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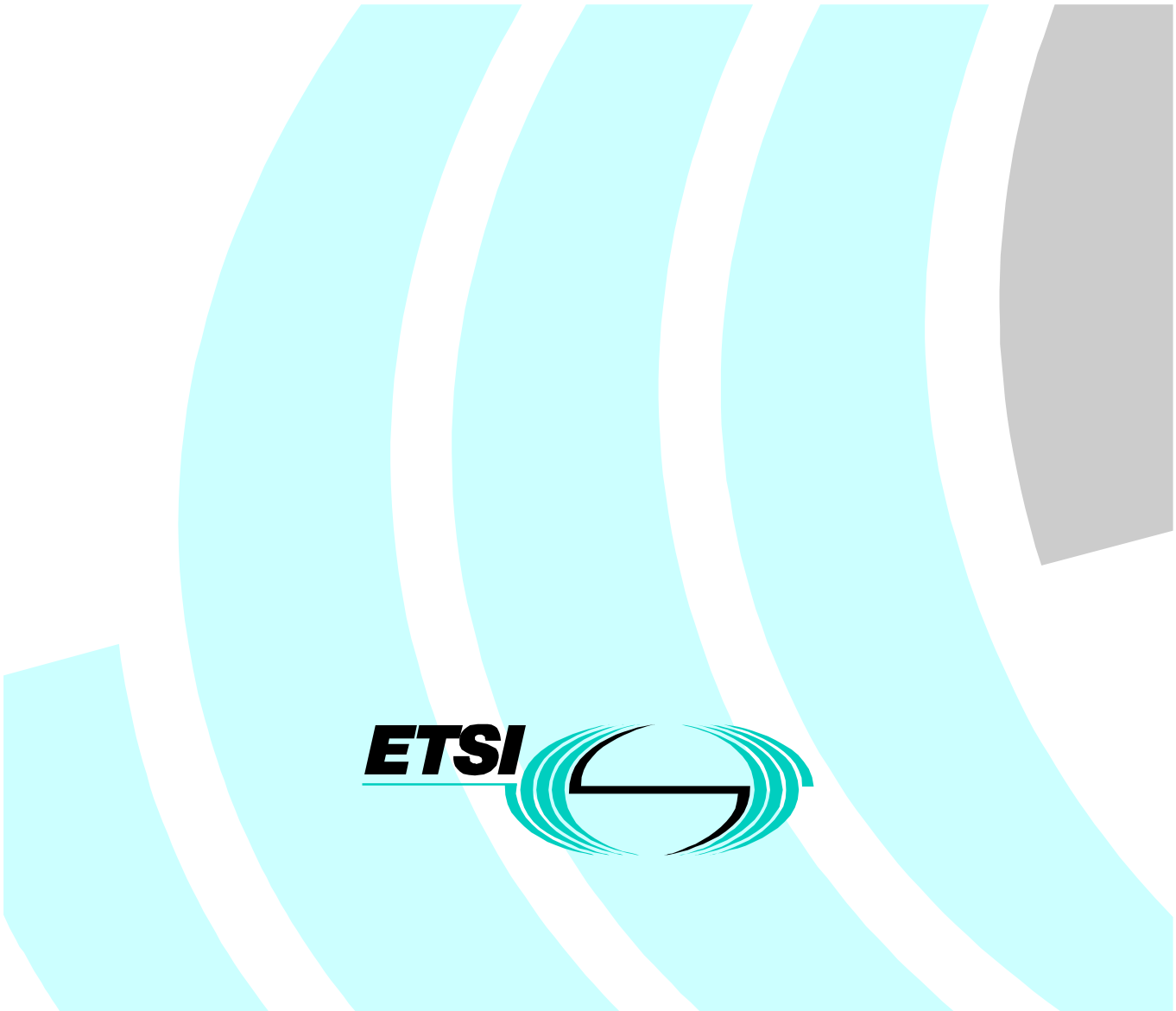
European Standard (Telecommunications series)

Telecommunications Management Network (TMN); Management interfaces associated with the VB5.1 reference point



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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).

National transposition dates	
Date of adoption of this EN:	6 July 2001
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1 Scope

The present document specifies the management interfaces (Q3 interfaces) associated with the VB5.1 reference point [1], [2] and EN 301 217-1 (see bibliography) for the support of configuration, fault & performance management functions. Fault and performance management together include both passive monitoring of reports and active fault isolation.

The Q3 interface [9] is the TMN interface between network elements or Q-adapters which interface to OSs without mediation and between OSs and mediation devices.

Existing protocols are used where possible, and the focus of the work is on defining the object model. The definition of the functionality of TMN Operations Systems is outside the scope of the present document.

ITU-T Recommendation Q.2931 [11] is supported at the UNI, and the ATM Forum UNI is supported for compatibility with the established base of ATM equipment.

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] ETSI ETR 257: "V interfaces at the digital Service Node (SN); Identification of the applicability of existing protocol specifications for a VB5 reference point in an access arrangement with Access Networks (ANs)".

[2] ETSI EN 301 005-1: "V interfaces at the digital Service Node (SN); Interfaces at the VB5.1 reference point for the support of broadband or combined narrowband and broadband Access Networks (ANs); Part 1: Interface specification".

[3] Void.

[4] ITU-T Recommendation G.773: "Protocol suites for Q-interfaces for management of transmission systems".

[5] ITU-T Recommendation G.784: "Synchronous digital hierarchy (SDH) management".

[6] ITU-T Recommendation G.902: "Framework Recommendation on functional access networks (AN) Architecture and functions, access types, management and service node aspects".

[7] ITU-T Recommendation G.967.1 (1998): "V-interfaces at the service node (SN): VB5.1 reference point specification".

[8] ITU-T Recommendation I.751: "Asynchronous transfer mode management of the network element view".

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

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

[11] ITU-T Recommendation Q.2931 (1995): "Broadband Integrated Services Digital Network (B-ISDN) - Digital Subscriber Signalling System No. 2 (DSS 2) - User-Network Interface (UNI) - Layer 3 specification for basic call/connection control".

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

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

[14] Void

[15] ITU-T Recommendation Q.824.6: "Stage 2 and stage 3 description for the Q3 interface - Customer administration: Broadband switch management ".

[16] ITU-T Recommendation Q.832.1 (1998): "VB5.1 Management".

[17] ITU-T Recommendation Q.832.2 (1999): "VB5.2 Management".

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

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

3 Definitions, abbreviations, and conventions

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ITU-T Recommendations G.902 [6] , G.967.1 [7] and M.3010 [9] and the following apply:

resources: management of user port functions and service port functions providing User Network Interface (UNI) and Service Node Interface (SNI) functionality, respectively, are considered in the present document based on the framework defined in ITU-T Recommendation G.902 [6]. Transmission specific resources lie outside the scope of this term in the present document.

3.2 Abbreviations

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

AEMF	ATM Equipment Management Function
AN	Access Network
ASN.1	Abstract Syntax Notation One
ATM	Asynchronous Transfer Mode
GDMO	Guidelines for the Definition of Managed Objects
LME	Layer Management Entry
LSP	Logical Service Port
LUP	Logical User Port
ME	Management Entry
MIB	Management Information Base
MOC	Managed Object Class
OAM	Operations, Administration and Maintenance
OS	Operations System
RTMC	Real Time Management Coordination
SAAL	Signalling ATM Adaptation Layer
SDH	Synchronous Digital Hierarchy
SN	Service Node
SNI	Service Node Interface
TMN	Telecommunications Management Network
TTP	Trail Termination Point
UNI	User-Network Interface
VC	Virtual Channel
VP	Virtual Path
VPC	Virtual Path Connection

VPCI Virtual Path Connection Identifier

3.3 Conventions

Objects and their characteristics and associated ASN.1 defined here are given names with capitals used to indicate the start of the next word, and acronyms are treated as if they were words.

Throughout the present document, all new attributes are named according to the following guidelines:

- the name of an attribute ends in the string "Ptr" if and only the attribute value is intended to identify a single object;
- the name of an attribute ends in the string "PtrList" if and only the attribute value is intended to identify one or more objects;
- the name of an attribute is composed of the name of an object class followed by the string "Ptr" if and only the attribute value is intended to identify a specific object class;
- if an attribute is intended to identify different object classes, a descriptive name is given to that attribute and a description is provided in the attribute behaviour;
- the name of an attribute ends in the string "Id" if and only the attribute value is intended to identify the name of an object, in which case this attribute should be the first one listed, should use ASN.1 NameType and should not be used to convey other information;
- the name of an attribute is composed of the name of an object class followed by the string "Id" if and only the attribute value is intended to identify the name of the object class holding that attribute.

4 General Overview

The following information model diagrams have been drawn for the purpose of clarifying the relations between the different object classes of the model:

1) entity-relationship models showing the relations of the different managed objects;
2) inheritance hierarchy showing how managed objects are derived from each other (i.e. the different paths of inherited characteristics of the different managed objects).

These diagrams are only for clarification. The formal specification in terms of GDMO templates and ASN.1 type definitions are the relevant information for implementations.

4.1 Entity-relationship models

The following conventions are used in the diagrams (see figure 1):

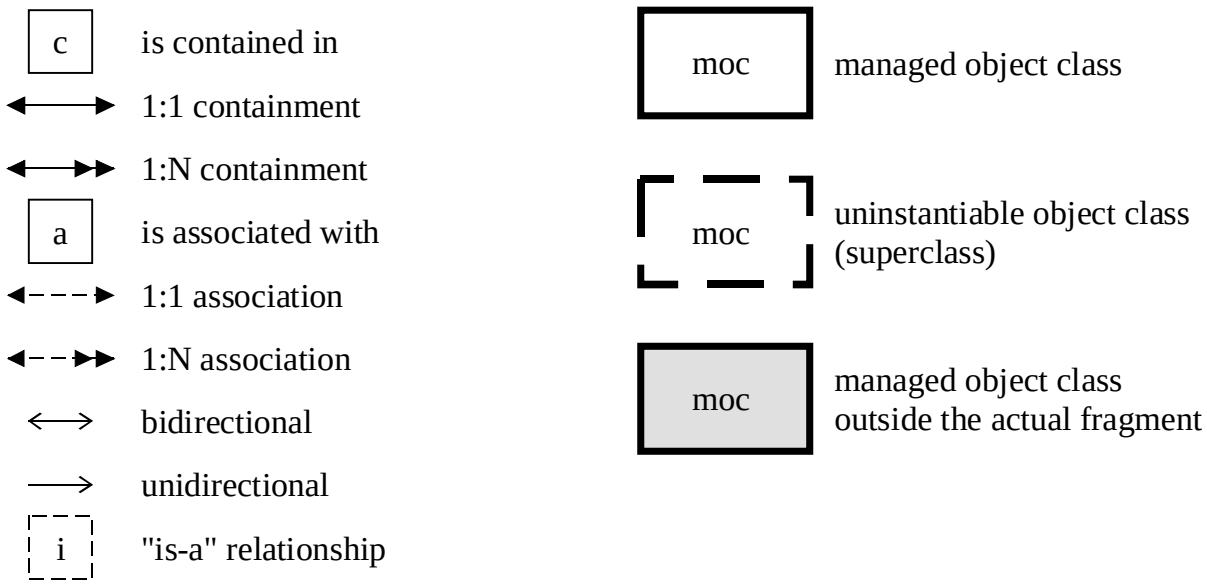
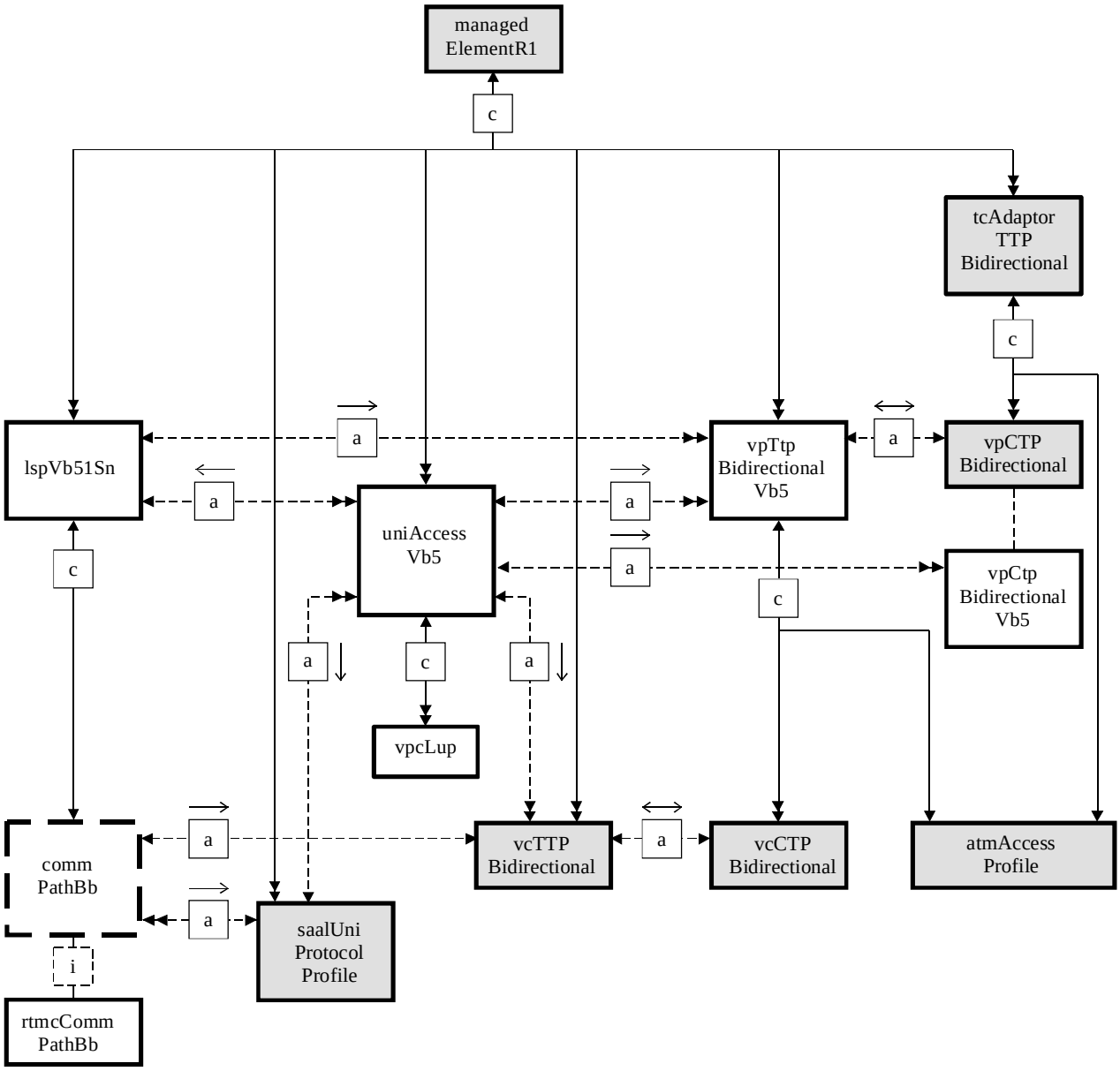


Figure 1: Conventions used in diagrams for entity-relationship models

Where the directionality of containment is not clear, it can be identified by implications since the root class is unique.

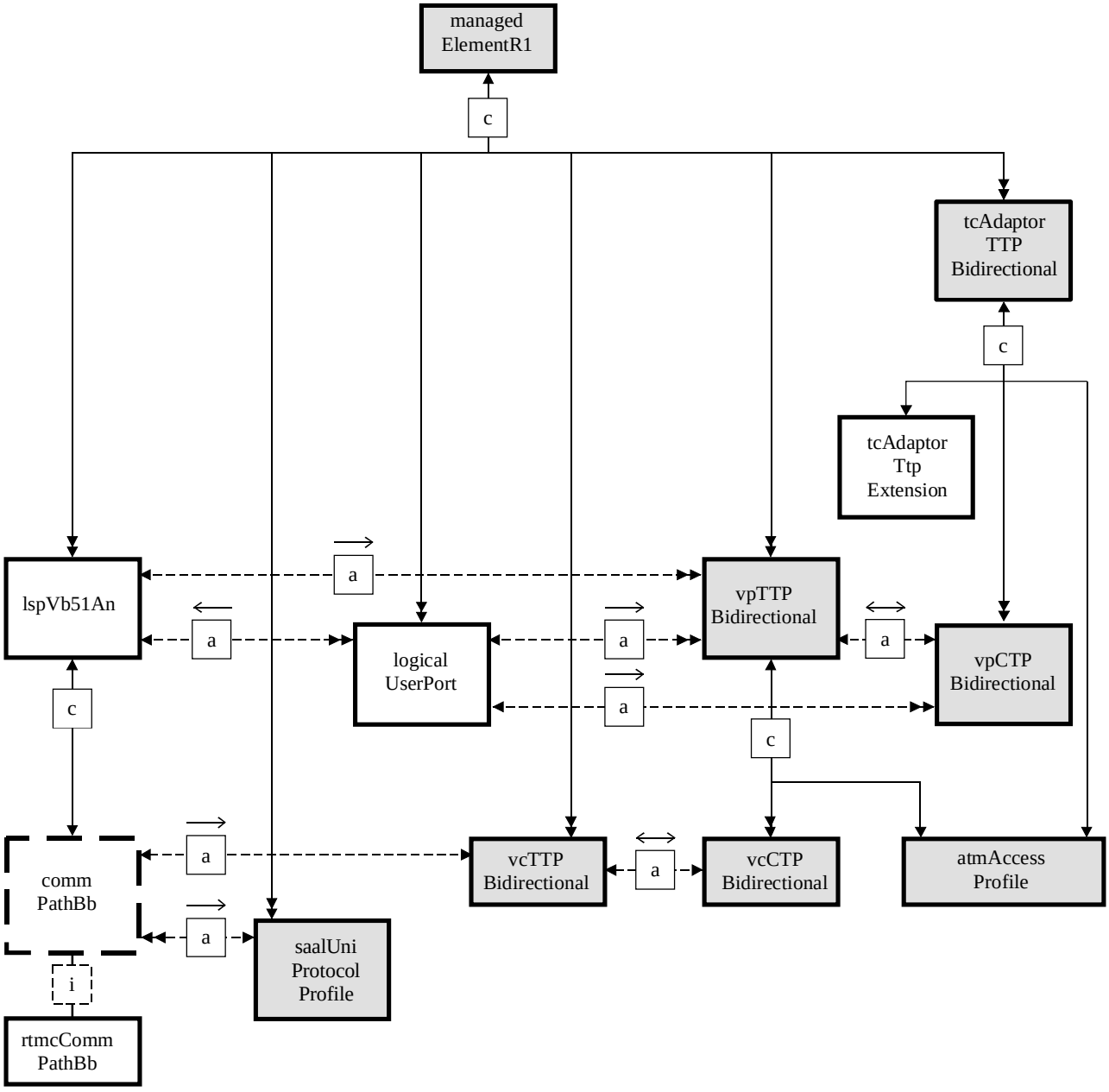
4.1.1 Entity relationship diagram for the service node



NOTE: Not all object classes are shown in this diagram as some object classes are reused unchanged from ITU-T Recommendation I.751 [8].

Figure 2: Entity-relationship diagram - Service node

4.1.2 Entity relationship diagram for the access network



NOTE: Not all object classes are shown in this diagram as some object classes are reused unchanged from ITU-T Recommendation I.751 [8].

Figure 3: Entity-relationship diagram - Access network

4.2 Inheritance hierarchy

Figure 4 traces the inheritance relationships from the highest level object (ITU-T Recommendation X.721 [18], "top") to the managed objects which are defined in the present document.

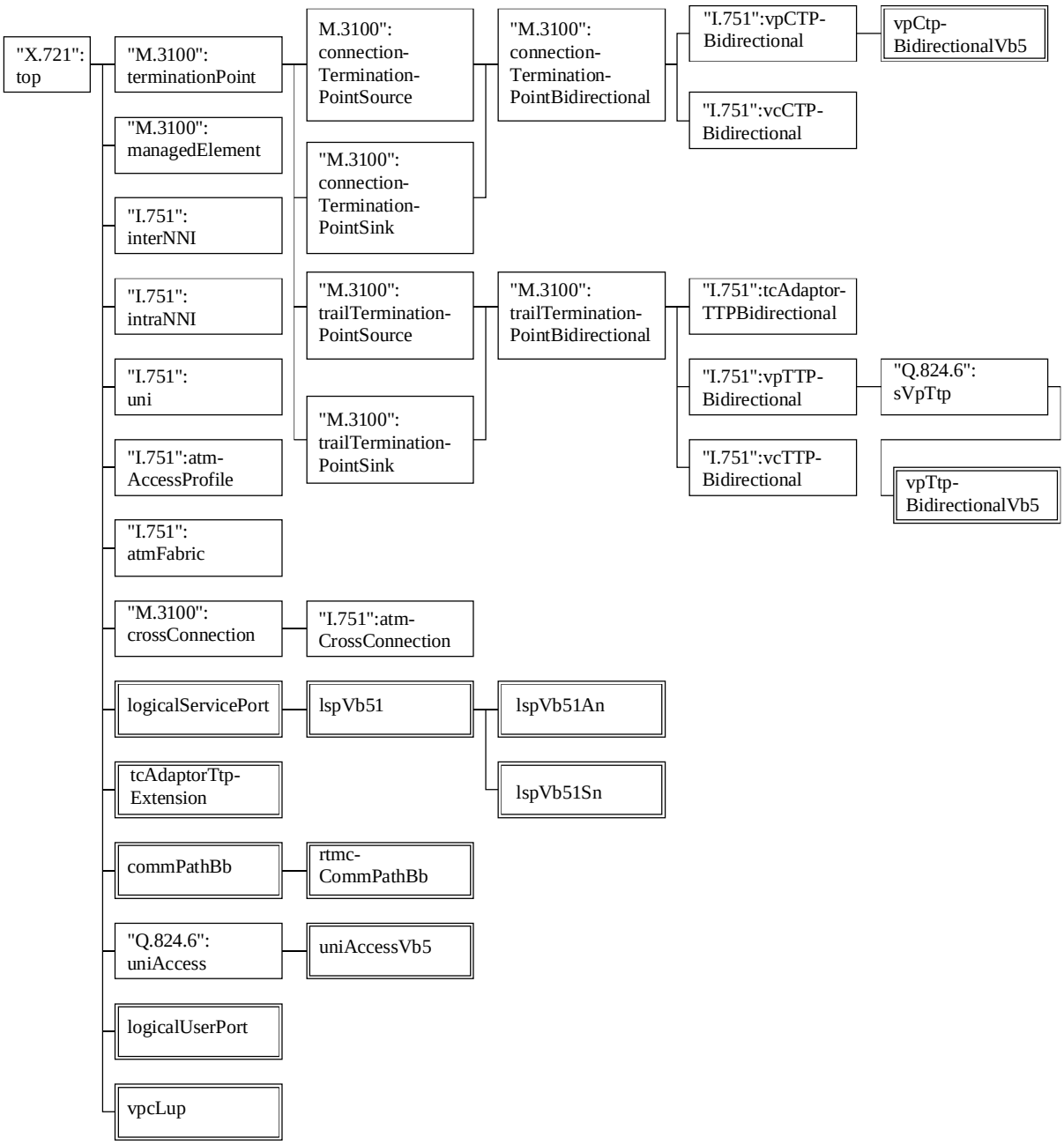


Figure 4: Inheritance hierarchy

5 Formal Definitions

This clause gives the formal definitions of the managed object classes, name bindings, general packages, behaviours, attributes, actions and notifications.

Formal definitions are shown in annex F.

6 Type definitions

Type definitions are shown in annex F.7.

7 Protocol stacks

The protocol stacks specified in ITU-T Recommendation Q.811 [12], Q.812 [13], G.773 [4] and the SDH digital cross-connect part of ITU-T Recommendation G.784 [5] can be used as part of the protocol stack for the present document.

Annex A (normative): Management requirements

A.1 General management requirements

A.1.1 General configuration management requirements

a) There is a requirement to assign a VB5 interface identifier, also known as a logical service port identifier, to a VB5 interface.

b) There is a requirement to assign VPCIs to VPCs on a VB5 interface when these VPCs are terminated in the access network.

A.2 Real-time management coordination requirements

A.2.1 Configuration management requirements

A.2.1.1 General configuration management requirement

The general configuration requirements include the general real-time management coordination functions between the access network and the service node.

A.2.1.2 Common configuration management requirement for AN and SN

A.2.1.2.1 Shutting-down of VPs

The model should support the MEE primitives associated with the shutting down of VPs.

A.2.1.2.2 VB5 interface ID checking

The management interfaces must support the verification of logical VB5 interface IDs so that the connection of VB5 interfaces can be checked by the operations systems.

A.2.1.2.3 Handling of VB5 primitives

The operations system must be able to handle the MEE primitives in AN and the SN.

A.2.1.2.4 Coordination of VP and VC resources

There is a requirement for the service node to have knowledge of the state of VP and VC resources used to provide service to the customer.

A.2.1.2.5 Non B-ISDN accesses

There is a requirement to take account of VCs terminated in the access network for non-B-ISDN accesses represented by virtual user ports (whose nature is not explicit) and to allow cross connections for these.

A.2.1.3 Configuration management requirement for AN

A.2.1.4 Configuration management requirement for SN

A.2.1.4.1 Assignment of indirect accesses

There is a requirement to assign indirect UNI accesses in the service node to VB5 interfaces at the service node.

A.2.1.4.2 Coordination of indirect accesses with logical user ports

There is are requirement to relate indirect UNI accesses in the service node to logical user ports in the access network.

A.2.1.4.3 Consistency of configuration

There is a requirement to check the consistency of the configuration VPCIs between the access network and the service node.

A.2.2 Fault management requirements

A.2.2.1 Alarm surveillance requirements

A.2.2.1.1 General alarm surveillance requirements

A.2.2.1.1.1 Coordination of operational states

Where changes of the operational state of ATM entities are communicated between the access network and the service node using ATM OAM cells, it must be possible to inform the operations systems about these communicated changes since higher management functions may be affected. This is dealt with in ITU-T Recommendation I.751 [8].

A.2.2.2 Test and fault localization requirements

A.2.2.2.1 General test and fault localization requirements

A.2.2.2.1.1 Test traffic

There is a requirement to be able to permit only test traffic across a VB5 interface.

A.3 Non-real time management requirements

These requirements are given in ITU-T Recommendation Q.832.2 [17].

Annex B (normative): Functional architecture

B.1 Functional architecture associated with VB5 reference point

The functional architecture associated with the VB5 reference point is given in figure B.1 for the access network and in figure B.2 for the service node (VB5 fragment). Each trail of the physical layer can serve a number of trails of the transmission convergence layer, corresponding to the support of a number of logical ports by a single physical port.

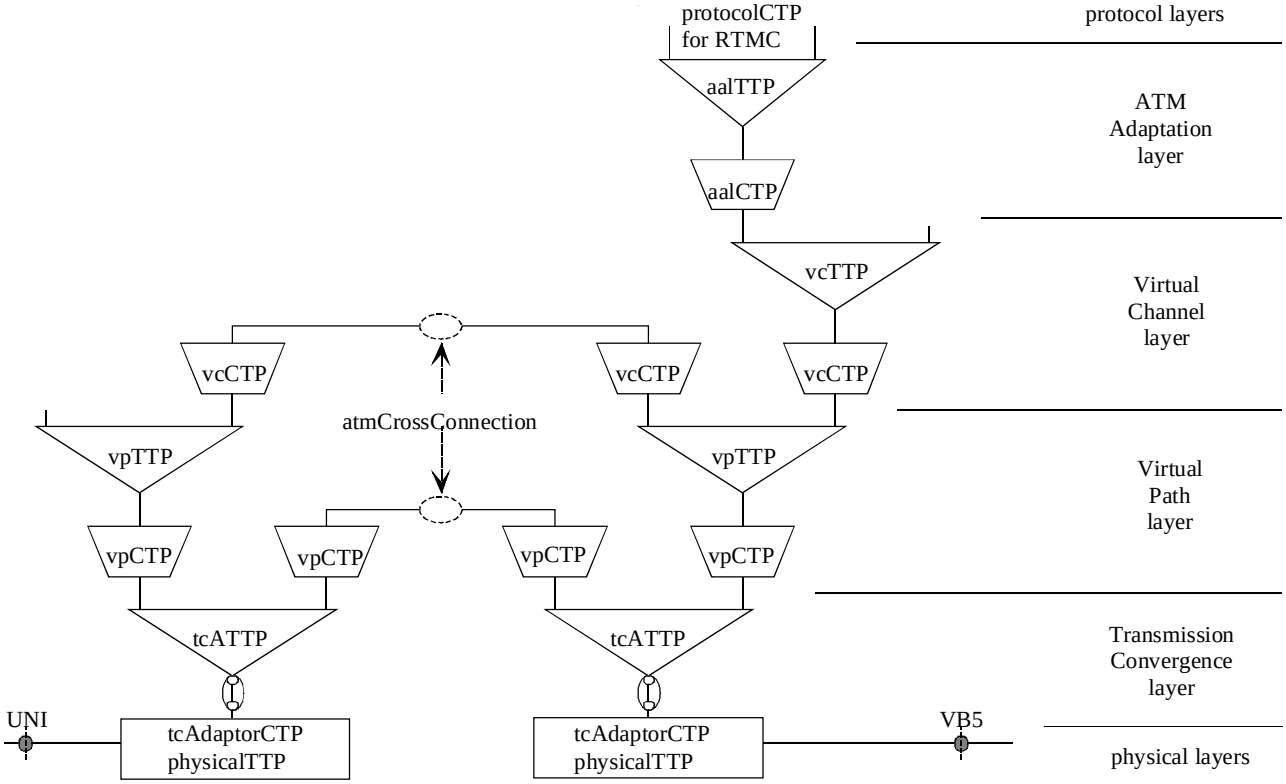


Figure B.1: VB5 functional architecture - Access network

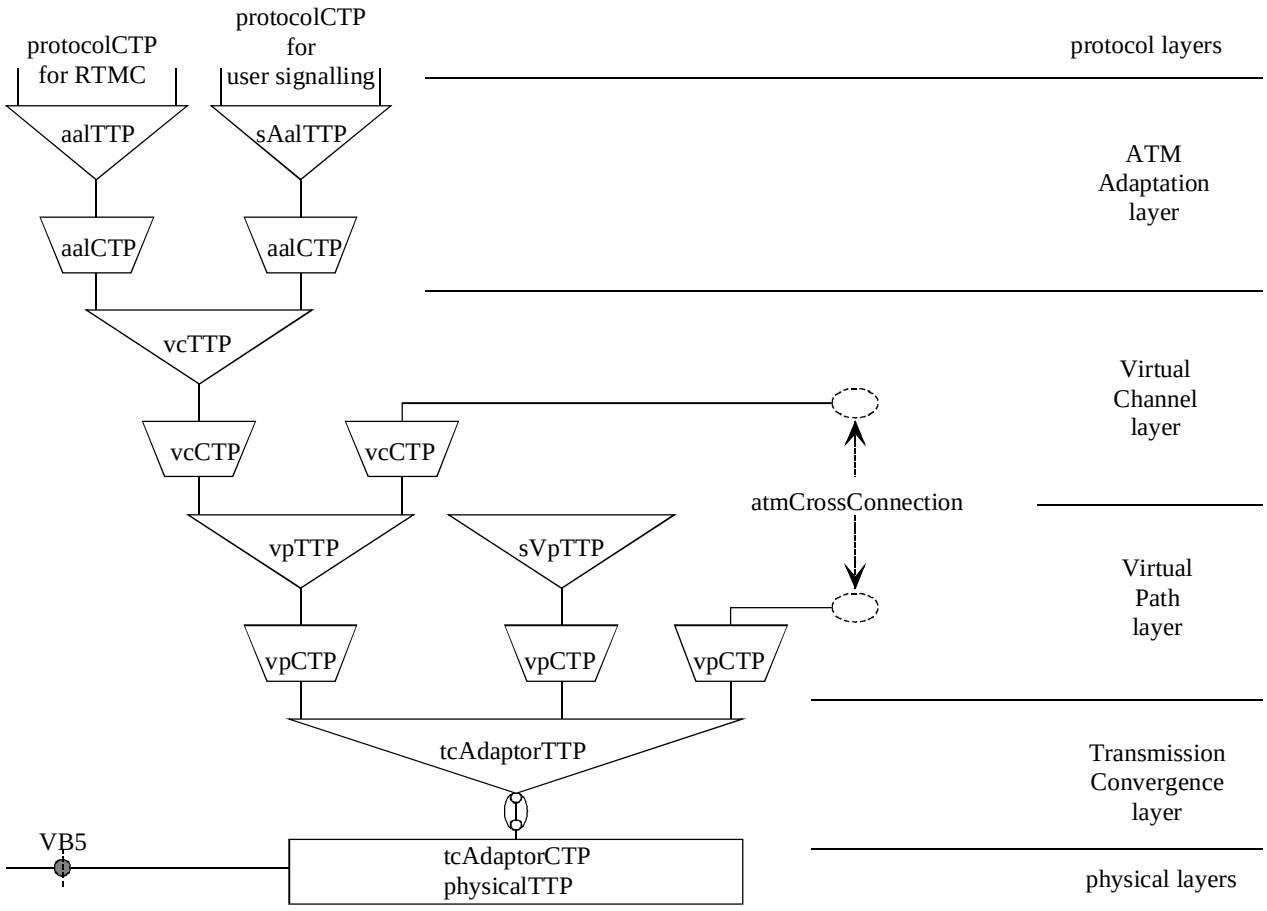


Figure B.2: VB5 functional architecture - Service node

Within the ATM service node or broadband access network, each trail of the transmission convergence layer supports a number of trails of the VP layer and these trails correspond to virtual path connections. If only VPs are switched then these trails of the VP layer are re-routed, but not terminated. If VCs are switched, then it terminates the trails of the VP layers and there is adaptation to the VC layer. If a trail at the VC layer carries signalling which is processed by the ATM service node or access network, then the VC trail is terminated at the ATM service node or access network and the information flow passes up to the ATM adaptation layer and to the higher protocol layers. Only VCs carrying VB5 protocols are terminated in the access network.

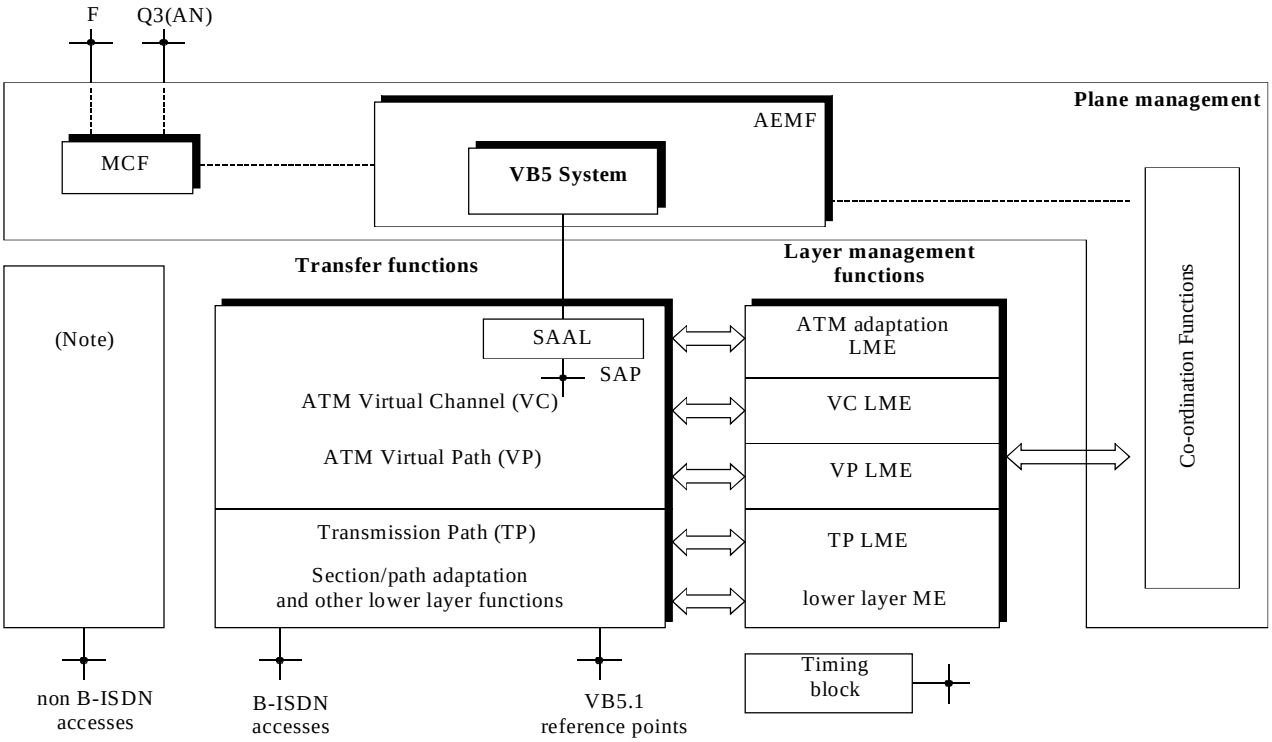
The adaptation functions between the layers are represented by instances of connection termination point classes and the termination of trails are represented by instances of trail termination point classes.

Annex C (normative): Relationship between VB5.1 interfaces and the management model

C.1 Introduction

This annex describes the relationships between VB5.1 interfaces and the management model. In particular it describes when MEE primitives (see "VB5.1 system architecture, structure and procedures" in ITU-T Recommendation G.967.1 [7]) are created due to messages from the OS and when messages are sent to the OS as a result of primitives generated by the managed system.

Figure C.1 shows the position of the VB5 system in the management plane of an ATM network element. The MCF (Message Communication Function) functional block receives the management commands sent by the OS via Q3 or F interface and forwards them to the AEMF (ATM Equipment Management Functions) functional block in an internal format. The MIB of the equipment and the VB5 system are contained in the AEMF; the message sent by the MCF is received by a managed object of the MIB that will generate an MEE primitive to the VB5 system.



NOTE: Although non-B-ISDN accesses are non excluded, they are not described in the present document.

Figure C.1: General functional blocks for the AN

In cases where attributes are changed as a result of primitives generated by the managed system, the OS may be informed by change notifications.

The following clauses within this annex describe the use of the various VB5 labels, the relationship of shutting-down and blocking to the state attributes, VPCI consistency checking, LSP identity checking, RTMC reset and start-up. The clauses, one for each of the RTMC procedures, relate the information model of the AN and the SN to the primitives of the VB5 system, whether the procedures are activated by the OS via Q3 interface or by the peer system via RTMC protocol.

C.2 LSP, LUP and VPCI labels

The LSP identifier which is used in VB5 messages corresponds to the logicalServicePortNumber attribute of the logical service port objects. The LUP identifiers which are used in VB5 messages correspond to the logicalUserPort attribute of the VB5 UNI access objects in the SN or of the logical user port objects in the AN.

The VPCI values for LUPs in AN used in VB5 messages correspond to the values associated with the vpCtpAndVpciPtrList attribute of logical user port objects if the VPCs at the LUPs do not terminate in the AN, or to the values associated with the vpTtpAndVpciPtrList attribute of logical user port objects if the VPCs at the LUPs do terminate in the AN.

The VPCI values for LUPs in the SN used in VB5 messages correspond to the values associated with the tpAndVpciPtrList attribute of the VB5 UNI access objects for VPCs which terminate in the SN, or to the values associated with the vpCtpVb5AndVpciPtrList for VPCs which do not terminate in the SN. For VPCs which are associated with VB5 UNI accesses and which terminate in the AN, the VPCI values used in VB5 messages correspond to the values of the vpcLupNumber attribute of the vpcLup objects in the SN.

The VPCI values for LSPs used in VB5 messages correspond to the values associated with the vpTtpAndVpciPtrList attribute of the logical service port objects.

C.3 Shutting down

Shutting down is initiated by the OS of the AN changing the administrativeState attribute of an object which affects a VP or group of VPs related to the VB5 interface to its shutting-down value, or the partialAdministrativeState attribute to the partial shutting-down value for those objects which support this value. This results in the creation of an MEE_await_clear_req primitive or primitives in the AN.

Following the exchange of VB5 messages, the SN generates an MEE_await_clear_ind primitive or primitives which results in the changing of the remoteBlockingVb5 attribute from remoteUnblocked to remoteAwaitingClear in the relevant VB5 VP CTP or TTP objects or in the relevant vpcLup objects.

The SN responds to the MEE_await_clear primitive or primitives by waiting for calls to clear. When this is complete, the SN generates an MEE_await_clear_res primitive or primitives and sends the appropriate message to the AN, which responds and generates an MEE_await_clear_conf primitive or primitives. This allows the administrativeState or partialAdministrativeState attribute which initiated the process in the AN to change to locked or partially locked respectively.

C.4 Blocking and unblocking

When the relevant administrativeState or partialAdministrativeState attributes in the AN change to locked or partially locked, either as a result of shutting down or due to direct intervention by the OS, an MEE_block_request primitive with an administrative cause is generated and a message is sent to the SN. On receipt of this message, an MEE_block_ind primitive is generated in the SN. In addition, in the relevant VP CTP, TTP, vpcLup or logical service port objects the remoteBlockingVb5 attribute changes to remoteBlocked and the administrative field of the remoteBlockingReasonVb5 attribute changes to administrative cause partial or full, depending on the nature of the blocking.

If there is a fault which affects a VP or group of VPs in the AN, then an MEE_block_request primitive with a fault cause is generated, a message is sent to the SN, and often there will be an operationalState attribute in an object in the AN which changes to disabled. On receipt of the message, an MEE_block_ind primitive is generated in the SN and in the relevant VP CTP, TTP, vpcLup or logical service port objects the remoteBlockingVb5 attribute changes to remoteBlocked and the fault field of the remoteBlockingReasonVb5 attribute changes to error.

When the administrativeState or partialAdministrativeState attribute in the AN is changed to unlocked by the OS or the fault condition is cleared, an MEE_unblock_req primitive is generated in the AN and a message is sent to the SN. On receipt of this message, an MEE_unblock_ind primitive is generated in the SN and in the relevant VP CTP, TTP, vpcLup or logical service port objects the remoteBlockingVb5 attribute changes to remoteUnblocked and the fault or administrative field of the remoteBlockingReasonVb5 attribute changes to none.

The administrative and fault fields in the remoteBlockingVb5 attribute are independent.

C.5 VPCI consistency checking

The CheckVpciConsistency action is initiated by the OS of the SN via Q3 and is only applicable to VPCs on a VB5 interface which terminate in the AN and are associated with an LSP. The SN environment is responsible for ensuring that there is no second CheckVpciConsistency initiated as long the first one is running. The VPC on which the CheckVpciConsistency action is performed has to be in the operational state enabled. When starting the action, the operator has to provide the CheckVpciConsistencyInformation. The environment of the SN creates a MEE_cons_check_req primitive and a VB5 message is sent across the interface to the AN.

On receipt of this VB5 message, the AN generates a MEE_cons_check_ind primitive to activate the loopback monitoring function on the requested VPCI in AN environment. A MEE_cons_check_res primitive generated in the AN environment directed to the system management contains the information whether the activation of the loopback monitoring function was successful or the CheckVpciConsistency was rejected (e.g. if another CheckVpciConsistency started by a different SN is already running).

The appropriate VB5 message carries the result information back to the SN side. A MEE_cons_check_conf primitive is generated which triggers the SN environment to start sending end-to-end loopback cells (successful case) or leads to an action reply which is sent to the operator and terminates the CheckVpciConsistency action with the RemoteReason "notPerformed" (rejected or unknown resource case).

If the CheckVpciConsistency is successful up to this point, the detection by the SN of cells which have been looped back or the termination of the test results in the generation of a MEE_cons_check_end_req primitive followed by a VB5 message across the VB5.1 interface towards the AN.

On receipt of this VB5 message, the AN generates a MEE_cons_check_end_ind primitive which results in the deactivation of the loopback monitoring function. The AN environment generates a MEE_cons_check_end_res primitive and a VB5 message crosses the VB5.1 interface to the SN.

This message confirms the stopping of the VPCI consistency check procedure and carries the information whether the AN monitored the loopback cells or not (successful or failed). In the SN a MEE_cons_check_end_conf primitive is generated which transfers the result (successful, failed at AN) to the SN environment. The action reply CheckVpciConsistencyResult transfers this information via Q3 to the OS which started the action.

C.6 Start-up

The start-up procedure deals with the individual VB5 interface and therefore involves the LSP managed object that models the specific interface. The procedure may be activated by either the AN or the SN, in the following two cases:

1) by the OS, which requests the start-up action to activate the interface;

2) by the system, due to a failure of the SAAL, without start-up action requested.

These two cases are described in the clauses below; as the same primitives and managed objects are involved in the AN and the SN a generic description has been used; in particular, the managed object modelling the interface is called LSP and the VB5 System Management functional blocks in the AN and SN are called VB5 System Management.

C.6.1 Activation by OS

The start-up procedure is activated by the OS of the AN or the SN, that sends a start-up action request to activate the VB5 interface. The request is addressed to the specific LSP managed object that models the VB5 interface; the LSP identifier is contained in the start-up action request.

The activation state of the interface is modelled by the lspActivationState attribute that is contained in the LSP managed object; this attribute indicates whether the VB5 interface is active, not active or restarting after a failure.

As soon as the LSP receives the message, it activates the start-up action that examines the value of the lspActivationState.

If the interface is already active (lspActivationState = activated) or restarting (lspActivationState = restarting), the start-up action ends, the OS is informed on the interface state by the start-up action reply and no messages are sent to the VB5 System Management block.

If the interface is not active (lspActivationState = notActivated), the LSP activates the start-up process by generating a MEE_startup_req which is sent to the associated VB5 SYSMGT functional block. The nonActivated value indicates that there is a fault condition or some other condition preventing automatic start-up.

The start-up process is activated in the remote system by the primitives concerning the SAAL establishment, after that VB5 messages are sent to perform the RTMC reset and check procedures. If the procedure succeeds the remote LSP managed object receives an MEE_startup_ind; then the lspActivationState is changed to activated, and the attribute value change notification is sent to inform the OS on the interface activation.

At the end of the procedure the initiator LSP receives from the VB5 System Management block an MEE_startup_conf primitive, which contains the result of the procedure; the result is sent to the OS by the start-up action reply.

If the procedure succeeds the lspActivationState attribute changes to activated and an attribute value change notification is sent to the OS; besides the LSP of the AN blocks all VPCs not available for service due to administrative reasons or faults.

Figure C.2 points out the entities of the information model and the VB5 system involved in the start-up procedure and the messages they exchange.

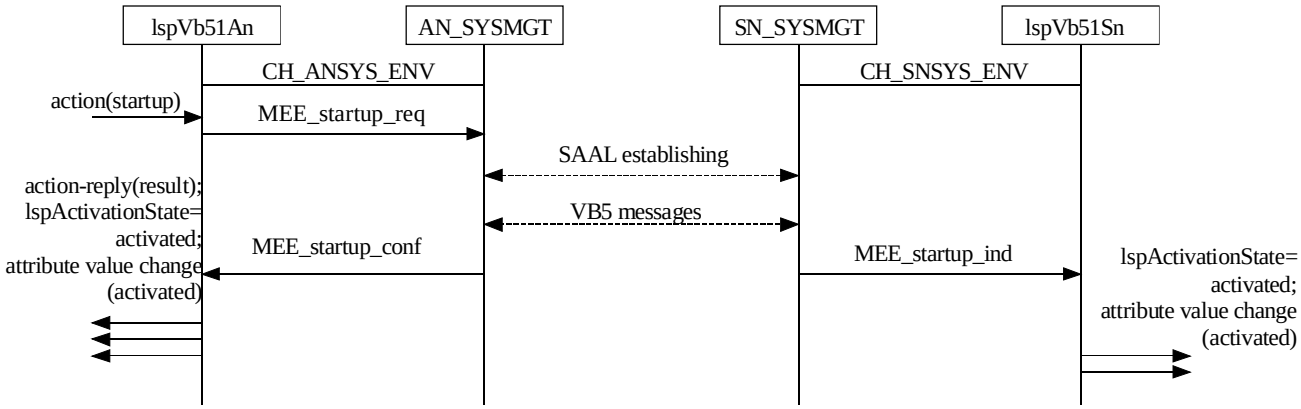


Figure C.2: Successful start-up procedure triggered by the AN OS

The start-up procedure fails if any of the SAAL establishment, LSP verification or RTMC reset procedures fail.

If the start-up procedure fails, the lspActivationState attribute does not change its value set to notActivated and the remote VB5 System Management block does not send the remote LSP the MEE_startup_ind message. The failure is reported to the OS by the action reply: if the interface is already in activated state the start-up result will be activated, if the interface is in restarting state the start-up result will be restarting.

Figure C.3 represents the entities and the relationships identified in case of failure.

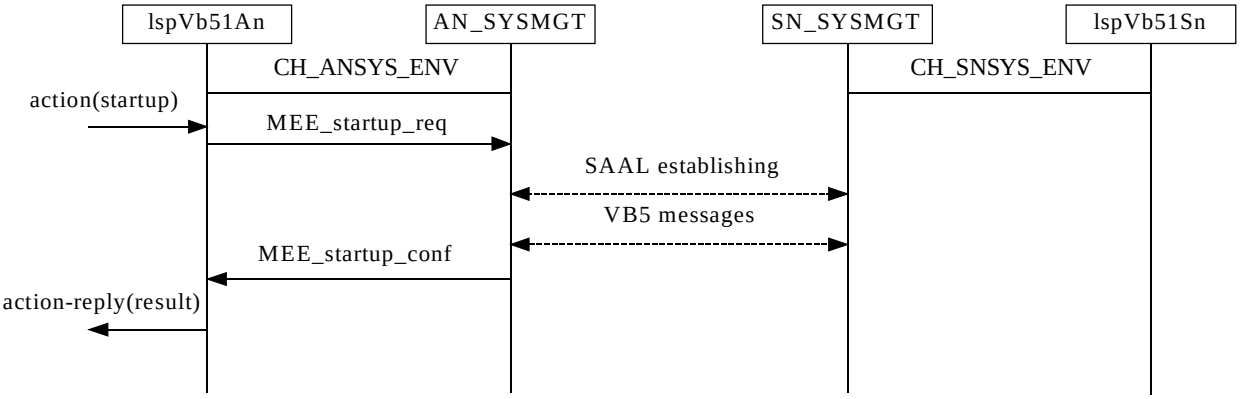


Figure C.3: Unsuccessful start-up procedure triggered by the AN OS

C.6.2 Automatic start-up

The start-up procedure is activated by the system when an SAAL failure occurs or when the fault or other condition preventing automatic start-up no longer exists; this event is notified both to the AN and SN LSP managed objects by an MEE_LSP_failure_ind, which changes the lspActivationState attributes to restarting. This change is notified to the OS by an attribute value change notification; actually, this notification informs the OS of the interface failure. After that, both the LSP managed objects in the AN and SN side will try to restart the interface as in the previous case, sending an MEE_startup_req primitive periodically to the system management block, without notifying the OS of any start-up failures. In figure C.3, the dashed lines mean repeated failed attempts.

If an attempt succeeds the initiating LSP receives a successful MEE_startup_conf, the remote LSP an MEE_startup_ind, the lspActivationState attributes change to activated and an attribute value change notification is sent to each OS (AN side and SN side); besides the LSP of the AN blocks all VPCs not available for service due to administrative reasons or faults.

Figure C.4 represents the case of successful procedure after a number of repeated failed attempts (the dashed lines).

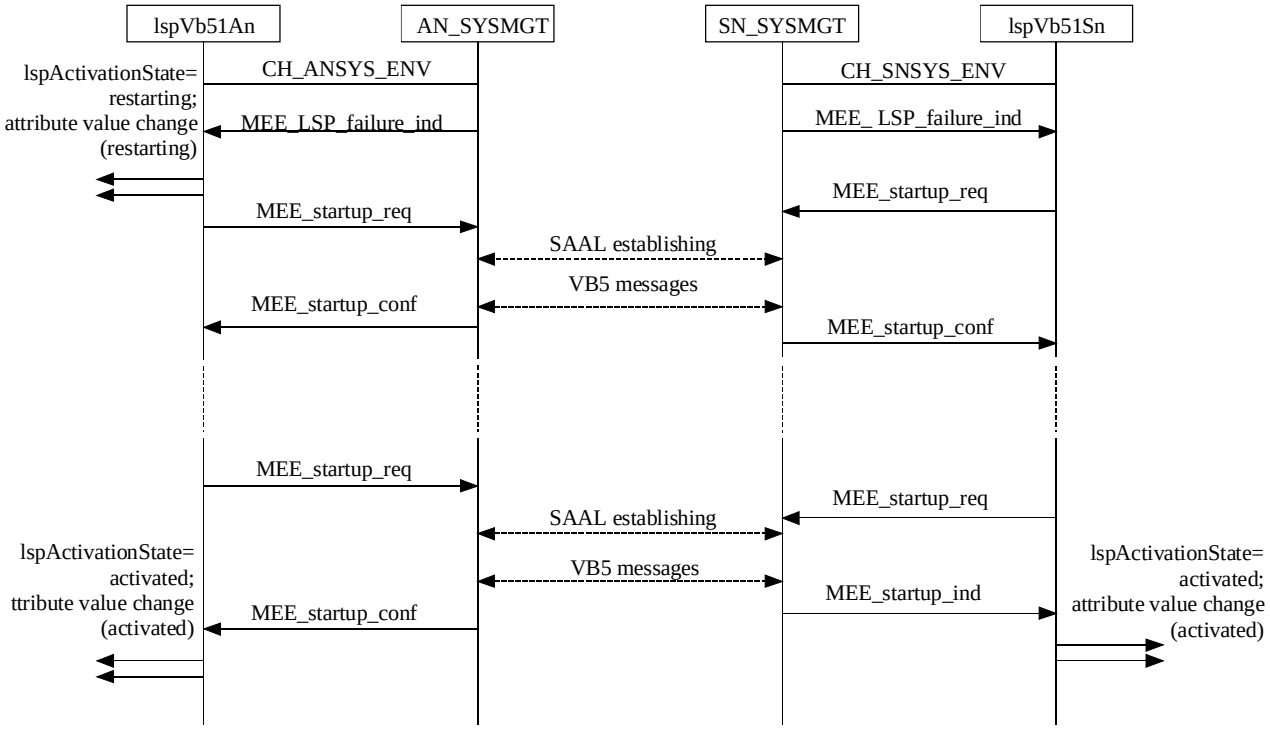


Figure C.4: Successful start-up procedure automatically triggered

If the procedure stops, due to a fault or other condition preventing automatic start-up, the attributes lspActivationState on the AN side and the SN side are set to notActivated and the OSs are informed with the relevant attribute value change notifications.

C.7 LSP identity checking

The check logical service port identification can be invoked from either side SN or AN. Due to a checkLspIdentification action initiated by an OS via the Q3 interface, the related environment creates a primitive MEE_verify_LSP_ID_req which results in the appropriate message across the VB5.1 interface.

On the other side, no MEE primitive is created to inform the environment about the procedure. A VB5 message is sent back to the SN containing the requested information about the logical service port identifier. After comparison of the two LSP Id values, a MEE_verify_LSP_ID_conf primitive is created which provides the result (positive result indication for consistency and negative result indication for mismatch) to the environment. The action reply checkLspIdentificationResult transfers the information via Q3 to the OS which started the action.

C.8 RTMC reset

The RTMC Reset procedure is carried out by the Logical Service Port managed object by means of the RTMC reset action. An RTMC reset results in the SN taking appropriate action which can include the release of on-demand connections although the intention is to minimize the interruption of service. Furthermore, the states of all VPCs and the state of the LSP are set to unblocked; VPCs not available for service due to administrative reasons shall be blocked again by the Logical Service Port managed object. Shut-down requests and VPCI consistency checks are aborted as a consequence of an RTMC reset request.

According to the interface specification, this procedure may be initiated both by the AN OS and by the SN OS and involves the peer system as well, where the procedure is activated by RTMC commands.

The case is described below; as the same primitives and managed objects are involved in the AN and the SN a generic description has been used; in particular, the managed object modelling the interface is called LSP and the VB5 System Management functional blocks in the AN and SN are called VB5 System Management.

The command sent by the OS will be carried on the Q3 interface by the RTMC reset action; the parameter specifies the managed object identifier that will carry it out.

The action command is received by MCF that will generate an internal message to the LSP managed object identified by the appropriate parameter; this message activates the RTMC reset action of the LSP that in turn will generate an MEE_reset_req to the VB5 System Management functional block.

The RTMC reset action is activated on the peer system by the RTMC VB5 messages across the VB5 interface; on receipt of the VB5 messages the VB5 System Management block of the remote system carries out the RTMC reset procedure and reports the result to the remote LSP managed object by means of an MEE_reset_ind primitive.

Only if the RTMC reset is triggered by the AN OS then the peer LSP in the SN, as soon as it receives the RTMC reset indication, informs the OS by the resetRtmcResult notification.

At the end of the VB5 messages phase the VB5 System Management block of the initiating system sends the LSP an MEE_reset_conf primitive with the result of the action, which may be successful or unsuccessful. Finally, the LSP managed object reports the result to the OS by the action reply.

The relationships described above are summarized in figure C.5; in this example, the AN is the initiating system.

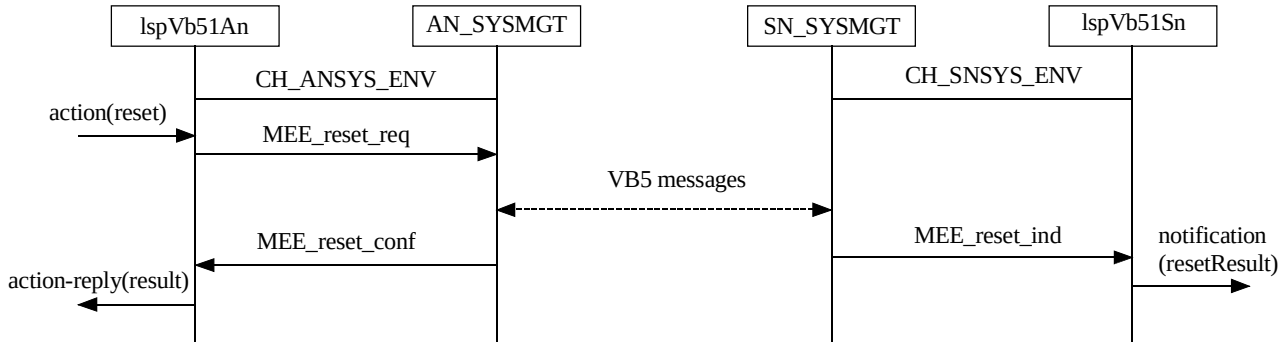


Figure C.5: RTMC Reset procedure triggered by the AN OS

Annex D (normative): State transitions

D.1 State transition table for AN

Table D.1 maps the transitions of the administrativeState attribute, the partialAdministrativeState attribute and the operationalState attribute on MEE primitives towards the VB5 system in the AN. Table D.2 identifies which state attributes are applicable to which VB5 resources and gives the MOC representation of each resource.

Table D.1: Mapping of state transitions on MEE primitives in the AN

admin state	unlocked					shuttingDown			locked			
partadm state	partialUnlocked		partial Shutting Down	partialLocked		partial Unlocked	partial Shutting Down	partialLocked	partialUnlocked		partialLocked	
operat state	enabled	disabled	enabled	enabled	disabled	enabled			enabled	disabled	enabled	disabled
Event (see note 1)	1.1.1	1.1.2	1.2	1.3.1	1.3.2	2.1	2.2	2.3	3.1.1	3.1.2	3.3.1	3.3.2
disabling reason	meeBlock RscReq (E); 1.1.2	-; -	meeBlock RscReq (P, E); 1.3.2	meeBlock RscReq (P, E); 1.3.2	-; -	meeBlock RscReq (F; E); 3.1.2	meeBlock RscReq (F; E); 3.3.2	meeBlock RscReq (F; E); 3.3.2	meeBlock RscReq (F, E); 3.1.2	-; -	meeBlock RscReq (F, E); 3.3.2	-; -
enabling reason	-; -	meeUnblock RscReq; 1.1.1	-; -	-; -	meeBlock RscReq (P); 1.3.1	-; -	-; -	-; -	-; -	meeBlock RscReq (F); 3.1.1	-; -	meeBlock RscReq (F); 3.3.1
LOCK (see note 2)	meeBlock RscReq (F); 3.1.1	meeBlock RscReq (F, E); 3.1.2	meeBlock RscReq (F); 3.3.1	meeBlock RscReq (F); 3.3.1	meeBlock RscReq (F, E); 3.3.2	meeBlock RscReq (F); 3.1.1	meeBlock RscReq (F); 3.3.1	meeBlock RscReq (F); 3.3.1	-; -	-; -	-; -	-; -
SHUTDOWN (see note 2)	meeAwait ClearReq ; 2.1	meeBlock RscReq (F, E); 3.1.2	-; 2.2	meeAwait ClearReq; 2.3	meeBlock RscReq (F, E); 3.3.2	-; -	-; -	-; -	/	/	/	/
UNLOCK (see note 2)	-; -	-; -	-; -	-; -	-; -	meeUnblock RscReq; 1.1.1	-; 1.2	meeBlock RscReq (P); 1.3.1	meeUnblock RscReq; 1.1.1	meeBlock RscReq (E); 1.1.2	meeBlock RscReq (P); 1.3.1	meeBlock RscReq (P, E); 1.3.2
PARTIAL LOCK (see note 3)	meeBlock RscReq (P); 1.3.1	meeBlock RscReq (P, E); 1.3.2	meeBlock RscReq (P); 1.3.1	-; -	-; -	-; 2.3	-; 2.3	-; -	-; 3.3.1	-; 3.3.2	-; -	-; -
PARTIAL SHUTDOWN (see note 3)	meeAwait ClearReq ; 1.2	meeBlock RscReq (P, E); 1.3.2	-; -	/	/	-; 2.2	-; -	/	-; 3.3.1	-; 3.3.2	/	/
PARTIAL UNLOCK (see note 3)	-; -	-; -	meeUnblock RscReq; 1.1.1	meeUnblock RscReq; 1.1.1	meeBlock RscReq (E); 1.1.2	-; -	-; 2.1	-; 2.1	-; -	-; -	-; 3.1.1	-; 3.1.2
meeAwait ClearConf [XC flag FALSE]	-; -	-; -	meeBlock RscReq (P); 1.3.1	-; -	-; -	meeBlock RscReq (F); 3.1.1	meeBlock RscReq (F); 3.3.1	meeBlock RscReq (F); 3.3.1	-; -	-; -	-; -	-; -
meeAwait ClearConf	-; -	-; -	Q3notif sdcomp;	-; -	-; -	Q3notif sdcomp;	Q3notif sdcomp;	Q3notif sdcomp;	-; -	-; -	-; -	-; -

admin state	unlocked					shuttingDown			locked			
partadm state	partialUnlocked		partial Shutting Down	partialLocked		partial Unlocked	partial Shutting Down	partialLocked	partialUnlocked		partialLocked	
operat state	enabled	disabled	enabled	enabled	disabled	enabled			enabled	disabled	enabled	disabled
Event (see note 1)	1.1.1	1.1.2	1.2	1.3.1	1.3.2	2.1	2.2	2.3	3.1.1	3.1.2	3.3.1	3.3.2
[XC flag TRUE]			-			-	-	-				
meeAwait ClearConf [XC flag TRUE]	-; -	-; -	Q3notif sdcomp; -	-; -	-; -	Q3notif sdcomp; -	Q3notif sdcomp; -	Q3notif sdcomp; -	-; -	-; -	-; -	-; -
meeResetRscInd or meeResetRscConf	-; -	meeBlock RscReq (E); -	meeAwait Clear (P); -	meeBlock RscReq (P); -	meeBlock RscReq (P, E); -	meeAwait ClearReq ; -	meeAwait ClearReq ; -	meeAwait ClearReq ; -	meeBlock RscReq (F); -	meeBlock RscReq (F, E); -	meeBlock RscReq (F); -	meeBlock RscReq (F, E); -

The following conventions are used:
< primitive [(attributes)] | Q3 action > ; < new state >
- no primitive or Q3 action to be generated or no state change
/ event not possible or not allowed for this state
Abbreviations used for reason codes: F = admFull; P = admPart; E = Err
NOTE 1: Not all of these events are applicable to a particular resource. For details, reference is made to the relevant GDMO definition.
NOTE 2: Q3 SET request on the administrativeState ATTRIBUTE.
NOTE 3: Q3 SET request on the partialAdministrativeState ATTRIBUTE.

Table D.2: AN resources: Support of state attributes

Resource	MOC representation	administrative State	partial administrative State	operational State
PUP	tcAdaptorTtpBidirectional *plus contained* tcAdaptorTtpExtension	Y	Y	Y
PSP	tcAdaptorTtpBidirectional	Y	N	Y
LUP	logicalUserPort	N	N	N
LSP	lspVb51An	N	Y (Note)	Y
VP	vpCtpBidirectional	Y	N	Y
	vpTtpBidirectional	Y	N	Y
NOTE: Partial shut-down state is not supported.				

D.2 State transition table for SN

Table D.3 presents the transition of the remoteBlockingVb5 attribute on the reception of primitives coming from the VB5 system in the SN. For the event "last user quit", reference should be made to the description of generic states in ITU-T Recommendation X.731 [19]. Table D.4 identifies for which resources the remoteBlockingVb5 attribute is applicable and gives the MOC representation of each resource.

Table D.3: Mapping of MEE primitives on state transitions in the SN

	remoteUnblocked	**remoteAwaitClear**	**remoteBlocked**				
admin	**none**		**adminPartial**		**adminFull**		**none**
error	**none**		**none**	**error**	**none**	**error**	**error**
Event (Note)	**1**	**2**	**3.1.1**	**3.1.2**	**3.2.1**	**3.2.2**	**3.3**
meeUnblockRscInd	-; -	-; 1	-; 1	-; 1	-; 1	-; 1	-; 1
meeAwaitClearInd	-; 2	-; -	mee Await ClearRes; -	mee Await ClearRes; -	meeAwait ClearRes; -	meeAwait ClearRes; -	meeAwait ClearRes; -
last user quit	-; -	meeAwait ClearRes; -	-; -	-; -	-; -	-; -	-; -
meeBlockRscInd (P)	-; 3.1.1	-; 3.1.1	-; -	-; 3.1.1	-; 3.1.1	-; 3.1.1	-; 3.1.1
meeBlockRscInd (F)	-; 3.2.1	-; 3.2.1	-; 3.2.1	-; 3.2.1	-; -	-; 3.2.1	-; 3.2.1
meeBlockRscInd (E)	-; 3.3	-; 3.3	-; 3.3	-; 3.3	-; 3.3	-; 3.3	-; -
meeBlockRscInd (P,E)	-; 3.1.2	-; 3.1.2	-; 3.1.2	-; -	-; 3.1.2	-; 3.1.2	-; 3.1.2
meeBlockRscInd (F, E)	-; 3.2.2	-; 3.2.2	-; 3.2.2	-; 3.2.2	-; 3.2.2	-; -	-; 3.2.2
meeResetRscInd or meeResetRscConf	-; -	-; 1	-; 1	-; 1	-; 1	-; 1	-; 1
The following conventions are used: < primitive [(attributes)] | Q3 action > ; < new state > - no primitive or Q3 action to be generated or no state change / event not possible or not allowed for this state Abbreviations used for reason codes: F = admFull; P = admPart; E = Err NOTE: Not all of these events are applicable to a particular resource. For details, reference is made to the relevant GDMO definition.							

Table D.4: SN resources: Support of remote blocking attributes

Resource	MOC representation	remoteBlockingVb5
PSP	tcAdaptorTtpBidirectional	N
LUP	uniAccessVb5	N
LSP	lspVb51Sn	Y
VP	vpCtpBidirectionalVb5	Y
	vpTtpBidirectionalVb5	Y
	vpcLup	Y

Annex E (informative): Clarification of the pointer relationships between the instances

The operations systems of the AN and the SN need to coordinate with each other for VB5 management, and they need to manage many object instances, especially termination points and their vpci values, with pointer relationships. Therefore, it is necessary for us to clarify the pointer relationships between the instances contained in the SN and the AN because their relationships are complex but important for VB5 management. Figure E.2 shows an instantiation example based on the conventions shown in figure E.1. It should be noted that the flexibility in the representation of the managed object instances is to improve visual clarity only.

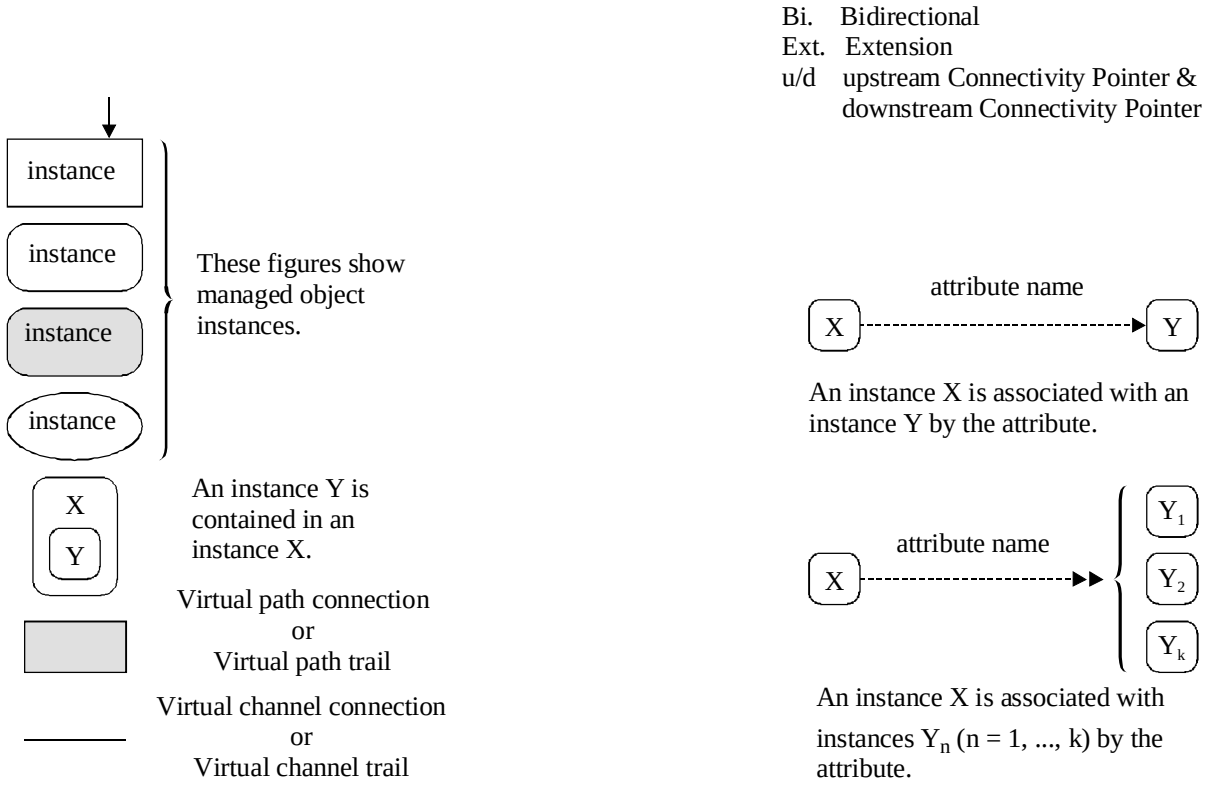
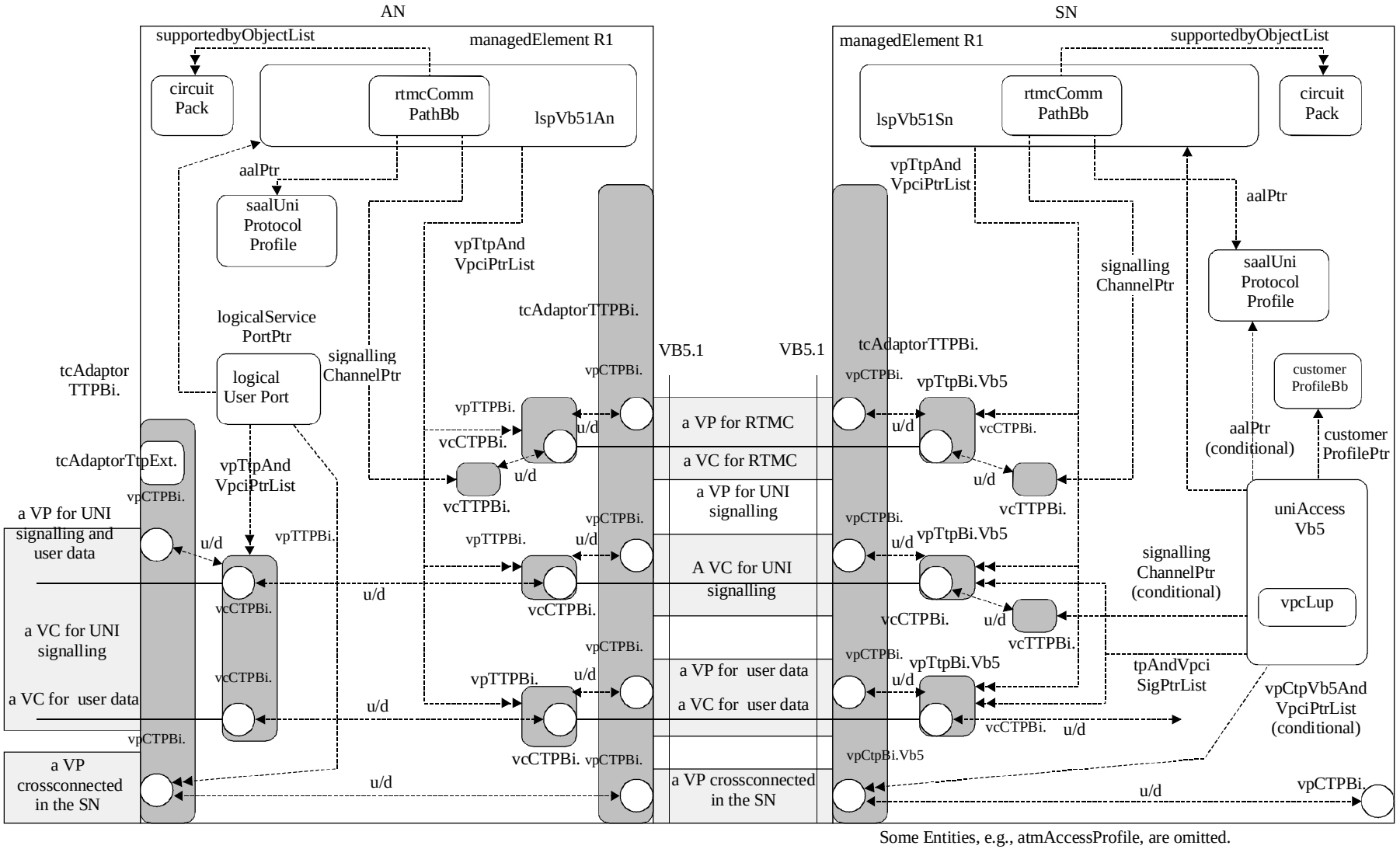


Figure E.1: Conventions used for instantiation example



Some Entities, e.g., atmAccessProfile, are omitted.

Figure E.2: An instantiation example of the managed objects contained in the SN and AN

Annex F (informative): Referenced Definitions

This annex contains the referenced GDMO and ASN.1 definitions from ITU-T Recommendation Q.832.1 [16] with known corrections included.

F.1 Object classes

This clause specifies the object classes for all of the managed objects used in the management information model. These object classes are either defined here or by reference to other specifications. Classes of managed objects which are defined elsewhere and which are only used for containment are not included, but are identified by the name bindings for the classes specified here.

Unidirectional trails are modelled by bidirectional objects with the traffic descriptor in the unused direction set to a null value.

Multipoint cross connections are modelled as in ITU-T Recommendation Q.824.6 [15].

The following class which is defined in ITU-T Recommendation M.3100 [10] may be instantiated:

- managedElementR1.

The following classes which are defined in ITU-T Recommendation Q.824.6 [15] may be instantiated:

- aalProfile;
- aalProtocolCurrentData;
- aalProtocolHistoryData;
- cesServiceProfile;
- interworkingVcTtpBidirectional;
- saalUniProtocolProfile.

The following class which is defined in ITU-T Recommendation X.721 [18] may be instantiated:

- log.

The following classes which are defined in ITU-T Recommendation I.751 [8] may be instantiated:

- atmAccessProfile;
- atmCrossConnection;
- atmCurrentData;
- atmFabric;
- atmTrafficLoadCurrentData;
- atmTrafficLoadHistoryData;
- bidirectionalContinuityMonitor;
- bidirectionalPerformanceMonitor;
- cellHeaderAbnormalityLogRecord;
- cellLevelProtocolCurrentData;
- cellLevelProtocolHistoryData;
- interNNI;
- intraNNI;
- tcAdaptorCurrentData;
- tcAdaptorHistoryData;
- tcAdaptorTTPBidirectional;
- uni;
- upcNpcCurrentData;
- upcNpcHistoryData;
- vcCTPBidirectional;
- vcTTPBidirectional;
- vpCTPBidirectional;
- vpTTPBidirectional;
- vpVcPMCurrentData;
- vpVcPMHistoryData.

F.1.1 Profiling notes for imported classes

F.1.1.1 atmFabric (ATM fabric)

VCs from a logical user port shall only be cross-connected with VCs on the VB5 interface associated with that logical user port.

F.1.1.2 tcAdaptorTTPBidirectional (TC adapter TTP bidirectional)

In this management model, an instance of tcAdaptorTTPBidirectional together with an instance of the associated transmission TTP represents a Physical User Port or a Physical Service Port.

F.1.2 Definition of classes

F.1.2.1 commPathBb (communications path for broadband)

```
commPathBb MANAGED OBJECT CLASS
    DERIVED FROM "Rec. X.721| ISO/IEC 10165-2":top;
    CHARACTERIZED BY
        commPathBbPkg PACKAGE
            BEHAVIOUR commPathBbBeh;
            ATTRIBUTES
                commPathBbId
                    GET,
                "Rec. Q.824.6":aalPtr
                    GET-REPLACE,
                "Rec. Q.824.6":signallingChannelPtr
                    GET,
                "ITU-T M.3100":supportedByObjectList
                    GET-REPLACE;
            NOTIFICATIONS
            "Rec. X.721 | ISO/IEC 10165-2":objectCreation,
            "Rec. X.721 | ISO/IEC 10165-2":objectDeletion;;;
REGISTERED AS {q832-1ManagedObjectClass 1};

commPathBbBeh BEHAVIOUR
    DEFINED AS
        "The communication path object class represents a VB5 communication path. While the
communication path object class is not instantiated, it is a superclass from which specialized
subclasses are derived and instantiated.";
```

F.1.2.2 logicalServicePort (logical service port)

```
logicalServicePort MANAGED OBJECT CLASS
    DERIVED FROM "Rec. X.721|ISO/IEC 10165-2":top;
    CHARACTERIZED BY
        logicalServicePortPkg PACKAGE
            BEHAVIOUR logicalServicePortBeh;
            ATTRIBUTES
                logicalServicePortId
                    GET,
                vpTtpAndVpciPtrList
                    GET-REPLACE
                    ADD-REMOVE;;;
        CONDITIONAL PACKAGES
            "ITU-T M.3100":operationalStatePackage
                PRESENT IF "supplied by the managing system",
            "ITU-T M.3100":userLabelPackage
                PRESENT IF "supplied by the managing system",
            "ITU-T M.3100":tmnCommunicationsAlarmInformationPackage
                PRESENT IF "supplied by the managing system",
            "ITU-T M.3100":alarmSeverityAssignmentPointerPackage
                PRESENT IF "supplied by the managing system",
            "ITU-T M.3100":objectManagementNotificationsPackage
                PRESENT IF "supplied by the managing system",
            "ITU-T M.3100":stateChangeNotificationPackage
                PRESENT IF "supplied by the managing system";
```

```
REGISTERED AS {q832-1ManagedObjectClass 2};

logicalServicePortBeh BEHAVIOUR
    DEFINED AS
        "This managed object represents a group of labelled VPs in a Service Node or in an Access
Network which all go between the same Service Node and the same Access Network.";
```

F.1.2.3 lspVb51 (logical service port for VB5.1)

```
lspVb51 MANAGED OBJECT CLASS
    DERIVED FROM logicalServicePort;
    CHARACTERIZED BY
        lspVb51Pkg PACKAGE
            BEHAVIOUR lspVb51Beh;
            ATTRIBUTES
                logicalServicePortNumber
                    GET-REPLACE,
                lspActivationState
                    INITIAL VALUE   Q832-1Asn1Module.lspActivationInitial
                    GET;
            NOTIFICATIONS
                resetRtmcResult,
                " Rec. X.721 | ISO/IEC 10165-2": attributeValueChange;;;
        CONDITIONAL PACKAGES
            resetRtmcPkg
                    PRESENT IF "supplied by the managing system",
            startupLspPkg
                    PRESENT IF "supplied by the managing system",
            checkLspIdentificationPkg
                PRESENT IF "supported by the managed system and supplied by the
                    managing system",
            partialAdministrativeStatePkg
                PRESENT IF "supplied by the managing system";
REGISTERED AS {q832-1ManagedObjectClass 3};

lspVb51Beh BEHAVIOUR
    DEFINED AS
        "This managed object represents a group of labelled VPs in a Service Node or in an Access
Network which all go between the same Service Node and the same Access Network and are controlled by
the same VB5.1 protocol. The stateChange notification defined in Recommendation X.721 shall be
emitted if the value of the partial administrative state attribute changes and the state change
notification package is present. The partial administrative state attribute only supports the
partialLocked and partialUnlocked values; the partialShuttingDown value is not allowed on instances
of this managed object class.
        Changes of the lspActivationState attribute are indicated by attributeValueChange
notifications.
        VB5.1 specific values for the ProbableCause and SpecificProblems fields of the inherited
generic TMN communications alarm are given in the ASN.1 definitions.";
```

F.1.2.4 lspVb51An (logical service port for VB5.1 in the access network)

```
lspVb51An MANAGED OBJECT CLASS
    DERIVED FROM lspVb51;
    CHARACTERIZED BY
        lspVb51AnPkg PACKAGE
            BEHAVIOUR lspVb51AnBeh;;;
REGISTERED AS {q832-1ManagedObjectClass 4};

lspVb51AnBeh BEHAVIOUR
    DEFINED AS
        "This managed object represents a group of VPs coming from the same Service Node and
controlled by the same VB5.1 protocol.";
```

F.1.2.5 lspVb51Sn (logical service port for VB5.1 in the service node)

```
lspVb51Sn MANAGED OBJECT CLASS
    DERIVED FROM lspVb51;
    CHARACTERIZED BY
        remoteBlockingVb5Pkg,
        lspVb51SnPkg PACKAGE
            BEHAVIOUR lspVb51SnBeh;;;
        CONDITIONAL PACKAGES
            automaticVpciConsistencyCheckPkg
                PRESENT IF "supplied by the managing system",
            checkVpciConsistencyPkg
                PRESENT IF "supplied by the managing system";
REGISTERED AS {q832-1ManagedObjectClass 5};

lspVb51SnBeh BEHAVIOUR
    DEFINED AS
        "This managed object represents a group of VPs coming from the same Access Network and
controlled by the same VB5.1 protocol.
        The value administrativeReason adminFull for the remoteBlockingReasonVb5 attribute of the
remoteBlockingVb5Pkg is not supported for this managed object class.";
```

F.1.2.6 logicalUserPort (logical user port)

```
logicalUserPort MANAGED OBJECT CLASS
    DERIVED FROM "Rec. X.721| ISO/IEC 10165-2":top;
    CHARACTERIZED BY
        logicalUserPortPkg PACKAGE
            BEHAVIOUR logicalUserPortBeh;
            ATTRIBUTES
                logicalUserPortId
                    GET,
                logicalUserPortNumber
                    GET-REPLACE,
                logicalServicePortPtr
                    GET-REPLACE,
                vpCtpAndVpciPtrList
                    GET-REPLACE
                    ADD-REMOVE,
                vpTtpAndVpciPtrList
                    GET-REPLACE
                    ADD-REMOVE;;;
REGISTERED AS {q832-1ManagedObjectClass 6};

logicalUserPortBeh BEHAVIOUR
    DEFINED AS
        "The logical user port object class represents the group of VPs at a UNI on an AN associated
with the same logical service port.";
```

F.1.2.7 rtmcCommPathBb (RTMC communications path for broadband)

```
rtmcCommPathBb MANAGED OBJECT CLASS
    DERIVED FROM commPathBb;
    CHARACTERIZED BY
        rtmcCommPathBbPkg PACKAGE
            BEHAVIOUR rtmcCommPathBbBeh;;;
REGISTERED AS {q832-1ManagedObjectClass 7};

rtmcCommPathBbBeh BEHAVIOUR
    DEFINED AS
        "The RTMC communication path object class carries the RTMC protocol information. Only one
object of this class shall be contained within the superior managed object.";
```

F.1.2.8 tcAdaptorTtpExtension (TC adaptor TTP extension)

```
tcAdaptorTtpExtension MANAGED OBJECT CLASS
    DERIVED FROM "Rec. X.721|ISO/IEC 10165-2":top;
    CHARACTERIZED BY
        tcAdaptorTtpExtensionPkg PACKAGE
            BEHAVIOUR tcAdaptorTtpExtensionBeh;
            ATTRIBUTES
                tcAdaptorExtensionId
                    GET,
                partialAdministrativeState
                    GET-REPLACE;;;
        CONDITIONAL PACKAGES
            "ITU-T M.3100": stateChangeNotificationPackage
                PRESENT IF "supplied by the managing system",
            "ITU-T M.3100": createDeleteNotificationsPackage
                PRESENT IF "supplied by the managing system";
REGISTERED AS {q832-1ManagedObjectClass 8};

tcAdaptorTtpExtensionBeh BEHAVIOUR
    DEFINED AS
        "An instance of this managed object class models the partial administrative state of a PUP
in the AN. The stateChange notification defined in Recommendation X.721 shall be emitted if the
value of the partial administrative state attribute changes and the stateChangeNotificationPackage
is present.";
```

F.1.2.9 uniAccessVb5 (UNI access VB5)

```
uniAccessVb5 MANAGED OBJECT CLASS
    DERIVED FROM "Rec. Q.824.6":uniAccess;
    CHARACTERIZED BY
        uniAccessVb5Pkg PACKAGE
            BEHAVIOUR uniAccessVb5Beh;
            ATTRIBUTES
                logicalUserPortNumber
                    GET-REPLACE,
                logicalServicePortPtr
                    GET-REPLACE;;;
        CONDITIONAL PACKAGES
            vpCtpVb5AndVpciPtrListPkg
                PRESENT IF "supported by the managed system and supplied by the managing system";
REGISTERED AS {q832-1ManagedObjectClass 9};

uniAccessVb5Beh BEHAVIOUR
    DEFINED AS
        "The UNI access VB5 object class represents a group of VPs in the SN which come from the
same UNI in the AN over the same VB5 interface and which use the same type of signalling protocol.
If the ‘signallingChannelPtrPkg’ is not present and the attribute ‘vpCtpVb5AndVpciPtrList’ is empty
then the value of the attribute ‘signallingStandard’ is ignored.
If the ‘vpCtpVb5AndVpciPtrListPkg’ is present then the attribute ‘vpCtpVb5AndVpciPtrlist’ identifies
instances of the ‘vpCtpBidirectionalVb5’ managed object class or its subclasses.";
```

F.1.2.10 vpcLup (VPC at logical user port)

```
vpcLup MANAGED OBJECT CLASS
    DERIVED FROM "Rec. X.721 | ISO/IEC 10165-2":top;
    CHARACTERIZED BY
        remoteBlockingVb5Pkg,
        vpcLupPkg PACKAGE
            BEHAVIOUR vpcLupBeh;
            ATTRIBUTES
                vpcLupId
                    GET,
                vpcLupNumber
                    GET-REPLACE;
            NOTIFICATIONS
                " Rec. X.721 | ISO/IEC 10165-2": attributeValueChange,
                " Rec. X.721 | ISO/IEC 10165-2": objectCreation,
                " Rec. X.721 | ISO/IEC 10165-2": objectDeletion;;;
REGISTERED AS {q832-1ManagedObjectClass 10};
```

```
vpcLupBeh BEHAVIOUR
    DEFINED AS
        "This managed object represents a VPC at a logical user port which is terminated within the
AN.";
```

F.1.2.11 vpCtpBidirectionalVb5 (VP CTP bidirectional VB5)

```
vpCtpBidirectionalVb5 MANAGED OBJECT CLASS
    DERIVED FROM "Rec. I.751":vpCTPBidirectional;
    CHARACTERIZED BY
        remoteBlockingVb5Pkg,
        vpCtpBidirectionalVb5Pkg PACKAGE
            BEHAVIOUR vpCtpBidirectionalVb5Beh;;;
REGISTERED AS {q832-1ManagedObjectClass 11};

vpCtpBidirectionalVb5Beh BEHAVIOUR
    DEFINED AS
        "Objects of this class represent VPCs at the VB5 interface which are cross-connected in the
SN.";
```

F.1.2.12 vpTtpBidirectionalVb5 (VP TTP bidirectional VB5)

```
vpTtpBidirectionalVb5 MANAGED OBJECT CLASS
    DERIVED FROM "Rec. Q.824.6":sVpTtp;
    CHARACTERIZED BY
        remoteBlockingVb5Pkg,
        vpTtpBidirectionalVb5Pkg PACKAGE
            BEHAVIOUR vpTtpBidirectionalVb5Beh;;;
REGISTERED AS {q832-1ManagedObjectClass 12};

vpTtpBidirectionalVb5Beh BEHAVIOUR
    DEFINED AS
        "Objects of this class represent VPCs at the VB5 interface.
        The ‘blockedForMaintenancePkg’ and the ‘remoteBlockingPkg’ derived from the sVpTtp object
class are not supported.
        If the instance of this class is related to a lspVb51Sn instance to indicate assignement,
the vpType value ‘mixed’ is not supported.";
```

F.2 Name bindings

F.2.1 commPathBb-logicalServicePort

```
commPathBb-logicalServicePort NAME BINDING
    SUBORDINATE OBJECT CLASS commPathBb AND SUBCLASSES;
    NAMED BY SUPERIOR OBJECT CLASS logicalServicePort AND SUBCLASSES;
    WITH ATTRIBUTE commPathBbId;
    CREATE
        WITH-AUTOMATIC-INSTANCE-NAMING;
    DELETE;
REGISTERED AS {q832-1NameBinding 1};
```

F.2.2 logicalServicePort-managedElementR1

```
logicalServicePort-managedElementR1 NAME BINDING
    SUBORDINATE OBJECT CLASS logicalServicePort AND SUBCLASSES;
    NAMED BY SUPERIOR OBJECT CLASS "ITU-T Rec. M.3100":managedElementR1
        AND SUBCLASSES;
    WITH ATTRIBUTE logicalServicePortId;
    CREATE
        WITH-AUTOMATIC-INSTANCE-NAMING;
    DELETE
        ONLY-IF-NO-CONTAINED-OBJECTS;
REGISTERED AS {q832-1NameBinding 2};
```

F.2.3 logicalUserPort-managedElementR1

```
logicalUserPort-managedElementR1 NAME BINDING
    SUBORDINATE OBJECT CLASS logicalUserPort AND SUBCLASSES;
    NAMED BY SUPERIOR OBJECT CLASS "ITU-T Rec. M.3100":managedElementR1
        AND SUBCLASSES;
    WITH ATTRIBUTE logicalUserPortId;
    CREATE
        WITH-AUTOMATIC-INSTANCE-NAMING;
    DELETE;
REGISTERED AS {q832-1NameBinding 3};
```

F.2.4 tcAdaptorTtpExtension-tcAdaptorTTPBidirectional

```
tcAdaptorTtpExtension-tcAdaptorTTPBidirectional NAME BINDING
    SUBORDINATE OBJECT CLASS tcAdaptorTtpExtension
        AND SUBCLASSES;
    NAMED BY SUPERIOR OBJECT CLASS "Rec. I.751":tcAdaptorTTPBidirectional
        AND SUBCLASSES;
    WITH ATTRIBUTE tcAdaptorExtensionId;
    CREATE WITH-AUTOMATIC-INSTANCE-NAMING;
    DELETE;
REGISTERED AS {q832-1NameBinding 4};
```

F.2.5 vpcLup-uniAccessVb5

```
vpcLup-uniAccessVb5 NAME BINDING
    SUBORDINATE OBJECT CLASS vpcLup AND SUBCLASSES;
    NAMED BY SUPERIOR OBJECT CLASS uniAccessVb5
        AND SUBCLASSES;
    WITH ATTRIBUTE vpcLupId;
    CREATE
        WITH-AUTOMATIC-INSTANCE-NAMING;
    DELETE;
REGISTERED AS {q832-1NameBinding 5};
```

F.3 Definition of packages

F.3.1 automaticVpciConsistencyCheckPkg (automatic VPCI consistency check package)

```
automaticVpciConsistencyCheckPkg PACKAGE
    NOTIFICATIONS
        automaticVpciConsistencyCheckInitiated,
        automaticVpciConsistencyCheckResult;
REGISTERED AS {q832-1Package 1};
```

F.3.2 checkLspIdentificationPkg (check logical service port identification package)

```
checkLspIdentificationPkg PACKAGE
    ACTIONS
        checkLspIdentification;
REGISTERED AS {q832-1Package 2};
```

F.3.3 checkVpciConsistencyPkg (check VPCI consistency package)

```
checkVpciConsistencyPkg PACKAGE
    ACTIONS
        checkVpciConsistency;
REGISTERED AS {q832-1Package 3};
```

F.3.4 partialAdministrativeStatePkg (partial administrative state package)

```
partialAdministrativeStatePkg PACKAGE
    ATTRIBUTES
        partialAdministrativeState
            GET-REPLACE;
REGISTERED AS {q832-1Package 4};
```

F.3.5 remoteBlockingVb5Pkg (remote blocking VB5 package)

```
remoteBlockingVb5Pkg PACKAGE
    ATTRIBUTES
        remoteBlockingVb5
            INITIAL VALUE Q832-1Asn1Module.remoteBlockingVb5InitialValue
            GET,
        remoteBlockingReasonVb5
            INITIAL VALUE Q832-1Asn1Module. remoteBlockingReasonVb5InitialValue
            GET;
REGISTERED AS {q832-1Package 5};
```

F.3.6 resetRtmcPkg (reset RTMC package)

```
resetRtmcPkg PACKAGE
    ACTIONS
        resetRtmc;
REGISTERED AS {q832-1Package 6};
```

F.3.7 startupLspPkg (startup logical service port package)

```
startupLspPkg PACKAGE
    ACTIONS
        startupLsp;
REGISTERED AS {q832-1Package 7};
```

F.3.8 vpCtpVb5AndVpciPtrListPkg (VP CTP VB5 and VPCI pointer list package)

```
vpCtpVb5AndVpciPtrListPkg PACKAGE
    BEHAVIOUR vpCtpVb5AndVpciPtrListBeh;
    ATTRIBUTES
        vpCtpVb5AndVpciPtrList
            GET-REPLACE
            ADD-REMOVE;
REGISTERED AS {q832-1Package 8};
```

```
vpCtpVb5AndVpciPtrListBeh BEHAVIOUR
    DEFINED AS
        "This is a set-valued attribute whose value(s) point to instances of the
vpCtpBidirectionalVb5 managed object class or its subclasses. A VPCI value is related to every
pointer.";
```

F.4 Definition of attributes

F.4.1 commPathBbId (communications path for broadband identifier)

```
commPathBbId ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.NameType;
    MATCHES FOR EQUALITY;
    BEHAVIOUR commPathBbIdBeh;
REGISTERED AS {q832-1Attribute 1};

commPathBbIdBeh BEHAVIOUR
    DEFINED AS
        "This attribute is used for naming instances of the managed object class commPathBb and
subclasses.";
```

F.4.2 logicalServicePortId (logical service port identifier)

```
logicalServicePortId ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.NameType;
    MATCHES FOR EQUALITY;
    BEHAVIOUR logicalServicePortIdBeh;
REGISTERED AS {q832-1Attribute 2};

logicalServicePortIdBeh BEHAVIOUR
    DEFINED AS
        "This attribute is used for naming instances of the class logicalServicePort and
subclasses.";
```

F.4.3 logicalServicePortNumber (logical service port number)

```
logicalServicePortNumber ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.Integer;
    MATCHES FOR EQUALITY;
    BEHAVIOUR logicalServicePortNumberBeh;
REGISTERED AS {q832-1Attribute 3};

logicalServicePortNumberBeh BEHAVIOUR
    DEFINED AS
        "This attribute is used to label a logical service port. It has the same format as that used
on the VB5 protocol.";
```

F.4.4 logicalServicePortPtr (logical service port pointer)

```
logicalServicePortPtr ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.PointerOrNull;
    MATCHES FOR EQUALITY;
    BEHAVIOUR logicalServicePortPtrBeh;
REGISTERED AS {q832-1Attribute 4};

logicalServicePortPtrBeh BEHAVIOUR
    DEFINED AS
        "This attribute is used to reference logical service port objects.";
```

F.4.5 logicalUserPortId (logical user port identifier)

```
logicalUserPortId ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.NameType;
    MATCHES FOR EQUALITY;
    BEHAVIOUR logicalUserPortIdBeh;
REGISTERED AS {q832-1Attribute 5};

logicalUserPortIdBeh BEHAVIOUR
    DEFINED AS
        "This attribute is used for naming instances of the class logicalUserPort and subclasses.";
```

F.4.6 logicalUserPortNumber (logical user port number)

```
logicalUserPortNumber ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.Integer;
    MATCHES FOR EQUALITY;
    BEHAVIOUR logicalUserPortNumberBeh;
REGISTERED AS {q832-1Attribute 6};

logicalUserPortNumberBeh BEHAVIOUR
    DEFINED AS
        "This attribute is a reference to a logical user port which is either local, if the object
using the attribute is in the AN, or remote if the object using the attribute is in the SN. It has
the same format as that used on the VB5 interface. Logical user port numbers are unique within an
AN, but need not be unique within an SN which is connected to more than one AN.";
```

F.4.7 lspActivationState (logical service port activation state)

```
lspActivationState ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.LspActivationState;
    MATCHES FOR EQUALITY;
    BEHAVIOUR lspActivationStateBeh;
REGISTERED AS {q832-1Attribute 7};

lspActivationStateBeh BEHAVIOUR
    DEFINED AS
        "This attribute indicates the activation state of the LSP. The value ‘restarting’ indicates
that the LSP is restarted after the occurence of a persistent SAAL failure.";
```

F.4.8 partialAdministrativeState (partial administrative state)

```
partialAdministrativeState ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.PartialAdministrativeState;
    MATCHES FOR EQUALITY;
    BEHAVIOUR partialAdministrativeStateBeh;
REGISTERED AS {q832-1Attribute 8};

partialAdministrativeStateBeh BEHAVIOUR
    DEFINED AS
        "This attribute is used to constrain the user information flow on the resource. The
semantics of this attribute is specified in the VB5 interface specification";
```

F.4.9 remoteBlockingReasonVb5 (remote blocking reason VB5)

```
remoteBlockingReasonVb5 ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.RemoteBlockingReasonVb5;
    MATCHES FOR EQUALITY;
    BEHAVIOUR remoteBlockingReasonVb5Beh;
REGISTERED AS {q832-1Attribute 9};

remoteBlockingReasonVb5Beh BEHAVIOUR
    DEFINED AS
        "This attribute indicates the reason for blocking this resource (VPC or LSP) in the AN.";
```

F.4.10 remoteBlockingVb5 (remote blocking VB5)

```
remoteBlockingVb5 ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.RemoteBlockingVb5;
    MATCHES FOR EQUALITY;
    BEHAVIOUR remoteBlockingVb5Beh;
REGISTERED AS {q832-1Attribute 10};

remoteBlockingVb5Beh BEHAVIOUR
    DEFINED AS
        "This attribute indicates the remote blocking state of this resource (VPC or LSP) in the
AN.";
```

F.4.11 tcAdaptorExtensionId (TC adaptor extension identifier)

```
tcAdaptorExtensionId ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.NameType;
    MATCHES FOR EQUALITY;
    BEHAVIOUR tcAdaptorExtensionIdBeh;
REGISTERED AS {q832-1Attribute 11};

tcAdaptorExtensionIdBeh BEHAVIOUR
    DEFINED AS
        "This attribute is used for naming instances of the managed object class
tcAdaptorTtpExtension and subclasses.";
```

F.4.12 vpcLupId (VPC at logical user port identifier)

```
vpcLupId ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.NameType;
    MATCHES FOR EQUALITY;
    BEHAVIOUR vpcLupIdBeh;
REGISTERED AS {q832-1Attribute 12};

vpcLupIdBeh BEHAVIOUR
    DEFINED AS
        "This attribute is used for naming instances of the vpcLup managed object class and
subclasses.";
```

F.4.13 vpcLupNumber (VPC at logical user port number)

```
vpcLupNumber ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.VpciValue;
    MATCHES FOR EQUALITY;
    BEHAVIOUR vpcLupNumberBeh;
REGISTERED AS {q832-1Attribute 13};

vpcLupNumberBeh BEHAVIOUR
    DEFINED AS
        "This attribute is the VPCI value of the Virtual Path Connection terminating in the Access
Network without reaching the Service Node.";
```

F.4.14 vpCtpAndVpciPtrList (VP CTP and VPCI pointer list)

```
vpCtpAndVpciPtrList ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.TpAndVpciPtrList;
    MATCHES FOR EQUALITY;
    BEHAVIOUR vpCtpAndVpciPtrListBeh;
REGISTERED AS {q832-1Attribute 14};

vpCtpAndVpciPtrListBeh BEHAVIOUR
    DEFINED AS
        "This attribute is used to reference vpCTPs and to assign VPCI values to these vpCTPs.";
```

F.4.15 vpCtpVb5AndVpciPtrList (VP CTP VB5 and VPCI pointer list)

```
vpCtpVb5AndVpciPtrList ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.TpAndVpciPtrList;
    MATCHES FOR EQUALITY, SET-COMPARISON, SET-INTERSECTION;
REGISTERED AS {q832-1Attribute 15};
```

F.4.16 vpTtpAndVpciPtrList (VP TTP and VPCI pointer list)

```
vpTtpAndVpciPtrList ATTRIBUTE
    WITH ATTRIBUTE SYNTAX Q832-1Asn1Module.TpAndVpciPtrList;
    MATCHES FOR EQUALITY;
    BEHAVIOUR vpTtpAndVpciPtrListBeh;
REGISTERED AS {q832-1Attribute 16};

vpTtpAndVpciPtrListBeh BEHAVIOUR
    DEFINED AS
        "This attribute is used to reference vpTTPs and to assign VPCI values to these vpTTPs.";
```

F.5 Definition of actions

F.5.1 checkLspIdentification (check logical service port identification)

```
checkLspIdentification ACTION
    BEHAVIOUR checkLspIdentificationBeh;
    MODE CONFIRMED;
    WITH REPLY SYNTAX Q832-1Asn1Module.CheckLspIdentificationResult;
REGISTERED AS {q832-1Action 1};

checkLspIdentificationBeh BEHAVIOUR
    DEFINED AS
        "This action is used to check the consistent use of the LSP Identification label in the AN
and in the SN. The value TRUE of the result syntax indicates the successful result of the action.";
```

F.5.2 checkVpciConsistency (check VPCI consistency)

```
checkVpciConsistency ACTION
    BEHAVIOUR checkVpciConsistencyBeh;
    MODE CONFIRMED;
    WITH INFORMATION SYNTAX Q832-1Asn1Module.CheckVpciConsistencyInformation;
    WITH REPLY SYNTAX Q832-1Asn1Module.CheckVpciConsistencyResult;
REGISTERED AS {q832-1Action 2};

checkVpciConsistencyBeh BEHAVIOUR
    DEFINED AS
        "This action is used to check the consistency of the VPCI values. The value localReason of
the result syntax indicates that the check was not performed due to local reasons.";
```

F.5.3 resetRTMC (reset RTMC)

```
resetRtmc ACTION
    BEHAVIOUR resetRtmcBeh;
    MODE CONFIRMED;
    WITH REPLY SYNTAX Q832-1Asn1Module.ResetRtmcResult;
REGISTERED AS {q832-1Action 3};

resetRtmcBeh BEHAVIOUR
    DEFINED AS
        "This action is used to start the RTMC reset procedure.";
```

F.5.4 startupLsp (startup logical service port)

```
startupLsp ACTION
    BEHAVIOUR startupLspBeh;
    MODE CONFIRMED;
    WITH REPLY SYNTAX Q832-1Asn1Module.StartupLspResult;
REGISTERED AS {q832-1Action 4};

startupLspBeh BEHAVIOUR
    DEFINED AS
        "This action is used by the AN and the SN to start up a LSP.";
```

F.6 Definition of notifications

F.6.1 automaticVpciConsistencyCheckInitiated (automatic VPCI consistency check initiated)

```
automaticVpciConsistencyCheckInitiated NOTIFICATION
    BEHAVIOUR automaticVpciConsistencyCheckInitiatedBeh;
    WITH INFORMATION SYNTAX Q832-1Asn1Module.CheckVpciConsistencyInformation;
REGISTERED AS {q832-1Notification 1};

automaticVpciConsistencyCheckInitiatedBeh BEHAVIOUR
    DEFINED AS
        "This notification indicates to the operator that a VPCI Consistency Check has been
initiated automatically and gives the associated VPCI value.";
```

F.6.2 automaticVpciConsistencyCheckResult (automatic VPCI consistency check result)

```
automaticVpciConsistencyCheckResult NOTIFICATION
    BEHAVIOUR automaticVpciConsistencyCheckResultBeh;
    WITH INFORMATION SYNTAX Q832-1Asn1Module.CheckVpciConsistencyResult;
REGISTERED AS {q832-1Notification 2};

automaticVpciConsistencyCheckResultBeh BEHAVIOUR
    DEFINED AS
        "This notification indicates to the operator the result of a VPCI Consistency Check which
was initiated automatically. The value localReason of the result syntax indicates that the check was
not performed due to local reasons.";
```

F.6.3 resetRtmcResult (reset RTMC Result)

```
resetRtmcResult NOTIFICATION
    BEHAVIOUR resetRtmcResultBeh;
    WITH INFORMATION SYNTAX Q832-1Asn1Module.ResetRtmcResult;
REGISTERED AS {q832-1Notification 3};

resetRtmcResultBeh BEHAVIOUR
    DEFINED AS
        "This notification is sent to the operator when an RTMC reset procedure which has not been
initiated by a local Q3 command is finished. It contains the result of the procedure, which may be
successfull or not.";
```

F.7 Type definitions

```
Q832-1Asn1Module {itu-t(0) recommendation (0) q(17) q832(832) dot(127) vb51(1) informationModel(0)
asn1Modules(2) asn1DefinedTypesModule(0)}

DEFINITIONS IMPLICIT TAGS ::=

BEGIN
-- EXPORTS everything

IMPORTS
    ObjectInstance
    FROM CMIP-1 {joint-iso-ccitt ms(9) cmip(1) modules(0) protocol(3)}

    NameType,
    PointerOrNull
    FROM ASN1DefinedTypesModule {ccitt recommendation m 3100 informationModel(0) asn1Modules(2)
asn1DefinedTypesModule(0)}

    ProbableCause, SpecificProblems
    FROM Attribute-ASN1Module
            {joint-iso-ccitt ms(9) smi(3) part2(2) asn1Module(2) 1}

    TpAndVpciPtrList,
    VpciValue
    FROM ASN1DefinedTypesModule {itu-t recommendation q(17) 824(824) dot(127)
bsm(6) informationModel(0) asn1Module(2) asn1TypeModule(0)}
; -- end of imports

-- start of object identifier definitions

q832-1InformationModel
OBJECT IDENTIFIER ::= {itu-t(0) recommendation (0) q(17) q832(832) dot(127) vb51(1)
informationModel(0)}
q832-1StandardSpecificExtension
    OBJECT IDENTIFIER ::= {q832-1InformationModel standardSpecificExtension(0)}
q832-1ManagedObjectClass
    OBJECT IDENTIFIER ::= {q832-1InformationModel managedObjectClass(3)}
q832-1Package
    OBJECT IDENTIFIER ::= {q832-1InformationModel package(4)}
```

```
q832-1NameBinding
    OBJECT IDENTIFIER ::= {q832-1InformationModel nameBinding(6)}
q832-1Attribute
    OBJECT IDENTIFIER ::= {q832-1InformationModel attribute (7)}
q832-1Action
    OBJECT IDENTIFIER ::= {q832-1InformationModel action(9)}
q832-1Notification
    OBJECT IDENTIFIER ::= {q832-1InformationModel notification(10)}

vb51ProbableCause
    OBJECT IDENTIFIER ::= {q832-1StandardSpecificExtension 0}
vb51SpecificProblems
    OBJECT IDENTIFIER ::= {q832-1StandardSpecificExtension 1}
-- end of object identifier definitions

    -- The value assignments for the
    -- ProbableCause parameter of the
    -- VB5.1 specific TMN communications alarm notification
    -- are specified below

rtmcProtocolError
    ProbableCause ::= globalValue : {vb51ProbableCause 1}
rtmcProtocolSyntaxError
    ProbableCause ::= globalValue : {vb51ProbableCause 2}
rtmcProtocolTimeOutError
    ProbableCause ::= globalValue : {vb51ProbableCause 3}
nonRecoverableSSCOPError
    ProbableCause ::= globalValue : {vb51ProbableCause 4}

    -- The value assignments for the
    -- SpecificProblems parameter of the
    -- VB5.1 specific TMN communications alarm notification
    -- are specified below

protocolDiscriminatorError
    SpecificProblems ::= {oid : {vb51SpecificProblems 0}}
unrecognizedMessageType
    SpecificProblems ::= {oid : {vb51SpecificProblems 1}}
    -- UnkMsgType RTMCProtErrCause 1
repeatedInformationElement
    SpecificProblems ::= {oid : {vb51SpecificProblems 2}}
    -- RepIE RTMCProtErrCause 2
mandatoryInformationElementMissing
    SpecificProblems ::= {oid : {vb51SpecificProblems 3}}
    -- MandIEMiss RTMCProtErrCause 3
unrecognizedInformationElement
    SpecificProblems ::= {oid : {vb51SpecificProblems 4}}
    -- UnrecogIE RTMCProtErrCause 4
informationElementContentError
    SpecificProblems ::= {oid : {vb51SpecificProblems 5}}
    -- IEContErr RTMCProtErrCause 5
informationElementNotAllowed
    SpecificProblems ::= {oid : {vb51SpecificProblems 6}}
    -- IENotAllowed RTMCProtErrCause 6
messageNotCompatibleProtocolState
    SpecificProblems ::= {oid : {vb51SpecificProblems 7}}
    -- MsgNotCompatWithProtState RTMCProtErrCause 7

-- other ASN1 definitions in alphabetical order

AdministrativeReason ::= INTEGER {
    none            (0),
    adminPartial    (1),
    adminFull       (2) }

CheckLspIdentificationResult ::= BOOLEAN

CheckVpciConsistencyInformation ::= INTEGER (0..65535)

CheckVpciConsistencyResult ::= CHOICE {
    localReason     NULL,
    remoteReason    RemoteReason }

ErrorReason ::= INTEGER {
    none        (0),
    error       (1) }

Integer ::= INTEGER
```

```
lspActivationInitial LspActivationState ::=notActivated

LspActivationState::= INTEGER {
    notActivated        (0),
    activated       (1),
    restarting      (2) }

PartialAdministrativeState::= ENUMERATED{
    partialLocked       (0),
    partialUnlocked     (1),
    partialShuttingDown (2) }

RemoteBlockingReasonVb5 ::= SEQUENCE {
    errorReason         ErrorReason,
    administrativeReason    AdministrativeReason }

remoteBlockingReasonVb5InitialValue
    RemoteBlockingReasonVb5 ::= {
                errorReason         none,
                administrativeReason    adminFull }

RemoteBlockingVb5 ::= INTEGER {
    remoteBlocked       (0),
    remoteUnblocked     (1),
    remoteAwaitClear        (2) }

remoteBlockingVb5InitialValue
    RemoteBlockingVb5 ::= remoteBlocked

RemoteReason ::= INTEGER {
    notSuccessful   (0),
    successful      (1),
    notPerformed    (2) }

ResetRtmcResult::= INTEGER {
    notSuccessful   (0),
    successful      (1) }

StartupLspResult::= INTEGER {
    notSuccessful   (0),
    successful      (1),
    activating      (2),
    restarting      (3) }

END -- of Q832-1Asn1Module
```

Annex G (informative): Bibliography

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