Working Draft

MEF W103 v0.1

LSO L1 Service Schemas and Developer Guide

December 2024

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1 List of Contributing Members

The following members of the MEF participated in the development of this document and have requested to be included in this list.

Editor Note 1: *This list will be finalized before Letter Ballot. Any member that comments in at least one CfC is eligible to be included by opting in before the Letter Ballot is initiated. Note it is the MEF member that is listed here (typically a company or organization), not their individual representatives.*

2 Abstract

This MEF Standard consisting of this Developer Guide and its associated software artifacts (JSON/YAML Schemas) defines and describes the service-specific payload for the LSO APIs for a set of Service Functions – specifically, Service Order and Service Inventory, for Layer 1 Subscriber and Operator Services. It then provides a basic information model for the MEF L1 Service Attributes. The final sections describe the Data Model focused on the JSON/YAML Schemas associated with this specification.

This document can be thought of as a developer's guide for the Subscriber and Operator L1 Services Data Model and the schemas provided that embody the Data Model. L1 Services are described by a set of Service Attributes. Each Service Attribute describes an aspect of the service that is agreed between the provider and the user of the service. The document that describes the Service Attributes for Subscriber L1 Services is MEF 63 [5] and Operator L1 Services is MEF 64 [6].

This Standard normatively incorporates the following files by reference as if they were part of this document, from GitHub repository https://github.com/MEF-GIT/MEF-LSO/tree/develop_l1cs_service.

3 Terminology and Abbreviations

This section defines the terms used in this document. In many cases, the normative definitions of terms are found in other documents. In these cases, the third column is used to provide the reference that is controlling, in other MEF or external documents. If the reference includes an asterisk (*), the definition has been adapted from the original.

Term	Definition	Reference
Business Applications	The Service Provider functionality supporting Business Management Layer functionality (e.g., product catalog, order management, billing, relationship management, etc.)	MEF 55.1 [7]
BUS	See Business Applications	MEF 55.1 [7]
Data Model	A representation of concepts of interest to an environment in a form that is dependent on data repository, data definition language, query language, implementation language, and/or protocol (typically, but not necessarily, all five).	IETF RFC 3444 [3]
ENNI	Used for brevity when referring to an L1 ENNI.	MEF 64 [6]
L1CI	Layer 1 Characteristic Information.	MEF 63 [5]
L1 ENNI	Layer 1 External Network Network Interface	MEF 64 [6]
L1 Service	A connectivity service which delivers Layer 1 Characteristic Information that is specified using Service Attributes.	MEF 63 [5]
Information Model	A representation of concepts of interest to an environment in a form that is independent of data repository, data definition language, query language, implementation language, and protocol.	IETF RFC 3444 [3]
Order	One or more Service Order Items formulated into a fulfillment request made by a Client to a Server.	This document (derived from MEF 57.2)
Service Provider	In the context of this document, a Service Provider is an Ethernet Service Provider. In this document, we use Service Provider to include Super Operator as specified in MEF 26.2 (also referred to as SP/SO).	This Document

Table 1-Terminology and Abbreviations

4 Compliance Levels

The key words "**MUST**", "**MUST NOT**", "**REQUIRED**", "**SHALL**", "**SHALL NOT**", "**SHOULD**", "**SHOULD NOT**", "**RECOMMENDED**", "**NOT RECOMMENDED**", "**MAY**", and "**OPTIONAL**" in this document are to be interpreted as described in BCP 14 (RFC 2119 [2], RFC 8174 [4]) when, and only when, they appear in all capitals, as shown here. All key words must be in bold text.

Items that are **REQUIRED** (contain the words **MUST** or **MUST NOT**) are labeled as **[Rx]** for required. Items that are **RECOMMENDED** (contain the words **SHOULD** or **SHOULD NOT**) are labeled as **[Dx]** for desirable. Items that are **OPTIONAL** (contain the words **MAY** or **OPTIONAL**) are labeled as **[Ox]** for optional**.**

5 Numerical Prefixes

This document uses the prefix notation to indicate multiplier values as shown in Table 2-Numerical Prefix Conventions.

Decimal		Binary	
Symbol	**Value**	**Symbol**	**Value**
k	10^3	Ki	2^{10}
M	10^6	Mi	2^{20}
G	10^9	Gi	2^{30}
T	10^{12}	Ti	2^{40}
P	10^{15}	Pi	2^{50}
E	10^{18}	Ei	2^{60}
Z	10^{21}	Zi	2^{70}
Y	10^{24}	Yi	2^{80}

Table 2-Numerical Prefix Conventions

6 Introduction

LSO provides programmatic interfaces for establishing automated exchange of information (i.e., Service Order, Service Inventory) between a Business Application and Service Orchestration Function. These APIs are hierarchically structure. The outer-most structure includes information relating to the access method (e.g., REST), next is information relating to the function being requested (e.g., Service Order or Inventory, etc.) and the inner-most structure contains information relating to the specific service, for example L1 Service.

The specific types of L1 Services are Subscriber and Operator Services. Subscriber L1 Services are requested between a Customer and a Service Provider or a Service Provider and a Partner. Operator L1 Services are requested between a Service Provider (SP) and a Partner. The Service Attributes for Subscriber and Operator L1 Services are defined in MEF 63 [5] and MEF 64 [6] respectively.

This specification is accompanied by a Data Model for Subscriber and Operator L1 Services instantiated as a set of YAML schemas that can be used with MEF LSO APIs to perform Service Order, and request an Inventory for the Subscriber and Operator L1 Services consisting of:

The Data Model for Subscriber L1 Services includes:

- L1 Subscriber VC: A L1 Subscriber VC is an association of two or more L1 VC End Points (L1 VC EPs).
- L1 VC End Point: A L1 VC End Point is a construct at a L1 Subscriber UNI that selects a subset of the Service Frames that pass over the L1 Subscriber UNI. A L1 VC End Point represents the logical attachment of an L1 Subscriber VC to a L1 Subscriber UNI.
- L1 Subscriber UNI: A construct that represents the L1 Network Interface demarcation point between the responsibility of the Service Provider and the responsibility of the Subscriber.

The Data Model for Operator L1 Services includes:

- L1 Operator VC: The L1 Operator VC is the building block for constructing a L1 VC spanning multiple Operator CENs. A L1 Operator VC is an association of L1 Operator VC End Points.
- L1 VC End Point: A logical entity at a given External Interface that is associated with a distinct set of frames passing over that External Interface. A L1 Operator VC End Point represents the logical attachment of an L1 Operator VC to an External Interface (a L1 Operator UNI or L1 ENNI).
- L1 Operator UNI: UNI used in L1 Operator Service solution where attributes are agreed to by the Service Provider/Super Operator and the Operator.
- L1 ENNI: A reference point representing the boundary between two or more Operator CENs that are operated as separate administrative domains.

- L1 ENNI Service: A construct that represents the L1 ENNI Service Attributes for a L1 ENNI used by a particular SP/SO. For each instance of a L1 ENNI, there can be multiple sets of L1 ENNI Service Attributes.

The document contains the following sections:

An overview of LSO Services (Section 7)

An overview L1 Service Model (Section 8)

An overview of L1 Subscriber Services (Section 9)

An overview of L1 Operator Services (Section 10)

Data Model Design Principles and Assumptions (Section 11)

Data Models for L1 Services (Section 12)

Relationship between the Entities (Section 13)

Subscriber L1 Services Data Model (Section 14)

Operator L1 Services Data Model (Section 15)

Common Classes and Types (Section 16)

L1 Service Level Specification (Section 17)

7 Overview of LSO Services

MEF 55.1 [7] describes the Reference Architecture for Lifecycle Service Orchestration (LSO) of MEF-defined connectivity services. MEF 55.1 [7] defines seven LSO Reference Points that are abstract interconnection points between different domains - either within the service provider domain (intra-domain) or between service provider and other business entities (inter-domain).

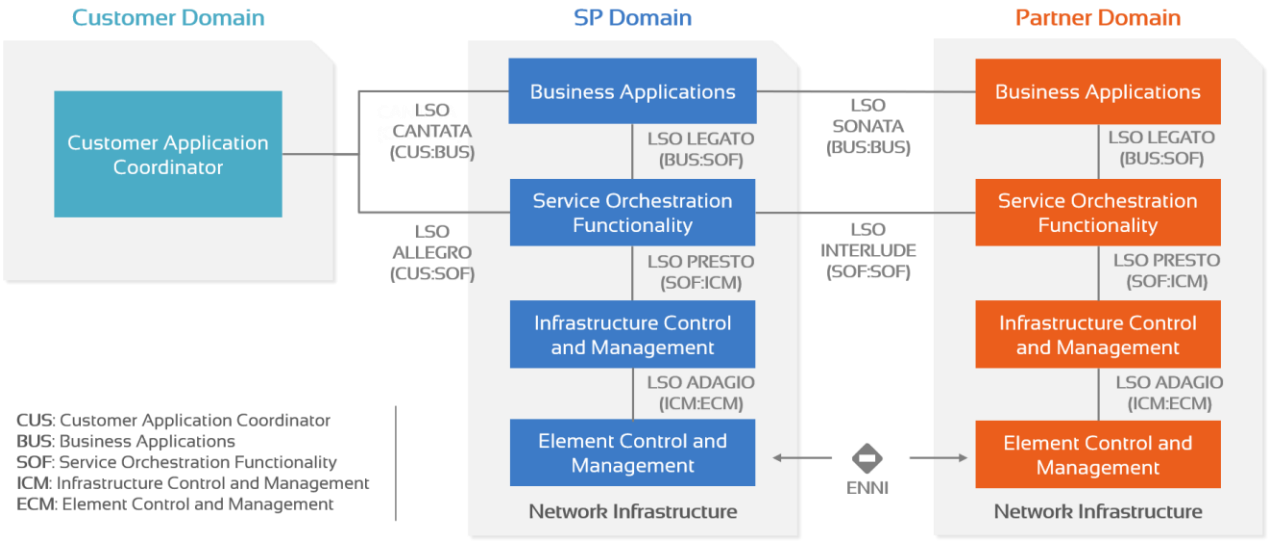
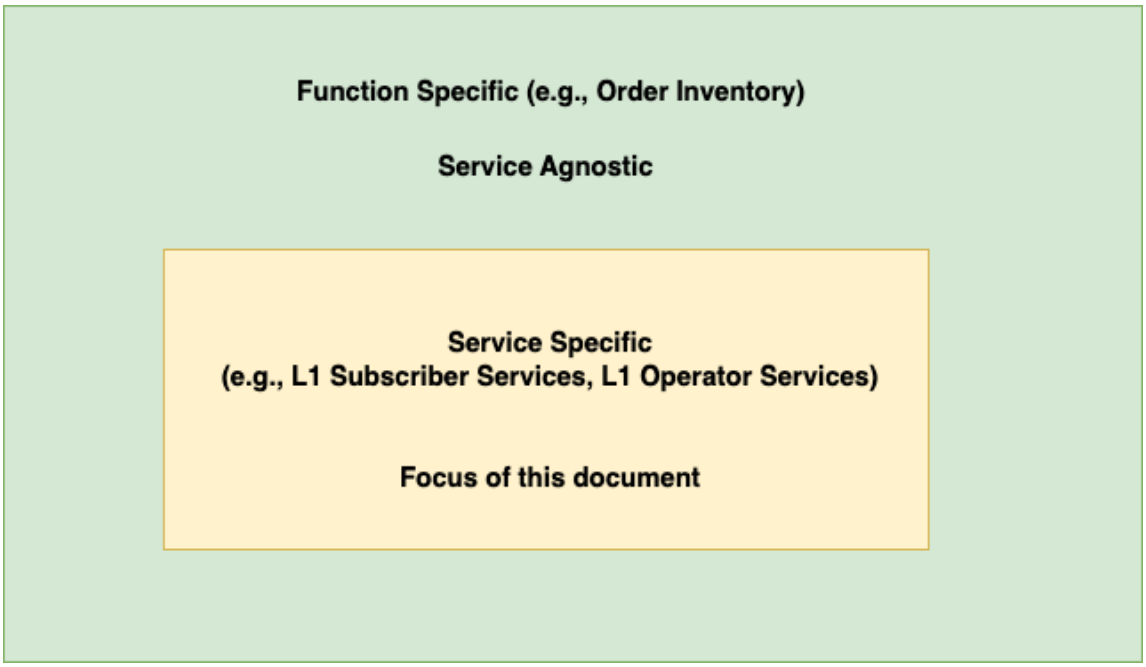


Figure 1-LSO Reference Diagram

The access to automated service provisioning functionality is provided using the Service Provisioning API at multiple LSO Interface Reference Points. LSO provides a suite of APIs for ordering, inventory, etc. which are standardized by MEF as LSO APIs, and which are made available by MEF in a series of releases of the LSO SDKs.

The LSO APIs comprise two parts: one is the service-independent functionality, or Basic API Structure, and the second is the service-specific payload, or Information Payload, as shown in diagram below.



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317 **Figure 2-LSO Service API Structure**

318 This document defines the service-specific payload, shown as YAML/JSON Data Model in the figure above,
319 specifically for a L1 Subscriber and L1 Operator Services as defined in MEF 63 [5] and MEF 64 [6]
320 respectively. The envelope resources of the API and association to specific payload resources will be
321 discussed in detail later in this document.

8 Overview of Layer 1 Service Model

The L1 Service model has eight main classes, L1SubscriberVc, L1SubscriberVcEndPoint, L1SubscriberUni, L1OperatorVc, L1OperatorVcEndPoint, L1OperatorUni, L1Enni and L1EnniService. A L1 Service is defined as either a L1 Subscriber Service or an L1 Operator Service.

A L1 Subscriber Service has two L1 Subscriber UNIs and corresponding L1 VC and L1 VC End Points provided by a Service Provider to a Customer. In some L1 Services the Subscriber will have locations that are not all served by a single L1 Operator. Specifically, to support all L1 Subscriber's UNIs one or more L1 Operators are required. This is where an L1 Operator Service is used.

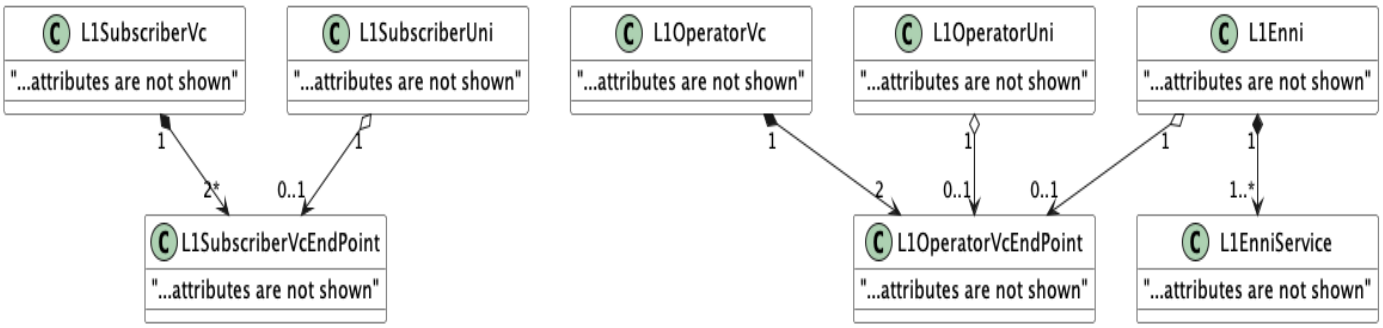


Figure 3- L1 Service Model Overview

9 Overview of L1 Subscriber Services

This specification describes a data model for MEF-defined Subscriber L1 Services. A Subscriber L1 Service is a Layer 1 Service provided to an end user (the Subscriber) by a Service Provider. There is no restriction on the type of organization that can act as a Subscriber; for example, a Subscriber can be an enterprise, a mobile operator, an IT system integrator, a government department, etc. At its most basic, a L1 Subscriber Service provides connectivity between different parts of the Subscriber's network (usually at different physical locations) or between the Subscriber's network and an external network. The subsequent sub-sections provide background on the set of objects that are associated with a L1 Subscriber Service.

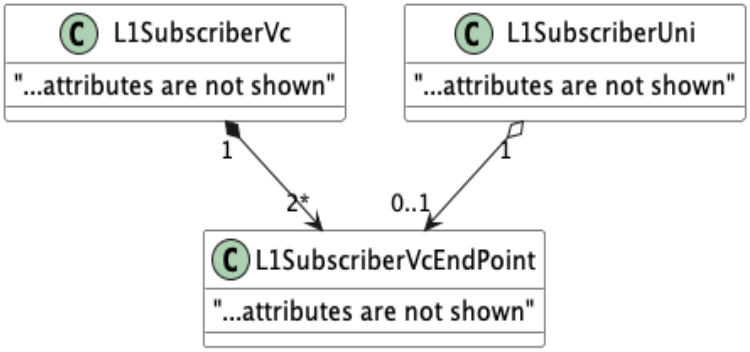


Figure 4-L1 Subscriber Service Model

9.1 L1 Subscriber UNI

A User Network Interface (UNI) is the demarcation point between the responsibility of the Service Provider (SP) and the responsibility of the Subscriber. A Subscriber is connected to the SP at one or more UNIs.

9.2 L1 Virtual Connection and L1 Virtual Connection End Points

A fundamental aspect of L1 Subscriber Service is the L1 Virtual Connection (L1 VC) is an association of two or more L1 VC End Points (L1 VC EPs). A L1 VC EP is a construct at a L1 UNI that selects a subset of the Service Frames that pass over the L1 UNI.

10 Overview of L1Operator Services

This specification describes a data model for MEF-defined L1 Operator Services. When a Service Provider provides an end-to-end L1 Subscriber Service to a Subscriber, they might not be able to implement the entire service using their own network - for instance, one of the Subscriber UNIs might not be in a geographic region where the Service Provider does not operate. In this case, the Service Provider must partner with another Operator who can reach that UNI. The Operator provides L1 connectivity service between the UNI and a point where they can interconnect with the SP's network as described in [6].

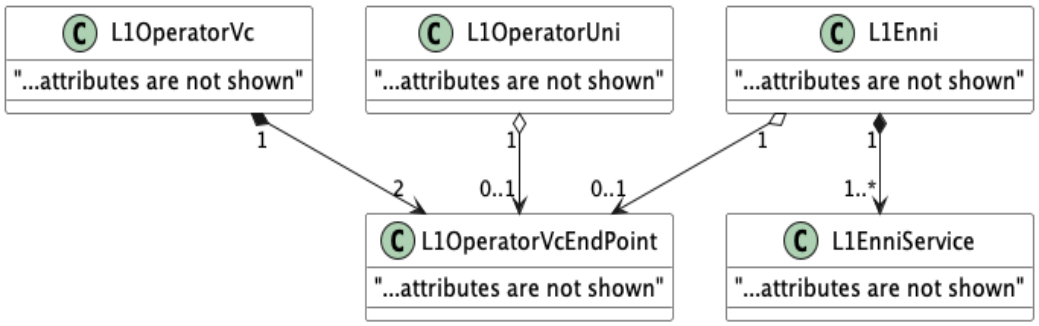


Figure 5-L1 Operator Service Model

10.1 L1 Operator UNI

A L1 Operator UNI is the supporting interface between a customer and SP/SO when the SP/SO is serving L1 Operator Services. The L1 Operator UNI is different from the L1 Subscriber UNI. They are different because the value of each Operator UNI Service Attribute is agreed by the SP/SO and the Operator while the value of each Subscriber UNI Service Attribute is agreed to by the Subscriber and Service Provider.

10.2 L1 Operator Virtual Connection and Operator Virtual Connection End Points

The L1 Operator Virtual Connection (L1 VC) is the building block for constructing a L1 VC spanning multiple Operator L1 networks. In the same way that a L1 VC defines an association of UNIs, an L1 VC is and association of L1 VC End Points. An L1 VC End Point is a logical entity at a given External Interface that is associated with a distinct set of frames passing over that External Interface. An L1 VC End Point represents the logical attachment of an L1 VC to an External Interface (a L1 UNI or L1 ENNI) [6].

10.3 L1 ENNI and ENNI Service

An External Network Network Interface (ENNI) is the demarcation point between the responsibility of one Operator and another - in other words, it is the interface where two Operators interconnect. For each instance of an ENNI, there are multiple sets of ENNI Service Attributes. The value for each ENNI Service Attribute in a set for an Operator network is specific to a SP/SO that is using the ENNI per [6]. Each such value is agreed to by the SP/SO and the Operator.

11 Data Model Design Principles and Assumptions

A Service Attribute for a Service can have a value that is a simple datatype such as an integer or string (or list of simple datatypes) or a value that is an object with multiple properties or a composition of objects. Within this document each simple value (integer, string, Boolean, etc.) is referred to as a Service-Specific Attribute. A Service-Specific Attribute could be a Service Attribute (in the case where the Service Attribute itself has a simple type) or it could be a parameter within a Service Attribute (if the Service Attribute is a structured object or a composition of such objects). The classification for each Service-Specific Attribute may be different across Service Function, Service Action, and Service Offering.

The L1 Service data model supports both INSTALL and CHANGE actions for Service Order for L1 Subscriber VC, L1 Operator VC, L1 Subscriber UNI, L1 Operator UNI, L1 Subscriber VC End Point, L1 Operator VC End Point, L1 ENNI and L1 ENNI Service. The L1 Service data model supports the RETRIEVE action for Inventory for all Service Order components.

The location and physical layer of a L1 Subscriber or Operator UNI and L1 ENNI cannot be changed once it is ordered; instead, this is handled as an installation (L1 Subscriber or Operator UNI or L1 ENNI at new location) and disconnect (L1 Subscriber or Operator or L1 ENNI at previous location), as there is often a requirement for a smooth transition with minimum downtime.

12 Data Models for Layer 1 Services

The data models for the L1 Service configuration are expressed as a set of JSON schemas based on JSON schema draft 7 and encoded in YAML. These schemas accompany this document. This section explains the organization and structure of these schemas.

12.1 Organization and Structure of the Schemas

The schemas are organized into a file structure as shown in Figure 6.

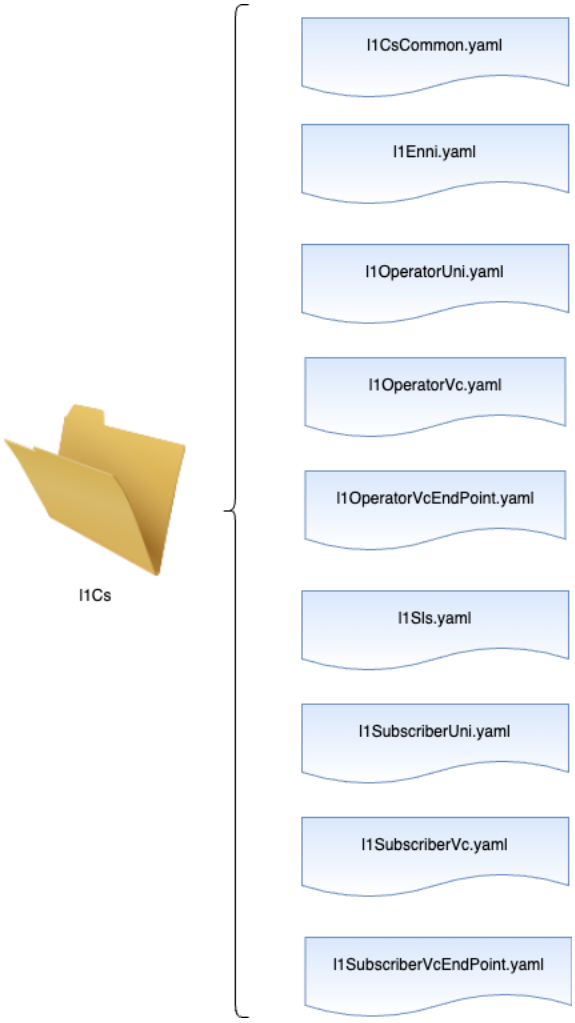


Figure 6-Schema Files Organization

Both Subscriber and Operator L1 Service schemas are provided in the same directory. The is one file that provides common resources that are shared with Subscriber and Operator service:

- l1Cs/l1CsCommon.yaml – provides classes shared among all L1 services.

These common classes are referenced in the relevant service component schema files. For example, the `L1UniPhysicalLayer` attribute specified in l1CsCommon.yaml file refers to common `Layer 1 Physical Layer` definition:

```
  L1UniPhysicalLayer:
    type: object
    description: >-
       The L1 Physical Layer Service Attribute specifies the Client Protocol, the
       Coding Function and the Optical Interface Function.  Reference MEF 63
       Section 8.1.2 Physical Layer Service Attribute.
    properties:
      clientProtocol:
        $ref: '#/definitions/ClientProtocol'
      l1UniCodingFunction:
        $ref: '#/definitions/L1UniCodingFunction'
      l1UniOpticalInterfaceFunction:
        $ref: '#/definitions/L1UniOpticalInterfaceFunction'
```

12.1.1 Naming Conventions

In the schemas, class and type names are UpperCamelCase and Service Attribute/property names are lowerCamelCase.

13 Relationships Between Entities

This section describes the constraints and relationships between the primary Service Order Items for both L1 Subscriber Service (L1 Subscriber VC, L1 Subscriber UNI and L1 Subscriber VC End Point) and L1 Operator Service (L1 Operator VC, L1 Operator UNI, L1 ENNI and L1 Operator VC End Points).

The L1 Service is associated with two or more UNIs each associated with an VC End Point and End Points associated with L1VC. The Operator Ethernet Service is one UNI and one ENNI associated with an VC End Point and End Points associated with L1VC.

13.1 Subscriber L1 Services Relationships Between Entities

A MEF Service Order for Subscriber L1 Service has one or more Service Order Items which are components of the Service-agnostic envelope part of the MEF 99 API[8]. Each Service Order Item is associated to the Service-specific payload components (L1SubscriberVc, L1SubscriberVcEndPoint and L1SubscriberUni. The relationships between the envelope and payload components are shown in Figure 7.

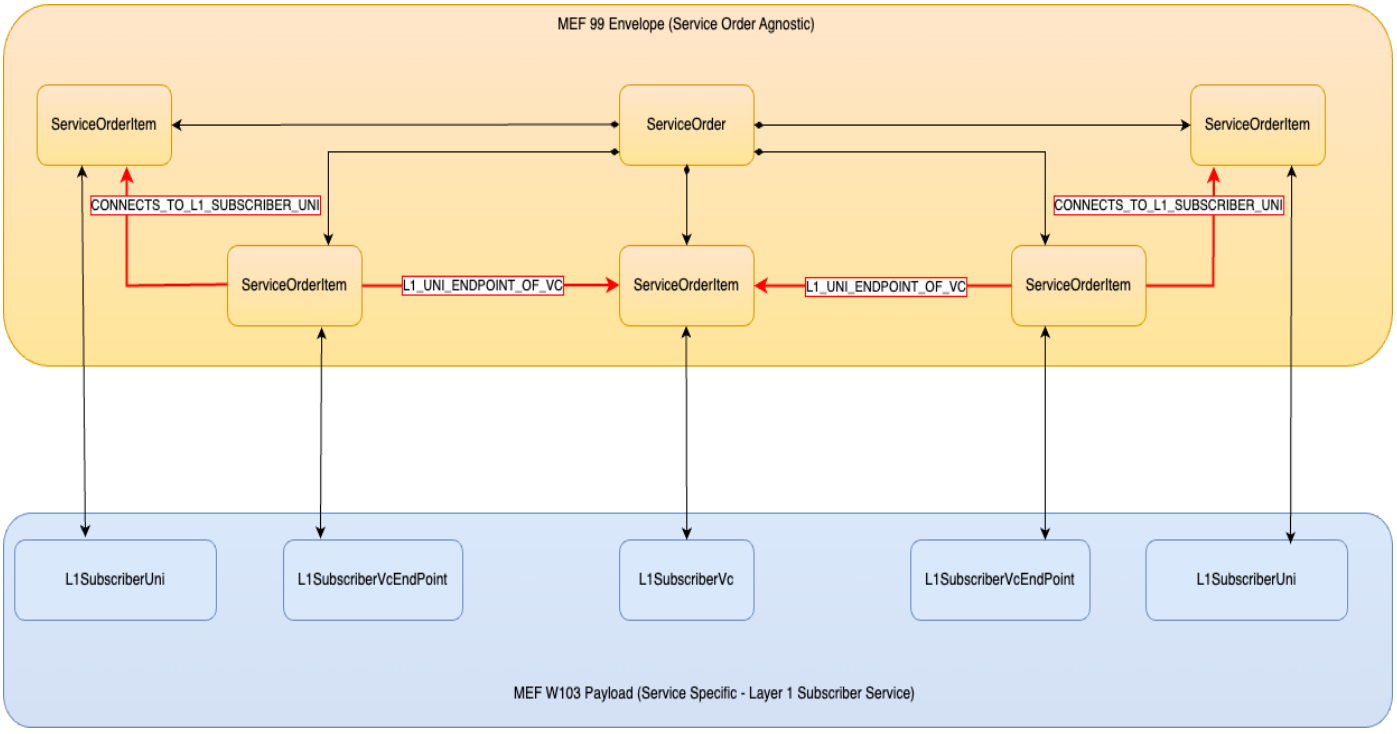


Figure 7-Subscriber L1 Service Order API Associations

#	Source Service	Relationship Type	Cardinality	Target Service
1	L1SubscriberVcEndPoint	L1_UNI_ENDPOINT_OF_VC	1	L1SubscriberVc
2	L1SubscriberVcEndPoint	CONNECTS_TO_L1_SUBSCRIBER_UNI	1	L1SubscriberUni

Table 3-Service Relationship Roles L1 Subscriber Service

[R1] For a service listed in Source Service column in Table 3, the Relationship Type field of the Service Order Item Relationship types **MUST** contain one the corresponding values shown in the Relationship Type column.

[R2] For Order, the relationships to L1 Subscriber UNIs **MUST** be specified for every INSTALL of, or CHANGE to a L1 Subscriber VC.

[R3] For Order, the relationships to L1 Subscriber UNIs **MUST** be specified for every INSTALL of, or CHANGE to a L1 Subscriber VC End Point.

[R4] For a L1 Subscriber VC service, the relationship to a UNI **MUST** reference a L1 Subscriber Uni Order Item.

[R5] For a CHANGE to an L1 Subscriber VC Service, the relationship to the L1 Subscriber UNI **MUST NOT** be changed from the value present in the Service Inventory.

[R5] indicates that once a L1 Subscriber VC and L1 Subscriber VC End Point are associated with a Subscriber UNI, it cannot be associated with a different L1 Subscriber UNI.

A L1SubscriberUni and a L1SubscriberVcEndPoint may be included in the same Service Order as the L1SubscriberVc. The L1SubscriberUni is associated with a specific INSTALL_LOCATION, which is required at INSTALL and CHANGE. Once a L1SubscriberUni is associated with a specific location, the INSTALL_LOCATION cannot be changed and as, the same INSTALL_LOCATION value must be specified for every CHANGE.

The install location is captured in the service-agnostic part of the Service Order API. The value in the Place Relationship Role column in the table below is used in the *role* field of the *RelatedPlaceRefOrValue* type.

Service	Place Relationship Role	Cardinality	CHANGE
L1SubscriberUni	INSTALL_LOCATION	1	Must be same value as Service Inventory.

Table 4-Place Relationship Role

[R6] For a L1SubscriberUni, the Role field (role) of the Related Place (RelatedPlaceRefOrValue) type, MUST contain one of the values shown in Place Relationship Role in Table 4.

[R7] For Order, the Related Place (*RelatedPlaceRefOrValue)* **MUST** be specified for every INSTALL of, or CHANGE to, a L1SubscriberUni.

[R8] For a CHANGE to a L1SubscriberUni the Related Place **MUST NOT** be changed from the value present in the Service Inventory.

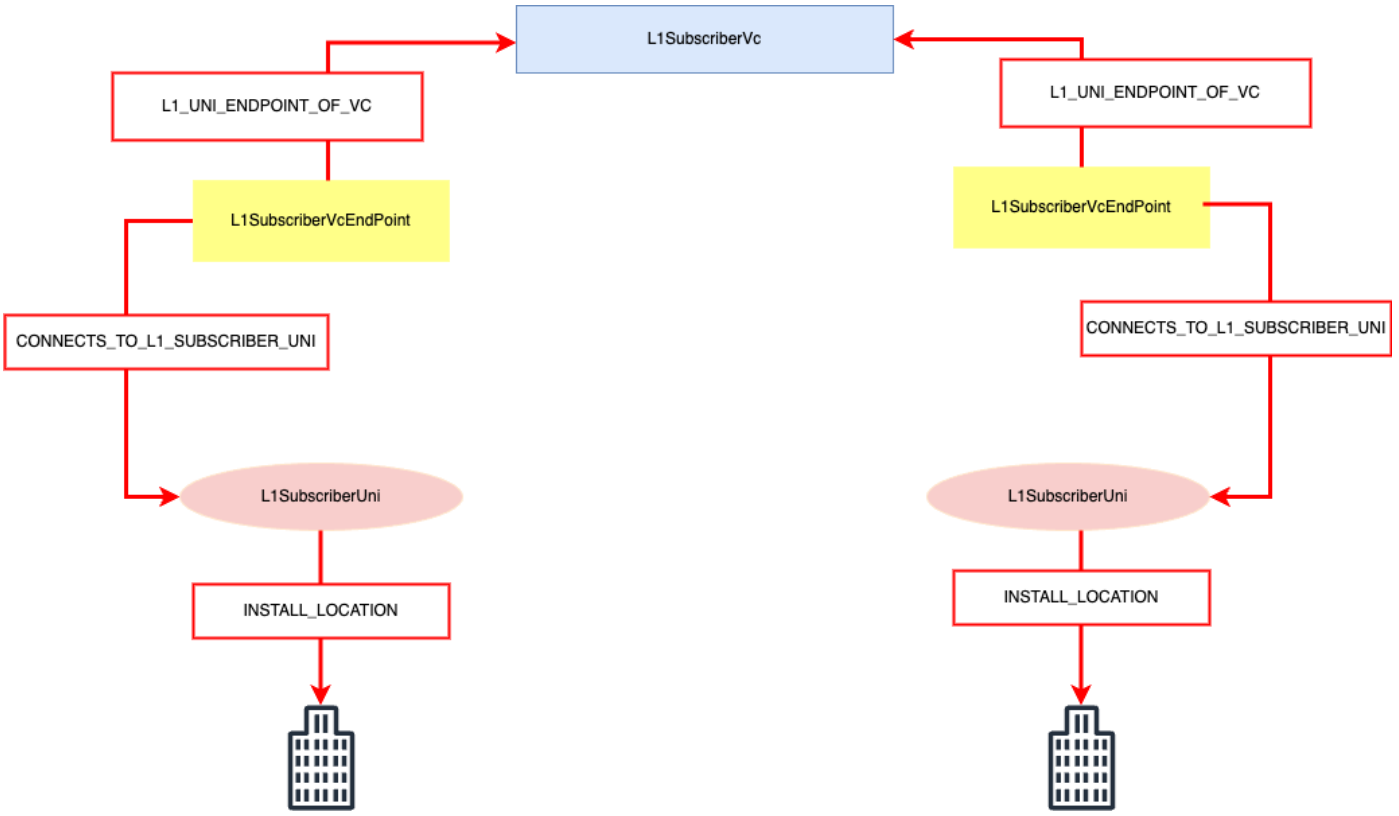


Figure 8-L1 Subscriber Services Entities and Relationships

13.2 Operator Ethernet Services Relationships Between Entities

A MEF Service Order for an L1 Operator Service has one or more Service Order Items which are components of the Service-agnostic envelope part of the MEF 99 API[8]. Each Service Order Item is associated to the Service-specific payload components (L1OperatorVc, L1OperatorVcEndPoint, L1OperatorUni, L1Enni and L1EnniService. The relationships between the envelope and payload components are shown in Figure 9.

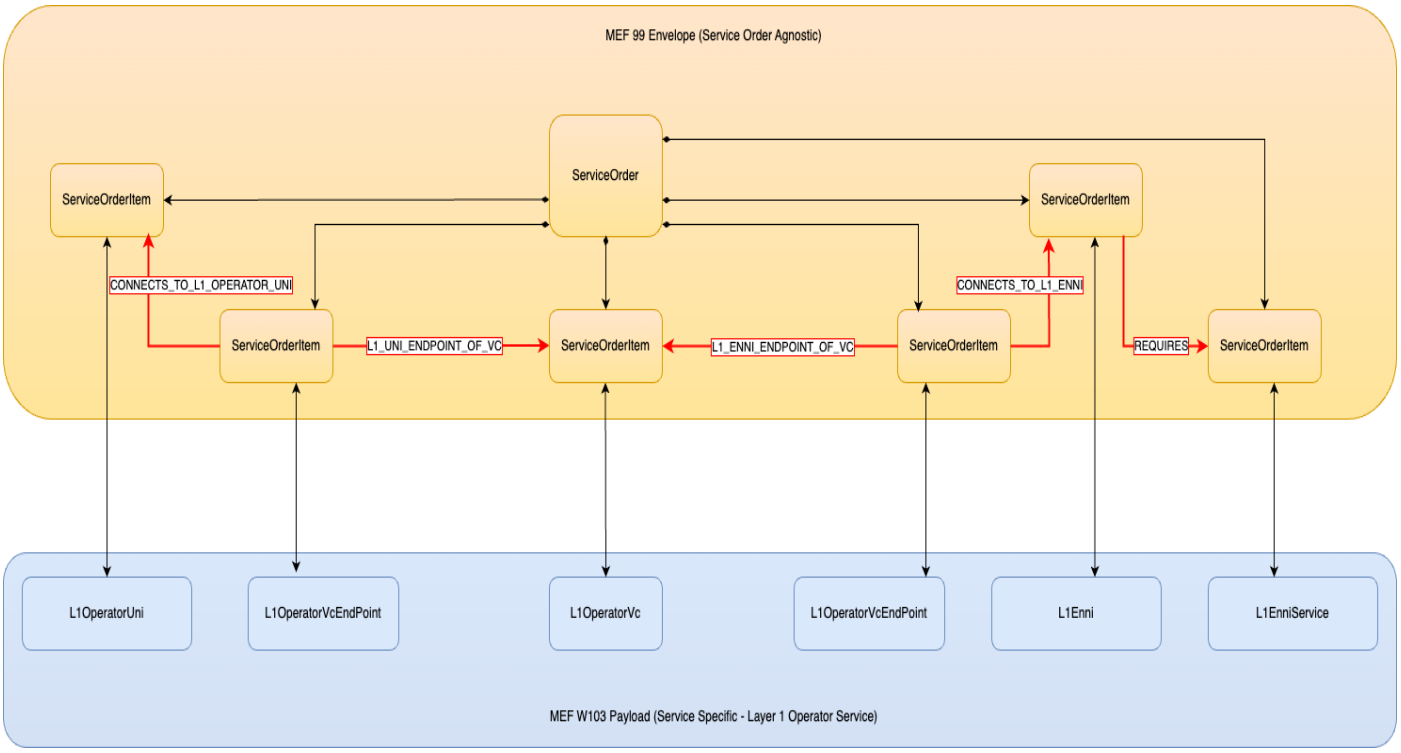


Figure 9-L1 Operator Service Order API Associations

#	Source Service	Relationship Type	Cardinality	Target Service
1	L1OperatorVcEndPoint	L1_UNI_ENDPOINT_VC	1	L1OperatorVc
2	L1OperatorVcEndPoint	L1_ENNI_ENDPOINT_VC	1	L1OperatorVc
3	L1OperatorVcEndPoint	CONNECTS_TO_L1_OPERATOR_UNI	1	L1OperatorUni
4	L1OperatorVcEndPoint	CONNECTS_TO_ENNI	1	L1Enni
5	L1Enni	REQUIRES	1..*	L1EnniService

Table 5-Service Relationship Roles L1 Operator

[R1] For a service listed in Source Service column in Table 3, the Relationship Type field of the Service Order Item Relationship types **MUST** contain one the corresponding values shown in the Relationship Type column.

[R2] For Order, the relationships to L1OperatorUni **MUST** be specified for every INSTALL of, or CHANGE to an L1OperatorVc.

[R3] For Order, the L1Enni **MUST** specify an L1EnniService specific to relationship between SP/SO.

[R4] For Order, the relationships to L1Enni **MUST** be specified for every INSTALL of, or CHANGE to an L1 Operator VC.

[R5] For Order, the relationships to L1 Operator UNIs **MUST** be specified for every INSTALL of, or CHANGE to an L1 Operator VC End Point.

[R6] For Order, the relationships to L1 ENNI **MUST** be specified for every INSTALL of, or CHANGE to an L1 VC End Point.

[R7] For an L1 VC service, the relationship to an L1 Operator UNI **MUST** reference a L1 Operator UNI Order Item.

[R8] For an L1 VC service, the relationship to an L1 ENNI **MUST** reference a L1Enni Order Item.

[R9] For a CHANGE to an L1 VC Service, the relationship to the L1 Operator UNI **MUST NOT** be changed from the value present in the Service Inventory.

[R10] For a CHANGE to an L1 VC Service, the relationship to the L1 ENNI **MUST NOT** be changed from the value present in the Service Inventory.

[R9] indicates that once an L1 VC and L1 VC End Point are associated with an L1 Operator UNI, it cannot be associated with a different L1 Operator UNI.

[R10] indicates that once an L1 VC and L1 VC End Point are associated with an L1 ENNI, it cannot be associated with a different L1 ENNI.

An L1 Operator UNI and an L1 VC End Point may be included in the same Service Order as the L1 VC. The L1 Operator UNI is associated with a specific INSTALL_LOCATION, which is required at INSTALL and CHANGE. Once a L1 Operator UNI is associated with a specific location, the INSTALL_LOCATION cannot be changed and as, the same INSTALL_LOCATION value must be specified for every CHANGE.

The install location is captured in the service-agnostic part of the Service Order API. The value in the Place Relationship Role column in the table below is used in the *role* field of the *RelatedPlaceRefOrValue* type.

Service	Place Relationship Role	Cardinality	CHANGE
L1OperatorUni	INSTALL_LOCATION	1	Must be same value as Service Inventory.
L1Enni	INSTALL_LOCATION	1	Must be same value as Service Inventory.

Table 6-Place Relationship Role

[R11] For a L1OperatorUni, the Role field (role) of the Related Place (RelatedPlaceRefOrValue) type, **MUST** contain one of the values shown in Place Relationship Role in Table 6.

[R12] For Order, the Related Place (*RelatedPlaceRefOrValue)* **MUST** be specified for every INSTALL of, or CHANGE to, a L1OperatorUni.

[R13] For a CHANGE to a L1OperatorUni the Related Place **MUST NOT** be changed from the value present in the Service Inventory.

[R14] For Order, the Related Place (*RelatedPlaceRefOrValue)* **MUST** be specified for every INSTALL of, or CHANGE to, a L1Enni.

[R15] For a CHANGE to a L1Enni the Related Place **MUST NOT** be changed from the value present in the Service Inventory.

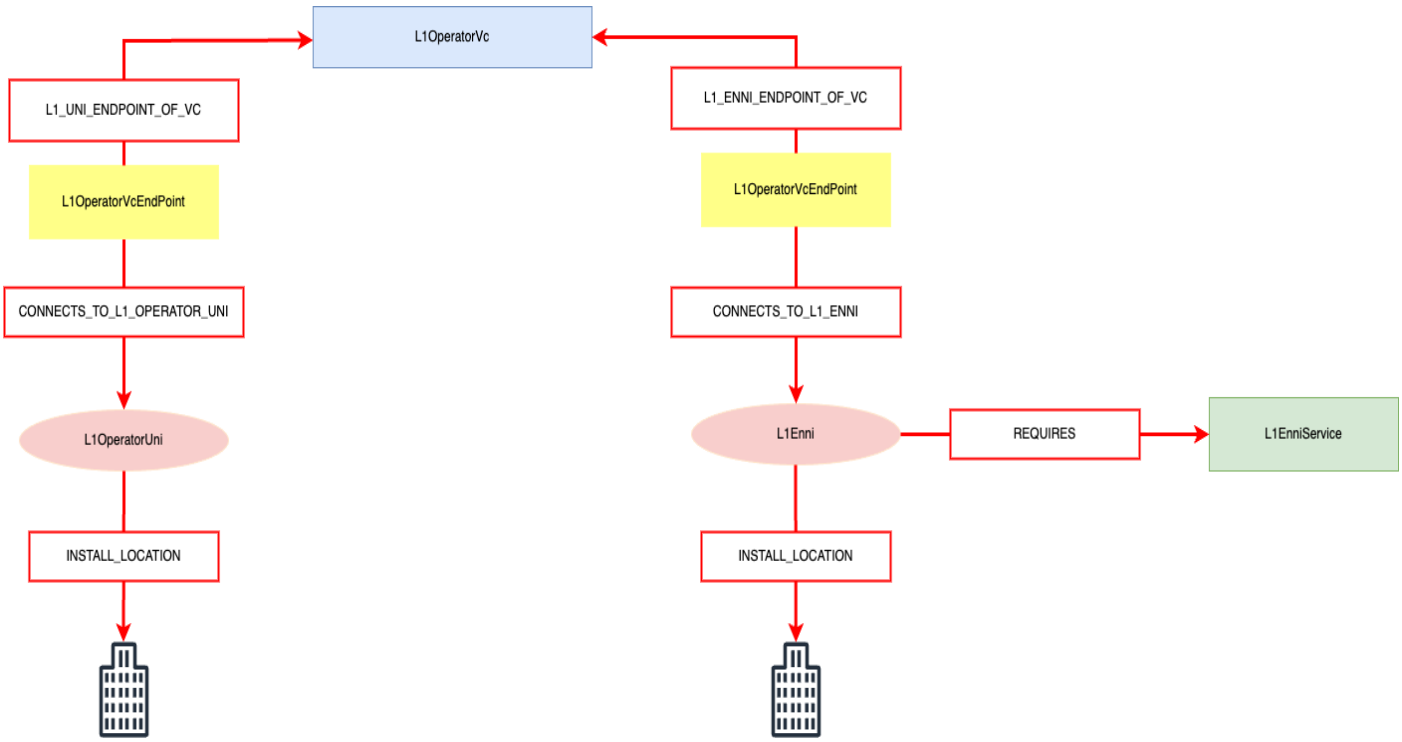


Figure 10-L1 Operator Entities and Relationships

14 Subscriber L1 Services Data Model

A Subscriber L1 Service is a Layer 1 Service provided to an end user (the Subscriber) by a Service Provider. There is no restriction on the type of organization that can act as a Subscriber; for example, a Subscriber can be an enterprise, a mobile operator, an IT system integrator, a government department, etc. At its most basic, a Subscriber L1 Service provides connectivity for frames between different parts of the Subscriber's network (usually at different physical locations).

The L1 Subscriber Services Resources and corresponding Attributes are listed in groups:

- L1SubscriberUni
- L1VcEndPoint
- L1Vc

14.1 L1SubscriberUni

The UNI is the physical demarcation point between the responsibility of the L1 Service Provider and the responsibility of the L1 Subscriber. Reference MEF 63 [5] Section 8.

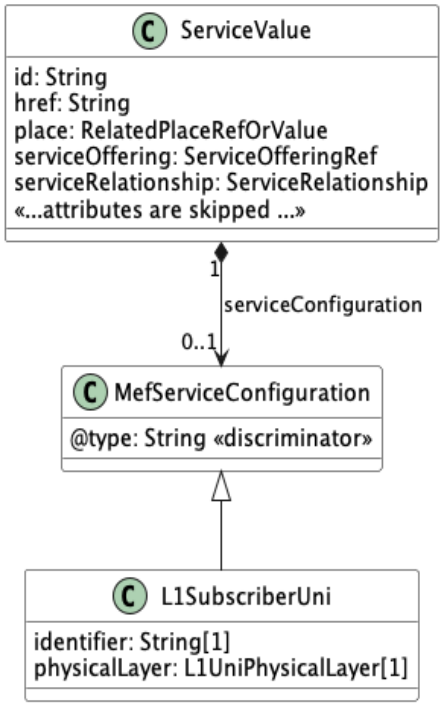


Figure 11-L1SubscriberUni Model

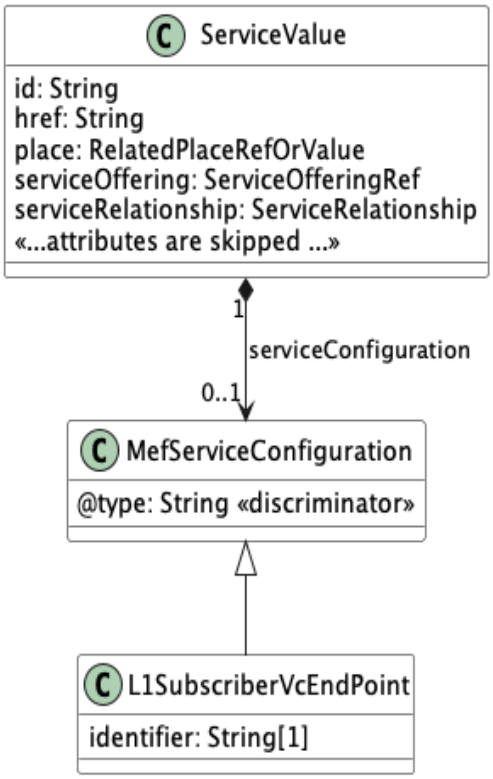
Schema File Name: l1Cs/l1SubscriberUni.yaml $id: urn:mef:lso:spec:service:l1-subscriber-uni:v0.0.2:all			
Attribute Name	**Type**	**Multiplicity**	**Description**

Schema File Name: l1Cs/l1SubscriberUni.yaml $id: urn:mef:lso:spec:service:l1-subscriber-uni:v0.0.2:all			
identifier	String *Min length=1* *Max length=45* *Pattern=pattern: "[\x20-\x7F]+"*	1	The value of the UNI ID Service Attribute is a string that is used to allow Subscriber and Service Provider to uniquely identify the UNI. Reference MEF 64 Section 8.1.1 UNI ID Service Attribute.
physicalLayer	L1UniPhysicalLayer	1	The Physical Layer Service Attribute specifies the Client Protocol, the Coding Function and the optical interface Function. Reference MEF 63 Section 8.1.2 Physical Layer Service Attribute.

Table 7-L1SubscriberUni Service Attributes

14.2 L1SubscriberVcEndPoint

A L1SubscriberVcEndPoint is a logical entity at a given L1SubscriberUni that is associated with L1CI passing over that L1SubscriberUni. A L1SubscriberVc is an association of two L1SubscriberVcEndPoints. A L1SubscriberVcEndPoint represents the logical attachment of a L1SubscriberVc to a L1SubscriberUni. Reference MEF 63 [5] Section 8.3 Subscriber L1VC End Point Service Attributes.



545

546 **Figure 12-L1SubscriberVcEndPoint Model**

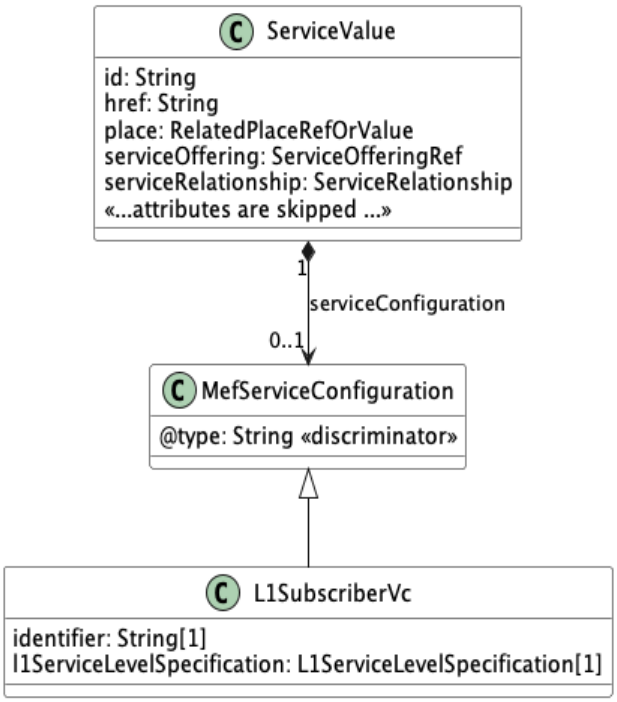
Schema File Name: l1Cs/l1SubscriberVcEndPoint.yaml **$id: urn:mef:lso:spec:service:l1-subscriber-vc-end-point:v0.0.2:all**			
Attribute Name	**Type**	**Multiplicity**	**Description**
identifier	String *Min length=1* *Max length=45* *Pattern=pattern: "[\x20-\x7F]+"*	1	

547 **Table 8-L1SubscriberVcEndPoint Service Attributes**

548 *NOTE: that L1VC EP L1Subscriber UNI attributes is not provided given the relationship to Subscriber UNI is*
549 *provided in the envelope part of API (i.e., MEF 99).*

550 ## 14.3 L1SubscriberVc

551 A L1SubscriberVc is an association of two or more L1VC End Points (L1 VC EPs). Reference MEF 63 Section
552 8.2 Subscriber L1VC Service Attributes [5].



553

554 **Figure 13-L1SubscriberVc Model**

Schema File Name: l1Cs/l1SubscriberVcEndPoint.yaml **$id: urn:mef:lso:spec:service:l1-subscriber-vc:v0.0.2:all**			
Attribute Name	**Type**	**Multiplicity**	**Description**
identifier	String *Min length=1* *Max length=45* *Pattern=pattern: "[\x20-\x7F]+"*	1	

555 **Table 9-L1SubscriberVc Service Attributes**

556 *NOTE: that L1VC List of L1VC EPs attributes is not provided given the relationship to L1VC EP is provided in*
557 *the envelope part of API (i.e., MEF 99).*

15 Operator L1 Services Data Model

An Operator L1 Service is a Layer 1 Service provided to an end user (the Subscriber) by a Service Provider.

The L1 Operator Services Resources and corresponding Attributes are listed in groups:

- L1OperatorUni
- L1OperatorVcEndPoint
- L1OperatorVc
- L1Enni
- L1EnniService

15.1 L1OperatorUni

This class represents the Operator UNI Service Attributes that are agreed on by the SP/SO and the Operator for each UNI. The model below illustrates the payload component association to envelope components.

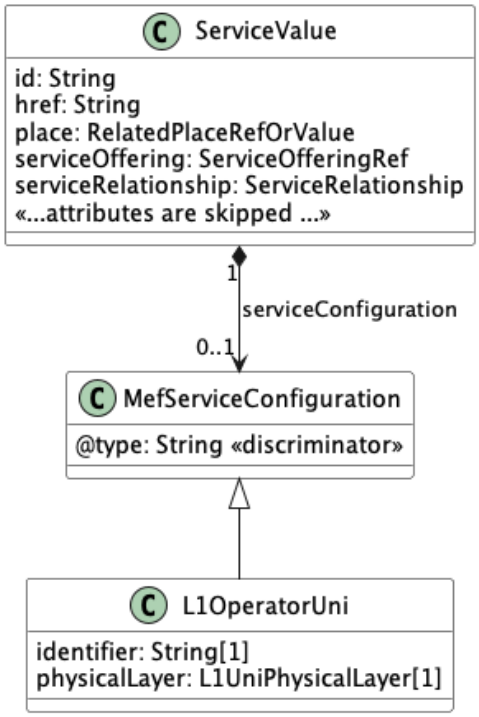


Figure 14-L1OperatorUni Model

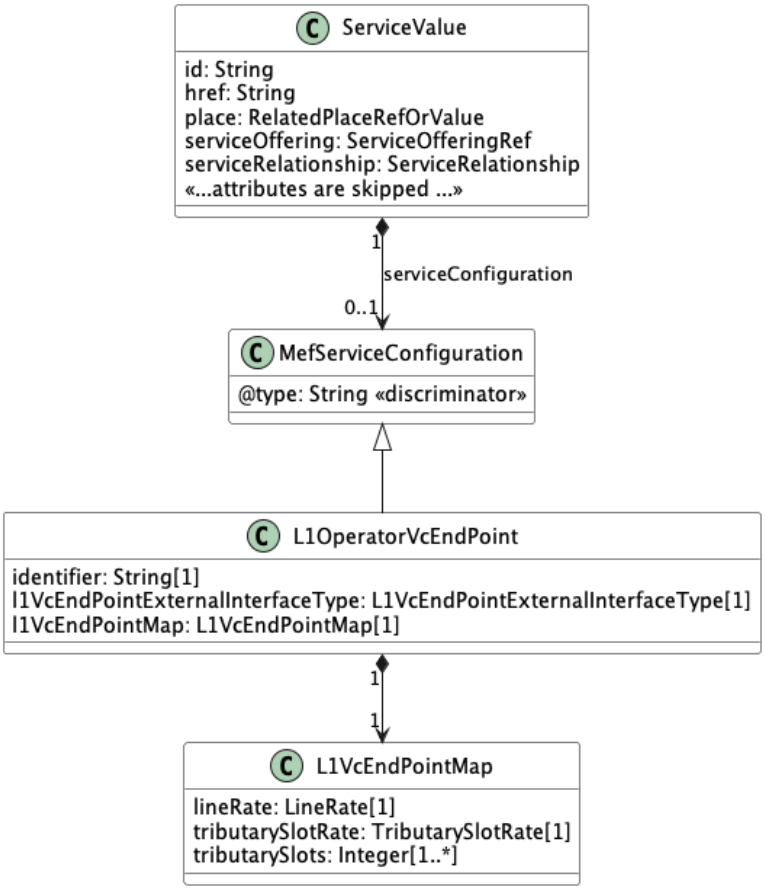
Schema File Name: l1Cs/l1OperatorUni.yaml **$id: urn:mef:lso:spec:service:l1 -operator-uni:v0.0.2:all**			
Attribute Name	**Type**	**Multiplicity**	**Description**
Identifier	String	1	An identifier for the UNI intended for SP/SO and

Schema File Name: l1Cs/l1OperatorUni.yaml $id: urn:mef:lso:spec:service:l1 -operator-uni:v0.0.2:all			
	Min length=1 *Max length=45* *Pattern=pattern: "[\x20-\x7F]+"*		Operator to uniquely identify the UNI. Reference MEF 64 Section 8.3.1 Operator UNI Identifier Service Attribute.
physicalLayer	L1UniPhysicalLayer	1	The Physical Layer Service Attribute specifies the Client Protocol, the Coding Function and the optical interface Function. Reference MEF 64 Section 8.3.2 Physical Layer Service Attribute.

571 **Table 10-L1OperatorUni Service Attributes**

572 ## 15.2 L1OperatorVcEndPoint

573 An Operator L1VC End Point represents the logical attachment of an Operator L1VC to an EI. Reference
574 MEF 64 Section 8.5 Operator L1VC End Point Service Attributes.



575

576 **Figure 15-L1OperatorVcEndPoint Model**

Schema File Name: l1Cs/l1OperatorVcEndPoint.yaml **$id: urn:mef:lso:spec:service:l1-operator-ovc-end-point:v0.0.2:all**			
Attribute Name	**Type**	**Multiplicity**	**Description**
identifier	String Min length=1 Max length=45 Pattern=pattern: "[\x20-\x7F]+"	1	An identifier for the Operator L1VC End Point is a string that is used to allow the SP/SO and operator to uniquely identify the Operator L1VC End Point. Reference MEF 64 Section 8.5.1 Operator L1VC End Point Identifier Service Attribute.
L1VcEndPointExternalInterfaceType	L1VcEndPointExternalInterfaceType	1	Enumeration used to indicate if the L1VC end point is either UNI or ENNI.
l1VcEndPointMap	L1VcEndPointMap	1	Either Not Applicable or non-empty list of tuples of attributes in Table 16. Reference MEF 64

Schema File Name: l1Cs/l1OperatorVcEndPoint.yaml $id: urn:mef:lso:spec:service:l1-operator-ovc-end-point:v0.0.2:all			
			Section 8.5.4 Operator L1VC End Point Map Service Attribute.

577 **Table 11-L1OperatorVcEndPoint Service Attributes**

578 ### 15.2.1 L1VcEndPointMap

579 Either Not Applicable or non-empty list of tuples of attributes in Table 16. Reference MEF 64 Section 8.5.4
580 Operator L1VC End Point Map Service Attribute.

Schema File Name: l1Cs/l1OperatorVcEndPoint.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
lineRate	LineRate	1	Enumeration representing physical line rate.
tributarySlotRate	TributarySlotRate	1	Enumeration representing tributary slot rate in Gb/s.
tributarySlots	Integer	1..*	Tributary Slot is list of integers that represents Tributary Slots occupied in a HO ODUi.

581 **Table 12-TributarySlotRate Service Attributes**

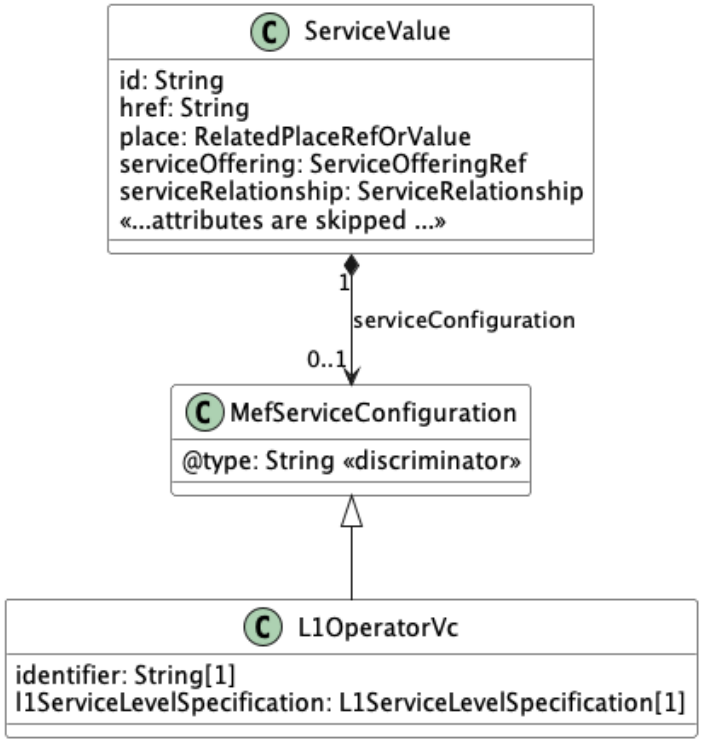
582 ### 15.2.2 TriburtarySlotRate

583 Enumeration representing tributary slot rate in Gb/s.

584 • 1.25
585 • 2.5

586 ## 15.3 L1OperatorVc

587 An Operator L1VC is an association of two Operator L1VC End Points. Reference MEF 63 Section 8.4
588 Operator L1VC Service Attributes.



589

590 **Figure 16-L1OperatorVcModel**

Schema File Name: l1Cs/l1OperatorVc.yaml **$id: urn:mef:lso:spec:service:l1-operator-vc:v0.0.2:all**			
Attribute Name	**Type**	**Multiplicity**	**Description**
identifier	String Min length=1 Max length=45 Pattern=pattern: "[\x20-\x7F]+"	1	An identifier for the OVC intended for management purposes. Reference MEF 26.2 Section 12.1 OVC Identifier Service Attribute.
l1ServiceLevelSpecification	L1ServiceLevelSpecification	1	The Subscriber L1VC Service Level Specification (SLS) Service Attribute is the technical specification of aspects of the service performance agreed to by the Service Provider and Subscriber. Reference MEF 63 Section 8.2.3.

591 **Table 13-L1OperatorVc Service Attributes**

NOTE: L1VC List of L1VC EPs attributes is not provided given the relationship to L1VC EP is provided in the envelope part of API (i.e., MEF 99).

15.4 L1Enni

The ENNI is a reference point representing the boundary between two or more Operator CENs that are operated as separate administrative domains.

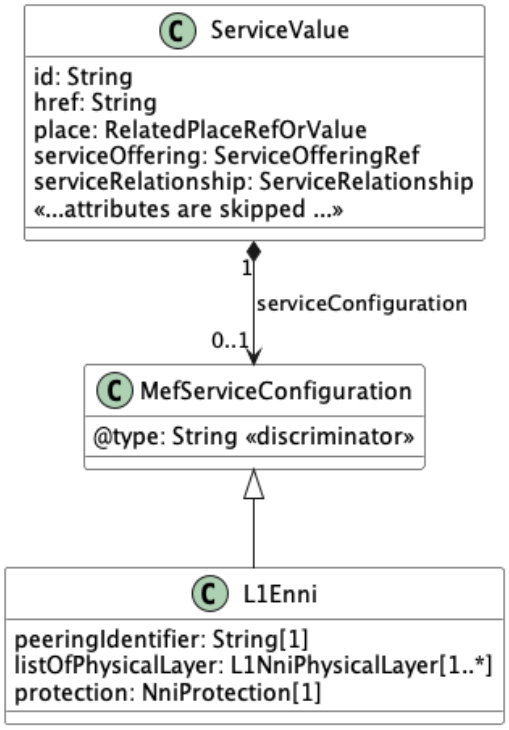


Figure 17-L1Enni Model

Schema File Name: 1Cs/l1Enni.yaml **$id: urn:mef:lso:spec:service:l1-enni:v0.0.2:all**			
Attribute Name	**Type**	**Multiplicity**	**Description**
peeringIdentifier	String *Min length=1* *Max length=45* *Pattern=pattern: "[\x20-\x7F]+"*	1	The ENNI Peering Identifier value is a string used to allow the Operators at ENNI to uniquely identify the ENNI. Reference MEF 64 Section 8.1.1 ENNI Peering Identifier Common Attribute.
listOfPhysicalLayer	L1NniPhysicalLayer	1..*	The list of coding function and wavelength structure supporting the ENNI. Reference MEF 64 Section 8.1.2 ENNI List of

Schema File Name: 1Cs/l1Enni.yaml $id: urn:mef:lso:spec:service:l1-enni:v0.0.2:all			
			Physical Layers Common Attribute.
protection	NniProtection	1	Enumeration representing the protection protocol employed at ENNI for the ODU container exchanged by the operator. The enumeration value is either None or one of the rows as specified in G.873.

599 **Table 14-L1Enni Service Attributes**

600 ### 15.4.1 L1NniPhysicalLayer

601 The L1 NNI Physical layer Service Attribute is a list of 2-tuples of the ENNI Coding Function and ENNI Optical
602 Interface Function. Reference MEF 64 Section 8.1.2 ENNI List of Physical Layers Common Attribute.

Schema File Name: 1Cs/l1Enni.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
l1NniOpticalInterfaceFunction	L1NniOpticalInterfaceFunction	1	The L1 NNI Physical layer Service Attribute is a list of 2-tuples of the ENNI Coding Function and ENNI Optical Interface Function. Reference MEF 64 Section 8.1.2 ENNI List of Physical Layers Common Attribute.
l1NniCodingFunction	L1NniCodingFunction	1	ENNI Coding function is a 3-tuple of the <k, OTUk OH, HO ODUk OH>. • k is an index representing the physical layer line rate. • OTUk OH is a list of overhead values corresponding to the terminated OTUk. • HO ODUk OH is either None or List where the value represents the overhead values corresponding to the terminated HO ODUk.

603 **Table 15-L1NniPhysicalLayer Service Attributes**

15.4.2 L1NniOpticalInterfaceFunction

The L1 NNI Physical layer Service Attribute is a list of 2-tuples of the ENNI Coding Function and ENNI Optical Interface Function. Reference MEF 64 Section 8.1.2 ENNI List of Physical Layers Common Attribute.

oneOf:

- Otu1OpticalInterfaceFunction
- Otu2AndEOpticalInterfaceFunction
- Otu3OpticalInterfaceFunction
- Otu4OpticalInterfaceFunction

15.4.3 L1NniCodingFunction

ENNI Coding function is a 3-tuple of the <k, OTUk OH, HO ODUk OH>. k is an index repre-senting the physical layer line rate. OTUk OH is a list of overhead values corresponding to the terminated OTUk. HO ODUk OH is either None or List where the value represents the overhead values corresponding to the terminated HO ODUk.

Schema File Name: 1Cs/l1Enni.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
otukOverHead	OtuKOverHead	1..*	A list of overhead values corre-sponding to the terminated OTUk.
highOrderOdukOverhead	HighOrderOduOverHead	1..*	The overhead values corresponding to the terminated HO ODUk (or SHO ODUk), where each entry in the list has the value Disabled or Enabled.
lineRate	LineRate	1	Enumeration representing physical line rate.

Table 16-L1NniCodingFunction Service Attributes

15.4.4 OtuKOverHead

OTUk Overhead must be a list of three pairs {field,values} with each field and corresponding values in MEF 64 Section 8.1.2 ENNI List of Physical Layers Common Attribute Table 3 - OTUk Overhead Data Type Attributes.

Schema File Name: 1Cs/l1Enni.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
otukTti	EnabledDisabled	1	OTUk Trail Trace Identifier.

Schema File Name: 1Cs/l1Enni.yaml			
otukGcc0	EnabledDisabled	1	OTUk General Communications Channel.
otukOsmc	EnabledDisabled	1	OTUk OTN Synchronization Messaging Channel.

Table 17-OtuKOverHead Service Attributes

15.4.5 HighOrderOduOverHead

The value of HO ODUk OH is either None or List of overhead values corresponding to the terminated HO ODUk, where each entry in the list has the value Disabled or Enabled.

Schema File Name: 1Cs/l1Enni.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
superHighOrderHighOrderOduTti	EnabledDisabled	1	Super High Order/High Order ODUk Trail Trace Identifier.
superHighOrderHighOrderOduKGcc1	EnabledDisabled	1	Super High Order/High Order ODUk General Communications Channel 1.
superHighOrderHighOrderOduKGcc2	EnabledDisabled	1	Super High Order/High Order ODUk General Communications Channel 2.
superHighOrderHighOrderOduAps	EnabledDisabled	1	Super High Order/High Order ODUk Automatic Protection Switching.

Table 18-HighOrderOduHead Service Attributes

15.4.6 NniProtection

Enumeration representing the protection protocol employed at ENNI for the ODU container exchanged by the operator. The enumeration value is either *None* or one of the rows as specified in G.873.

Contains Enumeration Literals:

- NONE
- 1_PLUS_1_UNIDIR_SNC_I
- 1_PLUS_1_BIDIR_SNC_I
- 1_TO_N_BIDIR_SNC_I
- 1_PLUS_1_UNIDIR_SNC_NE
- 1_PLUS_1_BIDIR_SNC_NE
- 1_PLUS_1_UNIDIR_SNC_NS
- 1_PLUS_1_BIDIR_SNC_NS

- 1_PLUS_1_UNIDIR_SNC_S
- 1_PLUS_1_BIDIR_SNC_S
- 1_TO_N_BIDIR_SNC_S
- 1_PLUS_1_UNIDIR_CL-SNCG_1
- 1_PLUS_1_BIDIR_CL-SNCG_1
- 1_TO_1_BIDIR_CL-SNCG_1

15.5 L1EnniService

The ENNI is a reference point representing the boundary between two or more Operator CENs that are operated as separate administrative domains. For each instance of an ENNI, there are multiple sets of ENNI Service Attributes. The value for each ENNI Service Attribute in a set for an Operator CEN is specific to a SP/SO that is using the ENNI.

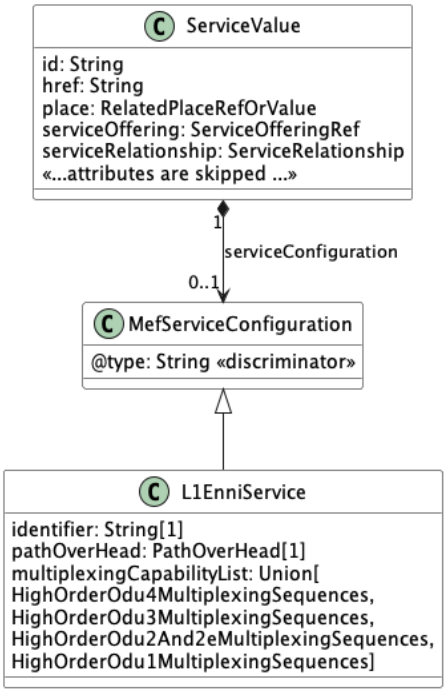


Figure 18-L1EnniService Model

Schema File Name: l1Cs/EnniService.yaml **$id: urn:mef:lso:spec:service:l1-enni-service:v0.0.2:all**			
Attribute Name	**Type**	**Multiplicity**	**Description**
identifier	String *Min length=1* *Max length=45*	1	The Operator ENNI Identifier Service Attribute value is a string used to allow the SP/SO and Operator to uniquely identify the ENNI. Reference MEF 64

Schema File Name: l1Cs/EnniService.yaml $id: urn:mef:lso:spec:service:l1-enni-service:v0.0.2:all			
	Pattern=pattern: "[\x20-\x7F]+"		Section 8.2.1 Operator ENNI Identifier Service Attribute.
pathOverHead	PathOverHead	1	An ODU path is the connectivity between the locations where the path overhead is terminated. Either None or List. When the value of the Operator Path Overhead Service Attribute is List, the entries are the overhead values corresponding to each of the SHO/HO/LO ODU paths carried across an ENNI which is terminated in an Operator's network. Reference MEF 64 Section 8.2.3 Operator Path Overhead Service Attribute.
multiplexingCapability List	one of: • HighOrderOdu4MultiplexingSequences • HighOrderOdu3MultiplexingSequences • HighOrderOdu2And2eMultiplexingSequences • HighOrderOdu1MultiplexingSequences		Indicates the Operator's ability to mulitiplex a given LO ODUj into a HO ODUk (single-stage), or multiplex a given LO ODUi into a HO ODUj and into a SHO ODUk (two-stage), or more multiplexing stages. Reference MEF 64 Section 8.2.2 Operator Multiplexing Capability List Service Attribute.

Table 19-L1EnniService Attributes

15.5.1 PathOverHead

An ODU path is the connectivity between the locations where the path overhead is terminated. Either None or List. When the value of the Operator Path Overhead Service Attribute is List, the entries are the overhead values corresponding to each of the SHO/HO/LO ODU paths carried across an ENNI which is terminated in an Operator's network. Reference MEF 64 Section 8.2.3 Operator Path Overhead Service Attribute.

Schema File Name: l1Cs/EnniService.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
oduTti	EnabledDisabled	1	Overhead value, corresponding to each of the SHO/HO/LO ODU

Schema File Name: l1Cs/EnniService.yaml			
			paths carried across an ENNI, ODU TTI is enabled or disabled.
oduGcc1	EnabledDisabled	1	Overhead value, corresponding to each of the SHO/HO/LO ODU paths carried across an ENNI, ODU GCC1 is enabled or disabled.
oduGcc2	EnabledDisabled	1	Overhead value, corresponding to each of the SHO/HO/LO ODU paths carried across an ENNI, ODU GCC2 is enabled or disabled.
oduAps	EnabledDisabled	1	Overhead value, corresponding to each of the SHO/HO/LO ODU paths carried across an ENNI, ODU APS is enabled or disabled.

659 **Table 20-PathOverHead Attributes**

16 Common Classes and Types

This section is structure like the previous section but focuses on common classes and types used by the Service Attributes. Most of these are structured to support a variety of L1 Services. This section details the data types and enumerations that are used by the L1 Service model.

16.1 ClientProtocol

Enumeration representing client protocol of L1 physical layer.

Contains Enumeration Literals:

- ETHERNET
- FIBERCHANNEL
- SDH
- SONET

16.2 EnabledDisabled

Enumeration used to indicate state as ENABLED or DISABLED.

Contains Enumeration Literals:

- ENABLED
- DISABLED

16.3 Eth1000BaseXOpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- SX-PMD
- LX-PMD
- LX10-PMD
- BX10-PMD

16.4 Eth10GBaseWOpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- LW-PWD
- EW-PWD

16.5 Eth10GBaseROpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- LR-PMD
- ER-PMD

16.6 Eth100GBaseROpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- LR4-PMD
- ER4-PMD

16.7 Eth40GBaseROpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- LR4-PMD
- ER4-PMD
- FR-PMD

16.8 Fc100OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- FC-PI-2-100-SM-LC-L

16.9 Fc200OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- FC-PI-2-200-SM-LC-L

16.10 Fc400OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- FC-PI-5-400-SM-LC-L
- FC-PI-5-400-SM-LC-M

16.11 Fc800OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

719 Contains Enumeration Literals:
720 - FC-PI-5-800-SM-LC-L
721 - FC-PI-5-800-SM-LC-I

722 ### 16.12 Fc1200OpticalInterfaceFunction

723 Optical Interface Function value. Reference MEF 63 Section 8.1.2.

724 Contains Enumeration Literals:
725 - FC-10GFC-1200-SM-LL-L

726 ### 16.13 Fc1600OpticalInterfaceFunction

727 Optical Interface Function value. Reference MEF 63 Section 8.1.2.

728 Contains Enumeration Literals:
729 - FC-PI-5-1600-SM-LC-L
730 - FC-PI-5-1600-SM-LZ-I

731 ### 16.14 Fc3200OpticalInterfaceFunction

732 Optical Interface Function value. Reference MEF 63 Section 8.1.2.

733 Contains Enumeration Literals:
734 - FC-PI-6-3200-SM-LC-L

735 ### 16.15 L1UniCodingFunction

736 MEF 63 Coding Function <c>, functionality which encodes bits for transmission and corresponding decode
737 upon reception.

738 Contains Enumeration Literals:
739 - 1000BASE-X
740 - 10GBASE-W
741 - 10GBASE-R
742 - 40GBASE-R
743 - 100GBASE-R
744 - FC-100
745 - FC-200
746 - FC-400
747 - FC-800
748 - FC-1200
749 - FC-1600
750 - FC-3200
751 - STM-1

- STM-4
- STM-16
- STM-64
- STM-256
- OC-3
- OC-12
- OC-48
- OC-192
- OC-768

16.16 L1UniOpticalInterfaceFunction

Optical Interface Functional value. Reference MEF 63 Section 8.1.2.

oneOf:

- Eth1000BaseXOpticalInterfaceFunction
- Eth10GBaseWOpticalInterfaceFunction
- Eth10GBaseROpticalInterfaceFunction
- Eth100GBaseROpticalInterfaceFunction
- Eth40GBaseROpticalInterfaceFunction
- Fc100OpticalInterfaceFunction
- Fc200OpticalInterfaceFunction
- Fc400OpticalInterfaceFunction
- Fc800OpticalInterfaceFunction
- Fc1200OpticalInterfaceFunction
- Fc1600OpticalInterfaceFunction
- Fc3200OpticalInterfaceFunction
- Stm1OpticalInterfaceFunction
- Stm4OpticalInterfaceFunction
- Stm16OpticalInterfaceFunction
- Stm64OpticalInterfaceFunction
- Stm256OpticalInterfaceFunction
- Oc3OpticalInterfaceFunction
- Oc12OpticalInterfaceFunction
- Oc48OpticalInterfaceFunction
- Oc192OpticalInterfaceFunction
- Oc768OpticalInterfaceFunction

16.17 L1VcEndPointExternalInterfaceType

Enumeration used to indicate if the L1VC end point is either UNI or ENNI.

Contains Enumeration Literals:

- UNI
- ENNI

16.18 L1UniPhysicalLayer

The L1 Physical Layer Service Attribute specifies the Client Protocol, the Coding Function and the Optical Interface Function. Reference MEF 63 Section 8.1.2 Physical Layer Service Attribute.

Schema File Name: l1Cs/l1CsCommon.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
clientProtocol	ClientProtocol	1	Pointer to ClientProtocol.
L1UniCodingFunction	L1UniCodingFunction	1	Pointer to L1UniCodingFunction.
L1UniOpticalInterfaceFunction	L1UniOpticalInterfaceFunction	1	Pointer L1UniOpticalInterfaceFunction.

Table 21-L1UniPhysical Service Attributes

16.19 LineRate

Enumeration representing physical line rate.

- OTU1: SONET OC-48 or STM-16
- OTU2: SONET OC-192, STM-64 or 10GBASE-W
- OTU2e: 10Gigabit Ethernet LAN
- OTU3: SONET OC-768, STM-256 or 40 Gigabit Ethernet
- OTU4: 100 Gigabit Ethernet

Contains Enumeration Literals:

- OTU1
- OTU2
- OTU2E
- OTU3
- OTU4

16.20 Oc3OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- SR-1
- IR-1
- IR-2
- LR-1
- LR-2

- LR-3

16.21 Oc12OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- SR-1
- IR-1
- IR-2
- LR-1
- LR-2
- LR-3
- VR-1
- VR-2
- VR-3
- UR-2
- UR-3

16.22 Oc48OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- SR-1
- IR-1
- IR-2
- LR-1
- LR-2
- LR-3
- VR-2
- VR-3
- UR-2
- UR-3

16.23 Oc192OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- SR-1
- SR-2
- IR-1
- IR-2

- IR-3
- LR-1
- LR-2
- LR-2a
- LR-2b
- LR-2c
- LR-3
- VR-2a
- VR-2b
- VR-3

16.24 Oc768OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- SR-1
- SR-2
- IR-1
- IR-2
- IR-3
- LR-1
- LR-2
- LR-3

16.25 Stm10OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- I-1
- S-1.1
- S-1.2
- L-1.1
- L-1.2
- L-1.3

16.26 Stm4OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- I-4
- S-4.1

- S-4.2
- L-4.1
- L-4.2
- L-4.3

16.27 Stm16OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- I-16
- S-16.1
- S-16.2
- L-16.1
- L-16.2
- L-16.3

16.28 Stm64OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- I-64.LR
- I-64.I
- I-64.2R
- I-64.3
- I-64.5
- S-64.1
- S-64.2
- S-64.3
- S-64.5
- L-64.1
- L-64.2
- L-64.3

16.29 Stm256OpticalInterfaceFunction

Optical Interface Function value. Reference MEF 63 Section 8.1.2.

Contains Enumeration Literals:

- VSR2000-3R1
- VSR2000-3R2
- VSR2000-3R3
- VSR2000-3R5

- VSR2000-3M1
- VSR2000-3M2
- VSR2000-3M3
- VSR2000-3M5
- VSR2000-3H2
- VSR2000-3H3
- VSR2000-3H5

17 L1 Service Level Specification

The Subscriber L1VC Service Level Specification (SLS) Service Attribute is the technical specification of aspects of the service performance agreed to by the Service Provider and the Sub-scriber. For any given SLS, a given Performance Metric may or may not be specified.

The value of the Subscriber L1VC SLS Service Attribute is either None or a 3-tuple of the form (t-s, T, PM) where:

1) t-s is a time that represents the date and time for the start of the SLS.

2) T is a duration that is used in conjunction with t-s to specify a contiguous sequence of time intervals for determining when performance objectives are met. The units for T are not constrained. For example, a calendar month is an allowable value. Since the duration of a month varies it could be specified as, e.g. from midnight on the 10th of one month up to but not including midnight on the 10th of the following month.

3) PM is a list where each element in the list consists of a Performance Metric Name, a list of parameter values specific to the definition of the Performance Metric, and Performance Metric Objective.

The following performance metrics are supported as part of an SLS:

1. One-way Delay Performance Metric (Sls1wDelayPerformanceMetric)
2. One-way Errored Second Performance Metric (Sls1wErroredSecondPerformanceMetric)
3. One-way Severely Errored Second Performance Metric (Sls1wSeverelyErroredSecondPerformanceMetric)
4. One-way Unavailable Second Performance Metric (Slsw1UnavailabilitySecondPerformanceMetric)
5. One-way Availability Performance Metric (Slsw1AvailabilityPerformanceMetric)

17.1 L1ServiceLevelSpecification

The Subscriber L1VC Service Level Specification (SLS) Service Attribute is the technical specification of aspects of the service performance agreed to by the Service Provider and the Subscriber. For any given SLS, a given Performance Metric may or may not specified.

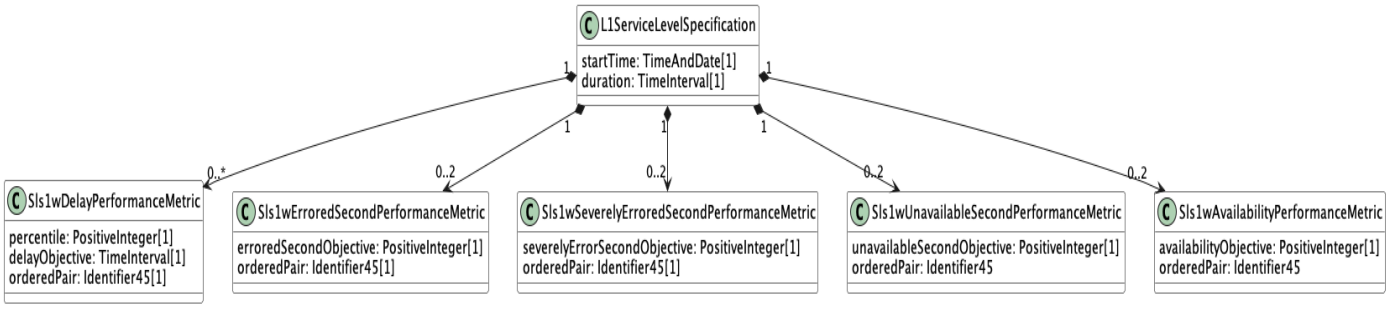


Figure 19-Service Level Specification Model

Schema File Name: l1Cs/l1ServiceLevelSpecification.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
startTime	TimeAndDate	1	StartTime is a time that represents the date and time for the start of the SLS. MEF 63: [R22] t-start MUST be specified to the nearest second. MEF 64: [R30] t-start MUST be specified to the nearest second.
duration	TimeIntervalT	1	Duration is a duration that is used in conjunction with ts to specify a contiguous sequence of time intervals for determining when performance objectives are met. The units for T are not constrained.
sls1wDelayPerformanceMetric	Sls1wDelayPerformanceMetric	0..2	The One-way Delay for the L1CI that ingresses at UNI 1 and that egresses at UNI 2 is defined as the time elapsed from the reception of the first bit of the ingress L1CI at UNI 1 until the reception of that first bit of the corresponding L1CI egressing at UNI 2.
sls1wErroredSecondPerformanceMetric	Sls1wErroredSecondPerformanceMetric	0..2	An errored second (ES) is defined as one second sigma-k in Available Time with at least one errored block (EB) and is not a SES. An EB is defined as a block in which one or more bits are in error.

sls1wSeverelyErroredSecondPerformanceMetric	Sls1wSeverelyErroredSecondPerformanceMetric	0..2	An errored second (ES) is defined as one second sigma-k in Available Time with at least one errored block (EB) and is not a SES. An EB is defined as a block in which one or more bits are in error.
sls1wUnavailableSecondPerformanceMetric	Sls1wUnavailableSecondPerformanceMetric	0..2	An Unavailable Second (UAS) is defined as a second during Unavailable Time (UAT).
sls1wAvailablityPerformanceMetric	Sls1wAvailablityPerformanceMetric	0..2	Availability is defined as the percentage of Available Time over a given interval T-I which does not include Maintenance Interval Time (MIT).

957 **Table 22-L1ServiceLevelSpecification Attributes**

958 17.2 L1VcEndPointRef

959 First reference VC, then specific VC End Point.

Schema File Name: l1Cs/l1ServiceLevelSpecification.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
vcRef	L1VcRef	1..*	Pointer to L1VcRef.
id	String Format: uuid	1	Points to L1VcEndPoint.

960 **Table 23-L1VcEndPointRef Attributes**

961 17.3 L1VcRef

962 Reference to a L1 Virtual Connection Instance.

Schema File Name: l1Cs/l1ServiceLevelSpecification.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
id	String	1..*	VC reference.
href	String Format: uri	1	VC URI reference.

963 **Table 24-L1VcEndPointRef Attributes**

17.4 Sls1wDelayPerformanceMetric

The One-way Delay for the L1CI that ingresses at UNI 1 and that egresses at UNI 2 is defined as the time elapsed from the reception of the first bit of the ingress L1CI at UNI 1 until the reception of that first bit of the corresponding L1CI egressing at UNI 2. Reference MEF 63 Section 8.2.3.3 One-way Delay Performance Metric.

Schema File Name: l1Cs/l1ServiceLevelSpecification.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayFdPercentile	Percentage	1	Frame Delay percentile.
oneWayFdObjective	Time	1	Frame Delay objective.

Table 25-Sls1wDelayPerformanceMetric Attributes

17.5 Sls1wErroredSecondPerformanceMetric

An errored second (ES) is defined as one second sigma-k in Available Time with at least one errored block (EB) and is not a SES. An EB is defined as a block in which one or more bits are in error. Reference MEF 63 Section 8.2.3.4 One-way Errored Second Performance Metric.

Schema File Name: l1Cs/l1ServiceLevelSpecification.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
timeDuration	Time	1	Time duration.
oneWayIfdvPercentile	Percentage	1	Inter-Frame Delay Variation percentile.
oneWayIfdvObjective	Time	1	Inter-frame Delay Variation objective.

Table 26-Sls1wErroredSecondPerformanceMetric Attributes

17.6 Sls1wSeverelyErroredSecondPerformanceMetric

An errored second (ES) is defined as one second sigma-k in Available Time with at least one errored block (EB) and is not a SES. An EB is defined as a block in which one or more bits are in error. Reference MEF 63 Section 8.2.3.5 One-way Severely Errored Second Performance Metric.

Schema File Name: l1Cs/l1ServiceLevelSpecification.yaml

Attribute Name	Type	Multiplicity	Description
orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayMfdObjective	Time	1	Mean Frame Delay objective.

Table 27-Sls1wSeverelyErroredSecondPerformanceMetric Attributes

17.7 Sls1wUnavailabilitySecondPerformanceMetric

An Unavailable Second (UAS) is defined as a second during Unavailable Time (UAT). Reference MEF 63 Section 8.2.3.6 One-way Unavailable Second Performance Metric.

Schema File Name: l1Cs/l1ServiceLevelSpecification.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayFdrPercentile	Percentage	1	Frame Delay Range percentile.
oneWayFdrObjective	Time	1	Frame Delay Range objective.

Table 28-Sls1wUnavailabilitySecondPerformanceMetric Attributes

17.8 Sls1wAvailabilityPerformanceMetric

Availability is defined as the percentage of Available Time over a given interval T-l which does not include Maintenance Interval Time (MIT). Reference MEF 63 Section 8.2.3.7 One-way Availability Performance Metric.

Schema File Name: l1Cs/l1ServiceLevelSpecification.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
orderedPairs	OrderedPair	1..*	A non-empty subset of the ordered pairs of OVC/EVC End Points.
oneWayFrameLossRatioObjective	Percentage	1	Frame Loss Ratio objective.

Table 29-Sls1wAvailabilityPerformanceMetric Attributes

17.9 Time

This data type is for the Time and Date in UTC.

Schema File Name: l1Cs/l1ServiceLevelSpecification.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
day	Integer	1	Denotes the day.
hour	Integer	1	Denotes the hour.
month	Integer	1	Denotes the month.
second	Integer	1	Denotes the second.
year	Integer	1	Denotes the year.

991 **Table 30-Time Attributes**

992 17.10 TimeIntervalT

993 This attribute sets the time interval to evaluate the performance for the SLS. All performance of this SLS
994 use the same time interval T, which itself may not be constrained, e.g., 1 month.

Schema File Name: l1Cs/l1ServiceLevelSpecification.yaml			
Attribute Name	**Type**	**Multiplicity**	**Description**
number	Integer	1	This denotes the value (for the unit).
unit	String Enum: - second - minute - hour - day - month - week - year	1	Time interval unit.

995 **Table 31-TimeIntervalT Attributes**

996 Figure 20 below provides an example of the value for the L1 VC Service Level Specification Attribute. Some
997 observations:

998 • A single value of `startTime` and a single value of `duration` apply to all Performance Metrics.

999 • The SLS is defined with a single instance of each of the Performance Metrics between an Ordered
1000 Pair:

1001 ○ One-way Delay
1002 ○ One-way Errored Seconds
1003 ○ One-way Severely Errored Seconds

- One-way Unavailable Seconds
- One-way Availability

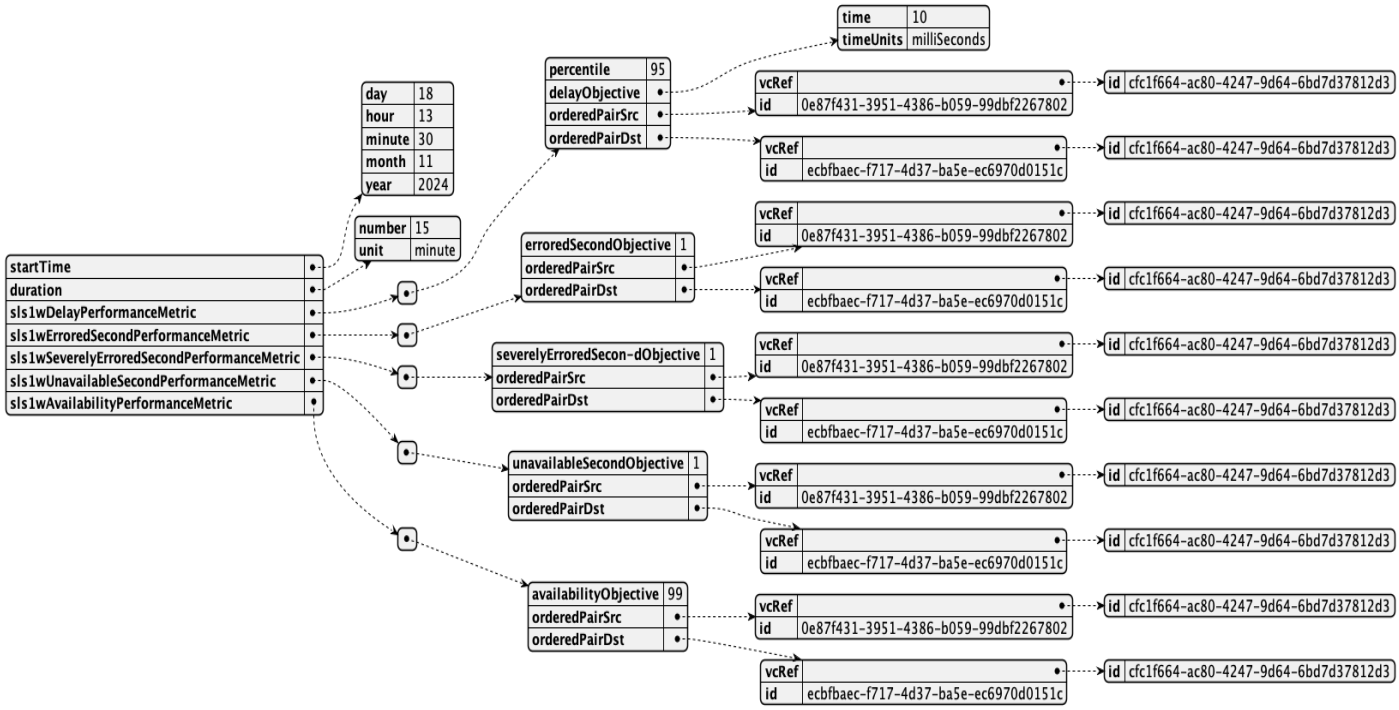


Figure 20-L1 VC Service Level Specification Service Attribute Value Example

```
{
  "startTime" : {
    "day" : 18,
    "hour" : 13,
    "minute" : 30,
    "month" : 11,
    "year" : 2024
  },
  "duration" : {
    "number" : 15,
    "unit" : "minute"
  },
  "sls1wDelayPerformanceMetric" : [ {
    "percentile" : 95,
    "delayObjective" : {
      "time" : 10,
      "timeUnits" : "milliSeconds"
    },
    "orderedPairSrc" : {
      "vcRef" : {
        "id" : "cfc1f664-ac80-4247-9d64-6bd7d37812d3"
      },
      "id" : "0e87f431-3951-4386-b059-99dbf2267802"
```

```
    },
    "orderedPairDst" : {
      "vcRef" : {
        "id" : "cfc1f664-ac80-4247-9d64-6bd7d37812d3"
      },
      "id" : "ecbfbaec-f717-4d37-ba5e-ec6970d0151c"
    }
  } ],
  "sls1wErroredSecondPerformanceMetric" : [ {
    "erroredSecondObjective" : 1,
    "orderedPairSrc" : {
      "vcRef" : {
        "id" : "cfc1f664-ac80-4247-9d64-6bd7d37812d3"
      },
      "id" : "0e87f431-3951-4386-b059-99dbf2267802"
    },
    "orderedPairDst" : {
      "vcRef" : {
        "id" : "cfc1f664-ac80-4247-9d64-6bd7d37812d3"
      },
      "id" : "ecbfbaec-f717-4d37-ba5e-ec6970d0151c"
    }
  } ],
  "sls1wSeverelyErroredSecondPerformanceMetric" : [ {
    "severelyErroredSecon-dObjective" : 1,
    "orderedPairSrc" : {
      "vcRef" : {
        "id" : "cfc1f664-ac80-4247-9d64-6bd7d37812d3"
      },
      "id" : "0e87f431-3951-4386-b059-99dbf2267802"
    },
    "orderedPairDst" : {
      "vcRef" : {
        "id" : "cfc1f664-ac80-4247-9d64-6bd7d37812d3"
      },
      "id" : "ecbfbaec-f717-4d37-ba5e-ec6970d0151c"
    }
  } ],
  "sls1wUnavailableSecondPerformanceMetric" : [ {
    "unavailableSecondObjective" : 1,
    "orderedPairSrc" : {
      "vcRef" : {
        "id" : "cfc1f664-ac80-4247-9d64-6bd7d37812d3"
      },
      "id" : "0e87f431-3951-4386-b059-99dbf2267802"
    },
    "orderedPairDst" : {
      "vcRef" : {
        "id" : "cfc1f664-ac80-4247-9d64-6bd7d37812d3"
      },
      "id" : "ecbfbaec-f717-4d37-ba5e-ec6970d0151c"
```

```
      }
    } ],
    "sls1wAvailabilityPerformanceMetric" : [ {
      "availabilityObjective" : 99,
      "orderedPairSrc" : {
        "vcRef" : {
          "id" : "cfc1f664-ac80-4247-9d64-6bd7d37812d3"
        },
        "id" : "0e87f431-3951-4386-b059-99dbf2267802"
      },
      "orderedPairDst" : {
        "vcRef" : {
          "id" : "cfc1f664-ac80-4247-9d64-6bd7d37812d3"
        },
        "id" : "ecbfbaec-f717-4d37-ba5e-ec6970d0151c"
      }
    } ]
}
```

Figure 21-L1 SLS JSON Example

Appendix A Usage examples (Informative)

This appendix aims to provide an extensive set of examples to cover:

- Different Service Order configuration variants,
- Basic Service Order API walkthrough to order a L1 Service,
- Common modifications,
- Deletion of a L1 Service.

The examples are delivered in two forms:

- As part of this document – to allow comments and rich explanation.
- As a Postman collection – for ease of use in testing.

A.1 High-level Flow

The Interface Reference Points each form a set of APIs that service different functions in the end-to-end flow.

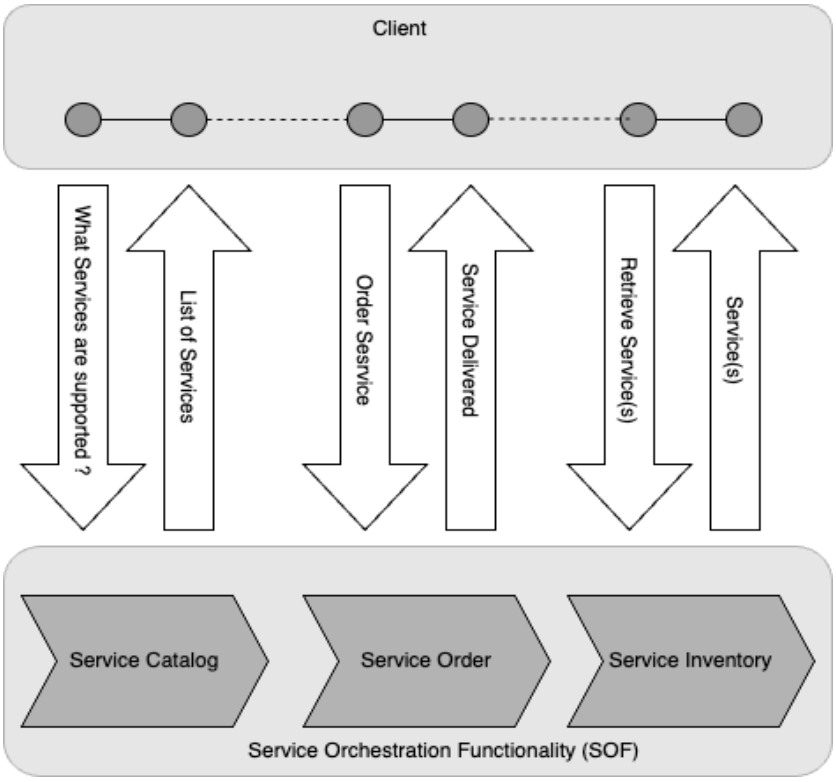


Figure 22-Service End-to-End Function Flow

Service Catalog – allows the Client to query SOF for available Services as well as what attributes are fixed and/or elastics with values/ranges.

Service Order – allows the Client to request the SOF to initiate and complete the fulfillment process of installation of a Service Offering, an update to an existing Service, or a disconnect of an existing Service.

Service Inventory – allows the Client to retrieve information about existing Service instances from the SOF's Service Inventory.

All the above-mentioned APIs are provided in the SDK together with accompanying Developer Guides. Please refer to those documents for more details and examples of functional APIs.

A.2 Integration of Service Specification into the Service Order API

The Service Order API is service-agnostic in the meaning that they serve as an interaction between the Client and the Server (SOF) and they do not contain any service-specific information in their specifications. To pass the service-specific information, an extension pattern is used. This applies to any of the Legato Service APIs that carry service-specific information: Service Catalog, Service Order and Service Inventory [8].

The extension hosting type in the API data model is `MefServiceConfiguration`. The `@type` attribute of that type must be set of a value that uniquely identifies the service specification. See Figure 23 and Figure 24. A unique identifier for MEF standard service specifications is in URN format and is assigned by MEF. This identifier is provided as root schema `$id` and in service specification documentation. The example below shows a header of a Carrier Ethernet Subscriber UNI, where **`$id: urn:mef:lso:spec:service:l1-subscriber-uni:v0.0.2:all`** the above-mentioned URN:

```
$id: urn:mef:lso:spec:service:l1-subscriber-uni:v0.0.1:all
$schema: http://json-schema.org/draft-07/schema#
title: MEF LSO Service - L1 Subscriber UNI Specification
```

In this case, this will be in format of examples below:

- `urn:mef:lso:spec:service:l1-subscriber-uni:v0.0.2:order`
- `urn:mef:lso:spec:service:l1-subscriber-vc:v.0.0.2:order`
- `urn:mef:lso:spec:service:l1-subscriber-vc-end-point:v.0.0.2:order`

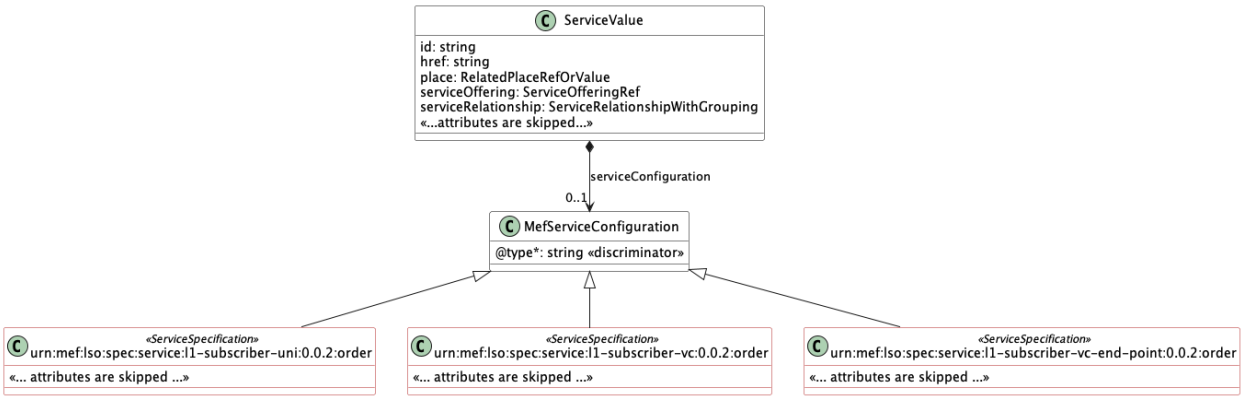


Figure 23-Extension Pattern: L1 Subscriber Service-Specific Extensions

- `urn:mef:lso:spec:service:l1-operator-uni:v0.0.2:order`
- `urn:mef:lso:spec:service:l1-operator-vc:v.0.0.2:order`
- `urn:mef:lso:spec:service:l1-operator-vc-end-point:v.0.0.2:order`
- `urn:mef:lso:spec:service:l1-enni:v.0.0.2:order`
- `urn:mef:lso:spec:service:l1-enni-service:v.0.0.2:order`

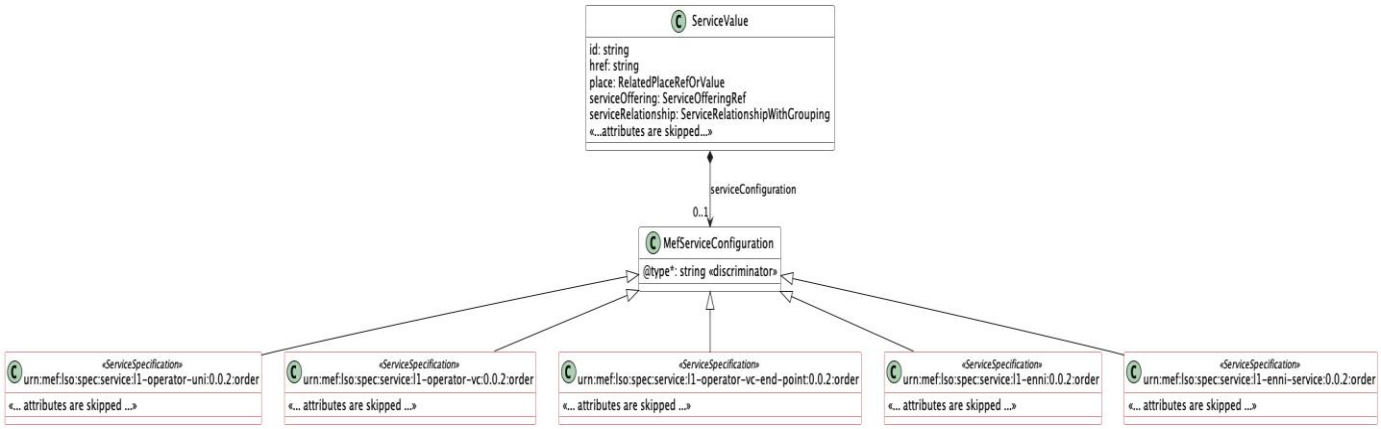


Figure 24-Extension Pattern: L1 Operator Service-Specific Extensions

A.3 Use Case 1: Create Service Order

The `ServiceOrderCreate` process is initiated by the Buyer/Client with the determination of the one or more `ServiceOrderItems` that will be part of a Service Order using the `ServiceOrderCreate`. Each Service Order Item through the Extension pattern is associated with a MEF Service specific payload component (i.e., `L1SubscriberUni`, `L1VcEndPoint`, `L1Vc`).

The Buyer/Client sends a request with a `ServiceOrderCreate` type in the body. The SOF performs request validation, assigns an `id`, and returns `ServiceOrder` type in the response body, with a state set to `acknowledged`. From this point, the `ServiceOrder` is ready for further processing. The Buyer/Client can track the progress of the process by either subscribing for notifications (Asynchronous operation) or by periodically polling (Synchronous operation) the `ServiceOrder`. The two patterns are illustrated in sequence diagrams below.

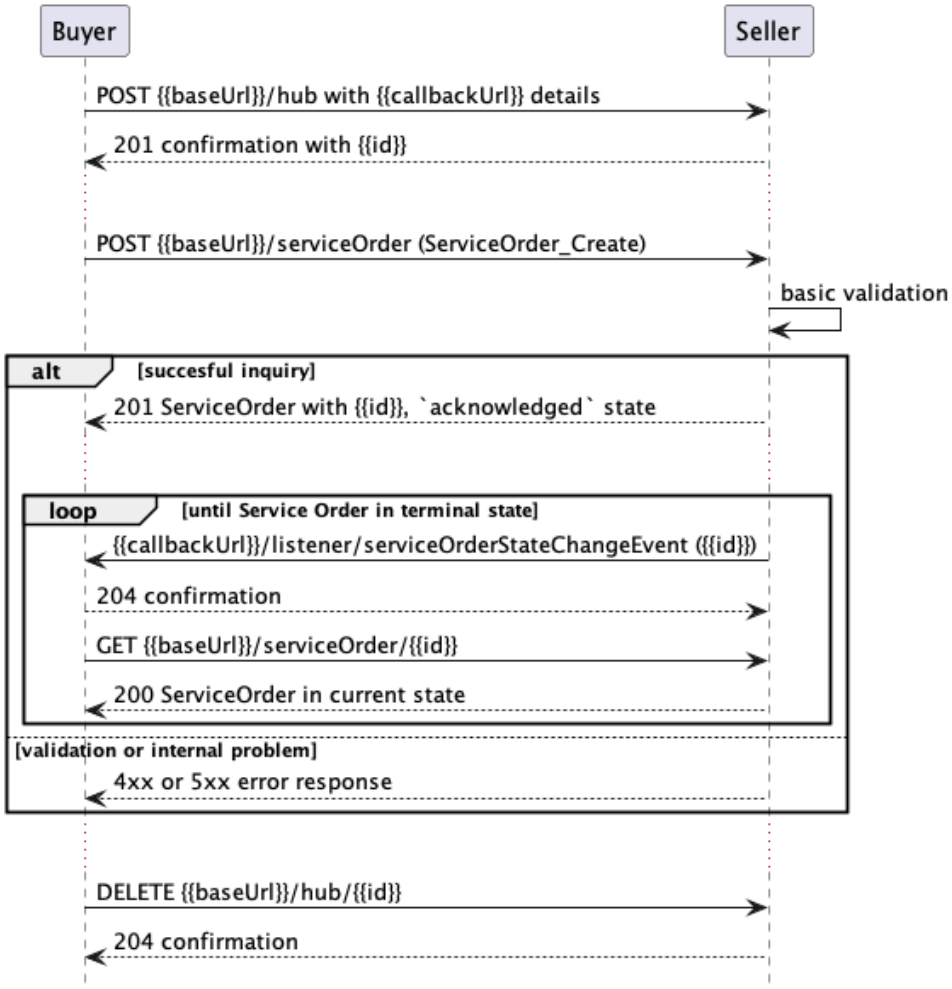


Figure 25-Service Order progress tracking – Notifications (Asynchronous)

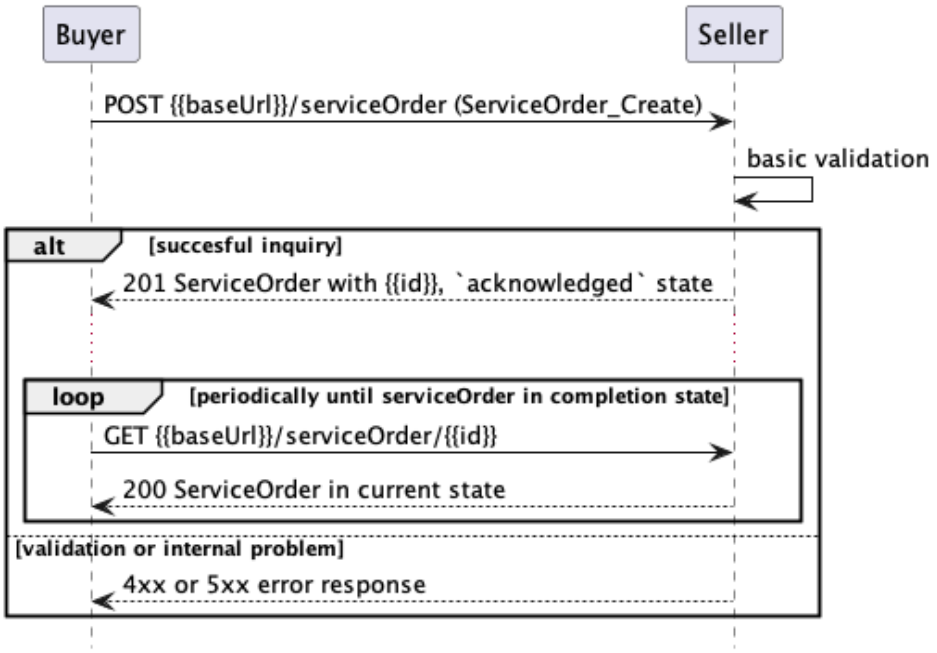


Figure 26-Service Order progress tracking – Polling (Synchronous)

A.3.1 Create Service Order Request

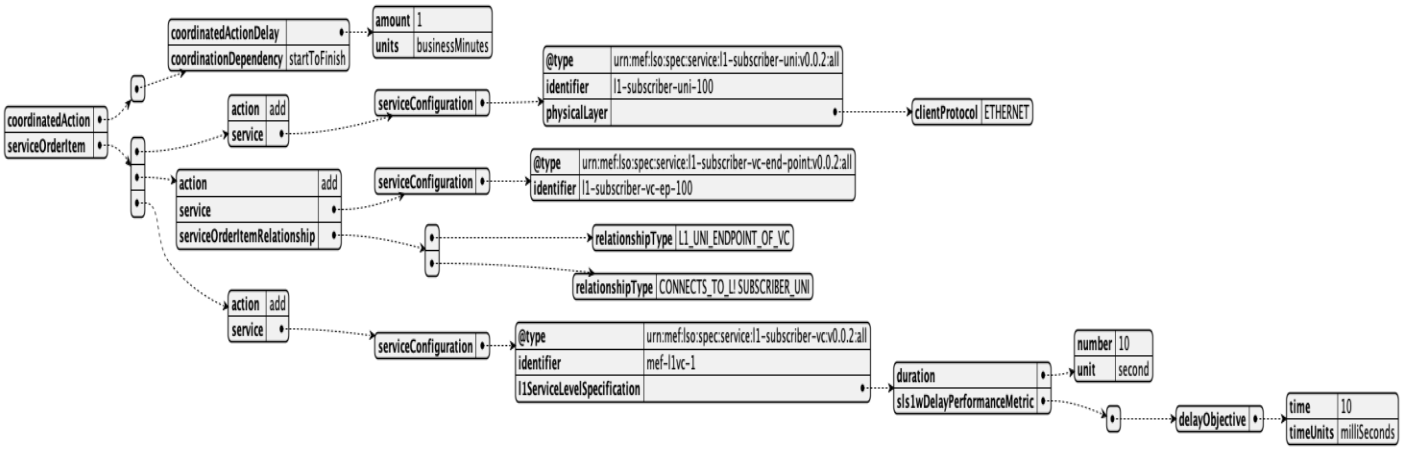


Figure 27-Service Order Request

Entities use for providing a response to a `ServiceOrderCreate` request are presented in Figure 28. The main types used for response are `ServiceOrder` and `ServiceOrderItem`, which add attributes set by the SOF (like id or state) `ServiceOrder` is the root entity of a response. The response echoes back all attributes as provided by the BUS/CLIENT and contains the same number of `ServiceOrderItems` as in the request. The following snippet presents the SOF's response including an example L1CS payload.

This section guides through all the steps of Service Order API that is needed to be performed to successfully order a L1 Subscriber UNI service.

NOTE: SOF is free to mandate some of these steps.

NOTE: As the examples of steps in many cases will replicate the service-specific information, in some of the snippets some parts of it will be omitted for better readability.

There are rules for all request items for creation requests (Service Order):

- `item.action` must be set to `add`
- `item.service.id` must not be provided.
- `service.serviceConfiguration` must contain all desired configurations

A.3.2 Create Service Order Response

The SOF response to the `CreateServiceOrder` is a `ServiceOrder` which is shown below. The main types used for the response are `ServiceOrder` and `ServiceOrderItem`. The one or more `ServiceOrderItems` will reference a specific L1CS resource as part of the payload and association(s) to other `ServiceOrderItems` as an attribute in the envelope. The response echoes back all the attributes as provided by the Client/Buyer and contains the same number of `ServiceOrderItems` as in the request.


```
{
    "coordinatedAction": [
        {
            "coordinatedActionDelay": {
                "amount": 10,
                "units": "businessMinutes"
            },
            "coordinationDependency": "startToFinish",
            "orderId": "0000000-2222-5555-00000000123"
        }
    ],
    "description": "l1-cs-so-0001",
    "note": [
        {
            "author": "admin",
            "date": "2024-11-17T02:15:00Z",
            "id": "0000000-2222-5555-00000000123",
            "source": "bus",
            "text": "automatic_so"
        }
    ],
    "orderRelationship": [
        {
            "serviceOrder": {
                "href": "0000000-2222-5555-00000000123",
                "id": null
            },
            "relationshipType": null
        }
```

```
    ],
    "relatedContactInformation": [
        {
            "emailAddress": "admin@sof.com",
            "name": "admin",
            "number": "651-555-0000",
            "organization": "SOF Co.",
            "postalAddress": {
                "city": "Duluth",
                "country": "USA",
                "streetName": "100 Postal Street"
            },
            "role": null
        }
    ],
    "requestedCompletionDate": "2024-11-17T02:15:00Z",
    "requestedStartDate": "2024-11-17T02:15:00Z",
    "href": "{{baseUrl}}/serviceOrder/0000000-2222-5555-00000000123",<< added by SOF >>
    "id": "0000000-2222-5555-00000000123",
    "serviceOrderItem": [
        {
            "id": null,
            "action": "add",
            "coordinatedAction": null,
            "note": null,
            "service": {
                "note": null,
                "serviceRelationship": null,
                "relatedContactInformation": null,
                "place": null,
                "serviceConfiguration": {
                    "@type": "urn:mef:lso:spec:service:l1-subscriber-uni:v0.0.2:all",
                    "identifier": "l1subscriberuni-100"
                }
            },
            "serviceOrderItemRelationship": [
                {
                    "orderItem": null,
                    "relationshipType": "L1_UNI_ENDPOINT_OF_VC"
                }
            ],
            "state": null,
            "terminationError": null
        }
    ],
    "state": "acknowledged", << added by SOF >>
    "orderDate": "2024-11-17T02:15:00Z"
}
```

The attributes that are set by the SOF in the response are marked with the <<added by SOF>> tag. The response to create request does not contain all possible attributes.

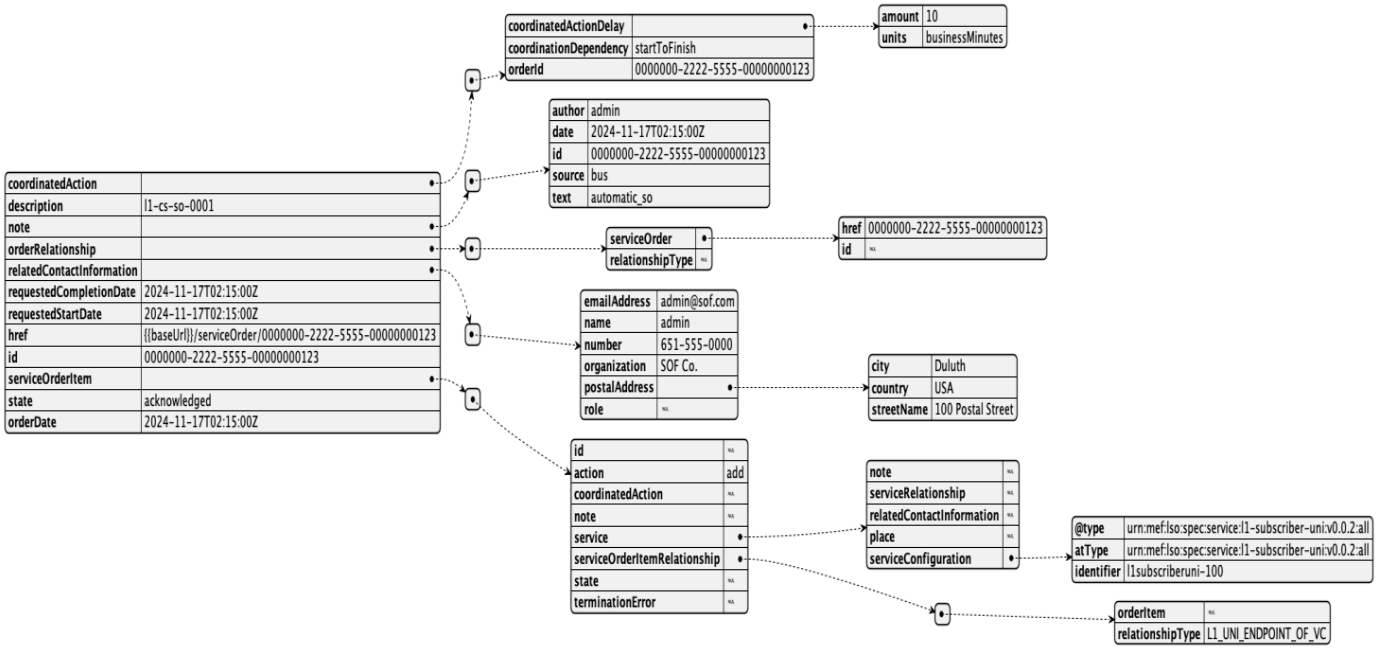


Figure 28-Service Order Response

The set of requirements for the Service Order Response are specified in [8].

A.4 Use Case 2: Service Order Item to Modify Existing Service

The following use case shows a request for an order for an existing L1 VC Subscriber Service modification (`action` equal to `modify`). A change to L1 Service Level Specification objective is performed.

The following requirements based on [8] apply to `serviceOrderItem` when action is `modify`:

[R16] The modify request **MUST** specify a reference (provide `service.id`) to an existing service that is a subject of this order and provide the desired `service.configuration`.

[R17] The modify request **MUST** repeat the same values (specified or empty) of `service.relationship`, and `service.place` as they are available in the inventory for a given service instance. These values cannot be update or deleted.

[R18] If there is a relationship with another Service Order Item, the `serviceOrderItemRelationship` **MUST** be also specified unchanged.

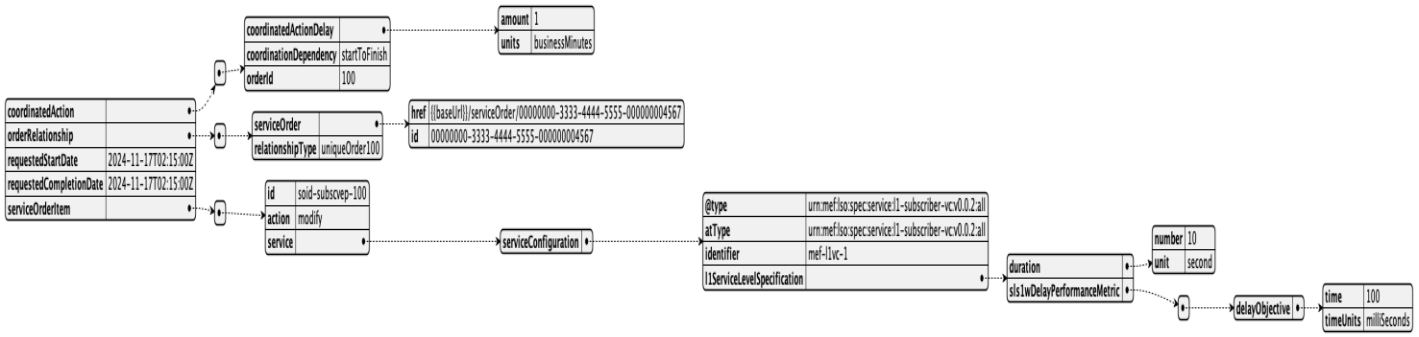


Figure 29-Service Order Modify Existing Service Request

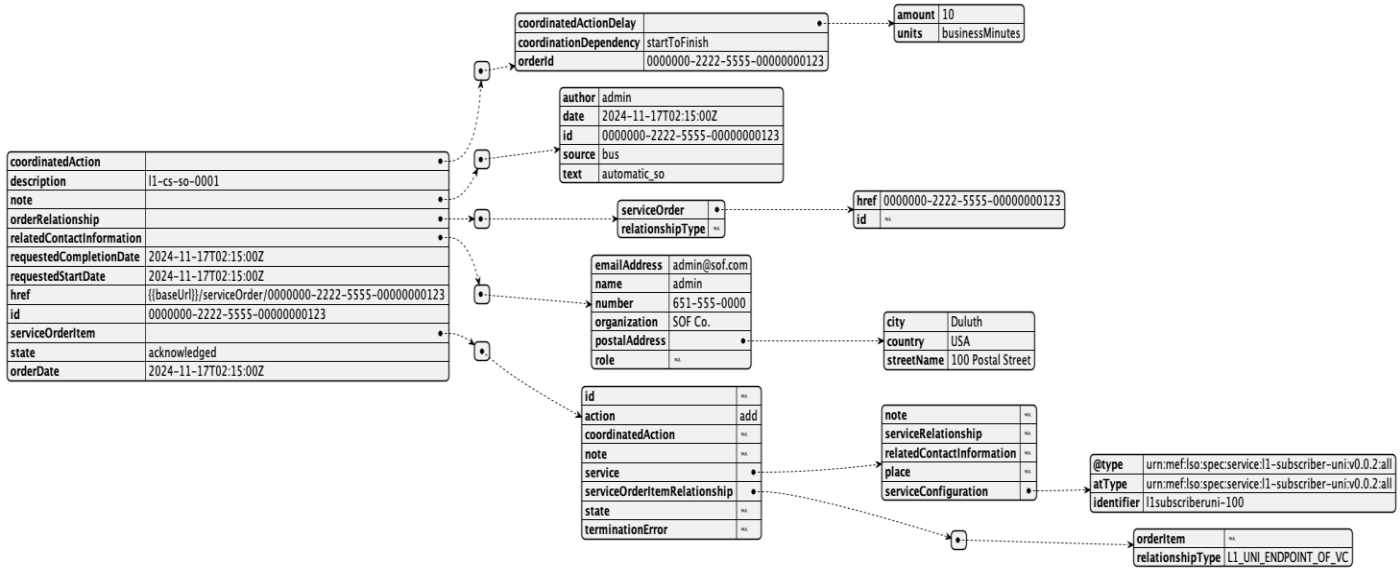


Figure 30-Service Order Modify Existing Service Response

A.5 Use Case 3: Service Order Item to Delete Existing Service

The following use case represents a single Service Order request for deletion (`action=delete`) of an existing service identified by `serviceOrderItem.id`.

```
{
  "description" : "Example Service Order to Delete L1 VC End Point Service",
  "externalId" : "serviceOrder-100",
  "requestedCompletionDate" : "2024-11-17T02:15:00Z",
  "requestedStartDate" : "2024-11-17T02:15:00Z",
  "serviceOrderItem" : [ {
    "id" : "so-item-001",
    "action" : "delete",
    "service" : {
      "id" : "00000000-5555-6666-7777-000000009999"
    }
  } ]
}
```

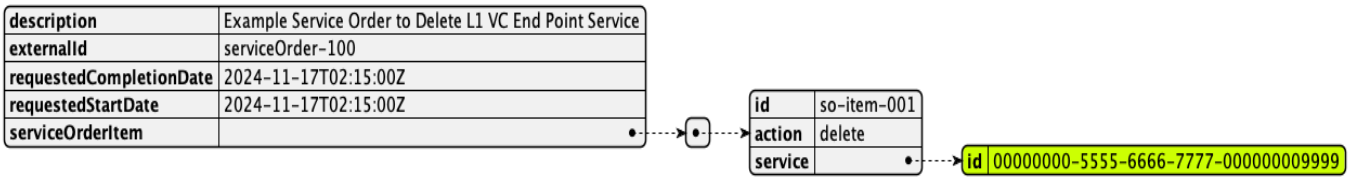


Figure 31-Service Order to Delete Existing Service

[R19] `service.id` **MUST** be provided.

[R20] The Buyer/Client **MUST NOT** provide any service attributes other than `service.id`.

A.6 Use Case 4: Retrieve List of Service Orders

The Buyer/Client can retrieve a list of `ServiceOrders` by using a `GET /serviceOrders` operation with desired filtering criteria. Reference [8] for complete set of mandatory and optional requirements.

[O1] The Buyer's/Client's request MAY contain none or more of the following attributes:

- `state`
- `orderDate.gt`
- `orderDate.lt`
- `completionDate.gt`
- `completionDate.lt`
- `expectedCompletionDate.gt`
- `expectedCompletionDate.lt`
- `startDate.gt`
- `startDate.lt`

A.7 Use Case 5: Retrieve Service Order by Service Order Identifier

The Buyer/Client can get detailed information about the Service Order from the SOF by using a `GET/serviceOrder/{{id}}` operation. The payload returned in the response includes all attributes the Buyer/Client has provided when a Service Order create request was sent. The attributes provided by the SOF depend on the state of the `ServiceOrder` and may require some additional processing and time to be set.

A.8 Use Case 6: Register for Notifications

The SOF communicates asynchronously with the Buyer/Client using Notifications provided that:

- Buyer/Client support a notification mechanism
- Buyer/Client has registered to receive notifications from the SOF

To register for notifications the Buyer/Client uses the `registerListerner` operation from the `API: POST /hub`. The request contains two attributes:

- `callback` – mandatory, to provide the callback address the events will be notified to,
- `query` – optional, to provide the required types of event(s).

Below is an example Register for Notifications for all supported Notifications:

```
http://{server.com}:port/mefApi/service/serviceOrderingManagement/v5/hub
{
  "callback": "https://client.com/listenerEndpoint",
  "query":
"eventType=serviceOrderCreateEvent,serviceOrderItemStateChangeEvent,serviceOrde
rInformationRequiredEvent,serviceOrderItemStateChangeEvent"
}
```

Below is corresponding response from Server:

```
{
    "callback": "https://client.com/listenerEndpoint",
    "id": "1e29afb6-6d91-48a1-b4a7-5bca047f8764",<< added by SOF >>
    "query":
"eventType=serviceOrderCreateEvent,serviceOrderItemStateChangeEvent,serviceOrderInform
ationRequiredEvent,serviceOrderItemStateChangeEvent"
}
```

A.9 Use Case 7: Retrieve Event Subscription by Identifier

The Buyer/Client can get detailed information about their subscribed to Notification(s) from the SOF by using a `GET/hub/{{id}}` operation. The payload returned in the response includes all attributes the Buyer/Client has provided when a Hub register a listener request was sent.

Below is an example of retrieval of Event Subscription by Identifier request:

```
http://localhost:8080/mefApi/legato/serviceOrderingManagement/v5/hub/1e29afb6-
6d91-48a1-b4a7-5bca047f8764
```

Below is corresponding response from Server:

```
{
    "callback":
"eventType=serviceOrderCreateEvent,serviceOrderItemStateChangeEvent,serviceOrderInform
ationRequiredEvent,serviceOrderItemStateChangeEvent",
    "id": "1e29afb6-6d91-48a1-b4a7-5bca047f8764"
}
```

A.10 Use Case 8: Send Notification

The Buyer/Client Supports a notification mechanism. The notification mechanism used by the SOF is REST-based and notifications are transmitted by the SOF using a `POST /listener/[serviceOrderCreate|serviceOrderStateChangeEvent|serviceOrderInformationRequiredEvent|serviceOrderItemStateChangeEvent]`.

18 References

[1] IETF JSON Schema draft 7, *JSON Schema: A Media Type for Describing JSON Documents* and associated documents, by Austin Wright and Henry Andrews, March 2018. Copyright © 2018 IETF Trust and the persons identified as the document authors. All rights reserved.

[2] IETF RFC 2119, *Key words for use in RFCs to Indicate Requirement Levels*, by Scott Bradner, March 1997

[3] IETF RFC 3444, *On the Difference between Information Models and Data Models*, January 2003

[4] IETF RFC 8174, *Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words*, by Barry Leiba, May 2017. Copyright © IETF Trust and the persons identified as the document authors (2017). All Rights Reserved

[5] MEF 63 Subscriber Layer 1 Service Attributes, August 2018.

[6] MEF 64 Operator Layer 1 Service Attributes and Services, February 2020.

[7] MEF 55.1, Lifecycle Service Orchestration (LSO): Reference Architecture and Framework, January 2021.

[8] MEF 99 LSO Service Ordering Management API-Developer Guide, October 2023.