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Foreword

This ETSI Technical Report (ETR) was produced by the Signalling Protocols and Switching Technical Committee of the European Telecommunications Standard Institute (ETSI).

This work was initiated in response to a Commission of the European Communities (CEC) mandate (BC-T-309) on ONP standardization for access to the local loop.

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1 Scope

This ETSI Technical Report (ETR) is the response to BC-T-309 [1] "Standardization Mandate Forwarded to CEN/CENELEC/ETSI in the Field of Information Technology and Telecommunications" entitled "ONP Standardization for Access to the Local Loop" issued by the Commission of the European Communities (CEC). The ETR has been prepared by an ETSI Task Group, set up by ETSI Technical Committee SPS (Signalling Protocols and Switching) which is responsible for the V5 interface specifications.

The first step of the mandated work is the development of this ETR covering:

a) the standardization requirements for interfaces between an Access Network (AN) and a core network taking into account the regulatory situation after 1998, where these interfaces could serve as a boundary of responsibility between an organization providing the local access network and an organization providing a telecommunication service;

b) an analysis of the V5 series interface specifications as a basis for these standards;

c) identification of additional specifications required to extend and to complement the above interface specifications, in particular in relation to the selection on a call-by-call, semi-permanent and permanent basis of core network or service provider;

d) an analysis of the Q3 specifications as a basis for the network management standards to complement the above interface specifications.

Clause 4 outlines the standardization requirements, in response to item a).

Clause 5 outlines the status of standardization work in both ETSI and ITU-T, concerned with V5 interfaces and related matters which are relevant to BC-T-309 [1].

Clause 6 provides an introduction to network architecture and modelling concepts, drawn from ITU-T Recommendations, which are essential to ONP consideration of access to the local loop.

Clause 7 provides an analysis of the V5 and related standards and identifies the extent to which they meet the needs of BC-T-309 [1] and the manner in which they do so. Clauses 7 and 8 address item b).

Clause 8 discusses the particular considerations which apply to leased lines.

Clause 9 discusses the management capabilities which are necessary to support the needs of BC-T-309 [1]. It covers item d).

Clause 10 identifies the additional standardization which is desirable in order to properly meet the needs of BC-T-309 [1]. It therefore covers item c).

Clause 11 summarizes the material in this ETR, so as to provide easy access to the main conclusions of the study.

Annex A discusses a supplementary approach to service provider access, which may be appropriate in some situations for Private Branch eXchange (PBX) users.

2 References

This ETR incorporates by dated and undated reference, provisions from other publications. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] CEC BC-T-309 (23-02-1994): "Standardization mandate forwarded to CEN/CENELEC/ETSI in the field of information technology: ONP standardization for access to the local loop".

[2] ETS 300 011: "Integrated Services Digital Network (ISDN); Primary rate user-network interface; Layer 1 specification and test principles" (based on ITU-T Recommendation I.431).

[3] ETS 300 012: "Integrated Services Digital Network (ISDN); Basic user-network interface; Layer 1 specification and test principles" (based on ITU-T Recommendation I.430).

[4] ETS 300 166 (1993): "Transmission and Multiplexing (TM); Physical and electrical characteristics of hierarchical digital interfaces for equipment using the 2 048 kbit/s-based plesiochronous or synchronous digital hierarchies" (based on CCITT Recommendation G.703).

[5] ETS 300 167 (1993): "Transmission and Multiplexing (TM); Functional characteristics of 2 048 kbit/s interfaces" (based on CCITT Recommendations G.704 and G.706).

[6] ETS 300 233: "Integrated Services Digital Network (ISDN); Access digital section for ISDN primary rate" (based on ITU-T Recommendation G.962).

[7] ETS 300 297: "Integrated Services Digital Network (ISDN); Access digital section for ISDN basic rate" (based on ITU-T Recommendation G.960).

[8] ETS 300 324-1: "Signalling Protocols and Switching (SPS), V interfaces at the digital Local Exchange (LE); V5.1 interface for the support of Access Network (AN); Part 1: V5.1 interface specification" (also ITU-T Recommendation G.964).

[9] ETS 300 347-1: "Signalling Protocols and Switching (SPS), V interfaces at the digital Local Exchange (LE); V5.2 interface for the support of Access Network (AN); Part 1: V5.2 interface specification" (also ITU-T Recommendation G.965).

[10] ETS 300 376-1 (1994): "Signalling Protocols and Switching (SPS); Q3 interface at the Access Network (AN) for configuration management of V5 interfaces and associated user ports; Part 1: Q3 interface specification" (also draft ITU-T Recommendation Q.57CM).

[11] ETS 300 377-1 (1994): "Signalling Protocols and Switching (SPS); Q3 interface at the Local Exchange (LE) for configuration management of V5 interfaces and associated customer profiles; Part 1: Q3 interface specification" (also draft ITU-T Recommendation Q.57CM).

[12] ETS 300 378-1 (1994): "Signalling Protocols and Switching (SPS); Q3 interface at the Access Network (AN) for fault and performance management of V5 interfaces and associated user ports; Part 1: Q3 interface specification" (also draft ITU-T Recommendation Q.57FPM).

[13] ETS 300 379-1 (1995): "Signalling Protocols and Switching (SPS); Q3 interface at the Local Exchange (LE) for fault and performance management of V5 interfaces and associated customer profiles; Part 1: Q3 interface specification" (also draft ITU-T Recommendation Q.57FPM).

[14] CCITT Recommendation G.703 (1991): "Physical/electrical interfaces of hierarchical digital interfaces" (see also ETS 300 166 [4]).

[15] CCITT Recommendation G.704 (1991): "Synchronous frame structures used at primary and secondary hierarchical levels" (see also ETS 300 167 [5]).

[16] CCITT Recommendation G.705 (1988): "Characteristics required to terminate digital links on a digital exchange".

[17] ITU-T Recommendation I.112 (1993): "Vocabulary of terms for ISDNs".

[18] CCITT Recommendation I.324 (1991): "ISDN network architecture".

[19] CCITT Recommendation I.340 (1988): "ISDN connection types".

[20] ITU-T Recommendation I.411 (1993): "ISDN user-network interfaces - Reference configurations".

[21] ITU-T Recommendation I.414 (1993): "Overview of Recommendations on layer 1 for ISDN and B-ISDN customer accesses".

[22] CCITT Recommendation I.511 (1988): "ISDN-to-ISDN layer 1 internetwork interface".

[23] CCITT Recommendation I.601 (1988): "General maintenance principles of ISDN subscriber access and subscriber installation".

[24] CCITT Recommendation M.3602 (1992): "Application of maintenance principles to ISDN subscriber installations".

[25] CCITT Recommendation M.3603 (1992): "Application of maintenance principles to ISDN basic rate access".

[26] CCITT Recommendation M.3604 (1992): "Application of maintenance principles to ISDN primary rate access".

[27] CCITT Recommendation Q.511 (1988): "Exchange interfaces towards other exchanges".

[28] ITU-T Recommendation Q.512 (1995): "Digital exchange interfaces for subscriber access".

[29] ITU-T Recommendation Q.521 (1993): "Digital exchange functions".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this ETR, the following definitions apply, together with those given in standards referenced:

Access Network (AN): A system implemented between the Local Exchange (LE) and users, replacing part or the whole of the local line distribution network. The functions associated with the V5 interface(s) of an AN can be configured and operated flexibly via a management Q interface. An AN may consist of multiplexing, cross connect and transmission functions. The V5 interface standard is independent of the transmission media used inside the AN. An AN may support services which are outside the scope of the V5 standards.

Local Exchange (LE): An exchange on which user lines are terminated via an AN. The functions associated with the V5 interface(s) on a LE can be configured and operated flexibly via a management Q interface. An LE may also directly terminate user lines but these are outside the scope of the V5 standards.

V5 interface: A general term for the group of V interfaces for connection of ANs to the LE, i.e. V5.1 and V5.2 interface.

Q3 interface: A TMN interface between a Network Element (NE), such as an AN or LE, and the Operations System (OS) responsible for the management of that NE.

service provider: An organization which provides a telecommunications service. In this ETR, it refers particularly to the organization which provides a switched telephony and/or ISDN service (and therefore operates the local exchange) or a leased line service.

AN provider: An organization which operates an access network and therefore provides user access to one or more service providers.

transit network provider: An organization which provides a switched service, particularly long distance service, between other switched-service providers.

provisioned: A parameter is said to be provisioned if the Q interface has the capability to verify and change it. Such a parameter may have a default value and/or may be altered by a local interface.

user selection of switched-service provider (permanent): The case where selection of switched-service provider is by pre-arrangement between the user and the AN and service providers and is set up by management action.

user selection of switched-service provider (semi-permanent): The case where selection of switched-service provider is set up:

a) at times pre-arranged between the user and the AN and service providers, with switch-over by automatic management action, e.g. different service providers during the working day and at night, or

b) under user control via a user-network management interface.

user selection of switched-service provider (call-by-call): The case where selection of switched-service provider is part of the call set-up procedure.

transit network selection: The case where selection of transit network provider is part of the call set-up procedure.

user selection of leased-line service provider (permanent): The case where selection of leased-line service provider is by pre-arrangement between the user and the AN and service providers and is set up by management action.

semi-permanent leased line: A permanently established connection between two User-Network Interfaces (UNIs) routed through the switched digital network.

permanent leased line: A permanently established connection provided between two leased-line UNIs routed through the transmission network bypassing network nodes of the switched digital network. The UNIs may be analogue or digital. Permanent leased line services, provided by an access network, bypass the local exchange and have no effect on the V5 interface.

Permanent Line (PL): A permanently established connection provided between two ISDN UNIs routed through the transmission network bypassing network nodes of the switched digital network. The PL reduces the access capability at the UNI for switched services.

user access: The means by which a user is connected to a telecommunication network in order to use the service and/or facilities of that network.

access connection element (subscriber access): The equipment providing the concatenation of functional groups between and including the Exchange Termination (ET) and the Network Termination type 1 (NT1).

bearer channel: A 64 kbit/s time slot in the V5.1 or V5.2 interface allocated for a B-channel of an ISDN user port or a PCM encoded 64 kbit/s channel from a PSTN user port.

control: Control is concerned with status and control of user ports; V5.1 or V5.2 interface layer 1 and layer 2 establishment and other common procedures.

3.2 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

AN	Access Network
BA	Basic Access
CE	Connection Element
CEC	Commission of the European Communities
CRF	Connection Related Function
DN	Directory Number
ET	Exchange Termination
IN	Intelligent Network
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
LE	Local Exchange
LT	Line Termination
NE	Network Element
NT1	Network Termination type 1
ONP	Open Network Provision
OS	Operations System
PBX	Private Branch eXchange
PCM	Pulse Code Modulation
PL	Permanent Line
PRA	Primary Rate Access
PSTN	Public Switched Telephone Network
TMN	Telecommunication Management Network
UNI	User-Network Interface

4 Standardization requirements

4.1 Introduction

Open Network Provision (ONP) is the Community policy aimed at harmonizing conditions for open and efficient access to, and use of, Public Telecommunications Networks and Public Telecommunications Services.

This clause investigates the first item of BC-T-309 [1] (see item a) in clause 1), i.e. the standardization requirements for interfaces between an AN and a core network. It is assumed that the V5 series interface specifications (i.e. ETS 300 324-1 [8] and ETS 300 347-1 [9]) serve as a basis for these standards.

4.2 Liberalization of infrastructure

With the liberalization of the infrastructure the AN and the core network could be operated by different providers. Figure 1 shows the connection of a user to the network.

To allow interconnection of different providers of the entities shown above the interfaces between them needs to be open and standardized. Additionally every entity needs to support user selection of the connected network providers in a flexible manner.

Three different interfaces can be identified in figure 1.

a) Network Termination Point (User - Network Interface):

In a competitive environment, the user may choose to connect his equipment to different AN providers. This interface would be at the coincident S and T reference point or T reference point in the narrowband Integrated Services Digital Network (ISDN) case, for which standards are available. However, there is no equivalent European standard for the Public Switched Telephone Network (PSTN), the physical interface and protocol being national matters. This impacts the situation at the loop-core boundary.

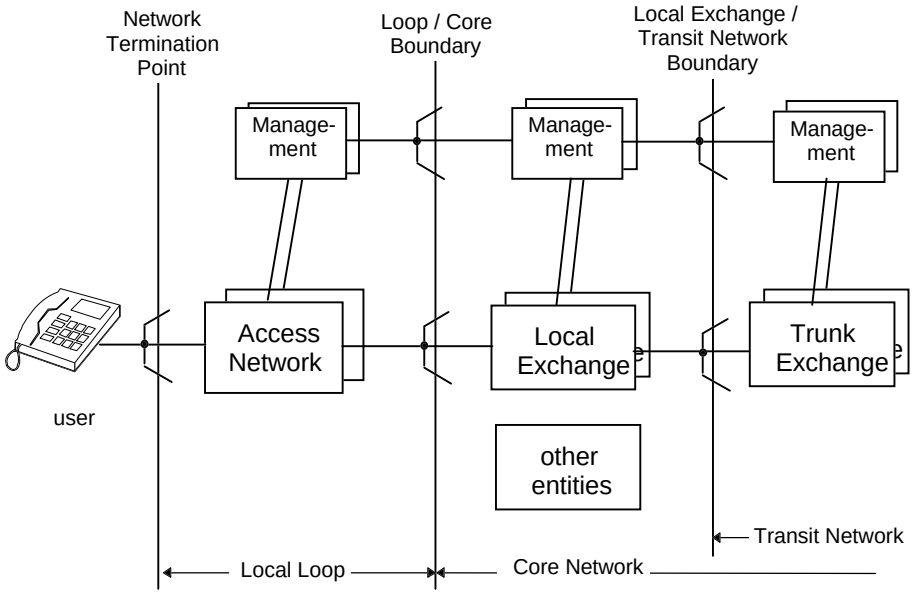


Figure 1: Connecting a user to the network

b) Loop - Core boundary:

Since the infrastructure is going to be liberalized, this interface needs to be based on standards. ANs and core networks could be offered by different providers. Every AN provider could offer a certain range of connections to core networks and the user could choose the AN provider he/she prefers. There have to be means for the user to tell the AN, which core network is to be used. This selection needs to be as easy as possible for the user.

The interface could be at the V reference point for ISDN. To support PSTN services at the V reference point, the mappings of PSTN User-Network Interface (UNI) signalling protocols onto the V reference point PSTN protocol have to be standardized, as discussed in clause 10.

NOTE: If no agreement on a minimum set of PSTN functionality can be achieved on a European basis, these protocol mappings will have to be provided by the national regulatory bodies.

c) Local Exchange - Transit Network boundary:

In some European countries, the user can choose the long distance carrier on a per-call basis by dialling a certain code. The interface between LE and transit network could be the Signalling System No. 7 ISDN User Part (ISUP).

4.3 Standardization requirements at the loop - core boundary

a) Open interface:

The standardization requirements depend on the services to be covered.

As this ETR will show, the V5 standards can be used as a basis for this interface for ISDN and PSTN. Clause 7 investigates the possibilities of the V5 standards. The V5.1 standard, ETS 300 324-1 [8] supports PSTN and ISDN Basic Access (BA). The V5.2 standard, ETS 300 347-1 [9] also supports ISDN Primary Rate Access (PRA).

Since there is no common standard for PSTN, the V5 interface can only provide a tool kit of protocol elements to be used to convey the information about the static and dynamic electrical conditions at the user port to the LE and vice versa. If the V5 interface should serve as an open interface for PSTN, this protocol mapping needs to be standardized. This covers not only the use of the protocol elements on the V5 interface but requires also the exact specification of the static and dynamic electrical behaviour at the UNI and their mapping onto V5 messages. Clause 10 expands on this standardization requirement.

Broadband services, however, are not yet covered by any standard. ETSI work items for broadband V5-type interfaces exist (DE/SPS-03046-1 and DE/SPS-03047-1) and work is progressing.

Connections to dedicated data networks could be seen as leased lines. Leased lines are considered in clause 8.

b) Selection of core network:

Call-by-call selection of the core network requires call related functions in the AN. As clause 6 will show, this is in contradiction with the V5 architecture. Since it is assumed that the V5 interface should serve as a basis for the loop/core boundary this kind of selection is considered to be impracticable.

Semi-permanent and permanent selection of the service provider is supported via management functions. All entities in figure 1 are associated with management systems. Telecommunication Management Network (TMN) based Q3 interface specifications exist for V5 related AN and LE configuration management and fault and performance management (ETS 300 376-1 [10], ETS 300 377-1 [11], ETS 300 378-1 [12] and ETS 300 379-1 [13], see also clause 9).

In order to select the core network, the user could be given access to the management system of the access provider. No standards exist in this area.

Every provider manages a certain amount of user related data. Selection of core networks requires co-ordinated actions in management systems of different providers. No standards exist in this area.

5 Status of access network and V5 standards work

This clause lists the European standards, ETRs and related ITU-T Recommendations existing or in the process of being drafted, both V5 related and for ANs in general.

5.1 V5-related documents

Reference	Subject	Status (November 1995)
ETS 300 324-1 [8] (also ITU-T Rec. G.964)	V5.1 interface specification	published 1994
ETS 300 324-2	Protocol Implementation Conformance Statement (PICS) proforma specification for the V5.1 interface	published 1994
ETS 300 324-3, 5 and 7	Test Suite Structure and Test Purposes (TSS&TP) for the V5.1 interface	published 1995
ETS 300 324-4, 6 and 8	Abstract Test Suites (ATS) for the V5.1 interface	on Public Enquiry 89
ETS 300 324-9	Physical layer test specification for the V5.1 interface	prepared for Vote
ETS 300 347-1 [9] (also ITU-T Rec. G.965)	V5.2 interface specification	published 1994
ETS 300 347-2	PICS proforma specification for the V5.2 interface	published 1994
ETS 300 347-3, 5 and 7	TSS&TP for the V5.2 interface	prepared for Vote
ETS 300 347-4, 6 and 8	ATS for the V5.2 interface	on Public Enquiry 89
ETS 300 347-9	Physical layer test specification for the V5.2 interface	prepared for Vote
ETR 150	V5 interface PSTN mappings	published 1994

Reference	Subject	Status (November 1995)
ETS 300 376-1 [10] (also draft ITU-T Rec. Q.57CM)	Q3 interface at the AN for the configuration management of V5 interfaces; Q3 interface specification	published 1994
ETS 300 376-2	Q3 interface at the AN for the configuration management of V5 interfaces; Managed Object Conformance Statement (MOCS) proforma specification	published 1995
ETS 300 377-1 [11] (also draft ITU-T Rec. Q.57CM)	Q3 interface at the LE for the configuration management of V5 interfaces; Q3 interface specification	published 1994
ETS 300 377-2	Q3 interface at the LE for the configuration management of V5 interfaces; MOCS proforma specification	published 1995
ETS 300 378-1 [12] (also draft ITU-T Rec. Q.57FPM)	Q3 interface at the AN for the fault and performance management of V5 interfaces; Q3 interface specification	published 1995
ETS 300 378-2	Q3 interface at the AN for the fault and performance management of V5 interfaces; MOCS proforma specification	drafting
ETS 300 379-1 [13] (also draft ITU-T Rec. Q.57FPM)	Q3 interface at the LE for the fault and performance management of V5 interfaces; Q3 interface specification	published 1995
ETS 300 379-2	Q3 interface at the LE for the fault and performance management of V5 interfaces; MOCS proforma specification	drafting
DE/SPS-03024 (based on ITU-T Rec. Q.511, Q.512 and Q.513)	Reference points and interfaces for digital exchanges	drafting in progress
DE/SPS-03027	LE and AN performance design; Requirements for call handling and bearer connection management	drafting in progress
DTR/SPS-03040	Identification of the applicability of existing protocol specifications for a VB interface in an access arrangement with ANs	for TC SPS approval

5.2 Other AN-related documents

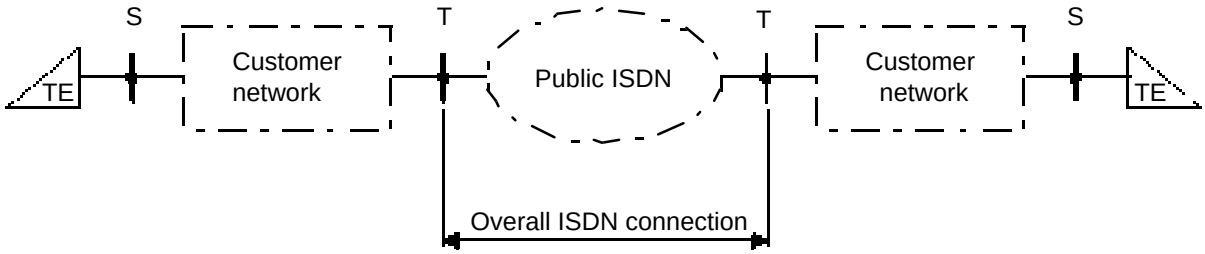
Reference	Subject	Status (November 1995)
ETS 300 463	Requirements of passive Optical Access Networks (OANs) to provide services up to 2 Mbit/s bearer capacity	prepared for Vote
DE/TM-02209	Operation and maintenance of OANs	work item created
DTR/TM-02226	Operations and maintenance of OANs; Ensembles applicable to OANs	drafting in progress
DTR/TM-03024	General functional architectures for ANs	drafting in progress
draft ITU-T Rec. G.9XX	Framework Recommendation on access networks; Architecture and functions, access types, management and service node aspects	drafting in progress

6 Architecture and modelling

Clause 4 provides a summary of BC-T-309 [1] with the identified architecture as extracted from the mandate. There are, however, some inconsistencies of this access concept shown in figure 1 and the internationally specified network architecture for ISDN, which has been taken as the basis for the definition of the functions and procedures for the V5 interfaces. Although there is no such architecture defined for PSTN in ITU-T, the ISDN architecture can generally be used for PSTN as well because the concept of the architecture based on connections is the same for both ISDN and PSTN and both types of accesses are often supported by the same LE.

6.1 The general network architecture and modelling

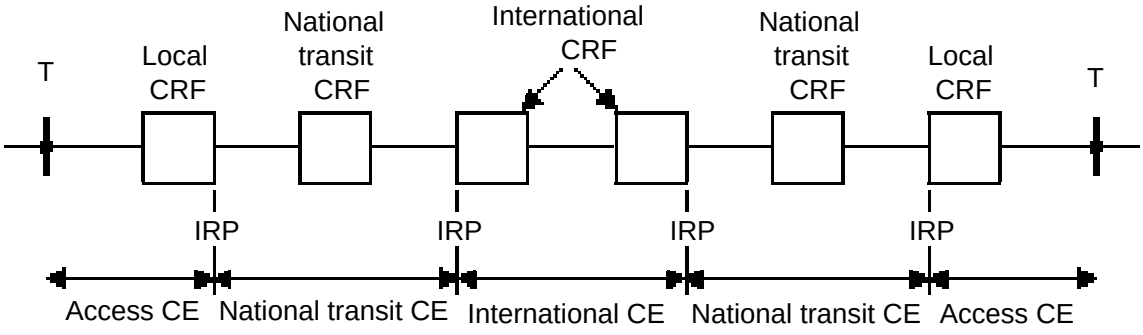
Figure 2 shows the general ISDN reference configuration as defined in CCITT Recommendation I.324 [18], figure 2/I.324. It shows the relevant reference points for the reference configuration, for easy comparison with other figures of this ETR.



NOTE 1: The functional grouping customer network is described in ITU-T Recommendation I.411 [20].
NOTE 2: In the case where the customer network is null (i.e. null NT2), then the ISDN connection type can be considered to end at the S/T reference point.
NOTE 3: Other configurations are possible where the call is asymmetrical or terminates in or involves Higher Layer Functions (HLF).
NOTE 4: The terms "customer network" and "Public ISDN connection type" do not presuppose a particular regulatory situation in any country and are used purely for technical reasons. The connection type concept is defined in CCITT Recommendation I.340 [19].

Figure 2: General ISDN reference configuration

Figure 3 gives the reference configuration of public ISDN connection type taken from CCITT Recommendation I.324 [18], figure 3/I.324. This figure is useful to identify, on the basis of the defined connection type, the individual Connection Elements (CEs) forming the connection, the "access CE" and the "transit CE". This may help to clarify, on the basis of the defined reference configuration in ITU-T, the separation of the functions and the support of expected functional capabilities of the relevant network elements (e.g. AN, LE).



IRP Internal Reference Point
CRF Connection Related Functions
CE Connection Element

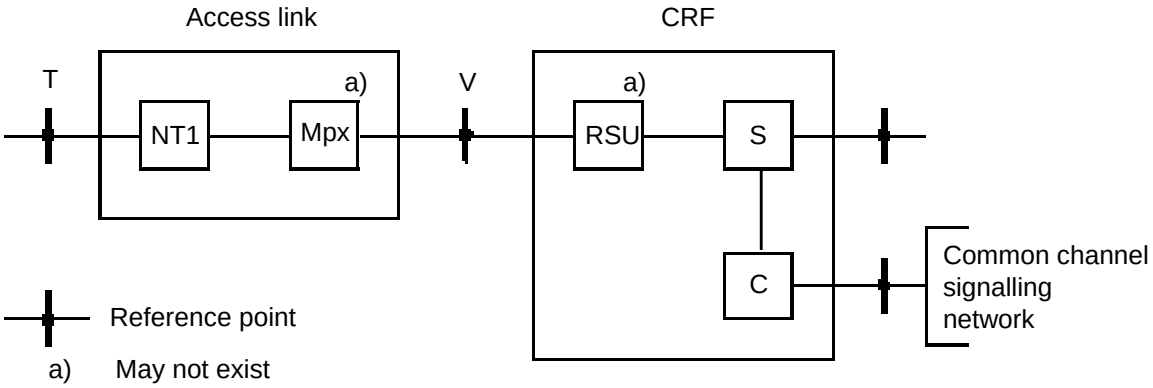
Figure 3: Reference configuration of public ISDN connection type

The following definition of the **access connection element** is taken from CCITT Recommendation I.324 [18], subclause 4.2.1.1:

> *The access connection element is bounded by the T reference point at the customer end and the reference point which marks the transition from the access signalling system to the common channel signalling system on the network side.*
>
> *The model for the access connection element in the case of 64 kbit/s circuit switched is shown in Figure 4/I.324. Depending on the national situations and on the type of access, a number of different possibilities are available for this element, in particular with regard to the use of multiplexer (Mpx) or Remote Switching Units (RSU).*

Figure 4/I.324 of CCITT Recommendation I.324 [18] is reproduced in figure 4 for information. The definition and figure 4 show clearly that the access connection element is not bounded at the V reference point. This conclusion is based on ITU-T Recommendation Q.521 [29], defining the exchange functions, (refer to clause 4 of ITU-T Recommendation Q.521 [29]) and the definition of the **connection related function** in CCITT Recommendation I.324 [18], subclause 4.2.2.1:

> *The connection related function includes all aspects involved in establishing and controlling the connections within the particular connection element. This includes functions such as exchange terminations, switching, control, network management, operation and maintenance. The specific capabilities of each CRF are not specified in the general reference model: this is done in the reference configuration for each group of connection types.*



NT1 Network termination 1
S 64 kbit/s circuit switch
C Signalling handling and exchange control functions
Mpx (Remote) multiplexer
RSU Remote switching unit and/or concentrator
CRF Connection related function

Figure 4: Access connection element model

Figure 5 is reproduced from figure 1 of ITU-T Recommendation Q.521 [29] and shows that in the Q-series of Recommendations there is no reference point defined (as mentioned in CCITT Recommendation I.324 [18]) between the functions belonging to the access connection element and the transit connection element. A possible location could be the switching matrix but this is just a functional point because the terminating part of the access connection element and the originating part of the transit connection element is functionally part of and therefore implemented in the LE. This view is fully covered by the definition of the term **reference point** in CCITT Recommendation I.324 [18], subclause 1.2:

> *Reference points are the conceptual points at the conjunction of two functional groupings. In a particular example, a reference point may correspond to a physical interface between pieces of equipment, or in other examples there may not be any physical interface corresponding to the reference point. Interfaces will not be defined by CCITT for an ISDN unless the corresponding reference points have been already specified.*

This general principle is also applicable to any other architecture and modelling concept. Nevertheless it is evident that the Exchange Termination (ET) function at the left hand side of figure 5 is part of the access connection element defined in CCITT Recommendation I.324 [18].

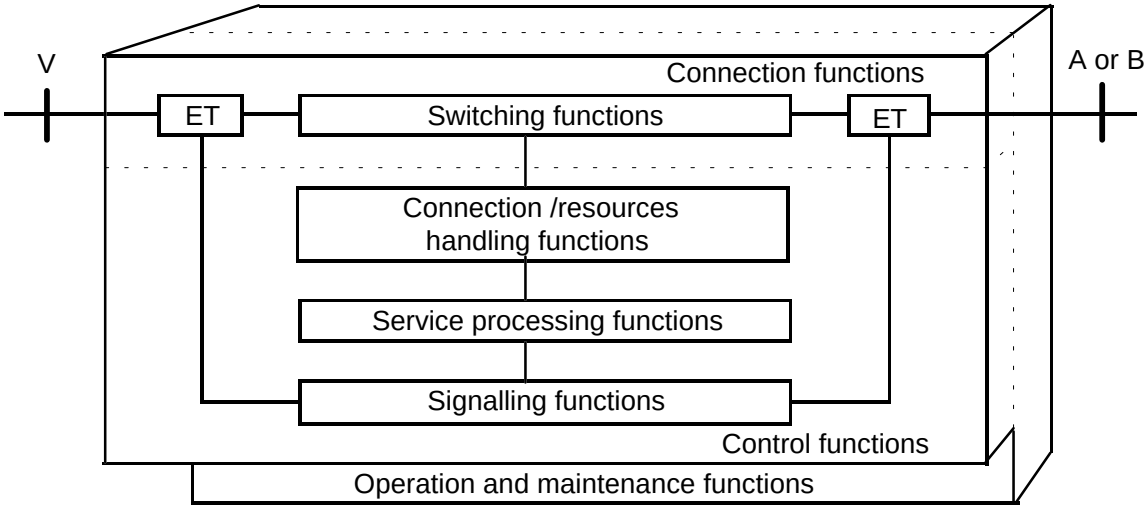


Figure 5: Local exchange functional model

The **ET function** itself is defined in ITU-T Recommendation I.112 [17] as follows:

> *The functional group containing at least the layer 2 and layer 3 network-side functions of the I.420 interface at the T reference point.*
>
> *NOTE 1: This may not be true if concentrators or intelligent equipment are located in the local line distribution network.*
>
> *NOTE 2: The ET is not the switching function. The extent to which the ET supports call control processing and management is not defined.*

6.2 The architecture and modelling of the access connection element

In the definition of the access connection element in CCITT Recommendation I.324 [18] there is the indication that there may be different physical realizations possible. This is shown in figure 6 which is based on ITU-T Recommendation I.414 [21] and ITU-T Recommendation Q.512 [28].

From figure 6 one can easily identify that, depending on the implementation of the access connection element, more than one V reference point may exist between the T reference point and the ET function. Five basic configuration types can be distinguished:

a) the passive access type;
b) the direct access type;
c) the remotely connected direct access type;
d) the remote access type; and
e) the remotely connected remote access type.

The passive access type uses only the transmission medium provided in the access connection element between the UNI and the ET function in the LE. One example is the analogue PSTN access using a copper pair from the customer premises to the LE.

The direct access type connects the UNI to the ET function in the LE through its individual access digital section using a transmission system. There is functionally an individual V-reference point for any customer between the ET function and the access digital section. Examples are the ISDN basic access with its associated V1-reference point and the ISDN primary rate access with its associated V3-reference point.

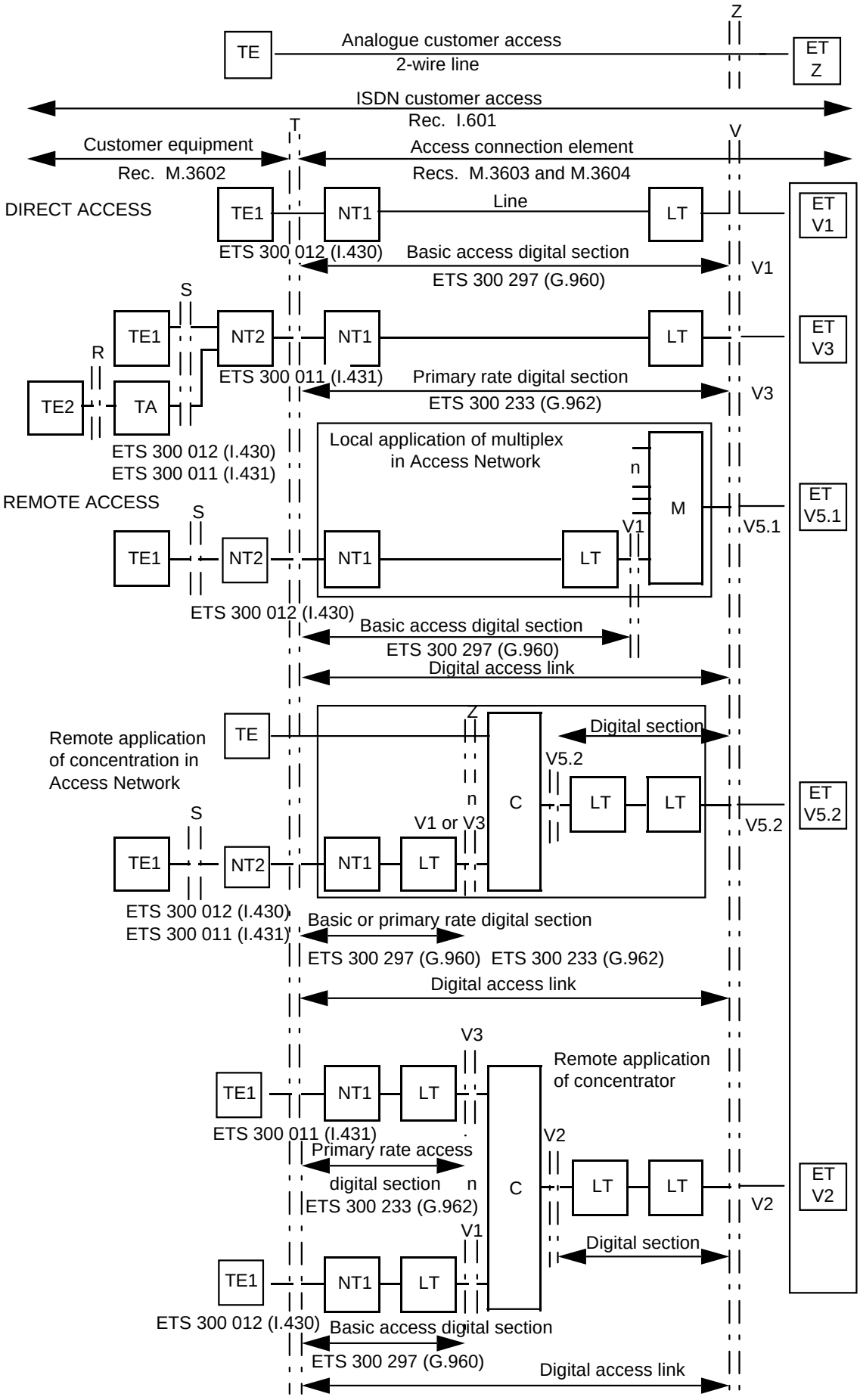


Figure 6: Overview of PSTN and ISDN customer access configurations

The remotely connected direct access type connects the UNI to the ET function in the LE through its individual access digital section using a transmission system. But for the provision of the remote access a further digital section is incorporated between the V-reference point at the network side of the access digital section and the V-reference point at the LE. This additional digital section shall not change the structure and the content of the information at the V-reference point at the network side of the access digital section, i.e. it is considered transparent to the information. In this access type there exists the relevant V-reference point at the network side of the access digital section and an associated V'-reference point at the LE.

The remote access type uses the concatenation approach of V-reference points which is based on a functional hierarchy of reference points. This approach allocates the V-reference points to either:

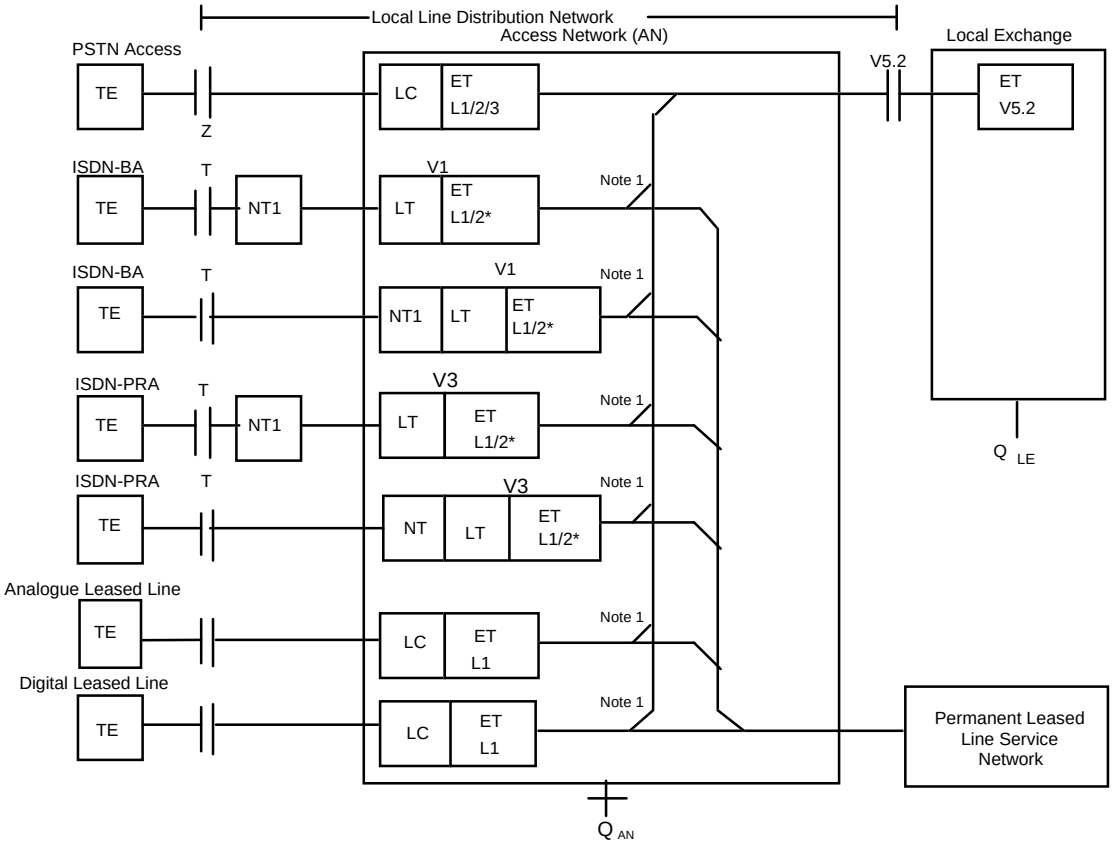
a) the Access Individual Class of reference points; or

b) the Access Integrating Class of reference points.

The Access Integrating Class of reference points is defined as that providing a signal structure which is a multiplex of several accesses of the same or of different access types. The V2 and V5 reference points belong to this class. In this case, functionally both, the customer individual access V-reference point and the access integrating reference point, are present in the access connection element.

The remotely connected remote access type is identical to the remote access type but the AN is remotely connected to the LE by a transparent digital link as defined in clause 4 of both V5 interface standards.

The functional split between the AN and the LE is identical in all five configuration types with regard to call handling. The functions from the T reference point up to the V reference point associated with the LE is limited to the transport of the access bearer channels and information, which may include flexible allocation of bearer channels under control of the LE. The peer point for the call control protocol is the ET layer 3 and this function is allocated to the LE.

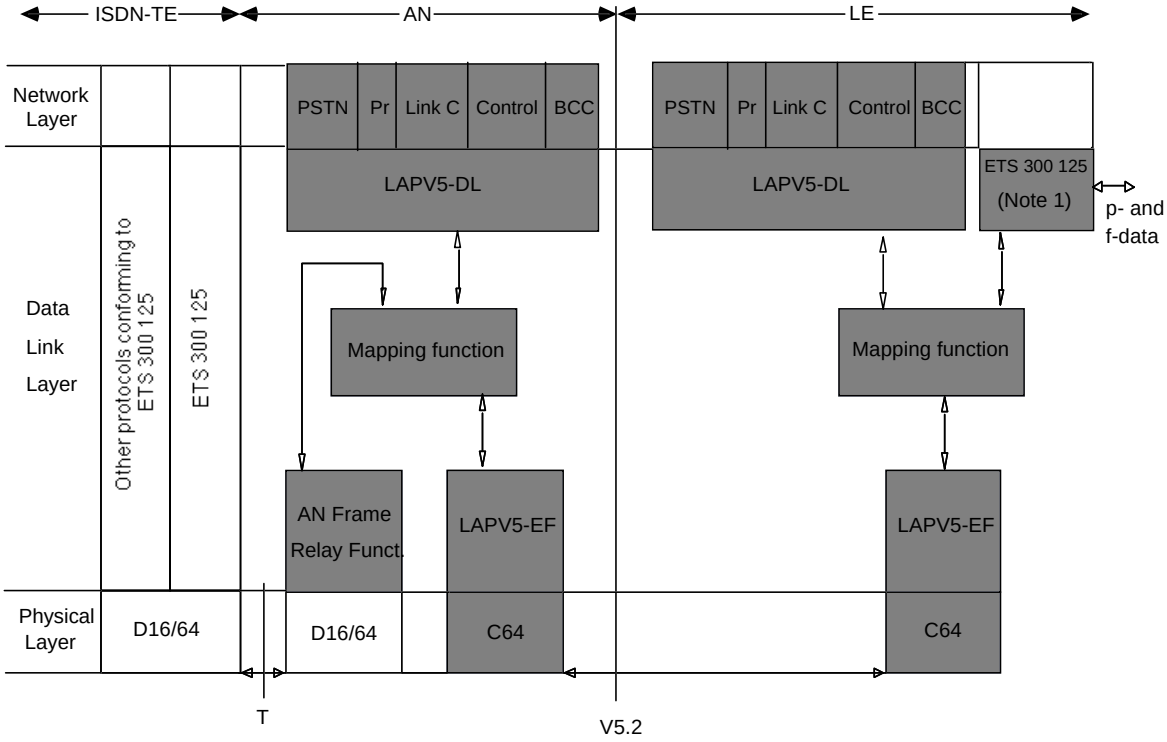


NOTE 1: The selection of channels and the service allocation is part of the provisioning.
NOTE 2: The asterisk indicates that layer 2 is only partially terminated in the AN.

Figure 7: Architecture of V5.2 interface from a service point of view

Figure 7 reproduces figure 2 of the V5.2 ETS 300 347-1 [9] showing the consistency of the approach taken in the V5 specification work concerning the internationally defined architecture and modelling.

It should be clear that the ET V5.2 functionally includes the customer access individual ET functions of layer 2 and layer 3 as shown in figure 8, which is reproduced from figure 6 of ETS 300 347-1 [9].



NOTE 1: Except those functions terminated in the AN Frame Relay function in the AN.
NOTE 2: "Pr" refers to the protection protocol. "Link C" refers to the link control protocol.

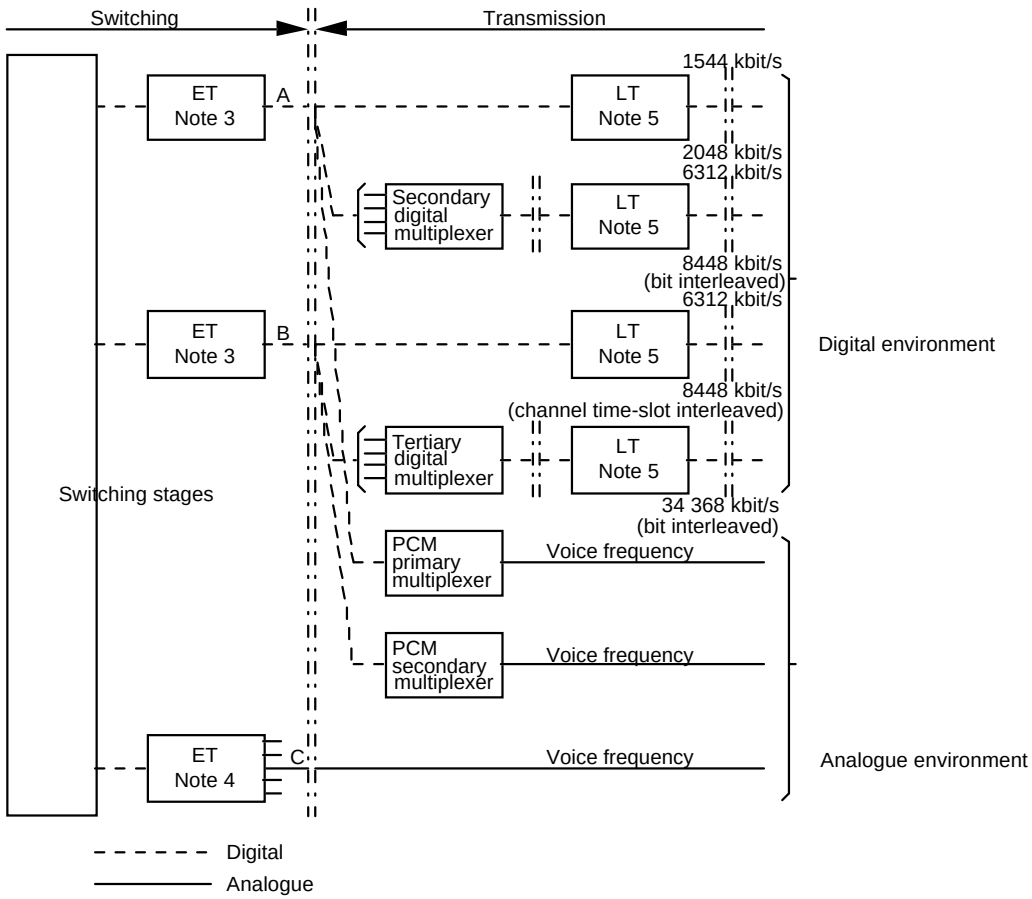
Figure 8: Protocol architecture of V5.2

6.3 The network selection function in the ISDN

The network selection function on a call-by-call basis, mentioned in BC-T-309 [1], is part of layer 3 of the access protocol and will be interpreted in the ET function of the LE. In general this case is covered in the international standardization of network architecture and modelling by the interworking between ISDNs defined in CCITT Recommendation I.324 [18] and as well in CCITT Recommendation I.511 [22]. There is however not sufficiently detailed information covering all the possible cases where such interworking in the chain of connection elements may be made. On the other hand CCITT Recommendation I.324 [18] states in clause 5 clearly that these points are at inter-network interfaces.

CCITT Recommendation I.511 [22] states in subclause 3.1.1 that one of the equipment interfaces standardized in the G.700-G.900 series of Recommendations should be used. CCITT Recommendation Q.511 [27] clarifies this further in the context of exchange interfaces towards other exchanges.

The interface alternatives given are the interfaces A and B according to the CCITT Recommendations G.703 [14], G.704 [15] and G.705 [16], see figure 9, which is reproduced from figure 1/Q.511 of CCITT Recommendation Q.511 [27].



NOTE 1: The G and Q series of ITU-T Recommendations applicable to each interface are detailed in the text.

NOTE 2: Other configurations, such as series connection of secondary, tertiary or higher order muldex, may be used.

NOTE 3: Examples of functions of Exchange Termination (ET) - interfaces A and B:
- Signalling insertion and extraction;
- Code conversion;
- Frame alignment;
- Alarms and fault indication.

NOTE 4: Examples of functions of Exchange Termination (ET) - interface C:
- A/D conversion;
- Signalling insertion and extraction;
- Multiplexing;
- 2-wire/4-wire conversion.

NOTE 5: Examples of functions of Line Termination (LT):
- Power feed;
- Fault location;
- Regeneration;
- Code conversion.

NOTE 6: Not all interfaces will necessarily exist in every implementation.

Figure 9: Interfaces towards other exchanges

In conclusion, the required functionality of network selection cannot be, according to the current network architecture and modelling in ITU-T Recommendations, a function of the AN because it requires handling of layer 3 of the access protocol, which is part of the ET function in the LE. Even a functional split of layer 3 between the AN and the LE for the support of such a function in the AN would create an inconsistency in the network architecture with regard to the allocation of connection related management functions to the LE in such a way that a re-definition of the network architecture and modelling is required before being used in equipment and interface specifications.

Furthermore, there is no interface defined at the reference point between the access connection element and a transit connection element which could be used for the interworking with another network. The first point for connection of another network selected on a call-by-call basis is therefore the interface A or interface B defined in CCITT Recommendation Q.511 [27] as appropriate for the particular case.

6.4 Discussion of the term "core network"

In BC-T-309 [1] the term "core network" is used assuming that a specific functionality exists at the user side of this boundary:

a) the capability to handle layer 3 of the D-channel protocol;

b) to extract some call control related information; and

c) to perform minimum switching functions to select different networks.

It is not clear in which way the term "core network" relates to the general network architecture and modelling and relevant terms as provided in subclause 6.3. Nevertheless this assumption requires that the relevant equipment outside the "core network" can select on a per call basis different interfaces to different LEs and channels and can communicate with the specific network provider call control function in the LE.

There are two possible interpretations of the boundary of the "core network":

a) according to the statements in BC-T-309 [1], it is assumed that the boundary is at the V5 interface;

b) according to the general network architecture and modelling and the allocation of functions to network elements it is assumed that the boundary is at the reference point between the access connection element and the transit connection element as described in CCITT Recommendation I.324 [18].

According to the conclusions made in subclause 6.3 the functional "core network" boundary, on the basis of the required functionality from BC-T-309 [1], can only be at the point between the access connection element and a transit connection element. There is, of course, a possible functional boundary of the "core network" at the V5 interface. However, in this case the functionality is different from the assumed one in the mandate.

7 Analysis of V5 and associated specifications

This clause addresses the second bullet item of BC-T-309 [1] (see item b) of clause 1).

7.1 Introduction

This introduction is abstracted from the V5.1 and V5.2 interface specifications, ETS 300 324-1 [8] and ETS 300 347-1 [9], respectively, with minor modifications to improve clarity in the context of this ETR.

7.1.1 Scope of V5 specifications

ETS 300 324-1 [8] specifies the electrical, physical, procedural and protocol requirements for the V5.1 interface between an AN and the LE for the support of the following access types:

- analogue telephone access;

- ISDN Basic Access (BA) with a line transmission system conforming to ETS 300 297 [7] for the case with a NT1 separate from the AN;

- ISDN BA with a UNI according to ETS 300 012 [3] at the user side of the AN, (i.e. the interface at the T reference point);

- other analogue or digital accesses for semi-permanent connections without associated outband signalling information,

with flexible (provisioned) information channel (bearer channel) allocation but without concentration capability within the AN.

ETS 300 347-1 [9] specifies the additional electrical, physical, procedural and protocol requirements for the V5.2 interface. In addition to the above, the V5.2 interface supports the following access types:

- ISDN Primary Rate Access (PRA) with a line transmission system conforming to ETS 300 233 [6] for the case with a NT1 separate from the AN;

- ISDN PRA with a UNI according to ETS 300 011 [2] at the user side of the AN (i.e. the interface at the T reference point),

with flexible bearer channel allocation on a call-by-call basis which provides concentration capability within the AN and over the V5.2 interface.

7.1.2 Multiple V5 interface applications

Conclusions on multiple V5 interface applications were as follows:

a) an AN may have one or a number of V5 (V5.1 and/or V5.2) interfaces;

b) the V5 interfaces of an AN may all connect to one LE or to several LEs. However, in the latter case, any individual V5 interface is connected to only one LE (single homing principle).

Dual homing allows a user port to be associated, via a V5 interface, with an exchange and alternatively be associated, by co-ordinated re-provisioning or re-configuration, to another exchange via a V5 interface. Implementation of the dual homing feature shall have no impact on the V5 interface.

The association of a user port to the V5 interface covers all channels of this port, except those allocated for Permanent Lines (PLs), which are allocated to an interface to the leased line network:

c) a user port at an AN is served by only one V5 interface. This includes all the channels of this user port allocated for on-demand services or for semi-permanent leased lines established under the control of the LE;

   NOTE 1: The PL service through this user port, which bypasses the LE, is not included since the affected channels go through another type of interface and not another V5 interface.

d) different user ports belonging to the same customer may be provisioned for the same V5 interface or for different V5 interfaces. However, the restriction given in item c) applies.

   NOTE 2: There is no restriction in the use of the principle described under item b).

7.1.3 Architecture aspects

Conclusions on architecture aspects were as follows:

The V5.1 interface is limited to one physical 2 048 kbit/s link.

Any V5.2 interface may have a minimum of one and a maximum of sixteen physical 2 048 kbit/s links.

The number and mix of V5.1 and V5.2 interfaces between any particular AN and LE is not limited by the specification.

Additional channel switching between the AN and the LE, e.g. by a separate cross connect, is allowed but without impacting the functionality of the V5 interface specified in the standard. Cascading of ANs (i.e. by connecting them with a "V5 type" interface) shall not impact the functions of the V5 interface.

The scope of the V5 interface is not limited to ANs exclusively and is independent of their architecture. Cross connect(s) between an AN and the LE are seen from the V5 interface as being an integral part of the AN.

The coexistence of interface V5.1, V5.2 and V3 within the AN or LE shall be possible.

7.1.4 Control principles

7.1.4.1 General requirements and assumptions

The following general requirements have been identified:

a) the responsibility for call control resides in the LE (i.e. the AN may have no knowledge of the call state during normal operation of the V5 interface);

b) the access management in the AN and the service management in the LE each maintain their Finite State Machines and protocol entities and communicate over the V5 interface.

7.1.4.2 Control of ISDN user port for the PL capability

a) Statements and assumptions

1) The PL capability supported by an AN in the V5 interface configuration is an additional feature at an ISDN UNI which cannot be supported by an access connected directly to a LE.

2) The PL capability may as an option use one or more B-channels on a user port (BA or PRA), that are not provisioned in the AN and LE to carry on-demand services. Permanent activation of the access is required (for ISDN BA).

3) The LE is responsible for on-demand services, as well as for the permanent activation of the access (ISDN BA) during normal operational conditions of the user port.

b) ISDN and PL capability

The PL service shall not use the D-channel.

The currently defined ISDN service over the basic or primary rate access, delivered to an ISDN user port at an AN shall be the same as for direct access connections to the LE.

For an AN, no impact on an ISDN on-demand service can be accepted from any service (e.g. PL service) that uses one or more of the B-channels for other than on-demand service. The definition of such a service shall accept any unavoidable impact due to the activation/deactivation control responsibility of the access by the LE.

The LE system management has the capability of overruling the permanent activation for the PL capability in case of fault occurrence and fault recovery, because in these conditions the responsibility for activation control changes from the LE to AN or vice versa. Under operational conditions the PL capability will not be affected.

7.1.5 Provisioning strategy and requirements

Provisioning is one of many aspects to control functions. It has been separated from the other control requirements because provisioning shall be performed through the Q3 interfaces of the AN and the LE and is therefore not directly relevant to the V5 interface specification. Only those provisioning aspects having at least conceptual or indirect implication to the interface definition are defined below:

a) the association of V5.1 bearer channels to user ports at the AN and LE shall be provisioned (this does not apply to V5.2 where the association of bearer channels is under the control of the Bearer Channel Connection (BCC) protocol). In the case where an AN equipment has only a single 2 048 kbit/s interface, the equipment may have a pre-defined association of bearer channels to user ports. As a principle the same applies to the allocation of an EFaddr to an ISDN user port or a L3addr to a PSTN user port. Further exceptions from this principle however may be defined in the AN specification;

b) all data for provisioning, including modification and cessation, shall be handled by the relevant Q-interface. Data for provisioning shall be consistent with the splitting of control functionality between the LE and the AN. This includes data related to the user interface (for example line circuit parameters) and the signalling protocol (for both the LE and the user interfaces).

The TMN function has the responsibility of ensuring that the configuration of the LE and of the AN are compatible, and there is no impact on the V5 interface specification. This includes provisioning of PL capability which are multiplexed onto an ISDN user port:

c) changing the provisioning (re-provisioning) shall only be applied when the relevant user port is in the non-operational state in order not to interfere with on-going calls or calls being set-up or cleared down;

d) the AN may support ports and services which are not associated with the V5 interface. These ports or services shall not impact the operability of ports associated with the V5 interface;

e) a single AN may have multiple V5 interfaces. The association of user ports with different V5 interfaces shall be performed through provisioning.

7.1.6 Protocol requirements for PSTN and ISDN

The protocol specification for PSTN ports is based on the following:

a) the analogue PSTN signalling information shall be transported over the V5 interface using the layer 3 messages of the V5 PSTN protocol. Since analogue line signalling varies from PSTN to PSTN, the line signals needs to be mapped onto V5 PSTN protocol messages on a national basis;

b) signalling information shall be multiplexed at layer 3 and carried over a single layer 2 data link;

c) only the LE shall have knowledge about the PSTN services under operational condition of the V5 interface;

d) DTMF senders, receivers, tone generators and announcements shall be located in the LE.

The ISDN D-channel information shall be multiplexed at layer 2 and frame relayed over the V5 interface.

7.2 Access network services not covered by the V5 standards

As indicated in subclause 7.1.5 item d), an AN may support ports and services which are not associated with a V5 interface and are thus not covered by the V5 standards. This particularly applies to permanent leased lines which have dedicated user ports connected by provisioning to non-V5 interfaces to permanent leased line service networks, as shown in figure 7. These interfaces will generally conform to ETSI transmission interface standards, e.g. ETS 300 166 [4] and ETS 300 167 [5].

Permanent leased lines are considered in clause 8, along with semi-permanent leased lines and ISDN permanent line capability which are V5 relevant.

7.3 Consideration of CEC BC-T-309 requirements

7.3.1 Separate AN and switched-service providers

The V5.1 and V5.2 specifications were written to meet the need for open interfaces between ANs and LEs, to enable network operators to take advantage of multi-vendor equipment supply. In achieving this aim, the interfaces are also suitable for the case where the AN and the LE are operated by different network/service providers. This is facilitated by the specification of separate Q3 interfaces for the management of V5 related (and other) AN and LE functions.

7.3.2 Access to more than one switched-service provider

As indicated in subclause 7.1 of this ETR, an AN may support any number of V5 interfaces. There may be several LEs connected to a single AN but any one V5 interface only connects between an AN and one particular LE. The LEs may be operated by the same or by different switched-service providers. Thus, an AN using standard V5.1 and/or V5.2 interfaces, can be used to provide access to two or more switched-service providers, each having its own LE.

However, an individual user port at an AN can be served by only one V5 interface and therefore by only one switched-service provider. This includes all the channels of an individual ISDN BA or PRA user port allocated for on-demand services or for semi-permanent leased lines established under the control of the LE. This constraint is necessary since, in accordance with the ISDN architectural concepts, of which V interfaces are an integral part, the associated LE is responsible for the switched service provided to the complete UNI.

7.3.3 User selection of switched-service provider (permanent)

From the foregoing, it is apparent that a user with a single user port served by an AN having V5 interfaces to more than one service provider's LE, has the possibility to determine which switched-service provider to access on a permanent basis. This would be done by provisioning action via the Q3 management interface of the AN and the Q3 management interface of the appropriate LE.

Although an individual user port can have access to only a single LE, a multi-channel user port (i.e. ISDN BA or PRA) can have one or more channels providing access to each of one or more permanent-leased-line service networks, which may have service providers different to the switched-service provider. In this case, the LE management needs to be aware of the non-availability for switched service of those channels which have been allocated by AN management to PL capability.

If a user has more than one user port on an AN, one or more user ports may be associated with each LE and therefore with each switched-service provider (see also annex A).

7.3.4 User selection of switched-service provider (semi-permanent)

A user served by an AN having V5 interfaces to more than one switched-service providers LE, has the possibility to determine which switched-service provider is accessed, on a semi-permanent basis. The Q3 management interface functions, defined to support the V5 interfaces, are capable of supporting this. However, semi-permanent user selection of switched-service provider requires close co-ordination of management of the several network/service providers areas of responsibility, to ensure timely changeover in the AN and in the LEs involved.

Calls incoming to the user need to be routed via the appropriate switched-service provider. This generally requires the user to have a separate Directory Number (DN) from each switched-service provider, which could be a severe barrier to adoption of the user selection capability.

General acceptance of user selection of switched-service provider may require the provision of DN portability between switched-service providers. For limited usage, this could be achieved by call forwarding or drop-back call rerouteing but with a per-call cost in network resource utilization (see also subclause 9.3).

7.3.5 User selection of switched-service provider (call-by-call)

As explained in clause 6, the ISDN concept of access connection element (which applies equally to the PSTN) covers the AN plus the ET function in the LE. The LE provides the local CRF, which allows call-by-call selection of transit network provider (transit network selection). This involves local exchange A-type or B-type trunk interfaces, rather than V5-type interfaces.

User selection of LE by the AN, on a call-by-call basis, is not possible within the network architectural concepts, which also define V interfaces, since it requires LE call routeing functions to be provided in the AN. The introduction of limited call routeing functions in the AN requires termination of layer 3 protocols in the AN and is not considered to be practicable. Furthermore, it would compromise the architectural concepts on which present narrowband networks and planned future broadband networks are based.

This does not preclude a user from having accesses to more than one switched-service provider, which may in the future share a common physical interface into the AN. The user could then select switched-service provider on a call-by-call basis, by selecting the appropriate access (see annex A).

8 Support of leased lines

This clause supplements clause 7 in addressing the second bullet item of BC-T-309 [1] (see item b) of clause 1).

The V5 interface specifications enable the AN to provide leased line connections having different capabilities and establishment requirements. Three main groups can be distinguished:

a) semi-permanent leased line connections;
b) permanent leased line connections;
c) PL capability for permanent leased line connections.

8.1 Semi-permanent leased line connections

Semi-permanent leased line connections can be provided through various types of user port but these user ports need to be associated with a V5 interface and thus with a LE by provisioning. The user ports can be:

a) an analogue user port without signalling (other than in-band signalling);
b) a digital user port with a single or with multiple bearers;
c) an ISDN user port using one or more bearer channels.

The semi-permanent leased line connection is set-up under control of the LE. The detailed requirements are defined in annex B of ETS 300 324-1 [8].

8.2 Permanent leased line connections

The AN may have other user ports which are not associated with the LE. These ports may be used for permanent leased line connections routed through the permanent leased line service network. The user port may provide the suitable UNI which may support a single bearer or multiple bearers. Permanent leased lines are outside the scope of the V5 interface standards.

The establishment of the connection is through provisioning of the AN and the permanent leased line service network and may be set-up on a permanent basis or timed basis according to the requirements of the user and the provisions of the leased line service provider.

8.3 Permanent line capability for permanent leased line connections

An ISDN user port having more than one B-channel can support, in addition to switched connections and semi-permanent connections, also the PL capability. Although this user port is associated to a LE through provisioning and thus is operated and maintained accordingly, one or more B-channels may be extracted at the ET layer 1 function in the AN and routed through the permanent leased line service network. The implications on both the LE and the PL capability from this type of application are defined in the V5 interface specifications.

The establishment of the connection using the permanent leased line capability is through provisioning of the AN, the permanent leased line service network and the LE. The connection may be set-up on a permanent basis or timed basis according to the requirements of the user and the provisions of the leased line service provider and, in the latter case, if supported by the service provider operating the LE.

9 Management

This clause addresses the fourth bullet item of BC-T-309 [1] (see item d) of clause 1), i.e. analysis of the Q3 specifications associated with V5.

9.1 Access network management architecture

In considering the management requirements for ONP access to the local loop, it is helpful to look at the management architecture planned for use with ANs. The current management architecture assumes a vertical management hierarchy of the form given in figure 10.

From this it can be seen that ANs are managed from a different management stack to those for the LEs. This allows ANs to be managed by AN providers different from the service providers who manage the LEs. A top layer of functionality, provided by the TMN will be used to give both of these sub-networks a common management framework.

In practice, the management networks are incomplete for most of the telecommunications operators within Europe. In all cases, the full TMN functionality is yet to be provided in one electronic system and the appropriate management capabilities normally reside as a series of (frequently manual) processes within each of the service providers' domains. It is expected that this situation will persist for some years before all the necessary TMN standards are available and have been implemented.

The result of this incompleteness of the management architecture is that it will be some time before it can be guaranteed that the management functions in an AN could be guaranteed to operate in real time (or near real time) with those in the exchange.

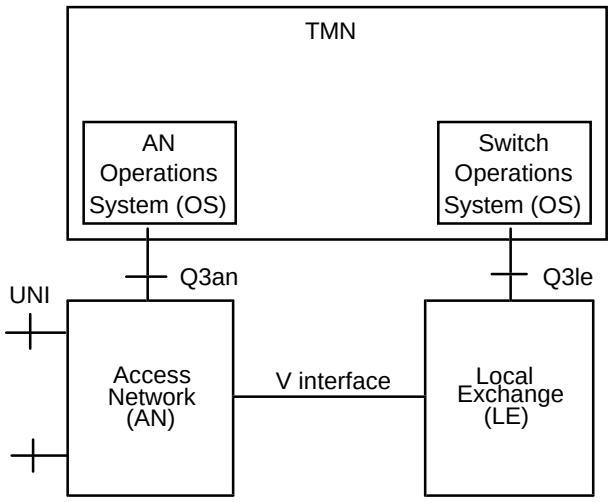


Figure 10: Access network management architecture

9.2 Management interface capabilities

Much of the functionality required in order to support ONP has already been designed into the Q3 interface standards associated with management of V5 interface capabilities (ETS 300 376-1 [10], ETS 300 377-1 [11], ETS 300 378-1 [12] and ETS 300 379-1 [13]). What has yet to be done, is to build the top level support functions into the TMN in order to correctly support these new service capabilities. This functionality is outside the scope of current Q3 standardization work and will depend upon the generation of appropriate TMN standards and service providers being willing to provide the functionality at reasonable cost.

It is expected that ONP will result in more management activity, if not increased management functionality, being required of the management systems connected both to the exchanges and the ANs. This is because the functions associated with user choice of service provider would need to be updated on a more frequent, possibly periodic, basis.

9.3 Management associated with user selection of switched-service provider

User selection of switched-service provider (permanent or semi-permanent) involves more than just re-configuration in the AN and in the LEs concerned. The management changes required for routeing of incoming calls via the appropriate service provider, including directory number portability between service providers, as identified in subclause 7.3.4, comprise a major uncharted area. The means of implementing number portability are only just beginning to be addressed and it could be some years before these mechanisms can be incorporated into European standards. The problems are exacerbated in the case of selection on a semi-permanent basis, where network routeing changes may be required several times per day, potentially for a large number of users.

User selection of switched service provider by the AN on a call-by-call basis would require not only LE call control functions to be performed in the AN but also the management responsibility for the switched service would be split between the AN provider and the switched service providers. This is one of the major reasons for the established architectural assignment of functionality, which precludes call-by-call selection in the AN.

It is anticipated that users may wish to change the usage of the whole or part of their access between switched services and leased line services, possibly from different service providers. This would probably occur at regular times in order to be reasonably easily controllable by the service providers but puts further demands on near real-time management functionality, across AN and service providers.

9.4 Management associated with leased lines

The present V5-related Q3 interface standards support the basic requirements of leased-line service provider selection. However, as indicated in subclauses 9.1 and 9.2, the TMN standards for co-ordinating configuration changes across disparate ANs and service provider domains are not yet in place.

A further aspect is that user control of service provision may be desirable, particularly in the area of leased line configuration. Standardization in this area is still immature.

10 Additional specifications required

This clause addresses the third bullet item of BC-T-309 [1] (see item c) of clause 1) by identifying requirements for additional standardization.

10.1 V5 PSTN signal mappings

10.1.2 The need for V5 PSTN mappings

It was realized early in the specification of the V5 interfaces that PSTN analogue line signalling protocols were standardized only on a national basis. In fact, the analogue line signalling implementations of PSTN vary significantly from country to country, although superficially many of the services appear similar from a functional point of view. It was also accepted that standardization of the analogue line signalling aspects of these services on a European basis was not likely to be possible, particularly in the short term. It was therefore decided that the only way in which V5 could provide the capability for providing PSTN service support on a European basis was to define, rather than a single PSTN protocol, a comprehensive protocol tool kit, from which any PSTN analogue line signalling protocol could be created.

This protocol tool kit became known as the V5 PSTN protocol. In reality, it is a collection of messages and other protocol elements. For the main part, these messages control the electrical conditions on the analogue line, although some of them contain a small amount of functional type information, in order to allow establishment of a reliable signalling path and for support of special, time critical, sequences.

In addition, a number of messages were defined as part of the PSTN protocol which are used in order to unambiguously provide information, both about the functional state of the user port, and whether the message set used in order to control the electrical conditions on the analogue line could be used at any particular instant in time. The use of these messages is rigidly defined in the V5 interface standards.

The way that the messages controlling the electrical conditions on the analogue line are used in order to create the relevant services was called the V5 PSTN mappings. By definition, the V5 PSTN standards allow some freedom in the way that these V5 PSTN messages are used in order to support a particular PSTN analogue line signalling protocol.

10.1.3 The current approach to the production of V5 PSTN mappings

Although initially it was thought that the V5 PSTN mappings would be produced on a national basis, to date this has not been enforced by the relevant standards bodies. The result is that there is the potential for companies within countries to create and utilize their own proprietary V5 PSTN mappings. Hence, within any country there could be two or more V5 PSTN mappings supporting the same PSTN analogue line signalling protocol.

The impact of a number of V5 PSTN mappings in existence for a particular PSTN analogue line signalling protocol within a country on ONP is easy to envisage. It would lead to potential interworking problems, as equipment designed for ANs using a particular V5 PSTN mapping would not interwork with LEs provided to a different V5 PSTN mapping, even though the PSTN analogue line signalling protocol to be supported was identical.

10.1.4 Standardization of the V5 PSTN mappings

It is highly desirable that the V5 PSTN mapping, used to support the particular PSTN analogue line signalling protocol provided within a country, should be standardized, in order to minimize interworking problems. This would seem to be in line with ONP principles. In order for this to happen, the V5 PSTN mappings would have to be standardized on a national basis and made available to all that required them.

The way in which this should be achieved is not clear. The responsibility could be handed to the national standards bodies or the work could be co-ordinated through ETSI. This ETR has identified the problem; however it is not within its scope to determine how the necessary standardization should be achieved.

10.2 Management

Much of the functionality required in order to support ONP access to the local loop is already being built into the management architectural models and hence into the Q3 interface and associated TMN standards. However, a significant amount of further standardization activity in the TMN area is necessary, in order to support the proper co-ordination of management operations, across multiple AN and service provider domains. Furthermore, it may be desirable to generate standards for user management of his own semi-permanent service provision. The cost effectiveness of developing and implementing such standards has yet to be demonstrated.

11 Conclusion

The existing ETSs go a long way towards meeting the needs identified in BC-T-309 [1]. The V5 interfaces and associated Q3 managed objects already support:

a) the case of separate network/service providers for the AN and LE;

b) the case of an AN providing access to two or more service providers via separate V5 interfaces;

c) user selection of service provider on a permanent basis, i.e. by management via Q3AN and the Q3 interface of each LE;

d) user selection of service provider on a semi-permanent basis, assuming that the appropriate management infrastructure is available.

Existing ETSs and ITU-T Recommendations provide for user selection on a call-by-call basis of transit network provider at the LE.

However, user selection in the AN of service provider on a call-by-call basis is considered to impossible within the concepts of current and future networks and of V interfaces, since it requires LE functions to be provided in the AN. V interfaces would then no longer be applicable. Possible solutions which would not conform to established architectural concepts have not received detailed consideration during the preparation of this ETR.

Further standardization is desirable in the following areas:

a) mapping of national PSTN signalling protocols onto the V5 PSTN protocol;

b) TMN standards to support proper co-ordination of management across multiple network/service providers domains and, possibly, to allow user control of semi-permanent service provision.

Annex A: Private Branch eXchange (PBX) selection of service provider

A PBX may have access via separate UNIs to more than one switched-service provider, either directly or via an AN, as shown in figure A.1. The UNIs may be of any type.

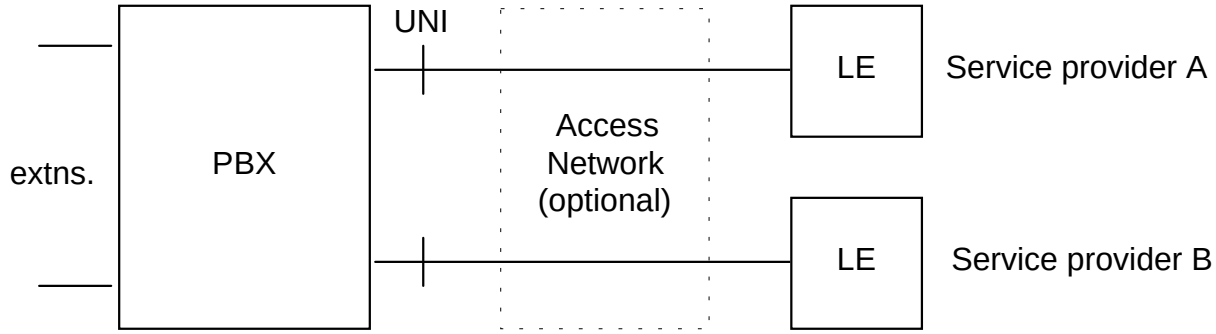


Figure A.1: PBX supporting service provider selection

With such a configuration, the PBX can provide service provider selection on the basis of:

a) automatic selection of lowest-cost routeing (which may be time of day dependent); or

b) user selection of service (by dialling code).

History

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