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ETP RECOMMENDATIONS ON LOCAL LOOP UNBUNDLING:

PROVISIONING AND O&M ISSUES

SEPTEMBER 2001 ISSUE 2

CHANGE CONTROL

DATE	ISSUE	CHANGE
June 2000	1	Original document
September 2001	2	Introduction updated to include reference to Regulation and sub-loop unbundling
		Glossary updated
		New appendix 2 included on sub-loop unbundling
		Appendix 5 deleted
		Appendix 6 updated
		Appendix 7 updated

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APPENDICES

0 INTRODUCTION AND SCOPE

0.1 The Working Group was established at the ETP Plenary Session in September 1999. The first meeting was held in November and the mandate was approved at ETP Plenary also in November.

0.2 The Working Group was established before the Commission's Recommendation[1] and it has addressed only issues relating to the Commission's Option 1 as described in the earlier Working Document[2]. Specific issues associated with Options 2 and 3 are not addressed in this document.

0.3 This document, drafted by members of the ETP, is intended to provide a common set of procedures to which operators can refer to when introducing services over unbundled fixed copper local loops. This document does not necessarily represent EU or any national regulatory authority rulings. The document provides recommendations on the provisioning, operational and management issues connected with these services, without prejudice to existing regulatory provisions and is not intended to be a source for regulatory obligations. As well, it is recognised that in any one Member State the products and services listed in the document may differ

0.4 The mandate of the group:

Objectives and Scope of the WG

- The WG will prepare a common set of procedures to which Operators can refer when introducing services over unbundled local loops
- Primarily focusing on copper loops using xDSL access technology
- Avoid unnecessary duplication of work across Europe
- The following will NOT be addressed by the group but the group will take due regard of these issues
  - technical and standards issues
  - specific spectrum management plan (allocation of frequency bands)
  - costing and pricing
  - EMC radiation issues
  - power line or cable modems

Scope of Work proposed

- EMC cable management (within the cable bundle)
- Collocation
- Testing
- Maintenance
- R&TTE and related CPE issues
- Provisioning, installation & commercial issues
- Line / cable management

- Issues for formulating spectrum management plan

Source documentation

- The WG will take due account of existing work, including for example:
  - ETSI documents especially from TM 6
  - ONPCOM (99) 44 High speed internet access & ADSL deployment
  - UK NICC
  - ETP Network Integrity O&M handbook

0.5 The aim is to recognise and make use of existing work produced at member state level and adopt a flexible approach compatible with the ongoing development of policy in member states, ensuring that this document continues to provide recommendations as to best practice.

0.6 Timescales for the group

- 23rd / 24th November approval of ToR by ETP Plenary
- March 2000 review of draft deliverable
- May 2000 approval of final draft
- Mid May 2000 circulation of draft to ETP
- June 2000 Plenary approval of output

0.7 This document (Issue 1) is the deliverable to ETP Plenary June 2000.

0.8 **Commission Regulation on unbundled access to the local loop**[3]

In September 2000, the Working Group was asked to update its recommendations on unbundling to include issues relating to sub-loop unbundling. These can be found at Appendix 2.

0.9 This document (Issue 2) is the deliverable to ETP Plenary September 2001.

[1] Commission Recommendation C(2000)1059, 26 April 2000, On Unbundled Access to the Local Loop: Enabling the competitive provision of a full range of electronic communications services including broadband multimedia and high-speed Internet

[2] DG Information Society Working Document, INFSO A/1, 09 February 2000, Subject: Unbundled access to the local loop

[3] Regulation (EC) No 2887/2000 of the European Parliament and of the Council of 18 December 2000 on unbundled access to the local loop

1 PRODUCTS AND SERVICES

1.1 Background

The aim of this document is to list the main product items needed for a clear description of unbundled local loop products and services as provided by the LLP.

This should also include customer premises aspects, although this varies a great deal between countries. The aim of this document is to look at copper pairs, not fibre. The local loop refers to the copper pair between the customer's premises and the telecommunications operator's MDF.

Diagrams of business models, describing a set of roles and commercial relationships, as well as technical descriptions will not be primarily analysed. This WG is not looking at business modelling but this definitely needs to be addressed at a later stage. The working group mandate does not include issues surrounding line sharing. For this reason issues raised by line sharing will not be covered in this report.

1.2 Driving Principle

To ensure non-discrimination between the LLC requests and the LLP use of the local loop.

1.3 Collocation Product components

Four product groups are identified as required to enable LLU:

- Access to the raw copper loop (network elements);
- Collocation products;
- Interface to the Operational Support Services e.g. provisioning, ordering, fault resolution, maintenance etc.
- Provision of data information (e.g. network information)

Recommendation 1.1

The product definitions should at least cover four types of products:

- Access to the copper pair product
- Collocation product
- Interface to the Operational Support Services eg. ordering, fault resolution, product
- Provision of data product

The individual components in each of the categories will be covered below.

1.3.1 Access to the copper pair product

The product can be based on any copper pair that can be provisioned in accordance with a minimum set of technical standard specifications in accordance with the cable management plan. These standards can be divided into frequencies and number of copper pairs. Nevertheless, it does not necessarily need to use the existing customer telephone line, ie. spare pairs can be used.

Demarcation points are:

- MDF (Main Distribution Frame) at the operator side
- end-user premises at the NTP (Network Termination Point), the LLP defines where this is.

The product will be provided with a service level agreement that has to be agreed between the LLP and the LLC. This could either be related to the specification criteria as specified above or to line length and characteristic.

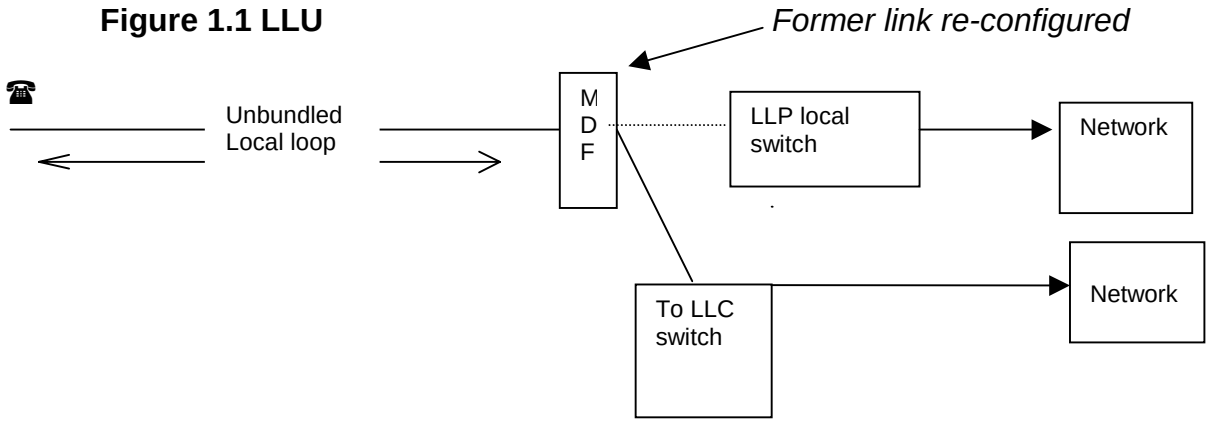
Recommendation 1.2

The copper pair product should be provided subject to a service level agreement agreed between the LLP and the LLC.

Illustration for ULL services

The end-user wishes to change his network provider, and the LLC uses an unbundled local loop to take over the subscriber from the LLP and to provide competitive services.

Figure 1.1 LLU



Copper Path

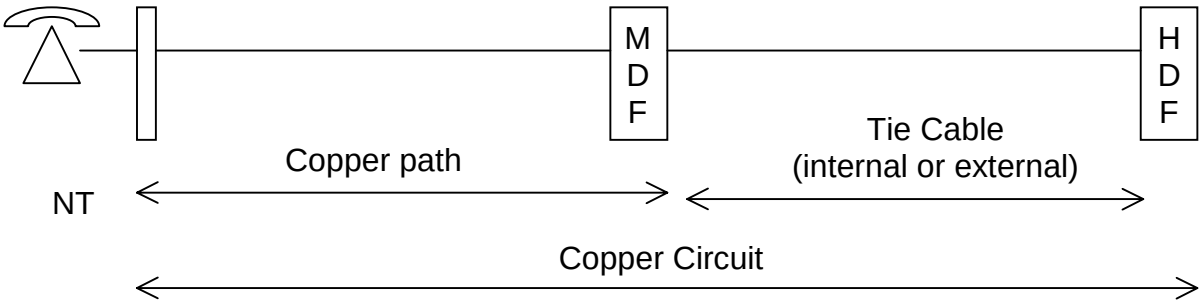
A copper path is a 2-wire, point to point, copper transmission path, extending between a Network Termination Point at a served end-user premise and a Main Distribution Frame located in a MDF Site. This is indicated in Figure 1.2 below.

Copper Circuit

Copper Circuit is a 2-wire, point to point, Copper transmission path, extending between a Network Termination Point at a served end-user premise and a Handover Distribution Frame (HDF) in the LLC's collocation (Physical, Shared, or Distant), as shown in the diagram above. A copper circuit comprises both an copper path and a 2-wire Copper transmission path within either an Internal or an External Tie Cable depending on collocation type.

Various LLPs have different types of copper products (information regarding the various types can be found at some of the website addresses in Appendix 6).

Figure 1.2 Circuit & path definitions



1.3.2 Collocation product definition

There will be several components to the collocation product including:

Internal Tie Cable
The provision, including testing, termination and maintenance of Copper tie pairs. Each cable will connect termination blocks on the exchange side of the MDF with either a Handover Distribution Frame (HDF) in the LLC Physical Collocation room/site, or with the LLP Cable Chamber for subsequent connection to an LLC Distant Collocation site. The tie cable product will include termination blocks at the LLC end, to enable connection to the HDF.

External Tie Cable
Is defined as the copper connection between the exchange side of the MDF and the HDF at an LLC Distant Collocation node.

Handover Distribution Frame
The provision (including installation) and maintenance of an HDF within the Operator Equipment Room, or in appropriate street furniture designated by the Operator, or in a distant collocation node. The HDF will be chosen by the Operator from a range of sizes. The HDF includes only the 'iron work' and excludes termination blocks, which are provided as part of the Internal or External tie cable. The HDF will be located in the Operator Equipment room according to the agreed room layout.

Backhaul Set-up Service
Pull-through and connection of an LLC's fibre cable from an Optical Distribution Frame (ODF) in the operator's Physical (or Shared) Collocation to a defined Footway Box sited by LLP as near as is practicably possible to the building main cable entry but outside the curtilage of the LLP MDF Site.

Operator External Tie Cable Pull-Through Service
The pull-through of a LLC-supplied External Tie Cable, from a defined Footway Box to the Cable Chamber and connection from the Cable Chamber to the MDF by an Internal Tie Cable, as described in this document. This service also includes co-operative end- to-end Copper circuit testing and labelling.

Escorted Access to the HDF/MDF Site Services

Where the LLP MDF Site, in which the LLC has a Physical or Shared collocation site, does not provide dedicated entrance facilities for the LLC to gain access to its HDF and associated equipment, the LLP will provide escorted building access services.

Recommendation 1.3

If secure, 24/7/365 access is not available, escorted building access services should be offered:

- planned access, during normal working hours
- planned access, outside normal working hours
- unplanned access, during normal working hours
- unplanned access, outside normal working hours

Types of Collocation

Physical collocation on the premises of the LLP, with LLC equipment housed in a variety of ways including caged areas, separate rooms, common rooms, common caged areas, etc.

Distant collocation where the LLC equipment is housed near to the LLP premises but not on the LLP premises. In some member states this may be called adjacent or virtual collocation.

Virtual collocation where the LLP houses, owns and runs equipment located in its premises on behalf of the LLC.

1.3.3 Interface to the OSS

In order to gain efficiency in the operational process, especially during the ongoing process of LLU, between the LLP and the LLC, it is important to define specifications concerning an interface between the LLP and the

LLC information systems. Technical specification concerning the content of this interface and the protocol and type of exchange need to be defined on a national level. A sensible delay between the preparation of the specifications and the implementation must be agreed on a consensual basis in the transitional period.

There is correlation between the OSS interface and the Information products that are provided by the LLP.

1.3.4 Provision of Information

Provision of network information is another key product. Information about the MDF sites, coverage, maps or postcodes covered by particular MDFs, is necessary in order to enable operators to evaluate the market for LLU prior to investing in equipment and resources.

Data may be divided into two parts, some available as a basic and some on demand. The definition of this information, as well as the classification between basic and on demand has to be decided. Types of information provided, which will vary among member states, may include:

- postcode coverage or MDF to postcode mapping
- location and postcode associated with the MDFs and the name of the associated local switch
- size of MDFs, ie. number of lines
- maps - paper or electronic
- list of street names
- number ranges associated with MDFs
- information concerning line characteristics
- line length distribution per MDF
- type of disturbers per MDF
- distribution of each class of spectrum management per MDF

In order to cope with the evolution of the local loop architecture, for instance extension of FTTC, FTTB facilities or reduction of the number of local switch implying transforming of MDF into remote distribution frames it is necessary to have visibility of proposed changes to the network. The level of the information refreshment will vary on a country-by-country basis and is subject to contract between the LLP and the LLC.

Recommendation 1.4

Exchange and provision of information should be agreed between the LLP and the LLC, in a non-discriminatory fashion, and the information should be updated at agreed, regular intervals.

Recommendation 1.5

Information provided by the LLP to facilitate LLU should made available in a controlled, secure fashion. Information can be obtained via a web-based interface or web publisher, or by other means, for example, by CD-ROM.

2 COLLOCATION

2.1 Background

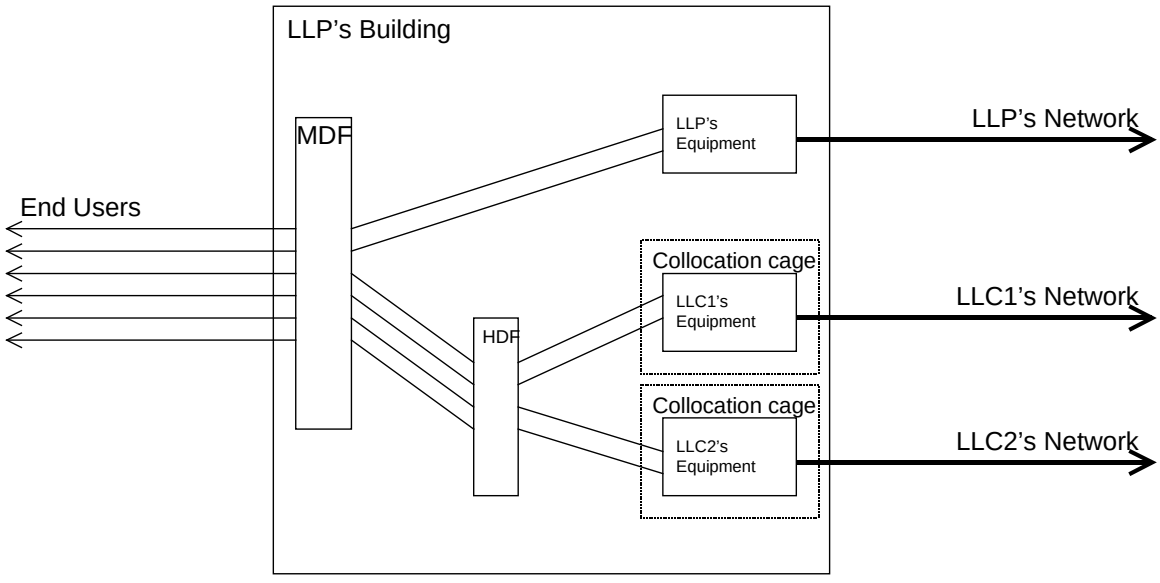
The unbundling of the local loop will result in the LLC being able to connect equipment to copper pairs directly. Operationally, it is essential that the line termination device of the LLC is located as close as possible to the LLP's Main Distribution Frame (MDF), particularly in cases where xDSL service is to be offered, because of the associated limitations on the length of the copper tail with such technologies. This requirement will result in LLCs wishing to collocate their equipment with, or as near as possible to, that of the LLP.

2.2 Physical Collocation

Wherever possible, the LLC should be allowed to locate its equipment in the same building as the LLP's MDF. This is known as Physical Collocation (see Figure 2.1) and raises a number of issues that need to be negotiated and agreed before equipment can be installed, such as security, compatibility, access to space and safe operational practices.

The equipment configuration in Figure 2.1 shows individual LLCs having physically separate collocation cages. It should be noted that this is only one of many different ways that LLC equipment can be housed. The options that are available will be discussed later in this section.

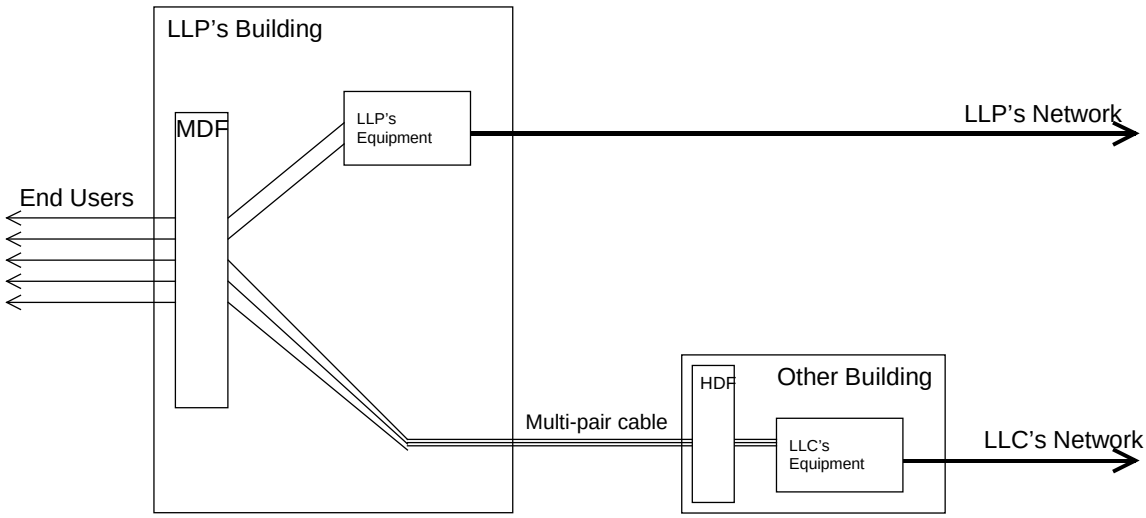
Figure 2.1 Physical Collocation



2.1.2 Distant Collocation

In some cases it will not be possible for the LLC to gain Physical Collocation space, and so an alternative site for equipment to be housed, should be sought. This site should be as close as possible to the LLP's MDF and fed by multiple-pair cables. This is known as Distant Collocation (see Figure 2.2).

Figure 2.2



As with Figure 2.1, the layout displayed in Figure 2.2 is not the only Distant Collocation option. It could easily be that many LLCs share a single Distant collocation site, or that each LLC has their own building near to the LLP's. Also, HDFs may be allocated per site, or per LLC. In both Physical and Distant Collocation, the HDF acts as a point of demarcation between the LLP and the LLC networks.

In both Physical and Distant Collocation, the HDF marks the point where the LLP's responsibility for the Local Loop ends and the LLC's begins. There should be at least one HDF per collocation site, although it is quite possible to have as many as one per LLC at that site.

2.1.3 Virtual Collocation

A third collocation option exists, which overcomes many of the issues that need to be negotiated in Physical Collocation, but also generates other problems such as the inability of the LLP to provide the necessary service and maintenance. The LLC provisions equipment to be housed in the LLP's real estate, but it is the LLP that maintains that equipment, thus removing the requirement for the LLC to have access to the LLP's building. However, this option does provide difficulties for both the LLP and the LLC. This is known as Virtual Collocation.

2.2 Issues considered

Collocation of equipment is not a new idea in telecommunications, and so many of the issues that occur in such arrangements are considered in more general terms in other documents[4]. It is important that these issues are considered in the light of the specific challenges that Local Loop Unbundling (LLU) presents, and that any additional issues that are specific to LLU are taken into account. To this end, the following areas have been identified for discussion here:

- Facilities available
- Availability of suitable space
- Allocation rules
- Reservation of space
- Timescale for provisioning
- Security
- Access to space
- Restrictions on use
- Third party agreements

In some cases, the resolution of these issues will have to be negotiated between LLCs and LLPs on a case-by-case basis. Where this is the case, recommendations on these negotiations will be made as far as possible.

2.2.1 Facilities available

For collocation to be viable, a number of facilities must be available. These facilities should meet predetermined and documented minimum requirements for safe maintenance and operation of the equipment to be installed within. Space within an LLP's real estate will be referred to from here on as 'suitable' if it meets the requirements.

Recommendation 2.1

Suitable space within the LLP's real estate for Physical Collocation should have the following facilities available to the LLC:

- physical floor space, sufficient for the installation of necessary equipment and safe maintenance of that equipment once installed.
- a physical interface to the local loop by means of a HDF
- power supply, including provision for back-up powering where possible
- necessary ventilation and/or air conditioning to allow for the thermal compatibility of all equipment within the collocation space
- earthing points for equipment
- sufficient light for installation and maintenance

Recommendation 2.1 continued

- power points for small power devices, such as test equipment
- smoke and/or fire detection systems
- provisioning of security measures for both property and access
- access to and use of basic amenities for LLC personnel

each of these facilities should be provisioned to at least the minimum requirements for safe and functional operation and maintenance

2.2.2 Availability of suitable space

Space within a LLP's real estate can only be considered suitable for collocation of LLC equipment if the facilities detailed in Recommendation 2.1 are in place

In cases where space is deemed unsuitable for collocation, the possibility of redevelopment of that space, where this is reasonable, shall be thoroughly investigated, particularly in cases where rejection is on the grounds of insufficient lighting, powering, access to the loop or air conditioning resources or because of issues surrounding security of the LLC's and/or LLP's equipment. The cost of any required redevelopment may be incorporated in the collocation fees. Where lack of floor space is cited as a reason for refusal of access, alternative solutions should be investigated by the LLC.

Recommendation 2.2

A definition of the standards that should be met in order for space within the LLP's real estate to be considered "suitable" should be decided through negotiations between interested industry parties, and recorded by the NRA. However, special needs as specified by the LLC may be consiered by the LLP on a case-by-case basis, provided they are not detrimental to equipment of other LLCs or that of the LLP on the same site.

Recommendation 2.3

Where an LLC requests collocation space within the real estate of an LLP (Physical Collocation), if suitable space (not pre-reserved by other LLCs or the LLP) is available within the specified real estate it should be allocated to the LLC making the request.

Recommendation 2.4

If the LLP is unable to provision any suitable space within the requested real estate and is unable to redevelop the real estate to provision, it is their right to refuse the collocation request of the LLC. In such cases the LLP should detail all reasons for refusal, so that the LLC may challenge the decision if they disagree with the LLP's decision.

2.2.3 Allocation rules

Rules for the allocation of space should address the following factors:

- The number of LLCs seeking space at any given site
- Available capacity
- Requirements of the individual LLCs
- Reservation rights of the LLP
- Possibility of relocation due to closure of the real estate.
- Limitations on the usage of the capacity
- Technological development

In general, space should be allocated on a First Come First Served basis. However, initial offerings of collocation sites may need to be handled differently.

Recommendation 2.5

The LLP and potential LLCs should agree in advance the processes to be used for allocation of space within the LLP's real estate, both for the initial launch of unbundling and for steady state demand.

Recommendation 2.6

Should the LLP decide to close the building where Physical Collocation is in use, the LLP should provide reasonable notice (agreed in advance) of site closure. The LLC must continue to be able to access local loops previously served through that site.

2.2.4 Reservation of space

It may be necessary for the LLP to reserve some space within their real estate. This space is for the LLP to expand and develop their own infrastructure. LLCs hold no rights to this space unless they have previously contributed significant capital to the site.

Recommendation 2.7

LLPs should have the option to reserve space within their real estate to allow for the continued development of their own network. Dated documentary evidence of these reservations should be made available to LLCs requesting space within relevant real estate in the case of dispute.

2.2.5 Timescale for provisioning

Guidance with regard to the timescales for the process from a LLC requesting collocation space to the installation and operation of equipment should be given and adhered to as far as possible. This will enable the LLC to provide its customers with an accurate estimate as to when they will be able to receive the services that the LLC intends to provide over the unbundled local loop.

Recommendation 2.8

The process from request for collocation space to installation of LLC equipment should contain at least the following steps:

- study request (LLC)
- reply to request, including results of study (LLP)
- order for collocation space, based on results (LLC)
- preparatory work, ready for installation of equipment (LLP)
- delivery of access, upon completion of preparatory work, for installation of LLC equipment
- installation of equipment (LLC)

Recommendation 2.9

The process for provisioning of collocation space should be documented in the reference offer, including agreed timescales for each stage of the process. Where these timescales are not met the party concerned should offer an explanation for delay and may be subject to pre-defined penalties and/or sanctions.

Different processes may be required when LLU is first offered compared to steady state when unbundling has been available for some time.

Timescales for provisioning of facilities to enable Distant Collocation must also be agreed.

2.2.6 Security

It is important to both the LLP and the LLCs that, once physical collocation has been agreed, their respective equipment is secure. Various solutions for keeping one operator's equipment apart from another's have been considered including physically separate rooms, lockable cages or racks. The applicability of these methods to any one local situation will vary based on a number of factors, with the most significant of these being cost and level of security required.

Recommendation 2.10

Provision of security for equipment should be negotiated by LLCs and the LLP in advance of LLU taking effect and should form part of the LLU reference offer. Security measures should take account of possible emergency situations, such as fire.

2.2.7 Access to space

Once space within a LLP's real estate has been provisioned, it is important to have clear agreement on how and when the LLC may have access to that space. Access will be required initially for the installation of equipment and subsequently for maintenance and upgrade of that equipment. Routine, planned maintenance is easy to provision for and can be pre-arranged with the LLP, but in the case of emergency repair on the part of the LLC, special procedures will need to be in place.

Where individual rooms are allocated to each of the LLCs, (e.g. with swipe card entrance to the rooms), access to their own equipment on a 24 hours a day, seven days a week basis is simple to manage without causing problems with security. However, where collocation cages and/or locked racks are in place, there is potentially the need for escorted access in all cases. Often, buildings housing collocation space are unmanned and the LLP may have difficulty meeting the expectation of the LLC for rapid attendance at sites where unplanned attendance to the LLC's equipment is required.

Recommendation 2.11

Wherever possible, LLCs should be granted access to their collocated equipment on a 24/7/365 basis.

Recommendation 2.12

Where 24/7/365 access for the LLC is not possible, the LLP and LLC should agree in advance the access arrangements and timescales.

2.2.8

The LLP should supply space for the LLC specifically for the installation and operation of equipment to terminate the local loops that have been allocated to them and for the transport of the LLC's traffic away from site. This covers the installation of TDM Multiplexers where analogue services are being provided by the LLC, Digital Subscriber Line Access Multiplexers (DSLAMs) where xDSL service is being provided, and also splitters for the separation of analogue and DSL signals where both are being provided.

Recommendation 2.13

Collocation space may only be used by the LLC for the housing and operation of equipment necessary to provide the services described under the negotiated LLU agreement, unless otherwise agreed between the LLP and LLC.

It is the responsibility of the LLC to ensure that its equipment installed within the allocated collocation space does not adversely affect the suitability of the surrounding space or fall outside agreed standards for equipment compatibility.

Recommendation 2.14

Equipment installed within the collocation space should be compatible with regard to electromagnetic emission and thermal requirements with the equipment already installed by other LLCs and the LLP. Where DSLAMs are installed, they must conform to any local cable management plan.

2.2.9 Third party agreements

Agreements between parties other than between the LLC and the LLP are, in general, to benefit both with regard to cost saving or operational simplicity. Such agreements should be encouraged provided they do not impact adversely on competition or on other parties' operations. Examples of such agreements might be:

- LLCs sub-contracting the installation and/or maintenance of their collocated equipment
- A number of LLCs leasing common backhaul

Recommendation 2.15

The LLC should be responsible for any actions taken on its behalf by a third party, subject to the agreement between the LLP and the LLC.

Recommendation 2.16

The LLP should allow LLCs to share backhaul capacity under agreement between the LLCs concerned.

[4] Recommended Practices for Collocation and other Facilities Sharing for Telecommunications Infrastructure, DG XIII of the EC

3 PROVISIONING

3.1 Background

Agreed and adopted processes for the provisioning of a service between two operators are critical for the efficient introduction of LLU. Provisioning procedures and the commercial principles that underpin them make the difference between effective implementation of a service, with all the associated competitive benefits, and a service that complies with national regulations but is difficult and costly to implement. Inefficient provisioning will effectively remove any competitive benefits to the detriment of all players in the market. Delays in provisioning will be especially harmful. There is significant potential for industry-wide co-ordination and common negotiation of provisioning processes and principles at a national and pan-European levels. This section documents the key issues that are likely to be faced in developing a provisioning process for LLU services in the EU Member States, assesses likely impacts, lists some possible processes to overcome the issues and, where appropriate, makes recommendations on a preferred solution.

As the communications industry converges in the area of broadcast and computing, the principles of e-commerce and the development of trading relations etc. that are Internet compatible will become the vehicle for information exchange and therefore ever more important. Electronic data handling is critical in the provisioning process and linkages to e-commerce and automated processes should be an integral part of the development of LLU.

3.2 Issues

3.2.1 Provisioning Definition

In this section, provisioning means the processes and procedures that enable the hand-over of local loops from an LLP to an LLC. There will be further processes involved in an LLC providing services to an end-user. It is assumed that the provisioning process includes the provision of information for the validation of business plans and that there will be commercial agreements between the LLP and the LLC prior to physical provisioning activity.

3.2.2 Clear Definitions of Products etc.

Development and deployment of an LLU service is essentially the same as that for any other new product development and will therefore be subject to normal product/project management principles and techniques. One of the key issues will be clear, unambiguous and agreed statements on deliverable products that make up the service. This will be particularly important for any aspect of the product that requires development by external suppliers, for example, changes to order handling and end-user

management systems, as these changes are generally on the critical path of any product launch. The service description also needs to be clear on the rights and responsibilities of each party at each stage.

3.2.3 Control of End-user Information

The relationship between the end-user and the LLP may involve a number of intermediaries such as competing operators, LLCs, resellers, etc. Each of these intermediaries will need information about the end-user and/or line but the end-user and the intermediaries also have rights/requirements for data confidentiality. It is therefore essential that the provisioning process ensures a timely flow of information between all parties involved in the provision of a service to an end-user within the context of data protection legislation and commercial confidentiality.

3.2.4 Order Handling Processes Between Operators

The aim of order handling should be an automated process which will facilitate competition and enable end-user demands to be met more readily. The details of the provisioning and order handling process need to be clearly defined in terms of information requirements, responsibility for provision of information, ownership of the process and ownership of the end-user/equipment at each stage. Additionally, issues such as contractual liability for the service to the end-user, fallback systems if local loop transfer fails etc., will also need to be resolved.

3.2.5 Rules for Allocation of Resources

LLU involves the transfer of a right to use resources that by their nature tend to be in short supply. Similarly, access to the connection points will need to be controlled in such a manner as to ensure that all necessary works on one asset does not jeopardise the operation of any other asset. Therefore it will be necessary to develop clear rules on what circuits are to be made available and how assets will be apportioned amongst competing parties in a fair and equitable manner. Even with this process, it will still be necessary to ensure that rules for handling the situation where no LLU resources are available for a particular end-user are well understood in advance.

3.2.6 Procedures to Ensure Service Continuity on Provisioning

The process of transferring a local access line from one operator's switching infrastructure to that of another is inherently liable to inject faults into the system, both for the line concerned and other lines/end-users in the vicinity. The provisioning process must therefore have a clear set of processes with agreed demarcation points, ownership, actions and escalation systems to deal with provisioning faults both on the line undergoing unbundling and others associated with it. It is also important that clear distinctions can be made between faults caused by the provisioning process (provisioning faults) and a fault caused by some

other event after the provisioning is complete. This gives rise to a responsibility to perform an agreed set of tests and hand-over operations to clarify this boundary.

3.2.7 Legal Liability on Failure During Provisioning

The fact that things can, and will, go wrong with the process of transferring local loop assets between operators means that at some point an end-user is going to feel that he has been disadvantaged or lost business etc. because of the failure. This will be particularly important for business lines but will also occur with residential lines particularly where operators concerned offer any form of service guarantee. Such failures will give rise to claims against one or more operators. It is therefore vital that ownership of the customer is clear at each stage of the provisioning process and the legal liability for actions in the hand-over is well defined. In addition past experience has shown that it is generally beneficial for all concerned if end-user service is restored as a matter of priority; disputes about where the fault lies and who is liable need to be held over until service is restored.

3.2.8 Line Qualification

Line qualification may be useful for the implementation, provision and maintenance of xDSL services on unbundled local loops. It provides information on which other requirements and features, such as the Cable management Plan, are applied.

- **Line qualification testing**

Current line test systems are based on the requirements for providing POTS to the end-user. Such testing will only provide a rough guide to the capability of xDSL service and will not guarantee that a circuit will carry the full service offering from the LLC.

Where an incumbent operator carries out routine line testing, a database of knowledge can be built and this may be used to provide information to the LLC at an early stage. Equally the LLC can test the circuit when it is passed over to its control. This would provide further relevant information on service capabilities.

Recommendation 3.1 The LLP, when providing routine pre-qualification line tests, should build a database of information on the metallic circuits handed over to LLPs.
The LLC also should build a database of knowledge on the metallic circuits in order to apply risk management on service capability.

- **Quality of service ("one-off" testing)**

At this time the only way of guaranteeing the quality of service to the end-user is to use two test sets to determine the throughput of the circuit. A number of test systems are available to provide "one-off" end-to-end capability testing before installation using this double-ended test process. This style of testing is expensive, especially when many hours are spent travelling from exchange to end-user and back again. Technology is now emerging that reduces the "one-off" testing to a single end reducing the cost of provision and maintenance. These test systems provide not only the xDSL capabilities but also further data on the quality of the cable and possible interference from other xDSL sources in adjacent pairs. These single-ended test systems can be combined with digital cross-connect systems to provide remote test and provisioning facilities.

In the unbundled environment it would be the responsibility of the LLCs to satisfy themselves as to the capabilities of the metallic path handed over by the LLP.

Recommendation 3.3

Wherever possible, the LLC should employ line-testing equipment which permits "single-ended" line testing.

- **Line test parameters**

The line test must determine the characteristics of the cable circuit used and estimate the line length and capabilities against known parameters. These parameters include the cable specification, wire diameter, mutual capacitance, impedance etc, and the equipment parameters that will be connected to the circuit, such as insertion loss, return loss, impedance etc. The normal "POTS" type parameters for electrical performance must also be applied so that any remedial work may be ordered if necessary. The latest DSL testing equipment utilises the higher frequencies to determine the throughput capabilities of the circuit under test and checks for longitudinal balance and crosstalk.

Recommendation 3.4

Line test parameters should match the contractual agreements between the LLP and the LLC.

- **Impact on live services**

Current test systems are intrusive, as they require direct access to the metallic loop. However, the latest systems are non-intrusive monitoring devices, which are able to detect faults developing both on the DSL

circuit and the physical loop. Both the LLP and the LLC should adopt such methods as they become available.

- **Untested metallic loops**

Untested loops passed by an LLP to an LLC will require testing by the LLC to determine their suitability for the LLC's equipment and service. Disputes over the suitability of the circuit could arise that might delay the provision to the end-user.

- **Right of appeal/redress**

Within the inter-operating agreement under any unbundling regime there should be review and redress clauses. These clauses will have to explicitly address time-scales and events for the reparation of the metallic loop as well as other issues created from disputes.

3.2.9 Installation Time-scales

A key commercial element of the process will be agreed time-scales for each stage of the provisioning operation, including order handling, validation, provisioning, testing and hand-over as well as any associated in-service fault handling. Clear definitions of these timelines and factors affecting their start- and end-point need to be included as part of the process and commercial agreement. If the various required inputs are not provided in a timely way, the LLU process may fail as end-users become frustrated during the critical service launch period.

Recommendation 3.5

Installation timescales should match the contractual agreements between the LLP and the LLC.

3.2.10 Performance Monitoring and Audit Trail Requirements

As part of the commercial agreement for this type of service it is usual to develop a system of monitoring and measurement of performance during and after the provisioning process to enable improvements to be made and to confirm that process parameters and commercial agreements are being met. This is also essential feedback to product managers and end-users on the quality of service that end-users can expect. For example, such measures as number of orders handled in a set time, with breakdowns into successful and unsuccessful orders, those processed within the agreed time-scales, reasons for failure etc. would all be candidates for this type of monitoring and measurement.

3.2.11 Forecasting and Provisioning Resources

As with other inter-operator products involving potentially large numbers of small orders (c.f. Number Portability and CPS), LLU is likely to require significant resources from the LLP to serve the needs of the LLC. The amount of resource required and who is responsible for predicting the resource, as well as what happens if resources are too few, or too many, will be a critical item in the commercial agreement. It is therefore likely that resource forecasting systems will be required to take account of the needs of LLCs in such a way as to ensure that sufficient resources are provided by the LLP for provisioning without the LLP incurring significant extra cost through over-resourcing.

3.2.12 Generation of Billing Data

As with any other commercial service it is important to consider at the outset how the end-user bill is to be generated and to ensure that the relevant data to enable this can be generated in a consistent and accurate manner. This will be particularly important when there are intermediaries involved, resulting in chains of bills. Accurate billing will require adequate and timely exchange of information between LLPs and LLCs within the context of data protection and commercial confidentiality.

Recommendation 3.6

Provisioning procedures should be developed jointly by the industry within Member States to consider and address the issues.

Recommendation 3.7

Order-handling and provisioning processes for unbundled local loops should comply with the principles of e-commerce.

4 CABLE MANAGEMENT

4.1 Background

In order to maximise the capability of the systems deployed over the copper network the effects of their mutual interference must be minimised. Even in the case of a single operator network an overall cable management plan must be in place to achieve this objective. However, where there are multiple operators over the same infrastructure, as in the case of an unbundled local loop access network such a plan is essential in order that:

- Maximum benefits are obtained for the end user
- All operators can understand the limitations the network places on their service delivery capability
- Installation is simplified by increasing the certainty of being able to deliver the required service
- Disputes may be minimised
- Disputes may be settled in a transparent way

In addition to maximising the benefits delivered, such a plan must ensure that this continues to be so by the encouragement of the evolution of copper access technology.

One important issue of cable management is the design of deployment rules, as these determine the achievable penetration limits, reach and bit rates with xDSL technology. Although the design of deployment rules for xDSL systems is determined mainly by technical figures, the business plans of all the operators that share a particular cable also have an impact. Since different operators may have different views on their individual expected business, it is possible that conflicts may arise over how to allocate the limited transmission resources of a cable to different types of xDSL systems.

This section offers guidelines on the issues associated with the generation of a Cable Management Plan. The guidelines are of a general nature and are not based on technical details. These will differ from country to country because of the differing conditions and deployment scenarios that already exist in the copper access networks. The target here is to provide basic rules that can be further detailed and codified by using technical figures, provided by standards bodies like ETSI TM6, in order to obtain the exact deployment rules for a particular country.

4.2 Issues and Recommendations

The generation of a Cable Management Plan is considered in the following stages:

- Setting the basic principles and objectives
- Developing the methodology
- Applicability of the Regulatory Regime relating to xDSL equipment and access to ULL
- Implementation
- Enforcement and Policing
- Maintenance and Evolution of the plan

Specific issues and recommendations associated with the above stages are highlighted within the text.

4.2.1 Setting the basic principles and policy objectives

4.2.1.1 Defining the variables

Before recommending particular guidelines or developing a Cable Management Plan, a clear definition of terminology to be used is required.

- **Transmission Systems and Classes**

We distinguish between different classes of transmission systems (ADSL, HDSL, etc.) on the one hand and different individual systems on the other hand. An individual system is a particular link on a particular twisted pair in a particular cable. In contrast to this, the term system class refers to a whole set of systems in the network. A system class is defined by the amount of noise disturbance that is introduced in the cable, which should be approximately the same for any system that belongs to the class. This means for example that *echo-cancellation based ADSL* and *FDM based ADSL* should be considered as different system classes. On the other hand, systems from different manufacturers may be considered to belong to the same class, if the system specification ensures the same signal parameters. We assume that any deployment rules refer to system classes.

- **System Reach**

Because of physical limits, xDSL systems are always limited in reach. This means that typically a certain amount of end-users on long loops can not be served, if the bitrate is predefined. For some technologies, reach can be extended by using repeaters. Achieving high reach is of major importance for high end-user penetration.

- **Cable Fill**

It may be necessary to limit the allowed number of xDSL systems per cable or per cable bundle in order to achieve reasonable performance. Hence, the allowed cable fill could be significantly below 100% (for example, in some complex environment, early implementations figures as low as 10% have been quoted).

- **Performance of xDSL transmission systems**

The primary performance parameter of an xDSL system is a combination of bitrate & reach. Performance is mainly determined by electrical cable length (attenuation) and the existing amount and type of crosstalk in the cable. Higher performance means higher bitrate at the same reach, higher reach at the same bit rate, or both parameters higher. In general the attainable performance will be set by the conditions of the network and not by choice of equipment.

With rate-adaptive systems, like certain ADSL implementations, the corresponding bit rate at a particular cable length is automatically adapted. In the case of systems with constant bitrate, like HDSL, varying performance in different deployment scenarios transforms into varying system reach.

- **Power Spectral Density (PSD)**

The PSD of transmit signals injected into a cable is one of the most significant measures for the negative impact on any other transmission in the same cable. Therefore, it is a key figure in any Cable Management Plan. More detailed discussions of PSDs for particular systems can be found in ETSI TM6 documentation.

4.2.1.2 Clear goals and objectives are essential

It is possible to create a number of Cable Management Plans with very different results depending upon the initial objectives. It is essential that these objectives are clearly stated, agreed by all parties and adhered to in the creation of a Cable Management Plan.

Recommendation 4.1

The following goals are the minimum set that shall be achieved by defining suitable deployment rules:

- ensuring network integrity
- achieving a high level of customer penetration for broadband services
- foster the introduction of innovative technology
- ensure efficient use of the transmission capacity of the cable

The protection of existing services must be guaranteed. Whether account should be taken of all existing services or just those services deployed in

significant volume needs to be considered (although all USO services should be taken into account).

Deployment is demand/market driven and decisions may be made on the type of xDSL systems to deploy and their bit rates to meet the business plans of the players in satisfying this demand. Where conflicts arise on this issue, attempts should be made to resolve them between the interested parties but where this cannot be achieved they may need to be resolved by the regulator.

Deployment rules must allow for the mixture of different system classes.

Situations such as a single pair having a signal so strong that many other pairs cannot be used, should be avoided.

4.2.1.3 Establishing clear roles and responsibilities

It is essential that the roles and responsibilities of all parties are understood. It is possible to distinguish logically between two distinct roles which have a different scope of objectives:

- The **Cable User,** both LLP and LLC**,** is characterised by its intention to make use of the existing infrastructure for delivering its services. The Cable User desires to have no limitations of reach and cable fill as it limits its possible business. On the other hand, the Cable User is interested in high performance for its end-users and also requires network integrity. Because of these goals on the other hand, he may be willing to accept reasonable deployment limits.

- The **Cable Manager**, LLP or independent body, is responsible for the provision and maintenance of a Cable Management Plan, whereby transparency and non-discrimination must be achieved.

4.2.2 Developing the Cable Management Plan methodology

Whichever methodology is chosen, rules are required to ensure network integrity and service quality. These are constraints on which, and how, particular transmission systems can be connected to the network. In particular, these refer to:

- PSD (→Frequency Management)
- Line length (→PSD against line length)
- Possible position in the cross-section of the cable (→ Pair Management)
- Allowed number of systems per cable or cable bundle (→ Cable Fill)
- The system orientation, where applicable, (e.g. the prevention of the connection of an ADSL system with high rate upstream).

Different combinations of these rules may be used to achieve the goals listed in Recommendation 4.1. One can see that because of different

network characteristics and available management systems there are two very different Cable Management Plan methodologies evolving in Europe:

- Control of the transmission systems and their deployment
- Control of the access network frequency spectrum

A Cable Management Plan may adopt either of these two methods or may be made up of a combination of the techniques described.

In the following a "Cable Management Plan" (CMP) will refer to any combination of the above listed restrictions in order to ensure that the goals set in Recommendation 4.1 are achieved. In special cases where statements are completely based on PSD limits, the more detailed term of "Access Network Frequency Plan" (ANFP) will be used.

4.2.2.1 Control of Transmission Systems and their deployment - Process 1

In this process, network integrity and performance are ensured by the following measures:

- Prior to any deployment of transmission systems the corresponding system class has to be tested (by third party or network owner). It is found to be compliant to the CMP if other classes will not be significantly degraded.
- The location within the access network (site and cable pair) at which the various transmission systems can be deployed is also controlled by the Cable Manager.

The adoption of this method requires:

- Accurate knowledge of the existing copper network deployment.
- Accurate knowledge of the way that systems are currently deployed over the network.
- Declaration of the types of systems that can be installed and the development of a CMP that defines which system classes may be deployed where in the network. This includes a plan on pair management and allowed cable fill. Frequency Management is performed implicitly by considering suitable system classes.
- A process to be put in place to record the deployment of the new systems.
- An authority to be in place to resolve disputes when the rules cannot be achieved.
- A vision of future systems in order that their effects may be taken into account.

The implementation of such a process, which must operate in a non-discriminatory way, could be complex, costly & time consuming.

The advantages of these efforts, however, are that the actual deployment situation is known, which will help in optimising the network utilisation and evolution and in the case of faults. Also the CMP will offer high performance. Finally, the measures mentioned above may be necessary to protect existing systems.

On the other hand, certain circumstances may not allow this procedure:

- In some networks, historically, a "random jointing“ policy has been adopted. This means that when joining two cables together, there was no need to ensure that the position of a pair within the binder in the two cables was maintained. Hence, adjacent pairs in one part of the cable may not be adjacent in another part of the cable making pair management not sensible.
- In some networks, records may not be adequate. In this case pair management is not possible.

4.2.2.2 Control of frequency spectrum - Process 2

In this process, no pair management is performed. Only an Access Network Frequency Plan (ANFP) is defined that is *technology-independent* and is applicable to all users of the access network. Typically, the ANFP is specified by a number of PSD masks applicable at a number of defined points in the access network. Any systems that transmit within the defined PSD are suitable for connection to the access network at that point. Systems with a transmit output in excess of the PSD mask may cause interference and a process is required for resolving the interference.

The adoption of such a method requires:

- The development of an ANFP which is technology neutral and can be agreed by all parties.
- Any transmission system on any pair. The CMP would allow any transmission system class that conforms to the ANFP to be used on any pair in the access cable.
- 100% cable fill by any system is assumed. This means that the CMP would allow *all* pairs in an access cable to support any of the transmission systems allowed by the spectrum ANFP. Equally, all pairs in the cable must be capable of supporting the same transmission system.
- Agreement to abide by the ANFP from the LLC before connection of LLC equipment to the unbundled local loop.
- Declaration of conformity to the ANFP by suppliers.
- A vision of future systems in order that their effects may be taken into account.

The advantage of this method is that management requirements are minimised. A disadvantage is that in case of faults the actual deployment is not known, rendering fault detection more complicated.

4.2.2.3 Summary of methodologies

It can be seen that Process 1 allows enforcement of the CMP prior to implementation. A process to resolve interference problems will still be necessary in the event of a modem malfunction, but this is unlikely to be a frequent occurrence.

For Process 2, there is no pre-implementation policing of the CMP. Hence, there is greater probability that interference problems will occur, (especially as the capacity of the access network to support broadband services reaches its limit). A robust and well-defined enforcement strategy needs to be defined and accepted by all parties. Such a strategy needs to be in place before local loop unbundling takes place.

The RTTE Directive requires terminal equipment at the end-user's premises, (but not at the exchange end), that meets the essential requirements of that directive to be allowed to be connected to the public network without further provisions. Hence, a method of control which requires manufacturers' equipment to be on a tested list before allowing connection to the network would appear to be contradictory to the RTTE Directive.

For both Processes 1 and 2, in addition to the PSD mask specification, there needs to be an associated test specification to allow testing of xDSL systems for conformance to the mask. The test specification needs to cover not only conformance testing at, or prior to, installation but also during operation (as this is required for CMP enforcement). Currently, there is no international recognised test method to fulfil this function and the international standards fora, including ETSI TM6, are studying this issue.

4.2.3 Applicability of the Regulatory Regime relating to xDSL equipment and access to ULL

The regulatory regime under which local loop unbundling is implemented in each European country is a matter for the NRA and is unlikely to be the same in every country. This section therefore reviews relevant EC Directives that NRAs may choose to use to enforce the CMP. Implementation of the CMP requires that xDSL equipment is in compliance with the technical conditions laid down in the CMP. There are no Directives that allow *a priori* enforcement of the CMP (for example, as would have been possible under the old Telecommunications Terminal Equipment directive where compliance to the CMP could have formed a requirement for terminal equipment approval).

4.2.3.1 Radio & Telecommunications Terminal Equipment Directive

The Radio and Telecommunications Terminal Equipment (RTTE) Directive 99/5/EC (which came into force on 08 April 2000) impacted fixed networks in three areas:

- changes to the telecommunications terminal equipment attachment requirements (removal of the approvals regime)
- the requirement on all public network operators to publish technical specification of their customer-network interfaces
- changes to the requirements under which network operators may disconnect terminal equipment that is deemed to be causing harm to the network.

All three of these areas have implications in the unbundled local loop environment and CMP enforcement. They are considered in more detail below.

- **Terminal Equipment attachment requirements under the RTTE Directive**

With the introduction of the RTTE Directive, terminal equipment for attachment to public networks needs only to comply with the essential requirements of the RTTE Directive. For fixed networks, these essential requirements are:

- safety
- EMC.

Whilst the directive does allow the possibility to make 'network harm' an essential requirement for certain types of interfaces, current discussions in TCAM indicate that no such essential requirements will be defined (at least for the present) [1].

Hence, xDSL equipment that meets the safety and EMC requirements may be connected to the fixed network as terminal equipment. Consequently, the RTTE directive as currently implemented cannot be used to enforce xDSL equipment connected to:

- unbundled local loops, or
- baseband leased circuits

to comply with the CMP defined for that access network.

Recommendation 4.2

That EC/TCAM consider the application of Article 3.3 of the RTTE Directive to make compliance to the CMP an essential requirement for connection to fixed analogue network interfaces.

[1] The R
terminal
failure/d
Commis
introduction of the RTTE directive. A network operator disconnecting a user because of network harm could result (via the processes set down in the directive) in the Commission having to re-consider the possible application of essential requirements for network harm.

- **Other Equipment outside of the RTTE Directive**

The definition of telecommunications terminal equipment used in the RTTE Directive does not apply to operator installed (network-side) equipment. Furthermore, it excludes equipment that may be connected (directly or indirectly) in the end-user's premises to the network but is not intended to communicate to an entity within the network. This is relevant to home LAN distribution systems currently on the market and for which standards are being defined in ITU-T SG15.

An example is the Phone Network Transmission system which has been specified in ITU-T SG15 in Recommendation G.pnt that has recently been determined. This recommendation was originated by the Home Phone Networking Alliance (HPNA)[5] which has developed specifications for Home Phoneline Networking equipment using 4-10 MHz frequency band. This overlaps with VDSL frequencies. The HPN signals will leak out onto the access cable either directly (if the HPN equipment is connected to the 'a' & 'b' pair) or indirectly via crosstalk (if connected to spare pairs in the end-user's wiring). The HPN signal will interfere with any VDSL on the end-user's line and via crosstalk, with VDSL on adjacent lines in the same access cable. However, the RTTE directive cannot be used to control the use of such equipment as this equipment does not fall within the definition of telecommunications terminal equipment used in the directive. Early implementations of Home Networking equipment used frequencies in the ADSL range and these would cause interference with ADSL systems.

- **Interface Publication**

Article 4.2 of the RTTE required all public network operators to publish technical information about their end-user – network interfaces in sufficient detail to permit the design of terminal equipment to be capable of using all the service provided through the corresponding interface. There is no regulatory obligation on terminal equipment manufacturers, suppliers or users to take notice of these declarations. Nevertheless, the publication provides the opportunity for network operators to specify any conditions that may be applied to terminal equipment avoiding harm to the network.

Recommendation 4.3

All network operators should refer in their interface specifications to the CMP applicable to the access network supporting their service as being the conditions that terminal equipment needs to meet in order to minimise the potential for network harm via crosstalk.

- **Disconnection of equipment according to RTTE**

Article 7(4) states that apparatus declared to be compliant to the requirements of the Directive but causes "serious damage … or harm to the network or its functioning“ may be disconnected by the network operator following authorisation by the Member State. Under such circumstances, the Member State needs to notify the EC who will consider the reason for the disconnection and consider whether additional essential requirements need to be included under the RTTE for such interfaces.

Article 7(5) allows network operators to make the disconnection in an emergency without the prior authorisation of the Member State *but in this case the network operator must provide the user, without delay and without cost to the user an alternative system.*

4.2.3.2 Restriction of access according ONP Framework and RVTD Directive

Article 13(2b) of the Revised Voice Telephony Directive (RVTD – Directive 98/10/EC) requires network operators to declare the conditions under which access to the network will be restricted or removed in order to protect the integrity of the network. Whilst the RVTD specifically applies to fixed public networks supporting voice telephony, Article 3(2) of the revised ONP framework directive (Directive 90/387/EC – revised) would allow the same requirements to apply to non-voice telephony networks.

Unlike the RTTE Directive, there is no requirement on network operators to provide a user an alternative system, if that user’s equipment is being disconnected because it is causing network harm. The only requirement is that the criteria for disconnecting such equipment are:

- published in advance,
- non-discriminatory
- based on objective requirements.

Both the RTTE Directive and the ONP Directive conditions apply to network operators. If there is any conflict between the two directives concerning the circumstances under which a network operator may remove access to its network, then this would need to be considered by the NRA.

4.2.4 Implementation of the Cable Management Plan

In developing a CMP, account must be taken of the many systems already deployed and their performance must be protected.

Recommendation 4.4

The CMP should be developed according to a transparent process and involve the Cable Users as well as the Cable Manager so that all interests are taken into account.

Recommendation 4.5

Due to the complexity and uncertainty involved, with the over-riding need to preserve network integrity, the initial CMP should be cautious and may apply more limitations than are subsequently found necessary.

Recommendation 4.6

The initial CMP should be reviewed and possibly optimised, reducing deployment limitations, at a later date. The date of this optimisation review should be fixed at the time of creating the intial CMP and the optimisation should again be open. Cable Users should be encouraged to contribute as it is believed that this will speed up the process.

Recommendation 4.7

The allocation of the costs and responsibilities of the Cable Manager and Cable User within the total process should be clearly defined. This includes the ongoing costs of network policing.

4.2.4.1 Taking account of analogue leased lines

In some cases, end-users have taken advantage of existing opportunities to deploy xDSL systems over analogue leased line pairs where simple copper pairs can be established between two premises. These deployments can be either according to a contract with the network owner or not. In the latter case, the Cable Manager should not design a CMP that particularly protects these systems at the cost of significant performance degradation of other system classes that would be able to operate efficiently in the cable, because this would be against Recommendation 4.1.

If deployment is based on a valid contract and the performance of other systems classes would be severely degraded, it is recommended that the existing CMP is reconsidered. Any equipment connected to an analogue leased line must be CMP compliant.

4.2.5 Enforcement and policing of the Cable Management Plan

Due to the statistical nature of the figures involved (for example, crosstalk), no CMP can give a complete guarantee of the performance of a system class over a particular copper pair. Therefore, the development of a CMP is insufficient to prevent harmful interference between transmission systems on the same access network in *all* cases. The implementation of that plan needs to be enforced and procedures need to be pre-defined and agreed to allow resolution of interference problems when they occur. This interference is considered here in a number of stages:

- The effect on the end-user
- The policing policy which may be adopted
- The actions which may be taken following a violation and the issues which these actions may raise.

4.2.5.1 End-User Perspective

The description below outlines the end-user's perception of a system where the CMP is violated. It is an example and attempts only to cover interference between xDSL systems. For the purposes of this description, the xDSL systems are categorised into 3 types:

- symmetric systems (e.g. HDSL, SDSL)
- fixed rate ADSL (i.e. ADSL systems which are managed to operate at a constant data rate to support their application)
- rate adaptive ADSL (i.e. ADSL systems that are managed so that they operate at the highest data rate that can be supported over that metallic line). Also known as ‘best effort’.

The exact nature of the interference interaction caused by non-compliance with the plan is very complex and is dependent on which

system is non-compliant, in which direction (upstream or downstream) and over which frequencies. However, the end user' s perception can be summarised as follows:

- **End Users on Symmetric systems and Fixed Rate ADSL**

Non-compliance with the CMP will result in the noise level in the access network increasing above that predicted by the CMP. This will result in increased error rates in the xDSL systems. Whether or not the increased error rate is perceptible to the end-user will depend very much on the application being used. As the noise level increases further, the point will be reached where the xDSL system is unable to support the data rate set for that system and the transmission system will fail. It is highly likely that the end-user perception will be that there is no degradation of their system until it suddenly stops working.

- **End users on Rate Adaptive ADSL**

For these systems, as the noise level in the access network increases the data rate that can be supported by the ADSL system reduces. Again the end-user perception will depend on the application being used. Such systems are typically used for non-time critical applications and hence the end-user perception is likely to be an increase in the response time from their far-end server.

The impact of non-compliance of a given xDSL system is not necessarily restricted to xDSL systems of the same class. For example, if an SDSL system were configured to operate at higher line rates than that permitted, the SDSL modem would transmit power in higher frequencies than that allowed under the plan. This would not impact other SDSL systems but would impact ADSL systems.

In order to define fully the impact of non-compliance, a detailed matrix of non-compliant systems and the nature of their non-compliance against compliant systems supported on the access network would need to be developed. Such a matrix would be so complex that it would be very difficult to develop.

The above shows that non-compliance with the CMP does not necessarily lead to immediately observable service degradation. Therefore it is recommended that some network performance monitoring is implemented, as detailed in the next section.

4.2.5.2 Policing Policy

Various policing policies can be envisaged ranging from:

- A pro-active surveillance policy e.g. all new ULL loops are policed at implementation time and random surveillance is performed on the access network.
- Policing is restricted to investigations initiated solely as the result of a complaint.

Both policies have their drawbacks. A pro-active policy will require a lot of resources and will be expensive. Such a policy would be analogous to the radio frequency surveillance measures that are used in some countries.

The consequence of adopting a complaint driven process is that particularly in the early days of ULL when the penetration of xDSL systems is low, there will be few if any complaints due to non-conformance with the CMP. By the time that such complaints do arise, there could be a large number of non-compliant systems in operation and recovering conformance to the CMP from such a situation would be extremely difficult and resolution of the problem to the satisfaction of all parties concerned becomes increasingly difficult.

Recommendation 4.8

As a matter of urgency, studies should be initiated (possibly in ETSI) to develop capabilities for non-intrusive monitoring of the noise level in an access network for use in a multi-operator environment.

- **Detecting non-compliance**

Detecting and locating systems that are non-compliant with the CMP is a difficult task. Non-intrusive test equipment to allow such detection is currently the subject of development and is not widely available. Whilst detection tools are now coming onto the market, they have yet to be evaluated and it is likely that special skilled operators will be required to perform the tests.

It remains to be seen whether non-intrusive spectrum management detection tools become available which are sufficient to unambiguously identify a non-compliant system. It is proposed that the contract between LLP and LLC together with the associated processes for ULL should allow for intrusive testing.

It is recommended that emphasis be placed on preventative measures such as:

- Promoting the requirement on all network operators to only use transmission systems that have been tested for conformance with the CMP. Such a requirement could be enforced through the contract between the LLP and LLC and a system of self declaration similar to that defined in the RTTE Directive could be used.
- Promoting the use of the management capability built into modern xDSL modems to monitor any changes to end-user xDSL equipment.
- Promoting the publication of a User Guide to be associated with the CMP. This User Guide could provide information to mitigate the possibility of accidental non-conformance to the CMP.

When fault finding, it will probably be necessary to have co-operation between all cable users. This would include those who are not themselves suffering from interference and are not suspect as the interference source. The xDSL modems themselves could provide information about the noise environment being experience in the access cable (this is a subject of further work in the international standards fora). Hence, when hunting an interferer, use of the population of xDSL modems as a detection instrument could prove to be very useful.

It should be required that all cable users declare the equipment connected to a particular cable under investigation, if this is not already part of the CMP process This would allow a faultsman to identify actually faulty equipment much faster.

- **Definitions of responsibilities**

The body responsible for undertaking the policing can be either the Cable Manager or a third (neutral) party. In either case a pre-defined test specification needs to be agreed by all parties. If a third party is used, they could need access to the access networks of all Cable Users and this would raise issues of security and network integrity (for example, if a cable fault occurs following a surveillance operation, who is responsible?)

4.2.5.3 Actions following the violation of the CMP or network integrity

As described in the previous section, detecting non-compliance with the CMP either indirectly by user observation or by technicians is problematic. The user may observe severe degradation only or he observes degradation with a large delay only. In any case, he is not able to say what is the reason for the service degradation.

A technician with or without specialised test-equipment may face a difficulty in locating the non-compliant equipment. However, if non-compliance is detected reliably, the disturbing system should be disconnected from the network. As analogue NTEs are generally transparent to the signals generated by the end-user equipment, the CMP will need to invoke CMP enforcement procedures whether the disturbing system is owned by LLC or end-user. Where it is not possible to locate the disturbing system by measurement, the "last -in-first out" (LIFO) principle could be applied.

Recommendation 4.9

Where it can be identified with reasonable certainty that a system is violating the CMP appropriate procedures should be enforced immediately.

Recommendation 4.10

In case of disturbances, without clear localisation of the non-compliant system, the last-in-first-out principle (LIFO) should be applied to re-establish network integrity.

The adoption of the last-in-first-out-principle creates conflict between two objectives. On the one hand, the provision of access to copper pairs with any transmission system that does not immediately disturb another transmission system. On the other hand, achieving high utilisation of the potentially available transmission capacity of the cable. However, the adoption of the last-in-first-out-principle alone is not sufficient to achieve the latter. For example, if an xDSL system is installed and operates close to its reach limit, eventually many other systems will not be able to share the same cable, because the first system would break down because of the additional crosstalk noise. This severely reduces the totally available transmission capacity and must be avoided.

The operation of the “last-in-first-out“ principle alone is not a suitable procedure for cable management as it favours the single system at the cost of the many other systems.

4.2.6 Maintenance and evolution of the Cable Management Plan

The CMP should be a "living document" capable of change and evolution over time. This will be essential for a number of reasons:

- Improved knowledge of network parameters may allow deployment restrictions to be reduced, while ensuring the same level of network integrity.

- Changes in business opportunities due to market movements or innovative technology may lead to the desire to modify deployment rules.
- New innovative classes of transmission systems may be introduced
- Adaption of deployment rules to particular carrier serving areas on request of Cable Users.

Without the ability to change there is no incentive for further evolution of the copper access network.

4.2.6.1 Managing change

Any changes to an existing CMP could adversely affect the transmission systems (e.g. in terms of reduced reach, reduced bit-rate) originally permitted and already deployed. Such changes would impact on the business cases not only of the network operator(s) using those adversely affected systems but also those of their customers (e.g. ISPs and their end users). Hence, the mechanism for the control of changes to the plan needs to be pre-defined so that Cable Users can assess the risks associated with possible changes. This mechanism may be different for each Member State but should be clearly defined.

Recommendation 4.11

The change control process of the CMP should be clearly defined by the Cable Users & Cable Manager.

The following issues need to be considered for managing change:

- The stability of the CMP will be a major factor in the business cases of all Cable Users. Hence it is extremely unlikely that any changes which are not backwards compatible will be agreed.

- A newly introduced system class or a modification of the CMP must not lead to a “significant degradation” of performance for existing system classes or already deployed technology. It needs to be defined what is considered a “significant degradation”. It can be distinguished between degradation of service quality (bitrate) and degradation of end-user penetration (reach or cable fill). Also, one has to distinguish between system classes with variable bitrate (e.g. ADSL) and system classes with fixed bitrates (e.g. HDSL):

  - For systems with variable bitrate, reduction in bitrate of x% and more is considered a significant degradation.
  - For systems with fixed bitrate, a reduction in end-user penetration (due to reduced reach) of y% and more is considered significant.

  Whilst such an approach is a logical way of managing this problem, the determination of the values of x% and y% is beset with practical

difficulties, for example, the impact assessment will probably be undertaken using a model of the access network. This requires agreement of both the model to be used and the access network data used by that model. Correlation between the model and actual experience for various representative scenarios would be required to provide confidence that the model is representative of the access. In addition, agreement needs to be achieved on what is a “worse case” scenario and, of course, the values of x% and y% need to be agreed. Agreement on all of these issues could take a very long time and prove impossible (as has been the case in some countries).

- A CMP may be designed initially for the whole set of service areas. Nevertheless, Cable Users may request the Cable Manager to optimise the CMP for specific access network areas, in order to adapt these better to the local business opportunities.

- In specific access network areas with an already existing high penetration for a particular xDSL system class, that is higher than the value allowed by the deployment rules, the existing systems are protected.

Recommendation 4.12

Any changes to the CMP should take into account the issue of backwards compatibility.

[5] See HPNA www site: http://www.homepna.org/

5 MAINTENANCE

5.1 Background

Maintaining the access network and restoring individual lines in a multi-carrier environment requires a set of rules which give guidance with regard to the responsibilities of the players involved, the relevant inter-carrier processes, and standards e.g. on repair time and similar issues, in order to ensure a level of service which is acceptable to the end-user involved

5.2 Issues involved

5.2.1 Defining relevant spheres of responsibility

In a multi-carrier environment, in which different carriers are operating different parts of an access line or an access network, it must be clear who carries the responsibility for which part of the access network or the access line in order to ensure clear and practical procedures in case of any faults or disturbances.

Therefore, the product definition and any subsequent design of installation or maintenance processes should include the definition of a ”borderline” which separates the different spheres of responsibility so that no part of the network or the individual line is neglected and any part is attributed to a carrier, i.e. either the LLP or the LLC. Where the co-operation of both parties (including resellers or other third parties) is necessary, clear procedures for the interaction must be established.

The HDF where access to the line is provided could be the relevant borderline of responsibilities, where:

- maintenance of the line between the NTP on the end-user’s premises and the termination of the internal tie cable at the HDF, including any transmission equipment of this part of the local loop, is the responsibility of the LLP.
- maintenance of the extension line from the HDF to the equipment of the LLC is the responsibility of the LLC (possibly subject to commercial agreements).

Each part of the access network, for which a carrier holds the responsibility, must be accessible at any time for this carrier.

Recommendation 5.1

The contractual basis for any unbundling of the local loop should contain a clear definition of the respective spheres of responsibility with regard to the different parts of the access line.

5.2.2

There should be a clear definition and separation of the provisioning and maintenance processes. If this is not in place, it could be a possible source of misunderstanding and conflict with regard to the question as to whether a specific line has been provided successfully or whether provisioning is not yet complete. Maintenance should be regarded as any intervention after initial provision of the loop.

Recommendation 5.2

There should be a clear definition and separation of the provisioning and maintenance processes.

5.2.3 Defining fault reporting process

As with the provision of any service or product, a process has to be designed to allow the LLC to report a fault or degradation of the service to the service provider. The unbundling of the local loop complicates this interaction since, with the end-user, the LLP and the LLC, at least three different parties are involved in the process. Where the business model is extended to resellers and service providers, further complexity is added. Therefore, it is necessary to clearly design the relevant process of fault reporting.

The process of fault reporting can be split into two aspects: between the end-user and access provider (LLC) and, between the LLC and the LLP. The first part should be dealt with in the end-user general contract conditions, the latter part should be agreed upon by the LLC and LLP involved, possibly at a multilateral level as a standard process to be used by all actors in a given national market or at the European level.

The process to be designed should include a clear definition of the responsibilities of the LLC with regard to its part of the access line after having received a fault report from the end-user. The ways and means by which a fault report then is transmitted to the LLP have to be specified. Also, the necessary data which have to be reported to the LLP have to be defined. The addressees of such fault reports have to be agreed and also a possible receipt of a fault report. Also, the times during which a fault can be reported could be a matter of negotiation. Finally, this process should also include the necessary procedure on how to inform the LLC about the successful restoration of the line.

Recommendation 5.3

A clear fault reporting process should be agreed among the parties involved, preferably on a multilateral basis. The process should include clear provisions with respect to responsibilities, the provision of relevant data and the means of transmission of that data. The mechanism for feedback on restoration of service should be agreed.

5.2.4 Defining repair time standards and optional service levels

Service levels are of increasing importance in the telecommunications sector. Therefore, the standard time periods in which a reported fault should be cleared need to be agreed among the parties involved. Where possible, different service levels should be subject to commercial agreements. Sometimes the maintenance process will include the gathering of additional information by the LLP from the LLC. Standard time periods should be set for all relevant steps in the maintenance process.

Recommendation 5.4

The parties involved should agree upon standard repair time periods. Where possible, different service levels should be offered, subject to commercial agreement.

5.2.5 Informing end-users about repair procedures

Experience from markets where unbundling is already taking place, shows that sometimes it is necessary for the LLP´s personnel to contact the end-user, who is the customer of the LLC, when carrying out maintenance on a line. This can lead to misunderstandings on the side of the end-user and to further complications. Therefore, the LLC should be responsible for informing its end-users about possible contact and maintenance procedures being carried out by the LLP´s staff.

Recommendation 5.5

The party with the contractual relationship with the end-user should inform the end-user of any possible contact by the LLP's staff during necessary maintenance.

5.2.6 Handling of changes to the access network

Where in a multi-carrier environment different parts of an access network are used by different actors it becomes important to have a clear understanding on the rights and obligations of the LLP, when it comes to changes in the existing network technology, the network structure and topology or any other necessary changes.

These changes could include the whole access network, certain parts of it or individual lines. The right of an LLP to exercise any of these changes

should not be restricted by the fact that it has granted access to parts of its network, i.e. the unbundled local loop. On the other hand, the LLCs need to have information about any changes well in advance, so that they can prepare measures in order to continue the service to their end-users

Recommendation 5.6

The LLP should not be restricted in any upgrade of the access network also used by the LLC, nor in any changes to the technology or network topology. The LLC should be given notice of any changes to the network or to individual lines well in advance of any measure. Such notice periods should be agreed.

APPENDIX 1

Glossary

Beneficiary	Means a third party duly authorised in accordance with Directive 97/13/EC or entitled to provide communications services under national legislation, and which is eligible for unbundled access to a local loop.[6]
High-speed Bitstream access	Where the incumbent installs a high speed access link to the customer's premises (eg. by installing its preferred ADSL equipment and configuration in its local access network) and then makes this access link available to third parties, to enable them to provide high speed services to customers. The incumbent may also provide transmission services to its competitors, to carry traffic to a 'higher' level in the network hierarchy where new entrants may already have a point of presence (eg. a transit switch location).[7]
BSP	Broadband Service Provider
Cable Manager	Typically the LLP but depends upon the local agreements on cable management.
Cable User	Typically the LLC.
Collocation or COLO	Means the provision of physical space and technical facilities necessary to reasonably accommodate and connect the relevant equipment of a beneficiary.[1]
Distant Collocation	Where access to the unbundled local loop service is performed by means of equipment located in premises close to the real estate of the LLP, connection being by means of an external tie cable. Also known as Virtual Collocation.
DSL	Digital Subscriber Line.
DSLAM	Digital Subscriber Line Access Module.
End-user	The end customer being served by means of an unbundled local loop by the LLC or another party. In the case of shared access, this is the end customer being provided with services

Glossary

	over a local loop by both the LLP and the LLC.
ETP	European Telecommunications Platform
HDF	Handover Distribution Frame, the demarcation point at which the local loop as a whole or partially is handed over to the LLC.
Line Sharing	see Shared Access
LLC	Local Loop Customer, the operator taking up the unbundled local loop service from the LLP. The LLC, in the case of shared access, may also take on the role of Broadband Service Provider.
LLP	Local Loop Provider, the operator providing unbundled local loops in its local access network. The LLP, in the case of shared access, will also take on the role of Voice Telephony Provider.
Local Loop	Means the physical twisted metallic pair circuit connecting the network termination point at the subscriber's premises to the main distribution frame or equivalent facility in the fixed public telephone network.[1]
Local Sub-Loop	Means a partial local loop connecting the network termination point at the subscriber's premises to a concentration point or a specified intermediate access point in the fixed public telephone network. [1]
MDF	Main Distribution Frame where the local loops are originally terminated within the LLP's network.
Notified Operator	Means operators of fixed public telephone networks that have been designated by their national regulatory authority as having significant market power in the provision of fixed public telephone networks and services under Annex I, Part 1, of Directive 97/33/EC or Directive 98/10/EC.
NRA	National Regulatory Authority

Glossary

OSS	Operational Support System
Physical Collocation	See Collocation
PSD	Power Spectral Density. The PSD of a data signal gives the distribution of the signal's power over a frequency range.
QoS	Quality of Service
R&TTE Directive	Radio and Telecommunications Terminal Equipment (RTTE) Directive 99/5/EC
Reference Offer	Means the Reference Offer for unbundled access to the local loop required to be published by notified operators. [1]
Shared Access or Line Sharing	Means the provision to a beneficiary of access to the local loop or local sub-loop of the notified operator, authorising the use of the non-voice band frequency spectrum of the twisted metallic pair; the local loop continues to be used by the notified operator to provide the telephone service to the public.
Splitter	A filter bank that separates the low frequency voice telephony band from the high frequency band used for broadband services. It also prevents interference between the voice telephony service and the broadband services provided over the same metallic pair. For more detail see ETSI TR 101 728 [Reference 1].
TOR	Terms of Reference
Virtual Collocation	(1) Where access to the unbundled local loop service is performed by means of equipment managed by the LLP. (2) Also known as Distant Collocation.
Voice Telephony VTP	Telephony Services which - including ISDN. Voice Telephony Provider
WG	Working Group
xDSL	Different versions of DSL, e.g. ADSL, VDSL and SDSL

Glossary

[6] Regulation (EC) No 2887/2000 of the European Parliament and of the Council of 18 December 2000 on unbundled access to the local loop

[7] Communication from the Commission COM(2000) 237, 26 April 2000, Unbundled Access to the Local Loop: Enabling the competitive provision of a full range of electronic communications services including broadband multimedia and high-speed Internet

APPENDIX 2

SUB-LOOP UNBUNDLING

2.1 Introduction

Sub-loop unbundling is a requirement under Regulation (EC) No 2887/2000 of the European Parliament and of the Council of 18 December 2000 on unbundled access to the local loop. The Regulation defines a sub-loop as: “a partial local loop connecting the network termination point at the subscriber’s premises to a concentration point or a specified intermediate access point in the fixed public telephone network”. Sub-loop unbundling applies to both, full unbundled access and shared access.

The sub-loop specific issues documented in this Appendix are additional to the Recommendations for full unbundling and the Recommendations on Shared Access which remain valid.

2.2 Technical restrictions

The use of an xDSL system at the sub-loop level may degrade the performance (e.g. bit rate) of other systems on neighbouring loops in the same cable due to higher crosstalk. The integrity of the network cannot always be guaranteed.

In particular, an xDSL service or another high speed service (like HDB3) using a certain frequency spectrum and connected to the local loop at an intermediate point between the NTP and the MDF would cause serious interference to an xDSL service with an overlapping frequency spectrum connected to the local loop at MDF level and using the same cable. Also, in the case of a VDSL service intended for ADSL-compatible use by using frequencies higher than 1.1 MHz[8], VDSL starting at sub-loop level is not compatible with VDSL starting at the MDF level and being transmitted within the same cable.

2.3 Access at sub-loop level

Sub-loop unbundling may take place at an agreed intermediate access point Either the LLC or the LLP may provide the collocation facility, eg. a cabinet or footway box, close to this agreed intermediate point for the installation of the necessary access equipment (eg. additional distribution frame, splitter, xDSL modem, optical network unit, power supply equipment). Detailed implementation rules will be subject to agreement within each Member State.

The LLP and LLC should agree on provision of the tie cable, including the minimum technical requirements for it. In the case of shared access, the provision and location of the splitter must be agreed. The provider of the splitter is responsible for preventing unauthorised access to the loop in order to protect the voice telephony service. The provision of power should be secured by the provider of the collocation facility.

2.4 Products

The majority of products for sub-loop unbundling are the same as those for full unbundling or shared access. There are at least three additions to this:

- sub-loops are the metallic lines between the agreed intermediate access point and the NTP owned by the LLP.
- provision of collocation facilities and subsystems (like power supply etc.) at the intermediate access points.
- provision of information of the types listed in section 1.3.4 of this document relating to intermediate access points in order to enable sub-loop unbundling.

2.5 Provisioning

As for full unbundling, shared access and the provision of bitstream services, the provisioning process will have to be co-ordinated between the LLP and the LLC. In particular, the security of the collocation facility at the intermediate access point must be ensured. The installation process should be organised with the aim to minimise the impact on the continuity of the voice telephony service, where appropriate.

2.6 Cable management

As for full unbundling and shared access, a non-discriminatory cable management plan is necessary which encompasses deployment of equipment at sub-loop level. The methods are the same as described for full unbundling. The higher signal levels in the whole frequency band and characteristics of the local cable environment have to be taken into account.

Recommendation A2.1

xDSL equipment should not be introduced at sub-loop level unless a non-discriminatory cable management plan which includes the case of sub-loop access has been developed in accordance with Recommendation 4.4 for full unbundling.

2.7 Maintenance

Maintenance of sub-loops might be more complicated than for access at the MDF in the exchange building e.g. due to the added complexity of having a fibre connection between the MDF and the agreed intermediate access points.

The maintenance procedures should be clear as to responsibilities in the case of service disruption introduced by equipment deployed at sub-loop level.

[8] ETSI TS 101 270 (VDSL frequencies higher than 1.1 MHz)

APPENDIX 3

Summary of Recommendations

PRODUCTS AND SERVICES

Recommendation 1.1

The product definitions should at least cover four types of products:

- Access to the copper pair product
- Collocation product
- Interface to the Operational Support Services eg. ordering, fault resolution, product
- Provision of data product

Recommendation 1.2

The copper pair product should be provided subject to a service level agreement agreed between the LLP and the LLC.

Recommendation 1.3

If secure, 24/7/365 access is not available, escorted building access services should be offered:

- planned access, during normal working hours
- planned access, outside normal working hours
- unplanned access, during normal working hours
- unplanned access, outside normal working hours

Recommendation 1.4

Exchange and provision of information should be agreed between the LLP and the LLC, in a non-discriminatory fashion, and the information should be updated at agreed, regular intervals.

Recommendation 1.5

Information provided by the LLP to facilitate LLU should made available in a controlled, secure fashion. Information can be obtained via a web-based interface or web publisher, or by other means, for example, by CD-ROM.

COLLOCATION

Recommendation 2.1

Suitable space within the LLP's real estate for Physical Collocation should have the following facilities available to the LLC:

- physical floor space, sufficient for the installation of necessary equipment and safe maintenance of that equipment once installed.
- a physical interface to the local loop by means of a HDF
- power supply, including provision for back-up powering where possible
- necessary ventilation and/or air conditioning to allow for the thermal compatibility of all equipment within the collocation space
- earthing points for equipment
- sufficient light for installation and maintenance

Recommendation 2.2

A definition of the standards that should be met in order for space within the LLP's real estate to be considered "suitable" should be decided through negotiations between interested industry parties, and recorded by the NRA. However, special needs as specified by the LLC may be considered by the LLP on a case-by-case basis, provided they are not detrimental to equipment of other LLCs or that of the LLP on the same site.

Recommendation 2.3

Where a LLC requests collocation space within the real estate of a LLP (Physical Collocation), if suitable space (not pre-reserved by other LLCs or the LLP) is available within the specified real estate it should be allocated to the LLC making the request.

Recommendation 2.4

If the LLP is unable to provision any suitable space within the requested real estate and is unable to redevelop the real estate to provision, it is their right to refuse the collocation request of the LLC. In such cases the LLP should detail all reasons for refusal, so that the LLC may challenge the decision if they disagree with the LLP's decision.

Recommendation 2.5

The LLP and potential LLCs should agree in advance the processes to be used for allocation of space within the LLP's real estate, both for the initial launch of unbundling and for steady state demand.

Recommendation 2.6

Should the LLP decide to close the building where Physical Collocation is in use, the LLP should provide reasonable notice (agreed in advance) of site closure. The LLC must continue to be able to access local loops previously served through that site.

Recommendation 2.7

LLPs should have the option to reserve space within their real estate to allow for the continued development of their own network. Dated documentary evidence of these reservations should be made available to LLCs requesting space within relevant real estate in the case of dispute.

Recommendation 2.8

The process from request for collocation space to installation of LLC equipment should contain at least the following steps:

- study request (LLC)
- reply to request, including results of study (LLP)
- order for collocation space, based on results (LLC)
- preparatory work, ready for installation of equipment (LLP)
- delivery of access, upon completion of preparatory work, for installation of LLC equipment
- installation of equipment (LLC)

Recommendation 2.9

The process for provisioning of collocation space should be documented in the reference offer, including agreed timescales for each stage of the process. Where these timescales are not met the party concerned should offer an explanation for delay and may be subject to pre-defined penalties and/or sanctions.

Recommendation 2.10

Provision of security for equipment should be negotiated by LLCs and the LLP in advance of LLU taking effect and should form part of the LLU reference offer. Security measures should take account of possible emergency situations, such as fire.

Recommendation 2.11

Wherever possible, LLCs should be granted access to their collocated equipment on a 24/7/365 basis.

Recommendation 2.12

Where 24/7/365 access for the LLC is not possible, the LLP and LLC should agree in advance the access arrangements and timescales.

Recommendation 2.13

Collocation space may only be used by the LLC for the housing and operation of equipment necessary to provide the services described under the negotiated LLU agreement, unless otherwise agreed between the LLP and LLC.

Recommendation 2.14

Equipment installed within the collocation space should be compatible with regard to electromagnetic emission and thermal requirements with the equipment already installed by other LLCs and the LLP. Where DSLAMs are installed, they must conform to any local cable management plan.

Recommendation 2.15

The LLC should be responsible for any actions taken on its behalf by a third party, subject to the agreement between the LLP and the LLC.

Recommendation 2.16

The LLP should allow LLCs to share backhaul capacity under agreement between the LLCs concerned.

PROVISIONING

Recommendation 3.1

The LLP, when providing routine pre-qualification line tests, should build a database of information on the metallic circuits handed over to LLPs.

Recommendation 3.2

The LLC also should build a database of knowledge on the metallic circuits in order to apply risk management on service capability.

Recommendation 3.3

Wherever possible, the LLC should employ line-testing equipment which permits “single-ended” line testing.

Recommendation 3.4

Line test parameters should match the contractual agreements between the LLP and the LLC.

Recommendation 3.5

Installation timescales should match the contractual agreements between the LLP and the LLC.

Recommendation 3.6

Provisioning procedures should be developed jointly by the industry within Member States to consider and address the issues.

Recommendation 3.7

Order-handling and provisioning processes for unbundled local loops should comply with the principles of e-commerce.

CABLE MANAGEMENT

Recommendation 4.1

The following goals are the minimum set that shall be achieved by defining suitable deployment rules:

- ensuring network integrity
- achieving a high level of customer penetration for broadband services
- foster the introduction of innovative technology
- ensure efficient use of the transmission capacity of the cable

Recommendation 4.2

That EC/TCAM consider the application of Article 3.3 of the RTTE Directive to make compliance to the CMP an essential requirement for connection to fixed analogue network interfaces.

Recommendation 4.3

All network operators should refer in their interface specifications to the CMP applicable to the access network supporting their service as being the conditions that terminal equipment needs to meet in order to minimise the potential for network harm via crosstalk.

Recommendation 4.4

The CMP should be developed according to a transparent process and involve the Cable Users as well as the Cable Manager so that all interests are taken into account.

Recommendation 4.5

Due to the complexity and uncertainty involved, with the over-riding need to preserve network integrity, the initial CMP should be cautious and may apply more limitations than are subsequently found necessary.

Recommendation 4.6

The initial CMP should be reviewed and possibly optimised, reducing deployment limitations, at a later date. The date of this optimisation review should be fixed at the time of creating the intial CMP and the optimisation should again be open. Cable Users should be encouraged to contribute as it is believed that this will speed up the process.

Recommendation 4.7

The allocation of the costs and responsibilities of the Cable Manager and Cable User within the total process should be clearly defined. This includes the ongoing costs of network policing.

Recommendation 4.8

As a matter of urgency, studies should be initiated (possibly in ETSI) to develop capabilities for non-intrusive monitoring of the noise level in an access network for use in a multi-operator environment.

Recommendation 4.9

Where it can be identified with reasonable certainty that a system is violating the CMP appropriate procedures should be enforced immediately.

Recommendation 4.10

In case of disturbances, without clear localisation of the non-compliant system, the last-in-first-out principle (LIFO) should be applied to re-establish network integrity.

Recommendation 4.11

The change control process of the CMP should be clearly defined by the Cable Users & Cable Manager.

Recommendation 4.12

Any changes to the CMP should take into account the issue of backwards compatibility.

MAINTENANCE

Recommendation 5.1

The contractual basis for any unbundling of the local loop should contain a clear definition of the respective spheres of responsibility with regard to the different parts of the access line.

Recommendation 5.2

There should be a clear definition and separation of the provisioning and maintenance processes.

Recommendation 5.3

A clear fault reporting process should be agreed among the parties involved, preferably on a multilateral basis. The process should include clear provisions with respect to responsibilities, the provision of relevant data and the means of transmission of that data. The mechanism for feedback on restoration of service should be agreed.

Recommendation 5.4

The parties involved should agree upon standard repair time periods. Where possible, different service levels should be offered, subject to commercial agreement.

Recommendation 5.5

The party with the contractual relationship with the end-user should inform the end-user of any possible contact by the LLP's staff during necessary maintenance.

Recommendation 5.6

The LLP should not be restricted in any upgrade of the access network also used by the LLC, nor in any changes to the technology or network topology. The LLC should be given notice of any changes to the network or to individual lines well in advance of any measure. Such notice periods should be agreed.

Recommendation A2.1

xDSL equipment should not be introduced at sub-loop level unless a non-discriminatory cable management plan which includes the case of sub-loop access has been developed in accordance with Recommendation 4.4 for full unbundling.

APPENDIX 4

A4 OTHER MATTERS REQUIRING ATTENTION (not an exhaustive list)

A4.1 Financial Matters

A4.1.1 How to charge for collocation space?

A4.1.2 How to charge for unbundled loop?

A4.1.3 Financial penalties for non-performance

A4.2 Legal & Contractual

A4.2.1 Liability, LLP-LLC

A4.2.2 Terms of contracts between LLP and LLCs (reference offer[9])

A4.3 Types of Service

A4.3.1 Option 2, line sharing[10]

A4.3.2 Option 3, bitstream access[11]

A4.4 Timescales

A4.4.1 Timescales for: provisioning, exchange and provision of data, fault repair and maintenance activities, collocation space availability etc.

A4.5 Service Level Agreements

A4.5.1 Expected levels of performance of each party's responsibilities.

A4.6 Interaction with Other Services

A4.6.1 A number of other services will have interaction with or be impacted by local loop unbundling provisions, eg. number portability, Carrier Pre-Selection.

[9] See the Annex to Commission Recommendation C(2000)1059, 26 April 2000, On Unbundled Access to the Local Loop: Enabling the competitive provision of a full range of electronic communications services including broadband multimedia and high-speed Internet

[10] Described in DG Information Society Working Document, INFSO A/1, 09 February 2000, Subject: Unbundled access to the local loop. Addressed in the ETP document "ETP recommendations on shared access to the local loop", June 2001

[11] Described in DG Information Society Working Document, INFSO A/1, 09 February 2000, Subject: Unbundled access to the local loop. Addressed in the ETP document "ETP recommendations on high speed bitstream services in the local loop", June 2001

APPENDIX 5

A5 NATIONAL ISSUES, EXAMPLES

The national issues and examples have been removed from Issue 2 of this document. Readers should refer to the relevant websites, some of which are listed in Appendix 6.

APPENDIX 6

A6 Sources, References

A6.1 Website Directory

Sweden: Skanova
Products for Carrier Services and Service Providers
http://www.skanova.com

Netherlands: KPN
KPN Carrier Services website
http://www.kpn-telecom.nl/carrierservices

UK: Oftel
Option 2 Implementation Working Group (local loop unbundling)
http://www.oftel.gov.uk/ind_info/network_inter/index.htm#Option 2 Implementation Working Group

UK: BT
BT Wholesale
http://www.btinterconnect.com/

Germany: RegTP
Home page
http://www.regtp.de

Germany: Deutsche Telekom
Carrier Services
http://www.dtag.de/carrier-services

Italy: Italian Communications Authority
Home page
http://www.agcom.it/provv/d2_00_cir_allb.htm

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APPENDIX 7

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