Office of the Director of
**Telecommunications**
**Regulation**

# Local Loop Unbundling

Consultation Paper

**Document No.** ODTR 99/21 **March, 1999**

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## Foreword by the Director

Providing for consumer choice in terms of quality and price is the key benefit that should flow from liberalisation. Enabling operators to access the widest range of feasible delivery methods is one of the best ways of ensuring that users of Irish telecommunications services get the highest quality and cheapest services at the earliest possible date.

Within the liberalised framework set by the EU and Irish authorities for the telecommunications market, there are many alternative means of delivering services, all of which should be examined for their usefulness in Ireland, in the same way as they are being examined in other EU countries and elsewhere.

We now have in Ireland a telecommunications licensing regime and interconnect rates which encourage competition and consumer choice and we expect this to develop rapidly with new wireless telephony licenses due shortly. Those licensees will be preparing to deliver competitive services to residential and business users, particularly in less populated areas, by the end of the year.

Local Loop Unbundling (LLU) is another way of delivering choice to consumers, encouraging growth of the market and delivery of new services. It should now be considered in the Irish context. Looking at experience elsewhere, it can be particularly useful in the early stages of competition when new entrants have limited networks of their own. It is complex and perhaps costly to operate, and it may not suit in all circumstances but, where it is appropriate, it could result in rapid delivery of upgraded services to users. It is not a magic formula for opening the market to competitors, but a potentially useful additional mechanism to stimulate growth and competition.

LLU is primarily a commercial matter the details of which should be worked out between the parties. Given the complexity of the issues and in particular pricing, regulators can assist by examining the critical issues and by developing the pricing mechanisms and the modalities which may be required, in the context of 'special network access' as provided for in the EU regulatory framework.

There may be considerable merit in the development of the existing network infrastructure and providing it for use by many operators to provide a range of services to end-users, including potential benefits to the incumbent arising from increased network utilisation. TE indicate that they have no objection to LLU so long as their costs are covered and that the issues of price rebalancing and de-averaging are addressed. In addition there are obviously complex practical issues associated with such matters as access and security.

As the national Regulatory Authority under EU and national legislation, the ODTR has unique functions and expertise in regard to LLU. We recognise that while the aim of LLU may be easily stated, there is a need for a structured and planned approach to the issue. Pricing is critical to the operation of the local loop, and it also presents particular difficulties as to how it should be calculated. The paper set out various pricing options and asks for comments. It also addresses issues relating to likely markets and technical requirements.

I look forward to the responses to this consultation. They will help frame what role LLU might play in the development of telecommunications in Ireland. Other consultations and in particular costing work with Telecom Eireann will also be very relevant to the final conclusions to be reached.

**ETAIN DOYLE**
**Director of Telecommunications Regulation**

# 1 The case for unbundling the local loop

## 1.1 Introduction

The issue of Local Loop Unbundling (LLU) has been widely debated in the telecommunications sector. To date six EU member states have introduced or are in the process of introducing LLU with most other member states holding consultations on the topic. The widespread interest arises from the potential of LLU to be a key enabler of competition in local telecommunications services.

The European Commission is assessing the issue of LLU as part of the 1999 Review of Liberalisation in the Telecommunications Sector and this may lead to legislative changes in the future. In the meantime, EU legislation does not explicitly specify a regime for LLU. Irish legislation transposes EU legislation and similarly does not explicitly specify a framework for LLU.

However, in many EU member states, the provisions in EU legislation in relation to Special Network Access have been used to devise an appropriate framework for LLU. The relevant provisions are set out in the Voice Telephony Directive (98/10/EU). The most relevant provisions of the Directive in relation to Special Network Access are as follows:

- Operators with Significant Market Power must deal with requests for access to their networks at network termination points other than those commonly provided (Special Network Access)
- The provision of such access must be at cost oriented rates and comply with the principle of non-discrimination
- The conclusion of agreements is a matter for negotiation between the parties in the first instance
- The National Regulatory Authority, (the Director of Telecommunications Regulation) may intervene and shall do so if requested by either party, to set terms and conditions for access and to ensure that agreements are implemented in the interests of users.

The Minister for Public Enterprise, Mary O'Rourke, TD, signed the Irish Regulations transposing EU Directive 98/10/EU into Irish law on Thursday 25th March 1999. (S.I. No. 71 of 1999). These Regulations, and the new Directive, renew the provisions on special network access originally included in previous legislation, and ensure that they are appropriate for a fully liberalised environment.

The Director is now anxious to examine the issues surrounding LLU as part of the development of the overall telecommunications market. If necessary, the Director must consider what form of regulation might best be implemented, in order to allow for the efficient implementation of LLU. This consultation document is an important element of her overall examination of the issue.

As indicated in this paper, other work on costing is also relevant to the issues raised by LLU, and this will take some time to complete. Following receipt and consideration of the replies, and in the light of the results of the costing work, it may be necessary to hold a further consultation on some issues.

The document is structured as follows:

- Section 1 sets out the background to LLU and discusses the nature and importance of LLU.
- Section 2 outlines the issues associated with the types of access, methods of access and location of access to unbundled loops.
- Section 3 and 4 deal with the costs and pricing issues.
- Section 5 discusses general regulatory issues.

The Director invites views from interested parties by **4th May 1999**. Comments should be submitted in writing to:

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All comments are welcome, but it would make the task of analysing responses easier if comments reference the relevant question numbers from this document. In the interests of promoting openness and transparency, the ODTR will summarise the comments received in its report on the consultation. The Director appreciates that many of the issues raised in this paper require respondents to provide a considerable amount of commercially sensitive information if their comments are to be meaningful. Such information will be treated as confidential. Respondents are requested to identify confidential material and if possible to include it in an Annex to the response.

*This consultative document does not constitute legal, commercial or technical advice. The Director is not bound by it. The consultation is without prejudice to the legal position of the Director or her rights and duties to regulate the market generally.*

## 1.2 What is local loop unbundling?

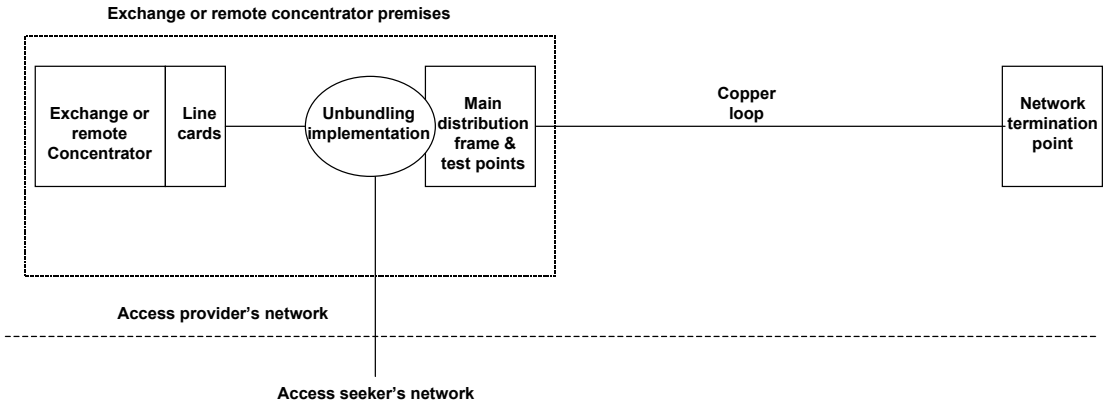
Local loop unbundling is an access service which:

- is provided at a point between the network termination on the customer premises and the line-side of the access provider's local switch

- gives the access seeker access to the local loop from the point of interconnect to the customer's premises.

This is illustrated in Figure 1.1.

Figure 1.1: Local loop unbundling




There are two main variations of LLU:

- physical access to the transmission medium in the local loop, where the access is defined in physical terms such as power spectrum masks. Examples of transmission media are copper cables, co-axial cables and optical fibre cables. This document only considers access to copper pairs, although access to optical media is possible and may become an issue in the future.
- bitstream access, where the access is defined in terms of a bitstream service with specified characteristics. This bitstream is conveyed between the customer's premises and the point of interconnection between the networks of the access provider and the access seeker.

In Chapter 2 and Annex 2 these and other forms of LLU are described in more detail, highlighting their various strengths and weaknesses.

## 1.3 Why is LLU important?

Local loop unbundling is important as a possible approach to achieving competition in telecommunications access and local services. Evidence from other liberalised telecommunications markets around the world suggests that competition will thrive in long distance services in Ireland. However, in some liberalised markets, high entry costs and low margins have deterred competitors from entering the local access markets. Many EU countries, (e.g. Austria, the Netherlands, Denmark, Sweden, Germany and Finland) have introduced, or are in the process of introducing local loop unbundling as one way of overcoming this bottleneck.

Local loop unbundling is potentially attractive to new entrants, compared to investing in their own local loops, because it:

- Replaces a large up-front capital investment cost with a rental cost. This greatly reduces the risk of market entry, enabling entrants to have direct access to customers in both high and low density areas. Also the rental cost structure improves cash flow, reduces borrowing costs and avoids the queue for limited capital.
- Allows the entrant to benefit from the economies of scale enjoyed by the incumbent.
- Provides a low cost and relatively quick means of obtaining access to all the customers served in an area.

There are substantial set-up costs involved in LLU, and significant technical issues to be dealt with which may limit these attractions. This paper seeks to clarify these issues and seeks views on whether and how LLU might operate effectively in Ireland.

Local loop unbundling can be used to access both the current PSTN/ISDN services and some higher speed data and multimedia services such as Internet and E-commerce. There is still some technical uncertainty about the best way to provide higher speed services and some problems in reaching subscribers with loops longer than 2-3 km, but technological advances should overcome these problems sufficiently to provide workable solutions in the near future.

The speed at which local loop unbundling is taken up would depend on the relative profitability of the local market compared to the long distance and international markets. At present the long distance and international markets are potentially much more profitable, suppressing interest in the local markets, but the balance will change as competition reduces long distance and international tariffs and as local access to new higher speed data services become practicable. As this happens, local loop unbundling could provide additional choice in spreading direct competition to households in Ireland.

## 1.4 Alternatives to LLU

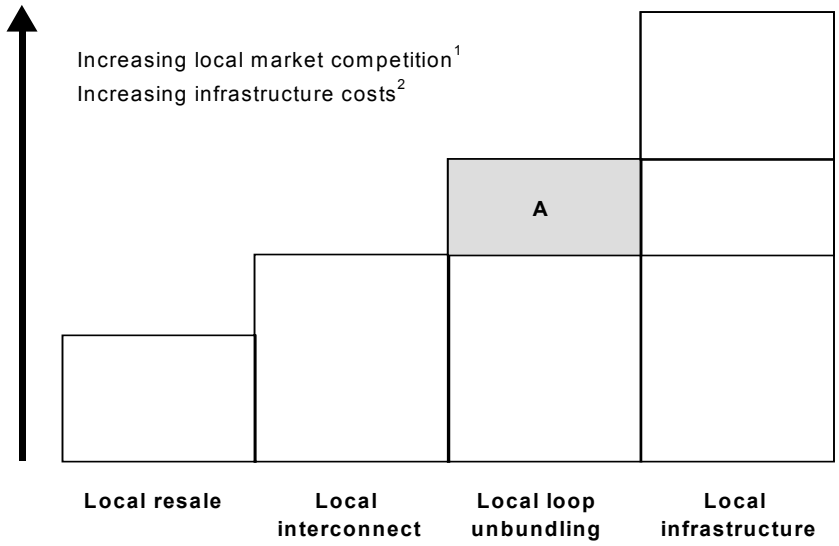
A prospective entrant in the local telecommunications market has a number of alternative approaches to service provision. These include:

- Resale of Telecom Eireann's service. In this case Telecom Eireann (TE) provides wholesale service to the entrant, and the entrant on-sells that service to the customer. The reseller may not need to provide any additional functionality other than the billing system. Typically the entrant will pay TE the retail price for service which it purchases, with a discount reflecting the volume of traffic which it generates.
- Local interconnect. In this case the entrant typically operates its own local switch and interconnects on the network side of TE's local switch. Service providers may also request interconnection services. Prices for local interconnect are regulated on the basis of the TE's relevant costs including a return on capital employed.
- Competing local loop infrastructure. In this case the entrant lays its own transmission facilities between the local switch and its customers. This may involve duct and pole sharing, where the entrant lays its cables in spare ducts belonging to the incumbent or hangs the cables on the incumbent's poles, or it may operate an entirely separate local network. Alternatively, access may be provided using different technology such as cable or fixed wireless access (FWA).

A feature in Ireland is the relatively high penetration of cable television services. More than 50% of households have access to cable television and this high penetration rate could allow alternative service delivery without the full up-front costs associated with a new network development. FWA is another means of reaching the market for which the Director has recently invited tenders for licences to provide narrowband and broadband services. FWA can be attractive because it enables rapid roll-out and coverage.

These three options, along with local loop unbundling, can be ranked both in terms of the extent to which they open the local and access market to competition and in terms of the investment they require of new entrants. This is shown in Figure 1.2. LLU requires additional investment over the options of local resale and local interconnection, but equally it offers the potential of a more competitive local market. Infrastructure based competition can extend the competitive market even further than unbundling, but it does so at a greater cost.

Figure 1.2: LLU in relation to alternative approaches to local competition




*[1]That is competition across different service elements within a given geographical area.*
*[2] While infrastructure costs increase there are compensating reductions in operating costs. In addition, the relationship between relative operating costs and build costs will vary from operator to operator and over time.*

This consultative document focuses on the shaded area A of Figure 1.2. TE already offers resale and local interconnection services, and entrants are free to invest in their own local infrastructure. Other service delivery platforms such as FWA and cable can be used to reach the market and are evolving in tandem with LLU. The rest of this consultation document examines LLU in a standalone manner but readers are reminded that it is one of a number of potential means of service delivery which can be used to develop a competitive and vibrant telecommunications market in Ireland.

*Q1.4.1 Do you consider LLU to be an appropriate alternative access mechanism for the Irish market? Please give your reasons.*

# 2. Forms of local loop unbundling

There are many possible forms of local loop unbundling. These forms can be described on the basis of three distinct and independent issues:

- The type of access provided (physical or bitstream)
- The method of access (co-location, virtual co-location or direct connection)
- The location of access (local or remote).

Most combinations of the type, method and location of access are practicable. However, not all combinations are appropriate for all the services for which LLU might be used.

## 2.1 Services offered

Local loop unbundling can be used to access the following services, either individually or as a bundled service package:

- Analogue PSTN
- ISDN basic access
- New telemetry services such as meter reading
- Higher rate xDSL services.

The services of most interest commercially are analogue PSTN access, where unbundling has the potential to increase competition and access to customers for new entrants, and higher rate xDSL services where unbundling could be used to enable the market to develop on competitive lines from the outset.

xDSL services are the subject of a great deal of interest because they can support higher speed data and multimedia services including Internet access, E-commerce and entertainment. There are several different types of xDSL device with different characteristics in terms of the bit rate achievable, the length of line over which they can operate and the symmetry of the communications. (See Annex 2)

*Q2.1.1 Do respondents agree that the services above are those that are likely to be provided over unbundled local loops? if not, please give reasons*

*Q2.1.2 Do respondents believe that other services could be provided over unbundled local loops? Please give reasons.*

*Q2.1.3 What is the order in which respondents consider that services would be brought to market? Please provide information and analysis to support your response.*

*Q2.1.4 How soon would service providers wish to start higher rate services based on existing networks or unbundled loops?*

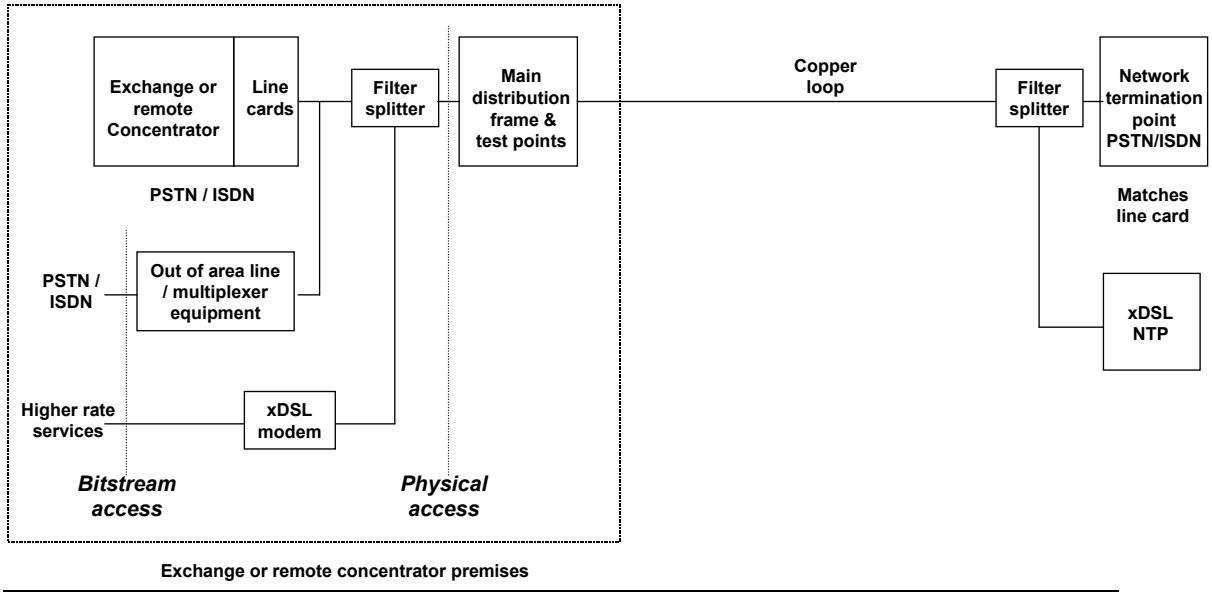
## 2.2 The type of access

Unbundling can support either physical or bitstream access.

- With physical access the access seeker has direct access to the transmission medium and can decide how to use it within limits defined in physical terms. For copper loops the characteristics of attached equipment would be limited in terms of power spectrum masks, absolute power levels and impedance matching. This arrangement gives some freedom as to how the medium is used by the access seeker.
- With bitstream access, the bitstream offered is defined and the access seeker can only use this bitstream. It is not allowed to add other equipment to implement alternative bitstreams. All the physical management of the medium is handled by the access provider. This arrangement does not give freedom to the access seeker, but gives freedom to the access provider to make changes to the medium whilst maintaining the same form of bitstream access.

Figure 2.1 shows a copper loop exchange line configuration from an exchange or remote concentrator to the network termination point (NTP). The points for physical and bitstream access are marked. Bitstream access requires additional equipment to be provided by the access provider. With physical access this equipment would be provided by the access seeker. Equipment for higher rate services is shown as well as equipment for PSTN/ISDN. In some cases the functions that would be needed in an xDSL NTP could be provided in xDSL terminal equipment, and it may not always be necessary to split xDSL signals on the network side of a PSTN NTP.

Figure 2.1: Physical and bitstream access




There are no fundamental technical problems with providing PSTN and ISDN services through unbundling, but there are significant technical issues for higher rate services where:

- Local loops require much more active management to maintain compatibility. Careful management (e.g. restrictions on the type of equipment used within the local loop) would enable more pairs in cables to use xDSL
- The addition of higher rate services is likely to involve changes at the NTP end of the loop as well as at the exchange/concentrator end
- Services cannot be offered indiscriminately to subscribers because some subscribers would be out of reach, and once the capacity limit is reached more subscribers cannot be accommodated.

There is as yet no uniform established approach to these issues in other countries. These are key issues that would need to be resolved before LLU is used for xDSL services.

Figure 2.2 summarises the opportunities for providing services using both bitstream and physical access.

Figure 2.2: Physical vs. bitstream access

| | Physical access | Bitstream access |
|---|---|---|
| **PSTN** | **Practicable now.**<br>**Tight specification advisable** | **Practicable now.**<br>**Provider would need to multiplex signals and run line cards** |
| **ISDN** | **Practicable now if there is demand.**<br>**NTP needs changing.**<br>**Some limits on numbers** | **Practicable now.**<br>**Provider would need to multiplex signals and run line cards and change NTP.**<br>**Some limits on numbers** |
| **Telemetry** | **Practicable soon if there is demand.**<br>**NTP needs changing.**<br>**Further work on compatibility needed** | **Service needs defining** |
| **Higher rate** | **Practicable soon.**<br>**Significant cable management problems and limits on numbers.**<br>**Only nearer subscribers reachable.** | **Practicable soon.**<br>**Requires co-ordinated innovation and non-discrimination by provider.**<br>**Limits on numbers**<br>**Only nearer subscribers reachable**<br>**Restricts service innovation by the access sharer** |

*Q2.2.1 Should physical access or bitstream access be required? Please provide reasons for your answer.*

*Q2.2.2 Should any initial requirements for physical access for PSTN include strict power spectrum and impedance restrictions to ensure maximum compatibility with future higher rate services?*

*Q2.2.3 What management strategies could be employed for physical and bitstream access?*

*Q2.2.4 Is a working party required to consider the technical and operational issues of telemetry and higher rate services? If not, what alternative mechanisms that could be used to develop these issues? Please provide support for your answer.*

The expectation for several years has been that optical fibres will gradually replace copper loops for access in urban areas. This may be a complete replacement, with fibre to the home, or a partial replacement, with fibre to the street or fibre to the kerb. These options are being developed in parallel with the xDSL developments and to some extent the technologies are competing. It is not yet clear how this scenario will develop. (There may be substantial differences between the more and the less populated areas in Ireland, as it may not be economically feasible to run optical fibre to small and scattered communities.)

In the worst case, shared use of the copper loops through local loop unbundling may constrain the access provider by preventing network modernisation based on optical fibres. This possibility may be less than it might first appear because practical installation considerations make it likely that existing cables will be retained in parallel with new fibre cables wherever possible. However, access principles would need to ensure both flexibility and continuity of service as the network develops.

*Q2.2.5 What provisions are required to give a reasonable balance between flexibility and continuity for network modernisation?*

## 2.3 The method of access

Connections between networks need to be compatible with both networks in order to work correctly. This means:

- Physical compatibility of connectors and cables or fibres
- Compatibility of the signals sent and received.

There are two main forms of connection arrangement:

- Arrangements where additional transmission equipment specific to the unbundling is needed on the premises of the access provider
- Arrangements where only cable connection is needed.

This leads to the three main types of access method:

- **co-location** on the premises of the access provider, where the access seeker chooses, supplies, installs and operates the equipment needed, and therefore access has to be provided for the staff of the access seeker
- **virtual co-location**, where the access seeker chooses and supplies the equipment, but installation and operation is carried out by the access provider. The access seeker must ensure that the staff of the access provider are adequately informed and trained to operate the equipment. In some cases the equipment remains under the ownership of the access seeker, in others it is sold or leased (at least nominally) to the access provider

- **direct connection**, where no additional equipment is needed. In this case, the cable types, connectors and transmission equipment must match the equipment of the access provider. The access provider may offer no choice or a choice of two or three alternatives. The location of the cable connection may be on the premises of the access provider or access seeker, or between the two (called "in-span interconnection"). With copper cable connection and physical access there would be limits to the distance between the premises of the access provider and seeker.

Figure 2.3 summarises these options.

Figure 2.3: Methods of access

| | Co-location | Virtual co-location | Direct connection |
|---|---|---|---|
| **Equipment choice** | **Seeker** | **Seeker** | **Provider** |
| **Equipment supply** | **Seeker** | **Seeker** | **Provider** |
| **Equipment installation** | **Seeker** | **Provider, with training** | **Provider** |
| **Equipment operation** | **Seeker** | **Provider, with training** | **Provider** |
| **Equipment ownership** | **Seeker** | **Either** | **Provider** |
| **Access to provider's premises** | **Needed** | **Not needed** | **Not needed** |
| **Security and privacy** | **Must be resolved** | **Not relevant** | **Not relevant** |

All three of these methods of access may be used with physical or bitstream access. For example:

- Co-location may be used with physical access, where the access seeker installs its own line cards and multiplexing equipment. Alternatively direct connection may be used where the copper loop is extended to the nearby premises of the access seeker.
- Co-location may be used with bitstream access, where the access seeker installs multiplexing or service related equipment. Alternatively, direct connection may be used if the access provider presents the bitstream access already multiplexed at an optical fibre interface.

Because co-location involves the access seeker gaining access to the premises of the access provider, it introduces additional issues of :

- Rights of access
- Security and privacy for the access provider
- Security and privacy for the access seeker
- Reservation of space.

Co-location implies that the access seeker needs to install, operate and maintain its equipment on the premises of the access provider. This involves access by staff to sites that may not be staffed all the time. Access may include issuing new electronic passes and providing some segregation between these passes and normal employees' passes.

Physical co-location requires access to the premises of a competitor. This raises issues of security because of the possibility that equipment could be tampered with. There are also issues of privacy. For example, an operator that is innovating may not wish other operators to know what equipment or supplier it is using.

The access provider may wish to secure its own equipment from access by the access seeker. This may be achieved by controlling access to different rooms or by adding a screen in rooms that are shared. Access seekers may also wish to secure their equipment.

In the USA, Germany and some other countries, this issue is solved by protecting equipment in cages or separate rooms. While certainly granting security and privacy, such separation can be expensive and inefficient.

*Q2.3.1 Which methods of access would be preferred and why?*

*Q2.3.2 Should the access provider be required to offer all forms of access? If not, which ones should be required?*

## 2.4 The location of access

The copper loop ends at the premises of a remote concentrator or exchange. Within the TE network this would typically be premises occupied formerly by an analogue local exchange. Some of these premises now host digital local exchanges and entrants would probably wish to obtain local interconnection at these sites. However, access seekers may not wish to bring their network to each of the premises which now host only remote concentrators. They may prefer to pay Telecom Eireann to provide transmission between these premises and their point of interconnect at the digital local exchange. This may be the case even if the access seeker co-locates equipment at the premises where the loop ends.

This raises the issue of whether the access provider should be required to provide remote access via leased lines or other links for these purposes and to backhaul bitstream services in some form through the network to a central location.

*Q2.4.1 Should the access provider be required to provide leased lines or other links from the premises where copper loops end, and to backhaul bitstream services in some form through the network to a central location? Are there other preferred ways of dealing with this issue?*

## 2.5 Quality and maintenance

The access seeker would be dependent on the access provider for a major part of the provision of service to customers. The area of service that is most at risk is fault repair. There is a risk of discrimination in that the access provider may correct problems on loops used by itself more quickly than on loops used by access seekers.

Quality issues would therefore need to be included in Service Level Agreements between the operators, and time limits for repairs, performance statistics and compensation would have to be included. The issue of Service Level Agreements is the subject of another ODTR consultation.

For loop rental, there needs to be an adequate procedure for investigating fault reports and locating their cause. Fault location using modern equipment is sufficiently accurate to locate faults and determine on which side of the connection point they lie. Detailed procedures would have to be worked out between the operators.

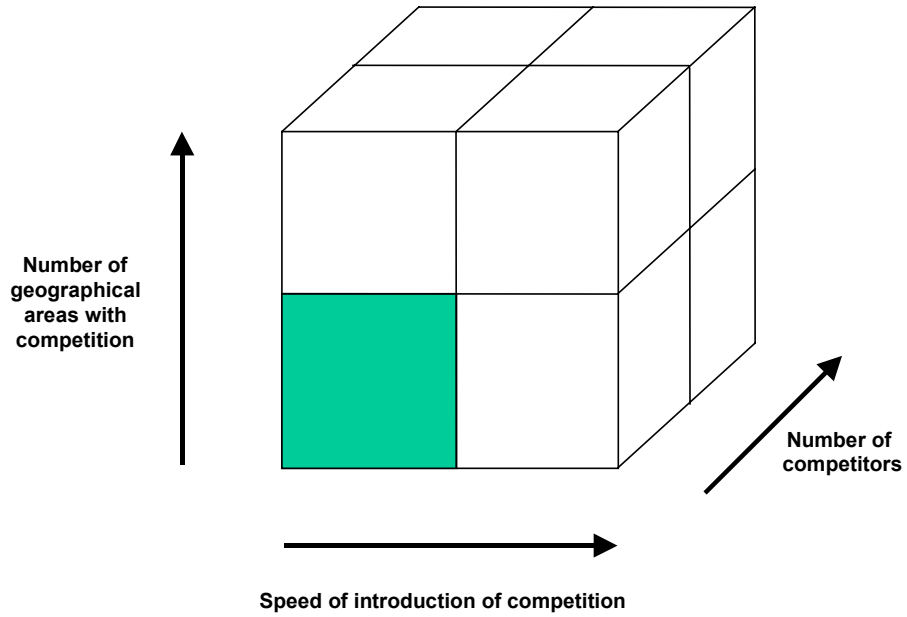
*Q2.5.1 Are the issues of quality and maintenance appropriate to be dealt with in Service Level Agreements? Are there other preferred ways of dealing with this issue? Please provide details.*

# 3. Costs and benefits from local loop unbundling

## 3.1 Enhancing competition

The key reason to consider introducing local loop unbundling in Ireland is to help stimulate competition by reducing the costs of direct access to subscribers, thereby providing additional choice to consumers. Figure 3.1 illustrates the three dimensions in which local loop unbundling may increase competition in the Irish telecommunications market.

Figure 3.1: The multi-dimensional competitive impacts of unbundling




Subject to the issues in respect to set-up costs discussed in the following sections, local loop unbundling decreases the cost of providing local access by replacing investment costs with rental costs. This cost reduction could:

- Make it cost effective for entrants to provide services in geographical areas where they would not invest in their own infrastructure be that fixed or wireless. With LLU new entrants should have a greater accessible market, and the benefits of competition could be brought to a wider user base.
- Make it practicable for entrants to roll-out services earlier than if the services depended on infrastructure development. The reason here is that unbundling enables many customers to be reached without drawing on the limited resources of investment capital or skilled labour for laying infrastructure.
- Make it possible for more organisations to enter the market. By reducing entry costs, local loop unbundling should lead to more competition and efficient pricing in a greater proportion of local areas.

*Q3.1.1 Do you believe that LLU has the potential to enable competition in a greater range of local areas, speed up the introduction of competition and increase the number of competitors? If you think it does not, please explain why.*

*Q3.1.2 To what extent would the competitive benefits of local loop unbundling in any case be achieved through the development of existing cable TV networks, the introduction of fixed wireless access services, and the continued development of mobile telephony?*

*Q3.1.3 What other options should be considered as part of the development of the telecommunications sector?*

## 3.2 The scope for LLU – impact of any unbalanced retail pricing

The price paid for LLU should relate to the cost of providing the access. LLU would be viable for new entrants to the extent that the cost of access would be below the existing retail price for line rental, and bear an appropriate relationship to the retail prices for calls. However, in many fixed markets (and indeed in the new and fast developing mobile market) the cost of access is subsidised by call charges, in particular long distance and international changes. To the extent that retail prices may be unbalanced in this way, the impact of LLU will be more limited. There are two separate historical market distortions that are common:

- Line rentals may be low compared to call charges
- Trunk and international call charges may be high compared to local call charges.

Telecom Eireann considers that line rentals need upward rebalancing and has raised this question with the ODTR. It will be necessary to carry out a detailed review of TE access costs in order to properly address this issue. This review will be carried out in the coming months. Any rebalancing will also have to take account of the requirement for USO as outlined in the regulations on Voice Telephony (SI No. 71 of 1999), signed by the Minister for Public Enterprise last week. When this has been analysed, it is likely that a further consultation paper will be issued.

It is likely that the initial impact of LLU would be in the emerging market for higher rate services. This is a new market where LLU has the potential to be effective in creating competition from the outset, subject to the various technical issues that must be addressed. The higher retail tariffs available from services such as high speed Internet access and remote LAN access, mean that entrants may be able to compete effectively using LLU. Also, as these are new markets, entrants may find them easier to enter compared to capturing TE's existing customers and services.

Depending on the relationship between line rental and local call charges for an efficient operator, LLU could also start to enhance competition in the local call market as well. The economic benefits of LLU in long distance and access markets are likely to be small because the long distance market can be served almost as effectively using indirect access.

A second way in which access costs may not reflect real costs is where they are geographically averaged. It is not proposed to change this structure as geographic deaveraging of retail tariffs would have significant other consequences, and if necessary may be more appropriately considered in the context of USO.

Geographic averaging of LLU prices could result in -

- LLU prices that are higher than cost in urban areas, and
- LLU prices that are lower than cost in rural areas.

As a result LLU could be somewhat less attractive in urban areas and somewhat more attractive in rural areas. This distortion could discourage the development of new rural networks.

*Q3.2.1 Do respondents agree with the analysis above? On the basis of the existing price structure, what market segments would be reached? How quickly and to what extent will the broadband access market develop?*

## 3.3 Set up costs and benefits of LLU

This section outlines the set-up costs for LLU and provides some international estimates as to cost levels. These cost estimates seem high for the Irish context, and the ODTR would carry out a detailed scrutiny of any costings presented to it.

The costs of LLU comprise two network specific components and general system set-up costs. The network specific components are:

- local set-up costs. These are the costs of establishing the capability for local loop unbundling between two operators and in a particular location. These include the costs of co-locating equipment, establishing points of interconnect and establishing transmission links from these points to the operators' switches.
- line unbundling costs. Local loop unbundling requires a new physical cross-connection to be established and tested at the distribution frame. These costs depend on whether the distribution frame is integrated within the local switch or situated remote from it.

These have been estimated internationally as:-

- £60,000 local set-up costs for co-location of equipment at the point of interconnect, plus £300,000 for each interconnect link between a remote concentrator unit and an entrant's switch (in the case of physical access only).
- £20 per line unbundling costs if unbundling occurs at a switch and £35 if it occurs remote from the switch.

The general system set-up costs are the costs of establishing the capability for local loop unbundling regardless of the actual demand for LLU. These costs are largely manpower related. They include the effort required for bilateral negotiations, development of industry standards and solving regulatory disputes and arise inside the incumbent, the new entrants and the regulator. Estimates of up to 200 man years have been indicated for the effort involved although this is based on markets that are significantly larger than the Irish market.

Clearly the general set-up costs are likely to be lower, even substantially lower in Ireland. If the Irish market were to be more focussed on specific segments or types of

operation, the costs could be further reduced substantially. The responses to this consultation from players in the market as to whether they would wish to prioritise or concentrate on specific markets of types of LLU would be very helpful in reducing these costs.

**Benefits**

The benefits of LLU depend on:

- The extent to which LLU enhances competition in the markets for local telephony and broadband network access. This in turn depends on whether these are the markets that are being targeted, the extent or otherwise of any need to rebalance prices and the effective demand for the delivery of xDSL services.
- The benefits of competition. Typically these benefits are in productivity improvements visible in the form of lower prices, and in service innovation.

Neither of these effects is easy to estimate, and again the responses to this consultation will be helpful in determining likely effective demand.

There is a specific relationship between general system set up costs and the benefits of LLU because the potential cost of introducing LLU would be capped at the total system set-up costs. Thereafter, if LLU was utilised there would be competitive benefits which would increasingly compensate for the set-up costs to produce an economic benefit. If, on the other hand, LLU was not utilised then there would be no further costs to the economy.

These costs could be minimised by:

- limiting the forms of LLU which operators need to support,
- only requiring LLU implementation in response to committed requests.

The ODTR preliminary assessment is that the addition of LLU to the portfolio of services available to competitors is likely to be useful in proving more choice in seeking to upgrade the delivery of service and enabling them to deliver services more widely. It may also be useful to Telecom Eireann in gaining a return on currently under-used capacity. However, it is not, any more than any one of the other measures being introduced for the liberalised market, a single magic formula that will transform the market. The complexities of pricing and the technical issues need careful review to ensure that any framework meets the needs of the market.

*Q3.3.1 What are the views of respondents on the likely costs they would incur in respect of the setting-up of LLU? Please provide information and analysis in support of your answer.*

*Q3.3.2 Do respondents agree with the above analysis? If you do not agree please state why.Q3.3.3 In order to minimise system set-up costs should there be a limit on the forms of LLU which are required? Please give reasons for your answers.*

# 4. Costs and Pricing

## 4.1 Costs to be recovered

In order to meet a request for local loop unbundling, an access provider would incur several costs. Possible cost items include:

- Use of the local loop
- Make ready of space in the exchange
- Rental of space in the exchange
- Staff training
- Security for own equipment
- Provision of power and cabling.

Not all of these costs should be recovered in the form of unbundled local loop prices. Some of the costs should be regarded as part of the general provision of communications and should not be charged. This would apply to:

- Training, except in the operation of co-located equipment
- Tasks undertaken by the access provider to ensure the security of its own equipment.

*Q4.1.1 Which are the relevant costs to be included in prices for unbundled local loops? Please justify and support your answer.*

## 4.2 Price structure

There are two types of cost that the access provider may incur and that may need to be recovered in prices charged to the access seeker:

- Costs that are incurred once (one-off costs) but benefit all access seekers. Examples are the preparation of an area for co-located equipment, and the provision of an additional entry point into a premises. Physical co-location would produce the highest proportion of one-off costs.
- Costs that are specific to each access sharer. The ODTR suggests that these costs should be recovered directly from the access sharer either as a connection or a monthly rental charge for the duration of the contract.

One-off costs can either be charged as lump sums or amortised and charged as rentals. There are two possible methods of calculating charges:

- The shared investment approach, where the first access sharer pays the full cost, the second sharer re-pays 50% to the first sharer, the third sharer repays 25% to the second sharer, and so on
- The fixed price approach in which each access sharer pays the same with the price being set taking into account the expected number of sharers.

The shared investment approach may be more appropriate where there is considerable uncertainty whether there would be a second access sharer. In these circumstances the first access seeker must bear the risks of the required investment. However, these risks together with a negative effect on cash-flow, may be sufficient to deter entry.

The fixed price approach is simpler and less risky for the access sharer if more than one sharer is expected. It also introduces a profit or loss element for the access provider that may give it some minor incentive for increasing the number of access sharers.

*Q4.2.1 Should the one-off costs of local loop unbundling be recovered on a shared-investment or a fixed-price approach? Please give reasons for your answer.*

## 4.3 Pricing methodology

There are three basic choices to be made in pricing unbundled local loops. These are:

- Whether prices should be established on the basis of cost.
- Whether there are grounds to deviate from the cost-standard used for other (e.g. interconnect) services.
- Whether prices should be geographically averaged.

### Cost-oriented prices

There are strong economic reasons for establishing access prices for LLU on the basis of cost. Cost-oriented prices enable efficient build-buy decisions on the part of entrants. In other words, they would have the incentive to build their own facilities only if they could provide them at a lower cost than Telecom Eireann while maintaining quality and service delivery standards.

The ODTR considers that the prices for LLU should, in line with the principle of cost orientation set out in the legislation, be based on relevant costs. To price otherwise would prejudice the entrants' decisions against investment in their own access infrastructure.

Cost-oriented access price levels are the subject of discussion between Telecom Eireann and the ODTR. If Telecom Eireann is correct in its view that retail prices (i.e. line rentals) are subsidised by other services (notably long distance and international calls), a cost-based wholesale price for renting an unbundled local loop could be higher than the equivalent retail line rental. This issue will need to be revisited when the work on relevant access costing is completed.

*Q4.3.1 Do you agree that prices for LLU should be based on the costs of service provision? If not, please give reasons.*

*Q4.3.2 Do you consider that the issue of rebalancing should be resolved before the introduction of LLU, or do you consider that it, or specific aspects of LLU should be introduced more quickly?*

### The choice of cost standard

The choice of cost standard for interconnection pricing is the subject of a separate ODTR industry consultation exercise. The Director has stated that interconnection costs should be established based on forward-looking long run incremental costs (LRIC) of an efficient operator. The LRIC cost standard is the standard proposed for interconnect pricing by the European Commission in October 1997.

The Director considers that LRIC is an appropriate base from which to start to consider pricing of unbundled local loops. In this consultation the ODTR would like to receive views on whether any deviation from the LRIC standard is justified in the specific case of LLU. For example:

- The use of current costs may be inappropriate for unbundled local loops. Valuing the access network using current costs will usually lead to higher prices than using historic costs, whereas the opposite is usually true when valuing the core network. There is then a danger of setting LLU prices above economically efficient levels, and encouraging over-investment in alternative access networks. It may be better to set prices somewhat below current costs, in order to take account of the external costs that would be borne by third parties if an entrant invests in alternative infrastructure (e.g. the costs of disruption, delay and environmental damage when roads are dug up).
- Higher rates of return on capital employed may be appropriate for some LLU services. For instance, to provide higher bandwidth services TE may need to invest in new local loop technology such as multiplexors and xDSL modems. This investment could be risky, both because the technology is unstable and because the use of the new network components relies on demand from a third party (the access seeker). It may be reasonable that, for these components of the local loop, the access provider is able to achieve a rate of return which is higher than the rate which TE uses as an average for its sunk investment.
- The new LLU regime introduced in the Netherlands provides for the introduction of a sliding scale of pricing over 5 years, starting with historic costs (retail minus costs not appropriate to alternative operators) and moving to current costs over the 5 year period.

*Q4.3.3 Does LLU introduce special circumstances which justify deviation from the LRIC standard for establishing interconnect prices?*

*Q4.3.4 If so, what adjustments are appropriate and why? Please give reasons for your answer and supporting analysis if possible.*

*Q4.3.5 Should there be any time limit placed on any adjustments to LRIC? Please give your reasons.*

## Averaged or de-averaged prices

Averaged or de-averaged prices means that the price paid by an entrant for a local loop could be set as a single price across the country or could vary depending on the de-averaging basis used.

As indicated earlier, de-averaging is not under consideration as it would have implications far wider than LLU. In any event it is not clear what the scale of any variation of costs between different geographic areas would be.

It should be noted that:

- There is a movement in many countries towards fewer bands of tariffs and the extension of local call areas to achieve wider coverage at local rates.
- New entrants to the Irish residential market have established single tariffs for all Ireland.

*Q4.3.5 What are the implications if any, of the above for your approach to LLU?*

# 5. General regulatory issues

## 5.1 The Requirement for Regulation

As outlined in the previous sections, LLU is enormously complex and regulatory involvement appears appropriate to have it implemented effectively.

*Q5.1.1 Do respondents agree that if LLU is to be implemented there is a case for regulatory involvement? Please provide reasons for your answer.*

*Q5.1.2 If there is a case for regulatory involvement should there be a limit to the issues to be covered and the period of such intervention? What should be the limits and why?*

## 5.2 What services should be required?

As described in Chapter 2, local loop unbundling can be used to access the following services, either individually or as a bundled service package:

- Analogue PSTN
- ISDN basic access
- New telemetry services such as meter reading
- Higher rate xDSL services.

*Q5.2.1 If LLU is to be implemented which of these services, or combinations of services should be provided and what form of unbundling should be provided for each of these services?*

### Analogue PSTN

Physical access for PSTN is straightforward. The ODTR considers that this would be the basic service for local loop unbundling.

*Q5.2.2 How important is unbundling for PSTN access to the development plans of the new entrants?*

*Q5.2.3 What spectrum mask restrictions should be placed to safeguard compatibility?*

### Basic access ISDN

The demand for basic access ISDN is uncertain. If there is demand, then physical access with the new entrant replacing the analogue NTP would seems to be the best approach. Bitstream access may be possible but is likely to be difficult and less efficient.

*Q.5.2.4How important is unbundling for ISDN access to the development plans of the new entrants? Which access methods are preferred?*

### Telemetry services

The demand for telemetry services is also uncertain. If there is demand, further information is needed on the exact services proposed.

*Q.5.2.5How important is unbundling for telemetry services to the development plans of the new entrants? What services are envisaged?*

### Higher rate services

The approach to higher rate services is difficult but important. The technology is not yet in widespread use and so there is little experience to draw on. A few standards exist but they cannot be regarded yet as fully stable. There is considerable scope for innovation and potentially large demand, yet there is also a need for careful management of the local loop above the frequencies used for analogue PSTN or ISDN.

The ODTR does not consider that allowing unrestricted use of frequencies above those used for PSTN and ISDN is a viable option. Management is needed to ensure an efficient overall use of cables, to achieve compatibility with current systems, and to avoid a situation where current systems preclude further developments. Furthermore the choice of system would affect the number of subscribers that can be served, both because of the effect of line attenuation and the effect of mutual interference.

The main options are to:

- Defer any decision for, say, two years until there is more knowledge and experience
- Require access providers who offer higher rate services themselves, to offer physical access with the same or similar equipment, and/or bitstream access based on the same equipment, in a non-discriminatory manner. This would ensure equality of access but would not allow innovation on loops belonging to others. In practice this approach would limit the rate of innovation and the geographic coverage to that set by Telecom Eireann.
- Set reasonably stringent power spectrum and impedance limits and require physical access to be offered, but with a review of the whole approach after, say, four years. With this option interference levels would have to be monitored and the number of users limited if interference increases to an unacceptable level. The services would have to be sold as “best efforts – no guarantees”, and operators and users would have to accept that this access could be withdrawn later, although hopefully there would be a broadly equivalent replacement service in most cases.
- Specify one or more bitstream services to be offered universally with operators free to choose how to implement them.

The issue is to find the best balance between competition and innovation and the caution needed to protect service quality and leave scope for future developments.

*Q5.2.6 How should requirements be formulated for higher rate services? Which of the options identified is preferred? Are there other better alternatives?*

## 5.3 Limitation in existing capacity

Any requirement to provide local loop unbundling needs to be defined with considerable care. For example the following points need to be defined explicitly in relation to existing capacity:

- Does the requirement apply only to the use of existing cable capacity (e.g. loops already installed to buildings), or is there a requirement to add new loops if requested? If so, does this apply only to buildings that are already served or to buildings not yet served (e.g. new buildings)? Should the requirement imply replacement with dedicated physical lines where pairs are currently shared between two or more subscribers?
- Does the requirement include cable replacement if more capacity is requested than is available, or if existing pairs in cables become faulty and unusable?
- Does the requirement extend to the provision of additional ducts if increases in capacity cannot be accommodated in existing ducts?

The approach to these questions should reflect whether unbundling is seen as an opportunity to use spare capacity in the incumbent's network to help the new entrant, or whether the provision of the local loop is seen as a central part of the incumbent's obligations.

*Q5.3.1 Where LLU requires additional investment by the service provider, how should the investment costs be recouped?*

## 5.4 Which operators should be regulated?

At present Telecom Eireann provides almost all the local loops to residential and small business premises. Therefore, if unbundling is to have any effect, any requirements which are introduced should be applied to Telecom Eireann.

However, if other operators develop their own local loops in some locations, should they also be required to provide unbundling in areas where they have network coverage? The case for this requirement is likely to increase over time as other operators gain coverage and customers. It would also increase as the number of services available on the same line increases as it would enable a customer to choose different services from different operators.

*Q5.4.1 Should requirements apply to operators with Significant Market Power or to all operators in the fixed market or to all operators of local loops?*

*Q5.4.2 Are there categories of local loop operators to whom requirements should apply? What are the categories and what criteria should apply e.g. market share, penetration, absolute size or other criteria?*

## 5.5 Provision of information

Adequate provision of information is essential for local loop unbundling. The information required would depend on the form of interconnection and the exact nature of the regulatory requirement.

In order to plan their use of unbundled local loops, access seekers need information on what is available. Although little information is needed for PSTN services, information is needed to make effective use of LLU for higher rate services. This information may include:

- The location of premises
- The length statistics of local loops in each remote concentrator area

- The extent to which systems other than plain copper local loops are used
- The connection arrangements, including the cable, connector and transmission systems used as appropriate. It may not be possible to specify transmission systems solely by reference to standards because systems may incorporate non-standard features. Thus it may be necessary to specify the equipment used.

The ODTR considers that this information could be provided in the form of a standard offer which is updated regularly.

Since the provision of unbundling is dependent on adequate capacity being available in existing cables, then information on available capacity should be provided on request within a specified timescale. Without this information, entrants would not be able to plan their services nor to market them effectively. For example, they may entice a customer to adopt a new broadband service only to discover that the customer's local loop is unable to support that service.

*Q5.5.1 Do respondents agree that there should be a standard offer for LLU?*

*Q5.5.2 What information should be published in the standard offer to enable access seekers to develop their plans for using unbundled local loops and why?*

*Q5.5.3 Are any other initiatives needed to ensure adequate provision of information?*

# Annex 1: Status of LLU in other countries

## A1.1 Overview

In the EU, six countries (Austria, Denmark, Finland, Germany, the Netherlands, Sweden) offer or are in the process of implementing varying levels of local loop unbundling and almost all other Member States are engaged in studying or planning for the introduction of LLU. LLU is required in the USA and in Canada and under consideration in Australia.

## A1.2 Developments in key countries

The following paragraphs give a picture of the developments in some leading countries.

### Finland

Unbundling of copper loops (but not fibre) with physical access is required and in operation. The access method is direct connection with access seekers bringing copper cables into the provider's premises and the provider terminating them directly onto the main distribution frame. This is the simplest and cheapest solution and interconnections can be established in 2-4 weeks.

Some operators are beginning to use xDSL equipment. If problems are experienced then TAC will introduce a technical regulation.

Some of the local operators such as Helsinki Telephone Corporation maintain databases of the use of their local loops but have difficulties in keeping the data correct and up-to-date.

The main problems being experienced are:

- Difficulties in negotiating prices, which would only be regulated as a matter of last resort
- Shortage of capacity in buried cables (not in ducts) that cannot easily be replaced, and uncertainty about obligations in these cases
- Refusals to provide pairs because of lack of capacity but with the full details not being given to the access seeker
- Time delays in providing individual pairs.

### Germany

LLU is available in Germany and a standard agreement is used. Access is available in some 8000 locations. Co-location is the main method but virtual co-location is required if it is not available. Connection takes place at a frame supplied by Deutsche Telekom on the wall of the co-location room, which is shared by access seekers who may also request cages. Access seekers have 24-hour access to their equipment.

The arrangements seem to work satisfactorily so far, partly because the regulator has a strict control of prices. The early stages of competition have been dominated by long distance and international competition, and commercial attention will focus more on

the local loop in the medium term. It is expected that higher speed services will form the core of demand for LLU.

## USA

Unbundling is in widespread operation, and some very small operators are reported to be making a viable business using unbundled local loops, PBXs and number portability. The requirements apply to both copper loops and higher rate systems such as primary rate ISDN.

The required solution is co-location and most incumbents insist on providing separate areas where cages are normally used. Contentious issues are:

- Pricing
- Set-up time and cost (typically there is an up-front charge of $50 000), including high prices for cages
- Unnecessary costs e.g. additional frames
- Charges for make-ready, where access seekers claim that the are required to pay for having buildings brought up to current standards (e.g. asbestos removed)
- Lack of space for co-location, especially where cages are used
- Lack of transparency or independent audit where access is refused

Some access seekers would prefer virtual co-location for higher rate services. A general solution for the use of xDSL has not yet been formulated.

# Annex 2 Higher rate xDSL services

## A2.1 Types of xDSL

A great deal of interest is focused in many countries on the development of xDSL[1] devices for sending high bit rates down copper pairs in addition to PSTN voiceband signals, especially for Internet Protocol (IP) based services. There are several different types of xDSL device with different characteristics in terms of the bit rate achievable, the length of line over which they can operate and the symmetry of the communications.

The following lists the main types:

**Basic rate DSL**

This is the system used for basic access ISDN. It provides two 64 kbit/s B-channels and the 16 kbit/s D-channel. It has a range of some 5-6 km.

**High Speed DSL (HDSL)**

HDSL is similar to basic DSL but operators at higher speeds and can combine the transmissions on two or three pairs to provide a 2Mbit/s circuit. Range is 3-4 km. A later version (HDSL-2) using more processing and a more advanced modulation is being developed to provide 1.5 or 2 Mbit/s on a single pair.

**Single Pair DSL (SDSL)**

SDSL is under development to provide 2Mbit/s on a single pair.

**Asymmetric DSL (ADSL)**

ADSL provides different rates in each direction with up to 8Mbit/s from network to subscriber and up to 640 kbit/s from subscriber to network. This asymmetry is considered to be well matched to the needs of subscribers who may wish to consume high rates of information (e.g. videos) but will only generate lower rates. ADSL uses a transmission system which is confined to the frequencies above those used for telephony and so it can be used on lines that are also used for telephony. There are several alternatives for the line codes, but Discrete Multi-Tone (DMT) is becoming the preferred choice.

**DSL Lite**

DSL Lite is a variant of ADSL designed to simplify the installation at the customer premises by removing the need to a splitter or filter to separate the telephony and DSL signals. DSL Lite is still under development and the details are not yet stable. It is likely that the performance of telephony or other services on the PSTN would be degraded somewhat while the DSL Lite systems is in operation.

**Very High Speed DSL (VDSL)**

VDSL systems are designed to provide bit rates of 12 or 25 Mbit/s with ranges of up to 1000m. They would be deployed in conjunction with fibre to street cabinets. The systems are still under development.

Figure A2.1 summarises the systems.

[1] DSL stands for Digital Subscriber Line

Figure A2.1: Digital subscriber line systems

| System | Capacity | Pairs used | PSTN on same line? | Range |
|---|---|---|---|---|
| **Basic DSL** | **Symmetric 160 kbit/s** | **1** | **No** | **5 - 6 km** |
| **HDSL** | **Symmetric 2 Mbit/s** | **2 - 3** | **No** | **3 - 4 km** |
| **SDSL** | **Symmetric 2 Mbit/s** | **1** | **No** | **Not known** |
| **ADSL** | **Asymmetric < 8 Mbit/s down < 640 kbit/s up** | **1** | **Yes** | **1 km for 8 Mbit/s**<br>**5 km for 2 Mbit/s** |
| **DSL Lite** | **Asymmetric < 1.5 Mbit/s down < 512 kbit/s up** | **1** | **Yes** | **Not known** |
| **VDSL** | **12 Mbit/s or 25 Mbit/s** | **1** | **No** | **< 1km** |

## A2.2 State of development

The development and plans for use of xDSL are not yet stable, although it is expected that such devices will begin to be deployed widely in late 1999. The following attempts to summarise the issues as currently understood:

- xDSL services will not work over the same length of pair as analogue PSTN, hence not all subscribers reached with PSTN will be reachable with higher rate services
- different types of xDSL provide different service characteristics with different maximum transmission distances and different compatibility issues
- xDSL services are more sensitive to the type and condition of copper pairs and it cannot be assumed that all pairs in a given cable are equal in their capacity for carrying xDSL signals
- xDSL is not compatible with some systems used on existing pairs where, for example, a single pair is used to provide two PSTN circuits or where other features are provided by out-of-band signalling
- unless there is an electronic xDSL NTP to act as a buffer, compatibility in the cable can be affected by customer wiring and the characteristics of terminal equipment. This is likely to be much more of an issue for xDSL than it has been for PSTN

- in order to maintain compatibility and avoid interference, there will be a limit to the number and mix of xDSL services that can be carried on a given cable. This limit is likely to depend strongly on the type and age of the cable and will be hard to define
- xDSL technology will develop significantly over the next few years and systems installed in the near future may restrict the capability for later technology to the used on the same cable

There is as yet no established approach to these issues. In the UK, Oftel has consulted on them and the UK Network Interoperability Consultative Committee (NICC) is studying them and at present seems to prefer the bitstream approach for higher rate services with management carried out by the access provider. (Local loop unbundling for PSTN/ISDN is not required in the UK.) NICC has published a two-part detailed technical report on the use of xDSL technologies and these reports represent the best currently available technical analysis:

"Report on the potential for DSL technology in the UK

- Part 1: Interference issues
- Part 2: Interoperability issues for DSL-Lite technology"

Both are downloadable from: http://www.oftel.gov.uk/NICC/Public

## A2.3 Conclusions

These factors lead to the following conclusions for higher bit rate services:

- Local loops require much more active management to maintain compatibility. Management and restrictions that ensure compatible, preferably similar, equipment will enable more pairs in cables to use xDSL
- The additional of higher rate services is likely to involve changes at the NTP end of the loop as well as at the exchange/concentrator end
- Services cannot be offered indiscriminately to subscribers because some subscribers will be out of reach, and once the capacity limit is reached more subscribers cannot be accommodated