undertake the upgrade of BT's loop. This should mean that consumers would receive services earlier than under options where these difficulties need to be resolved;

it would allow a customer to retain BT as a telephony provider, while taking higher bandwidth services from a competing operator or service provider.

4.9 But Option 4 alone would not meet OFTEL's objectives. It has serious drawbacks. If the pace and extent of roll-out were left to BT:

this could result in effective demand being unmet. BT could adjust the pace of roll out to match development of its own service offer even though competing service providers might be ready earlier. BT might judge roll out to a particular area of the country as uneconomic whereas another operator might judge it worthwhile. But the other operator would not be able to use BT's loop to offer services;

the choice of technology would be in the hands of BT. If, for reasons of economy of scale, BT used the

same technology – ADSL – throughout its network the needs of those who might prefer a symmetric option would not be met and other operators would be denied the possibility of offering this choice;

some of the above disadvantages could be avoided if OFTEL were to determine the pace and extent of roll-out. But this would involve the regulator substituting its assessment of economic viability for BT's. This is profoundly unattractive.

BT's assessment

4.10 BT has argued that Option 2 would affect adversely the business case for its ADSL roll-out. BT considers that:

the viability of any high bandwidth service depends on establishing very high volumes of customers giving rise to commensurate demand for network equipment. BT argues that without very high volumes, the substantial economies of scale would not be available and thus unit costs could not be brought down sufficiently to make the roll-out financially viable. It also argues that if Option 2 is available, it will lose high value SME customers to competing operators undermining the business case for its planned roll-out. BT says that the result is likely to be a delay in mass market roll-out;

the technical and operational difficulties of Option 2 (co-location issues, spectral management etc) are serious. While they are capable of resolution, they will require significant investment of BT's time and resources. This will divert effort from BT's own ADSL roll-out thus further contributing to delay.

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Chapter 5

OFTEL's initial conclusions and proposals

5.1 OFTEL has therefore taken into account BT's plans and representations, alongside the comments made directly in response to its December consultation. OFTEL welcomes BT's intention to begin rolling out its ADSL service and believes that it will benefit consumers significantly. However, this does not appear to satisfy all the requirements of consumers. In particular, it would leave in BT's hands the decision of when and where to target services and the nation would lose the potential innovation that competition would bring. This leads to the conclusion that Option 2, in addition to voluntary network upgrade by BT, is likely to present the optimal results for consumers in terms of choice, quality and value for money. This combination would stimulate competition both amongst operators and in the provision of services, in particular to SMEs.

5.2 While Option 2 might prove to be applied mainly in the SME sector, OFTEL believes that BT will face competitive pressure much more widely, especially in the next few years as cable modems become generally available. That should provide a significant incentive to BT to upgrade its local access network much more widely. This may not reach very far into rural areas in the next few years. (Indeed, on the basis of the current state of technology, a significant minority of lines, many in rural areas, are not suitable for ADSL services). Nevertheless, a virtuous circle should develop of demand giving rise to an ever-widening range of services, in turn driving more demand, thereby stimulating a reduction in unit costs driving more take-up. As a national operator, BT might find it causes increasing marketing difficulties to offer services in most of the country but not all of it. We also expect technological improvements to have a beneficial effect on the economics of roll-out. For all these reasons, OFTEL believes that there will be sound commercial reasons for BT to roll out higher bandwidth capability across the country within the medium term, irrespective of the introduction of Option 2. The combination of Option 2 and voluntary BT network upgrade should therefore provide an effective

supply route to the mass market.

5.3 On pricing, we propose that access under Option 2 should be made available at LRIC plus a mark-up to account for costs which are common to the line and to other BT services. OFTEL does not propose to control directly prices for BT wholesale higher bandwidth service provider and interconnection products. However, where such prices are not set by commercial negotiation and OFTEL is required to determine them, OFTEL proposes to adopt a 'retail minus' approach. Under this BT would have to offer a wholesale price equal to the retail price minus retail costs and this price would be available on a non-discriminatory basis to both BT's own service providers and independent service providers and operators. OFTEL would also retain competition powers to deal with any anti-competitive behaviour by BT. OFTEL believes this approach will allow commercial judgement to underpin the major and risky investment decisions required while providing safeguards against anti-competitive behaviour. Further detail is set out in Annex C.

5.4 We have considered whether there should be a general requirement on BT to offer unbundled loops in all areas; or whether the requirement should be conditional on a case by case analysis and should not apply in locations where BT had already upgraded. Where upgraded loops were available from BT, this would permit competition amongst suppliers of services which were compatible with BT's upgrade, thereby mitigating the competition concern. But, as noted above, BT might choose to upgrade in a way which did not permit certain types of higher bandwidth services to be offered. On balance, therefore, we believe that BT should be required to offer access to all local loops, except where there are insuperable technical or practical difficulties. This has the additional advantages of simplicity and legal certainty. **This document invites views on that proposal.**

Further work

Technological and practical issues arising from Option 2

5.5 Because operators could place different types of equipment on the Baseband Leased Circuits provided by Option 2, there is a risk that crosstalk between such equipment could cause mutual interference. It is therefore necessary that the industry develop a clear Spectral Management Plan for xDSL services over the copper loop. This will define power levels and frequency bands in which attached equipment would be permitted to operate. Clear industry specified standards and open interfaces will be vital to success. Such a plan would be published, so that there is a transparent, equitable and objective basis upon which BT would make decisions concerning the acceptability of other operators' equipment. BT's own equipment would need to meet the same criteria. This plan would also address, in principle, compatibility of future and higher frequency types of xDSL equipment with any radio emission standard developed by the Radiocommunications Agency. This would ensure that radio frequency emissions from wires carrying higher bandwidth services did not cause undue interference to radiocommunications generally.

5.6 Option 2 would require that other operators could locate their own attached equipment in BT's exchanges. Such co-location could raise practical issues of the management of, and access to, the accommodation. Continuity of service and network security will be of paramount importance. Decisions would need to be made on the technical facilities and environmental conditions appropriate to co-location areas. There would also need to be agreement on appropriate roll out plan for co-location facilities. Moreover it is also vital to develop appropriate commercial arrangements. Charges would probably need to be determined by OFTEL.

5.7 There would also be a number of process issues to be resolved concerning the ordering, provisioning, conditioning and repair of the partial baseband leased circuits.

5.8 As noted in paragraph 1.8, in order to facilitate introduction of Option 2 as early as possible if OFTEL's preliminary conclusions should be confirmed, work in these areas should be progressed immediately.

The NICC group on xDSL should be invited to continue its work and develop a Spectral Management

Plan for the UK, taking due account of similar work in the North American ANSI T1E1 group:

A Focus Group of the Operator Policy Forum should be established to develop guidelines for the provision of co-location facilities and operational processes, consulting the NICC as appropriate.

It is essential that this technical work should be prepared on a challenging but wholly realistic timescale. As with all major network innovation, Option 2 services will need to be trialled; such trials would commence as soon as practicable after the technical work described above.

Timescale for action

5.9 As noted above, the volume of technical work is substantial. But the need is to ensure that the bandwidth on the scale needed is delivered as soon as possible. If OFTEL decides in October 1999 to proceed on the basis now proposed, it will be important that this work is completed in time for a trial to be initiated by no later than the end of 2000. Option 2 services would then be available not later than July 1 2001. The timescale would require concentrated work by all sectors of the industry but we believe that it would be achievable.

5.10 In summary, if OFTEL's proposed way forward is confirmed, there should be the following outcomes:

Industry-wide discussions on technical and commercial issues associated with the introduction of Option 2 will begin immediately, with full BT co-operation;

BT will announce in the near future its plans for widespread roll-out of ADSL technology, giving due notice to operators and service providers so that they can have retail products ready to compete with BT's own products at launch. This process could begin in some areas within a matter of months;

Access to BT loops by competing network operators will be available not later than July 1 2001.

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Chapter 6

Other issues

6.1 *Other options:* The remaining three options received far less support than Options 2 and 4. Option 1 raised significant problems with Spectral Management. Option 3, while supported by some, raised difficulties in that most DSL access multiplexer equipment does not provide a clean bitstream output but depends on assumptions about the higher layer services provided, eg Internet Protocol. Many consumer groups supported option 5 and though it is seen as a desirable long-term goal and one which could evolve from Option 4, it is not practical in the short term in the absence of a general purpose switched ATM network.

6.2 *Lifetime of Option 2:* According to OFTEL's regulatory philosophy, rules should only remain in place for as long as they are justified. The rationale for intervention, set out in chapter 3 is lack of effective competition. If, as OFTEL expects, services become available across the country in the medium term from a number of competing delivery mechanisms, the case for imposition of Option 2 on BT will be weakened. On the other hand, if there were to be no certainty that Option 2 will be in place for more than a few years, few competitors to BT would find it attractive to invest in upgrading local loops. OFTEL will want to ensure that competing operators are confident that they can make a return on their investments when upgrading BT's local loops. Balancing these concerns, OFTEL's proposal is

therefore that the situation be reviewed 3 years after the introduction of Option 2 to assess its effectiveness. At a point where it had become clear that effective competition was present (or imminent), OFTEL would consider the way forward and give appropriate notice of any changes it intended to make to the terms under which local loops would be made available. **Views are welcome on this approach and, in particular, on the length of the appropriate notice period.**

6.3 *Variant of option 2:* Some respondents argued that operators should have higher bandwidth access to the loop (for attaching ADSL) on the basis of Option 2, but that BT should continue to provide the telephone service. This was seen as a way of allowing the customer a choice of higher bandwidth supply while continuing to receive the full benefits of service and choice available from BT's telephone network, including indirect access and Carrier Pre-Selection.

6.4 This option raises substantial difficulties. Services being conveyed over a single copper loop by two different companies could raise difficult issues of responsibility for service and maintenance. This might be overcome if the higher bandwidth supplier also provided the telephone service by being a reseller of BT's service, using BT's 'Calls and Access' product. It would also be less clear how shared and common costs of the two services should be divided. This needs further consideration.

6.5 *ADSL-Lite:* Some respondents questioned OFTEL's views on ADSL-Lite, or 'Splitterless ADSL'. OFTEL asked the NICC for advice on the deployment of this ADSL variant which would allow customers to buy their own ADSL modem and attach it as ordinary terminal equipment, most likely in the form of a plug-in computer card. It appears that ADSL-Lite could bring many cost and operational benefits, but that there are some technical issues that remain to be resolved. We understand that BT is investigating such an option as part of its ADSL roll-out. We would expect BT to give adequate notice to the terminal equipment industry about its intentions, including the provision of the technical characteristics of this new interface. As with all terminal equipment, competitive supply of ADSL-Lite modems must be assured.

6.6 *Large business customers:* There were some queries over the pricing and availability of DSL to large business customers. OFTEL's analysis suggests that the focus of any action should be on services provided to residential and small business customers and thus the pricing and terms of provision of higher bandwidth access will be based on their needs. OFTEL has taken the view that the market for services to larger businesses is competitive and so such customers are likely to be offered competing services by other suppliers, putting a downward pressure on prices. This view is based on the constraints on BT applying in the narrowband market – namely competition from competing access providers, the geographically averaged tariffs and competition from indirect access operators (particularly in national and international calls of which large businesses are significant customers). It is possible that these constraints will not apply in the market for higher bandwidth services. If this is the case there may be an argument for considering their needs in taking regulatory action. OFTEL intends to keep a close eye on market developments and consider this issue further. **Views are invited as to whether option 2 should cover provision of services to large businesses.**

6.7 *Universal Service and higher bandwidth:* The question of whether, in the longer term, universal service obligations should be adjusted to take account of the availability of higher bandwidth services will be considered in OFTEL's forthcoming consultation on universal service.

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Consultation

OFTEL seeks the views of operators, service providers and consumers on the proposals contained in this consultation document by **30 September 1999**. There will then be a further 2 week period during which comments on the representations made during the first period of this consultation are invited. This will

end on **15 October 1999**.

Views and comments should be made in writing and sent to:

Paul James

Regulatory Policy Directorate

OFTEL

50 Ludgate Hill

London, EC4M 7JJ

Tel: 0171 634 8926

Fax: 0171 634 8924

Email: pjames@oftel.gov.uk

Written comments will be made publicly available in OFTEL's Research and Intelligence Unit except where respondents indicate that their response, or parts of it, are confidential. Respondents are therefore asked to separate out any confidential material into a confidential annex which is clearly identified as containing confidential material. In the interests of transparency, respondents are asked to avoid confidentiality markings wherever possible. Appointments to view written comments in OFTEL's Research and Intelligence Unit, which must be made in advance, can be arranged by ringing: 0171 634 8761.

This document is also available at OFTEL's Internet Web site at <http://www.oftel.gov.uk>

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Annex A

Summary of Responses to December Consultation

1. In December 1998, OFTEL put out for consultation a series of questions concerning whether there could be said to be a market failure in the market for higher bandwidth services and whether OFTEL should intervene to regulate this market.

2. More than 60 responses were received from a wide variety of respondents including individual consumers;

consumer bodies representing a broad spectrum of consumers;

consumer bodies representing different interest groups;

- those with special needs or in rural areas;
- small businesses;
- larger organisations with atypical requirements, such as decentralised offices or educational and social objectives;

- commercial organisations wishing to compete in a market for higher bandwidth services who have

no access infrastructure of their own, but who wish to buy access services from those who provide and control access to end-users;

- network operators with their own access infrastructure

3. These service suppliers and network operators have expressed their views on the questions set out in December, and generally on the future of a higher bandwidth services market in the UK.

4. There is a clear consensus that some sort of action is needed to kick start the higher bandwidth access market if it is to enable the delivery of higher bandwidth services to residential and small business customers at reasonable prices within timescales matching other liberalised jurisdictions.

5. Views varied on the form that action should take. There is considerable support for the partial baseband leased circuit (option 2 in the December document an 'unbundling' option) and for a BT-run permanent virtual circuit access service (option 4 in the December document).

The information below is a brief summary of responses received.

Network Operators

6. In general network operators believe that the demand of the introduction of higher bandwidth services is developing but is very difficult to quantify at this time. BT has a distinct advantage because of its dominance in the access market and can use its unique position to gain a first mover advantage over other operators who wish to offer similar services. The network operators believe that some form of action needs to be taken, to ensure that other operators have the same rights of access as BT to the network. However, the precise form of action that network operators believe OFTEL should take in order to achieve this is less clear, with no real convergence of views on one particular option. The views expressed by the network operators very much reflect the commercial and business needs of the company responding to the consultation.

7. A selection of these comments is highlighted below.

- BT should be required to offer option 1 as well as option 4. That way there can be competition to BT's option 4 service which would otherwise dominate because all competitors would be dependent on BT for access and because of BT's ubiquity. Option 1 would prompt BT to offer competitive option 4 services.
- At present no case for regulatory intervention. It would interfere with demand driven investment and would create an erroneous assumption that BT is the only infrastructure provider capable of offering higher band width services on a national level, which would reinforce BT's dominance and undermine competing providers.
- Requiring BT to provide wholesale products does little to promote access competition and nothing to promote competition. Failure to act will stifle prospects for a lively market in higher bandwidth services. Option 2 is preferred to option 1 as it might reduce operational difficulties and costs because BT would be responsible for network and spectral and network management under a clearly defined service level agreement.
- Option 2 with a service level guarantee would allow flexibility about which equipment can be deployed, allowing operators to innovate on technical solutions and hence services. This scenario could be used to offer tailor made solutions to certain customer types. Option 4 also supported as it allows rapid roll out of competitors' services without collocation difficulties. The proviso being that operators know in advance what services will be available, how they will be managed and what they will cost.
- Option 4 would be reasonably quick and commercially attractive. Need to include consideration of BT's wholesale product and provision of information to competitors about BT's network. Option 1 or 2 should not be precluded as they potentially offer greater service provision and could be

mandated to provide service in areas where option 4 is not offered.

8. As can be seen from the above comments, some operators would like to take direct control of the local loop from BT in order to provide services to distinct sectors of the market (options 1 or 2). Other operators are concerned that some form of mandated access would have a detrimental effect on investment and reduce infrastructure competition and therefore prefer an option 4 approach.

Network Services and Enhanced Service Providers

9. The key issue for the service providers is that some form of open access provision should be mandated in order to ensure that service providers could gain access to BT's network, and to customers in a transparent and non-discriminatory manner. OFTEL should also encourage a rapid roll out of higher bandwidth equipment over BT's network. The mandating of an open access provision and rapid roll out of the network will lead to the development of competition for services and also kick-start the demand for these services. This in turn will act as a spur to the development of the market and increase the demand for higher bandwidth services, leading to further development of the market and the introduction of innovative new products and services.

Expert Bodies and Interest Groups

10. In general this group did not specify the mandating of one particular option as the right course of action to take. They believe that the market for higher bandwidth services will develop what ever the option. However, before OFTEL embarks on a particular course of action, proper consideration should be given to technical issues surrounding local loop unbundling, such as the potential impact on the radio spectrum and the development of technical standards based upon or supported by the relevant ESTI standards.

Consumer Groups

11. Again this group did not have a consensus on one particular option as the method by which to introduce higher bandwidth services. The main concern expressed by this group was that the higher bandwidth services should be made available to all sectors of society as opposed to those who can afford to pay for such services. OFTEL should also ensure that the network is rolled out as quickly as possible. Therefore any action undertaken by OFTEL to mandate the introduction of higher bandwidth services needs to take into consideration the social needs of society in order to ensure that everybody has access to the information society.

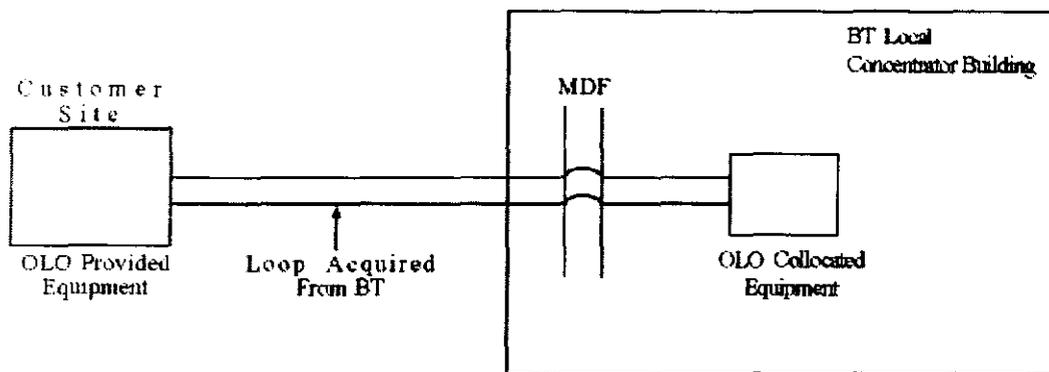
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Annex B

Technical Descriptions of Access Options

Option 1: Local Loop Unbundling (Layer 0 [physical medium] access)

In this option, the copper pair from the local exchange (actually more correctly described as the local concentrator building in most cases) to the customer is provided to the other operator to incorporate into their network. BT would remain responsible for the physical integrity of the circuit and no more.

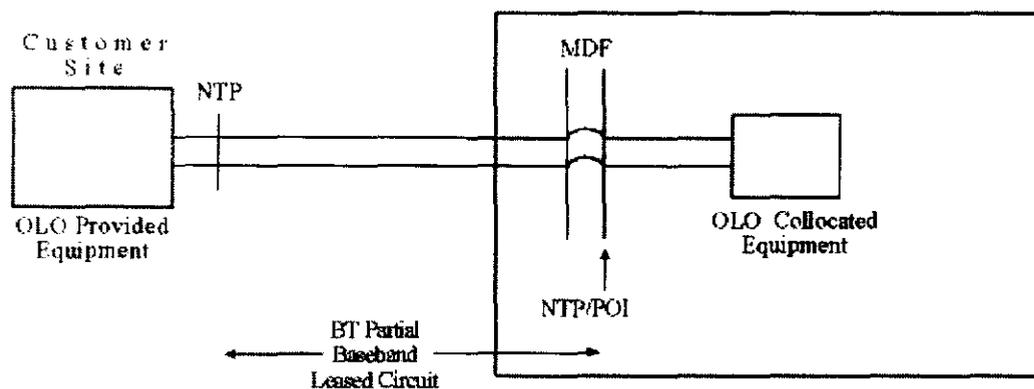


Key to this and later diagrams:

- MDF = Main Distribution Frame
- NTP = Network Terminating Point
- DSL = Digital Subscriber Line
- DSLAM = DSL Access Multiplexer
- POI = Point of Interconnection

Option 2: Partial Baseband Leased Circuit

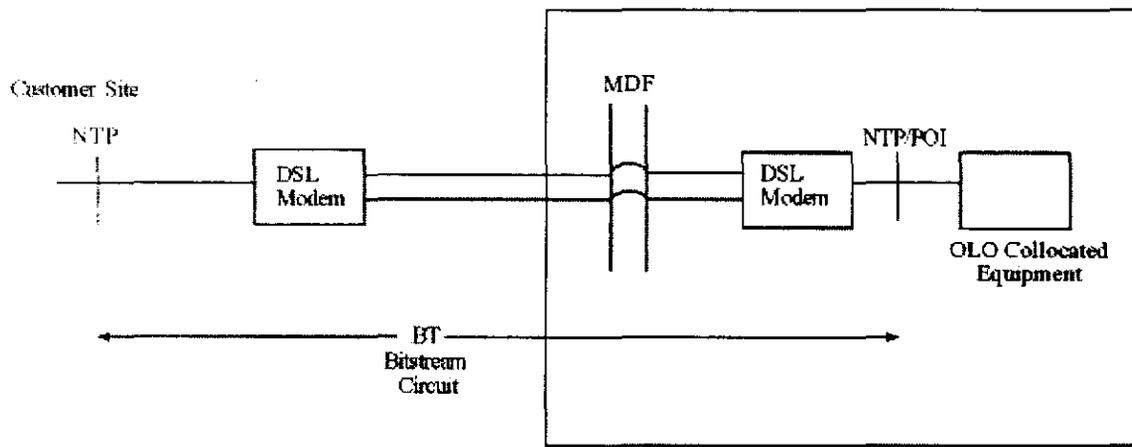
Under this option BT provides a leased line between the customer and the local exchange.



The other operator leases a Baseband Private Circuit extending from the Network Terminating Point (NTP) at the customer site to the NTP at the local concentrator building, most probably at the Main Distribution Frame or some other distribution frame convenient for the attachment of the other operator's collocated equipment. BT would remain responsible for the nature and quality of the communication service provided across its network. In accordance with the new Radio and Telecoms Terminal Equipment Directive (R&TTE) which comes into force on 1.1.2000, BT would have to describe the type of network interface provided and state the conditions required to ensure there could be no harm to the network, where these are agreed to be 'Essential Requirements'. This might require a system which goes beyond the traditional unconditional attachment system to which we have become familiar, whereby any customer can freely attach any approved apparatus. To the extent that interference depends on the nature and density of other services on the same copper cable, it might be necessary to have a system of 'conditional attachment' for higher bandwidth devices, such as ADSL modems. A set of such apparatus would be 'approved' as now (but increasingly by manufacturer self-declaration under the new R&TTE system) but might additionally require registration with BT so that any interference impact could be assessed and mitigated wherever possible. To ensure that BT did not use this as a barrier to others having access to its loops, the system would need to demonstrate that BT was treating its own services on equal terms with others' and based on transparent criteria identified in advance.

Option 3: Bitstream access (Layer 1 digital access)

This option is fairly straightforward, in that it provides a partial digital leased circuit service from the customer to the local concentrator site. As the DSL modems would be part of BT's system and attached by themselves, they would be in full control of the spectral management of the cables. This option would however require that the range of bitstream circuits made available by BT met all reasonable customer demands in terms of speed and bandwidths. This form of unbundling has been adopted in Canada for higher bandwidth services.

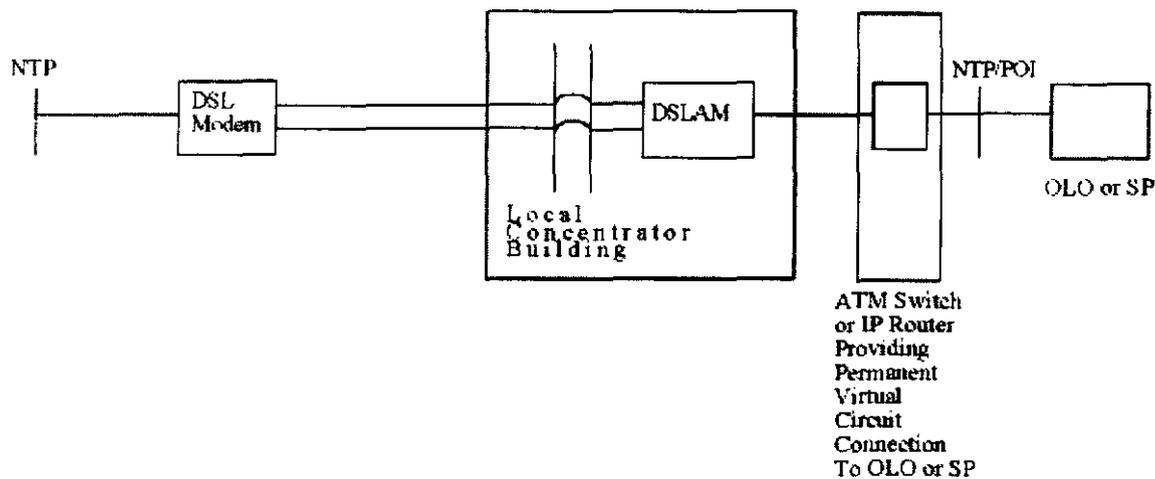


Option 4: Permanent Virtual Circuit Access

Under this option, BT provides other operators with higher bandwidth access to the end customer via a point to point data service between the higher bandwidth customer access

lines and the service provider's own site (diagram below). In other words, BT retains ownership of the line but allows service providers access to BT's customers using BT's lines. This is the configuration used in BT's present North-West London trial. The ADSL lines are connected at the exchange end to DSL Access Multiplexers and the data is statistically multiplexed together using IP or ATM techniques and delivered as an IP or ATM permanent virtual circuit service to the other operator or service provider. In this way, the bandwidth carried across the core network can be more economically dimensioned to meet a required quality of service (eg contention ratio) and avoids expensive broadband circuits to carry

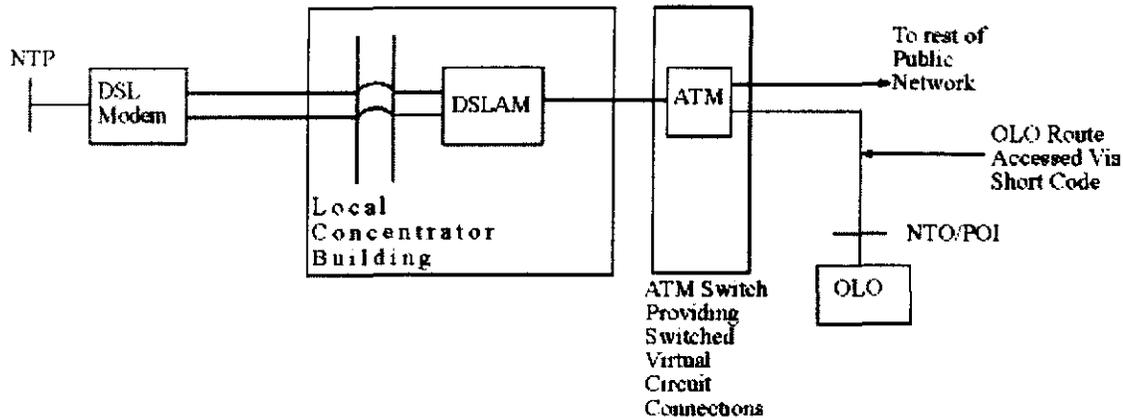
individual bit-streams across the network. (Note: because of the advantages of this multiplexing function, it is not thought that a Layer 2 access option would be helpful).



Option 5: Indirect Access (Layer 4 access)

The configuration of this option is somewhat similar to the previous, except that here the ATM switches are providing call by call selection of the destination, instead of the permanent association in the former. Such a system could support individual selection of service provider points as well as other broadband customers, in a similar manner to the system of Indirect Access used on today's telephone network. The ATM switches provide 'Switched Virtual Circuits'.

Intermediate selection of service providers is somewhat more difficult with Internet technologies, as the IP numbering and addressing system doesn't support Indirect Access using service provider short codes. There are a number of ways around this, using either ATM switched selection and IP over the ATM virtual circuit or other techniques, such as IP tunnelling.



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Annex C

Pricing Principles

1. OFTEL hopes that operators will be able to agree their own charges

through commercial negotiation. However if it proves impossible for them to reach agreement, OFTEL may be asked to determine the charges. This Annex explains OFTEL's proposed approach to any such requests to make determinations. **OFTEL welcomes views on these proposals.**

2. The appropriate charging arrangements are dependent on the option to be

implemented. Under Option 2 the requirement is to set a charge to the new operator for the lease of BT's line, while Option 4 involves setting charges for the use of BT's upgraded network facilities. OFTEL believes that the appropriate pricing principles in each case should balance two objectives – first to promote the development of high bandwidth services over BT's network and second to maintain incentives to invest by both BT and the providers of alternative delivery routes.

3. The issue is complicated by the fact that the BT has unbalanced tariffs for telephony, so while the line rental set by BT is below cost, the retail price of calls is above cost. For Option 2, this makes the attractiveness of customers to competing service providers vary because of the large variations in customer profitability for the provision of telephony services.

OFTEL's General Approach to Pricing

4. For ordinary PSTN services, the charging arrangements for wholesale services vary: some are subject

to direct price regulation, while others are priced according to operators' commercial judgement. In OFTEL's view, price control, under which prices are set equal to (or at least relate to) cost, is appropriate in two sets of circumstances: first, where an operator has an established dominant position in the provision of wholesale services and where the objective of regulation is to move the retail market structure from one of monopoly towards one of competition; second, for services such as call termination in which competitive provision is unlikely to emerge.

5. There are also two sets of circumstances in which it seems more appropriate to limit regulation of wholesale charges to the imposition of non-discrimination rules. This is sometimes described as 'retail minus' pricing of wholesale services (ie where the maximum wholesale charge is equal to the retail price less the costs incurred by the retail activity of the operator's in-house service provider). First, retail minus is appropriate where markets are competitive or moving sharply towards a competitive structure. In these circumstances, regulation of prices might be a disproportionate response to the degree of market power being exercised, and could even undermine the move towards competition. Second, where major risky investments are undertaken in order to provide the relevant services, price control would constitute the substitution of a regulator's judgement for an investor's judgement about the circumstances and prices under which an investment was likely to be viable. This would risk distortion of investment, and indeed could deter investment in new ventures.

6. A requirement for 'retail minus' pricing would constitute a lower level of regulatory control than direct price control. The aim of such controls is to avoid leverage of market power into other markets, although the absolute level of prices would not be controlled under such an approach. The focus of regulation would be on the prevention of a margin squeeze by the operator with market power. Such an operator would be obliged to serve its in-house service provider on the same terms as independent service providers, and should not cross-subsidise its in-house service provider. A set of rules such as this would allow an operator with market power to have a higher degree of flexibility in setting prices according to its commercial judgement while ensuring that independent service providers and other network operators would also be able to participate in the provision of services to customers on a fair competitive basis.

OFTEL's Approach to Pricing for High Bandwidth Services

Option 2 – Charge for the Local Loop

7. The focus of OFTEL's concerns is on the development of higher bandwidth services. However, the question of appropriate pricing principles should be considered against the background of the existing telephony tariff structure because Option 2 involves the loop which is currently designed and used for voice telephony.

8. The Consultation Document of December 1998 put forward three options for charges for BT's loop under Option 2:

- Line rental less retail costs (retail minus);
- LRIC plus a mark-up to account for costs that are common to the line and other BT services; and
- LRIC plus lost profit from line rental and calls (efficient component pricing rule, ECPR);

9. The first option is to set the charge equal to the existing line rental less an amount to take account of the new operator undertaking its own retail functions. However, in the presence of unbalanced tariffs this charge would not allow BT to recover the cost of its local loop and so would provide a disincentive for network build.

10. An alternative charging approach is to set the charge equal to LRIC plus some mark up to take account of costs that are common to this and other services. Allowing BT to recover the efficient cost of the line would remove the disincentive for network build that the first option would introduce. One drawback of this option is that it could allow inefficient entry. The operator leasing the line would gain the profit from telephony that was previously earned by the incumbent, which would enable an operator

with higher costs than the incumbent to enter profitably.

11. A way of preventing statically inefficient entry is to use the ECPR and compensate BT for lost profit from calls as well as lost revenue from line rental. The ECPR option allows only efficient entry, in the sense that, in order to undercut the incumbent and cover its cost, the entrant would have to have lower costs than the incumbent for the parts of the service it provided itself. The charge for the local loop would equal the incremental cost of the local loop, plus the profit on calls and line rental. However, a major concern with this approach is that it would base charges for a key input to higher bandwidth services on the imbalance in the telephony pricing structure.

12. The response to the Consultation Document indicated general support for LRIC as the correct approach to charging for lease of the local loop. It was generally felt that a charge based on the retail price of line rental would have a disincentive effect on network build. There was little comment about the possibility of using the Efficient Component Pricing Rule.

13. In the light of this consultation, OFTEL proposes that charges for Option 2 should be based on LRIC. OFTEL considers this strikes the appropriate balance between two objectives stated in paragraph 2 above – that is encouraging take-up of higher bandwidth services while maintaining incentives to invest in competing delivery routes to provide greater choice in the medium term. LRIC also avoids the disadvantages of the ECPR rule.

Charging for the Local Loop when Two Operators Use the Same Line

14. This issue arises under the variant of Option 2 described in paragraphs 6.3 and 6.4 of the main text. The operator controlling the line makes a charge to the other operator using the line. Under the variant of Option 2 the new operator leases the line from BT and charges BT for use of the line for telephony.

15. There are a number of options for how this charge might be set. The appropriate charge will depend on the charging principle adopted for Option 2, and on the view which is taken about which operator would be entitled to the profits from telephony under this option. Other criteria are that neither BT nor a new operator should be in a position to behave anti-competitively as a result of the charging structure, and that in the short-term it is also important that the charging structure is consistent with the price cap that is in place until 2001. **OFTEL welcomes views on the appropriate approach to pricing under this variant of Option 2.**

Charging Arrangements for Option 4

16. Option 4 involves a significant investment by BT in upgrading its network to provide new services. Given the requirement under this option for a very expensive and potentially risky investment by BT in this network upgrade, it would seem inappropriate for BT's prices or charges to be controlled. In any event, even if it were desired to set regulatory limits on BT's prices, it is unclear as to the basis on which these should be set. In particular, it is unclear what cost of capital would be appropriate to apply, given the uncertainty about the viability of the investment. Accordingly, OFTEL's view is that BT should be free to set prices for Option 4 services according to its commercial judgement, and that OFTEL should not attempt to second guess BT's judgement in this matter. However OFTEL believes there should be some regulatory rules to ensure fair competition, as described below.

17. If BT had freedom to set prices for wholesale higher bandwidth access

services, this creates the possibility that BT could extend its strong market position in wholesale narrowband services into the higher bandwidth wholesale services market. It might seek to exploit such a strong market position in 2 main ways:

- i. by leveraging its position from the wholesale market into the retail higher bandwidth market so to favour its own in-house higher bandwidth services provider; and

ii. by seeking to charge excessive prices for wholesale higher bandwidth access.

18. In order to safeguard against the first possibility OFTEL proposes to require BT

to make available a wholesale higher bandwidth access product to independent service providers. This must be provided on non-discriminatory or 'retail minus' terms ie BT must charge the same wholesale price to independent service providers and its own service provider and the wholesale price should be the retail price less the retail costs incurred by the in-house service provider.

19. In addition, OFTEL believes that BT should also make available a wholesale interconnection product to other operators on reasonable terms. In the absence of such a product, BT would be able to extend any market power it enjoyed in the wholesale market for higher bandwidth services into conveyance across the core network. In OFTEL's view, reasonable terms would be those established on a 'retail minus' basis ie non-discriminatory and would include charges equal to BT's implicit transfer charges to its own service provider business for the same service. For services to OLOs the charges should also reflect the costs saved by BT through part of the conveyance being undertaken by the other network operator.

20. As regards the potential concern identified in paragraph 17 ii), in OFTEL's

view, at this point in time it is not clear what level of pricing would constitute an abuse of market power. Indeed, it is not currently possible to establish that excessive pricing would be feasible, since it is quite possible that the maximum price that BT could charge, even as a sole supplier of high bandwidth services, would not generate any supernormal profits. However should BT's charges for wholesale higher bandwidth access give rise to concern in future, OFTEL would act using its competition powers to stop such behaviour.

21. OFTEL considers that this non-intrusive regulatory approach will allow commercial

judgements to underpin investment decisions, while providing safeguards against anti-competitive behaviour. However, OFTEL notes that this approach leaves the development of the higher bandwidth service market in BT's hands. In OFTEL's view, this is a powerful argument in favour of pursuing Option 2 as well, to allow others to exercise their commercial judgement in driving forward the market for higher bandwidth services.

Geographic de-averaging

22. If OFTEL has to determine the wholesale prices under either Option 2 or

Option 4, then a question which arises is whether OFTEL should set:

- a single national price (ie a 'geographically-averaged' price); or
- different prices for different regions reflecting different underlying costs of providing the service, but always consistent with the overriding principle of non-discrimination.

23. At present, charges for BT's exchange line rental are geographically averaged.

That is, the consumer pays the same regardless of cost differences between geographical areas. In the December Consultation Document OFTEL asked whether the price of higher bandwidth services should also be averaged in this way or whether price should differ geographically to reflect the variations in cost.

24. OFTEL has since considered this issue further and sees advantages and disadvantages in both approaches.

A single national price

25. This has the advantage of simplicity. It should also ensure that consumers throughout the country get access to higher bandwidth services at the same price, regardless of the different cost of provision in their area.

26. On the other hand, when prices are not related to costs, distortions are likely to be created. In the case of Option 2, a single national price could give the wrong signals about investment and thus could deter investment in competing delivery routes in some parts of the country. If single national prices were determined for Option 4, this could deter BT roll-out in some parts of the country.

Different prices to reflect differences in costs

27. The advantages of this approach are the converse of the disadvantage of a single national price – prices would more closely reflect costs and therefore give more appropriate signals for future investment. Roll-out to more costly regions of the country would be encouraged.

28. On the other hand, such prices might be complex to set. OFTEL would need information on costs according to different regions. And the price consumers would pay would reflect costs more accurately but could vary in different regions of the country.

29. **OFTEL would welcome views on this analysis and the best approach.** Our preliminary view, on the basis of this analysis, is that geographical averaging should not be obligatory.

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Glossary of terms

Asymmetric digital subscriber loop (ADSL) – a technology that allows the use of a copper line to send a large quantity of data (eg a television picture) in one direction and a small quantity (eg a control channel and a telephone call) in the other

Asynchronous Transfer Mode (ATM) – the internationally agreed basis for broadband ISDN. A technology that enables all types of information (data, voice and video in any combination) to be transported by a single network infrastructure.

Bandwidth – the physical characteristic of a telecommunications system that indicates the speed at which information can be transferred. In analogue systems, it is measured in cycles per second (Hertz) and in digital systems in binary bits per second. (bit/s).

Broadband – a service or connection allowing a considerable amount of information to be conveyed, such as television pictures. Generally defined as a bandwidth > 2Mbit/s

Carrier Pre-Selection - A service which enables customers to get their calls carried by a different operator through their existing phone lines without having to dial any extra digits.

Concentrator – the part the local exchange which is positioned close to the customers. It is sometimes within the local exchange, and sometimes located remote from the local exchange.

Copper line – the main transmission medium used in telephony networks to connect a telephone or other apparatus to the local exchange. Copper lines have relatively narrow bandwidth and so have limited ability to carry broadband services such as video unless combined with an enabling technology such as ADSL.

Crosstalk – the phenomenon whereby telecommunications signals on one circuit can leak across to another, potentially degrading the performance on the affected circuit.

Deaveraging – the move from a single averaged tariff or charge to separate ones based on differing geographical areas or types of service.

Digital – the coded representation of a waveform by binary digits, as opposed to analogue which is the direct representation of a waveform.

Digital Local Exchange (DLE) – the telephone exchange to which customers are directly connected.

Digital Main Switching Unit (DMSU) – a trunk exchange primarily used for connecting long distance calls.

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

E-Commerce - The action of buying online or establishing an online store-front. Also, using technology to speed up and make more efficient the transaction of commerce at all stages of the process from production to delivery.

Efficient component pricing rule (ECPR) – A rule for determining interconnection prices, under which the price is composed of the incremental cost of providing the interconnection service plus the profit (including contribution to common costs) that the network operator foregoes by selling interconnection to another operator rather than a service to the final customer.

Geographically averaged prices – prices established by averaging the costs of network elements across the country so that customers in different areas of the country do not pay different rates.

Incremental costs – the capital and operating costs that arise as a result of the provision of the 'increment'. In contrast to fully allocated costs, the incremental costs include only those costs that are caused by the provision of the increment. So long as revenue exceeds incremental costs, the company increases its value by providing the increment.

Indirect access – where a customer's call is routed and billed through operator A's network even though the call originated from the network of operator B. (It is the generic term for both easy access and equal access Carrier Pre-Selection)

Integrated Services Digital Network (ISDN) – a network based on the existing digital PSTN which provides digital links to customers and end to end digital connectivity between them. ISDN2 provides a maximum bandwidth of 128kbit/s.

Interactive services – this term covers two forms of interactivity. The first is where viewers use the remote control to click to applications, which are included in the broadcast stream. The second form of interactivity is where the modem is used to communicate with a remote server.

Interconnection – the physical and logical linking of telecommunications networks used by the same or a different organisation in order to allow the users of one organisation to communicate with users of the same or another organisation, or to access services provided by another organisation. Services may be provided by the parties involved or other parties who have access to the network.

Internet – a global network of networks, mainly narrowband, accessed by users with a computer and a modem via a service provider.

Internet Protocol (IP) - A set of instructions describing how to address and transfer information across a network. The Internet is a public network consisting of many interconnected IP networks.

Local loop – the access network connection between the customer's premises and the local PSTN exchange, usually a loop comprised by two copper wires.

Long-run incremental cost (LRIC) – the cost avoided through no longer providing the output of a defined increment; for example, the cost of call conveyance is the cost which would be saved in the long-run if this service was no longer provided

Main distribution frame – the apparatus in the local concentrator (exchange) building where the copper cables terminate and cross connection to other apparatus can be made by flexible jumpers.

Mbit/s – Mega (million) bits per second. A measure of the speed of transfer of digital information.

Modem – a device which converts digital signals from a data-transmitting terminal into modulated analogue signals which can be carried by a public telephone network.

Narrowband – a service or connection allowing only a limited amount of information to be conveyed, such as for telephony. This compares with broadband, which allows a considerable amount of information to be conveyed.

Network Interoperability Consultative Committee (NICC) - is leading UK telecommunications industry group which deals with the technical issues associated with network competition. It produces voluntary technical specifications on behalf of the industry and is a source of advice to the Director General of Telecommunications on the harmonisation of interconnect arrangements

Network Termination Point (NTP) – the edge of a network at which the network is connected to other networks or to terminal apparatus, eg a telephone.

Optical Fibre – cable made of glass fibres through which signals are transmitted as pulses of light. It is a broadband medium that can easily provide capacity for a large number of channels.

Partial baseband leased circuit – where a leased circuit extends from one customer to the local exchange and the bandwidth on that circuit extends down to zero Hertz.

Public Switched Telephone Network (PSTN) – the complete network of interconnections between telephone subscribers.

Radio Spectrum – the range of wavelengths used, for example, for broadcasting radio, terrestrial television and satellite television. Usable wavelength ranges from about 100 KHz to about 400 GHz although there are as yet no broadcasts above about 12 GHz.

Service provider – provider of telecommunication services, or services with a telecommunication service component, to third parties whether over its own network or otherwise.

Spectral management – managing the type and quantity of devices connected to the copper pairs, through analysing the impacts of the power and frequencies transmitted, so as to eliminate, as far as possible, any unwanted interference between services on the cable; and between those services and external radio services. Also, to optimise the effective use of technologies to deliver the maximum overall benefit from the cable concerned, for example, by deploying a higher density of lower capacity devices compared to a lower density of higher capacity devices.

Video-on-demand – a programme or film sent independently to a customer in response to his individual request. This contrasts with broadcast television, which is sent simultaneously to all customers able to receive it.

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