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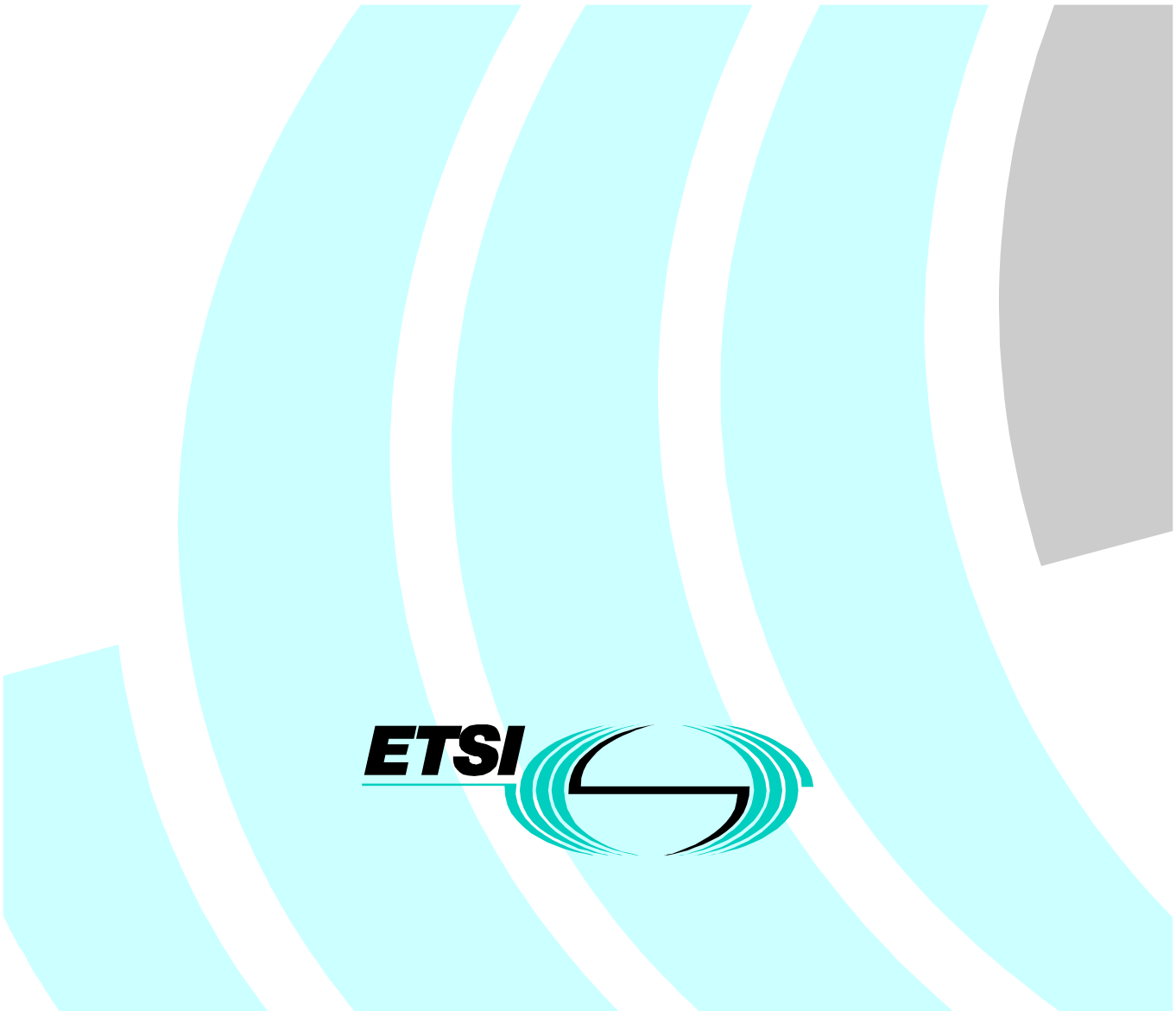
European Standard (Telecommunications series)

Q3 interface at the Local Exchange (LE) for configuration management of V5 interfaces and associated customer profiles; Part 1: Q3 interface specification



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Contents

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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Telecommunications Management Network (TMN).

The present document is part 1 of a multi-part EN covering the Q3 interface at the Local Exchange (LE) for configuration management of V5 interfaces and associated customer profiles.

Part 1: "Q3 interface specification";

Part 2: "Managed Objects Conformance Statement (MOCS) proforma specification".

National transposition dates	
Date of adoption of this EN:	8 October 1999
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Introduction

Customer administration is a management activity that the network operator performs in order to exchange with the customer all the customer related management data and functions required to offer a telecommunications service and to exchange with the network all the customer related management data and functions necessary for the network to produce that telecommunications service.

It is considered that the customer's terminal equipment can be connected directly to the Local Exchange (LE) or via a V5 interface.

In a wide sense, this could include interactions for the purpose of service provision management, configuration administration, fault administration, charging (including detailed billing) administration, complaints administration, quality of service administration, traffic measurement administration etc. In the present document, however, only customer administration in the more traditional sense of service provision and service configuration has been included.

In particular, the tasks to be performed in the LE to provide service for customers which are connected via a V5 interface to the LE are considered.

Administration of V5 interface related data is a management activity that the network operator performs in order to configure initially or to reconfigure a V5 interface to enable and maintain the service offering for the customers connected.

An agreement was reached to consider all items concerning configuration management of V5 interfaces. This covers:

- the labelling of a V5 interface with protocol version and provisioning variant;
- a switch-over possibility between V5 interface data sets with different provisioning variants and protocol versions for reconfiguration of a V5 interface;
- allocation of communication and bearer channels for a V5 interface;
- handling of customer port related data relevant for the LE;
- administrative blocking of user ports within a V5 interface;
- association of user ports to a specific V5 interface;
- marking of ISDN user port B-channels as unavailable when used for the permanent line service in the AN;
- upgrading a V5.1 interface to a V5.2 interface.

1 Scope

The present document specifies the Q3 interface between a Local Exchange (LE) and the Telecommunications Management Network (TMN) for the support of configuration management functions for V5 interfaces, as described in EN 300 324-1 [2] and EN 300 347-1 [3], and their associated customer profiles. The management of transmission, media and services which are not related to V5 interfaces is outside the scope of the present document.

The Q3 interface is the TMN interface between Network Elements (NEs) or Q-adapters which interface to Operations Systems (OSs) without mediation and between OSs and mediation devices. The location of the Q3 interface is illustrated in EN 300 376-1 [4].

Generic modelling of leased line ports which are associated with a V5 interface is within the scope of the present document, but the traffic from these ports can only be associated with 64 kbit/s bearer channels on the V5 interface.

The definition of OS functionality, and the specification of Qx interfaces and proprietary interfaces are outside the scope of the present document.

Existing protocols are used where possible, and the focus of the present document is on defining the object models.

Although security management is excluded from the present document, any aspects of security relating to configuration management are included as an integral part of configuration management.

NOTE: Configuration management includes provisioning and the provisioning activity may include testing, but this testing is not included in the present document. It is included in the specification relating to fault and performance management, EN 300 379-1 [6].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] EN 300 291-1: "Telecommunications Management Network (TMN); Functional specification of Customer Administration (CA) on the Operations Systems/Network Element (OS/NE) interface; Part 1: Single line configurations".

[2] EN 300 324-1: "V interfaces at the digital Local Exchange (LE); V5.1 interface for the support of Access Network (AN); Part 1: V5.1 interface specification".

[3] EN 300 347-1: "V interfaces at the digital Local Exchange (LE); V5.2 interface for the support of Access Network (AN); Part 1: V5.2 interface specification".

[4] EN 300 376-1: "Telecommunications Management Network (TMN); Q3 interface at the Access Network (AN) for configuration management of V5 interfaces and associated user ports; Part 1: Q3 interface specification".

[5] EN 300 378-1: "Telecommunications Management Network (TMN); Q3 interface at the Access Network (AN) for fault and performance management of V5 interfaces and associated user ports; Part 1: Q3 interface specification".

[6] EN 300 379-1: "Telecommunications Management Network (TMN); Q3 interface at the Local Exchange (LE) for fault and performance management of V5 interfaces and associated customer profiles; Part 1: Q3 interface specification".

[7] ITU-T Recommendation M.3010 (1996): "Principles for a Telecommunications management network".

[8] ITU-T Recommendation M.3100 (1995): "Generic network information model".

[9] ITU-T Recommendation Q.811 (1997): "Lower layer protocol profiles for the Q3 and X interfaces".

[10] ITU-T Recommendation Q.812 (1997): "Upper layer protocol profiles for the Q3 and X interfaces".

[11] CCITT Recommendation X.208 (1988): "Specification of Abstract Syntax Notation One (ASN.1)".

[12] ETR 047 (1992): "Network Aspects (NA); Telecommunications Management Network (TMN); Management services".

[13] ITU-T Recommendation X.720 / ISO/IEC 10165-1 (1992): "Information technology - Open Systems Interconnection - Structure of management information: Management information model".

[14] ITU-T Recommendation X.721 / ISO/IEC 10165-2 (1992): "Information technology - Open Systems Interconnection - Structure of management information: Definition of management information".

[15] ITU-T Recommendation X.730 / ISO/IEC 10164-1 (1992): "Information technology - Open Systems Interconnection - Systems management: Object management function".

[16] ITU-T Recommendation X.731 / ISO/IEC 10164-2 (1992): "Information technology - Open Systems Interconnection - Systems management: State management function".

[17] ITU-T Recommendation X.732 / ISO/IEC 10164-3 (1992): "Information technology - Open Systems Interconnection - Systems Management: Attributes for representing relationships".

[18] ITU-T Recommendation Q.824.5 (1997): "Configuration management of V5 interface environments and associated customer profiles".

[19] ITU-T Recommendation Q.824.0 (1995): "Common information".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Access Network (AN): see EN 300 324-1 [2].

B-channel number: identifies a B-channel on the ISDN basic User-Network Interface (UNI) and ISDN primary rate UNI.

bearer channel: see EN 300 324-1 [2].

Bearer Channel Connection (BCC): see EN 300 347-1 [3].

Communication channel (C-channel): see EN 300 324-1 [2].

Communication path (C-path): see EN 300 324-1 [2].

control protocol: see EN 300 324-1 [2].

D-channel signalling type (Ds-type) data: ISDN D-channel signalling type data with Service Access Point Identifier (SAPI) not equal to 16, and not equal to 32 to 62 (see EN 300 324-1 [2]).

envelope function address: see EN 300 324-1 [2].

frame type (f-type) data: ISDN D-channel data with SAPI in the range from 32 to 62 (see EN 300 324-1 [2]).

layer 3 address: see EN 300 324-1 [2].

Local Exchange (LE): see EN 300 324-1 [2].

Operations System (OS): see ITU-T Recommendation M.3010 [7].

packet type (p-type) data: ISDN D-channel data with SAPI equal to 16 (see EN 300 324-1 [2]).

Permanent line (PL): see EN 300 324-1 [2].

protection protocol: see EN 300 347-1 [3].

provisioning variant: see EN 300 324-1 [2].

semi-permanent leased line: see EN 300 324-1 [2].

time slot number: see EN 300 324-1 [2].

V5 interface: see EN 300 324-1 [2].

V5 time slot: object class representing a 64 kbit/s channel of a V5 interface that is used as bearer or communication channel. It is a subclass of ITU-T Recommendation M.3100 [8]: connectionTerminationPointBidirectional.

V5 Trail Termination Point (TTP): object class representing a 2 Mbit/s interface that is used as V5.1 interface or as part of a V5.2 interface. It is a subclass of ITU-T Recommendation M.3100 [8]: trailTerminationPoint-Bidirectional.

virtual access channel: object class representing an individual ISDN B-/D-channel of an ISDN access port, or an individual channel of a digital access port, or the bearer channel for an analogue access port. It is a subclass of EN 300 291-1 [1]: etsiAccessChannel.

virtual access port: object class representing an image of the customer access port which is located in an AN and connected to the LE via V5 interface. It is a subclass of EN 300 291-1 [1]: etsiAccessPort and used for provisioning services to the customer. This object class is subclassed for the different types of customer access ports.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AN	Access Network
ASN.1	Abstract Syntax Notation One (see CCITT Recommendation X.208 [11])
BCC	Bearer Channel Connection
C-channel	Communication channel
C-path	Communication path
CTP	Connection Termination Point
Ds-type	D-channel signalling type
DS	Default Standby
ET	Exchange Termination
f-type	frame type
FSM	Finite State Machine
ID	Identity, Identifier
ISDN	Integrated Services Digital Network
LE	Local Exchange
M/C/O	Mandatory/Conditional/Optional
MDU	Management Data Unit
MPH	primitive between Physical layer and layer 2 Management
NE	Network Element

OS	Operations System
p-type	packet type
PH	primitive between Physical layer and layer 2
PSTN	Public Switched Telephone Network
$Q3_{AN}$	Q3 interface at the Access Network
$Q3_{LE}$	Q3 interface at the Local Exchange
RDN	Relative Distinguished Name
SAPI	Service Access Point Identifier
TIB	Task Information Base
TMN	Telecommunications Management Network
TTP	Trail Termination Point
UNI	User Network Interface

4 Information model diagrams

The entity relationship diagram is given in subclause 4.1 and the inheritance hierarchy (is-a relationships) and naming hierarchy (containment relationships) are given in subclauses 4.2 and 4.3, respectively.

4.1 Entity relationship diagram

Figures 1 to 5 show the overall relationships between the various entities. These correspond to the managed objects which are manipulated at the Q3 interface.

For V5.1 interfaces, access channels on access ports are associated with bearer time slots on a V5.1 interface by configuration over the Q3 interface of the LE. For V5.2, access channels on access ports are associated with bearer time slots on a V5.2 interface by the V5.2 Bearer Channel Connection (BCC) protocol. For both V5.1 and V5.2, the association of user signalling with communication paths and the association between communication paths and logical communication channels on the V5 interface is by configuration over the Q3 interface of the LE. The association of logical communication channels with physical communication time slots on the V5 interface is initially established over the Q3 interface, but can be changed for V5.2 interfaces by the V5.2 protection protocol.

Signalling protocols and their associated communication are modelled using various objects which represent the communication paths and the communication time slots. There are six classes of communication path objects. There is a single class for all Integrated Services Digital Network (ISDN) signalling with an attribute to distinguish between Ds-type, p-type, and f-type data. There are classes for Public Switched Telephone Network (PSTN) signalling, the control protocol, the BCC protocol, the link control protocol, and the protection protocol. In addition to these six communication path object classes, there is also an object class which represents communication channels.

There is one instance of the appropriate object class per communication path and per communication channel. These are contained in instances of v5Interface.

V5 control messages relating to provisioning are managed by an optional object on the Q3 interface. These messages may not be required once a TMN X interface or an integrated OS is available.

If control messages relating to provisioning are not supported on the Q3 interface then a default value for provisioning variant will be automatically used on the V5 interface. All V5 interfaces will use this default value unless actively changed via the Q3 interface. The value of this default is all zeroes.

Protection group 1 and its contained protection unit(s) are to be instantiated for the V5.2 case only if there is more than one 2,048 Mbit/s link.

4.1.1 Overview

A single managedElement can contain a number of virtualAccessPortR1s, a number of v5Interfaces, and a number of v5Ttps (which each represent a 2,048 Mbit/s link). There is a bi-directional association between each v5Interface and all of its related virtualAccessPortR1s. Likewise there is a bi-directional relationship between each v5Interface and all of its related v5Ttps (2,048 Mbit/s links).

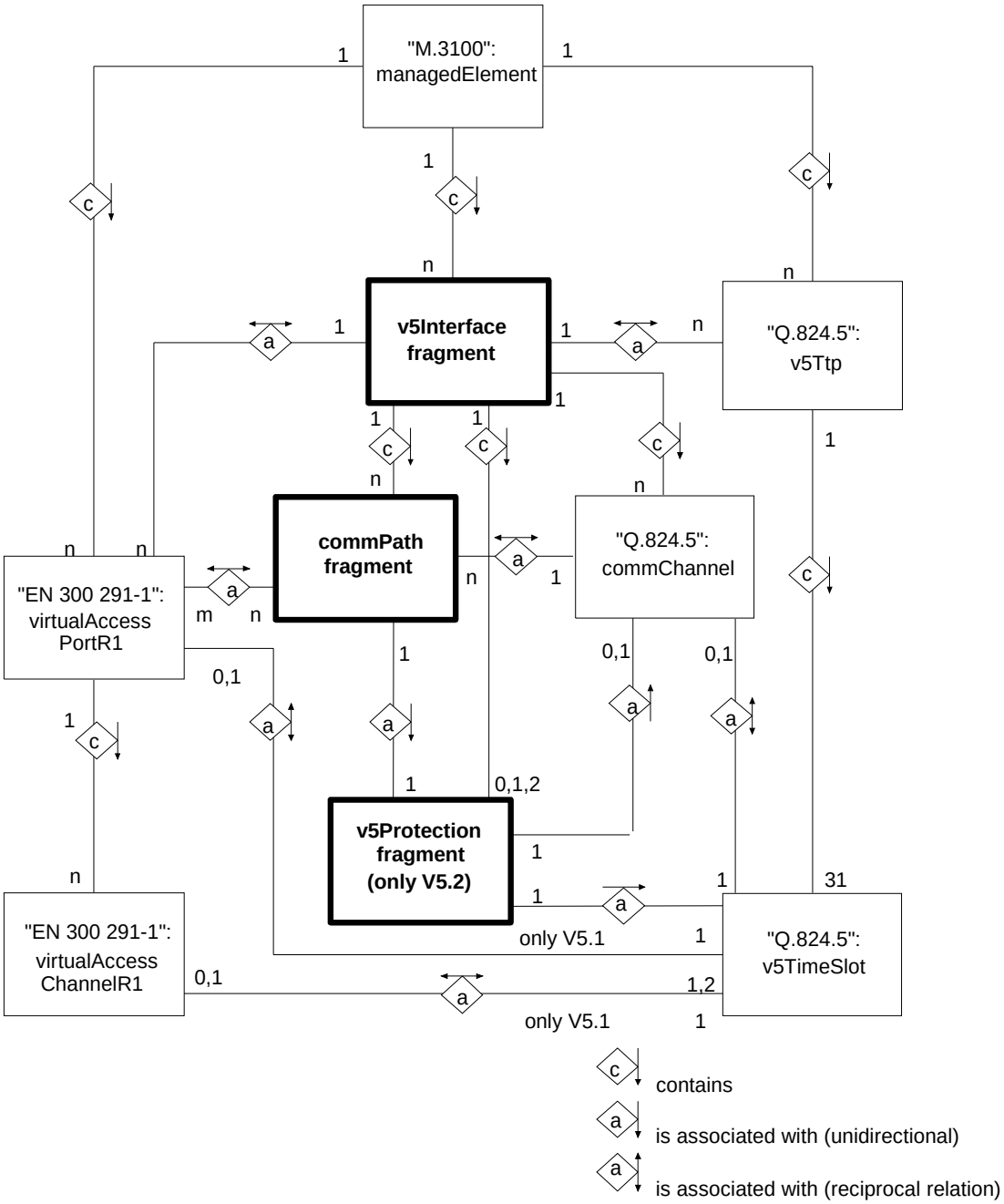


Figure 1: Entity relationship diagram - overview

Each virtualAccessPortR1 can contain a number of virtualAccessChannelR1s, each representing 64 kbit/s bearer channels. Each v5Ttp contains 31 v5TimeSlots which represent the CTPs corresponding to each of the 31 physical time slots. Each virtualAccessChannelR1 can be associated with a unique v5TimeSlot for a V5.1 interface, but for the V5.2 case there is no corresponding association because the relationship is controlled by the V5.2 BCC protocol.

4.1.2 V5 interface fragment

Each v5Interface contains a number of communication path objects in its commPath fragment, a number of commChannels, and one or two v5ProtectionGroup objects if it represents a V5.2 interface. Each instance of v5Interface may contain an instance of v5Provision to support the V5 pre-provisioning messages.

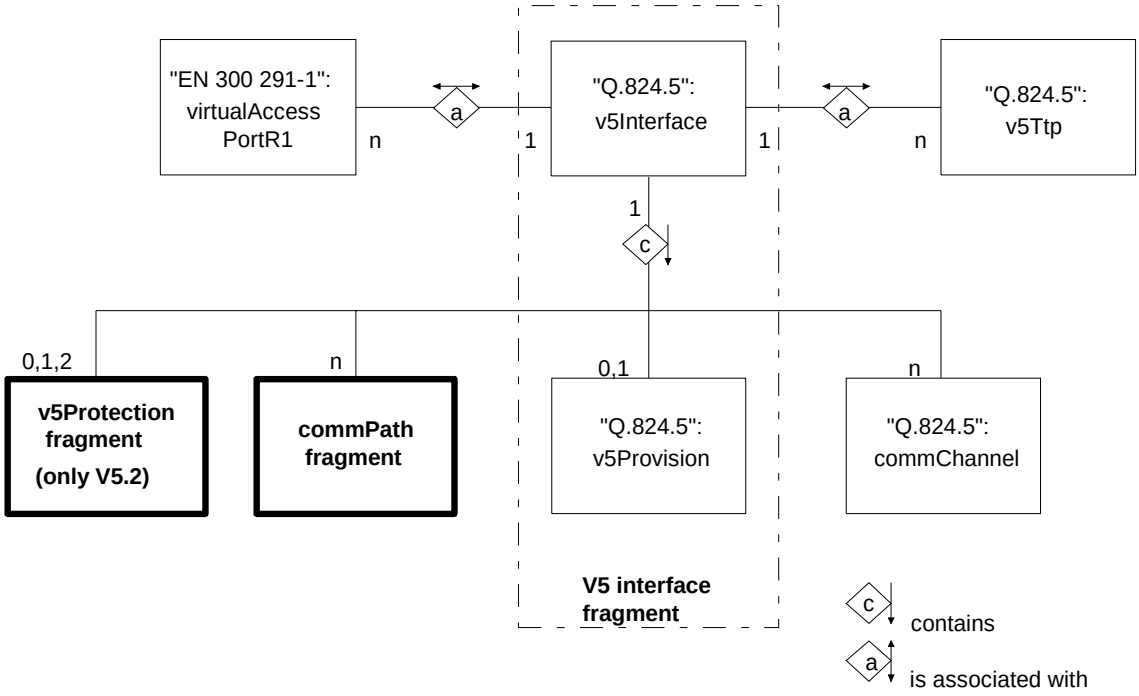


Figure 2: Entity relationship diagram - V5 interface fragment

4.1.3 Communication path fragment

Each ISDN virtualBasicRateAccessR1 or virtualPrimaryRateAccessR1 can be associated with up to three isdnCommPaths, one for each type of ISDN signalling. Each isdnCommPath handles a certain type of ISDN signalling for a number of virtualBasicRateAccessR1s and/or virtualPrimaryRateAccessR1s, and is associated with these. There may be more than one isdnCommPath contained in the v5Interface for each type of ISDN signalling.

The v5Interface contains a single controlCommPath. It contains a single pstnCommPath, but only if there are any virtualAnalogueAccessR1s associated with it. It also contains a single bccCommPath, a single protCommPath, and a single linkControlCommPath if it represents a V5.2 interface.

Each commChannel can be associated with up to three isdnCommPaths representing three different types of ISDN signalling. It can also be associated with the pstnCommPath. The commChannel which is associated with controlCommPath shall also be associated with the bccCommPath and with the linkControlCommPath if the v5Interface which contains it represents a V5.2 interface.

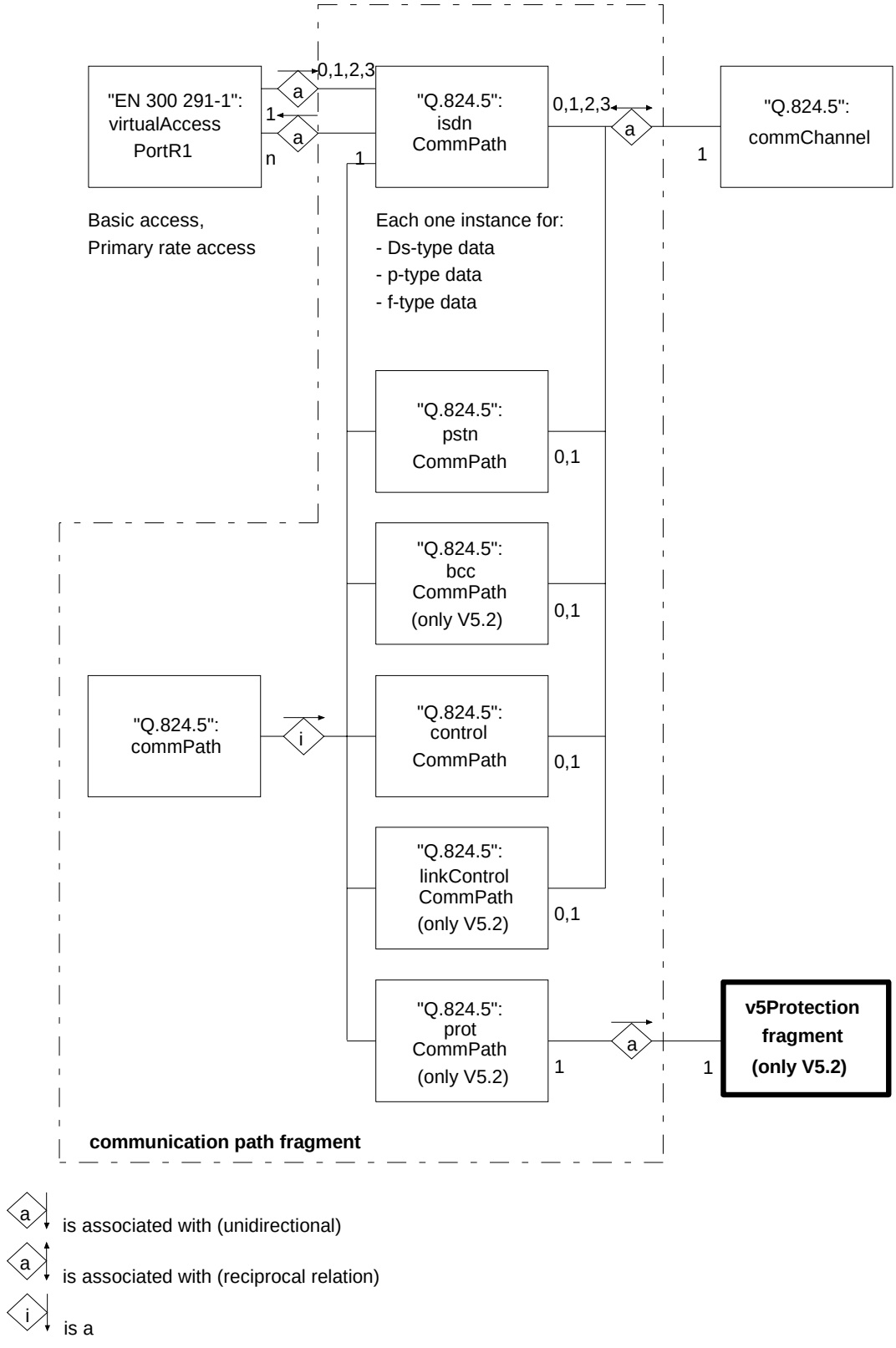


Figure 3: Entity relationship diagram - communication path fragment

4.1.4 Protection fragment

There is a bi-directional one-to-one association between commChannels and certain v5TimeSlots. Not every v5TimeSlot is associated with a commChannel. Some are used for bearer traffic and others are available for protection of commChannels on V5.2 interfaces. This protection adds onto the modelling for the V5.1 interfaces, and does not affect that modelling.

The time slots which may be associated with the commChannel which is associated with the controlCommPath are constrained by the V5 interface specifications EN 300 324-1 [2] and EN 300 347-1 [3]. A v5Interface which represents a V5.2 interface shall contain a v5ProtectionGroup of type 1 which contains two v5ProtectionUnits (see figure 4). One of these v5ProtectionUnits points to the protected commChannel which is associated with both the controlCommPath, the bccCommPath, and the linkControlCommPath. The corresponding pointer in the other v5ProtectionUnit is null. Both v5ProtectionUnits point to their associated v5TimeSlots. The containing v5ProtectionGroup of type 1 is pointed to by the protCommPath for the v5Interface, so there is an indirect mapping from the protCommPath through the v5ProtectionGroup of type 1, through its two contained v5ProtectionUnits onto its related v5TimeSlots.

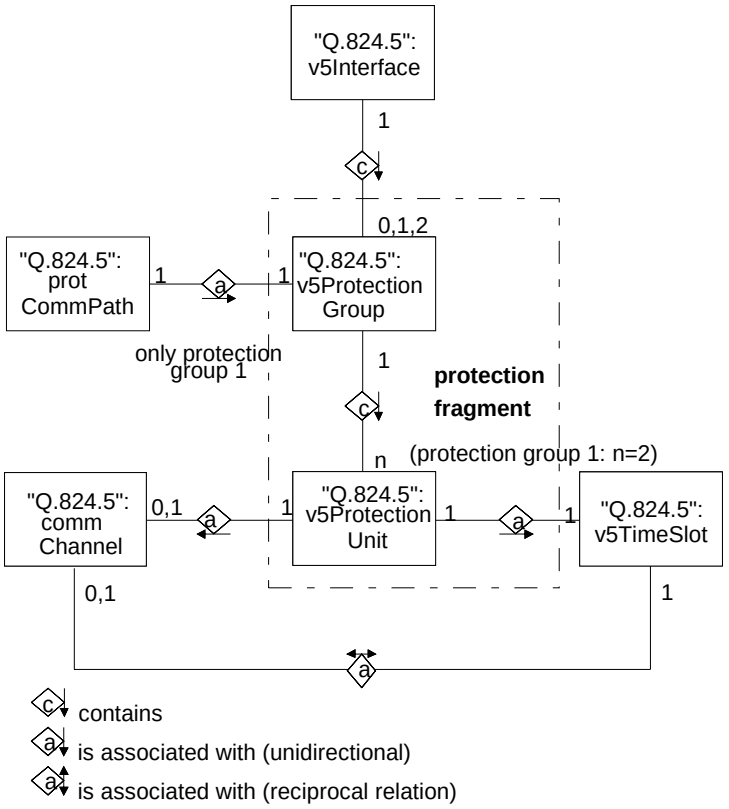


Figure 4: Entity relationship diagram - protection fragment

A v5Interface which represents a V5.2 interface also contains a v5ProtectionGroup of type 2 if other commChannels are protected (see figure 4). The v5ProtectionGroup of type 2 contains a number of v5ProtectionUnits, each of which points to its associated v5TimeSlot. The v5ProtectionUnits which point to active v5TimeSlots also point to the commChannels which are associated with the active v5TimeSlots. The corresponding pointers in the other v5ProtectionUnits are set to null.

4.1.5 Relation to EN 300 291-1 - customer administration

The provision of service to the customers follows the principles as defined in EN 300 291-1 [1]. Therefore, the virtualAccessPortR1, the virtualAccessChannelR1, and the V5 specific services are derived from the appropriate object classes defined in EN 300 291-1 [1].

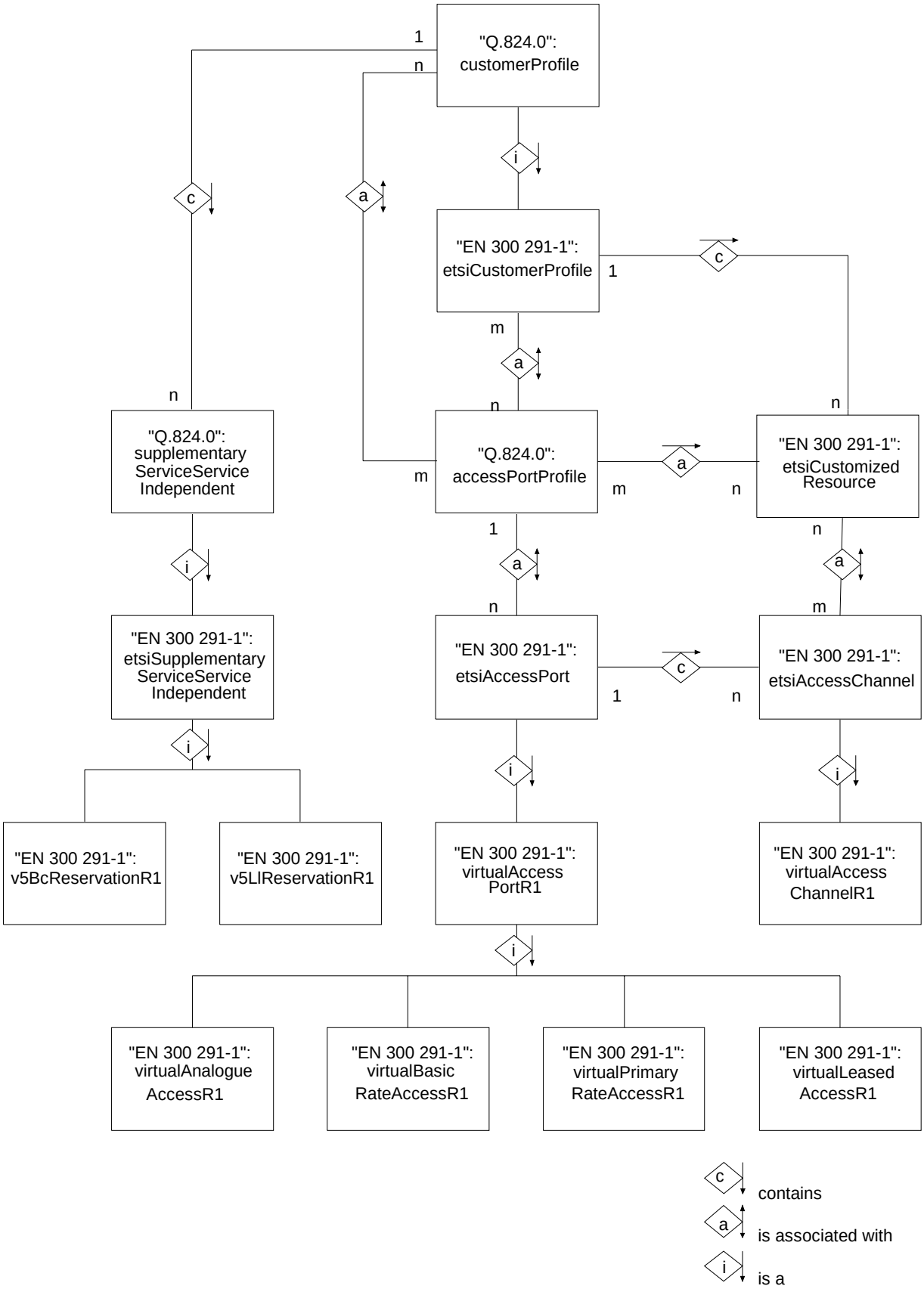
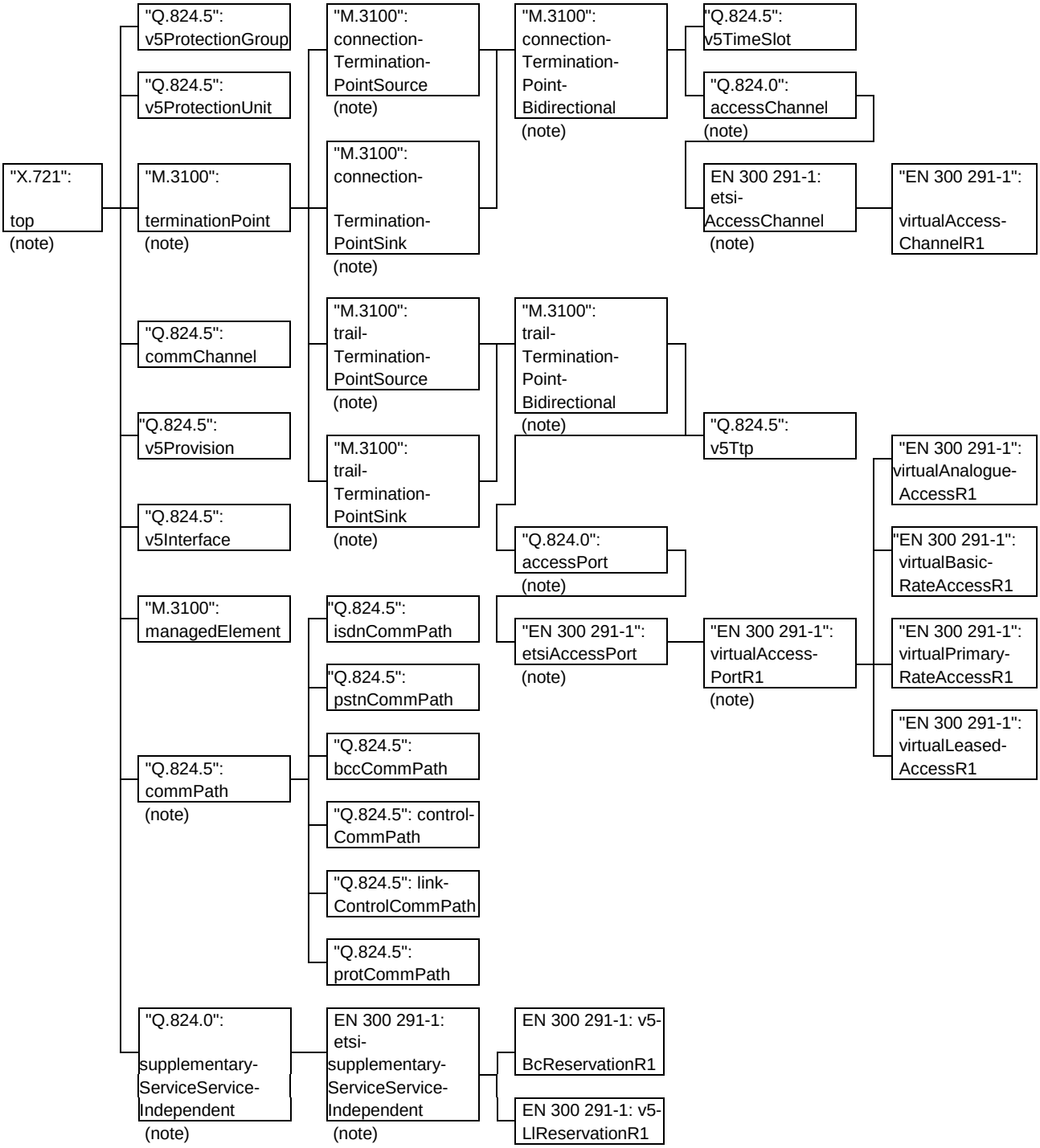


Figure 5: Relation to EN 300 291-1 - customer administration

4.2 Inheritance hierarchy

Figure 6 traces the inheritance from the highest level object ITU-T Recommendation X.721 [14]: top to the managed objects defined in the present document.



NOTE: Non-instantiable object class.

Figure 6: Inheritance hierarchy

4.3 Naming hierarchy

Figure 7 shows the naming (i.e. containment) relationships for the LE's managed objects associated with configuration management.

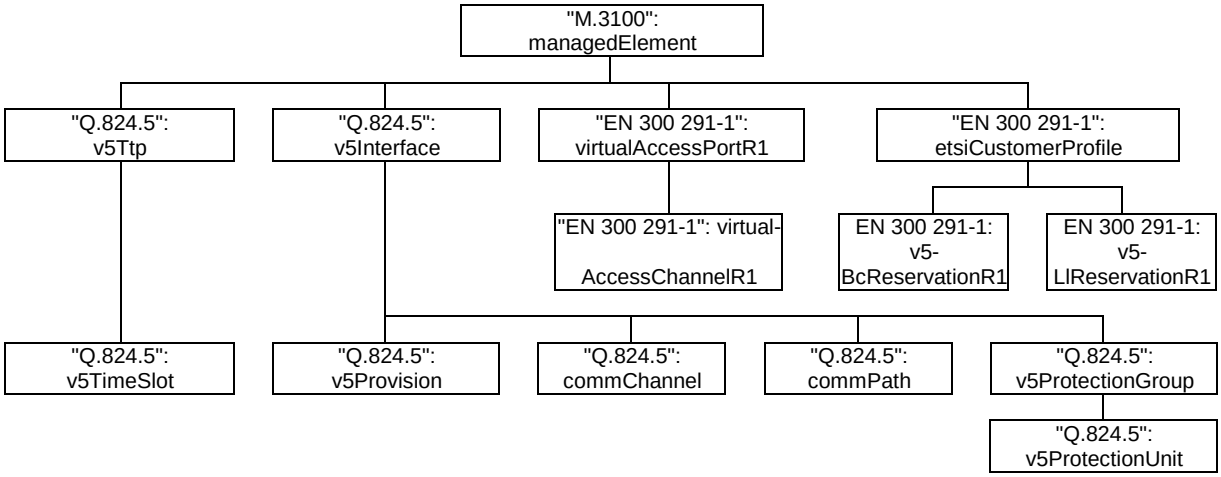


Figure 7: Naming hierarchy

5 Information model description

Clause 5 provides a high-level informal description of the customer administration and administration of V5 interface information model, related to customer installations accessed via V5 interface.

Subclause 5.1 contains a brief description for each object class used in the model covering:

- the purpose of the object class;
- the attributes defined and inherited for the object class; and
- the relationship of the object class to other object classes.

Subclause 5.2 describes attributes which are common to several object classes in the information model.

Subclause 5.3 describes actions which are influencing several object classes in the information model.

Subclause 5.4 describes the common aspects of the notifications used in the information model.

5.1 Managed object classes description

Subclause 5.1 is divided into further subclauses which describe the fragments of the information model.

In the tables listing the attributes of the object classes, the attributes inherited from ITU-T Recommendation X.721 [14]: top are not mentioned explicitly, although they are present in these object classes according to the conditions defined in ITU-T Recommendation X.721 [14]: top.

Attributes inherited from superclasses are mentioned in the tables if they are mandatory. If they are conditional or optional, they are listed as long as they are to be regarded in the scope of the present document. Nevertheless, they are present in these object classes. Inherited attributes have references to the documents in which the superclass is defined.

Attributes imported from other documents but not inherited from a superclass have references to the documents in which they are defined.

An instance of an object class mentioned hereafter having reciprocal pointer relationships shall only be deleted if these relationships are released.

5.1.1 Managed element fragment

5.1.1.1 Managed element (managedElement)

The managed element object class is defined in ITU-T Recommendation M.3100 [8].

5.1.2 V5 interface fragment

5.1.2.1 V5 interface (v5Interface)

A V5 interface is an object class representing either a V5.1 or a V5.2 interface as an abstract entity of its own right.

A V5 interface may comprise in the case of a V5.1 interface of one, and in the case of a V5.2 interface of one to 16 2 Mbit/s links represented by V5 Trail Termination Point (TTP) object instances, which are listed in the serverV5Ttps attribute.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

The clientUserPorts attribute points to the instances of the virtualAccessPortR1 subclasses in a LE, or to the instances of the userPort subclasses in an AN currently assigned to this particular V5 interface.

The actions setReciprocalPointers and releaseReciprocalPointers shall be used to maintain these relationship attributes. They shall not be applied on the reciprocal relationship between a commChannel object instance and a v5TimeSlot object instance if one of the instances or both are pointed at by a v5ProtectionUnit object instance.

The operational state shall be set to "disabled" whenever one of the vital protocols (control, link control, Bearer Channel Connection (BCC), protection) has a persistent failure which cannot be overcome by protection switching. All existing connections shall be released. All associated access port objects shall be set to "disabled" except for the ports with permanent lines assigned.

If all vital protocols are working, this attribute shall be set to "enabled". This shall result in all associated userPort/virtualAccessPortR1 instances being set to "enabled" if there are no other contradictory conditions.

If an instance supports the use of "degraded" then the availabilityStatus shall be set to "degraded" if the PSTN or ISDN services are affected by any interface internal problems, e.g. persistent protocol errors.

If the ITU-T Recommendation M.3100 [8]: tmnCommunicationsAlarmInformationPackage is instantiated, then the communicationsAlarm notification shall be used to report errors related to this object class. The errors to be reported and the usage of the alarm report parameters are specified in EN 300 378-1 [5].

Table 1

Name	M/C/O	Value Set
ITU-T Recommendation Q.824.5 [18]: v5InterfaceId	M	RDN
ITU-T Recommendation Q.824.5 [18]: peerManagedElement	O	single
ITU-T Recommendation Q.824.5 [18]: supportedProtocolVersion	M	single
ITU-T Recommendation Q.824.5 [18]: v5Identification	M	single
ITU-T Recommendation Q.824.5 [18]: serverV5Ttps	M	set according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.5 [18]: clientUserPorts	M	set according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation X.721.0 [14]: operationalState	O	single
ITU-T Recommendation X.721.0 [14]: availabilityStatus	O	set
ITU-T Recommendation M.3100.0 [8]: supportedByObjectList	C	set
ITU-T Recommendation M.3100.0 [8]: userLabel	O	single
ITU-T Recommendation M.3100.0 [8]: locationName	O	single
NOTE 1: v5InterfaceId: is the object identifier. The Relative Distinguished Name (RDN) is the V5 interface ID. NOTE 2: peerManagedElement: identifies in a LE the adjacent AN and in an AN the adjacent LE which this particular V5 interface is connected to. NOTE 3: supportedProtocolVersion: indicates the version of the V5 interface protocol this particular V5 interface is supporting. NOTE 4: serverV5Ttps: indicates the V5 TTP associated with the V5 interface. It is a group relationship attribute according to ITU-T Recommendation X.732 [17]. The V5 interface is the owner object. NOTE 5: clientUserPorts: lists the associated virtual access port or user port object instances. It is a group relationship attribute according to ITU-T Recommendation X.732 [17]. The V5 interface is the owner object. NOTE 6: operationalState: gives the system internal controlled status whether the object instance is enabled or disabled according to ITU-T Recommendation X.731 [16]. NOTE 7: availabilityStatus: indicates the availability status according to ITU-T Recommendation X.731 [16]. NOTE 8: supportedByObjectList, userLabel, locationName: are defined in ITU-T Recommendation M.3100 [8].		

5.1.2.2 V5 TTP (v5Ttp)

A V5 TTP is an object class representing a 2 Mbit/s interface of the LE that is used as V5.1 interface or as part of a V5.2 interface.

A V5 TTP contains 31 V5 time slots. Time slot 0 is not instantiated, as it is an intrinsic part of the 2 Mbit/s link and is modelled as part of the V5 TTP.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

The upstreamConnectivityPointer and the downstreamConnectivityPointer attributes have NULL value if this object class is instantiated in a LE. When instantiated in an AN, they will be set to NULL unless they point to TTPs within the transmission part of the AN.

The assocV5Interface attribute gives the relation to the v5Interface that v5Ttp is assigned to. It is a group relationship attribute according to ITU-T Recommendation X.732 [17]. The v5Interface is the owner object.

The relationship is maintained by use of the setReciprocalPointers and releaseReciprocalPointers actions of the v5Interface object class.

It is a specialization of the TTP bidirectional object class defined in ITU-T Recommendation M.3100 [8].

The operational state of an object shall be set to "disabled" whenever a link is in a non-operational state, e.g. because of a layer 1 failure or a remote link blocking request. Contained time slot objects shall be set to "disabled".

If the link is in the "operational" or "normal" state the attribute shall be set to "enabled". This shall result in contained time slot objects being set to "enabled" if there are no other contradictory conditions.

The administrative state may be set to the values "unlocked", "shutting down" or "locked".

LE: If set to "shutting down", all new call setup requests for time slots of this link will be rejected. Contained time slot objects will be set to "disabled" if the time slot is idle. Existing connections, including the semi-permanent ones, will not be affected.

AN: If set to "shutting down", deferred blocking for this link is requested in the LE via the V5 interface.

Shutting down can be rejected by the LE system management. The requester shall be informed by a shutdownRejected notification. The administrative state is to be set back to unlocked by the requester.

If set to "locked", the immediate (forced) link blocking procedure is initiated for this link and no further traffic is possible. All existing switched connections will be released. Semi-permanent and reserved connections will be re-established onto other links, if possible. Contained time slot objects will be set to "disabled".

If set to "unlocked", first a link unblock procedure followed by a link identification procedure will be initiated. The contained time slot objects shall be set to "enabled" if there are no other contradictory conditions.

If an instance supports the use of "degraded" then the availabilityStatus shall be set to "degraded" if the V5 link is still "enabled" but its ability to provide a transport service is reduced, e.g. if some but not all of the contained time slots are disabled.

If an instance supports the use of "dependency" then the availabilityStatus shall be set to "dependency" if objects on which the V5 link is functionally dependent are unavailable, as described in ITU-T Recommendation X.731 [16], e.g. if the time slots 1 to 31 represented by the time slot objects are disabled by any internal reason.

In the Monitored Attributes parameter of the communicationsAlarm notification, the linkId attribute and the assocV5Interface attribute and their values shall be indicated.

If the ITU-T Recommendation M.3100 [8]: tmnCommunicationsAlarmInformationPackage is instantiated, then the communicationsAlarm notification shall be used to report errors related to this object class. The errors to be reported and the usage of the alarm report parameters are specified in EN 300 378-1 [5].

Table 2

Name	M/C/O	Value Set
ITU-T Recommendation M.3100.0 [8]: tTpId	RDN	single
ITU-T Recommendation M.3100.0 [8]: supportedByObjectList	M	set
ITU-T Recommendation M.3100.0 [8]: upstreamConnectivityPointer	M	single
ITU-T Recommendation M.3100.0 [8]: downstreamConnectivityPointer	M	single
ITU-T Recommendation X.721.0 [14] administrativeState	M	single
ITU-T Recommendation X.721.0 [14]: operationalState	M	single
ITU-T Recommendation X.721.0 [14]: availabilityStatus	O	set
ITU-T Recommendation Q.824.5 [18]: assocV5Interface	M	single according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.5 [18]: linkId	M	single
ITU-T Recommendation Q.824.5 [18]: blockingStatus	M	single
ITU-T Recommendation Q.824.5 [18]: neSpecificPointer	C	single
NOTE 1: tTpId: is the object identifier. The RDN is the 2 Mbit/s interface number. NOTE 2: supportedByObjectList: is inherited from ITU-T Recommendation M.3100.0 [8]: trailTerminationPointBidirectional. NOTE 3: upstreamConnectivityPointer, downstreamConnectivityPointer: are inherited from ITU-T Recommendation M.3100.0 [8]: trailTerminationPointBidirectional. They have NULL value if this object class is instantiated in a LE. When instantiated in an AN, they will be set to NULL unless they point to TTPs within the transmission part of the AN. NOTE 4: administrativeState: in the case of a V5.2 interface, it gives the operator influenced blocking state according to ITU-T Recommendation X.731 [16]. NOTE 5: operationalState: gives the system internal controlled status whether the object instance is enabled or disabled according to ITU-T Recommendation X.731 [16]. NOTE 6: availabilityStatus: indicates the availability status according to ITU-T Recommendation X.731 [16]. NOTE 7: assocV5Interface: gives the relation to the V5 interface, that 2 Mbit/s interface is assigned to. It is a group relationship attribute according ITU-T Recommendation X.732 [17]. The V5 TTP is member. NOTE 8: linkId: indicates the link ID assigned to the v5Ttp. NOTE 9: blockingStatus: indicates if the V5 link is blocked for local or remote reasons, or both. If the v5Ttp is associated with a V5.1 interface, this attribute has the value "none". NOTE 10: neSpecificPointer: points to an object instance specific for an individual NE.		

5.1.2.3 V5 time slot (v5TimeSlot)

A V5 time slot is an object class representing a 64 kbit/s channel of a V5 interface that is either used as bearer channel or as C-channel. It is a specialization of the Connection Termination Point (CTP) bidirectional object class defined in ITU-T Recommendation M.3100 [8].

Each V5 time slot is either assigned as bearer channel or C-channel by setting the channel type attribute appropriately. In the case of a V5.1 interface, a V5 time slot assigned as a bearer channel points either to the associated virtual access port or to the associated virtual access channel object instance if instantiated in a LE, or to a user port bearer channel CTP if instantiated in an AN.

In the case of a V5.2 interface, V5 time slots foreseen as bearer channels need not be instantiated.

One V5 time slot assigned as C-channel points to the associated (active) communication channel object instance. In V5 time slots assigned as standby C-channels of a V5.2 interface, this pointer is set to NULL.

In a V5.1 interface, time slot 16 is always a communication channel (C-channel 1). A second communication channel (C-channel 2) may be installed in time slot 15. Time slot 31 may be assigned as a third communication channel (C-channel 3).

In a V5.2 interface, time slot 16 of all 2 Mbit/s links may be assigned as C-channel. Time slots 15 and 31 of all 2 Mbit/s links may be assigned as C-channels as well, if all time slots 16 are already used as C-channels.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

The upstreamConnectivityPointer and the downstreamConnectivityPointer attributes have NULL value if this object class is instantiated in a LE. When instantiated in an AN, they will be set to NULL unless they point to CTPs within the transmission part of the AN.

The assocResource attribute represents a peer relationship according to ITU-T Recommendation X.732 [17] and is maintained by using the setReciprocalPointers and releaseReciprocalPointers actions assigned to the V5 interface object class.

The v5ChannelType attribute of time slots 15, 16, and 31 can only be modified if the assocResource attribute has NULL value and in the case of a V5.2 interface the administrativeState is locked.

The operational state shall be set to "disabled" if one of the following conditions apply:

a) the containing v5Ttp object goes into the "locked" state;

b) the containing v5Ttp object goes into the "disabled" state;

c) the containing v5Ttp object goes into the "shutting down" state and the time slot serves no connection; or

d) any other internal reason.

In addition, this may also impact the operational state of user port/channel objects which are assigned to this time slot directly or via unprotected C-path.

V5.2 only: If the time slot carries a C-channel, then protection switching is initiated when the attribute is set to "disabled".

When the v5Ttp object goes to the state "unlocked"/"enabled" the operational state shall be set to "enabled". This shall result in assigned user port/channel objects being set to "enabled" if there are no other contradictory conditions.

The administrative state may be set to the values "unlocked", "shutting down" or "locked".

If set to "shutting down" the time slot will be locked after an existing connection has been terminated. In addition, this may also impact the operational state of virtualAccessPortR1/ChannelR1 objects which are assigned to this time slot directly or via unprotected C-path. An existing semi-permanent connection will not be affected.

If set to "locked" this time slot is no longer available for use. Any existing switched connection will be released. In addition, this may also impact the operational state of virtualAccessPortR1/ChannelR1 objects which are assigned to this time slot directly or via unprotected C-path.

V5.2 only: A semi-permanent or reserved connection will be re-established onto other links if possible. If the time slot carries a C-channel, then protection switching is initiated when the attribute is set to "locked".

If set to "unlocked" this time slot is available for use. All virtualAccessPortR1/ChannelR1 objects which are assigned to this time slot directly or via unprotected C-path shall be set to "enabled" if there are no other contradictory conditions.

The ITU-T Recommendation M.3100 [8]: tmnCommunicationsAlarmInformation package shall only be instantiated if the time slot is used as communication channel.

If the ITU-T Recommendation M.3100 [8]: tmnCommunicationsAlarmInformationPackage is instantiated, then the communicationsAlarm notification shall be used to report errors related to this object class. The errors to be reported and the usage of the alarm report parameters are specified in EN 300 378-1 [5].

If the channelNumberPackage is not instantiated, the cTPId attribute should be used to number the channels consecutively from 1.

Table 3

Name	M/C/O	Value set
ITU-T Recommendation M.3100.0 [8]: cTPId	M	RDN
ITU-T Recommendation M.3100.0 [8]: supportedByObjectList	M	set
ITU-T Recommendation X.721.0 [14]: administrativeState	C	single
ITU-T Recommendation X.721.0 [14]: operationalState	M	single
ITU-T Recommendation M.3100.0 [8]: upstreamConnectivityPointer	M	single
ITU-T Recommendation M.3100.0 [8]: downstreamConnectivityPointer	M	single
ITU-T Recommendation Q.824.5 [18]: v5ChannelType	M	single
ITU-T Recommendation Q.824.5 [18]: assocResource	M	single according to ITU-T Recommendation X.732 [17]

NOTE 1: cTPId: is the object identifier. The RDN is the time slot (channel) number.
NOTE 2: supportedByObjectList: is inherited from ITU-T Recommendation M.3100.0 [8]: connectionTerminationPoint-Bidirectional.
NOTE 3: upstreamConnectivityPointer, downstreamConnectivityPointer: are inherited from ITU-T Recommendation M.3100.0 [8]: connectionTerminationPointBidirectional. They have NULL value if this object class is instantiated in a LE. When instantiated in an AN, they will be set to NULL unless they point to CTPs within the transmission part of the AN.
NOTE 4: administrativeState: gives the operator influenced blocking state according to ITU-T Recommendation X.731 [16]. It is present if this object class is instantiated in an LE or an instance in an AN supports it.
NOTE 5: operationalState: gives the system internal controlled status whether the object instance is enabled or disabled according to ITU-T Recommendation X.731 [16].
NOTE 6: v5ChannelType: indicates whether the V5 time slot is used as bearer channel or C-channel.
NOTE 7: assocResource: points in the case of being used as C-channel to the associated communication channel object instance. In the case of being used as bearer channel of a V5.1 interface, it points to the associated virtual access port or virtual access channel or user port bearer channel CTP object instance. In the case of being used as bearer channel of a V5.2 interface, it has NULL value. It is a peer relationship according to ITU-T Recommendation X.732 [17].

5.1.2.4 V5 provision (v5Provision)

The V5 provision object class represents the messages of the V5 control protocol which communicate the provisioning variant. In this way it gives an OS the possibility to control a synchronized reconfiguration of the V5 interface via $Q3_{LE}$ or $Q3_{AN}$. One instance of this object class is contained in one instance of the V5Interface object class.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

Table 4

Name	M/C/O	Value set
ITU-T Recommendation Q.824.5 [18]: provId	M	RDN
ITU-T Recommendation Q.824.5 [18]: ownProvVariant	M	single

NOTE 1: provId: is the object identifier.
NOTE 2: ownProvVariant: indicates the provisioning variant which is currently valid in the local NE. This attribute will always be set by a management operation of the own OS. When a set operation has been performed on the attribute, the NE shall treat this as a "re-provisioning completed" and act according to EN 300 324-1 [2].

5.1.3 Virtual access port fragment

5.1.3.1 Virtual access port (virtualAccessPortR1)

A virtual access port is an object class representing an image of the customer access port which is located in an AN and connected to the LE via V5 interface. It is a subclass of EN 300 291-1 [1]: etsiAccessPort and used for provisioning services to the customer.

This managed object class is defined in EN 300 291-1 [1].

The upstreamConnectivityPointer and the downstreamConnectivityPointer attributes have NULL value.

The inherited operationalStatePackage is mandatory in this object class.

The operationalState attribute indicates whether or not the user port is able to provide its service to the customer's terminal equipment. It reflects the states of the user port Finite State Machine (FSM) in the LE according to annex A.

An access port may have assigned one or more bearer time slots and/or one or more C-paths providing transport for different data types (bearer, signalling, f-type, p-type). The operationalState attribute shall be set to "enabled" as long as the port has access to any service, and if there are no other contradictory conditions.

The operationalState attribute shall be set to "disabled" if an access port has no service at all, i.e. the V5 interface itself or the related ISDN Ds or the PSTN C-path has failed.

The assocV5Interface attribute gives the relation to the V5 interface, that virtual access port is assigned to. It is a group relationship attribute according to ITU-T Recommendation X.732 [17]. The V5 interface is the owner object.

The relationships are maintained by use of the setReciprocalPointers and releaseReciprocalPointers actions of the v5Interface object class.

If the ITU-T Recommendation M.3100 [8]: tmnCommunicationsAlarmInformationPackage is instantiated, then the communicationsAlarm notification shall be used to report errors related to this object class. The errors to be reported and the usage of the alarm report parameters are specified in EN 300 379-1 [6].

This object class is subclassed for the different types of virtual access ports and not instantiated within the scope of this application.

Table 5

Name	M/C/O	Value Set
ITU-T Recommendation M.3100.0 [8]: tTpId	M	RDN
ITU-T Recommendation M.3100.0 [8]: supportedByObjectList	M	set
ITU-T Recommendation M.3100.0 [8]: upstreamConnectivityPointer	M	single
ITU-T Recommendation M.3100.0 [8]: downstreamConnectivityPointer	M	single
ITU-T Recommendation X.721.0 [14]: administrativeState	M	single
ITU-T Recommendation X.721.0 [14]: operationalState	M	single
ITU-T Recommendation Q.824.0 [19]: accessPortProfilePtr	M	single according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.0 [19]: officeEquipment	M	single
EN 300 291-1 [1]: meteringCounter	C	single
EN 300 291-1 [1]: localDefinedNumber	O	single
ITU-T Recommendation Q.824.5 [18]: assocV5Interface	M	single according to ITU-T Recommendation X.732 [17]

NOTE 1: tTpId: is the object identifier.
NOTE 2: supportedByObjectList, administrativeState: are inherited from ITU-T Recommendation M.3100.0 [8]: trailTerminationPointBidirectional.
NOTE 3: upstreamConnectivityPointer, downstreamConnectivityPointer: are inherited from ITU-T Recommendation M.3100.0 [8]: trailTerminationPointBidirectional. They have NULL value.
NOTE 4: operationalState: indicates whether or not the user port is able to provide its service to the customer's terminal equipment. It reflects the states of the user port FSM in the LE according to annex A.
NOTE 5: accessPortProfilePtr, officeEquipment, meteringCounter, localDefinedNumber: are inherited from EN 300 291-1 [1]: etsiAccessPort.
NOTE 6: assocV5Interface: gives the relation to the V5 interface, that virtual access port is assigned to. It is a group relationship attribute according to ITU-T Recommendation X.732 [17]. The V5 interface is the owner object.

5.1.3.2 Virtual analogue access (virtualAnalogueAccessR1)

A virtual analogue access is an information entity used for the association of a PSTN customer's layer 3 port address with a V5.1/V5.2 interface. It is a specialization of the virtual access port object class.

This managed object class is defined in EN 300 291-1 [1].

If no virtual access channel object instance is contained in the virtual analogue access object instance in the case of a V5.1 interface, the assocV5TimeSlot attribute points to the associated V5 time slot object instance. Otherwise it has NULL value. It is a peer relationship according to ITU-T Recommendation X.732 [17]. The V5 time slot is provider.

Table 6

Name	M/C/O	Value Set
ITU-T Recommendation Q.824.5 [18]: layer3PortAddress	M	single
EN 300 291-1 [1]: lineSignalling	M	single
EN 300 291-1 [1]: semipermanentLine	C	single
ITU-T Recommendation Q.824.5 [18]: assocV5TimeSlot	M	single according to ITU-T Recommendation X.732 [17]
NOTE 1: layer3PortAddress: gives the layer 3 port address the analogue access is assigned to. NOTE 2: lineSignalling: specifies which signalling the analogue access port uses for the line (e.g. Dual Tone Multi Frequency (DTMF) or pulse dialling). NOTE 3: semipermanentLine: indicates whether this entity is related to a semipermanent line (TRUE) or not (FALSE). NOTE 4: assocV5TimeSlot: points to the associated V5 time slot object instance in the case of a V5.1 interface. It is a peer relationship according to ITU-T Recommendation X.732 [17].		

5.1.3.3 Virtual basic rate access (virtualBasicRateAccessR1)

A virtual basic rate access is an information entity used for the association of an envelope function address representing an ISDN basic access with a V5.1/V5.2 interface. It is a specialization of the virtual access port object class.

This managed object class is defined in EN 300 291-1 [1].

Table 7

Name	M/C/O	Value Set
ITU-T Recommendation Q.824.5 [18]: envelopeFunctionAddress	M	single
EN 300 291-1 [1]: dChannelLayer1Activation	M	single
EN 300 291-1 [1]: dChannelLayer2Activation	M	single
ITU-T Recommendation Q.824.5 [18]: assocV5TimeSlotB1	M	single according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.5 [18]: assocV5TimeSlotB2	M	single according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.5 [18]: assocIsdnSignallingCommPath	M	single according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.5 [18]: assocPacketCommPath	M	single according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.5 [18]: assocFrameCommPath	M	single according to ITU-T Recommendation X.732 [17]
NOTE 1: envelopeFunctionAddress: gives the envelope function address the basic access is assigned to. NOTE 2: dChannelLayer1Activation, dChannelLayer2Activation: specify whether layers one and/or two have to be held active. NOTE 3: assocV5TimeSlotB1, assocV5TimeSlotB2: indicates for B-channel 1 or 2 the associated V5 time slot object instance, if no virtual access channel object instance is contained in the virtual basic rate access object instance in the case of a V5.1 interface. It is a peer relationship according to ITU-T Recommendation X.732 [17]. NOTE 4: assocIsdnSignallingCommPath: points to the associated ISDN communication path carrying the signalling messages of the assigned ISDN access. It is a group relationship according to ITU-T Recommendation X.732 [17]. The ISDN communication path is owner. NOTE 5: assocPacketCommPath: points to the associated ISDN communication path carrying the D-channel packet mode data of the assigned ISDN access if the customer has subscribed to this service. It is a group relationship according to ITU-T Recommendation X.732 [17]. The ISDN communication path is owner. NOTE 6: assocFrameCommPath: points to the associated ISDN communication path carrying the D-channel frame mode data of the assigned ISDN access if the customer has subscribed to this service. It is a group relationship according to ITU-T Recommendation X.732 [17]. The ISDN communication path is owner.		

5.1.3.4 Virtual primary rate access (virtualPrimaryRateAccessR1)

A virtual primary rate access is an information entity used for the association of an envelope function address representing an ISDN primary rate access with a V5.2 interface. It is a specialization of the virtual access port object class.

This managed object class is defined in EN 300 291-1 [1].

Table 8

Name	M/C/O	Value Set
ITU-T Recommendation Q.824.5 [18]: envelopeFunctionAddress	M	single
EN 300 291-1 [1]: dChannelLayer2Activation	M	single
ITU-T Recommendation Q.824.5 [18]: assocIsdnSignallingCommPath	M	single according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.5 [18]: assocPacketCommPath	M	single according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.5 [18]: assocFrameCommPath	M	single according to ITU-T Recommendation X.732 [17]

NOTE 1: envelopeFunctionAddress: gives the envelope function address the primary rate access is assigned to.
NOTE 2: dChannelLayer1Activation: specifies whether layer two has to be held active.
NOTE 3: assocIsdnSignallingCommPath: points to the associated ISDN communication path carrying the signalling messages of the assigned ISDN access. It is a group relationship according to ITU-T Recommendation X.732 [17]. The ISDN communication path is owner.
NOTE 4: assocPacketCommPath: points to the associated ISDN communication path carrying the D-channel packet mode data of the assigned ISDN access if the customer has subscribed to this service. It is a group relationship according to ITU-T Recommendation X.732 [17]. The ISDN communication path is owner.
NOTE 5: assocFrameCommPath: points to the associated ISDN communication path carrying the D-channel frame mode data of the assigned ISDN access if the customer has subscribed to this service. It is a group relationship according to ITU-T Recommendation X.732 [17]. The ISDN communication path is owner.

5.1.3.5 Virtual Leased Access (virtualLeasedAccessR1)

A virtual leased access is an information entity used for the association of a single analogue or digital semi-permanent leased line or a multiple digital semi-permanent leased line configuration with a V5.1/V5.2 interface. It is a specialization of the virtual access port object class.

This managed object class is defined in EN 300 291-1 [1].

If it is a single semi-permanent leased line, and if no virtual access channel object instance is contained in the virtual leased access object instance, and if it is associated with a V5.1 interface, the assocV5TimeSlot attribute points to the associated V5 time slot object instance. Otherwise it has NULL value. It is a peer relationship according to ITU-T Recommendation X.732 [17]. The relationship shall be maintained by use of the setReciprocalPointers and releaseReciprocalPointers actions of the V5 Interface object class.

A virtual leased access object instance representing a single semi-permanent leased line shall contain either no or one virtual access channel object instance. In a multiple semi-permanent leased line configuration, the virtual leased access object instance shall contain the appropriate number of virtual access channel object instances.

The v5UserPortAddress attribute gives for a single semi-permanent leased line the layer 3 port address the access is assigned to, otherwise it gives the envelope function address.

Table 9

Name	M/C/O	Value Set
ITU-T Recommendation Q.824.5 [18]: v5UserPortAddress	M	single
ITU-T Recommendation Q.824.5 [18]: assocV5TimeSlot	M	single according to ITU-T Recommendation X.732 [17]
NOTE 1: v5UserPortAddress: gives for a single semi-permanent leased line the layer 3 port address the access is assigned to, otherwise it gives the envelope function address. NOTE 2: assocV5TimeSlot: points to the associated V5 Time Slot object instance in the case of a V5.1 interface. It is a peer relationship according to ITU-T Recommendation X.732 [17].		

5.1.3.6 Virtual access channel (virtualAccessChannelR1)

A virtual access channel is an object class representing an individual ISDN B-/D-channel of an ISDN access port, or the bearer channel for an analogue access port, or an individual channel of an access port for a semi-permanent leased line. It is a subclass of EN 300 291-1 [1]: etsiAccessChannel.

This managed object class is defined in EN 300 291-1 [1].

If the channelNumberPackage is not instantiated, the cTPId attribute should be used to number the channels consecutively from 1.

Table 10

Name	M/C/O	Value set
ITU-T Recommendation M.3100.0 [8]: cTPId	M	RDN
ITU-T Recommendation M.3100.0 [8]: supportedByObjectList	M	set
ITU-T Recommendation X.721.0 [14]: administrativeState	M	single
ITU-T Recommendation M.3100.0 [8]: upstreamConnectivityPointer	M	single
ITU-T Recommendation M.3100.0 [8]: downstreamConnectivityPointer	M	single
ITU-T Recommendation M.3100.0 [8]: channelNumber	O	single
ITU-T Recommendation X.721.0 [14]: alarmStatus	M	single
EN 300 291-1 [1]: channelType	M	single
EN 300 291-1 [1]: semipermanentLine	C	single
ITU-T Recommendation Q.824.0 [19]: customizedResourcePtrList	M	set according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.0 [19]: officeEquipment	C	single
ITU-T Recommendation Q.824.5 [18]: permanentLineReservation	M	single
ITU-T Recommendation Q.824.5 [18]: assocV5TimeSlot	M	single according to ITU-T Recommendation X.732 [17]
NOTE 1: cTPId: is the object identifier. NOTE 2: supportedByObjectList: is inherited from ITU-T Recommendation M.3100.0 [8]: connectionTerminationPointBidirectional. NOTE 3: upstreamConnectivityPointer, downstreamConnectivityPointer, channelNumber: are inherited from ITU-T Recommendation M.3100.0 [8]: connectionTerminationPointBidirectional. They have NULL value. NOTE 4: administrativeState, alarmStatus, channelType, semipermanentLine, customizedResourcePtrList: are inherited from EN 300 291-1 [1]: etsiAccessChannel. NOTE 5: permanentLineReservation: indicates whether this access channel is reserved as permanent line or not. NOTE 6: assocV5TimeSlot: points to the associated V5 time slot object instance if the channel type is an ISDN B-channel or a channel of a non-ISDN access in the case of a V5.1 interface. It is a peer relationship according to ITU-T Recommendation X.732 [17].		

5.1.4 Communication path fragment

5.1.4.1 V5 communication channel (commChannel)

A V5 communication channel is an object class representing the image of a V5 C-channel that multiplexes one or more C-paths.

One V5 C-channel relates to one V5 time slot with the associated C-paths.

Instances of this object class shall be created for active C-channels only.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

The RDN of the commChannel shall be used to indicate the logical C-channel number used on the V5 interface.

Restrictions and guidelines for the allocation of C-paths to C-channels are given in EN 300 324-1 [2] for V5.1 interfaces and in EN 300 347-1 [3] for V5.2 interfaces.

The operationalState attribute shall be set to "disabled" whenever one of the following conditions applies:

1) the assigned time slot is "disabled";

2) no time slot assigned, neither directly nor via protection unit; or

3) any other internal reason.

In addition, this may also impact the operational state of ISDN and PSTN virtualAccessPortR1 objects representing user ports which are served by this C-channel.

The operationalState attribute shall be set to "enabled" when a time slot being in the "enabled" state is assigned, either directly or via protection unit, or if the internal reason has been cleared.

Table 11

Name	M/C/O	Value set
ITU-T Recommendation Q.824.5 [18]: commChannelId	M	RDN
ITU-T Recommendation Q.824.5 [18]: assocV5CommPaths	M	set according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.5 [18]: assocV5TimeSlot	M	single according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation X.721.0 [14]: operationalState	M	single
ITU-T Recommendation M.3100.0 [8]: supportedByObjectList	M	set
NOTE 1: commChannelId: is the object identifier. NOTE 2: assocV5CommPaths: points to the associated instances of communication path object classes except protection communication path. It is a group relationship according to ITU-T Recommendation X.732 [17]. The V5 communication channel is owner. NOTE 3: assocV5TimeSlot: points to the associated V5 time slot object instance. It is a peer relationship according to ITU-T Recommendation X.732 [17]. NOTE 4: operationalState: gives the system internal controlled status whether the object instance is enabled or disabled according to ITU-T Recommendation X.731 [16]. NOTE 5: supportedByObjectList: is defined in ITU-T Recommendation M.3100 [8].		

5.1.4.2 Communication path (commPath)

The communication path object class is defined as a superclass for the different communication types:

- ISDN communication;
- PSTN communication;
- BCC communication;
- control communication;
- link control communication;
- protection communication.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

Restrictions and guidelines for the allocation of C-paths to C-channels are given in EN 300 324-1 [2] for V5.1 interfaces and in EN 300 347-1 [3] for V5.2 interfaces.

This object class is subclassed for the different types of communication paths and not instantiated within the scope of this application.

Table 12

Name	M/C/O	Value set
ITU-T Recommendation Q.824.5 [18]: commPathId	M	RDN
ITU-T Recommendation Q.824.5 [18]: assocCommChannel	M	single according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation M.3100.0 [8]: supportedByObjectList	M	set
NOTE 1: commPathId: is the object identifier. NOTE 2: assocCommChannel: points to the associated V5 communication channel object instance. It is a group relationship according to ITU-T Recommendation X.732 [17]. The V5 communication channel is owner. NOTE 3: supportedByObjectList: is defined in ITU-T Recommendation M.3100 [8].		

5.1.4.3 ISDN communication path (isdnCommPath)

The ISDN communication path object class groups either the Ds-type, or the p-type, or the f-type data of ISDN accesses connected to a LE via a V5 interface. It is a subclass of the communication path object class.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

Table 13

Name	M/C/O	Value set
ITU-T Recommendation Q.824.5 [18]: clientUserPorts	M	set according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.5 [18]: dataType	M	single
NOTE 1: clientUserPorts: lists the associated virtual access port or user port object instances. It is a group relationship attribute according to ITU-T Recommendation X.732 [17]. The ISDN communication path is the owner object. NOTE 2: dataType: indicates the type of data which is assigned to this ISDN communication path. This may be p-, f-, or Ds-type data.		

5.1.4.4 PSTN communication path (pstnCommPath)

The PSTN communication path object class carries the PSTN protocol information. It is a subclass of the communication path object class.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

No specific attributes are needed.

5.1.4.5 BCC communication path (bccCommPath)

The BCC communication path object class carries the BCC protocol information. It is a subclass of the communication path object class.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

No specific attributes are needed.

5.1.4.6 Control communication path (controlCommPath)

The control communication path object class carries the control protocol information. It is a subclass of the communication path object class.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

No specific attributes are needed.

5.1.4.7 Protection communication path (protCommPath)

The protection communication path object class carries the protection protocol information. It is a subclass of the communication path object class. The assocCommChannel attribute has NULL value.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

Table 14

Name	M/C/O	Value set
ITU-T Recommendation Q.824.5 [18]: assocProtectionGroup	M	single
NOTE: assocProtectionGroup: points to the associated V5 protection group object instance.		

5.1.4.8 Link control communication path (linkControlCommPath)

The link control communication path object class carries the link control protocol information. It is a subclass of the communication path object class.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

No specific attributes are needed.

5.1.5 Protection fragment

5.1.5.1 V5 protection group (v5ProtectionGroup)

A v5ProtectionGroup object instance contains zero or more v5ProtectionUnit object instances for defining a protection switching relationship where one or more standby v5TimeSlot object instances provide protection for one or more active v5TimeSlot object instances.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

The protectionSwitchReporting notification is emitted from the v5ProtectionGroup object to report any protection switching (automatic, manual, and forced switch over).

The v5ProtectionGroupType attribute shall have the value "colon" when more than one v5ProtectionUnit is protected. Changing the value of this attribute from "plus" to "colon" is allowed when only one protected v5ProtectionUnit and one protecting v5ProtectionUnit are contained by the v5ProtectionGroup, and if the underlying resources support m:n protection.

The v5ProtectionGroupType attribute of protection group 1 shall have the value "plus". For protection group 2, it can have both values.

The v5ProtectionGroupNumber is used to distinguish whether the V5 protection group is V5 protection group 1 or 2.

When a protection switch occurs, the reliableResourcePointer attribute of the protecting V5 protection unit shall be changed to the appropriate C-channel ID, whilst the reliableResourcePointer attribute of the protected V5 protection unit is changed to NULL. In parallel, the reciprocal relationship between the affected commChannel object instance and v5TimeSlot object instance shall be modified accordingly. The configuredReliableResourcePointer attribute of the contained V5 protection unit object instances is not affected by protection switching.

Table 15

Name	M/C/O	Value set
ITU-T Recommendation Q.824.5 [18]: v5ProtectionGroupId	M	RDN
ITU-T Recommendation Q.824.5 [18]: v5ProtectionGroupNumber	M	single
ITU-T Recommendation Q.824.5 [18]: v5ProtectionGroupType	M	single
NOTE 1: v5ProtectionGroupId: s the object identifier. NOTE 2: v5ProtectionGroupNumber: indicates protection group 1 or 2 of a V5 interface. NOTE 3: v5ProtectionGroupType: indicates whether the protection relation is 1:1 or m:n.		

5.1.5.2 V5 protection unit (v5ProtectionUnit)

A v5ProtectionUnit object instance represents a protected (i.e. active) unit or a protecting (i.e. standby) unit. For a protecting v5ProtectionUnit, the attribute protecting shall have the value TRUE. For a protected v5ProtectionUnit, the attribute protecting shall have the value FALSE. The value of the unreliableResourcePointer points to a v5TimeSlot object instance. In the "protected" case, the value of the reliableResourcePointer points to a commChannel object instance. In the "protecting" case, the reliableResourcePointer has NULL value.

This managed object class is defined in ITU-T Recommendation Q.824.5 [18].

On creation of a v5ProtectionUnit object instance, the configuredReliableResourcePointer attribute shall be set to the same value as the reliableResourcePointer attribute. The relationship between the affected commChannel object instance and v5TimeSlot object instance shall be maintained accordingly.

On restart of the protection protocol, the reliableResourcePointer attribute shall be set to the same value as the configuredReliableResourcePointer attribute. If this value is NULL, then the "protecting" attribute shall be set to TRUE. If the configuredReliableResourcePointer attribute contains a pointer to a commChannel object instance, the "protecting" attribute shall be set to FALSE. The relationship between the affected commChannel object instance and v5TimeSlot object instance shall be maintained accordingly.

The configuredReliableResourcePointer attribute of the contained V5 protection unit object instances is not affected by protection switching.

Table 16

Name	M/C/O	Value set
ITU-T Recommendation Q.824.5 [18]: v5ProtectionUnitId	M	RDN
ITU-T Recommendation Q.824.5 [18]: v5Protecting	M	single
ITU-T Recommendation Q.824.5 [18]: reliableResourcePointer	M	single
ITU-T Recommendation Q.824.5 [18]: unreliableResourcePointer	M	single
ITU-T Recommendation Q.824.5 [18]: configuredReliableResourcePointer	M	single
NOTE 1: v5ProtectionUnitId: is the object identifier. NOTE 2: v5Protecting: indicates the active or standby status. NOTE 3: reliableResourcePointer: points to a commChannel object instance. NOTE 4: unreliableResourcePointer: points to a v5TimeSlot object instance. NOTE 5: configuredReliableResourcePointer: points to a commChannel object instance to which the reliableResourcePointer attribute of this object instance shall be set automatically after a V5 interface restart.		

5.1.6 V5 service fragment

5.1.6.1 V5 bearer channel reservation (v5BcReservationR1)

The assignment of a V5 bearer channel reservation object instance to a customized resource indicates that a fixed assignment of bearer channels of a V5.2 interface is made for a customer. Which V5 time slot is assigned is controlled by the resource manager but visible at the Q3 interfaces.

V5 bearer channel reservation is a subclass of EN 300 291-1 [1]: etsiSupplementaryServiceServiceIndependent.

This managed object class is defined in EN 300 291-1 [1].

Table 17

Name	M/C/O	Value Set
ITU-T Recommendation Q.824.0 [19]: supplementaryServiceId	M	RDN
ITU-T Recommendation X.721.0 [14]: administrativeState	M	single
ITU-T Recommendation Q.824.0 [19]: servicePtrList	M	set according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.0 [19]: customizedResourcePtrList	M	set according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.5 [18]: noOfBcRequested	M	single
ITU-T Recommendation Q.824.5 [18]: bcReserved	M	set
NOTE 1: supplementaryServiceId, administrativeState, servicePtrList, customizedResourcePtrList: are inherited from EN 300 291-1 [1]: etsiSupplementaryServiceServiceIndependent. NOTE 2: noOfBcRequested: indicates the number of bearer channels requested for reservation. NOTE 3: bcReserved: indicates in a set of octets 3 and 4 of V5 time slot identification information elements which time slots are actually assigned by the BCC protocol.		

5.1.6.2 V5 leased line reservation (v5LlReservationR1)

The assignment of a V5 leased line reservation object instance to a customized resource indicates that a fixed assignment of the bearer channel of a V5 interface is made for a customer. It is used either for analogue semi-permanent leased lines without signalling or for digital semi-permanent leased lines without signalling. Which V5 time slot in the case of a V5.2 interface is assigned is controlled by the resource manager but visible at the Q3 interface.

V5 leased line reservation is a subclass of EN 300 291-1 [1]: etsiSupplementaryServiceServiceIndependent.

This managed object class is defined in EN 300 291-1 [1].

Table 18

Name	M/C/O	Value Set
ITU-T Recommendation Q.824.0 [19]: supplementaryServiceId	M	RDN
ITU-T Recommendation X.721.0 [14]: administrativeState	M	single
ITU-T Recommendation Q.824.0 [19]: servicePtrList	M	set according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.0 [19]: customizedResourcePtrList	M	set according to ITU-T Recommendation X.732 [17]
ITU-T Recommendation Q.824.5 [18]: bcReserved	M	set
NOTE 1: supplementaryServiceId, administrativeState, servicePtrList, customizedResourcePtrList: are inherited from EN 300 291-1 [1]: etsiSupplementaryServiceServiceIndependent. NOTE 2: bcReserved: indicates in a set of octets 3 and 4 of V5 time slot identification information elements which time slots are actually assigned by the BCC protocol.		

5.1.7 Supporting managed object classes

The following supporting object classes are defined in ITU-T Recommendation X.721 [14]:

- attributeValueChangeRecord;
- eventForwardingDiscriminator;
- log;
- objectCreationRecord;
- objectDeletionRecord;
- stateChangeRecord.

For the log and the eventForwardingDiscriminator object classes, the name bindings as defined in ITU-T Recommendation M.3100 [8] shall be applied.

5.2 Attributes description

Subclause 5.2 provides the description of all generic attributes used within this information model. The following generic attributes have been identified and its definition can be found within the appropriate standards mentioned in the text:

- relative distinguished name;
- state attributes;
- relationship attributes.

The attributes specific to this information model are already defined within the object class descriptions.

5.2.1 Relative distinguished name

The semantics of the RDN attribute type are specified in ITU-T Recommendation X.720 [13]. This attribute type is used to identify an instance of a managed object uniquely within the scope of its immediate superior in the management information tree. This is modelled as a single-valued attribute type.

Value type: identifier, graphic string or integer;

Inherent properties: the value shall be unique within the scope of superior managed object instance;

Permitted operations: get only;

Implicit relations: the object instance is contained in the superior managed object instance;

Specification properties: this attribute type may be used for naming all object classes defined in the present document.

5.2.2 State attributes

State related attributes of managed objects in this information model comprise the generic state model as defined by ITU-T Recommendation X.731 [16] and every specific state attribute type related only to object classes defined in the present document.

5.2.2.1 Operational state

The semantics of the operationalState attribute are specified in the operational state attribute in ITU-T Recommendation X.731 [16]. The syntax of the operationalState attribute is specified in the operational state attribute in ITU-T Recommendation X.721 [14].

5.2.2.2 Administrative state

The semantics of the administrativeState attribute are specified in the administrative state attribute in ITU-T Recommendation X.731 [16]. The syntax of the administrativeState attribute is specified in the administrative state attribute in ITU-T Recommendation X.721 [14].

5.2.2.3 Availability status

The semantics of the availabilityStatus attribute are specified in the availability status attribute in ITU-T Recommendation X.731 [16]. The syntax of the availabilityStatus attribute is specified in the availability status attribute in ITU-T Recommendation X.721 [14].

5.2.3 Relationship attributes

Relationship related attributes of managed objects within the scope of the present document comprise the generic relationship model as defined by ITU-T Recommendation X.732 [17].

The following relationships are used in The present document:

- group relationship;
- peer relationship.

All reciprocal relationships mentioned in The present document are maintained by using the setReciprocalPointers and releaseReciprocalPointers actions which are assigned to the V5 interface object class.

5.3 Actions description

All actions described below are performed on the various object classes as indicated in table 19.

Table 19

Actions	Defined in object class	Remarks
ITU-T Recommendation Q.824.5 [18]: setReciprocalPointers	ITU-T Recommendation Q.824.5 [18]: v5Interface	with reply syntax
ITU-T Recommendation Q.824.5 [18]: releaseReciprocalPointers	ITU-T Recommendation Q.824.5 [18]: v5Interface	with reply syntax
ITU-T Recommendation Q.824.5 [18]: restart	ITU-T Recommendation Q.824.5 [18]: v5Interface	no reply syntax
ITU-T Recommendation Q.824.5 [18]: systemStartup	ITU-T Recommendation Q.824.5 [18]: v5Interface	no reply syntax
ITU-T Recommendation Q.824.5 [18]: verifyRemoteProvVariant	ITU-T Recommendation Q.824.5 [18]: v5Provision	no reply syntax
ITU-T Recommendation Q.824.5 [18]: readyForReprovisioning	ITU-T Recommendation Q.824.5 [18]: v5Provision	no reply syntax
ITU-T Recommendation Q.824.5 [18]: notReadyForReprovisioning	ITU-T Recommendation Q.824.5 [18]: v5Provision	no reply syntax
ITU-T Recommendation Q.824.5 [18]: requestRemoteProvVariant	ITU-T Recommendation Q.824.5 [18]: v5Provision	no reply syntax
ITU-T Recommendation Q.824.5 [18]: switchOverToNewVariant	ITU-T Recommendation Q.824.5 [18]: v5Provision	no reply syntax
ITU-T Recommendation Q.824.5 [18]: anReprovisioningStarted	ITU-T Recommendation Q.824.5 [18]: v5Provision	no reply syntax
ITU-T Recommendation Q.824.5 [18]: leBlockingStarted	ITU-T Recommendation Q.824.5 [18]: v5Provision	no reply syntax
ITU-T Recommendation Q.824.5 [18]: cannotReprovision	ITU-T Recommendation Q.824.5 [18]: v5Provision	no reply syntax
ITU-T Recommendation Q.824.5 [18]: v5ProtectionAnSwitch	ITU-T Recommendation Q.824.5 [18]: v5ProtectionGroup	no reply syntax
ITU-T Recommendation Q.824.5 [18]: v5ProtectionLeSwitch	ITU-T Recommendation Q.824.5 [18]: v5ProtectionGroup	no reply syntax
ITU-T Recommendation Q.824.5 [18]: checkLinkId	ITU-T Recommendation Q.824.5 [18]: v5Ttp	no reply syntax

NOTE 1: setReciprocalPointers: is used to set reciprocal pointers between instances of two different object classes. The applicable relationship types are peer relationship and group relationship.

NOTE 2: releaseReciprocalPointers: is used to release reciprocal pointers between instances of two different object classes. The applicable relationship types are peer relationship and group relationship.

NOTE 3: restart: is used for initiating the restart procedure as specified in EN 300 324-1 [2], which will be performed automatically by the NE. The result of the restart procedure will be reported to the OS in the restartResult notification.

NOTE 4: systemStartup: is used for initiating the system startup procedure as specified in EN 300 324-1 [2], which will be performed automatically by the NE. The successful or failed completion of the procedure will be reported to the OS in the systemStartupResult notification.

NOTE 5: verifyRemoteProvVariant: initiates sending of the V5 control protocol message "Verify re-provisioning". The message will include the new variant as given in the information syntax of the action request. The verifyRemoteProvVariant notification will reflect the response of the remote NE which may be "Ready for re-provisioning" or "Not ready for re-provisioning".

NOTE 6: readyForReprovisioning: initiates sending of the V5 control protocol message "Ready for re-provisioning" as a positive reply on a previously received "Verify re-provisioning" message after the OS has compared its own new provisioning variant value with the value of the other side contained in the "Verify re-provisioning" message.

NOTE 7: notReadyForReprovisioning: initiates sending of the V5 control protocol message "Not ready for re-provisioning" as a negative reply on a previously received "Verify re-provisioning" message after the OS has compared its own new provisioning variant value with the value of the other side contained in the "Verify re-provisioning" message.

NOTE 8: requestRemoteProvVariant: initiates sending of the V5 control protocol message "Request variant and interface ID". The requestRemoteProvVariantResult notification will contain the provisioning variant and the interface ID which will be sent from the remote NE as a response to this message. The V5 control protocol message "Request variant and interface ID" may also be triggered by internal events in the NE (e.g. startup procedure).

NOTE 9: switchOverToNewVariant: may be used to initiate the re-provisioning procedure from the AN side. It shall initiate sending of the V5 control protocol message "Switch-over to new variant" which will cause an appropriate notification to the OS at the remote side of the V5 interface.

NOTE 10: anReprovisioningStarted: may be used to indicate to the AN that the OS has accepted a previous switch over request by the LE and that the management operations required for the re-provisioning will be performed afterwards. The action shall initiate sending of the V5 control protocol message "Re-provisioning started" to the LE.
NOTE 11: leBlockingStarted: may be used to indicate to the LE that a previous switch over request by the AN will be accepted and that the OS will start to block all affected user ports. The action shall initiate sending of the V5 control protocol message "Blocking started" to the AN.
NOTE 12: cannotReprovision: may be used to indicate to the NE that the OS has rejected a previous switch over request by the other side and that the management operations required for the re-provisioning can not be performed afterwards. The action shall initiate sending of the V5 control protocol message "Cannot re-provision" across the V5 interface.
NOTE 13: v5ProtectionAnSwitch: is used for manual protection switching of V5 time slot object instances being assigned as active or standby C-channel, respectively. It may only be requested on v5protectionGroup number 2 and shall be rejected otherwise. This action shall change the Protecting attributes in the appropriate V5 protection unit object instances to TRUE or FALSE, respectively. The reliableResourcePointer attribute of the protecting V5 protection unit shall be changed to the appropriate C-channel ID, whilst the reliableResourcePointer attribute of the protected V5 protection unit shall be changed to NULL. In parallel, the reciprocal relationship between the affected commChannel object instance and v5TimeSlot object instance shall be modified accordingly. The successful or failed protection switch will be reported to the OS by using v5ProtectionSwitchReporting Notification.
NOTE 14: v5ProtectionLeSwitch: is used for both manual and forced protection switching of V5 time slot object instances being assigned as active or standby C-channel. It may only be requested on v5protectionGroup number 2 and shall be rejected otherwise. A forced switch request permits the allocation of a C-channel to an already active channel (protecting attribute of related protection unit is FALSE). The pre-empted c-channel is switched to the time slot of the pre-empting c-channel. A manual switch request permits the allocation of a C-channel only to a stand-by channel (protecting attribute of related protection unit is TRUE). This action shall change the Protecting attributes in the appropriate V5 protection unit object instances to TRUE or FALSE, respectively. The reliableResourcePointer attribute of the protecting V5 protection unit shall be changed to the appropriate C-channel ID, whilst the reliableResourcePointer attribute of the protected V5 protection unit shall be changed to NULL. In parallel, the reciprocal relationship between the affected commChannel object instance and v5TimeSlot object instance shall be modified accordingly. The successful or failed protection switch will be reported to the OS by using v5ProtectionSwitchReporting Notification.
NOTE 15: checkLinkId: is used for triggering the V5 link identification check procedure on the 2 Mbit/s link the action is addressed to. The checkLinkIdResult notification will indicate whether the result of the procedure was positive or negative or that the check was rejected from the other side of the V5 interface.

5.4 Notifications description

The following generic notifications will be used:

- object creation according to ITU-T Recommendation X.721 [14] and ITU-T Recommendation X.730 [15];
- object deletion according to ITU-T Recommendation X.721 [14] and ITU-T Recommendation X.730 [15];
- attribute value change according to ITU-T Recommendation X.721 [14] and ITU-T Recommendation X.730 [15];
- state change according to ITU-T Recommendation X.721 [14] and ITU-T Recommendation X.731 [16];
- relationship change according to ITU-T Recommendation X.721 [14] and ITU-T Recommendation X.732 [17].

The following specific notifications will be used. They are defined in ITU-T Recommendation Q.824.5 [18]:

- switchOverRequest;
- switchOverToNewVariantResult;
- anBlockingStarted;
- verifyRequest;
- verifyRemoteProvVariantResult;
- requestRemoteProvVariantResult;

- v5ProtectionSwitchReporting;
- checkLinkIdResult;
- restartResult;
- systemStartupResult;

  shutdownRejected;

- anFaultReported.

The switchOverRequest notification indicates that a V5 control protocol message "Switch-over to new variant" has been received from the remote NE. The information syntax contains the new variant.

The switchOverToNewVariantResult notification indicates that the V5 control protocol message "Re-provisioning started" or "Cannot re-provision" has been received from the remote NE as a response to a previous switch over request

The anBlockingStarted notification indicates that the V5 control protocol message "Blocking started" has been received in the AN as a first positive response to a previous switch over request.

The verifyRequest notification indicates that the V5 control protocol message "Verify re-provisioning" has been received in the NE to verify whether a switch over has been prepared at both sides of the V5 interface.

The verifyRemoteProvVariantResult notification indicates that the V5 control protocol message "Ready for re-provisioning" or "Not ready for re-provisioning" has been received from the remote NE as a response to a previous verify re-provisioning request.

The requestRemoteProvVariantResult notification indicates that the V5 control protocol message "Provisioning variant and interface ID" has been received from the remote NE as a response to a previous remote provisioning variant request.

The v5ProtectionSwitchReporting notification shall be emitted in case of any successful or failed protection switching attempt (automatic, manual or forced) at both the requesting and responding sides. It indicates the origin of the protection switch and which V5 protection units have changed or tried to be changed from standby to active and vice versa.

The checkLinkIdResult notification indicates that the V5 link identification procedure was performed by the NE as a consequence of a previous checkLinkId action.

The successful or failed completion of the restart procedure shall be reported to the OS in the restartResult notification.

The successful or failed completion of the system startup procedure shall be reported to the OS in the systemStartupResult notification.

The shutdownRejected notification indicates that shutting down of a link was rejected.

The anFaultReported notification indicates that the LE has received a V5 BCC protocol message 'AN Fault' for the associated user port.

6 Formal managed object classes definition

Clause 6 specifies the object classes for all of the managed objects used in the management information model. These objects are defined by reference to other specifications.

6.1 Managed element fragment

In subclause 6.1, the definitions of the classes of the managed element fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
managedElement
FROM ITU-T Recommendation M.3100 [8];
END
```

6.2 V5 interface fragment

In subclause 6.2, the definitions of the new classes of the V5 interface fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    v5Interface,
    v5Ttp,
    v5TimeSlot,
    v5Provision
FROM ITU-T Recommendation ITU-T Recommendation Q.824.5 [18];
END
```

6.3 Virtual access port fragment

In subclause 6.3, the definitions of the new classes of the virtual access port fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    virtualAccessPortR1,
    virtualAnalogueAccessR1,
    virtualBasicRateAccessR1,
    virtualPrimaryRateAccessR1,
    virtualLeasedAccessR1,
    virtualAccessChannelR1
FROM EN 300 291-1 [1];
END
```

Profile: Those attributes and packages included in the managed object classes defined in subclause 6.3 which are currently imported from the former ETS 300 377-1 shall be replaced for those identically named defined in ITU-T Recommendation ITU-T Recommendation Q.824.5 [18].

6.4 Communication path fragment

In subclause 6.4, the definitions of the new classes of the communication path fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    commChannel,
    commPath,
    isdnCommPath,
    pstnCommPath,
    bccCommPath,
    controlCommPath,
    protCommPath,
    linkControlCommPath
FROM ITU-T Recommendation Q.824.5 [18];
END
```

6.5 Protection fragment

In subclause 6.5, the definitions of the new classes of the V5 protection fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    v5ProtectionGroup,
    v5ProtectionUnit
FROM ITU-T Recommendation ITU-T Recommendation Q.824.5 [18];
END
```

6.6 V5 service fragment

In subclause 6.6, the definitions of the new classes of the V5 service fragment are specified by importing from other specifications. In this context, the IMPORTS clause specifies the object classes which can be instantiated in the scope of the present document.

```
BEGIN
IMPORTS
    v5BcReservationR1,
    v5LlReservationR1
FROM EN 300 291-1 [1];
END
```

7 Protocol requirements

Protocol suites are specified in ITU-T Recommendation Q.811 [9] and ITU-T Recommendation Q.812 [10]. No special requirements are identified.

Annex A (normative): Mapping of management primitives for user port FSM onto state transitions for virtual analogue accesses, virtual basic rate accesses, and virtual primary rate accesses

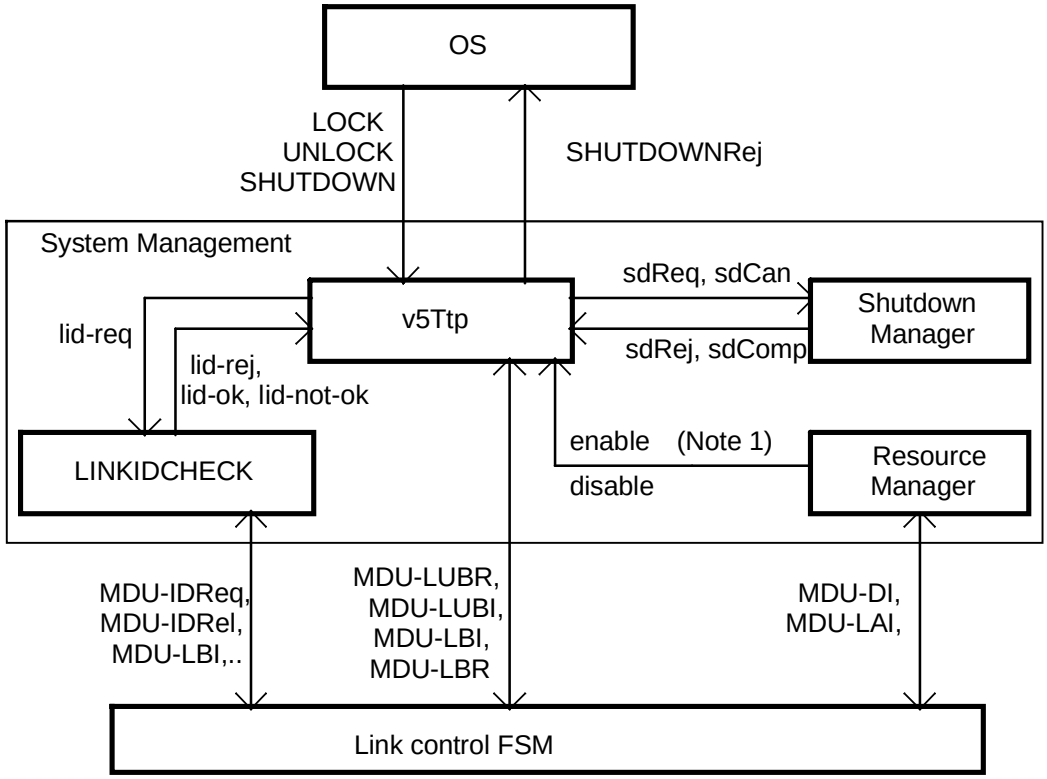
Table A.1

Event	Operational state	
	enabled	**disabled**
MPH-BI	disabled	-
MPH-BR	Ask resource manager to change to disabled as soon as the access becomes idle	/
MPH-UBR	/	Ask resource manager whether change to enabled is allowed
MPH-UBI	-	enabled
Resource manager sets operational state to disabled	MPH-BI; disabled	MPH-BI
Resource manager sets operational state to enabled	-	MPH-UBR
Resource manager rejects to set operational state to enabled	/	MPH-BI
Resource manager confirms to set operational state to enabled	/	MPH-UBR
NOTE: Key: / = unexpected event - = no action		

Annex B (normative): Mapping of link control states on X.731 states

The tables in clauses B.1 and B.2 specify detailed state machines for the link state mapping at the AN and LE side. They include substates of "disabled" to indicate the disabling reason.

V5 system management is responsible for sequencing of simultaneous link ID requests. This is the case when AN or LE unblocks a link (see e.g. table E.3), and when two links are to be checked at the same time. Figure B.1 indicates that by a separate system management procedure. The primitives MDU-AI, MDU-IDReq, MDU-IDAck, MDU-IDRej, MDU-IDRel, MDU-EIg are related to this procedure. Reactions of the link control FSM on MDU-IDReq are also directed to it.



NOTE 1: enable: disappearance of internal disabling reasons;
disable: occurrence of internal disabling reasons.
NOTE 2: This figure is for information only. The internal communication between Shutdown Manager, Resource Manager and LINKIDCHECK procedure is not shown.

Figure B.1: General relationship between v5Ttp object class and system management at the LE side

If the link ID check is rejected (lid-rej), it can only be invoked again by the OS command sequence LOCK, UNLOCK.

After link control FSM enters the operational state (AN2.0, LE2.0) from one of the blocked states, the link ID shall be checked at both sides, before the link is fully operational, i.e. ENABLED. For this purpose, system management is triggered by "lid-req". System management is responsible for sequencing of simultaneous link ID requests to avoid rejection whenever possible. Unblocking a link always leads to a simultaneous checking of a link by AN and LE, which requires sequencing to avoid the termination of the unblocking procedure at one side.

A shutdown request (sdReq) is handled by LE system management. It gracefully takes communication and switched services out of service. SHUTDOWN from the OS of the AN uses deferred blocking (MDU-LBR). The request can either be rejected (sdRej) or successfully completed (sdComp). LE system management shall reject a shutdown request if the required protection of the logical C-channels is not possible. It shall generate an unblock request (FE301, resulting in MDU-LUBI at the AN) if the shutdown request came from the AN (MDU-LBR, FE305). The OS of the AN shall then be notified by SHUTDOWNRej to change the administrative state from SHUTTINGDOWN back to UNLOCKED. If the shutdown request came from the OS at the LE, the SHUTDOWNRej notification is sent to it. The OS which initiated the shutdown procedure can interrupt it by sending an UNLOCK command, resulting in a shutdown cancel (sdCan) to the LE system management.

Non-deferred blocking (MDU-LBRN) immediately releasing switched connections is not used by the AN. LOCK means immediate (forced) blocking of the link (MDU-LBI), with all its consequences to services provided by this link.

Disabling reasons

None: intermediate state with no fault or blocking reason. It is reached during the unblock procedure.

Local: occurrence of a layer 1 failure (MPH-DI) or any other local reason, e.g. due to dependencies.

Remote: remote reason for blocking the link due to failure or management decision (MDU-LBI).

Sources of messages

LOCK, UNLOCK, SHUTDOWN are generated by the OS.

lid-rej, lid-ok, lid-not-ok are generated by system management at AN and LE side.

MDU-LUBR, MDU-LUBI, MDU-LBI, etc. are generated by the link control FSM.

sdReq and sdCan are sent to system management, e.g. a shutdown manager.

SHUTDOWNRej is sent from the v5Ttp object to the OS.

sdRej and sdComp are generated by LE system management, e.g. its shutdown manager.

"Occurrence of internal disabling reasons", "Disappearance of internal disabling reasons" are generated by system management.

B.1 State mapping tables for the AN side

Table B.1

	state 1 locked disabled			**state 2 locked enabled**	**state 3 shutting down**
	1.1 LBS: local	**1.2 LBS: remote**	**1.3 LBS: both**	**2.0**	**3.0**
LOCK	-	-	-	-	MDU-LBI; 2.0
UNLOCK	MDU-LUBR; 4.1	MDU-LUBR; 4.2	MDU-LUBR; 4.3	MDU-LUBR; 4.0	MDU-LUBR; 5.0
SHUTTING DOWN	/	/	/	/	-
occurrence of internal disabling reasons	-	-; 1.3	-	-; 1.1	-; 1.1
disappearance of internal disabling reasons	-; 2.0	/	-; 1.2	/	/
MDU-LUBR	-	-; 2.0	-; 1.1	-	/
MDU-LUBI	/	/	/	/	SHUTDOWNRej; -
MDU-LBI	-	-	-	-	-; 2.0
lid-rej	-	-	-	-	-
lid-ok	-	-	-	-	-
lid-not-ok	-	-	-	-	-

NOTE: Key: <output signal>;<new state>
/ = unexpected event
- = no action
LBS = Link Block Status

Table B.2

	state 4 unlocked disabled				**state 5 unlocked enabled**
	4.0 LBS: none	**4.1 LBS: local**	**4.2 LBS: remote**	**4.3 LBS: both**	**5.0**
LOCK	MDU-LBI; 2.0	MDU-LBI; 1.1	MDU-LBI; 1.2	MDU-LBI; 1.3	MDU-LBI; 2.0
UNLOCK	-	-	-	-	-
SHUTTING DOWN	MDU-LBI; 2.0	MDU-LBI; 1.1	MDU-LBI; 1.2	MDU-LBI; 1.3	MDU-LBR; 3.0
occurrence of internal disabling reasons	-; 4.1	-	-; 4.3	-	-; 4.1
disappearance of internal disabling reasons	/	MDU-LUBR; 4.0	/	MDU-LUBR; 4.2	/
MDU-LUBR	MDU-LUBR; -	-	MDU-LUBR; 4.0	/	/
MDU-LUBI	lid-req; -	/	lid-req; 4.0	/	-
MDU-LBI	-; 4.2	-; 4.3	-	-	-; 4.2
lid-rej	-	-	-	-	-
lid-ok	-; 5.0	-	-	-	-
lid-not-ok	-; 4.1	-	-	-	-

NOTE: Key: <output signal>;<new state>
/ = unexpected event
- = no action
LBS = Link Block Status

B.2 State mapping tables for the LE side

Table B.3

	state 1 locked disabled			**state 2 locked enabled**	**state 3 shutting down**
	1.1 LBS: local	**1.2 LBS: remote**	**1.3 LBS: both**	**2.0**	**3.0**
LOCK	-	-	-	-	MDU-LBI; 2.0
UNLOCK	MDU-LUBR; 4.1	MDU-LUBR; 4.2	MDU-LUBR; 4.3	MDU-LUBR; 4.0	sdCan; 5.0
SHUTTING DOWN	/	/	/	/	-
occurrence of internal disabling reasons	-	-; 1.3	-	-; 1.1	-; 1.1
disappearance of internal disabling reasons	-; 2.0	/	-; 1.2	/	/
MDU-LUBR	-	-; 2.0	-; 1.1	-	/
MDU-LUBI	/	/	/	/	-
MDU-LBI	-	-	-	-	-; 2.0
MDU-LBR	/	/	/	/	/
sdRej	/	/	/	/	SHUTDOWNRej; -
sdComp	/	/	/	/	MDU-LBI; 2.0
lid-rej	-	-	-	-	-
lid-ok	-	-	-	-	-
lid-not-ok	-	-	-	-	-

NOTE: Key: <output signal>;<new state>
/ = unexpected event
- = no action
LBS = Link Block Status

Table B.4

	state 4 unlocked disabled				state 5 unlocked enabled
	4.0 LBS: none	**4.1 LBS: local**	**4.2 LBS: remote**	**4.3 LBS: both**	**5.0**
LOCK	MDU-LBI; 2.0	MDU-LBI; 1.1	MDU-LBI; 1.2	MDU-LBI; 1.3	MDU-LBI; 2.0
UNLOCK	-	-	-	-	-
SHUTTING DOWN	MDU-LBI; 2.0	MDU-LBI; 1.1	MDU-LBI; 1.2	MDU-LBI; 1.3	sdReq; 3.0
occurrence of internal disabling reasons	-; 4.1	-	-; 4.3	-	-; 4.1
disappearance of internal disabling reasons	/	MDU-LUBR; 4.0	/	MDU-LUBR; 4.2	/
MDU-LUBR	MDU-LUBR; -	-	MDU-LUBR; 4.0	/	/
MDU-LUBI	lid-req; -	/	lid-req; 4.0	/	sdCan; -
MDU-LBI	-; 4.2	-; 4.3	-	-	-; 4.2
MDU-LBR	/	/	/	/	sdReq; -
sdRej	/	/	/	/	MDU-LUBR; -
sdComp	/	/	/	/	MDU-LBI; 4.2
lid-rej	-	-	-	-	-
lid-ok	-; 5.0	-	-	-	-
lid-not-ok	-; 4.1	-	-	-	-

NOTE: Key: <output signal>;<new state>
/ = unexpected event
- = no action
LBS = Link Block Status

Annex C (informative): Telecommunications Management Network (TMN) management service "Customer administration at the V5 interface and administration of V5 interface related data at the LE"

C.1 Task Information Base (TIB) A

NOTE: This TIB A is derived from ETR 047 [12]. It has been extended for being applicable to a V5 interface environment. Components of service and management functions, which are out of scope were nevertheless kept for completeness and cross reference.

C.1.1 Description

Customer administration is a management activity that the network operator performs in order to exchange with the customer all the customer related management data and functions required to offer a telecommunications service and to exchange with the network all the customer related management data and functions necessary for the network to produce that telecommunications service.

It is considered that the customer installation can be accessed directly at the LE as well as via a V5 interface.

In a wide sense, this could include interactions for the purpose of service provision management, configuration administration, fault administration, charging (including detailed billing) administration, complaints administration, quality of service administration, traffic measurement administration etc. Here, however, only customer administration in the more traditional sense of service provision and service configuration has been included.

In particular, the tasks to be performed in the LE to provide service for customers which are connected via a V5 interface to the LE are considered.

Administration of V5 interface related data is a management activity that the network operator performs in order to initially configure or to reconfigure a V5 interface to enable and maintain the service offering for the customers connected.

C.1.2 Components of service

C.1.2.1 Manage service provision

After receiving a customer order, find an available directory number and a suitable V5 interface with available time slot(s) in an appropriate exchange and connect these.

The management of service provision to customer installations accessed directly at the LE is covered by EN 300 291-1 [1].

Here, the additional requirements for managing service provision to customer installations accessed via a V5 interface at the LE are considered.

C.1.2.2 Administer service facilities and supplementary services

Record user service requirements as data related to directory number. Some services can be both customer controlled and operator controlled. Examples are abbreviated dialling, priority, malicious call tracing, charging observation, traffic restriction, free of charge etc.

This item is covered by EN 300 291-1 [1].

C.1.2.3 Administer customer line

Administer line characteristics which are relevant for the LE, considering lines accessing the LE via a V5 interface (e.g. line status, traffic direction). The administration of customer lines accessed directly at the LE is covered by EN 300 291-1 [1].

C.1.2.4 Manage line test

Out of scope.

C.1.2.5 Configure and reconfigure V5 interface

Record data related to a specific V5 interface to enable or maintain service offering and to yield data inconsistency detection between AN and LE.

C.2 Management function list

NOTE: This management function list is derived from ETR 047 [12]. V5 interface specific extensions/modifications are introduced. Subclause 5.6.2, item 2 and items 4 to 7 of ETR 047 [12] are out of scope of the present document.

C.2.1 Insert, delete, modify, read single and multi-line customer access (ISDN and analogue access) accessed via a V5 interface

C.2.1.1 Customers accessed via a V5.1 interface (ISDN basic and analogue access)

C.2.1.1.1 Insert customer accesses

Set up relations between:

- directory Number and its assigned customer service profile (see EN 300 291-1 [1]);
- V5.1 interface;
- time slot(s) in that interface;
- envelope function address (for ISDN access);
- layer 3 port address (for analogue access);
- in case of ISDN, B-channel number (B1, B2);
- in case of ISDN, time slot for D-channel packet and frame data;
- customer resources,

and provide the relevant data.

C.2.1.1.2 Delete customer accesses

Delete relations between the information elements mentioned in subclause C.2.1.1.1 and, if necessary, relevant data assigned to those elements.

C.2.1.1.3 Modify customer accesses

Modify one or more relation(s) and/or assigned data mentioned in subclause C.2.1.1.1.

C.2.1.1.4 Read customer accesses

Read information about one or more relations and/or assigned data mentioned in subclause C.2.1.1.1.

C.2.1.2 Customers accessed via a V5.2 interface (ISDN basic and primary rate and analogue access)

C.2.1.2.1 Insert customer accesses

Set up relations between:

- directory number and its assigned customer service profile (see EN 300 291-1 [1]);
- V5.2 interface;
- envelope function address (for ISDN access);
- layer 3 port address (for analogue access);
- in case of ISDN, time slot for D-channel packet and frame data;
- customer resources,

and provide the relevant data.

C.2.1.2.2 Delete customer accesses

Delete relations (ISDN basic and analogue access) mentioned in subclause C.2.1.2.1.

C.2.1.2.3 Modify customer accesses

Modify (ISDN basic and analogue access) in subclause C.2.1.2.1.

C.2.1.2.4 Read customer accesses

Read (ISDN basic and analogue access) in subclause C.2.1.2.1.

C.2.2 Insert, delete, modify, read customer (supplementary) service

Out of scope.

C.2.3 Block/unblock single and multi-line customers

It is to be regarded, that dynamic blocking and unblocking can be initiated across the V5 interface, The impact between administrative and dynamic blocking/unblocking needs to be considered.

C.2.4 Block/unblock customer (supplementary) service

Out of scope.

C.2.5 Activate/de-activate malicious call tracing

Out of scope.

C.2.6 Activate/de-activate charging observation

Out of scope.

C.2.7 Activate/de-activate line test and measurement

Out of scope.

C.2.8 Insert, delete, modify, read a V5 interface

C.2.8.1 V5.1 interface

C.2.8.1.1 Insert a V5.1 interface

Add a V5.1 interface:

- V5.1 interface ID;
- time slots for communication and for bearer channels;
- protocol version;
- provisioning variant.

C.2.8.1.2 Delete a V5.1 interface

Remove a V5.1 interface and delete relevant data mentioned in subclause C.2.8.1.1.

C.2.8.1.3 Modify a V5.1 interface

Modify one or more information elements given in subclause C.2.8.1.1. Each modification should result in an appropriate mark in the provisioning variant information element.

C.2.8.1.4 Read a V5.1 interface

Read one or more information element given in subclause C.2.8.1.1. Read AN synchronization state and/or provisioning variant.

C.2.8.2 V5.2 interface

C.2.8.2.1 Insert a V5.2 interface

Add a V5.2 interface and provide relevant data:

- V5.2 interface ID;
- associated 2 Mbit/s link(s);
- time slot(s) for C-channels;
- protocol version;
- provisioning variant.

C.2.8.2.2 Augment a V5.2 interface

Add 2 Mbit/s link(s) to the existing V5.2 interface and provide relevant data:

- associated 2 Mbit/s link(s);
- time slot(s) for C-channels;
- provisioning variant.

C.2.8.2.3 Delete a V5.2 interface

Remove a V5.2 interface ID and delete the relevant data.

C.2.8.2.4 Reducing a V5.2 interface

Remove 2 Mbit/s link(s) from a V5.2 interface and delete the relevant data.

C.2.8.2.5 Modify a V5.2 interface

Modify one or more information elements given in subclause C.2.8.2.1 except of the associated access port (no)s.

C.2.8.2.6 Read a V5.2 interface

Read AN synchronization state and/or provisioning variant in subclause C.2.8.2.1.

C.2.8.2.7 Upgrade a V5.1 to a V5.2 interface

The upgrade is performed by deleting the affected V5.1 interface and inserting a V5.2 interface using the relevant data having been assigned to the V5.1 interface.

Annex D (informative): Functional architecture

The functional architecture is described in EN 300 376-1 [4].

Annex E (informative): Link control message flows

A state and a message written in the same line means that this state is entered and the message is sent as part of the transition into this state. There are transitions where more than one message is sent. As explained in annex B, messages concerning the checking procedure of the link ID are sent to a special system management procedure. The V5 messages resulting from the link ID check procedure are not shown in the subsequent tables. MDU-DI and MDU-LAI issued by the link control FSM are sent to a resource manager, which transforms it into "occurrence of internal disabling reasons" and "disappearance of internal disabling reasons", shown in the following tables as dis(MDU-DI) and en(MDU-LAI), respectively. The messages sdReq and sdComp are exchanged with a system management procedure handling the shutdown of a link.

Notifications to the OS due to state transitions are not shown. Where two messages are issued to system management within one state transition, the resulting new states and the messages sent are written in two lines within the same row of the table.

Table E.1: Urgent blocking by AN

AN					LE			
OS command	**ITU-T Recommen-dation X.731 [16] state**	**MDU message**	**Link ctrl state**	**V5 message/ MPH**	**Link ctrl state**	**MDU message**	**ITU-T Recommen-dation X.731 [16] state**	**OS command**
	5.0		2.0		2.0		5.0	
LOCK###								
	2.0	MDU-LBI###						
			1.0	FE304###				
					1.0	MDU-LBI###		
							4.2	

Table E.2: Non urgent blocking by AN

AN					LE			
OS command	**ITU-T Recommen-dation X.731 [16] state**	**MDU message**	**Link ctrl state**	**V5 message/ MPH**	**Link ctrl state**	**MDU message**	**ITU-T Recommen-dation X.731 [16] state**	**OS command**
	5.0		2.0		2.0		5.0	
SHUTDOWN ###								
	3.0	MDU-LBR###						
			2.0	FE305###				
					2.0	MDU-LBR###		
						(###sdReq)	5.0	
						(sdComp###)		
						###MDU-LBI	4.2	
				###FE303	1.0			
		###MDU-LBI	1.0					
	2.0							

Table E.3: Unblocking by AN (both sides perform link ID checking)

AN					LE			
OS command	**ITU-T Recommen-dation X.731 [16] state**	**MDU message**	**Link ctrl state**	**V5 message/ MPH**	**Link ctrl state**	**MDU message**	**ITU-T Recommen-dation X.731 [16] state**	**OS command**
	2.0		1.0		1.0		4.2	
UNLOCK###								
	4.0	MDU-LUBR###						
			1.1	FE302###				
					1.2	MDU-LUBR###		
						###MDU-LUBR	4.0	
				###FE301	2.0	MDU-LUBI###		
		###MDU-LUBI	2.0			(###lid-req)	4.0	
	4.0	(lid-req###)				(lid-ok###)		
		(###lid-ok)					5.0	
	5.0							

Table E.4: Urgent blocking by LE

AN					LE			
OS command	**ITU-T Recommen-dation X.731 [16] state**	**MDU message**	**Link ctrl state**	**V5 message/ MPH**	**Link ctrl state**	**MDU message**	**ITU-T Recommen-dation X.731 [16] state**	**OS command**
	5.0		2.0		2.0		5.0	
								###LOCK
						###MDU-LBI	2.0	
				###FE303	1.0			
		###MDU-LBI	1.0					
	4.2							

Table E.5: Unblocking by LE (both sides perform link ID checking)

AN					LE			
OS command	**ITU-T Recommen-dation X.731 [16] state**	**MDU message**	**Link ctrl state**	**V5 message/ MPH**	**Link ctrl state**	**MDU message**	**ITU-T Recommen-dation X.731 [16] state**	**OS command**
	4.2		1.0		1.0		2.0	
								### UNLOCK
						###MDU-LUBR	4.0	
				###FE301	1.1			
		###MDU-LUBR	1.2					
	4.0	MDU-LUBR###						
		MDU-LUBI###	2.0	FE302###				
	4.0	(lid-req###)			2.0	MDU-LUBI###		
		(###lid-ok)				(###lid-req)	4.0	
	5.0					(lid-ok###)	5.0	

Table E.6: Link layer 1 failure and subsequent restoration

AN					LE			
OS command	**ITU-T Recommen-dation X.731 [16] state**	**MDU message**	**Link ctrl state**	**V5 message/ MPH**	**Link ctrl state**	**MDU message**	**ITU-T Recommen-dation X.731 [16] state**	**OS command**
	5.0		2.0		2.0		5.0	
				###MPH-DI				
		###dis(MDU-DI)	0.1					
	4.1			MPH-DI###				
					0.1	dis(MDU-DI)###		
							4.1	
				###MPH-AI				
		###en(MDU-LAI)	2.0					
	4.0	MDU-LUBR###						
		###MDU-LUBI	2.0	FE302###				
	4.0	(lid-req###) (###lid-rej)		###FE303	0.2			
		###MDU-LBI	1.0					
	4.2							
				MPH-AI###				
					1.0	en(MDU-LAI) ### MDU-LBI###		
						###MDU-LUBR	4.0 4.2	
				###FE301	1.1			
		###MDU-LUBR	1.2					
	4.0	MDU-LUBR###						
		###MDU-LUBI	2.0	FE302###				
	4.0	(lid-req###)			2.0	MDU-LUBI###		
		(###lid-ok)				(###lid-req)	4.0	
	5.0					(lid-ok###)		
							5.0	

Although a link failure or restoration happens at the AN and LE at the same time, there will be in general a different delay between the actual event and its observation.

In table E.7, it is assumed that the AN side receives MPH-AI first and tries to unblock the link and to check the link ID. Both will fail since the LE side is still in a failure state.

Table E.7: Link locked by AN, link layer 1 failure, link unlocked by AN, link layer 1 ok

AN					LE			
OS command	**ITU-T Recommen-dation X.731 [16] state**	**MDU message**	**Link ctrl state**	**V5 message/ MPH**	**Link ctrl state**	**MDU message**	**ITU-T Recommen-dation X.731 [16] state**	**OS command**
	5.0		2.0		2.0		5.0	
LOCK								
	2.0	MDU-LBI						
			1.0	FE304				
					1.0	MDU-LBI		
							4.2	
				###MPH-DI				
		###dis(MDU-DI)	0.2					
	1.1			MPH-DI###				
					0.2	dis(MDU-DI) ###		
							4.3	
UNLOCK###								
	4.1	MDU-LUBR###						
			0.2	FE304###				
					0.2			
				###MPH-AI				
		###en(MDU-LAI) ###MDU-LBI	1.0					
	4.0 4.2	MDU-LUBR###						
			1.1	FE302###				
				###FE303	0.2			
		###MDU-LBI	1.0					
	4.2							
				MPH-AI###				
					1.0	en(MDU-LAI) ### MDU-LBI###		
						###MDU-LUBR	4.0 4.2	
				###FE301	1.1			
		###MDU-LUBR	1.2					
	4.0	MDU-LUBR###						
		###MDU-LUBI	2.0	FE302###				
	4.0	(lid-req###)			2.0	MDU-LUBI###		
		(###lid-ok)				(###lid-req)	4.0	
	5.0					(lid-ok###)		
							5.0	

Although a link failure or restoration happens at the AN and LE at the same time, there will be in general a different delay between the actual event and its observation.

Table E.8: Link layer 1 failure, link locked by LE, link restoration

AN					LE			
OS command	**ITU-T Recommen-dation X.731 [16] state**	**MDU message**	**Link ctrl state**	**V5 message/ MPH**	**Link ctrl state**	**MDU message**	**ITU-T Recommen-dation X.731 [16] state**	**OS command**
	5.0		2.0		2.0		5.0	
				###MPH-DI				
		###dis(MDU-DI)	0.1					
	4.1			MPH-DI###				
					0.1	dis(MDU-DI) ###		
							4.1	
								###LOCK
						###MDU-LBI	1.1	
				###FE303	0.2			
			0.2					
				###MPH-AI				
		###en(MDU-LAI) ###MDU-LBI	1.0		0.2			
	4.0 4.2	MDU-LUBR###						
			1.1	FE302###				
				###FE303	0.2			
			1.0					
		###MDU-LBI						
	4.2							
				MPH-AI###				
					1.0	en(MDU-LAI) ### MDU-LBI###		
							2.0 2.0	

Although a link failure or restoration happens at the AN and LE at the same time, there will be in general a different delay between the actual event and its observation.

Annex F (informative): Message flows for the mapping of virtual access ports on ITU-T Recommendation X.731 states

F.1 PSTN ITU-T Recommendation X.731 state management

F.1.1 Blocking initiated by the AN

See also EN 300 324-1 [2].

Table F.1: Blocking initiated by the AN

$Q3_{AN}$ AN management	**AN primitive**	**AN state change**	**V5 FE**	**LE state change**	**LE primitive**	**$Q3_{LE}$ LE management**
SET administrative state = LOCKED						(operational state = ENABLED)
	MPH-BI###					
		AN2.0###AN1.0 ###blocked	### FE204			
				LE2.0###LE1.0 ###blocked	MPH-BI###	
						change operational state = DISABLED

F.1.2 Blocking request initiated by the AN

See also EN 300 324-1 [2].

Table F.2: Blocking request initiated by the AN

$Q3_{AN}$ AN management	AN primitive	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
SET administrative state = SHUTTING DOWN						(operational state = ENABLED)
	MPH-BR###					
			### FE205			
					MPH-BR###	
						WAIT until access is free (idle), then change operational state = DISABLED
					###MPH-BI	
			### FE203	LE2.0###LE1.0 ###blocked		
	###MPH-BI	AN2.0###AN1.0 ###blocked				
operational state = ENABLED administrative state = LOCKED						

F.1.3 Blocking initiated by the LE

See also EN 300 324-1 [2].

Table F.3: Blocking initiated by the LE

$Q3_{AN}$ AN management	AN primitive	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
						(operational state = ENABLED)
						change operational state = DISABLED (e.g. BER too high)
					###MPH-BI	
			### FE203	LE2.0###LE1.0 ###blocked		
	###MPH-BI	AN2.0###AN1.0 ###blocked				
operational state = DISABLED administrative state = UNLOCKED						

F.1.4 Co-ordinated unblocking initiated by the LE

See also EN 300 324-1 [2].

Table F.4: AN administrative state is UNLOCKED (i.e. AN agrees to unblocking request from LE)

$Q3_{AN}$ AN management	AN primitive	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
(operational state = DISABLED administrative state = UNLOCKED)						(operational state = DISABLED)
						operational state = ENABLED request
					### MPH-UBR	
			### FE201	LE1.0###LE1.1 ###local unblock		
	### MPH-UBR	AN1.0###AN1.2 ###remote unblock				
change operational state = ENABLED (note) administrative state = UNLOCKED						
	MPH-UBR ###					
	###MPH-UBI	AN1.2###AN2.0 ###operational	### FE202			
				LE1.1###LE2.0 ###operational	MPH-UBI###	
						change operational state = ENABLED
NOTE: If there is no local disabling reason.						

Table F.5: AN administrative state is LOCKED in the meantime (i.e. AN rejects unblocking request from LE)

$Q3_{AN}$ AN management	AN primitive	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
(operational state = DISABLED administrative state = LOCKED)						(operational state = DISABLED)
						operational state = ENABLED request
					### MPH-UBR	
			### FE201	LE1.0###LE1.1 ###local unblock		
	### MPH-UBR	AN1.0###AN1.2 ###remote unblock				
administrative state = LOCKED Unblock request is rejected						

F.1.5 Co-ordinated unblocking initiated by the AN

See also EN 300 324-1 [2].

Table F.6: Administrative state = LOCKED, Operational state = ENABLED

$Q3_{AN}$ AN management	AN primitive	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
(operational state = ENABLED administrative state = LOCKED)						
SET administrative state = UNLOCKED						
operational state = DISABLED administrative state = UNLOCKED						
	MPH-UBR ###					
		AN1.0###AN1.1 ###local unblock	### FE202			
				LE1.0###LE1.2 ###remote unblock	MPH-UBR ###	
						change operational state = ENABLED
					### MPH-UBR	
			### FE201	LE1.2###LE2.0 ###operational	MPH-UBI###	
	###MPH-UBI	AN1.1###AN2.0 ###operational				
change operational state = ENABLED						

Table F.7: Administrative state = UNLOCKED, Operational state = DISABLED

$Q3_{AN}$ AN management	AN primitive	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
(operational state = DISABLED administrative state = UNLOCKED)						
operational state = ENABLED request						
	MPH-UBR ###					
		AN1.0###AN1.1 ###local unblock	### FE202			
				LE1.0###LE1.2 ###remote unblock	MPH-UBR ###	
						change operational state = ENABLED
					### MPH-UBR	
			### FE201	LE1.2###LE2.0 ###operational	MPH-UBI###	
	###MPH-UBI	AN1.1###AN2.0 ###operational				
change operational state = ENABLED						

Table F.8: Administrative state = LOCKED, Operational state = ENABLED, LE local unblocked (LE1.1)

$Q3_{AN}$ AN management	AN primitive	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
(operational state = ENABLED administrative state = LOCKED)						
SET administrative state = UNLOCKED						
operational state = DISABLED administrative state = UNLOCKED						
	MPH-UBR ###					
	###MPH-UBI	AN1.2###AN2.0 ###operational	### FE202			
change operational state = ENABLED				LE1.1###LE2.0 ###operational	MPH-UBI###	
						change operational state = ENABLED

F.2 ISDN ITU-T Recommendation X.731 state management

F.2.1 Blocking initiated by the AN

See also EN 300 324-1 [2].

Table F.9: Port operational deactivated (AN2.0)

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
SET administrative state = LOCKED							(operational state = ENABLED)
	MPH-BI###						
			AN2.0###AN1.0 ###blocked	### FE204			
					LE2.0###LE1.0 ###blocked	MPH-BI###	
							change operational state = DISABLED

Table F.10: Port operational activation initiated (AN2.1)

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
SET administrative state = LOCKED							(operational state = ENABLED)
	MPH-BI###						
		DS### ET FE5	AN2.1###AN1.0 ###blocked STOP T1	### FE204			
					LE2.1###LE1.0 ###blocked	MPH-BI### ; PH/MPH-DI	
							change operational state = DISABLED

Table F.11: Port operational and activated (AN2.2)

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
SET administrative state = LOCKED							(operational state = ENABLED)
	MPH-BI###						
		DS### ET FE5	AN2.2###AN1.0 ###blocked STOP T1	### FE204			
					LE2.2###LE1.0 ###blocked	MPH-BI### ; PH/MPH-DI	
							change operational state = DISABLED

F.2.2 Blocking request initiated by the AN

See also EN 300 324-1 [2].

Table F.12: Port operational deactivated (AN2.0)

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
SET administrative state = SHUTTING DOWN							(operational state = ENABLED)
	MPH-BR ###						
				### FE205			
						MPH-BR ###	
							WAIT until access is free (idle), then change operational state = DISABLED
						###MPH-BI	
				### FE203	LE2.0###LE1.0 ###blocked		
	###MPH-BI		AN2.0###AN1.0 ###blocked				
operational state = ENABLED administrative state = LOCKED							

Table F.13: Port operational activation initiated (AN2.1)

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
SET administrative state = SHUTTING DOWN							(operational state = ENABLED)
	MPH-BR ###						
				### FE205			
						MPH-BR ###	
							WAIT until access is free (idle), then change operational state = DISABLED
						###MPH-BI	
				### FE203	LE2.1###LE1.0 ###blocked		
	###MPH-BI	DS### ET FE5	AN2.1###AN1.0 ###blocked STOP T1				
operational state = ENABLED administrative state = LOCKED							

Table F.14: Port operational and activated (AN2.2)

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
SET administrative state = SHUTTING DOWN							(operational state = ENABLED)
	MPH-BR ###						
				### FE205			
						MPH-BR ###	
							WAIT until access is free (idle), then change operational state = DISABLED
						###MPH-BI	
				### FE203	LE2.2###LE1.0 ###blocked		
	###MPH-BI	DS### ET FE5	AN2.2###AN1.0 ###blocked				
operational state = ENABLED administrative state = LOCKED							

F.2.3 Blocking initiated by the LE

See also EN 300 324-1 [2].

Table F.15: Port operational deactivated (AN2.0)

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
							(operational state = ENABLED)
							change operational state = DISABLED (e.g. BER too high)
						###MPH-BI	
				### FE203	LE2.0###LE1.0 ###blocked		
	###MPH-BI		AN2.0###AN1.0 ###blocked				
operational state = DISABLED administrative state = UNLOCKED							

Table F.16: Port operational activation initiated (AN2.1)

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
							(operational state = ENABLED)
							change operational state = DISABLED (e.g. BER too high)
						###MPH-BI	
				### FE203	LE2.1###LE1.0 ###blocked		
	###MPH-BI	DS### ET FE5	AN2.1###AN1.0 ###blocked STOP T1				
operational state = DISABLED administrative state = UNLOCKED							

Table F.17: Port operational and activated (AN2.2)

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
							(operational state = ENABLED)
							change operational state = DISABLED (e.g. BER too high)
						###MPH-BI	
				### FE203	LE2.1###LE1.0 ###blocked		
	###MPH-BI	DS### ET FE5	AN2.2###AN1.0 ###blocked				
operational state = DISABLED administrative state = UNLOCKED							

F.2.4 Co-ordinated unblocking initiated by the LE

See also EN 300 324-1 [2].

Table F.18: AN administrative state is UNLOCKED (i.e. AN agrees to unblocking request from LE)

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
(operational state = DISABLED administrative state = UNLOCKED)							(operational state = DISABLED)
							operational state = ENABLED request
						### MPH-UBR	
				### FE201	LE1.0###LE1.1 ###local unblock		
	### MPH-UBR		AN1.0###AN1.2 ###remote unblock				
change operational state = ENABLED (note) administrative state = UNLOCKED							
	MPH-UBR ###						
	### MPH-UBI		AN1.2###AN2.0 ###operational	### FE202			
					LE1.1###LE2.0 ###operational	MPH-UBI ###	
							change operational state = ENABLED
NOTE: If there is no local disabling reason.							

Table F.19: AN administrative state is LOCKED in the meantime (i.e. AN rejects unblocking request from LE)

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
(operational state = DISABLED administrative state = UNLOCKED)							(operational state = DISABLED)
							operational state = ENABLED request
						### MPH-UBR	
				### FE201	LE1.0###LE1.1 ###local unblock		
	### MPH-UBR		AN1.0###AN1.2 ###remote unblock				
administrative state = LOCKED Unblock request is rejected							

F.2.5 Co-ordinated unblocking initiated by the AN

See also EN 300 324-1 [2].

Table F.20: Administrative state = LOCKED, Operational state = ENABLED

$Q3_{AN}$ AN management	**AN primitive**	**V1 FE**	**AN state change**	**V5 FE**	**LE state change**	**LE primitive**	**$Q3_{LE}$ LE management**
(operational state = ENABLED administrative state = LOCKED)							
SET administrative state = UNLOCKED							
operational state = DISABLED administrative state = UNLOCKED							
	MPH-UBR ###						
			AN1.0###AN1.1 ###local unblock	### FE202			
					LE1.0###LE1.2 ###remote unblock	MPH-UBR ###	
							change operational state = ENABLED
						### MPH-UBR	
				### FE201	LE1.2###LE2.0 ###operational	MPH-UBI ###	
	### MPH-UBI		AN1.1###AN2.0 ###operational				
change operational state = ENABLED							

Table F.21: Administrative state = UNLOCKED, Operational state = DISABLED

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
(operational state = DISABLED administrative state = UNLOCKED)							
operational state = ENABLED request							
	MPH-UBR ###						
			AN1.0###AN1.1 ###local unblock	### FE202			
					LE1.0###LE1.2 ###remote unblock	MPH-UBR ###	
							change operational state = ENABLED
						### MPH-UBR	
				### FE201	LE1.2###LE2.0 ###operational	MPH-UBI ###	
	### MPH-UBI		AN1.1###AN2.0 ###operational				
change operational state = ENABLED							

Table F.22: Administrative state = LOCKED, Operational state = ENABLED, LE local unblocked (LE1.1)

$Q3_{AN}$ AN management	AN primitive	V1 FE	AN state change	V5 FE	LE state change	LE primitive	$Q3_{LE}$ LE management
(operational state = ENABLED administrative state = LOCKED)							
SET administrative state = UNLOCKED							
operational state = DISABLED administrative state = UNLOCKED							
	MPH-UBR ###						
	### MPH-UBI		AN1.2###AN2.0 ###operational	### FE202			
change operational state = ENABLED					LE1.1###LE2.0 ###operational	MPH-UBI ###	
							change operational state = ENABLED

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

- ITU-T Recommendation X.711 (1997): "Information technology - Open Systems Interconnection - Common Management Information Protocol: Specification".
- ETR 008 (1990): "Network Aspects (NA); The method for the characterization of the machine-machine interfaces utilized by a Telecommunications Management Network (TMN)".
- ETR 037: "Network Aspects (NA); Telecommunications Management Network (TMN); Objectives, principles, concepts and reference configurations".
- ETR 046: "Network Aspects (NA); Telecommunications management networks modelling guidelines".
- ETR 048:"Network Aspects (NA); Telecommunications Management Network (TMN); Management services prose descriptions".
- ETR 078: "Maintenance: Telecommunications management network; TMN interface specification methodology [ITU-T Recommendation M.3020 (1992)].
- ETS 300 150: "Transmission and Multiplexing (TM); Protocol suites for Q interfaces for management of transmission systems".
- EN 300 292: "Telecommunications Management Network (TMN); Functional specification of call routeing information management on the Operations System/Network Element (OS/NE) interface".
- I-ETS 300 293: "Telecommunications Management Network (TMN); Generic managed objects".
- EN 300 304: "Synchronous Digital Hierarchy (SDH) information model for the Network Element (NE) view".
- ITU-T Recommendation G.773 (1993): "Protocol suites for Q-interfaces for management of transmission systems".
- ITU-T Recommendation G.774 (1992): "Synchronous Digital Hierarchy (SDH) management information model for the network element view".
- ITU-T Recommendation G.803 (1997): "Architecture of transport networks based on the synchronous digital hierarchy (SDH)".
- ITU-T Recommendation G.831 (1996): "Management capabilities of transport networks based on the Synchronous Digital Hierarchy (SDH)".
- ITU-T Recommendation X.710 (1997): "Information technology - Open Systems Interconnection - Common Management Information service".
- ITU-T Recommendation X.722 | ISO/IEC 10165-4 (1992): "Information technology - Open Systems Interconnection - Structure of management information: Guidelines for the definition of managed objects".

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