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SERIES M: TMN AND NETWORK MAINTENANCE: INTERNATIONAL TRANSMISSION SYSTEMS, TELEPHONE CIRCUITS, TELEGRAPHY, FACSIMILE AND LEASED CIRCUITS

Telecommunications management network

TMN management services for dedicated and reconfigurable circuits network: Information model for management of virtual private network service

ITU-T Recommendation M.3108.3

(Formerly CCITT Recommendation)

ITU-T M-SERIES RECOMMENDATIONS

TMN AND NETWORK MAINTENANCE: INTERNATIONAL TRANSMISSION SYSTEMS, TELEPHONE CIRCUITS, TELEGRAPHY, FACSIMILE AND LEASED CIRCUITS

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ITU-T Recommendation M.3108.3

TMN management services for dedicated and reconfigurable circuits network: Information model for management of virtual private network service

Summary

This Recommendation provides a GDMO-based information model to support the management of the Virtual Private Network Service as outlined in ITU-T M.3208.3.

Source

ITU-T Recommendation M.3108.3 was prepared by ITU-T Study Group 4 (2001-2004) and approved under the WTSA Resolution 1 procedure on 19 January 2001.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

ITU-T Recommendation M.3108.3

TMN management services for dedicated and reconfigurable circuits network: Information model for management of virtual private network service

1 Scope, purpose and application

1.1 Scope

This Recommendation provides a GDMO-based information model to support the management of the Virtual Private Network Service as outlined in ITU-T M.3208.3.

1.2 Purpose

The purpose of this Recommendation is to support the standard interfaces, across the X-interface, between service customers and service providers for the purposes of managing the virtual private network services in the service management layer of the TMN. It specifically intended to support the requirements provided in ITU-T M.3208.3.

1.3 Application

This Recommendation is applicable to the interfaces between systems that participate in the ordering and the management of the virtual private network services.

2 References

The following ITU-T Recommendations, and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

- ITU-T G.805 (2000), *Generic functional architecture of transport networks*.
- ITU-T M.3010 (2000), *Principles for a telecommunications management network.*
- ITU-T M.3100 (1995), *Generic network information model*.
- ITU-T M.3108.1 (1999), *Information model for leased circuit and reconfigurable services*.
- ITU-T M.3200 (1997), *TMN management services and telecommunications managed areas: overview*.
- ITU-T M.3208.1 (1997), *TMN management services for dedicated and reconfigurable circuits network: Leased circuit services*.
- ITU-T M.3208.3 (2000), *TMN management services for dedicated and reconfigurable circuits network: virtual private network service.*
- ITU-T M.3400 (2000), *TMN management functions*.
- ITU-T Q.821 (2000), *Stage 2 and stage 3 description for the Q3 interface – Alarm surveillance*.

– ITU-T X.721 (1992), *Information technology – Open Systems Interconnection – Structure of management information: Definition of management information*.

– ITU-T X.734 (1992), *Information technology – Open Systems Interconnection – Systems Management: Event report management function.*

– ITU-T X.735 (1992), *Information technology – Open Systems Interconnection – Systems Management: Log control function*.

– ITU-T X.746 (2000), *Information technology – Open Systems Interconnection – Systems management: Scheduling function*.

– ITU-T X.790 (1995), *Trouble management for ITU-T Applications*.

3 Definitions

This Recommendation uses the definitions provided in ITU-T M.3208.3.

4 Abbreviations

This Recommendation uses the following abbreviations:

GDMS	Guidelines for the Definition of TMN Management Services
LCS	Leased Circuit Service
MOC	Managed Object Class
MOI	Managed Object Instance
NE	Network Element
NML	Network Management Layer
SAG	Service Access Group
SAP	Service Access Point
SC	Service Customer
SLA	Service Level Agreement
SML	Service Management Layer
SP	Service Provider
TMN	Telecommunication Management Network
UML	Unified Modelling Language
VPN	Virtual Private Network

5 Overview

This clause provides an overview of the information model and its use in the management of VPN services. Clause 6 provides the formal definition of the GDMO-based information model.

The management of a VPN service starts when a Service Customer (SC) requests the service. This can be achieved by the SC requesting SP to create an instance of vpnService.

The SP then informs the SC of the availability of the requested service through a notification of the creation of an instance of vpnService.

After the SC has been notified about the creation of the vpnService instance, the SC can modify the service through management operations for some attributes.

An instance of the networkR1 is used for naming. All entries in that MOI can be changed only by the SP, though the SC can read (GET) such information.

A vpnService MOI contains zero or more serviceAccessGroups, though a vpnService MOI containing less than two serviceAccessGroups is not very useful. The SC can create instances of serviceAccessGroup MOC. A serviceAccessGroup MOI contains zero or more SAPs. A serviceAccessGroup MOI is created without any SAPs. After creation a instance of serviceAccessGroup, the SC can add or remove SAPs from the serviceAccessGroup. The SC can identify some or all of the SAPs desired in a serviceAccessGroup. If the SC adds to a serviceAccessGroup more SAPs than are explicitly identified, then the SP assigns additional SAPs, from the same service location to the serviceAccessGroup, and informs the SC about the identity of those SAPs. The SC can add or remove SAPs from a serviceAccessGroup through management operations.

After the requested VPN service has been implemented by the SP, the SC can request the creation of one or more VPN Leased Circuit in the VPN service. The VPN Leased Circuit connects the VPN service access points that are included in the specified service access groups. The SC can create instances of vpnLeasedCircuit MOC.

Figures 5-1 and 5-2 represent the inheritance of the MOCs and the containment relationships of the MOIs respectively. Inheritance and containment are not shown for all of the MOs that are imported from other Recommendations. Figure 5-2 does not show the containment of the M.3100 network MO in directory objects as specified in ITU-T M.3100.

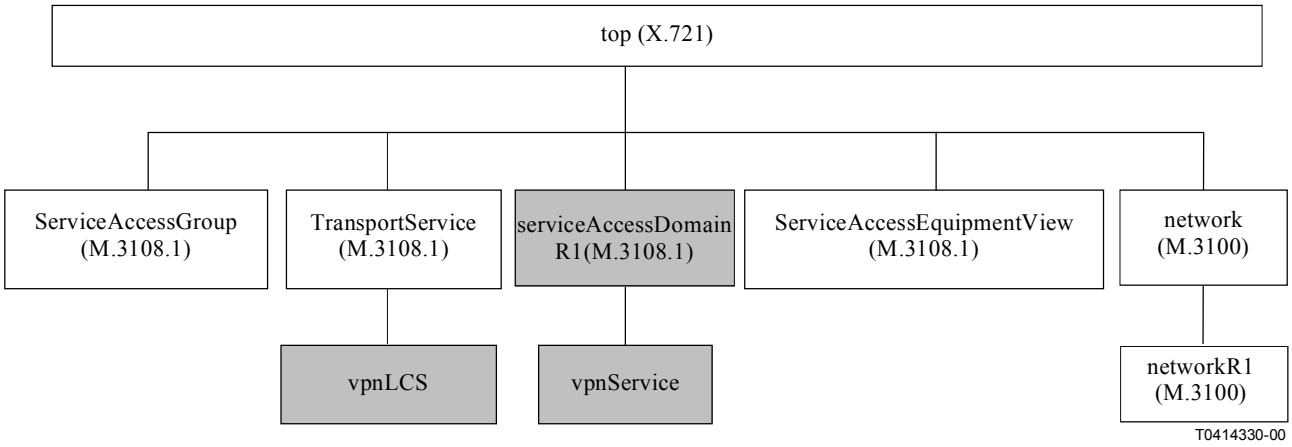

Figure 5-1/M.3108.3 – Inheritance relationship

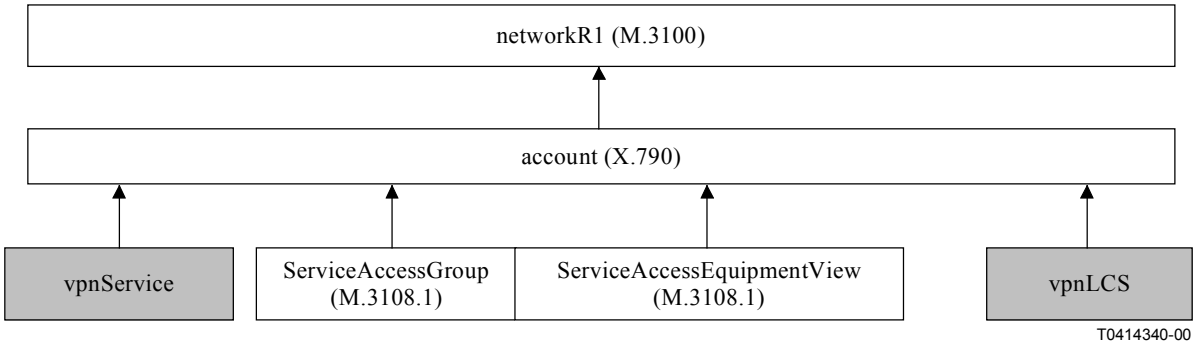

Figure 5-2/M.3108.3 – Containment relationship

This Recommendation defines two Functional Units (FUs):

- VPN service;
- VPN Leased circuit management.

These FUs cover the management functions defined in ITU-T M.3208.3.

6 Information model

This clause provides the information model for the management of VPN services using GDMO.

6.1 Managed objects

6.1.1 VPN service

```
vpnService MANAGED OBJECT CLASS
        DERIVED FROM "ITU-T Rec. M.3108.1:1999": serviceAccessDomainR1;
        CHARACTERIZED BY
                vpnServicePackage PACKAGE
                        BEHAVIOUR
                        vpnServiceBehaviour BEHAVIOUR
                        DEFINED AS " This instantiable MO represents a VPN service. The sadId equals to vpnId,
used to identify the VPN service. The serviceType in the serviceAccessDomainR1 is not present in this MOC.";;;,
                "ITU-T Rec. M.3108.1:1999": serviceDescriptionListPackage;
REGISTERED AS {m3108PartVPNObjectClass 1};
```

6.1.2 vpnLCS

```
vpnLCS MANAGED OBJECT CLASS
        DERIVED FROM  "ITU-T M.3108.1:1999": transportService;
        CHARACTERIZED BY
                vpnLeasedCircuitPackage PACKAGE
                        BEHAVIOUR
                        vpnLeasedCircuitBehaviour BEHAVIOUR
                                DEFINED AS "This instantiable MO represents a VPN leased circuit. If the SLA
allows the SC to specify the route and the SC did not specify the route in the service request, then the route
attribute shall be present as an empty SEQUENCE. The route cannot be changed through a management
operation on this MO. ";;
                        ATTRIBUTES
                                bandwidth                                       GET-REPLACE,
                                "ITU-T M.3108.1:1999": originatingLocationSap   GET SET-BY-CREATE,
                                "ITU-T M.3108.1:1999": terminatingLocationSap   GET SET-BY-CREATE;;;
```

```
        CONDITIONAL PACKAGES
            "ITU-T M.3108.1:1999": routePackage                                PRESENT IF "
route was present in the service request ",
            "ITU-T M.3108.1:1999": originatingLocationCPEModifyPackage         PRESENT IF
"originatingLocationCPE was present in the service request ",
            "ITU-T M.3108.1:1999": terminatingLocationCPEModifyPackage         PRESENT IF
"terminatingLocationCPE was present in the service request ";
REGISTERED AS {m3108PartVPNObjectClass 2};
```

6.2 Attributes

```
bandwidth ATTRIBUTE
    WITH ATTRIBUTE SYNTAX M3108PartVPNASN1Module.Bandwidth;
    MATCHES FOR EQUALITY;
REGISTERED AS {m3108PartVPNAttribute 1};
```

6.3 Name bindings

6.3.1 vpnService-account

```
vpnService-account NAME BINDING
    SUBORDINATE OBJECT CLASS vpnService AND SUBCLASSES;
    NAMED BY SUPERIOR OBJECT CLASS "Rec. X.790":account AND SUBCLASSES;
    WITH ATTRIBUTE "ITU-T M.3108.1:1999": sadId;
    CREATE
                    createVpnServiceError;
    DELETE
                    "ITU-T M.3108.1:1999": deleteServiceAccessDomainError;
REGISTERED AS {m3108PartVPNNameBinding 1};
```

6.3.2 vpnLCS-account

```
vpnLCS-account    NAME BINDING
    SUBORDINATE OBJECT CLASS vpnLCS AND SUBCLASSES;
    NAMED BY SUPERIOR OBJECT CLASS "Rec. X.790":account AND SUBCLASSES;
    WITH ATTRIBUTE "ITU-T M.3108.1:1999": serviceID;
    CREATE
                    createVpnLCSError;
    DELETE
                    deleteVpnLCSError;
REGISTERED AS {m3108PartVPNNameBinding 2};
```

6.4 Parameter Definitions

6.4.1 createVpnServiceError

```
createVpnServiceError PARAMETER
    CONTEXT SPECIFIC-ERROR ;
    WITH SYNTAX M3108PartVPNASN1Module.CreateVpnServiceError ;
    BEHAVIOUR
        createVpnServiceErrorBehaviour BEHAVIOUR
        DEFINED AS
        "the parameter is used for VPN service creation." ;;
REGISTERED AS { m3108PartVPNParameter 1 }   ;
```

6.4.2 createVpnLCSError

```
createVpnLCSError PARAMETER
    CONTEXT SPECIFIC-ERROR ;
    WITH SYNTAX M3108PartVPNASN1Module.CreateVpnLCSError ;
```

```
        BEHAVIOUR
                createVpnLCSErrorBehaviour BEHAVIOUR
                DEFINED AS
                "the parameter is used for VPN LCS creation." ;;
REGISTERED AS { m3108PartVPNParameter 2 }   ;
```

6.4.3 deleteVpnLCSError

```
deteteVpnLCSError PARAMETER
        CONTEXT SPECIFIC-ERROR ;
        WITH SYNTAX M3108PartVPNASN1Module.DeleteVpnLCSError ;
        BEHAVIOUR
                deleteVpnLCSErrorBehaviour BEHAVIOUR
                DEFINED AS
                "the parameter is used for VPN LCS deletion." ;;
REGISTERED AS { m3108PartVPNParameter 3 }   ;
```

6.5 ASN.1 syntax

6.5.1 Rules of extensibility

The following types will be indicated as being extensible:

– ENUMERATED;

– named INTEGER;

– named BIT STRING;

– tagged SET;

– tagged SEQUENCE;

– tagged CHOICE.

Under the rules of extensibility, new enumerations values (for ENUMERATED types), new bit name assignments (for named BIT STRING types), new named numbers (for named INTEGER types), and new tagged elements (for tagged SET, SEQUENCE, and CHOICE types) may be added in future versions of this Recommendation.

When processing information in a System Management Application Protocol (SMAP) PDU, the accepting SMAP-machine shall ignore:

– enumerations not recognized;

– unrecognized named numbers;

– unrecognized named bits;

– unrecognized tagged elements of sets, sequences, and choices.

6.5.2 ASN.1 module

```
M3108PartVPNASN1Module {ccitt recommendation m lcs(3108) vpnServiceManagement(3)
informationModel(0) asn1Modules(2) asn1DefinedTypesModule(0)}

DEFINITIONS IMPLICIT TAGS ::=

BEGIN
-- EXPORTS everything

IMPORTS

        NameType
                FROM ASN1DefinedTypesModule {itu-t(0) recommendation m gnm(100)
informationModel(0) asn1Modules(2) asn1DefinedTypesModule(0)}
```

```
        ServiceDescription
                FROM X790ASN1Module {itu-t(0) recommendation(0) x(24) x790(790) informationModel(0)
asn1module(2)}
;

m3108PartVPNInformationModel  OBJECT IDENTIFIER ::= {ccitt recommendation m lcs(3108)
vpnServiceManagement(3) informationModel(0) }
m3108PartVPNObjectClass OBJECT IDENTIFIER ::= { m3108PartVPNInformationModel
managedObjectClass(1)}
m3108PartVPNPackage OBJECT IDENTIFIER ::= { m3108PartVPNInformationModel  package(2)}
m3108PartVPNAttribute OBJECT IDENTIFIER ::= { m3108PartVPNInformationModel  attribute(3)}
m3108PartVPNNameBinding OBJECT IDENTIFIER ::= { m3108PartVPNInformationModel  nameBinding(4)}
m3108PartVPNNotification OBJECT IDENTIFIER ::= { m3108PartVPNInformationModel  notification(5)}
m3108PartVPNParameter OBJECT IDENTIFIER ::= { m3108PartVPNInformationModel  parameter(6)}
m3108PartVPNAction OBJECT IDENTIFIER ::= { m3108PartVPNInformationModel  action(7)}

Bandwidth ::= SEQUENCE {
                peakBandwidth                   [0] INTEGER             OPTIONAL,
                sustainableBandwidth            [1] INTEGER OPTIONAL,
                …
}
CreateVpnServiceError ::=  ENUMERATED  {
        invalidServiceClasses(1),
        duplicatedVPNIdentifier(2),
        invalidSAG(3),
    ...
}

CreateVpnLCSError ::= ENUMERATED  {
        unknownServiceClass (1),
        requestedBandwidthNotAvailable(2),
        resourcesUnavailable (3),
        invalidScheduleConflict(4),
        contractViolation(5),
        invalidParameterValue(6),
        requiredParameterNotSupplied(7),
        nonExistentSAP(8),
        sAPnotinVPN(9),
        serviceClassnotinserviceClassList(10),
        invalidTerminationDate(11),
        …
}

DeleteVpnLCSError ::= ENUMERATED  {
                invalidServiceID(1),
                unlockedAdministrativeState(2),
                alreadyDeleted(3),
                invalidCircuitNumber(4),
                notBeinginAppropriateServiceAdministrativeState(5),
                contractViolation(6),
                invalidVPNIdentifier(7),
                ...
}
END
```

7 Functional units

The services defined to support the functions specified in ITU-T M.3208.3 have been grouped into several functional units to allow negotiation of their use on an association (during association establishment), and to allow referencing by other Recommendations. Functional unit negotiation shall be performed as described in ITU-T X.701. The bit string defined in 6.5.1 shall be used to

represent functional units. No TMN-specific user information is supplied during an association release or aborts. Table 7-1 lists these functional units and their corresponding managed object classes and functions from ITU-T M.3208.3.

Table 7-1/M.3108.3 – Functional units, object classes and functions

Functional unit	Object classes	Functions (References to ITU-T M.3208.3)
VPN Service Order	networkR1 account vpnService serviceAccessGroup serviceAccessEquipmentView	Create VPN service (7.3.3.1.1) Delete VPN service (7.3.3.1.2) Modify VPN service (7.3.3.1.3) Create SAG (7.3.3.1.4) Delete SAG (7.3.3.1.5) Add SAP to SAG (7.3.3.1.6) Remove SAP from SAG (7.3.3.1.7) Report creation of VPN service (7.3.3.2.1) Report deletion of VPN service (7.3.3.2.2) Report configuration changes of VPN service (7.3.3.2.3) Retrieve service parameter (7.3.3.2.4)
VPN Leased Circuit Management	networkR1 account vpnService vpnLeasedCircuit serviceAccessEquipmentView (additional resource subject to SLA)	Create VPN leased circuit (7.3.3.3.1) Delete VPN leased circuit (7.3.3.3.2) Modify VPN leased circuit (7.3.3.3.3) Report creation of VPN leased circuit (7.3.3.4.1) Report deletion of VPN leased circuit (7.3.3.4.2) Report configuration changes of VPN leased circuit (7.3.3.4.3) Control administrative state of VPN leased circuit (7.3.3.4.4) Retrieve VPN leased circuit parameter (7.3.3.4.5)

7.1 VPN Service Order functional unit

The VPN Service Order functional unit permits the service customer to issue requests for VPN services.

7.2 VPN Leased Circuit Management functional unit

The VPN Leased Circuit Management functional unit permits the service customer to issue requests for VPN leased circuits.

7.3 Negotiation of functional units

This Recommendation assigns the following object identifier values:

{itu-t(0) recommendation(0) m(13) m3108(3108) partVPN(3) protocolSupport(1) functionalUnitPackage(1)}

as a value of the ASN.1 type FunctionalUnitPackageId defined in ITU-T X.701 to use for negotiating the following functional units:

0 VPN Service Order

1 VPN Leased Circuit Management

where the number identifies the bit positions in the BIT STRING assigned to the functional units, and the names referencing the functional units as defined in clause 7.

Within the systems management application context, the mechanism for negotiating the functional units is described in ITU-T X.701.

NOTE – The requirement to negotiate functional units is specified by the application context.

8 Conformance

8.1 Static conformance

A system claiming conformance to this Recommendation shall:

a) support the role of manager or agent or both, with respect to the FUs defined or referenced in this recommendation;

b) support the transfer syntax derived from the encoding rules specified in ITU-T X.209 and named {joint-iso-ccitt asn(1) basicEncoding(1)}, for the purpose of generating and/or interpreting the MAPDUs defined by the abstract data types defined in this recommendation for the role supported in a) above;

c) support at least one of the FUs defined in Table 7-1;

d) support the conformance requirements specified in Q.812 CMIP profile.

8.2 Dynamic conformance

The system shall, for the role for which conformance is claimed, support the elements of procedure defined in:

- ITU-T X.730, for the PT-GET, PT-CREATE, PT-DELETE, PT-SET services;
- ITU-T X.730, for the object creation reporting and object deletion reporting, if the create delete notifications are specified in the objects supported;
- ITU-T X.730, for the attribute value change reporting if the attribute value change notification is specified in the objects supported;
- ITU-T X.731, for the state change reporting service if the state change reporting notification is specified in the objects supported.

8.3 Conformance to managed object definitions

The managed objects supported by the open system for service provisioning shall comply with the syntax and semantics of the information model specified for the FUs to which conformance is claimed.

APPENDIX I

UML class diagrams for VPN service object model

I.1 Introduction

This appendix provides UML (Unified Modelling Language) diagrams for the VPN object model defined in this Recommendation.

In these diagrams, Classes are shown as boxes with three sections separated by horizontal lines, including: object class name section in the top, the attribute section in the second section, and access operations in the bottom. Attribute sections are not filled for readability.

The operation "set ()" is used to denote that some (at least one) of the class attributes may be modified after an instance of the class has been created.

The operation "get ()" is used to denote that some (at least one) of the class attributes are readable after an instance of the class has been created.

The operation "delete ()" is used to denote that an instance of the class can be deleted by management operation after it has been created.

I.2 UML class diagrams for inheritance of object classes

In UML class diagrams, large open headed arrows are used to indicate inheritance relationships. When a class is related to another class by inheritance, the operations from the superclass (the one has the large arrowhead touching it) are also supported by the inherited class (the source of the arrow), but are not repeated in the operation section of the class box (see Figure I.1).

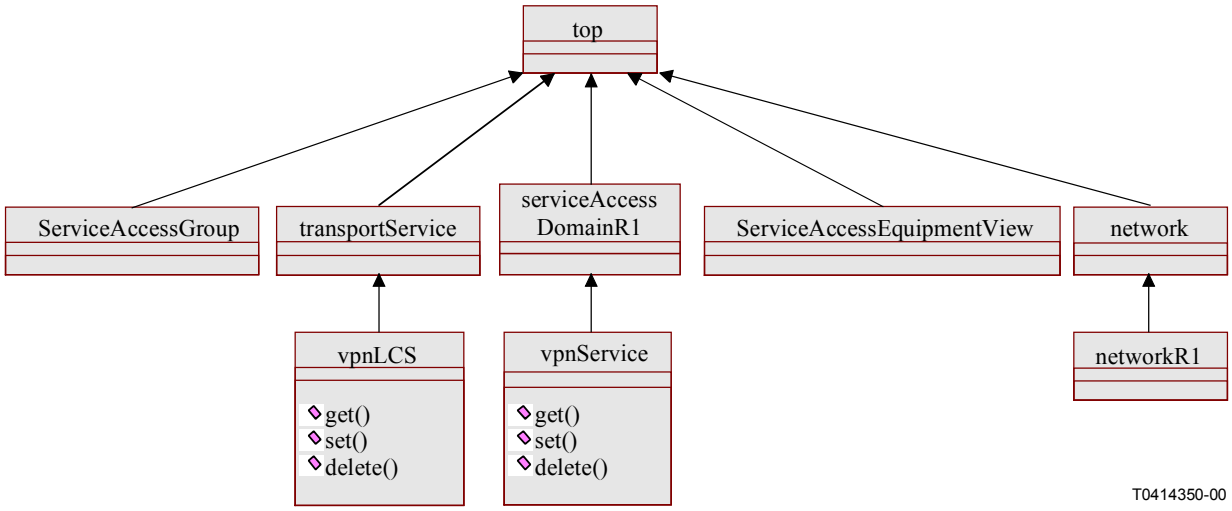

Figure I.1/M.3108.3 – Inheritance relationship

I.3 UML class diagrams for containment relationships

Containment relationships are denoted by a diamond headed line directing to the parent (UML aggregation) (see Figure I.2).

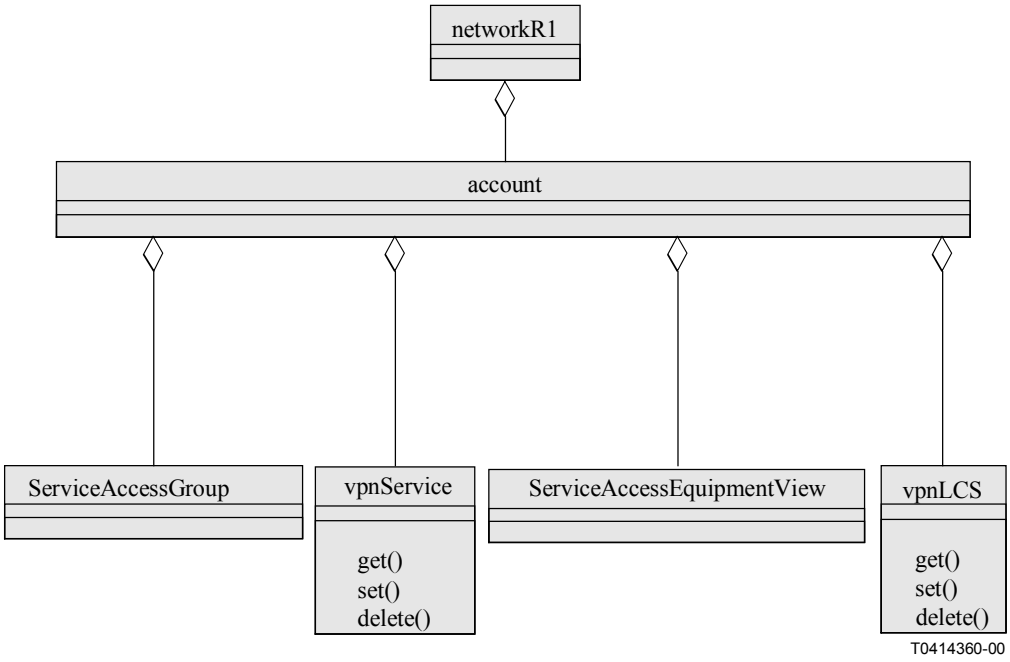

Figure I.2/M.3108.3 – Containment relationship

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