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

Telecommunications management network

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**TMN management services for dedicated and reconfigurable circuits network: Information model for connection management of preprovisioned service link connections to form a reconfigurable leased service**

ITU-T Recommendation M.3108.2

(Formerly CCITT Recommendation)

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## 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.3108.2**

### **TMN management services for dedicated and reconfigurable circuits network: Information model for connection management of preprovisioned service link connections to form a reconfigurable leased service**

#### **Summary**

This ITU-T Recommendation is one of the series of M.3100-M.3200 TMN management service Recommendations. Specifically, it provides a GDMO-based information model to support the real time management of preprovisioned leased circuit services as specified in ITU-T Recommendation M.3208.2. The model enables service customers to request, via a service layer X interface, the interconnect of preprovisioned service link connections to form a leased circuit service.

Also included in this ITU-T Recommendation are Unified Modelling Language diagrams describing selected aspects of the model and selected management functions and processes.

#### **Source**

ITU-T Recommendation M.3108.2 was prepared by ITU-T Study Group 4 (1997-2000) and approved under the WTSC Resolution 1 procedure on 4 February 2000.

#### **Keywords**

Connection management, dedicated and reconfigurable circuits network, information model, leased circuit services, leased circuits, telecommunications management network (TMN), TMN management service.

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## **Introduction**

ITU-T Recommendation M.3208.1 specifies functions that support customer management of leased circuit services. ITU-T Recommendation M.3208.2 applies these management functions to the case in which service customers manage preprovisioned resources. In this application, the service creation process from the submission of the customer request to create a service until the service is available for use only involves connecting existing, preprovisioned resources. The connection of the preprovisioned resources is normally completed within a very short time interval, i.e. nearly instantaneously.

ITU-T Recommendation M.3108.1 provides a GDMO-based information model to support the management of the leased circuit service as outlined in ITU-T M.3208.1. This ITU-T Recommendation provides a GDMO-based information model that supports the services specified in ITU-T M.3208.2. The information model is for use across a service layer X interface, among service customers, service providers, and network providers for the purposes of managing the leased circuit services specified in ITU-T Recommendation M.3208.2. It may optionally be used at the service layer within an administration.



## ITU-T Recommendation M.3108.2

### **TMN management services for dedicated and reconfigurable circuits network: Information model for connection management of preprovisioned service link connections to form a reconfigurable leased service**

#### **1 Scope**

This ITU-T Recommendation provides a GDMO-based information model to support connection management (CM) of leased circuit services (LCS) using preprovisioned service link connections (SLC) as outlined in ITU-T Recommendation M.3208.2.

Informative Appendix I provides a mapping of the attributes contained in this ITU-T Recommendation to the recommendations that are the immediate source of the attributes. Informative Appendix II provides Unified Modelling Language (UML) diagrams of selected aspects of the information model and selected aspects of the service management functions supported herein.

#### **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; all 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 Recommendation G.805 (1995), *Generic functional architecture of transport networks*.
- CCITT Recommendation M.125 (1988), *Digital loopback mechanisms*.
- ITU-T Recommendation M.3010 (2000), *Principles for a telecommunications management network*.
- ITU-T Recommendation M.3020 (2000), *TMN interface specification methodology*.
- ITU-T Recommendation M.3100 (1995), *Generic network information model*.
- ITU-T Recommendation M.3108.1 (1999), *TMN management services for dedicated and reconfigurable circuits network: Information model for management of leased circuit and reconfigurable services*.
- ITU-T Recommendation M.3200 (1997), *TMN management services and telecommunications managed areas: Overview*.
- ITU-T Recommendation M.3208.1 (1997), *TMN management services for dedicated and reconfigurable circuits network: Leased circuit services*.
- ITU-T Recommendation M.3208.2 (1999), *TMN management services for dedicated and reconfigurable circuits network: Connection management of preprovisioned service link connections to form a link connection service*.
- ITU-T Recommendation M.3320 (1997), *Management requirements framework for the TMN X interface*.
- ITU-T Recommendation M.3400 (2000), *TMN management functions*.

- ITU-T Recommendation Q.812 (1997), *Upper layer protocol profiles for the Q3 and X interfaces*.
- ITU-T Recommendation Q.813 (1998), *Security transformations application service element for remote operations service element (STASE-ROSE)*.
- ITU-T Recommendation Q.821 (1993), *Stage 2 and stage 3 description for the Q3 interface – alarm surveillance*.
- ITU-T Recommendation X.690 (1997) | ISO/IEC 8825-1:1998, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*.
- ITU-T Recommendation X.701 (1997) | ISO/IEC 10040:1998, *Information technology – Open Systems Interconnection – Systems Management overview*.
- CCITT Recommendation X.721 (1992) | ISO/IEC 10165-2:1992, *Information technology – Open Systems Interconnection – Structure of management information: Definition of management information*.
- CCITT Recommendation X.731 (1992) | ISO/IEC 10164-2:1993, *Information technology – Open Systems Interconnection – Systems Management: State management function*.
- CCITT Recommendation X.734 (1992) | ISO/IEC 10164-5:1993, *Information technology – Open Systems Interconnection – Systems Management: Event Report Management Function*.
- CCITT Recommendation X.735 (1992) | ISO/IEC 10164-6:1993, *Information technology – Open Systems Interconnection – Systems Management: Log control function*.
- ITU-T Recommendation X.746 (1995) | ISO/IEC 10164-15:1995, *Information technology – Open Systems Interconnection – Systems Management: Scheduling function*.
- ITU-T Recommendation X.790 (1995), *Trouble management function for ITU-T applications*.

### 3 Definitions

This ITU-T Recommendation makes use of the following terms defined and/or specialized in ITU-T Recommendation M.3208.1:

- connection point;
- dedicated leased circuit service;
- diversity;
- layer network;
- leased circuit service;
- link connection;
- network connection;
- reconfigurable leased circuit service;
- service access group;
- service access point;
- service characteristic;
- service customer;
- service node;
- service provider;
- subnetwork;

- subnetwork connection;
- termination connection point.

This ITU-T Recommendation makes use of the following terms defined and/or specialized in ITU-T Recommendation M.3208.2:

- CM schedule;
- dedicated service link connection;
- end link connection;
- route;
- service link connection;
- shared service link connection.

This ITU-T Recommendation makes use of the following terms defined in ITU-T Recommendation G.805:

- access group;
- access point;
- trail.

## **4 Abbreviations**

This ITU-T Recommendations uses the following abbreviations:

AP	Access Point
ATM	Asynchronous Transfer Mode
CM	Connection Management
CMIP	Common Management Information Protocol
CMISE	Common Management Information Service Element
CP	Connection Point
CPE	Customer Premises Equipment
DSn	Digital Signal Level n
GDMO	Guidelines for the Definition of Managed Objects
GDMS	Guidelines for the Definition of TMN Management Services
ISP	International Standardized Profile
LC	Link Connection
LCS	Leased Circuit Service
MAPDU	Management Application Protocol Data Unit
MOC	Managed Object Class
MOI	Managed Object Instance
MS	Management Services
NE	Network Element
NML	Network Management Layer
OSI	Open Systems Interconnection
PDH	Plesiochronous Digital Hierarchy

PDU	Protocol Data Unit
RDN	Relative Distinguished Name
ROSE	Remote Operations Service Element
SAP	Service Access Point
SC	Service Customer
SDH	Synchronous Digital Hierarchy
SLA	Service Level Agreement
SLC	Service Link Connection
SML	Service Management Layer
SN	Service Node
SNC	Sub-Network Connection
SP	Service Provider
STASE	Security Transformations Application Service Element
TCP	Termination Connection Point
TMN	Telecommunications Management Network
UML	Unified Modelling Language

## 5 Conventions

The entry, "See Recommendations M.3208.1/M.3208.2," in the Notes Column of an Attribute To Information Element Mapping Table means that the note for the associated information element is identical in ITU-T Recommendations M.3208.1 and M.3208.2. Consequently, the corresponding note from either Recommendation applies to this ITU-T Recommendation. The entry, "See Recommendation M.3208.2" means that the corresponding note in M.3208.2 is an extension or specialization of the equivalent one in M.3208.1. In this case only the note in M.3208.2 applies to this ITU-T Recommendation. A note entry that does not reference other ITU-T Recommendations means that the entry is an elaboration of the equivalent note in M.3208.2, or the note refers to an attribute that is not directly mapped to an M.3208.2 Information Element.

## 6 Overview of the CM Information Model

### 6.1 CM Managed Object Classes

The following two managed object classes (MOC) are defined in this ITU-T Recommendation to meet the functional requirements specified in ITU-T Recommendation M.3208.2.

#### 6.1.1 The preProvisionedSLC MOC

The preProvisionedSLC MOC models a preprovisioned, service level, link connection. A service link connection (SLC) provides service between two connection points (CP) or between a CP and a service access point (SAP). The preProvisionedSLC MOC represents only those aspects of a SLC that are relevant for connection management (CM) of preprovisioned service link connections to form a link connection service. The preProvisionedSLC MOC is a subclass of the M.3108.1: transportService MOC.

The following are three examples of SLCs. In the first example, the SLC models the service resources between a SAP at a service customer (SC) controlled facility and a subnetwork CP, e.g. a

multiplexer port located in the SP's network. In the next example, the SLC represents the service resources between two subnetwork CPs, e.g. two broadband digital cross-connects in the service provider's (SP) network. Lastly, a SLC can model the service resources between a subnetwork CP, such as a cross-connect in the SP's local exchange and a SAP located in SC's end user's premises.

When properly combined with other preProvisionedSLC managed object instances (MOI), a specific preProvisionedSLC MOI is a component of a leased circuit service (LCS) represented by a cmLeasedCircuitService MOI.

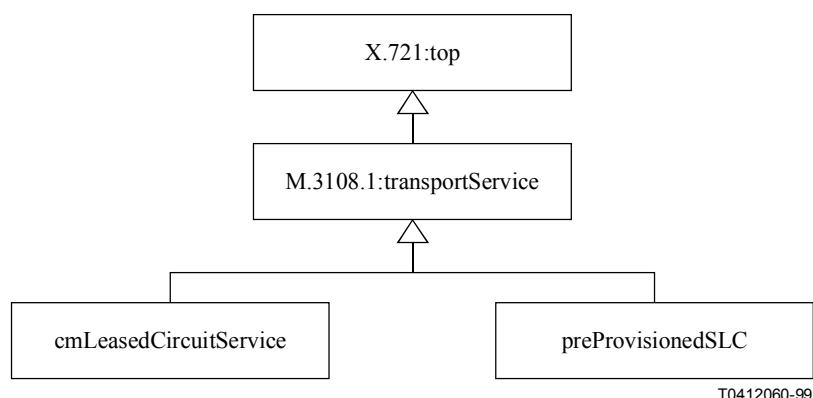
### 6.1.2 The cmLeasedCircuitService MOC

The cmLeasedCircuitService MOC is a subclass of the M.3108.1: transportService MOC. A cmLeasedCircuitService MOI represents an LCS as an ordered list of SLCs. This list must contain two or more SLCs. Exactly two of the SLCs in the list must be end link connections<sup>1</sup>. A cmLeasedCircuitService MOI may be created by specifying the complete list of its constituent preProvisionedSLC MOIs or by specifying the SAPs at the ends of the LCS.

The on duty and the off duty intervals of a cmLeasedCircuitService MOI are scheduled via the scheduling packages defined in ITU-T Recommendations X.734 and X.735.

## 6.2 Inheritance Hierarchy

Figure 1 contains the inheritance hierarchy for the MOCs defined in this ITU-T Recommendation.



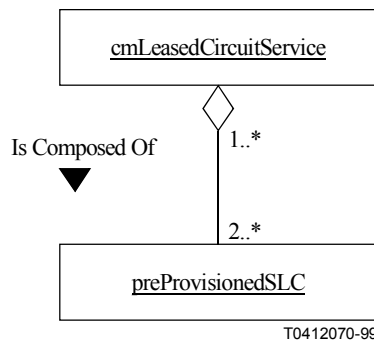
**Figure 1/M.3108.2 – Inheritance hierarchy**

## 6.3 Referential Relationships

Figure 2 displays the referential relationship that exists among the CM MOIs. Referential relationships represent logical dependencies between MOIs. As the relationship between an LCS and its constituent SLCs is very dynamic, existing only from the LCS creation time to its termination time, a pointer based approach is used in this ITU-T Recommendation to model this relationship.

For performance reasons, the model specified in this ITU-T Recommendation also defines an attribute in the preProvisionedSLC MOC that identifies all of LCSs it supports. At any time, a preProvisionedSLC MOI may point to more than one cmLeasedCircuitService MOI as long as these cmLeasedCircuitService MOIs have compatible schedules.

<sup>1</sup> M.3208.2 only applies to point-to-point circuits.



**Figure 2/M.3108.2 – Managed object class relationships**

## 6.4 Attributes

This subclause describes the attributes used in CM. The attributes of each of the MOCs defined in this ITU-T Recommendation are arranged in alphabetical order in the following subclauses. Major portions of these subclauses are reused as behaviour descriptions in the GDMO templates contained in clause Formal Model Specifications For Connection Management.

The following subclauses also indicate if an attribute is defined in this ITU-T Recommendation, if it is inherited from the transportService MOC defined in ITU-T Recommendation M.3108.1, or if it is imported. The table in Appendix I (see Table I.1) summarizes this information for all the attributes in the preProvisionedSLC and the cmLeasedCircuitService MOCs.

### 6.4.1 The preProvisionedSLC Attributes

This ITU-T Recommendation requires that the transportService conditional package, "Rec. X.721": availabilityStatusPackage<sup>2</sup>, shall not be instantiated in the preProvisionedSLC MOIs. Consequently, the availabilityStatus attribute does not appear in the preProvisionedSLC MOC.

#### 6.4.1.1 administrativeState

The administrativeState attribute is inherited from the M.3108.1: transportService MOC. For CM, the value of this attribute must be set to unlocked by the SP when the resource is made available to the SC. The SC may change this attribute to locked for dedicated SLCs only. The administrativeState of shared SLCs cannot be changed to locked by the SC. One possible implementation of this latter requirement is through the use of an access control process.

#### 6.4.1.2 bandwidth

The bandwidth attribute is inherited from the M.3108.1: transportService MOC. See ITU-T Recommendations M.3208.1 and M.3108.1 for the functions supported by and for this attribute.

#### 6.4.1.3 dedicatedOrShared

The dedicatedOrShared attribute identifies whether a SLC is dedicated to the SC or is in a shared resource pool. The value of this attribute cannot be changed by the SC.

When a SC specifies an LCS via its SAPs, one of the possible LCS restrictions that may be specified is the value of the dedicatedOrShared attribute for the SLCs used to support the LCS. See the description of the restrictionsOnSLC attribute in subclause restrictionsOnSLC and the description of the create CM LCS function in subclause Create CM, LCS for additional information.

<sup>2</sup> See Corrigendum 1 to ITU-T Recommendation M.3108.1.

#### **6.4.1.4 leasedCircuitServicePtrList**

For a given SLC, this attribute is a list of all cmLeasedCircuitService MOIs that employ it. That is, for a specific preProvisionedSLC MOI, this attribute contains a list of all the LCSs that contain the SLC. See subclause listOfSLCsUsedfor the specification of the means by which an LCS maintains a description of its constituent SLCs.

When a request is made by the SC to create a new LCS that will use this SLC, the leasedCircuitServicePtrList attribute is used to determine if a conflict exists between the requested schedule for the new LCS and the schedules of any existing LCSs that use this SLC.

#### **6.4.1.5 loopbackControl**

The loopbackControl attribute identifies whether or not an SLC is looped back. In general there are two possibilities for creating a loopback. Consequently for those SLCs that are looped back, this attribute also specifies which end of the SLC is looped back.

Note that establishing a loopback is considered to be an instantaneous service, i.e. the loopback is established by the SP on receipt of the loopback request. Only SLCs that are in unlocked LCSs with a status of on duty can be looped back.

This attribute is also used to set the loopback termination time. A loopback will be removed when the LCS which contains the looped back SLC transitions from an availability status of on duty to the off duty status or when the loopback termination time is reached.

See the slcEnds attribute in subclause slcEndsand the Initiate Loopback Of End-of-link Connection function in subclause Initiate Loopback Of End-of-link Connection for additional information on loopback.

#### **6.4.1.6 operationalState**

The operationalState attribute is inherited from the M.3108.1: transportService MOC. In order for an SLC to support an LCS, its operationalState must have a value of enabled. The operationalState may not be changed by the SC.

#### **6.4.1.7 protected**

The protected attribute is imported from ITU-T Recommendation M.3100. It identifies whether or not the SLC is protected, e.g. the service uses facilities that are on a survivable ring or are in an Automatic Protection System protection group. A value of true for this attribute indicates that the SLC is protected.

When a SC specifies an LCS via its SAPs, one of the possible LCS restrictions that may be specified is the value of the protected attribute of the SLCs used to support the LCS.

#### **6.4.1.8 serviceCustomerContact**

The serviceCustomerContact attribute is inherited from the M.3108.1: transportService MOC. See ITU-T Recommendations M.3208.1 and M.3108.1 for the functions supported by and for this attribute.

#### **6.4.1.9 serviceID**

The serviceID attribute is inherited from the M.3108.1: transportService MOC. The serviceID attribute is used to construct the Relative Distinguished Name (RDN) of the preProvisionedSLC MOIs. It uniquely identifies the preProvisionedSLC MOIs within a particular naming context. Note that the information element associated with this attribute is different from the information element associated with the serviceID attribute in the cmLeasedCircuitService MOC. For the preProvisionedSLC MOC, the serviceID attribute maps to the link connection identifier while in the cmLeasedCircuitService MOC, the serviceID attributes maps to the circuit number.

#### **6.4.1.10 serviceProviderContact**

The serviceProviderContact attribute is inherited from the M.3108.1: transportService MOC. See ITU-T Recommendations M.3208.1 and M.3108.1 for the functions supported by and for this attribute.

#### **6.4.1.11 serviceTerminationDate**

The serviceTerminationDate attribute is inherited from the M.3108.1: transportService MOC. See ITU-T Recommendations M.3208.1 and M.3108.1 for the functions supported by and for this attribute.

#### **6.4.1.12 slcEnds**

The slcEnds attribute specifies an identifier for each end of an SLC. It also indicates if a loopback can be established at a given end of an SLC. That is, for a given SLC, a loopback capability may be supported at both ends of the SLC, at only one end of the SLC, or not supported at either end. A value of true for the loopBackSupported component of the slcEnds attribute indicates that a loopback can be established at the indicated end of the SLC.

#### **6.4.1.13 usageState**

The usageState indicates whether or not an SLC is actively in use at a specific instant. A preProvisionedSLC MOI has a usageState of Busy<sup>3</sup> when it supports an on-duty cmLeasedCircuitService MOI. Its usageState is Idle when it is not supporting any cmLeasedCircuitService MOIs, or when it is supporting only locked or off-duty cmLeasedCircuitService MOIs.

### **6.4.2 The cmLeasedCircuitService Attributes**

Given the behaviour required of the availabilityStatus attribute in this ITU-T Recommendation, it is a requirement that the transportService conditional package, "Rec. X.721": availabilityStatusPackage<sup>2</sup>, shall not be instantiated in cmLeasedCircuitService MOIs. Rather, the availabilityStatus attribute is explicitly imported in the cmLeasedCircuitService MOIs. The behaviour appropriate for this ITU-T Recommendation is then specified. See subclause availabilityStatus for additional information on the availabilityStatus attribute.

#### **6.4.2.1 administrativeState**

The administrativeState attribute is inherited from the M.3108.1: transportService MOC.

The administrativeState of an LCS may be assigned by the SC with the create CM LCS function. If no value for the administrativeState is specified by the SC, a default value of unlocked is assigned.

#### **6.4.2.2 aliasName**

The aliasName attribute is explicitly imported from M.3108.1: transportService MOC. This attribute enables the SC to assign a name of its choosing to an LCS.

#### **6.4.2.3 availabilityStatus**

The availabilityStatus attribute is imported from ITU-T Recommendation X.721. Valid values for this attribute are in test, failed, off line, off duty, dependency, degraded, and not installed. See ITU-T Recommendation X.731 for a description of these values.

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<sup>3</sup> For CM, there is no difference between a usage state of busy or of active for an SLC. Consequently, the possible values of the state are limited to idle and busy.



#### **6.4.2.4 bandwidth**

The bandwidth attribute is inherited from the M.3108.1: transportService MOC. See ITU-T Recommendations M.3208.1 and M.3108.1 for the functions supported by and for this attribute.

#### **6.4.2.5 listOfSLCsUsed**

This attribute identifies the SLCs that support the LCS. Whenever a cmLeasedCircuitService object is created, the SC may specify a series of SLCs that support the LCS or may specify the pair of SAPs to be connected by the LCS. In the former case, the complete list of SLCs that defines the LCS must be provided by the SC. In the latter case, the SLCs are selected by the SP from the SC's inventory of dedicated SLCs and possibly from the pool of shared SLCs. The selection of SLCs is constrained by the restrictionsOnSLC attribute. The SP will place the selected SLCs in the listOfSLCsUsed attribute.

#### **6.4.2.6 operationalState**

The operationalState attribute is inherited from the M.3108.1: transportService MOC. In order to provide service, an LCS must have an administrativeState of unlocked, an operationalState of enabled, and an availabilityStatus of on-duty.

#### **6.4.2.7 originatingLocationCPE**

The originatingLocationCPE and the terminatingLocationCPE attributes are inherited from the M.3108.1: transportService MOC. See ITU-T Recommendations M.3208.1 and M.3108.1 for the functions supported by and for these attributes.

#### **6.4.2.8 originatingLocationSap**

The originatingLocationSap and the terminatingLocationSap attributes are imported from M.3108.1. They identify the LCS's service access points (SAP). Typically, SAPs are located in an environment controlled by the SC. When a cmLeasedCircuitService MOI is created, either the values of these attributes or a complete list of SLCs must be specified.

#### **6.4.2.9 restrictionsOnSLC**

When a SC requests the creation of an LCS via a pair of SAPs, the restrictionsOnSLC attribute specifies constraints on the SLCs that may be used. That is, the SP may only select SLCs for the LCS that satisfy the constraints. The constraints supported for the restrictionsOnSLC attribute are:

- a) no restrictions;
- b) protected SLCs only;
- c) protected and dedicated SLCs only;
- d) dedicated SLCs only with protected SLCs preferred;
- e) dedicated SLCs preferred and protected SLCs required;
- f) dedicated and protected SLCs preferred.

#### **6.4.2.10 Schedule Specification Attributes**

The schedule specification attributes are inherited from M.3108.1: transportService MOC. The following three attributes are used to represent the scheduled on and off-duty times of an LCS:

- g) intervalsOfDay;
- h) schedulerName;
- i) weekMask.

The `intervalsOfDay` attribute is defined in the `dailyScheduling` package. The `schedulerName` attribute is defined in the `externalScheduler` package. The `weekMask` attribute is defined in the `weeklyScheduling` package. All of these packages are defined in ITU-T Recommendation X.721.

For a specific LCS, only one of these scheduling attributes will be used.

#### **6.4.2.11 selectionPriority**

The `selectionPriority` attribute specifies the SC's relative ranking of `cmLeasedCircuitService` MOIs with the same value of the `serviceType` attribute that provide service between the same service access points.

This attribute may be employed by the SC when selecting a `cmLeasedCircuitService` MOI from the set of locked `cmLeasedCircuitService` MOIs. In this case, the SC identifies the set of LCSs by specifying a pair of SAPs and the `serviceType`. See subclause Identify Locked LCS for additional information on the Identify Locked LCS Function. The set of locked `cmLeasedCircuitService` MOIs may be empty. Valid values for the `selectionPriority` attribute are from 1 to 10 inclusive, with 1 being the highest priority. In the event of equal values of the `selectionPriority` attribute, the LCS returned by the SP is a local matter.

#### **6.4.2.12 serviceCustomerContact**

The `serviceCustomerContact` attribute is inherited from the M.3108.1: `transportService` MOC. The `serviceCustomerContact` attribute contains the name and contact information of the person in the SC's organization who may be called by the SP to discuss problems or questions relating to the particular LCS. This person is assumed to be knowledgeable about the SC's LCS requirements.

#### **6.4.2.13 serviceID**

The `serviceID` attribute is inherited from the M.3108.1: `transportService` MOC. It is used to construct the Relative Distinguished Name (RDN) of the `cmLeasedCircuitService` MOIs. It uniquely identifies the `cmLeasedCircuitService` MOIs within a particular naming context. A value for the `serviceID` is assigned by the SP when a `cmLeasedCircuitService` MOIs is created.

#### **6.4.2.14 serviceProviderContact**

The `serviceProviderContact` attribute is inherited from the M.3108.1: `transportService` MOC. The `serviceProviderContact` attribute contains the name and contact information of the person in the SP's organization who may be called by the SC to discuss problems or questions relating to the particular LCS. This person is assumed to be knowledgeable about the SP's LCSs.

#### **6.4.2.15 serviceTerminationDate**

The `serviceTerminationDate` attribute is inherited from the M.3108.1: `transportService` MOC. It is used to set a time for the automatic deletion of an LCS. The value of the `serviceTerminationDate` must be later than the time at which the request is sent. An attempt to set a `serviceTerminationDate` earlier than the request time will result in a processing specific error.

#### **6.4.2.16 startTime**

The `startTime` and the `stopTime` attributes are contained in the `duration` package that is imported from ITU-T Recommendation X.721. These attributes are used to support LCS schedules.

#### **6.4.2.17 stopTime**

The `startTime` and the `stopTime` attributes are contained in the `duration` package which is defined in ITU-T Recommendation X.721. These attributes are used to support LCS schedules.

#### **6.4.2.18 terminatingLocationCPE**

The originatingLocationCPE and the terminatingLocationCPE attributes are inherited from the M.3108.1: transportService MOC. See ITU-T Recommendations M.3208.1 and M.3108.1 for the functions supported by and for these attributes.

#### **6.4.2.19 terminatingLocationSap**

The originatingLocationSap and the terminatingLocationSap attributes are imported from M.3108.1. They identify the LCS's service access points (SAP). Typically, SAPs are located in an environment controlled by the SC. When a cmLeasedCircuitService MOI is created, either the values of these attributes or a complete list of SLCs must be specified.

#### **6.4.2.20 usageState**

The usageState attribute is imported from ITU-T Recommendation X.721. The usageState indicates whether or not an LCS is in use at a specific time. A cmLeasedCircuitService MOI has a usageState of Busy<sup>4</sup> when it is on-duty. Its usageState is Idle when it is locked or off-duty.

### **6.5 Notifications**

The following three subclauses describe the notifications used in the Connection Management (CM) information model. For additional information, see Subclause Connection Management Functions, Connection Management Functions.

#### **6.5.1 Attribute Value Change Notification**

The attributeValueChangeNotificationPackage is inherited from the M.3108.1: transportService MOC. See ITU-T Recommendations M.3100, X.721, and X.730 for a description of this notification.

#### **6.5.2 Create Delete Notifications**

The createDeleteNotificationPackage is inherited from the M.3108.1: transportService MOC. See ITU-T Recommendations M.3100, X.721, and X.730 for a description of this notification.

The Create and Delete notifications are generated by the creation and deletion of cmLeasedCircuitService MOIs. The preProvisionedSLC MOIs are required to exist prior to any use of CM by the SC. The functions contained in this ITU-T Recommendation do not support the creation or the deletion of preProvisionedSLC MOIs. See Appendix II/M.3208.2 for examples of possible processes for preProvisionedSLC creation. See ITU-T Recommendations M.3108.1 and M.3208.1 for a discussion of SLC deletion.

#### **6.5.3 State Change Notification**

The stateChangeNotificationPackage is inherited from the M.3108.1: transportService MOC. See ITU-T Recommendations M.3100, X.721, and X.730 for a description of this notification.

The State Value Change notifications apply to the administrativeState, operationalState, and the usageState attributes of the preProvisionedSLC and the cmLeasedCircuitService MOCs.

### **6.6 Connection Management Functions**

This subclause explains how the Connection Management model meets the CM requirements identified in ITU-T Recommendation M.3208.2. The functions listed in Table 1 are reviewed in the following subclauses. See ITU-T Recommendation M.3208.2 for additional information on the supported functions.

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<sup>4</sup> For CM, there is no difference between a usage state of busy or of active for an LCS. Consequently, the possible values of the state are limited to idle and busy.

**Table 1/M.3108.2 – Functions supported in this Recommendation**

<b>M.3208.2 Function Set</b>	<b>M.3208.2 Function</b>
CM leased circuit service configuration	Create CM LCS
	Delete CM LCS
	Modify CM LCS
Dedicated LCS configuration	Replace a failed CM LCS
Dedicated LCS status administration	Identify locked LCS
Leased circuit service test	Initiate loopback of end-of-link connection
	Terminate loopback of end-of-link connection

The functions are described in a logical order in the following subclauses and not in the order shown in Table 1.

### 6.6.1 Create CM LCS

Reconfigurable LCS are represented by cmLeasedCircuitService MOIs. Values for the following attributes must be supplied by the SC when an cmLeasedCircuitService MOI is created.

- j) Scheduling Attributes<sup>5</sup>, i.e. intervalsOfDay or schedulerName or weekMask;
- k) serviceCustomerContact;
- l) serviceType.

To specify the LCS itself, either the value of the listOfSLCsUsed attribute or the values of the following attributes must be specified.

- m) restrictionsOnSLC;
- n) originatingLocationSap;
- o) terminatingLocationSap.

Table 2 summarizes the information used by the create CM LCS function.

**Table 2/M.3108.2 – Mapping for CM LCS creation**

<b>M.3108.2 Attribute</b>	<b>M.3208.2 Information Element</b>	<b>Notes</b>
serviceType	Service name	See Recommendations M.3208.1 and M.3208.2.
ServiceDescription	Service class	See Recommendations M.3208.1 and M.3208.2.
bandwidth	Bandwidth	See Recommendation M.3208.2.
Implicitly Specified (Note 1)	Quantity	See Recommendation M.3208.2.
serviceTerminationDate	Service termination date	See Recommendations M.3208.1 and M.3208.2.
availabilityStatus	Schedule (Note 2)	See Corrigendum 1 to Recommendation M.3208.2.

<sup>5</sup> Corrigendum 1 to ITU-T Recommendation M.3208.2 requires that the SC provide scheduling information for the create CM leased circuit service function.

**Table 2/M.3108.2 – Mapping for CM LCS creation (*continued*)**

<b>M.3108.2 Attribute</b>	<b>M.3208.2 Information Element</b>	<b>Notes</b>
Schedule Attributes	Schedule (Note 2)	See Corrigendum 1 to Recommendation M.3208.2.
startTime	Schedule (Note 2)	See Corrigendum 1 to Recommendation M.3208.2.
stopTime	Schedule (Note 2)	See Corrigendum 1 to Recommendation M.3208.2.
No Attribute Defined (Note 3)	Service availability date	Although included in M.3208.1, this item is excluded in M.3208.2.
No Attribute Defined (Note 3)	Service request state	Although included in M.3208.1, this item is excluded in M.3208.2.
administrativeState	Service administrative state	See Recommendations M.3208.1 and M.3208.2.
operationalState	Service operational state	See Recommendations M.3208.1 and M.3208.2.
Not Required (Note 3)	Diversity	Although included in M.3208.1, this item is excluded in M.3208.2.
restrictionsOnSLC	Link connection selection criteria	See Recommendation M.3208.2.
listOfSLCsUsed	Route	See Recommendation M.3208.2.
No Attribute Defined (Note 3)	Originating location	Although included in M.3208.1, this item is excluded in M.3208.2.
No Attribute Defined (Note 3)	Terminating location	Although included in M.3208.1, this item is excluded in M.3208.2.
originatingLocationCPE	Originating location CPE type	See Recommendations M.3208.1 and M.3208.2.
terminatingLocationCPE	Terminating location CPE type	See Recommendations M.3208.1 and M.3208.2.
serviceCustomerContact	Customer contact	See Recommendations M.3208.1 and M.3208.2.
No Attribute Defined (note 3)	Provider request number	Although included in M.3208.1, this item is excluded in M.3208.2.
No Attribute Defined (note 3)	Customer request number	Although included in M.3208.1, this item is excluded in M.3208.2.
aliasName	Alias name	See Recommendations M.3208.1 and M.3208.2.
originatingLocationSap	Originating location service access point	See Recommendation M.3208.2.
terminatingLocationSap	Terminating location service access point	See Recommendation M.3208.2.
serviceID	Circuit number	See Recommendation M.3208.2.
serviceProviderContact	SP contact	See Recommendations M.3208.1 and M.3208.2.
selectionPriority	Selection priority	See Recommendation M.3208.2.

**Table 2/M.3108.2 – Mapping for CM LCS creation (*concluded*)**

<b>M.3108.2 Attribute</b>	<b>M.3208.2 Information Element</b>	<b>Notes</b>
See Processing Failure Specific Errors	Error and reason code	See Recommendation M.3208.2.
<p>NOTE 1 – Since only one cmLeasedCircuitService MOI can be created per invocation of the create function, explicit representation of a quantity attribute is not needed.</p> <p>NOTE 2 – M.3208.2 schedule information element is represented by several attributes of the MOC defined in this ITU-T Recommendation.</p> <p>NOTE 3 – Although the information element is included in the M.3208.2 information flow table, the corresponding Note in M.3208.2 states that although the information element is required in M.3208.1, it is not required in M.3208.2.</p>		

### **6.6.1.1 Processing Failure Specific Errors**

The processing failure specific errors support the error and reason codes defined for the Create CM LCS management function in M.3208.2. The following discussion provides additional information concerning these processing failures.

- p) Incompatible SLCs. In this case, the SC specified SLCs are not contiguous or have incompatible serviceTypes. This error applies to LCSs specified via a sequence of preprovisioned SLCs only.
- q) Specified LCS already exists. This error applies only if the specified administrativeState has the same value as the existing LCS.
- r) Dedicated SLC unavailable. For an LCS specified via its constituent SLCs, a schedule conflict exists for at least one constituent dedicated SLC.
- s) Shared SLC unavailable. For an LCS specified via its constituent SLCs, a schedule conflict exists for at least one constituent shared SLC.

Note that the creation of a Reconfigurable LCS also requires that the pointers, i.e. the leasedCircuitServicePtrList attribute, in the associated preProvisionedSLC MOIs be updated.

### **6.6.2 Identify Locked LCS**

This function is used when a SC creates an inventory of locked cmLeasedCircuitService MOIs. These MOIs serve as a collection of LCSs that can be actualized by the SC with a minimum amount of effort and analysis. For example, the inventoried LCSs may be used by the SC to quickly restore service to a failed LCS. Values of the following attributes must be supplied by the SC when requesting the list of locked LCSs.

- t) administrativeState;
- u) originatingLocationSap;
- v) terminatingLocationSap;
- w) serviceType.

The selectionPriority values will be returned for all cmLeasedCircuitService MOIs which were created by specifying a pair of SAPs.

Table 3 contains additional details on the attributes involved in this process.

**Table 3/M.3108.2 – Mapping for identifying locked LCS**

<b>M.3108.2 Attribute</b>	<b>M.3208.2 Information Element</b>	<b>Notes</b>
administrativeState	Service administrative state	The specified value is locked.
listOfSLCsUsed	Route	A value for this attribute must be returned by the SP. This list may be empty.
restrictionsOnSLC	Link connection selection criteria	See Recommendation M.3208.2.
originatingLocationSap	Originating location service access point	This value must be provided by the SC. See Recommendation M.3208.2.
terminatingLocationSap	Terminating location service access point	This value must be provided by the SC. See Recommendation M.3208.2.
Schedule Attributes	Schedule (Note)	A value for this attribute must be returned by the SP. See Corrigendum 1 to Recommendation M.3208.2.
selectionPriority	Selection priority	If a selectionPriority value is provided by the SC, this value will be returned by the SP. If no values are specified by the SC, the value of the selectionPriority attribute will be returned for each MOI which meets the selection criteria.
serviceCustomerContact	Customer contact	See Recommendations M.3208.1 and M.3208.2.
serviceDescription	Service class	See Recommendations M.3208.1 and M.3208.2.
serviceID	Circuit number	See Recommendation M.3208.2.
serviceType	Service name	This attribute serves as the "Service Name" as specified in M.3208.1.
startTime	Schedule (Note)	See Corrigendum 1 to Recommendation M.3208.2.
stopTime	Schedule (Note)	See Corrigendum 1 to Recommendation M.3208.2.
See Processing Failure Specific Errors	Error and reason code	No specific error and reason codes specified in M.3208.2.
NOTE – M.3208.2 schedule information element is represented by several attributes of the MOC defined in this ITU-T Recommendation.		

### 6.6.2.1 Processing Failure Specific Errors

The processing failure specific errors are invalid values or missing required values.

### 6.6.3 Modify CM LCS

The most significant use of this function is to change the administrative state of an LCS. Such a request may be made at any time. Some attributes of an LCS may only be changed if the administrativeState of the LCS is locked. Table 4 summarizes the information flows associated with modifying LCS attributes.

The following attributes may be changed independently of the value of the administrative state.

- x) selectionPriority;
- y) serviceCustomerContact.

The following attributes may be changed only when the administrative state is locked.

- z) bandwidth;
- aa) Schedule Attributes;
- bb) serviceTerminationDate.

**Table 4/M.3108.2 – Mapping for modifying LCS attributes**

<b>M.3108.2 Attribute</b>	<b>M.3208.2 Information Element</b>	<b>Notes</b>
selectionPriority	Selection priority	For further study in M.3208.2.
originatingLocationCPE	Originating location CPE type	See Recommendations M.3208.1 and M.3208.2.
terminatingLocationCPE	Terminating location CPE type	See Recommendations M.3208.1 and M.3208.2.
serviceCustomerContact	Customer contact	See Recommendations M.3208.1 and M.3208.2.
originatingLocationSap	Originating location service access point	See Recommendation M.3208.2.
terminatingLocationSap	Terminating location service access point	See Recommendation M.3208.2.
serviceID	Circuit number	See Recommendation M.3208.2.
No Attribute Defined (Note 1)	Provider request number	Although included in M.3208.1, this item is excluded in M.3208.2.
No Attribute Defined (Note 1)	Request Sequence Number	Although included in M.3208.1, this item is excluded in M.3208.2.
bandwidth	Bandwidth	See Recommendations M.3208.1 and M.3208.2.
composedOfSLCPtrList	Route	See Recommendation M.3208.2.
availabilityStatus	Schedule (Note 2)	See Corrigendum 1 to Recommendation M.3208.2.
Schedule Attributes	Schedule (Note 2)	See Corrigendum 1 to Recommendation M.3208.2.
startTime	Schedule (Note 2)	See Corrigendum 1 to Recommendation M.3208.2.
stopTime	Schedule (Note 2)	See Corrigendum 1 to Recommendation M.3208.2.
No Attribute Defined (Note 1)	Service request state	Although included in M.3208.1, this item is excluded in M.3208.2.
serviceTerminationDate	Service termination date	See Recommendation M.3208.2.
No Attribute Defined (Note 1)	Service availability date	Although included in M.3208.1, this item is excluded in M.3208.2.
administrativeState	Service administrative state	See Recommendations M.3208.1 and M.3208.2.



**Table 4/M.3108.2 – Mapping for modifying LCS attributes (*concluded*)**

<b>M.3108.2 Attribute</b>	<b>M.3208.2 Information Element</b>	<b>Notes</b>
aliasName	Alias name	See Recommendations M.3208.1 and M.3208.2.
See processing failure specific errors	Error and reason code	See Recommendation M.3208.2.
NOTE 1 – Although the information element is included in the M.3208.2 information flow table, the corresponding Note states that although the information element is required in M.3208.1, it is not required in M.3208.2.		
NOTE 2 – M.3208.2 schedule information element is represented by several attributes of the MOC defined in this recommendation.		

#### **6.6.3.1 Processing Failure Specific Errors**

See ITU-T Recommendation M.3208.2 for a list of the error and reason codes. It should be noted that the invalid schedule error indicates that the specified schedule is itself in error, e.g. inconsistent times. The schedule conflict error indicates that at least one of the SLCs in the LCS is scheduled to be in service on an existing LCS during the schedule specified in the modify request.

#### **6.6.4 Replace a failed CM LCS**

Depending on the conditions stated in the SLA, the SC may choose to restore a failed LCS. To restore a failed LCS, the SC must first lock the administrativeState of the failed LCS. If the SC has created a set of locked LCSs which can be used to replace the failed LCS, then the administrativeState of a backup LCS can be changed to unlocked by the SC. If no such set exists, the SC must create a new LCS. The existence of a replacement LCS is not guaranteed, but depends on the SLCs under the control of the SC and the existing on-duty times scheduled for these SLCs.

The requirement for a function to identify the best locked LCS based on values of the selectionPriority attribute of the eligible cmLeasedCircuitService MOIs, and to unlock this LCS is for further study.

##### **6.6.4.1 Processing Failure Specific Errors**

The processing failure specific errors for the Replace a failed CM LCS function are the same as those for the modify LCS function. See subclause Processing Failure Specific Errors.

#### **6.6.5 Delete CM LCS**

Deleting a Reconfigurable LCS is equivalent to deleting a cmLeasedCircuitService MOI. Only cmLeasedCircuitService MOIs whose administrative state is locked may be deleted. The LCS to be deleted is specified using the value of the serviceID attribute. See Table 5.

**Table 5/M.3108.2 – Mapping for delete CM LCS**

<b>M.3108.2 Attribute</b>	<b>M.3208.2 Information Element</b>	<b>Notes</b>
serviceID	Circuit number	See Recommendations M.3208.1 and M.3208.2.
No Attribute Defined (Note)	Service request state	Although included in M.3208.1, this item is excluded in M.3208.2.
serviceProviderContact	SP contact	See Recommendations M.3208.1 and M.3208.2.
serviceTerminationDate	Service termination date	See Recommendation M.3208.2.
No Attribute Defined (Note)	Provider request number	Although included in M.3208.1, this item is excluded in M.3208.2.
No Attribute Defined (Note)	Customer request number	Although included in M.3208.1, this item is excluded in M.3208.2.
See processing failure specific errors	Error and reason code	See Recommendation M.3208.2.
NOTE – Although the information element is included in the M.3208.2 information flow table, the corresponding Note states that although the information element is required in M.3208.1, it is not required in M.3208.2.		

#### **6.6.5.1 Processing Failure Specific Errors**

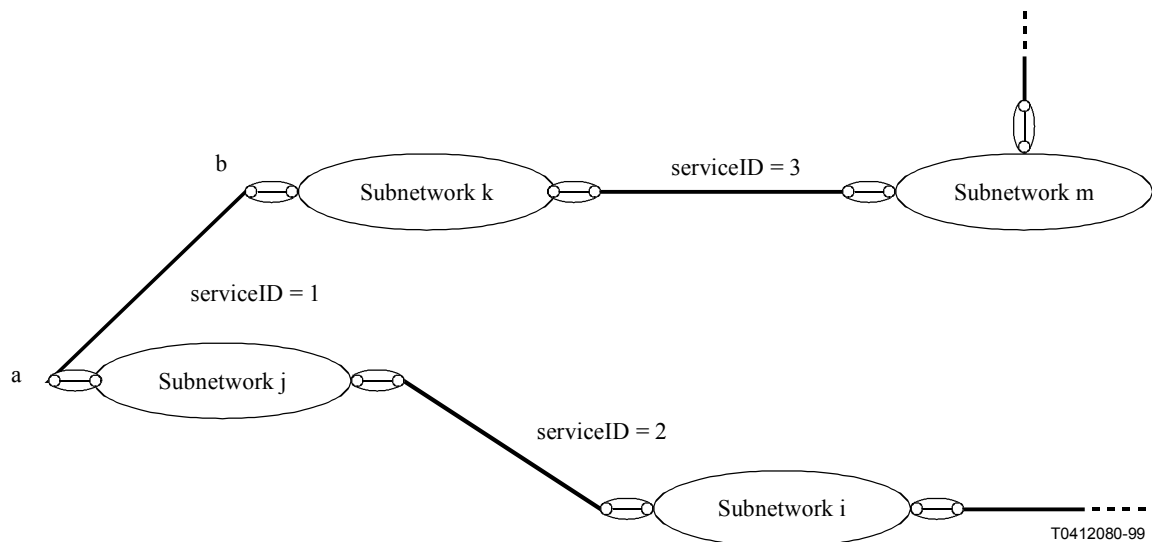
The error and reason codes defined in M.3208.2 apply. This function also requires that the values of the leasedCircuitServicePtrList attributes for all the preProvisionedSLC MOIs that support the deleted LCS be adjusted, i.e. the deleted LCS will be removed from the leasedCircuitServicePtrList.

The deletion of the cmLeasedCircuitService MOI and the updates of the leasedCircuitServicePtrList values require atomic cross-object synchronization.

#### **6.6.6 Initiate Loopback of End-of-link Connection**

CM allows the SC to control the creation of LCSs. However, the SC may also wish to do pre-use testing or to do a limited amount of problem segmentation on in-use LCSs. To support this need, the SC must have the ability to loopback SLCs. As support for loopback is an optional feature of many transport network elements (NE), this capability may not be available for every SLC. Additionally, for a given SLC, it may be available at only one end of the SLC.

The convention used in describing the circuit created when an SLC is looped back is the specified SLC is the "last" link connection in the circuit. Figure 3 illustrates this convention. In this figure, two different circuits can be set up depending upon the location of the loopback, i.e. if the a end or the b end of SLC 1 is looped back. If the b end of SLC 1 is looped back, the next to the last SLC in the circuit is SLC 2 and the last is SLC 1. If the a end of SLC 1 is looped back, the next to the last SLC in the circuit is SLC 3 and the last is SLC 1.



**Figure 3/M.3108.2 – Loopback location specification**

The status component of the loopbackControl attribute is used to specify which end of an SLC is to be looped back. Loopbacks can only be applied to an SLC if this is being used by an unlocked LCS with an availabilityStatus of on-duty. See Table 6.

**Table 6/M.3108.2 – Mapping for initiate loopback**

<b>M.3108.2 Attribute</b>	<b>M.3208.2 Information Element</b>	<b>Notes</b>
Not Used	Circuit number	Although M.3208.2 specifies the use of the circuit number information element, the equivalent model used in this ITU-T Recommendation requires that the Link Connection Identifier be provided by the SC.
serviceID	Link Connection Identifier	See Previous Note.
Not Directly Modelled	Loopback primary sublist	The location of the SLC to be looped back is specified by the loopbackControl attribute. This means locating the loopback is equivalent to the method specified in M.3208.2. See Recommendation M.3208.2 for a description of how the loopback primary sublist can be used to identify the location of the loopback.
loopbackControl	Loopback Termination Time	See Recommendation M.3208.2. The loopback termination time is a component of the loopbackControl attribute.
serviceProviderContact	SP contact	See Recommendations M.3208.1 and M.3208.2.
loopbackControl	Not Explicitly Defined	The loopbackControl attribute specifies, for a given SLC, which end of the SLC is looped back. It also contains the value of the loopback termination time.
See Processing Failure Specific Errors	Error and Reason Code	See Recommendation M.3208.2.

#### 6.6.6.1 Processing Failure Specific Errors

The following processing failure specific errors specified in ITU-T Recommendation M.3208.2 are defined for this function:

- a) LCS unavailable, i.e. the usageState of the LCS is busy.
- b) The LCS is off-duty.
- c) Loopback not supported by equipment.

#### 6.6.7 Terminate Loopback of End-of-link Connection

There are two processes that will terminate the Loopback of an end-of-link connection. The first process, called immediate termination, requires the SC to set the status component of the loopbackControl attribute to noLookback. On receipt of this request, the SP will immediately terminate the loopback on the indicated SLC. The second process is the expiration of the loopback termination time. Changing the loopback termination time to a value earlier than the time the request is sent is considered to be a processing error. See Table 7.

**Table 7/M.3108.2 – Mapping for terminate loopback**

<b>M.3108.2 Attribute</b>	<b>M.3208.2 Information Element</b>	<b>Notes</b>
serviceID	Link Connection Identifier	See Corrigendum 1 to Recommendation M.3208.2.
Not Directly Modelled	Loopback primary sublist	The location of the SLC to be looped back is specified by the loopbackControl attribute. This means locating the loopback is equivalent to the method specified in M.3208.2. See Recommendation M.3208.2 for a description of how the loopback primary sublist can be used to identify the location of the loopback.
serviceProviderContact	SP contact	See Recommendations M.3208.1 and M.3208.2.
loopbackControl	Not Explicitly Defined	The loopbackControl attribute specifies, for a given SLC, which end of the SLC is looped back. It also contains the value of the loopback termination time.
See processing failure specific errors	Error Messages	See Recommendation M.3208.2.

#### 6.6.7.1 Processing Failure Specific Errors

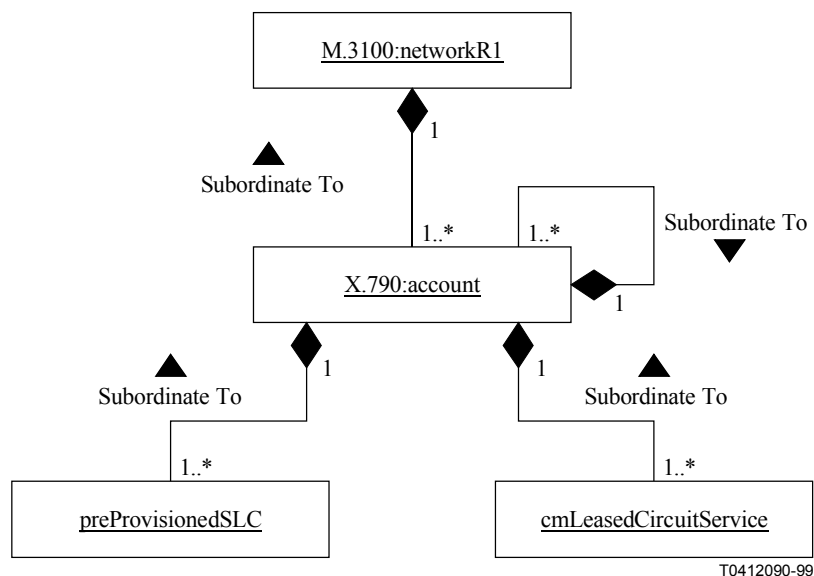
The following processing failure specific error is defined for this function:

- a) Requested loopback not supported or loopback not set.

### 6.7 Support for Security Requirements

The security services provided by the Security Transformations Application Service Element for ROSE (STASE-ROSE) will be used as the basis for meeting the security requirements stated in clause 6/M.3208.2. STASE-ROSE resides between ROSE and the OSI Presentation Layer. It provides security services for ROSE PDUs within the Application Layer and is independent of the

lower layer communications protocols. Specifically, the default STASE-ROSE security algorithms and security mechanism shall be used in Connection Management.



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**Figure 4/M.3108.2 – Naming tree**

## 6.8 Naming Tree and Pointer Relationships

Figure 4 contains the CM naming tree. This naming tree is based on logical containment, e.g. preProvisionedSLC MOIs are contained within an account MOI.

The networkR1 MOI in Figure 4 represents the service provider's network. A globally unique name can be achieved by treating network as a local root and using the X.500 (Country, Organization, etc.) naming structure above network.

## 7 Formal Model Specifications for Connection Management

### 7.1 Managed Object Class Definitions

#### 7.1.1 cmLeasedCircuitService

cmLeasedCircuitService MANAGED OBJECT CLASS

DERIVED FROM "Rec. M.3108.1": transportService ;

CHARACTERIZED BY

"Rec. M.3108.1": aliasNamePackage,

-- This package is optional in M.3108.1 but mandatory in this

-- Recommendation

"Rec. X.721 | ISO/IEC 10165-2": duration,

cmLeasedCircuitServicePkg PACKAGE

## BEHAVIOUR

cmLeasedCircuitServiceBehaviour BEHAVIOUR

DEFINED AS

"See Subclause The cmLeasedCircuitService MOC" ;;

## ATTRIBUTES

"X.721": availabilityStatus	GET,
listOfSLCsUsed	GET SET-BY-CREATE,
"Rec. M.3108.1": originatingLocationCPE	GET SET-BY-CREATE,
"Rec. M.3108.1": originatingLocationSap	GET SET-BY-CREATE,
restrictionsOnSLC	GET SET-BY-CREATE,
selectionPriority	GET-REPLACE ,
"Rec. M.3108.1": terminatingLocationCPE	GET SET-BY-CREATE,
"Rec. M.3108.1": terminatingLocationSap	GET SET-BY-CREATE ,
"Rec. X.721": usageState	GET;;;

REGISTERED AS {m3108Part2ObjectClass 1} ;

### 7.1.2 preProvisionedSLC

preProvisionedSLC MANAGED OBJECT CLASS

DERIVED FROM "Rec. M.3108.1": transportService ;

CHARACTERIZED BY

preProvisionedSLCPkg PACKAGE

## BEHAVIOUR

preProvisionedSLCPBehaviour BEHAVIOUR

DEFINED AS

"See Subclause The preProvisionedSLC MOC" ;;

## ATTRIBUTES

dedicatedOrShared	GET ,
leasedCircuitServicePtrList	GET-REPLACE ,
loopbackControl	GET-REPLACE ,
"Rec. M.3100": protected	GET ,
slcEnds	GET ,
"Rec. X.721": usageState	GET ;;;

REGISTERED AS {m3108Part2ObjectClass 2} ;

## 7.2 Package Definitions

No packages are defined in this ITU-T Recommendation.

### **7.3 Parameter Definitions**

#### **7.3.1 createCmLeasedCircuitServiceError**

createCmLeasedCircuitServiceError PARAMETER

CONTEXT SPECIFIC-ERROR ;

WITH SYNTAX M3108Part2ASN1Module.CreateCmLeasedCircuitServiceError ;

BEHAVIOUR

createCmLeasedCircuitServiceErrorBehaviour BEHAVIOUR

DEFINED AS

" See Subclause Processing Failure Specific Errorsfor details." ;;

REGISTERED AS {m3108Part2Parameter 1 } ;

#### **7.3.2 deleteCmLeasedCircuitServiceError**

deleteCmLeasedCircuitServiceError PARAMETER

CONTEXT SPECIFIC-ERROR ;

WITH SYNTAX M3108Part2ASN1Module.DeleteCmLeasedCircuitServiceError ;

BEHAVIOUR

deleteCmLeasedCircuitServiceErrorBehaviour BEHAVIOUR

DEFINED AS

" See Subclause Processing Failure Specific Errorsfor details. " ;;

REGISTERED AS {m3108Part2Parameter 2 } ;

#### **7.3.3 identifyLockedLCSError**

identifyLockedLCSError PARAMETER

CONTEXT SPECIFIC-ERROR ;

WITH SYNTAX M3108Part2ASN1Module.IdentifyLockedLCSError;

BEHAVIOUR

identifyLockedLCSErrorBehaviour BEHAVIOUR

DEFINED AS

" See Subclause Processing Failure Specific Errorsfor details." ;;

REGISTERED AS {m3108Part2Parameter 3 } ;

#### **7.3.4 initiateLoopbackError**

initiateLoopbackError PARAMETER

CONTEXT SPECIFIC-ERROR ;

WITH SYNTAX M3108Part2ASN1Module.InitiateLoopbackError;

BEHAVIOUR

initiateLoopbackErrorBehaviour BEHAVIOUR

DEFINED AS

" See Subclause Processing Failure Specific Errorsfor details." ;;

REGISTERED AS {m3108Part2Parameter 4 } ;

### **7.3.5 modifyLCSError**

modifyLCSError PARAMETER

CONTEXT SPECIFIC-ERROR ;

WITH SYNTAX M3108Part2ASN1Module.ModifyLCSError;

BEHAVIOUR

modifyLCSErrorBehaviour BEHAVIOUR

DEFINED AS

" See Subclause Processing Failure Specific Errorsfor details." ;;

REGISTERED AS {m3108Part2Parameter 5 } ;

### **7.3.6 terminateLoopbackError**

terminateLoopbackError PARAMETER

CONTEXT SPECIFIC-ERROR ;

WITH SYNTAX M3108Part2ASN1Module.TerminateLoopbackError;

BEHAVIOUR

terminateLoopbackErrorBehaviour BEHAVIOUR

DEFINED AS

" See Subclause Processing Failure Specific Errors for details." ;;

REGISTERED AS {m3108Part2Parameter 6 } ;

## **7.4 Name Binding Definitions**

### **7.4.1 cmLeasedCircuitService-account**

cmLeasedCircuitService-account NAME BINDING

SUBORDINATE OBJECT CLASS cmLeasedCircuitService AND SUBCLASSES;

NAMED BY

SUPERIOR OBJECT CLASS "X.790": account AND SUBCLASSES;

WITH ATTRIBUTE "X.790": serviceID ;

CREATE WITH-AUTOMATIC-INSTANCE-NAMING

createCmLeasedCircuitServiceError ;

DELETE deleteCmLeasedCircuitServiceError ;

REGISTERED AS {m3108Part2NameBinding 1 } ;



#### **7.4.2 preProvisionedSLC-account**

preProvisionedSLC-account NAME BINDING

SUBORDINATE OBJECT CLASS preProvisionedSLC AND SUBCLASSES;  
NAMED BY

SUPERIOR OBJECT CLASS "X.790": account AND SUBCLASSES;

WITH ATTRIBUTE "X.790": serviceID ;

REGISTERED AS {m3108Part2NameBinding 2 } ;

#### **7.5 Attribute Definitions**

##### **7.5.1 dedicatedOrShared**

dedicatedOrShared ATTRIBUTE

WITH ATTRIBUTE SYNTAX M3108Part2ASN1Module.DedicatedOrShared ;  
MATCHES FOR EQUALITY ;

BEHAVIOUR

dedicatedOrSharedBehaviour BEHAVIOUR

DEFINED AS

"See Subclause dedicatedOrShared." ;;

REGISTERED AS {m3108Part2Attribute 1 } ;

##### **7.5.2 leasedCircuitServicePtrList**

leasedCircuitServicePtrList ATTRIBUTE

WITH ATTRIBUTE SYNTAX  
M3108Part2ASN1Module.L leasedCircuitServicePtrList ;

MATCHES FOR EQUALITY ;

BEHAVIOUR

leasedCircuitServicePtrListBehaviour BEHAVIOUR

DEFINED AS

"See Subclause leasedCircuitServicePtrList" ;;

REGISTERED AS {m3108Part2Attribute 2 } ;

##### **7.5.3 listOfSLCsUsed**

listOfSLCsUsed ATTRIBUTE

WITH ATTRIBUTE SYNTAX M3108Part2ASN1Module.ListOfSLCsUsed ;

MATCHES FOR EQUALITY ;

BEHAVIOUR

listOfSLCsUsedBehaviour BEHAVIOUR

DEFINED AS

"See Subclause listOfSLCsUsed." ;;

REGISTERED AS {m3108Part2Attribute 3} ;

#### **7.5.4 loopbackControl**

loopbackControl ATTRIBUTE

WITH ATTRIBUTE SYNTAX M3108Part2ASN1Module.LoopbackControl ;

MATCHES FOR EQUALITY ;

BEHAVIOUR

loopbackControlBehaviour BEHAVIOUR

DEFINED AS

"See Subclause loopbackControl." ;;

REGISTERED AS {m3108Part2Attribute 4} ;

#### **7.5.5 restrictionsOnSLC**

restrictionsOnSLC ATTRIBUTE

WITH ATTRIBUTE SYNTAX M3108Part2ASN1Module.RestrictionsOnSLC ;

MATCHES FOR EQUALITY ;

BEHAVIOUR

restrictionsOnSLCBehaviour BEHAVIOUR

DEFINED AS

"See Subclause restrictionsOnSLC." ;;

REGISTERED AS {m3108Part2Attribute 5} ;

#### **7.5.6 selectionPriority**

selectionPriority ATTRIBUTE

WITH ATTRIBUTE SYNTAX M3108Part2ASN1Module.SelectionPriority ;

MATCHES FOR EQUALITY ;

BEHAVIOUR

selectionPriorityBehaviour BEHAVIOUR

DEFINED AS

"See Subclause selectionPriority." ;;

REGISTERED AS {m3108Part2Attribute 6} ;

### 7.5.7 slcEnds

slcEnds ATTRIBUTE

WITH ATTRIBUTE SYNTAX M3108Part2ASN1Module.SlcEnds ;

MATCHES FOR EQUALITY ;

BEHAVIOUR

slcEndsBehaviour BEHAVIOUR

DEFINED AS

"See Subclause slcEnds." ;;

REGISTERED AS {m3108Part2Attribute 7} ;

## 7.6 Behaviour definitions

No explicit behaviours are defined in this ITU-T Recommendation.

## 7.7 Action definitions

No actions are defined in this ITU-T Recommendation.

## 7.8 Notification definitions

### 7.8.1 Attribute Value Change

This notification is used to report attribute values changes in a MOI if defined in the MOC specification. It is defined in ITU-T Recommendation X.721.

### 7.8.2 Object Creation

This notification is used to report the creation of an MOI if defined in the MOC specification. It is defined in ITU-T Recommendation X.721.

### 7.8.3 Object Deletion

This notification is used to report the deletion of an MOI if defined in the MOC specification. It is defined in ITU-T Recommendation X.721.

## 7.9 Extensibility Rules

In accordance with Amendment 1 of ITU-T Rec. X.680 | ISO/IEC 8824-1 on extensibility rules, the productions that are extensible types are indicated by including the symbols enclosed in parentheses in their type descriptions, "...".

The following types will be indicated as being extensible:

- cc) ENUMERATED,
- dd) named INTEGER,
- ee) named BIT STRING,
- ff) SET,
- gg) SEQUENCE,
- hh) CHOICE.

Under the rules of extensibility, new enumerations (for ENUMERATED types), new bit name assignments (for named BIT STRING types), new named numbers (for named INTEGER types),

and new elements (for SET, SEQUENCE, and CHOICE types) may be added in future versions of this ITU-T Recommendation.

When processing information in a System Management Application Protocol (SMAP) PDU, the accepting SMAP-machine shall issue RORJapdu (corresponding to the service RO-REJECT-U) with "mistypedResult" parameter for the following conditions:

- ii) enumerations not recognized;
- jj) unrecognized named numbers;
- kk) unrecognized named bits;
- ll) unrecognized tagged elements of sets, sequences, and choices.

## 7.10 Supporting Productions

```
M3108Part2ASN1Module {itu-t recommendation m lcs(3108) connectionManagement(2)
informationModel(0) asn1Modules(2) asn1DefinedTypesModule(0)}
```

```
DEFINITION IMPLICIT TAGS ::= BEGIN
```

```
-- EXPORTS Everything
```

```
IMPORTS
```

```
    ObjectInstance
```

```
    FROM CMIP-1 {joint-iso-itu-t(2) ms(9) cmip(1) modules(0) protocol(3)}
```

```
; -- IMPORTS End
```

```
-- Begin Registration Values
```

```
m3108Part2Identifier OBJECT IDENTIFIER ::= {itu-t recommendation m lcs(3108)
connectionManagement(2) informationModel(0) asn1Modules(2)asn1DefinedTypesModule(0)}
```

```
m3108Part2ObjectClass OBJECT IDENTIFIER::= { m3108Part2Identifier objectClass(3)}
```

```
m3108Part2Parameter OBJECT IDENTIFIER::= { m3108Part2Identifier parameter(4)}
```

```
m3108Part2NameBinding OBJECT IDENTIFIER::= { m3108Part2Identifier nameBinding(5)}
```

```
m3108Part2Attribute OBJECT IDENTIFIER::= { m3108Part2Identifier attribute(6)}
```

```
-- End Registration Values
```

```

CreateCmLeasedCircuitServiceError ::= ENUMERATED {
    contractViolation          (0),
    dedicatedResourceUnavailable (1),
    incompatibleSLCs          (2),
    invalidSchedule            (3),
    invalidServiceTerminationDate (4),
    invalidValue                (5),
    nonExistentSAP             (6),
    quantitySpecifiedOutOfRange (7),
    requestedBandwidthNotAvailable (8),
    requiredParameterNotAvailable (9),
    sharedResourcesUnavailable (10),
    specifiedLCSAlreadyExists (11),
    unknownServiceDescription (12),
    unknownServiceType         (13),
    ...
}

```

```

DedicatedOrShared ::= ENUMERATED {
    dedicated (1),
    shared (2),
    ...
}

```

```

DeleteCmLeasedCircuitServiceError ::= ENUMERATED {
    alreadyDeleted          (0),
    contractViolation        (1),
    invalidCircuitNumber     (2),
    unlockedAdministrativeState (3),
    ...
}

```

```

InitiateLoopbackError ::= ENUMERATED {
    unavailableLCS          (1),
    offDutyLCS              (2),
    loopbackNotSupported    (3),
    ...
}

```

```

IdentifyLockedLCSError ::= ENUMERATED {
    administrativeStateUnlocked      (0),
    nonExistentSAP                   (1),
    unknownServiceType               (2),
    ...
}

```

```

LeasedCircuitServicePtrList ::= SEQUENCE OF ObjectInstance

```

```

LinkEndCharacteristics ::= SEQUENCE {
    endID                [0] GraphicString,
    loopbackSupported    [1] Boolean,
    ...
}

```

```

ListOfSLCsUsed ::= SEQUENCE OF {
    preProvisionedSLCPtr    ObjectInstance
}

```

```

LoopbackControl ::= SEQUENCE {
    status                [0] ENUMERATED {
        noLoopback        (0),
        endALoopedBack    (1),
        endBLoopedBack    (2)
    }
    terminationTime       [1] UTCTime,
    ...
}

```

```

ModifyLCSError ::= ENUMERATED {
    contractViolation      (0),
    invalidAliasName       (1),
    invalidCircuitNumber   (2),
    invalidCPEType         (3),
    invalidSchedule        (4),
    invalidServiceTerminationDate (5),
    invalidValue           (6),
    requestedBandwidthNotAvailable (7),
}

```

```

        resourceUnavailable      (8),
        scheduleConflicts        (9),
        ...
    }

```

```

RestrictionsOnSLC ::= SEQUENCE {
    restrictionId      [0] ENUMERATED {
        noRestrictions      (1),
        protectedSLCsOnly   (2),
        protectedDedicatedSLCsOnly (3),
        dedicatedSLCsOnlyWithProtectedSLCsPreferred (4),
        dedicatedSLCsPreferredProtectedSLCsRequired (5),
        dedicatedProtectedSLCsPreferred (6),
        ...
    },
    restrictionText    [1] GraphicString OPTIONAL,
    ...
}

```

```

SelectionPriority ::= INTEGER(1..10)

```

```

SlcEnds ::= SEQUENCE {
    endA      [0] LinkEndCharacteristics,
    endB      [1] LinkEndCharacteristics
}

```

```

TerminateLoopbackError ::= ENUMERATED {
    loopbackNotSet      (0),
    loopbackNotSupported (1),
    ...
}

```

END

## 8 Application Service Elements and Application Context

The System Management application context defined in ITU-T Rec. X.701| ISO/IEC 10040 may be used.

## 9 Functional Units

The functional units defined in ITU-T Recommendations X.730 and X.731 are required. No new functional units are required by this ITU-T Recommendation.

## 10 Conformance

An implementation claiming to conform to this model shall comply with the requirements as defined in the following subclauses.

This ITU-T Recommendation does not include tables for conformance statements in this version. These are expected to be included in the future.

### 10.1 Static Conformance

A system claiming conformance to this ITU-T Recommendation shall:

- mm) Support the role of manager or agent or both, with respect to the Functional Units defined or referenced in this ITU-T Recommendation, see clause Functional Units.
- nn) Support the transfer syntax derived from the encoding rules specified in Recommendation X.690 and named {joint-iso-itu-t asn(1) basicEncoding(1)}, for the purpose of generating and/or interpreting the MAPDUs defined by the abstract data types defined in this ITU-T Recommendation for the role supported in a) above.
- oo) Support the Functional Units referenced in clause Functional Units.
- pp) Support the conformance requirements specified in Q.812 CMIP profile.

### 10.2 Dynamic Conformance

The system shall, in the role(s) and for the functional units for which conformance is claimed,

- qq) Support the elements of procedure defined in:
  - 1) CCITT Recommendation X.730 for the PT-GET service,
  - 2) CCITT Rec. X.730 | ISO/IEC 10164-1 for the object creation reporting and object deletion reporting, if the create delete notifications are defined for the objects supported,
  - 3) CCITT Rec. X.730 | ISO/IEC 10164-1 for the attribute value change reporting service if the attribute value change notification is defined for the objects supported.
- rr) Support the procedures for all services defined in this ITU-T Recommendation.

## APPENDIX I

### Attribute Mapping Table

For each attribute use in this ITU-T Recommendation, Table I.1 indicates if the attribute is defined, imported, or inherited. For attributes inherited from M.3108.1: transportService, the table also indicates if the attributes are defined in M.3108.1 or imported.



**Table I.1/M.3108.2 – Attribute mapping table**

preProvisionedSLC – Subclause	cmLeasedCircuitService – Subclause	Attributes	Specified in M.3108.2				Inherited from M.3108.1	
			Defined	Imported			Defined	Imported
			In M.3108.2	From M.3100	From M.3108.1	From X.721	In M.3108.1	Various sources
6.4.1.1	6.4.2.1	administrativeState						X
	6.4.2.2	aliasName						X
	6.4.2.3	availabilityStatus				X		
6.4.1.2	6.4.2.4	bandwidth					X	
6.4.1.3		dedicatedOrShared	X					
6.4.1.4		leasedCircuitServicePtrList	X					
	6.4.2.5	listOfSLCsUsed	X					
6.4.1.5		loopbackControl	X					
6.4.1.6	6.4.2.6	operationalState						X
	6.4.2.7	originatingLocationCPE			X			
	6.4.2.8	originatingLocationSap			X			
6.4.1.7		protected		X				
	6.4.2.9	restrictionsOnSLC	X					
	6.4.2.10	scheduleAttributes (1)						X
	6.4.2.11	selectionPriority	X					
6.4.1.8	6.4.2.12	serviceCustomerContact					X	
6.4.1.9	6.4.2.13	serviceID						X
6.4.1.10	6.4.2.14	serviceProviderContact					X	
6.4.1.11	6.4.2.15	serviceTerminationDate					X	
6.4.1.12		slcEnds	X					
	6.4.2.16	startTime				X		
	6.4.2.17	stopTime				X		
	6.4.2.18	terminatingLocationCPE			X			
	6.4.2.19	terminatingLocationSap			X			
6.4.1.13	6.4.2.20	usageState				X		

## APPENDIX II

### UML Diagrams

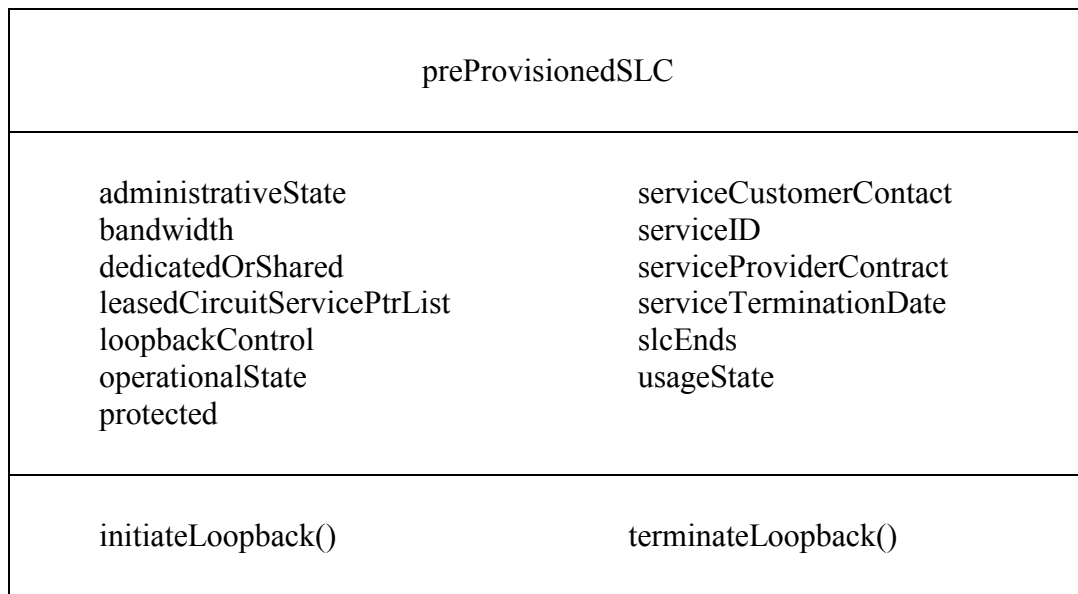
#### II.1 Introduction

This appendix contains selected Unified Modelling Language (UML) diagrams that provide a graphic representation of M.3208.2 functions supported by this ITU-T Recommendation.

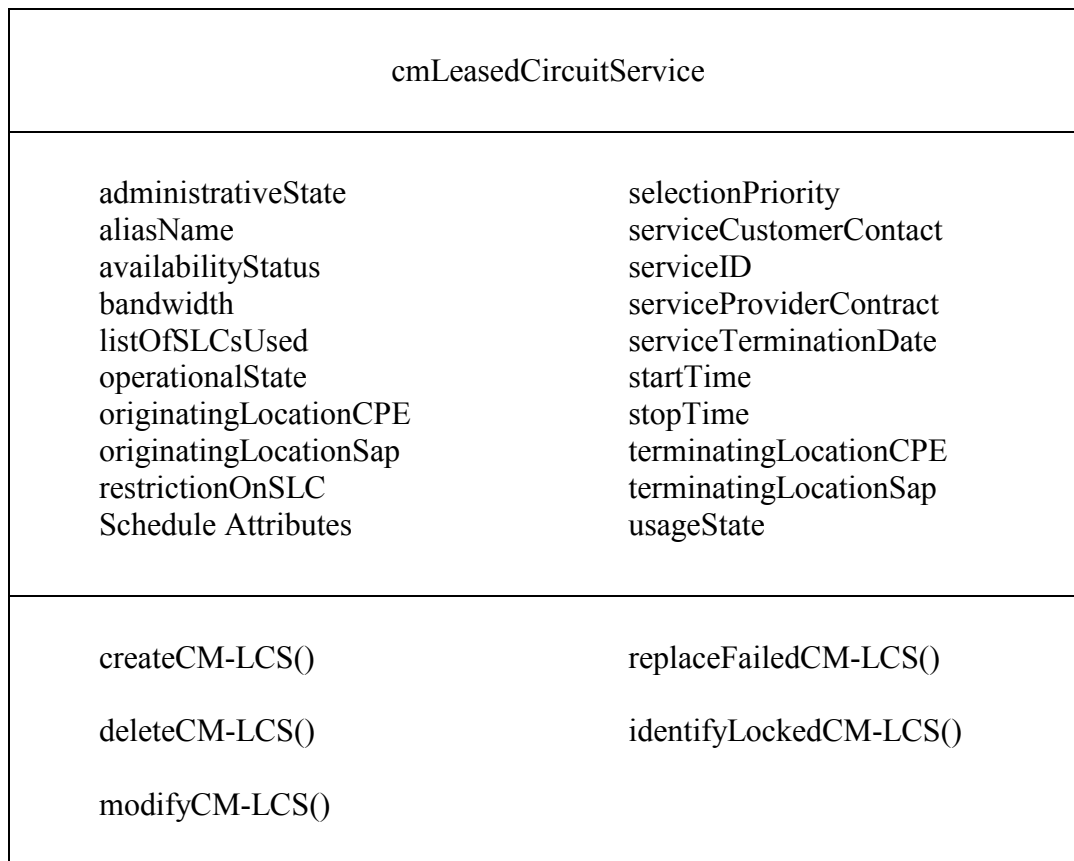
#### II.2 Class diagrams

This subclause contains UML class diagrams for the `preProvisionedSLC` and the `cmLeasedCircuitService` MOCs defined in this ITU-T Recommendation. Note that the UML convention of capitalizing the first letter of class names is not followed in this appendix.

See Figures II.1 and II.2.



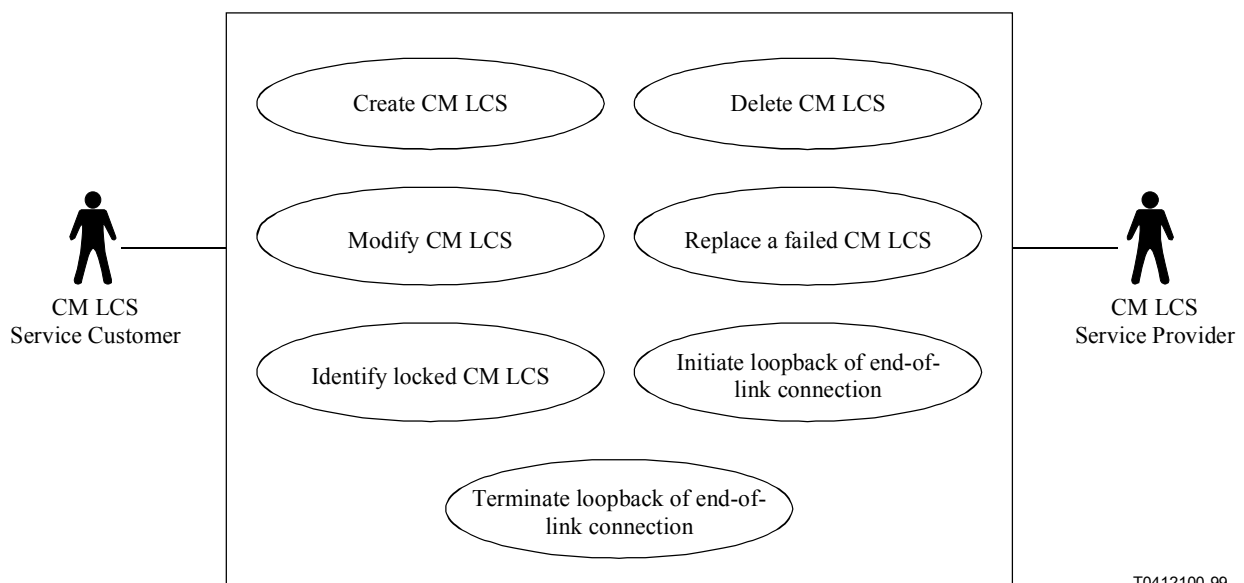
**Figure II.1/M.3108.2 – UML diagram for the `preProvisionedSLC` class**



**Figure II.2/M.3108.2 – UML diagram for the cmLeasedCircuitService class**

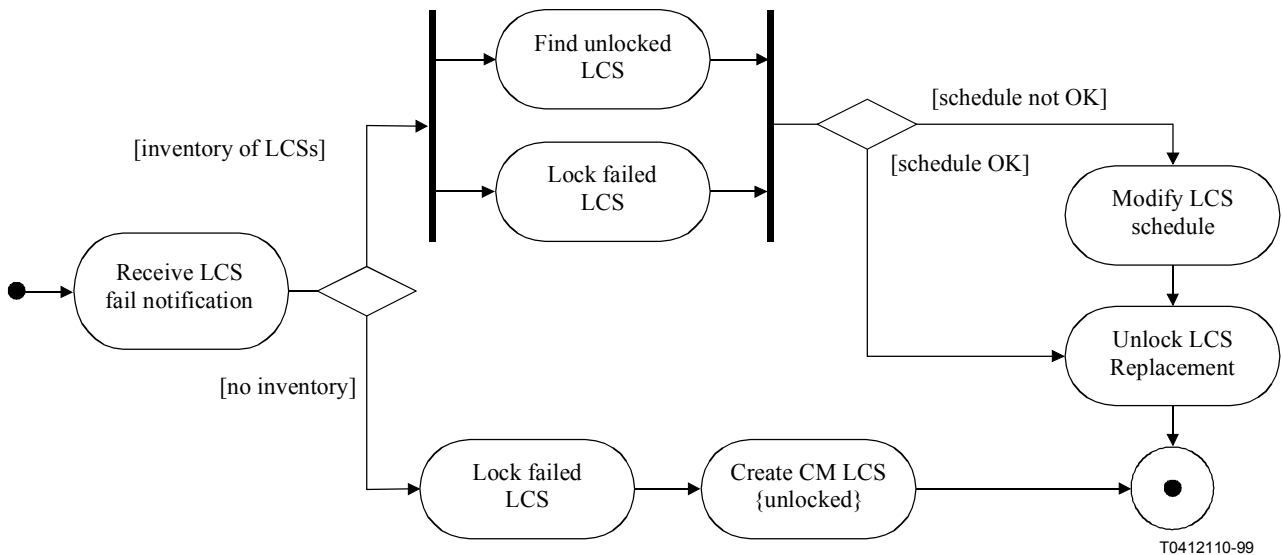
### II.3 Use cases

Figure II.3 depicts use cases for those functions defined or specialized in ITU-T Recommendation M.3208.2 and supported in this ITU-T Recommendation. See ITU-T Recommendation M.3208.1 for the specification of additional leased circuit management functions and ITU-T Recommendation M.3108.1 for additional use cases.



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**Figure II.3/M.3108.2 – Simplified diagram of use cases supported**



**Figure II.4/M.3108.2 – Activity diagram**

## II.4 Activity diagram

Figure II.4 contains an activity diagram for the Replace-a-failed-CM-LCS use case. Two conditions are included in this diagram. The first condition distinguishes between LCSs with and without an inventory of predefined, locked, replacement LCSs. The second condition illustrates the possible need to modify the schedule of the replacement LCS before it is unlocked.

## II.5 Sequence diagrams

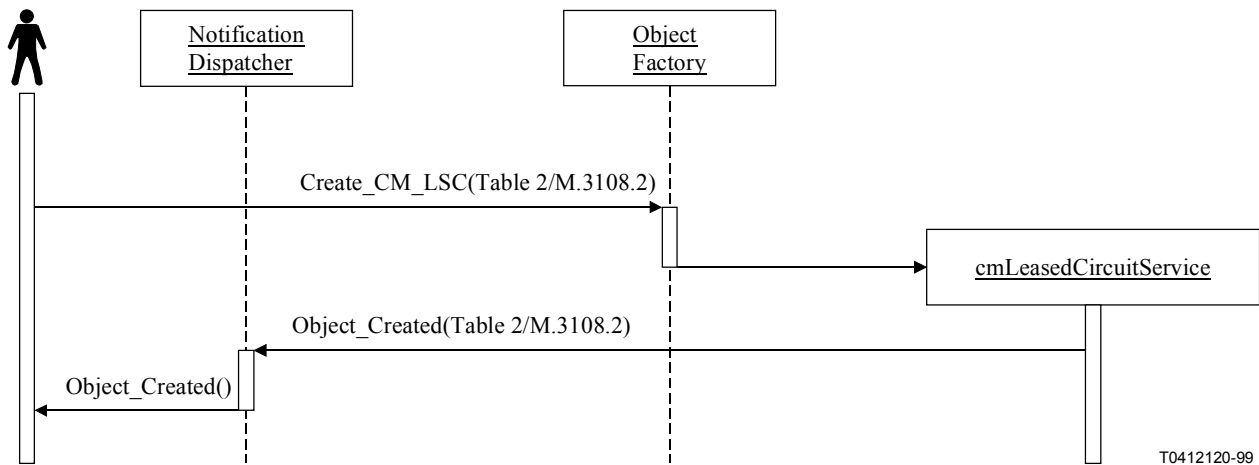
The sequence diagrams in this subclause contain references to instances of the objectFactory and the notificationDispatcher MOCs. These MOCs are defined in III.4, Appendix III, of ITU-T Recommendation M.3108.1. They are used in this appendix to represent the high level functionality of the MOIs. Additional operations that are unique to CM must be added to these classes for use with CM.

Figure II.10 contains a reference to an LCS Manager object. The LCS Manager class is not defined in this appendix. The need herein is for an object to provide scope and filtering functions to respond to the request to identity locked LCSs. Additional LCS Manager details are not considered relevant to this appendix.

### II.5.1 Successful creation of a cmLeasedCircuitService Object

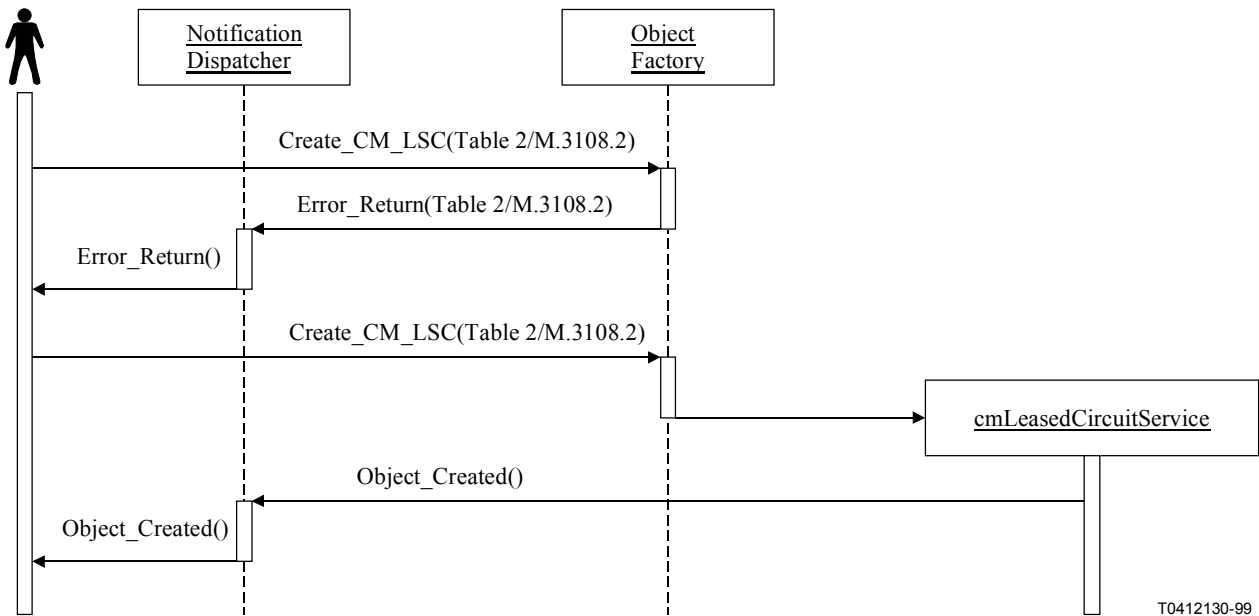
Figure II.5 illustrates the successful creation of a cmLeasedCircuitService Object. As noted in the figure, Table 2 contains the required and optional arguments for the creation and the response operations. See Figure II.5.

CM LCS SC

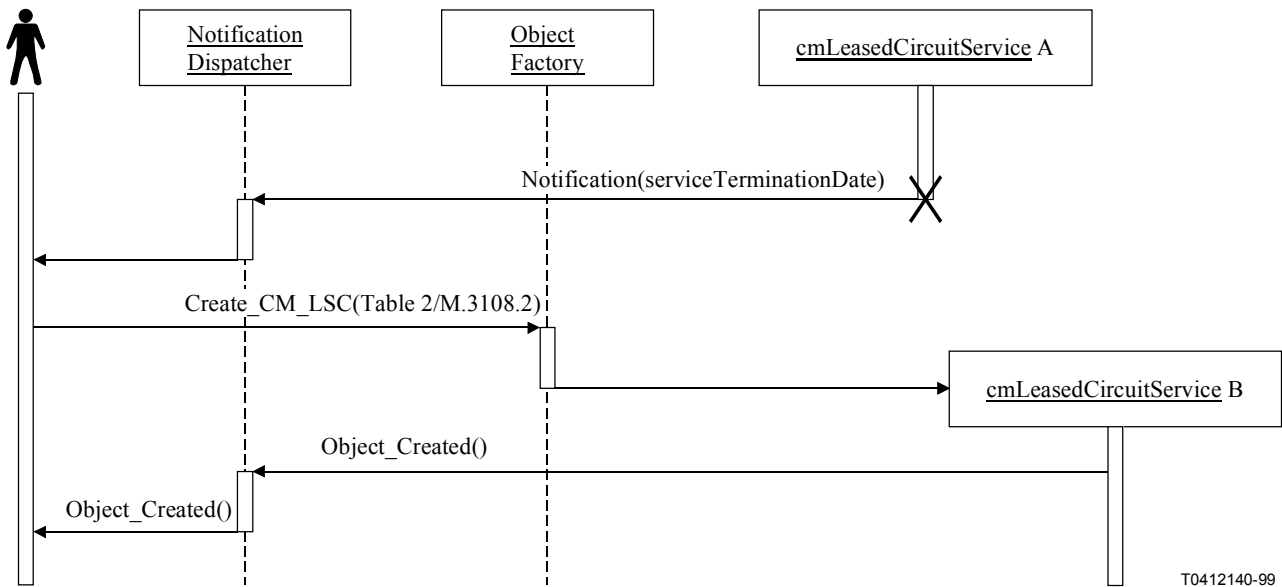


**Figure II.5/M.3108.2 – Successful creation of a cmLeasedCircuitService object**

CM LCS SC



**Figure II.6/M.3108.2 – Failure followed by successful creation**



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**Figure II.7/M.3108.2 – Automatic termination and creation**

### II.5.2 Failure and successful creation of a cmLeasedCircuitService Object

Figure II.6 illustrates the case where the initial request to create a cmLeasedCircuitService object failed due to processing specific errors. See subclause Processing Failure Specific Errors for a discussion of these errors. After the initial failure is relayed to the SC, the SC corrects the errors and successfully creates the cmLeasedCircuitService object.

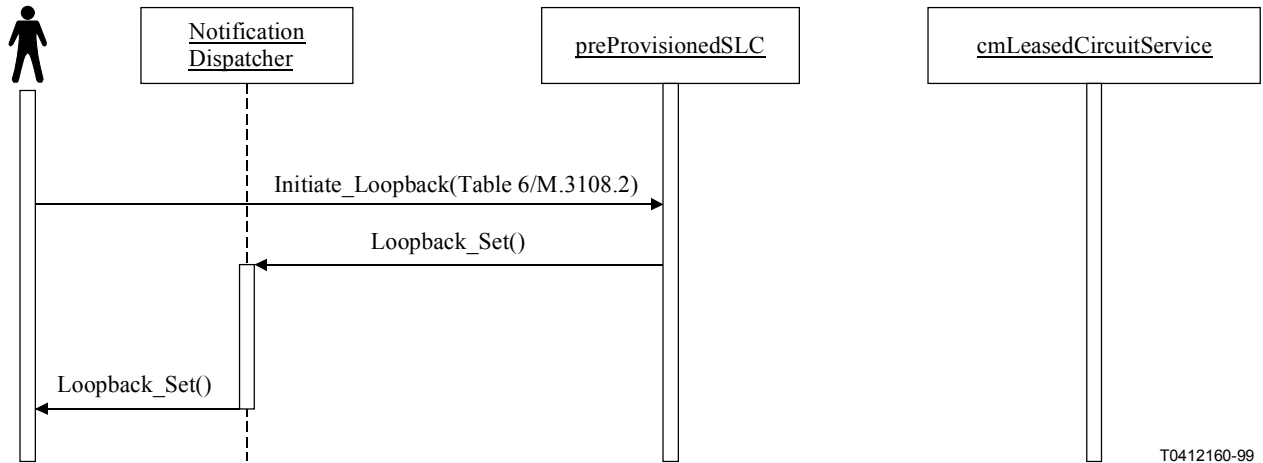
### II.5.3 Automatic termination followed by a cmLeasedCircuitService Creation

The example in Figure II.7 illustrates the automatic termination of cmLeasedCircuitService object A due to the expiration of its service termination date. This event is communicated to the SC. It is further assumed that some of the SLCs used in LCS A are also to be used in LCS B. However, a schedule conflict between LCSs A and B implies that LCS B could not be created as long as LCS A exists.

### II.5.4 Successful Initiation of Loopback

Figure II.8 illustrates the successful creation of a loopback of a specified preProvisionedSLC. Note that the SLC represented by the preProvisionedSLC object is assumed to be assigned to an unlocked LCS. Additionally, note that there are no messages passed between the looped back SLC and the LCS that is using it.

CM LCS SC



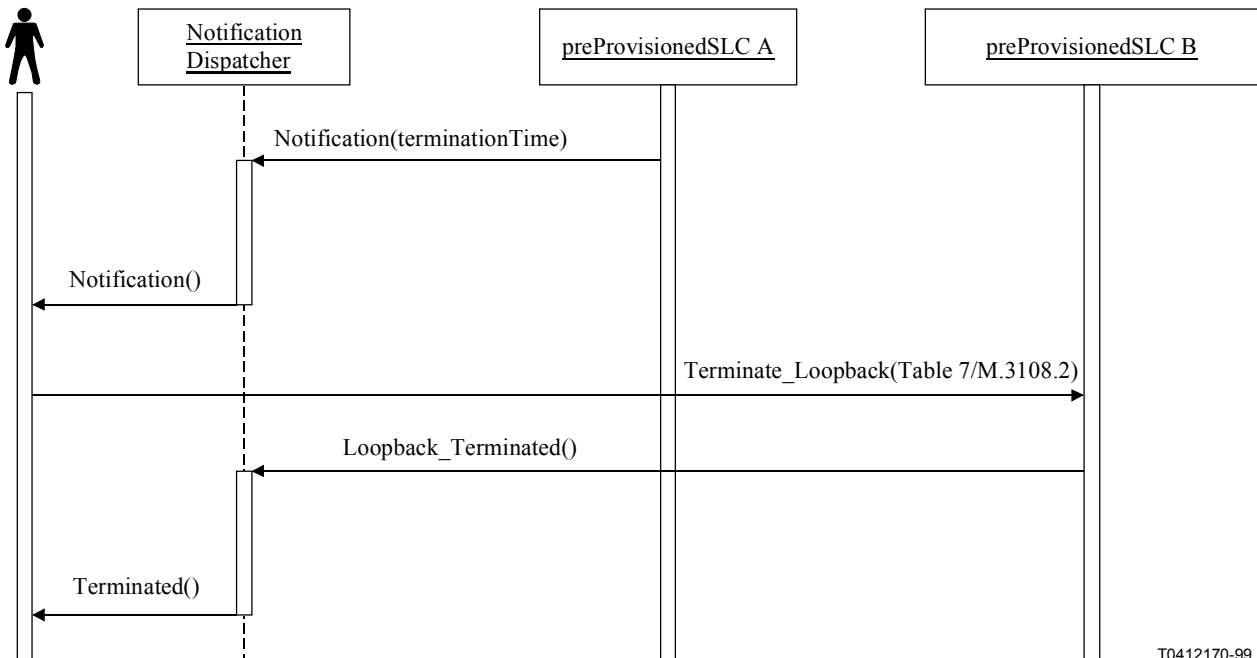
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**Figure II.8/M.3108.2 – Successful loopback**

### II.5.5 Termination of Loopback

Figure II.9 illustrates two of the possible ways that a loopback can be terminated. The first is the expiration of the loopback termination time. The second is by an explicit request from the SC to terminate the loopback. Loopbacks can also be terminated by the transition of the LCS containing the looped back SLC from an on-duty status to an off-duty status. This possibility is not illustrated.

CM LCS SC

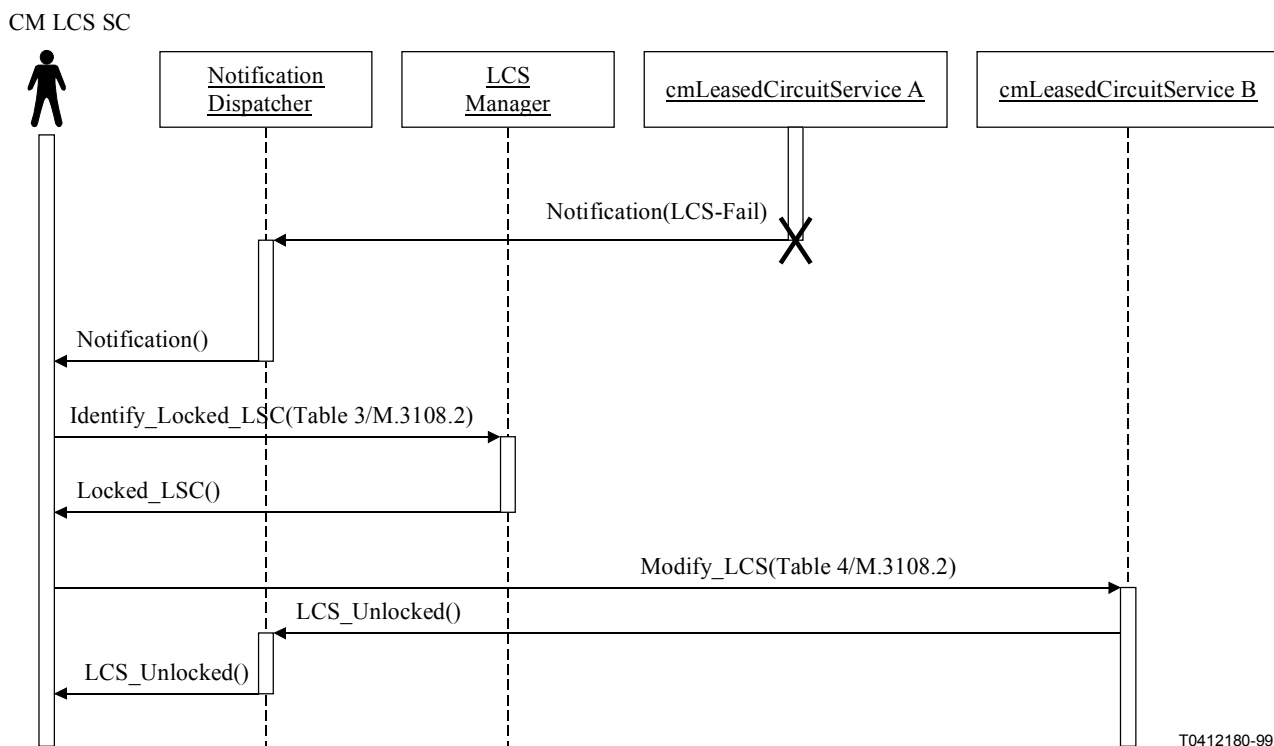


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**Figure II.9/M.3108.2 – Termination of loopback**

## II.5.6 Failure and replacement of a SLC

Figure II.10 illustrates the failure of a SLC followed by the replacement of the failed SLC with a predefined, locked SLC.



**Figure II.10/M.3108.2 – Failure and replacement of an SLC**



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