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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: Virtual private network service

ITU-T Recommendation M.3208.3

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ITU-T Recommendation M.3208.3

**TMN management services for dedicated and reconfigurable circuits network:
Virtual private network service**

Summary

This ITU-T Recommendation is one of the series of M.3200 TMN management service Recommendations that provides descriptions of management services, goals and context for the Dedicated and Reconfigurable Circuits Network. Its main focus is on the Virtual Private Network (VPN) service management. This ITU-T Recommendation is based on ITU-T Recommendation M.3208.1 and adds new function sets to support the VPN services.

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.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

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

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**TMN management services for dedicated and reconfigurable circuits network:
Virtual private network service**

1   Scope

This ITU-T Recommendation describes a subset of TMN management services for Dedicated and Reconfigurable Circuits network identified in ITU-T Recommendation M.3200 as a TMN managed area. Its main focus is on the VPN service management. These management services may also be applicable for interactions between management systems of different service providers or within a service provider.

TMN management services in this ITU-T Recommendation specify interface requirements between operation systems (OS) to perform customer network management of VPN service. The interfaces addressed by the TMN management services in this ITU-T Recommendation are applicable to both the X interface and the Q3 interface. Support for the services described in this ITU-T Recommendation are at the discretion of the Service Provider.

The TMN management services in this ITU-T Recommendation are described using the GDMS template contained in ITU-T Recommendation M.3020 and build on the management services defined in ITU-T Recommendations M.3208.1 and M.3208.2.

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 M.3010 (2000), *Principles for a Telecommunications Management Network.*

–   ITU-T Recommendation M.3020 (2000), *TMN Interface Specification Methodology.*

–   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 pre-provisioned service link connections to form a leased circuit 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 G.805 (2000), *Generic functional architecture of transport networks.*

3 Definitions

3.1 Service related definitions

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

– layer network;

– leased circuit service;

– network operator;

– reconfigurable leased circuit service;

– service access group;

– service access point;

– service characteristic;

– service customer;

– service provider;

– contract.

3.2 This ITU-T Recommendation defines the following terms:

3.2.1 virtual private network: A Virtual Private Network is a collection of service access groups that form a private network for reconfigurable leased circuit services. Any service access point can be connected to any other service access point in the Virtual Private Network.

NOTE – For the purpose of this ITU-T Recommendation, loopback within a service access group is undefined.

3.2.2 VPN service: A VPN service is a telecommunications service that provides for the transmission of information between two or more service access points in a layer network. These service access points are connected by the VPN leased circuits and included in the service access groups that compose the VPN.

3.3 Role related definitions

This ITU-T Recommendation makes use of the following roles defined in ITU-T Recommendation M.3208.1:

– service customer;

– service provider.

4 Abbreviations

This ITU-T Recommendation uses the following abbreviations:

ATM   Asynchronous Transfer Mode

GDMS   Guidelines for the Definition of TMN Management Services

LCS   Leased Circuit Services

NE   Network Element

NML   Network Management Layer

SAD   Service Access Domain

SAG   Service Access Group

SAP   Service Access Point

SC	Service Customer
SML	Service Management Layer
SP	Service Provider
TMN	Telecommunications Management Network
VPN	Virtual Private Network

5 Conventions used in this ITU-T Recommendation

Legend for the tables:

m	Mandatory.
m(=)	The SP must provide the same value in the response as provided in the request by the SC.
o	Optional, subject to definition according to the Service Level Agreement or Contract between the SC and SP, i.e. a parameter listed as optional may be made mandatory by the Contract.
o(=)	Return of the value by the SP is optional; however, if the SP elects to return the value, it must be the same value supplied by the SC in the request. SP is not allowed to alter this field.
c	Conditional parameter, definition of the condition will be specified in the notes column. A numeric suffix is used to enable reuse of the conditional statements.
c(=)	If the value is provided in the request by the SC, the SP must provide the same value in the response.
–	A dash implies that the parameter is not applicable.

6 VPN service security

The VPN service is defined between a single SC and SP. Several security services[1] are needed to assure the proper functioning of VPN management:

a) Peer entity authentication and data origin authentication are needed to prevent attacks and uniquely identify the SC.

b) Integrity is needed to prevent unauthorized modification of data in transit.

c) Access control is needed to assure that one Service Customer does not gain access, maliciously or accidentally, to other customers' data. The SP may use the authenticated identity of the SC to provide access control.

The following requirements are optional:

d) Confidentiality may be needed if private information is being exchanged. This security service may not be needed for all VPN management messages.

e) Non-repudiation of origin may be needed, e.g. when a SC requests a service that may cause the service provider to invest labour and/or materials. This security service may not be needed for all VPN management messages.

f) Non-repudiation of delivery may be needed, e.g. when a SC reports a problem. This security service may not be needed for all VPN management messages.

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[1] Note that a "service" in this context is not a management service. The term "security service" is used as in ITU-T Recommendation X.800.

In addition, security management functions, as per ITU-T Recommendation M.3400, are needed to manage the security-related information needed to support the security services described above. The exact nature of the security management functions depends on the selection of security mechanisms used to provide the security services. Security management is outside the scope of this ITU-T Recommendation.

7 Customer network management service

7.1 Management service description

This management service addresses the management interface between the SP domain and the SC domain. It is based on an abstract view of the resources underlying a particular service, a view that shields the service user from knowledge of the specific technical implementation that supports the service.

Management capabilities described by these management service enables customers to configure and to reconfigure their VPN services.

Possible interactions between TMN management roles are given in Figures 1/M.3208.1 and 2/M.3208.1.

7.2 Management Goals

The goal of this management service is to provide the SC with the capability to request, modify, or delete a VPN service. In addition, the SP is given a mechanism to keep the SC informed on the status of his/her VPN services.

7.2.1 High level service customer requirements for VPN service management

1) A TMN Service Management Layer X interface is required so that SCs can create VPN LCSs without a detailed knowledge of the SP's network elements and network topology.

2) The secure use of VPN service requires that unauthorized users cannot affect the management of VPN services.

7.2.2 Relationship with ITU-T Recommendations M.3208.1 and M.3208.2

The relationship with ITU-T Recommendations M.3208.1 and M.3208.2 includes the following concepts:

1) The service access domain configuration function set in ITU-T Recommendation M.3208.1 is modified for VPN configuration.

2) The VPN service configuration function set involves modifying VPN service (new function introduced in this ITU-T Recommendation).

3) Creating a VPN LCS is an instantaneous service. Consequently, there is no need for the concept of a service request, the associated state model and the status administration function set, nor the link connection status administration function set.

4) Every instance of a VPN LCS is an instance of a dedicated LCS for the period during which it is up.

5) As in ITU-T Recommendation M.3208.1, any access point may be connected to any other access point in the SCs VPN to form a VPN LCS. The loop back function is out scope of this ITU-T Recommendation.

7.3 Management context description

7.3.1 Roles

The following roles defined in ITU-T Recommendation M.3208.1 apply.

–   service customer;

–   service provider.

7.3.2 Telecommunications services and resources

The VPN management service is concerned with the management of VPN.
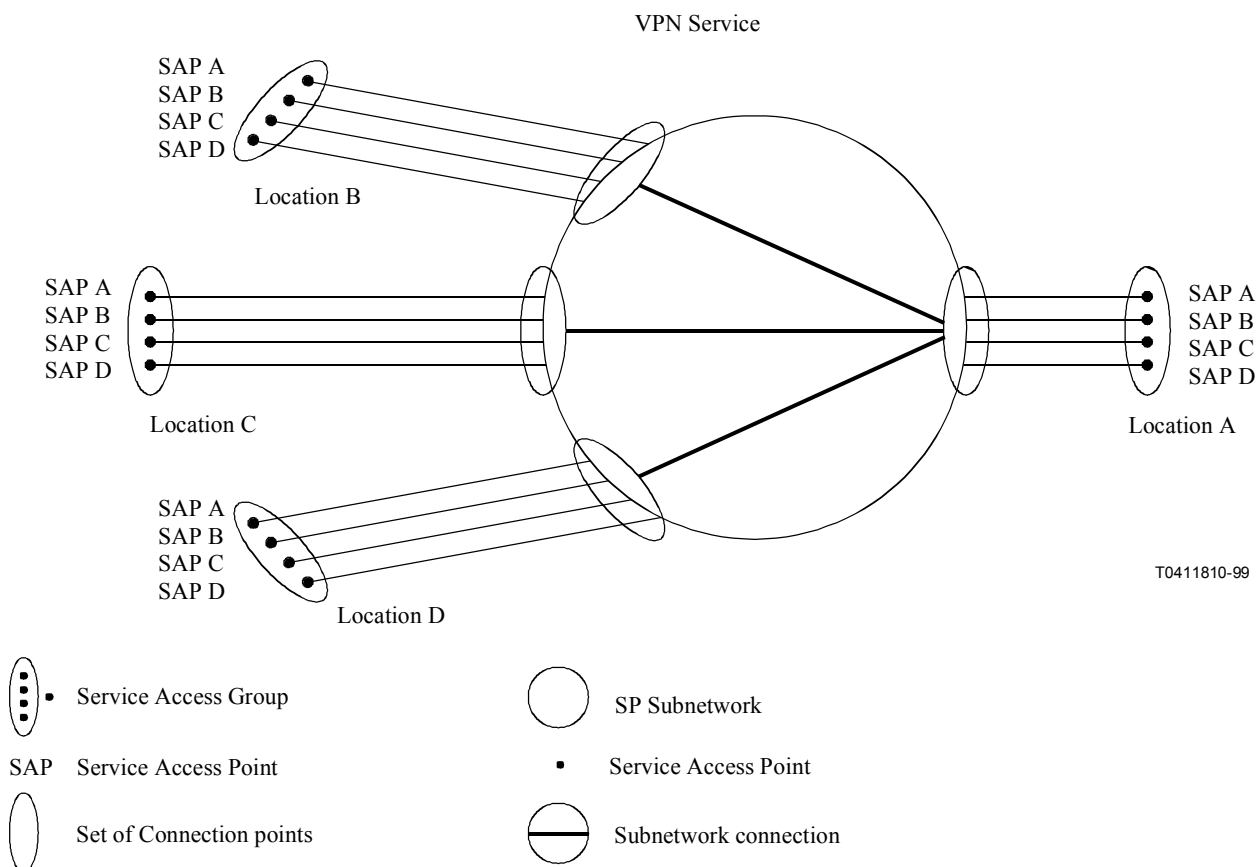
Figure 1/M.3208.3 – Example topology of the VPN service

Figure 1 illustrates an example topology of the VPN Service based on Figure 6/M.3208.1. A VPN service customer has 4 locations, A, B, C and D. The service access groups, shown as ellipses, at these four locations form a customer's VPN. The figure shows a VPN service consisting of the 4 Service Access Groups, each of which supports 4 individual service access points. The circle in the centre represents a sub-network. SAP A from Customer Location A is connected to SAP A at Customer Location B through a VPN leased circuit. SAP B from Customer Location A is connected to SAP B at Customer Location C through a VPN leased circuit and SAP C from Customer Location A is also connected to SAP D at Customer Location D through a VPN leased circuit.

7.3.3   Management functions

This subclause provides the configuration function set and administrative function set for VPN services.

Table 1 contains the management functions sets specified in ITU-T Recommendation M.3208.1 for the Customer Administration Management Service and indicates which function sets contain functions specialized in this ITU-T Recommendation.

Table 1/M.3208.3 – M.3208.1 function sets specialized in VPN service

M.3208.1 function sets	Function sets specialized in this ITU-T Recommendation[a]
Dedicated LCS Configuration Function Set	See 7.3.3.3
Dedicated LCS Status Administration Function Set	See 7.3.3.4
Link Connection Configuration Service Function Set	not used in this ITU-T Recommendation
Link Connection Status Administration Function Set	not used in this ITU-T Recommendation
Reconfigurable LCS Configuration Function Set	See 7.3.3.3
Reconfigurable LCS Function Set	not used in this ITU-T Recommendation
Service Access Domain Configuration Function Set	See 7.3.3.1 (Corresponding to item 1) in 7.2.2)
Reconfigurable LCS Administration Function Set	See 7.3.3.4
Access Equipment Status Administration Function Set	outside the scope of this ITU-T Recommendation
[a] Not all of the functions contained in the indicated function sets are specialized or required in this ITU-T Recommendation.	

In addition to the function sets specialized from ITU-T Recommendation M.3208.1, the following functions and function sets are used in this Recommendation.

Table 2/M.3208.3 – New function sets and functions

M.3208.1 function sets	Reference
Service Access Domain Configuration Function Set: Modify VPN service function	See 7.3.3.1.3
VPN service status administration Function Set: Report Creation of the VPN service to SC Report Deletion of the VPN service to SC Report configuration changes of the VPN service Retrieve the VPN service parameter by the service customer	See 7.3.3.2

In all following information flows that contain a SC and SP column, all implementations of the Recommendation must provide a means that enable the SP's response to be correlated with the appropriate SC's request by the SC's system.

7.3.3.1   VPN service configuration function set

The functions in this set are:

1)   create VPN service function;

2)   delete VPN service function;

3)   modify VPN service function;

4)   create service access group function;

5)   delete service access group function;

6)   add SAP to SAG function;

7)   remove SAP from SAG function.

7.3.3.1.1   Create VPN service function

This function is a based on the M.3208.1 Create Service Access Domain Function.

7.3.3.1.1.1 Summary

The purpose of this function is to enable the customer to create a named VPN, to which Service Access Groups and Service Access Points will be added to support the VPN Service.

7.3.3.1.1.2 Information flow

Information element	ITU-T Recommendation M.3208.1		This ITU-T Recommendation (M.3208.3)		Notes
	Service Customer	Service Provider	Service Customer	Service Provider	
Customer Contact	m		m	o(=)	The Customer contact name.
Alias Name	o		o	o(=)	Customer defined user-friendly name.
Service Class List	–	–	o	c	Service Class List to be supported by the VPN. NOTE – For VPN the Service Class is a multi-valued list containing all the service classes to be supported by the VPN. For Bearer Services, the Service Provider may return additional Service Classes contained within the Bearer Service. The service provider shall return as an error, a requested service which is unavailable with an appropriate probable cause. In the case of an error, the service provider shall return the subset of supported Service Classes and the VPN will be created with the list of returned service classes.
Service Class	o	o	–	–	Not used for VPN.
Service Name	m	o	–	–	Not used for VPN.
List of SAGs	o	o(=)	o	o(=)	
Provider Request Number		m	–	–	The Provider Request Number is not used as the VPN is created immediately.

Information element	ITU-T Recommendation M.3208.1		This ITU-T Recommendation (M.3208.3)		Notes
	Service Customer	Service Provider	Service Customer	Service Provider	
SP Contact		m		m	The Provider contact name in case of problems.
VPN Identifier	–	m	–	m	The VPN Identifier equals to the SAD Identifier defined in ITU-T Recommendation M.3208.1.
Error		c		c	This parameter is present if the request is rejected because of one or more of the following reasons (only one error cause may be returned by the SP): – Invalid Service Classes; – Duplicated VPN Identifier; – Invalid SAG.

7.3.3.1.2 Delete VPN service function

The purpose of this function is to enable the customer to delete a VPN service. This function is identical to M.3208.1 (Cor.1) "Delete Service Access Domain" function.

7.3.3.1.3 Modify VPN service function

7.3.3.1.3.1 Summary

The purpose of this function is to enable the customer to modify a VPN service.

7.3.3.1.3.2 Information Flow

Information element	Service Customer	Service Provider	Notes
Customer Contact	o	c(=)	The Customer contact name
Alias Name	o	c(=)	Customer defined user-friendly name.
Service Class List	o	c	The Service Class List to be added or deleted from the list of supported Service Classes for the VPN. For Bearer Services, the service provider may return additional service classes contained within the Bearer Service. For Bearer Services, the service provider must return a list of services contained within the Bearer Service. Before removing a service class, all LCSs of that Service Class must be in locked and idle state.
List of SAGs	o	o(=)	The SAGs can be added to or remove from VPN, to associate or dissociate the SAGs to the VPN.
VPN Identifier	m	o(=)	Identifier of the VPN Service.

Information element	Service Customer	Service Provider	Notes
Error		c	This parameter is present if the request is rejected because of one or more of the following reasons (only one error cause may be returned by the SP): – Invalid Service Classes; – SAG not in the list; – SAG is in use; – Invalid SAG; – Invalid VPN identifier.

7.3.3.1.4 Create service access group function

7.3.3.1.4.1 Summary

The purpose of this function is to enable the SC to create named Service Access Groups. This function is based on M.3208.1 "Create service access group" function.

7.3.3.1.4.2 Information flow

Information element	ITU-T Recommendation M.3208.1		This ITU-T Recommendation (M.3208.3)		Notes
	Service Customer	Service Provider	Service Customer	Service Provider	
Alias Name	o		o	o(=)	Customer defined user-friendly name.
Service Access Group Name	m		m		Name of Service Access Group.
VPN Identifier	o	o(=)	m	o(=)	The VPN identifier equals to the SAD Identifier defined in ITU-T Recommendation M.3208.1.
Service Administrative State	o	c	o	c	The state of the service access group. c – Must be returned if the state is different than the state requested by the SC.
SAG Location	m	c	m	c	c – must be returned when the location is invalid.
Error		c		c	c – This parameter is present if the request is rejected because of one or more of the following reasons (only one error cause may be returned by the SP): – Invalid SAG ID; – Invalid VPN identifier; – Invalid Location.

7.3.3.1.5 Delete service access group function

This function is identical to M.3208.1 "Delete service access group" function.

7.3.3.1.6 Add service access points to service access group function

This function is identical to M.3208.1 "Add service access points to service access group" function.

7.3.3.1.7 Remove service access points from service access group function

This function is identical to M.3208.1 "Remove service access points to service access group" function.

7.3.3.2 VPN service status administration function set

This function set includes functions that allow the service provider to inform the service customer of Service administrative functions and for the service customer to monitor administrative information related to the requested VPN service.

This function set contains the following functions:

1)   report deletion of VPN service;

2)   report creation of VPN service;

3)   report configuration changes of VPN service;

4)   retrieve VPN service parameters by the service customer.

7.3.3.2.1 Report deletion of VPN service to service customer function

7.3.3.2.1.1 Summary

This function is used to report the deletion of a VPN service to the service customer. This function is used in conjunction with the request to delete the service. Service customer may or may not acknowledge the report.

7.3.3.2.1.2 Information Flow

Information element	This ITU-T Recommendation (M.3208.3)	Notes
	Service Provider	
Customer Contact	o	The Customer contact name.
SP Contact	m	The Provider contact name in case of problems.
VPN Identifier	m	Identifier of the VPN Service

7.3.3.2.2 Report creation of VPN service to service customer function

7.3.3.2.2.1 Summary

This function is used to report the creation of a VPN service to the service customer. This function is used in conjunction with the request to create the service. Service customer may or may not acknowledge the report.

7.3.3.2.2 Information Flow

Information element	This ITU-T Recommendation (M.3208.3) Service Provider	Notes
Customer Contact	o	The Customer contact name.
Alias Name	o	Customer defined user-friendly name.
Service Class List	c	Service Class List to be supported by the VPN. NOTE – For VPN the Service Class is a multi-valued list containing all the service classes to be supported by the VPN. For Bearer Services, the Service Provider may return additional Service Classes contained within the Bearer Service. The service provider shall return as an error, a requested service which is unavailable with an appropriate probable cause. In the case of an error, the service provider shall return the subset of supported Service Classes and the VPN will be created with the list of returned service classes.
Service Name	–	Not used for VPN.
List of SAGs	o	
Provider Request Number	–	The Provider Request Number is not used as the VPN is created immediately.
SP Contact	m	The Provider contact name in case of problems.
VPN Identifier	m	Identifier of the VPN Service.

7.3.3.2.3 Report configuration changes of VPN service

7.3.3.2.3.1 Summary

This function is used to report the changes to configuration parameter of a VPN service to the service customer. Only some parameter may change due to either internal operation or because of request from the service customer.

7.3.3.2.3.2 Information Flow

Information element	Service Provider	Notes
Customer Contact	o	The Customer contact name.
Alias Name	o	Customer Defined user-friendly name.
Service Class List	o	Service Class to be supported by the VPN. NOTE – For VPN the Service Class is multi-valued indicating all the service classes (e.g. bearer services) to be supported by the VPN.
List of SAGs	o	
VPN Identifier	m	Identifier of the VPN Service.
SP Contact	o	The provider contact name in case of problems.

7.3.3.2.4 Retrieve VPN service parameters by the service customer

7.3.3.2.4.1 Summary

The service customer to retrieve the values of the parameter of a VPN service uses this function.

7.3.3.2.4.2 Information Flow

Information element	This ITU-T Recommendation (M.3208.3)		Notes
	Service Customer	Service Provider	
Customer Contact	o	o	The Customer contact name.
Alias Name	o	o	Customer defined user-friendly name.
Service Class List	o	o	Service Class to be supported by the VPN. NOTE – For VPN the Service Class is multi-valued indicating all the service classes (e.g. bearer services) to be supported by the VPN.
Service Name	–	–	Not used for VPN.
List of SAGs	o	o	
Provider Request Number	–	–	The Provider Request Number is not used as the VPN is created immediately.
SP Contact	o	o	The Provider contact name in case of problems.
VPN Identifier	m	m(=)	Identifier of the VPN Service.
Error		c	This parameter is present if the request is rejected because of one or more of the following reasons (only one error cause may be returned by the SP): – Invalid VPN identifier; – Invalid Parameter.

7.3.3.3 VPN leased circuit service configuration function set

The functions in this set are:

1) create VPN leased circuit service function;

2) delete VPN leased circuit service function;

3) modify VPN leased circuit service function.

7.3.3.3.1 Create VPN leased circuit service function

This function is based on the M.3208.1 "Create dedicated leased circuit service" function.

7.3.3.3.1.1 Summary

ITU-T Recommendation M.3208.1 provides the SC a general mechanism to request the creation of dedicated LCS from the SP. According to ITU-T Recommendation M.3208.1, the response from the SP must be one of the following three types:

1) The create request has been rejected with a reason code indicating probable cause.

2) A completion response indicating that the create function request has been processed coincident with receipt of the request. All information required to be provided to the SC is contained in the completion response.

3)   An acknowledgement to the SC that the request has been received is being processed, and that completion of the request will be reported to the SC at a later time.

One of the requirements of this ITU-T Recommendation is that the SC can create VPN LCS in real time or near-real time. Consequently, the SC is required to have pre-provisioned service link connections which are used to create the VPN LCS. Given this requirement, only responses 1 and 2 are possible in this ITU-T Recommendation. For this reason the service request state model is not used.

7.3.3.3.1.2 Information flow

Information element	ITU-T Recommendation M.3208.1		This ITU-T Recommendation (M.3208.3)		Notes
	Service Customer	Service Provider	Service Customer	Service Provider	
Service Name	m	o	–	–	Not used for VPN.
Service Class	o	c	c	o(=)	The service class must be consistent with the list of service class supported by the VPN.
Bandwidth	o	c	o	c	o – Support of bandwidth specification is subject to SLA. c – If the requested bandwidth cannot be provided by the SP, the SP shall return the value together with a reason code indicating that the bandwidth is not available. Bandwidth is multi-valued and specified in terms of peak bandwidth, sustainable bandwidth, and so on. The interpretation of the bandwidth parameter could also be by prior agreement. Additional requirements for this parameter is for further study.
Quantity	o	c	–	–	See ITU-T Recommendation M.3208.2.
Service Termination Date	o	c	o	c	See ITU-T Recommendation M.3208.1. If the value provided by SC is past, the request will be rejected and error with reason code of Invalid Termination Date will be returned.
Schedule	o	c	o	c	See ITU-T Recommendation M.3208.1.
Service Availability Date	o	m	–	–	See ITU-T Recommendation M.3208.2.
Service Request State	–	c	–	–	See ITU-T Recommendation M.3208.2.

Information element	ITU-T Recommendation M.3208.1		This ITU-T Recommendation (M.3208.3)		Notes
	Service Customer	Service Provider	Service Customer	Service Provider	
Service Administrative State	o	o(=)	o	o(=)	See ITU-T Recommendation M.3208.1.
Service Operational State	–	o	–	o	See ITU-T Recommendation M.3208.1.
Diversity	o	c	–	–	See ITU-T Recommendation M.3208.2.
Route	o	o	o	o	See ITU-T Recommendation M.3208.1.
Originating Location	m	o(=)	–	–	Not applicable to VPN.
Terminating Location	m	o(=)	–	–	Not applicable to VPN.
Originating Location CPE Type	o	o(=)	o	o(=)	See ITU-T Recommendation M.3208.1.
Terminating Location CPE Type	o	o(=)	o	o(=)	See ITU-T Recommendation M.3208.1.
Customer Contact	m	o(=)	m	o(=)	See ITU-T Recommendation M.3208.1.
Provider Request Number	–	m	–	–	This parameter is not required as services are provided in real-time or near real-time.
Customer Request Number	o	o(=)	–	–	This parameter is not required as services are provided in real-time or near real-time.
Alias Name	o	o(=)	o	o(=)	Customer supplied circuit identifier.
Originating Location Service Access Point	o	o	m	m(=)	The LCS is identified by the originating and terminating location service access points.
Terminating Location Service Access Point	o	o	m	m(=)	
Circuit Number	–	c	–	m	This is the Identifier that the service customer will use to manage the LCS. Because this is a real time service, the circuit number must be returned if the request is successful.
SP Contact	–	m	–	m	See ITU-T Recommendation M.3208.1.

Information element	ITU-T Recommendation M.3208.1		This ITU-T Recommendation (M.3208.3)		Notes
	Service Customer	Service Provider	Service Customer	Service Provider	
VPN Identifier	–	–	m	o(=)	The VPN identifier.
Error and reason code		c		c	This parameter is present if the request is rejected because of one or more of the following reasons: – Unknown Service Class; – Requested Bandwidth Not Available; – Resources Unavailable; – Invalid Schedule Conflict; – Contract Violation; – Invalid Parameter Value; – Required Parameter Not Supplied; – Non-Existent SAP; – SAP not in VPN; – Service class not in service class list; – Invalid Termination Date.

7.3.3.3.2 Delete VPN leased circuit service function

This function is based on M.3208.1 "Delete dedicated leased circuit service" function.

7.3.3.3.2.1 Summary

This function permits the SC to delete one or more VPN Leased Circuit Services. The SC shall identify the circuit number(s) to be deleted in the request. This action is atomic, i.e. either all or none of the specified VPN LCSs identified by circuit number(s) are deleted.

7.3.3.3.2.2 Information flow

Information element	ITU-T Recommendation M.3208.1		This ITU-T Recommendation (M.3208.3)		Notes
	Service Customer	Service Provider	Service Customer	Service Provider	
Circuit Number(s)	m	c	m	c	See ITU-T Recommendation M.3208.1.
Service Request State	–	c	–	–	This parameter is not required as services are provided in real-time or near real-time.
Service Provider Contact	–	o	–	o	See ITU-T Recommendation M.3208.1.

Information element	ITU-T Recommendation M.3208.1		This ITU-T Recommendation (M.3208.3)		Notes
	Service Customer	Service Provider	Service Customer	Service Provider	
Service Termination Date	o	o(=)	–	–	These parameters are not required as the delete function is provided in real-time or near real-time.
Provider Request Number	–	c	–	–	
Customer Request Number	o	o(=)	–	–	
VPN Identifier	–	–	m	o(=)	The VPN identifier together with the circuit number uniquely identifies the LCS to be deleted.
Error		c		c	This parameter is present if the request is rejected. Valid error codes are: – Already Deleted; – Invalid Circuit Number; – Not Being in Appropriate Service Administrative State; – Contract Violation; – Invalid VPN Identifier.

7.3.3.3.3   Modify VPN leased circuit service function

The modifying VPN LCS function enables a SC to request the modification of a number of applicable parameters of the established VPN LCS.

7.3.3.3.3.1 Summary

This function can be used to modify service parameters as applicable with service class, service name and SLA.

7.3.3.3.3.2 Information flow

Information element	ITU-T Recommendation M.3208.1		This ITU-T Recommendation (M.3208.3)		Notes
	Service Customer	Service Provider	Service Customer	Service Provider	
Originating Location CPE Type	o	o(=)	o	o(=)	See ITU-T Recommendation M.3208.1.
Terminating Location CPE Type	o	o(=)	o	o(=)	See ITU-T Recommendation M.3208.1.
Customer Contact	o	o(=)	o	o(=)	See ITU-T Recommendation M.3208.1.
Originating Location Service Access Point	c	o	–	–	The service access points cannot be modified.

Information element	ITU-T Recommendation M.3208.1		This ITU-T Recommendation (M.3208.3)		Notes
	Service Customer	Service Provider	Service Customer	Service Provider	
Terminating Location Service Access Point	c	o	–	–	
Circuit Number	c	o	m	m(=)	This is different from M.3208.1 because the M.3208.1 Provider Request Number is not a possible choice in this ITU-T Recommendation.
Provider Request Number	c1	c2	–	–	This parameter is not used as services are provided in real-time or near real-time.
Request Sequence Number	–	c	–	–	This parameter is not required as services are provided in real-time or near real-time.
Bandwidth	c3	o(=)	c3	o(=)	c3 – The presence of this optional parameter is controlled by the value specified in Service Name and Service Class. If the requested bandwidth is not available, the modify request will be rejected with a reason code.
Route	c3	c	–	–	The route cannot be changed.
Schedule	c3	c	c3	o(=)	If the requested schedule is not available, the modify request will be rejected with a reason code.
Service Request State	–	c	–	–	This parameter is not required as services are provided in real-time or near real-time.
Service Termination Date	o	o	o	o(=)	If the service termination date to be modified is in the past or present, the modify request will be rejected with a reason code of Invalid Termination Date.
Service Availability Date	c	c	–	–	This parameter is not required as services are provided in real-time or near real-time.
Service Administrative State	o	o	o	o	See ITU-T Recommendation M.3208.1.
Alias Name	o	o(=)	o	o(=)	See ITU-T Recommendation M.3208.1.

Information element	ITU-T Recommendation M.3208.1		This ITU-T Recommendation (M.3208.3)		Notes
	Service Customer	Service Provider	Service Customer	Service Provider	
VPN Identifier	–	–	m	o(=)	VPN id is required to uniquely identify the VPN LCS.

Error		c		c	c – This parameter is present if the request is rejected. Valid error codes are:
					– Invalid CPE Type;
					– Required Bandwidth Not Available;
					– Invalid VPN Identifier:
					  • Invalid Schedule;
					  • Invalid Circuit Number;
					  • Contract Violation;
					  • Resource Unavailable;
					  • Invalid Alias Name;
					  • Schedule cannot be supported.

7.3.3.4 VPN leased circuit service status administration function set

This function set includes functions that allow the service provider to inform the service customer of Service administrative functions and for the service customer to monitor administrative information related to the requested VPN LCS.

This function set contains the following functions:

1) report deletion of VPN LCS;

2) report creation of VPN LCS;

3) report configuration changes of VPN LCS;

4) control administrative state of the VPN LCS by the service customer;

5) retrieve VPN LCS parameters by the service customer.

7.3.3.4.1 Report deletion of VPN leased circuit service to service customer function

This function is identical to M.3208.1 "Report deletion of leased circuit service" function.

7.3.3.4.2 Report creation of VPN leased circuit service to service customer function

This function is identical to M.3208.1 "Report creation of leased circuit service" function.

7.3.3.4.3 Report configuration changes of leased circuit service parameters

This function is identical to M.3208.1 "Report configuration changes of leased circuit service parameters to service customer" function.

7.3.3.4.4 Control administrative state of the VPN leased circuit

This function is identical to M.3208.1 "Control administrative state of the leased circuit service by the service customer" function.

7.3.3.4.5 Retrieve service parameters by the service customer

This function is identical to M.3208.1 "Retrieve service parameters by the service customer" function.

8 Management scenarios

Management scenarios are described for examination of the relationships among roles, resources and functions of which management context are composed. For this purpose, scenarios show interactions between the service customer role and the service provider role, using the telecommunications services or resources and functions. Based on the purpose of examining the relationships among management context, management scenarios only show representative examples of interactions between service customer role and service provider role, but do not cover whole of cases. The scenarios are to be illustrated by using UML diagrams in Appendix II.

9 Architecture

9.1 Functional architecture

The architecture is described in ITU-T Recommendation M.3010. Applicable reference points are x, and q3, between SML and SML, and q3 between SML and NML.

9.2 Physical architecture

The architecture is described in ITU-T Recommendation M.3010. Applicable interfaces are X and Q3.

APPENDIX I

UML use case diagrams to illustrate VPN service provision functions

I.1 Introduction

This appendix provides UML (Universal Modelling Language) use case diagrams to assist in explanation of VPN service provision function discussed in this ITU-T Recommendation. Some use cases in this ITU-T Recommendation are similar in function with those defined in ITU-T Recommendation M.3208.1, but have different names.

I.2 Use cases

I.2.1 Service provision use case

Service Customer actor uses this use case to interact with Service Provider actor to get service. This use case uses two use cases: VPN service configuration function set and VPN leased circuit service administration function set. The stereo type <<include>> is used to indicate that the use case is decomposed into two reusable fragments.

The VPN service configuration function set use case is extended by VPN service status administration function set use case, and VPN leased circuit service administration function set use case is extended by VPN leased circuit service status administration function set use case. Using stereotype <<extend>>, behaviors defined in VPN service status administration function set use case are inserted at the location defined by the extension point in VPN service configuration function set use case. Thus the VPN service configuration function set use case are provided the functions in use

case VPN service status administration function set use case, for example status report of the request to create a new service, delete an existing service or modify an existing service.
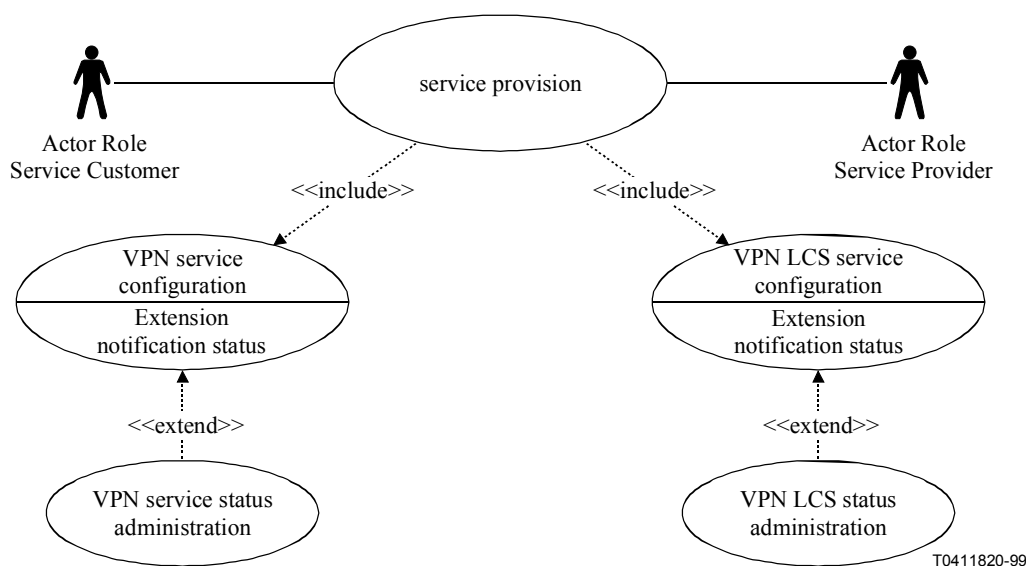

Figure I.1/M.3208.3 – Use case for VPN service provision

I.2.2 VPN service configuration function set use case

Figure I.2 decomposes the VPN service configuration function set use case in terms of the following use cases: Create VPN service, Delete VPN service, Modify VPN service, Create SAG, Delete SAG, Add SAP and Remove SAP. Stereotype <<extend>> is used to illustrate that the extended use case "invalid request parameter encountered" will be used by the extending use case, for example "Create VPN" use case, if customer request contains invalid parameter.

NOTE – Interactions corresponding to most use cases are illustrated by sequence diagrams.
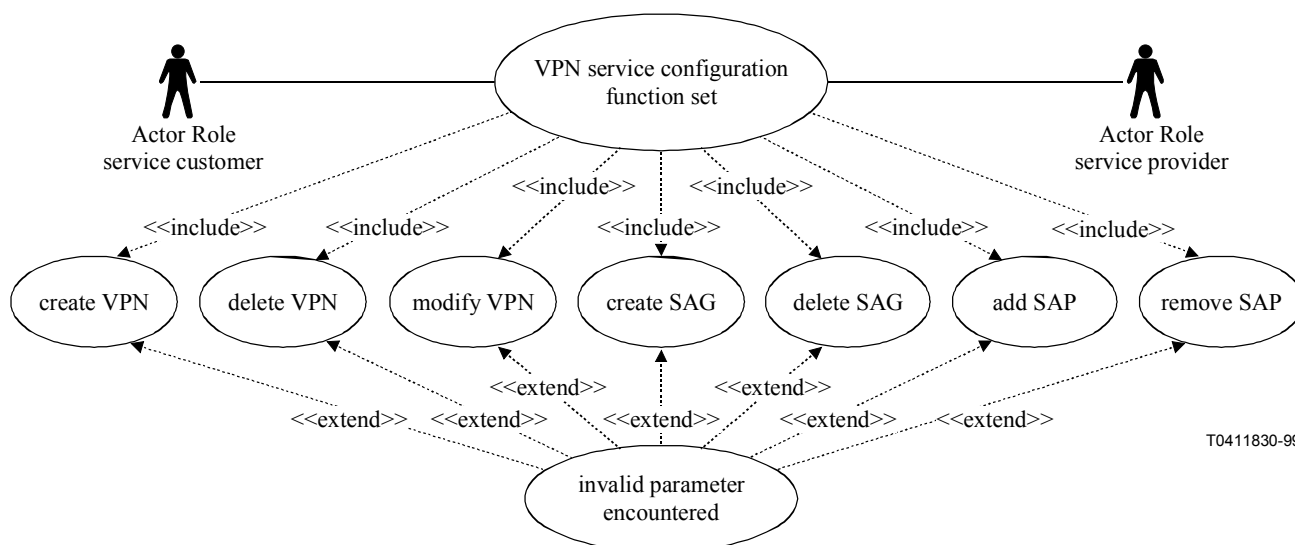
Figure I.2/M.3208.3 – Decomposition of VPN service configuration function set

I.2.3 VPN service status administration function set use case

Figure I.3 decomposes VPN service status administration function set in terms of following use cases: report VPN service creation, report VPN service deletion, report VPN service configuration changes and retrieve service parameters.

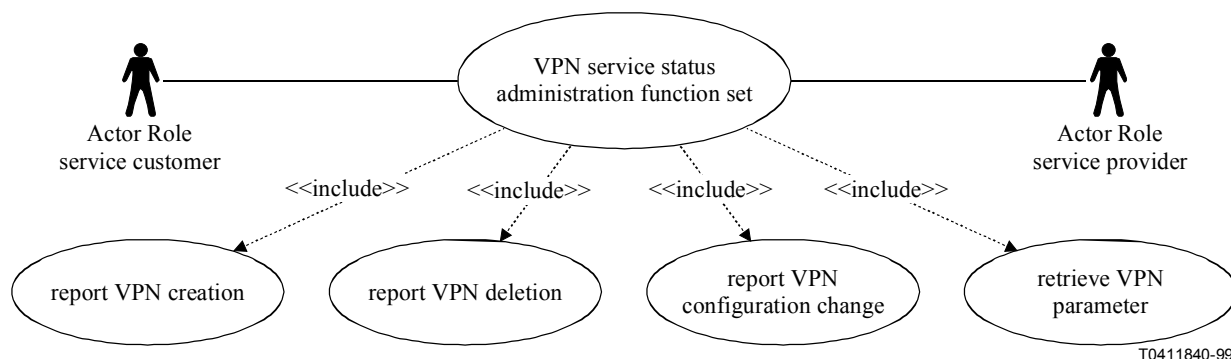NOTE – Interactions corresponding to most use cases are illustrated by sequence diagrams.

Figure I.3/M.3208.3 – Decomposition of VPN service status administration function set

I.2.4 VPN leased circuit service administration function set use case

Figure I.4 decomposes VPN leased circuit service administration function set in terms of following use cases: Create VPN leased circuit service, Delete VPN leased circuit service and Modify VPN leased circuit service. Stereo type <<extend>> is used to illustrate that the extended use case will be used when the service request contains invalid parameter.

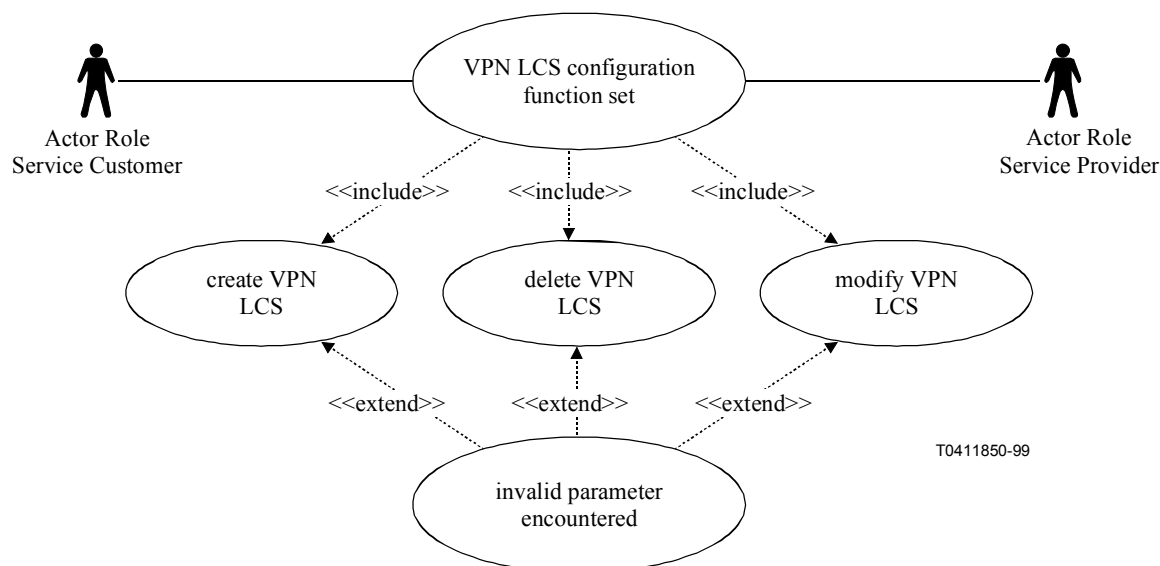NOTE – Interactions corresponding to most use cases are illustrated by sequence diagrams.

Figure I.4/M.3208.3 – Decomposition of VPN LCS configuration function set

I.2.5 VPN leased circuit service status administration function set use case

Figure I.5 decomposes VPN leased circuit service status administration function set in terms of following use cases: report VPN leased circuit service creation, report VPN leased circuit service deletion, report VPN leased circuit service configuration changes, retrieve service parameter and control VPN LCS administrative state.
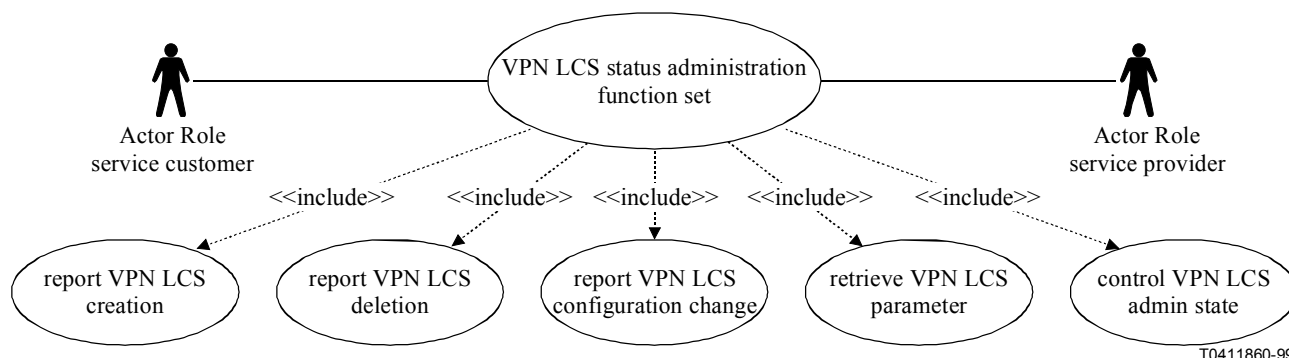

Figure I.5/M.3208.3 – Decomposition of VPN LCS status administration function set

APPENDIX II

UML sequence diagrams to illustrate VPN management scenarios

II.1 Introduction

This appendix provides Universal Modelling Language (UML) sequence diagrams to illustrate various scenarios discussed in this ITU-T Recommendation. Before illustrating the scenarios, some classes to be used in the sequence diagrams are introduced using UML class diagram.

II.2 UML class diagrams

II.2.1 UML class diagrams for modelling agent functionality

These class diagrams conform to the same class diagrams in ITU-T Recommendation M.3020.

Some UML classes are introduced (object factory and notification dispatcher) to model the actions for creating objects and distributing notifications from objects. Instances of these agent functionality classes appear in the sequence diagrams. When a creation request is made onto an object factory object, the factory object returns a response, and then instantiated the object (service object or service access group object). When a notification operation invocation is made onto a notification dispatch object, all destinations which have registered interest will receive a copy of that notification. These final delivery flows are not shown in the sequence diagrams in II.3, since many objects may be interested in receiving them.
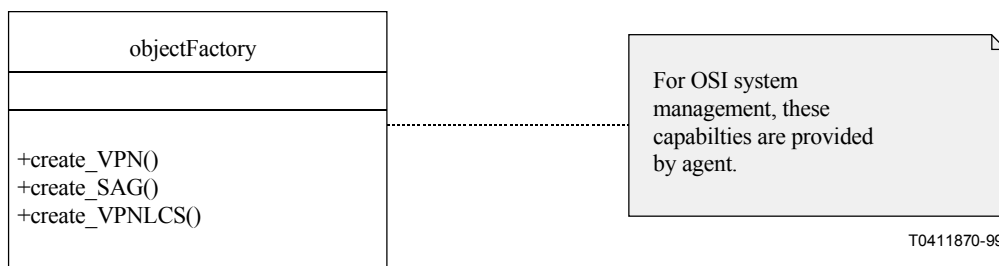
```
┌─────────────────────────────┐
│         objectFactory       │
├─────────────────────────────┤
│                             │
├─────────────────────────────┤
│ +create_VPN()               │
│ +create_SAG()               │
│ +create_VPNLCS()            │
└─────────────────────────────┘
```

For OSI system management, these capabilties are provided by agent.

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Figure II.1/M.3208.3 – UML class diagram for objectFactory for customer to create object

```
┌─────────────────────────────┐
│     notificationDispatcher  │
├─────────────────────────────┤
│                             │
├─────────────────────────────┤
│ +reportVPNCreation()        │
│ +reportVPNLCSCreation()     │
│ +reportVPNDeletion()        │
│ +reporVPNtLCSDeletion()     │
│ +reportVPNConfigChange()    │
│ +reportVPNLCSConfigChange() │
└─────────────────────────────┘
```

For OSI system management, these capabilties are provided by event forwarding discriminator.

T0411880-99
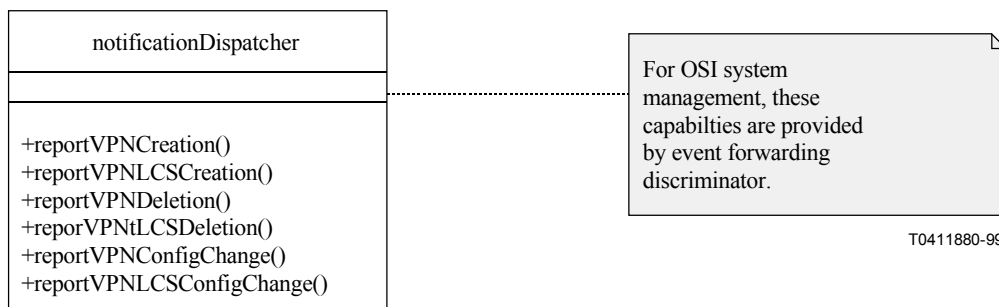
**Figure II.2/M.3208.3 – UML class diagram for notificationDispatcher
for customer to distribute notification**

II.2.2 UML class diagrams for VPN and LCS

This subclause provides class diagrams for VPN and that are involved in sequence diagrams in II.3.

In the class diagrams, attribute with property string "{frozen, naming}" means that the attribute is the naming attribute of the object and can not be changed by management operation after creation.
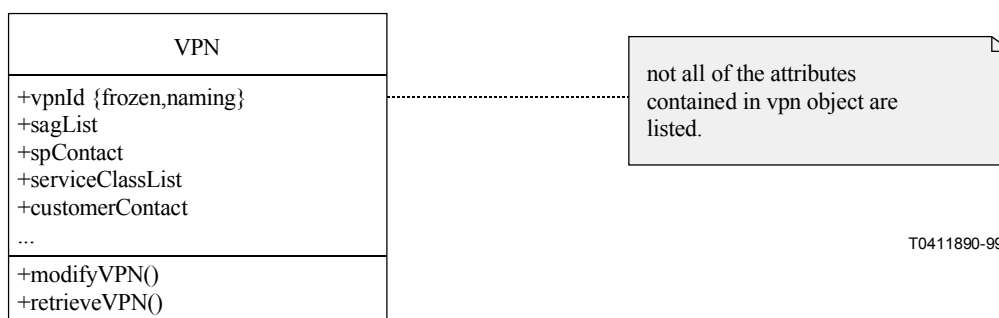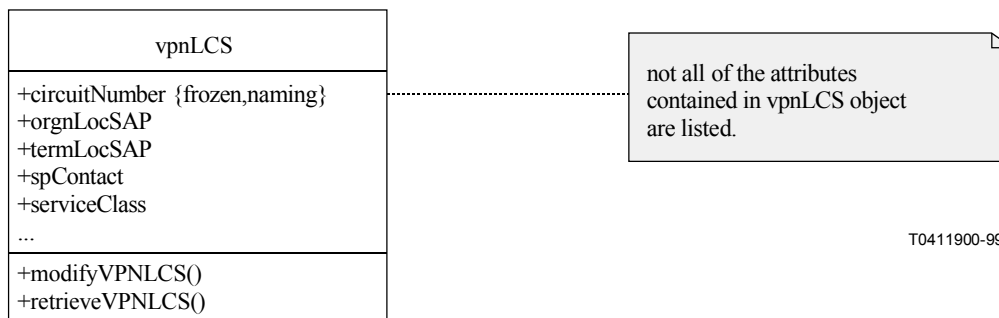
```
┌─────────────────────────────┐
│            VPN              │
├─────────────────────────────┤
│ +vpnId {frozen,naming}      │
│ +sagList                    │
│ +spContact                  │
│ +serviceClassList           │
│ +customerContact            │
│ ...                         │
├─────────────────────────────┤
│ +modifyVPN()                │
│ +retrieveVPN()              │
└─────────────────────────────┘
```

not all of the attributes contained in vpn object are listed.

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Figure II.3/M.3208.3 – UML class diagram for VPN

```
                    vpnLCS
  +circuitNumber {frozen,naming}
  +orgnLocSAP
  +termLocSAP
  +spContact
  +serviceClass
  ...
  +modifyVPNLCS()
  +retrieveVPNLCS()
```

not all of the attributes
contained in vpnLCS object
are listed.

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Figure II.4/M.3208.3 – UML class diagram for LCS

II.3 UML sequence diagrams to illustrate scenarios

The sequence diagrams in this subclause illustrate various scenarios discussed in clause 8.

The message flows from the notification dispatcher to the ultimate registered destinations are not shown in these diagrams. It would be normal for the customer (as well as other objects) to be a registered recipient for the notifications shown in these sequence diagrams. Not all of the scenarios are illustrated by the sequence diagrams, because others can be illustrated in the same way.

This subclause is composed of two parts. The first part shows an example to illustrate how several relevant scenarios work together to achieve a management task and the second part shows every sequence diagram for single scenario separately.

II.3.1 Relevant scenarios for creating VPN LCS(s) in a VPN

In this subclause, an illustrative example is given, to create LCS in a VPN, to show how relevant scenarios work together.
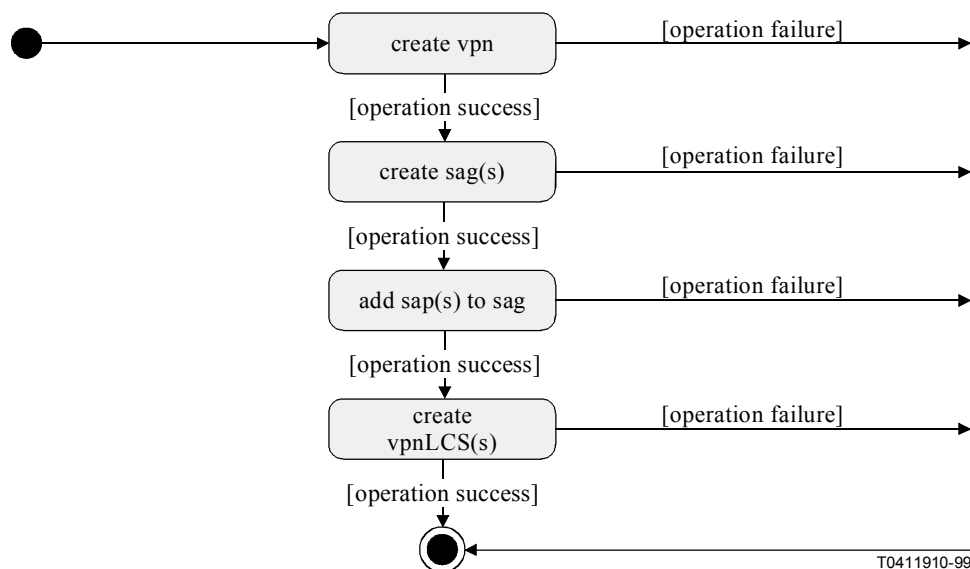
Figure II.5/M.3208.3 – Activity diagram for LCS creation in a VPN

Firstly, an activity diagram (UML) is given, Figure II.5, to show the whole process. Then, each scenario in the whole process is illustrated by a sequence diagram. In each sequence diagram, precondition and postcondition of the scenario are shown as notes. The sequence diagrams are listed according to the order of actual steps.

As this is an illustrative example and not a complete set of all interactions according to the information flow tables, the scenarios do not include every case.
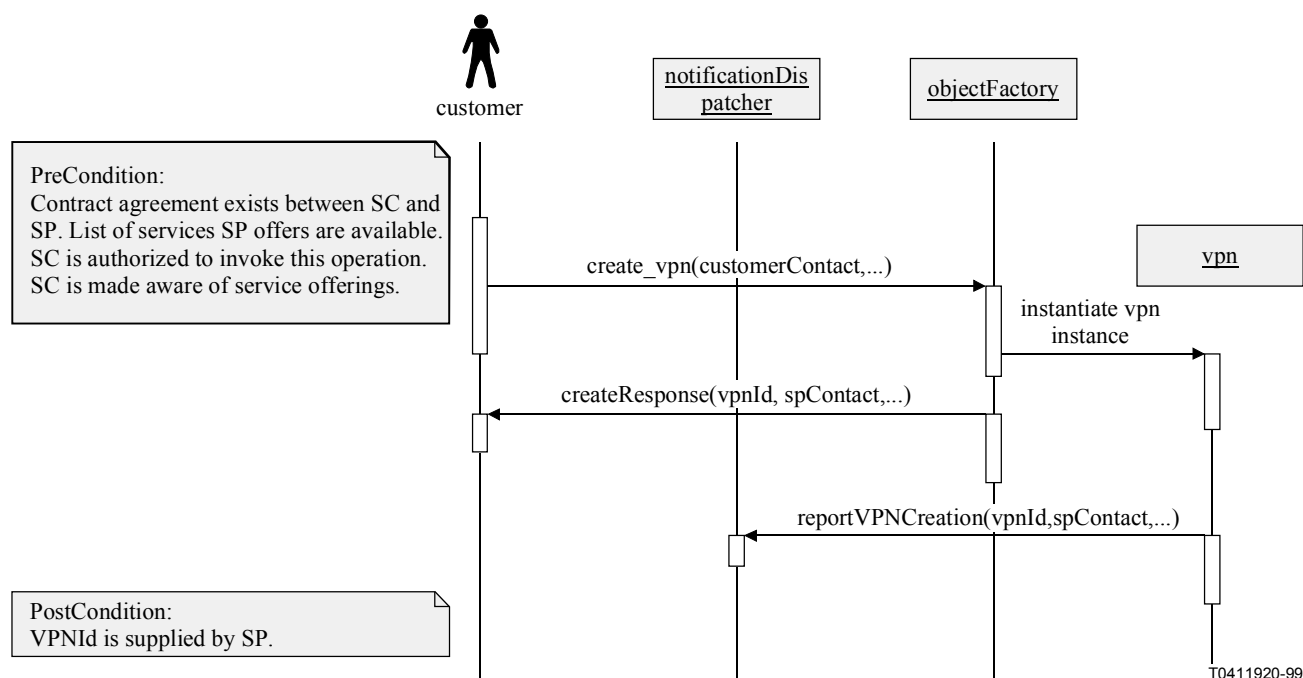

**Figure II.6/M.3208.3 – Sequence diagram for VPN service creation
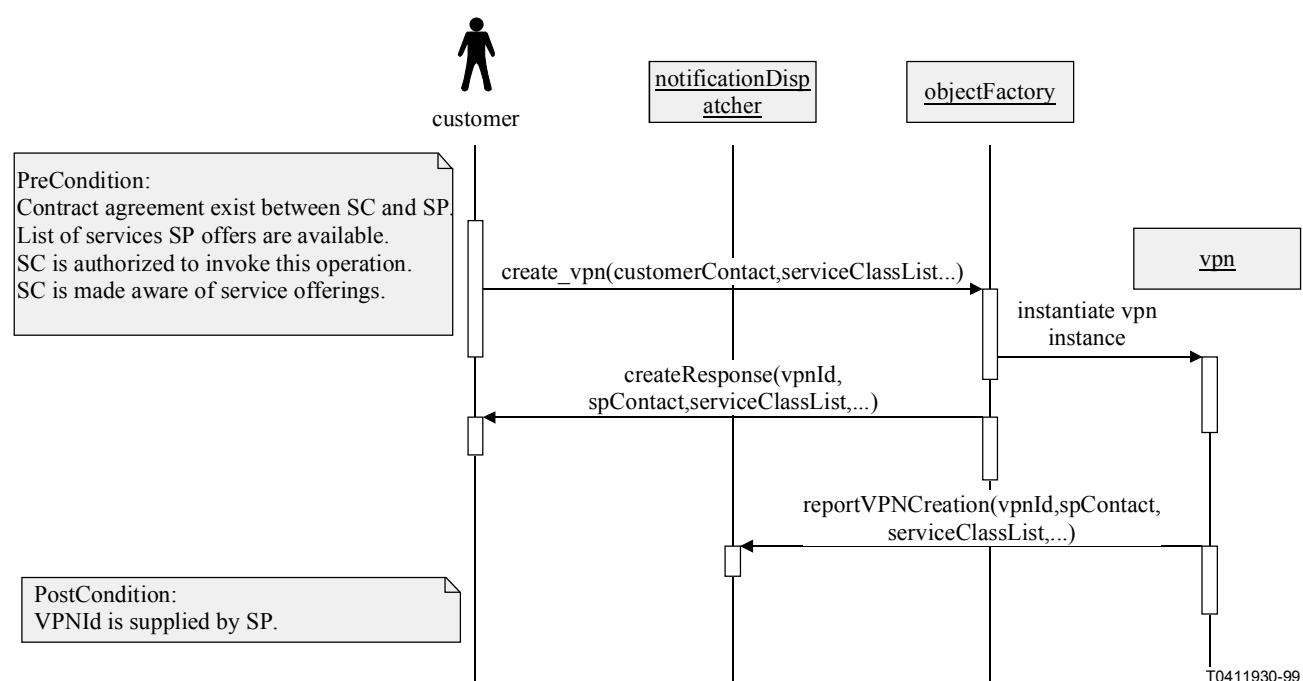and report of VPN service creation**

**Figure II.7/M.3208.3 – Sequence diagram for VPN service creation
and report of VPN service creation**

As in some requests, some parameters are conditional or optional, an example is also shown to illustrate the different cases. In Figure II.6, create_vpn operation does not contain the optional parameter serviceClassList, while in Figure II.7, parameter serviceClassList is contained.
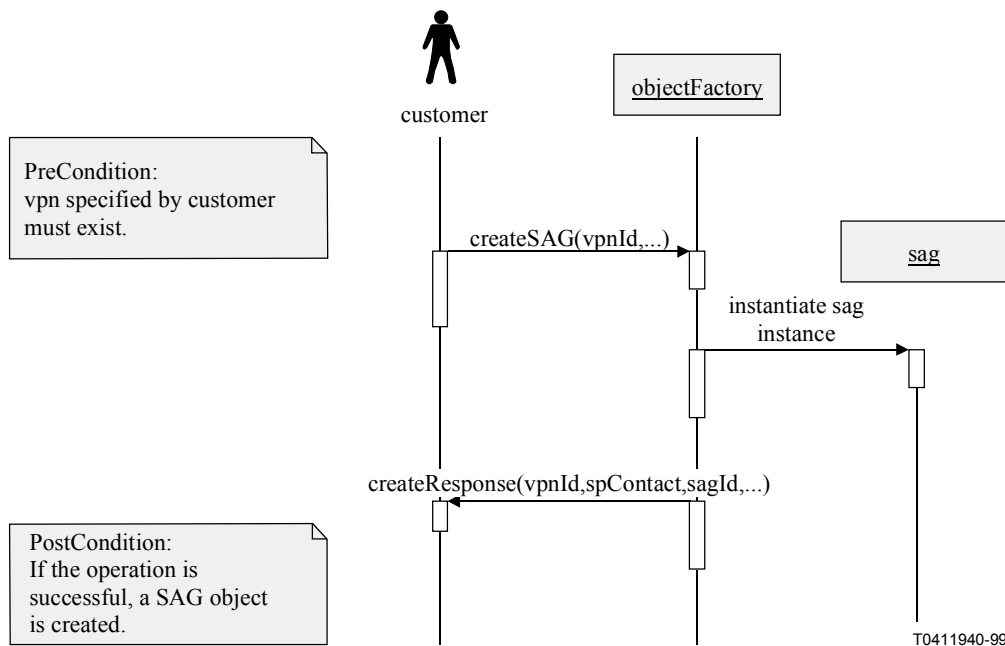
Figure II.8/M.3208.3 – Sequence diagram for SAG creation
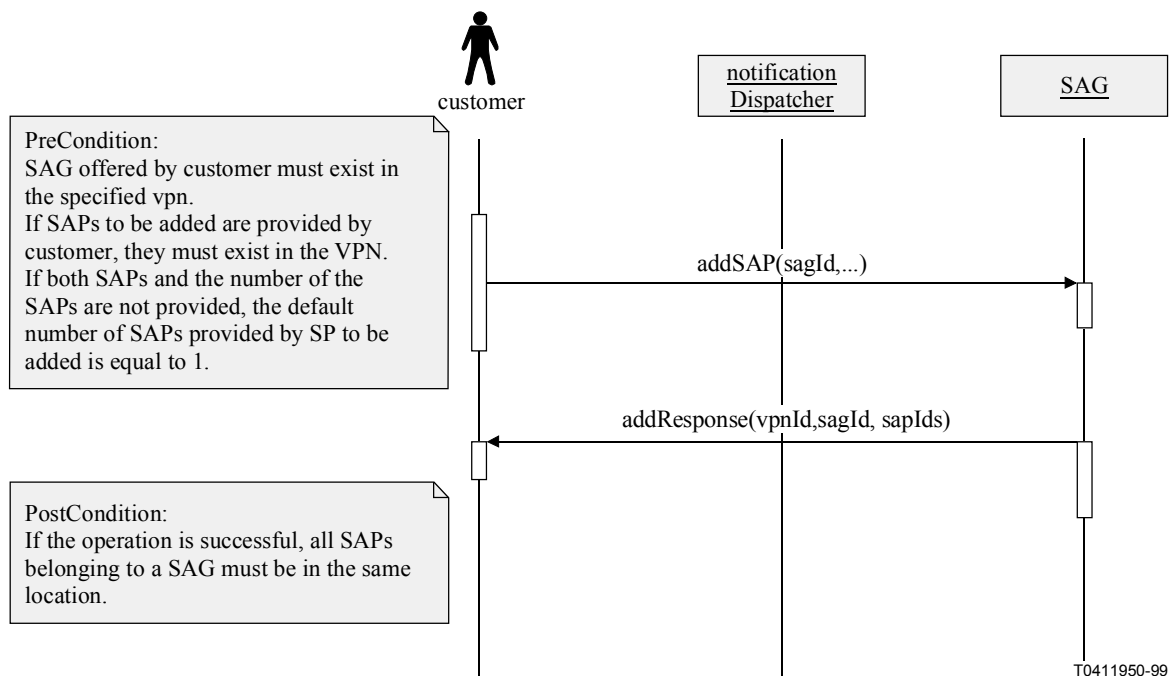
Figure II.9/M.3208.3 – Sequence diagram for adding SAP(s) to SAG
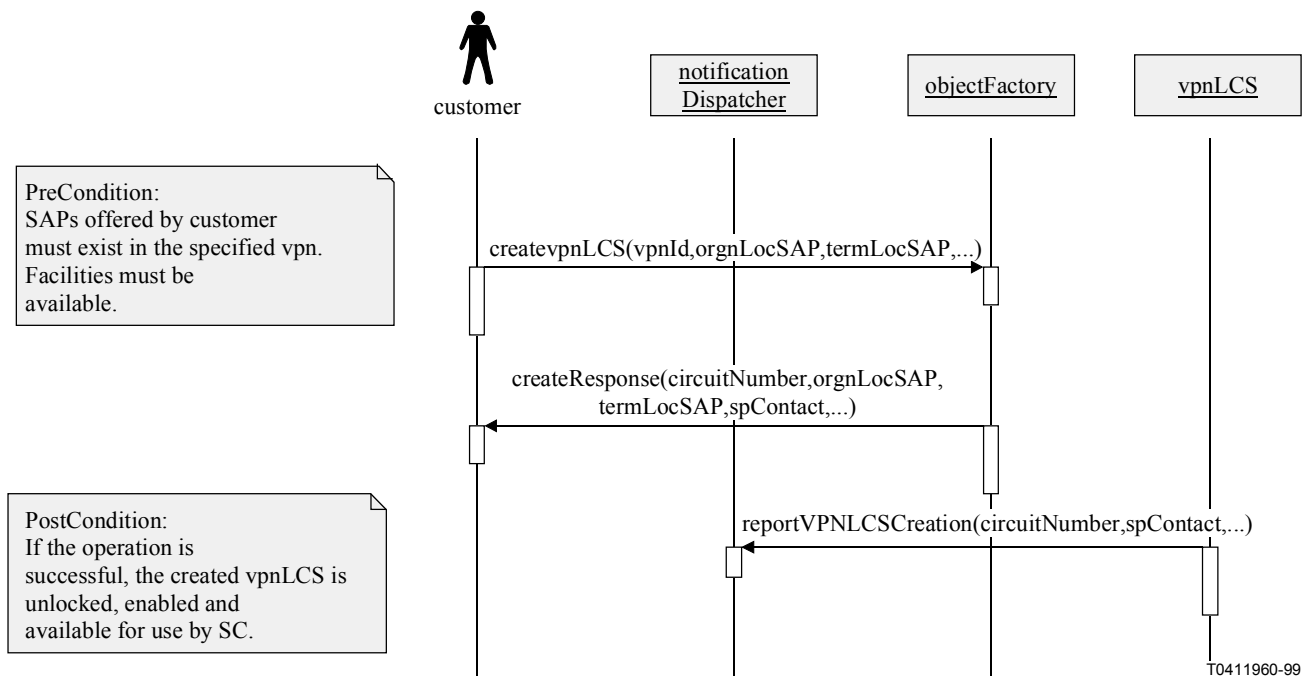
**Figure II.10/M.3208.3 – Sequence diagram for VPN LCS creation
and report of VPN LCS creation**

II.3.2 Sequence diagrams for management scenarios

In this subclause, each sequence diagram is only for a single scenario. No precondition and postcondition is contained in diagram. Sequence diagrams occurred in the subclause above are not shown.
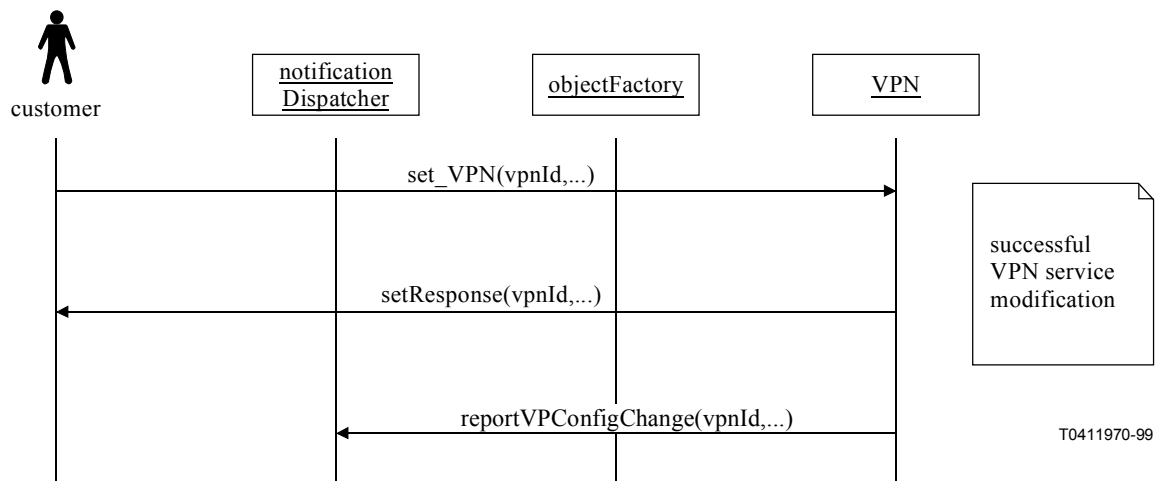
**Figure II.11/M.3208.3 – Sequence diagram for VPN configuration change
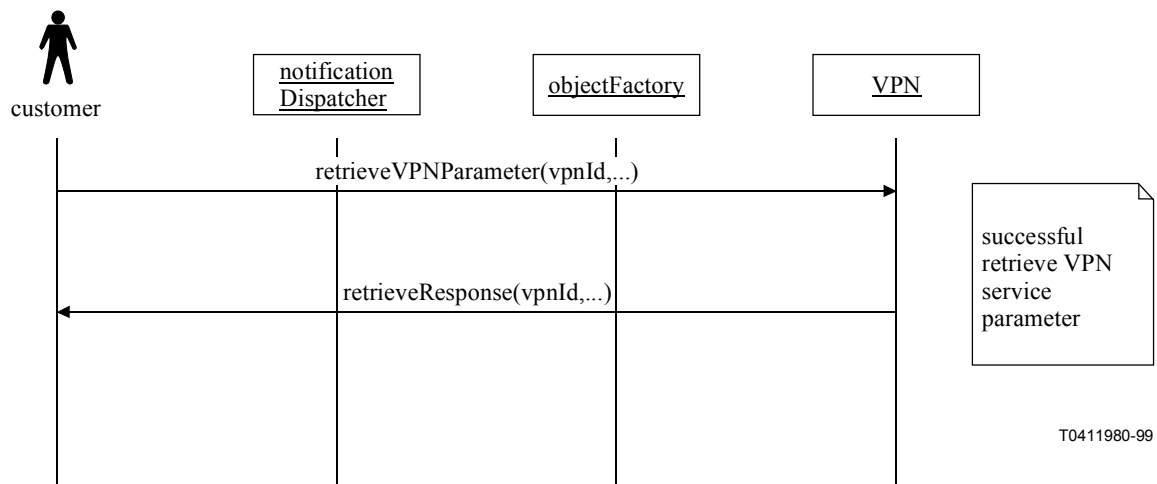and report of VPN configuration change**

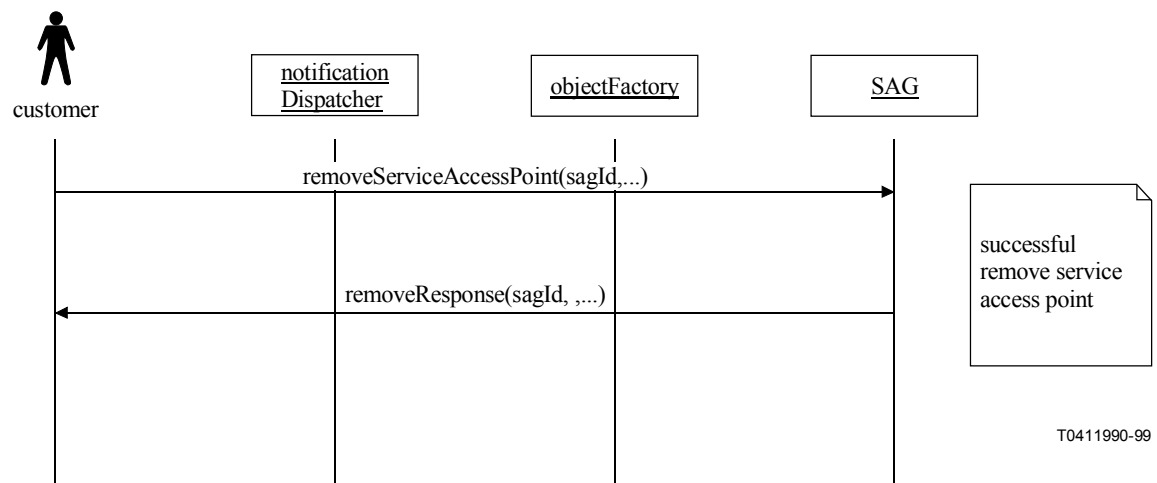**Figure II.12/M.3208.3 – Sequence diagram for retrieving VPN service parameter**

Figure II.13/M.3208.3 – Sequence diagram for removal of SAP(s) from SAG
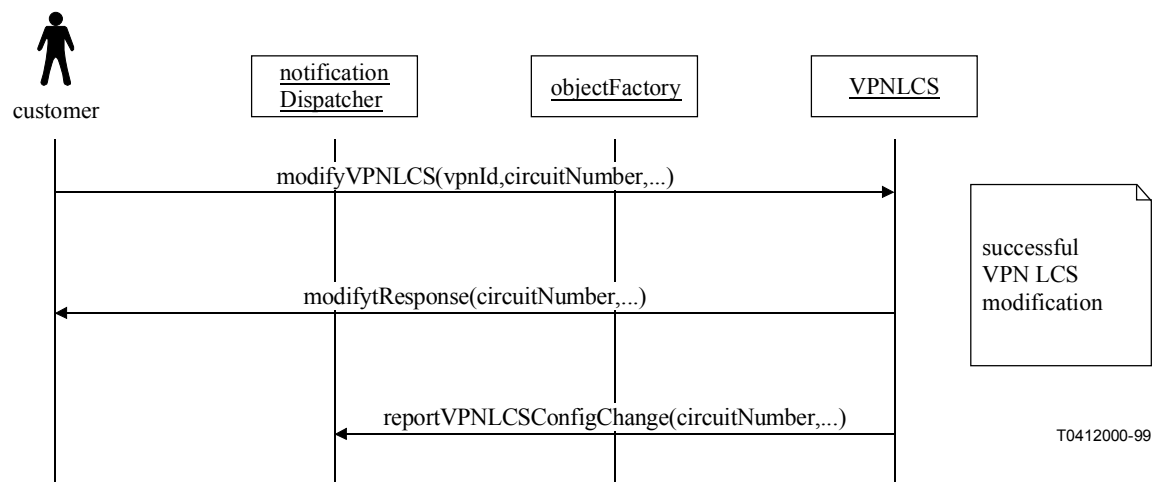

Figure II.14/M.3208.3 – Sequence diagram for VPN LCS modification
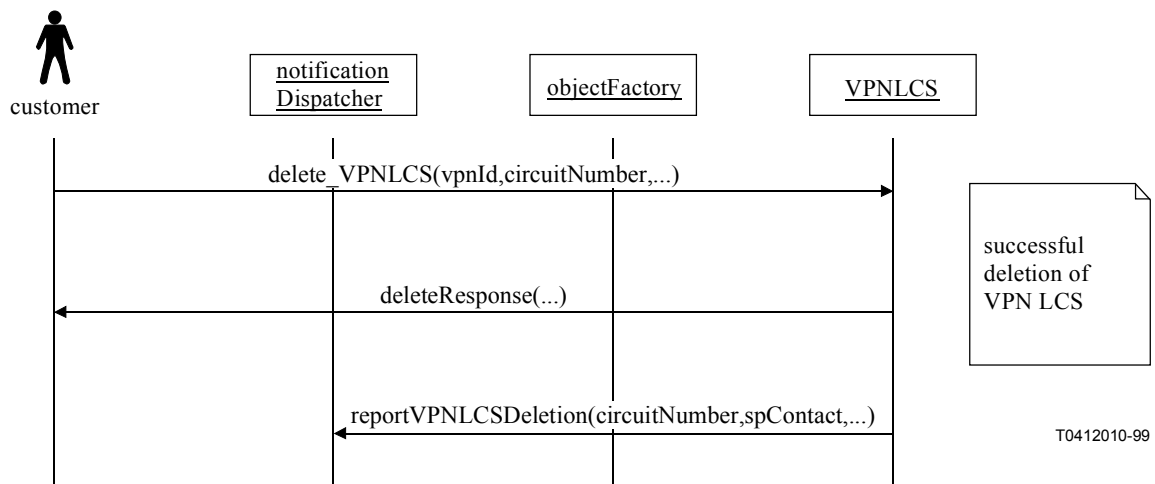
**Figure II.15/M.3208.3 – Sequence diagram for VPN LCS deletion and
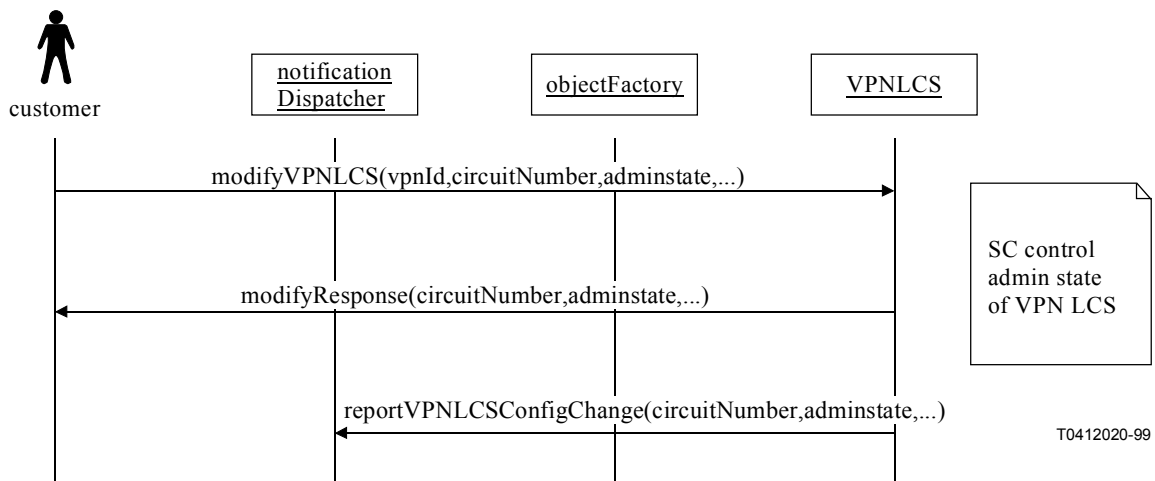report of VPN LCS deletion**

Figure II.16/M.3208.3 – Sequence diagram for SC control administrative state of VPN LCS

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