Interface Profile Specification

Service Configuration and Activation

MEF 56

May 2017

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1 List of Contributing Members

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

Member Company
albis-elcon
Cisco Systems, Inc.
Ciena Corporation
PLDT Corp. Business Solutions
XO Communications

Table 1 Contributing Member Companies

2 Abstract

This Interface Profile Specification specifies Legato [6] Management Interface in support of MEF 6.2 [2] Services and is a realization of relevant classes from MEF 7.3 [3] Information Model. The LEGATO_SCA Interface is for use at a Service Orchestrator Function for interfacing with Business Applications as described in MEF LSO RA [6] and process for Service Configuration & Activation [5].
This document normatively includes the content of the following files as if they were contained within this document:

- SCA_Interface.di (January 24th, 2017)
- SCA_Interface.uml (January 24th, 2017)
- SCA_Interface.notation (January 24th, 2017)

These files are available in the Technical Specifications area of MEF.net alongside this specification.

3 Terminology and Acronyms

This section defines the terms used in this document. In many cases, the normative definitions to 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.

Term	Definition	Reference
Application Programming Interface (API)	Management protocol specific interfaces providing the functions and information exchanges that implement reference points in the LSO reference model based on the functional requirements described in an Interface Profile.	This document
Attribute Value Change (AVC)	Attribute value change notification	ITU-T Q.827.1
Carrier Ethernet Network (CEN)	A network from a Service Provider or network operator supporting the MEF service and architecture models.	MEF 12.1
Connectivity Service	A managed network connectivity service delivering adjacency among service access points described by a set of both static and/or dynamic service attributes.	MEF LSO RA
Hypertext Transfer Protocol (HTTP)	A stateless application-level protocol for distributed, collaborative, hypertext information systems.	IETF RFC 7230
Information Model	Models managed objects at a conceptual level, independent of any specific implementations or protocols used to transport the data. The MEF uses UML Class Diagrams to model Information Models	IETF RFC 3444
Interface Profile	Defines the structure, behavior, and semantics supporting a specific Management Interface Reference Point identified in the LSO Reference Architecture. The Interface Profile specification contains all the necessary information to implement the related API, including objects, attributes, operations, notifications, and parameters.	MEF LSO RA
JavaScript Object Notation (JSON)	A text format that facilitates structured data interchange between all programming languages.	ECMA-404
Lifecycle Service Orchestration (LSO)	Open and interoperable automation of management operations over the entire lifecycle of Layer 2 and Layer 3 Connectivity Services. This includes fulfillment, control, performance, assurance, usage, security, analytics and policy capabilities, over all the network domains that require coordinated management and control in order to deliver the service.	MEF LSO RA
LSO Reference Architecture	A layered abstraction architecture that characterizes the management and control domains and entities that comprise a system, and the interfaces among them, to enable cooperative orchestration of Connectivity Services.	MEF LSO RA
Management Interface Reference Point	The logical point of interaction between specific management entities	MEF LSO RA
Service	Represents the customer experience of a Product Instance that has been realized within the service provider's infrastructure.	TMF GB922
Service Component	The elements or constructs that are used to assemble the Service.	MEF LSO RA
Service Configuration and Activation (SCA)	Service Configuration and Activation processes encompass allocation, implementation, configuration, activation and	TMF GB921D

	testing of specific services to meet customer requirements, or in response to requests from other processes to alleviate specific service capacity shortfalls, availability concerns or failure conditions.	
Unified Modeling Language (UML)	UML is a general-purpose, developmental, modeling language in the field of software engineering, that is intended to provide a standard way to visualize the design of a system.	OMG UML
Use Case	In the UML, a Use Case represents one particular type of a system's behavior based on stimuli from an external source (i.e., an actor). A system may have several Use Cases that define all its behavior.	OMG UML

Table 2 Terminology and Acronyms

4 Scope

This Interface Profile Specification defines the requirements, use cases, realized classes, service interfaces and associated operations/parameters, state machines, and sequence diagrams that describe the dynamic behavior of the LEGATO_SCA interface. LEGATO_SCA focuses on management and control functions to perform Service Configuration and Activation (SCA) processes across the Legato interface. MEF 50 defines the Process Elements and Process Flow for the Service Configuration and Activation stage of the Service Operations Lifecycle. The MEF LSO Reference Architecture includes Order Fulfillment Orchestration and Service Control Orchestration which expand on the MEF 50 Service Configuration and Activation processes with greater LSO detail. Phase 1 of this Specification includes EVC-based MEF EVC based services defined in MEF 6.2.

This Interface Profile Specification is intended to provide input into developing data schemas (e.g YANG modules) for the LEGATO_SCA interface.

The Legato interface exposes services, not products. Product-to-service transformations are handled by the Business Applications.

4.1 Phase 2

This section captures items that are candidates for a Phase 2 version of this specification.

- Service Test use case
- MEF 51, MEF 33 Services use case
- SOAM PM/FM use cases
- MEF 47 elastic service use cases

5 Compliance Levels

The requirements that apply to the functionality of this document are specified in the following sections. Items that are REQUIRED (contain the words MUST or MUST NOT) will be labeled as [R_]. Items that are RECOMMENDED (contain the words SHOULD or SHOULD NOT) will be labeled as [D_]. Items that are OPTIONAL (contain the words MAY or OPTIONAL) will be labeled as [O_].

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119. All key words use upper case, bold text to distinguish them from other uses of the words. Any use of these key words (e.g., may and optional) without [R_], [D_] or [O_] is not normative.

6 Numerical Prefix Conventions

This document uses the prefix notation to indicate multiplier values as shown in **Error! R eference source not found.**.

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 3 Numerical Prefix Conventions

7 Introduction

Figure 1 illustrates the MEF Lifecycle Service Orchestration Reference Architecture (MEF LSO RA) with the Legato interface highlighted. Legato is the Management Interface Reference Point between the Business Applications and the Service Orchestration Functionality needed to allow management and operations interactions supporting LSO connectivity services. As an example, Business Applications may use Legato to request the instantiation of a Connectivity Service. MEF 7.3 defines the static/structural Information Model for the Service Orchestration Functionality. This document defines the Legato SCA Interface realization of the MEF 7.3 static Information Model.

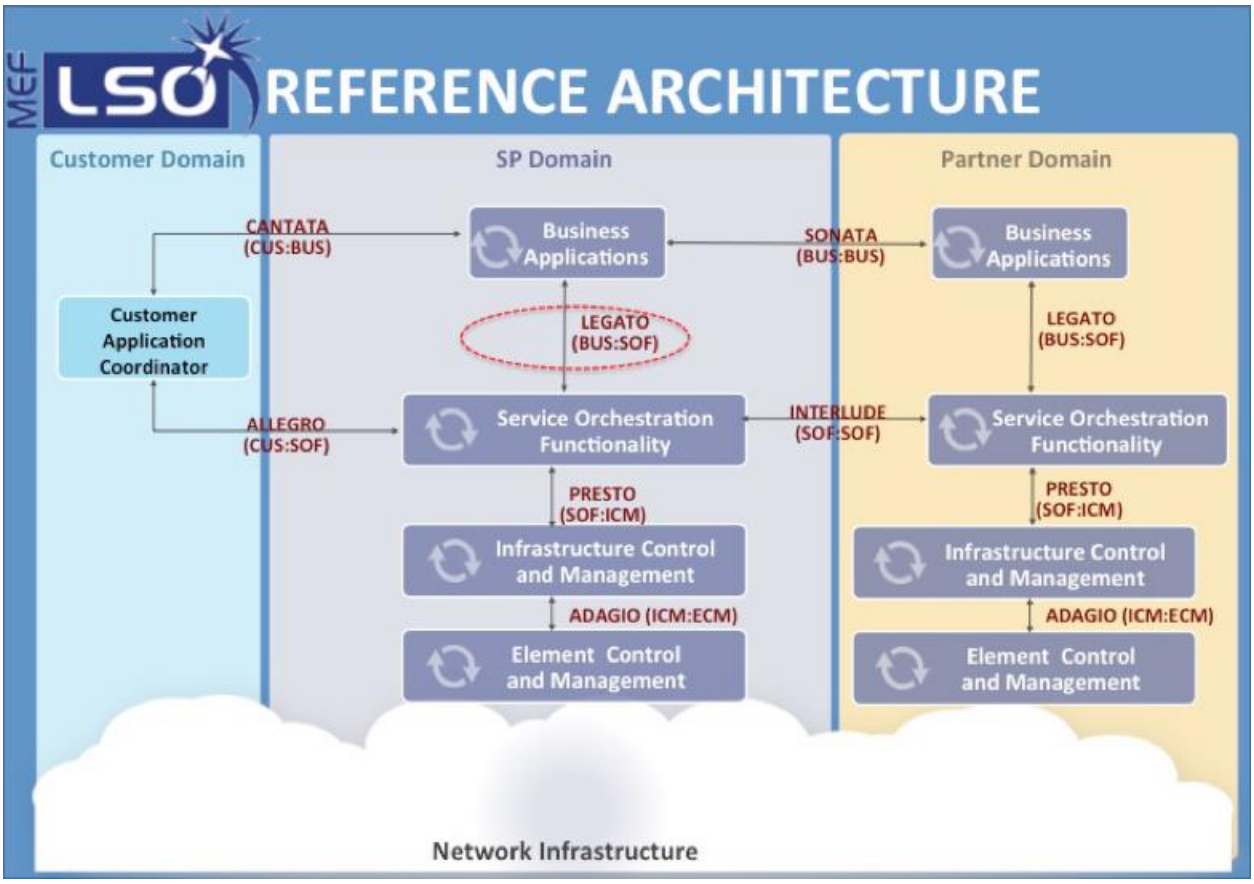


Figure 1 - LSO Reference Architecture and SCA Interface Profile Context

8 Requirements

The functional requirements specified in this section apply to the Legato Interface Reference Point. Where applicable, the requirements trace back to the MEF LSO RA requirements.

R_LEGATO_SCA_0001	The Legato SCA Interface MUST support creating a new MEF EVC based service instance.
Source	R-LSO-RA-3, R-LSO-RA-5

R_LEGATO_SCA_0002	The Legato SCA Interface MUST support modifying an instantiated MEF EVC based service.
Source	R-LSO-RA-3, R-LSO-RA-8, D-LSO-RA-4

R_LEGATO_SCA_0003	The Legato SCA Interface MUST support activating an instantiated MEF EVC based service.
Source	R-LSO-RA-8

R_LEGATO_SCA_0004	The Legato SCA Interface MUST support deactivating an

	activated MEF EVC based service.
Source	R-LSO-RA-8

R_LEGATO_SCA_0005	The Legato SCA Interface MUST support suspending an activated MEF EVC based service.
Source	R-LSO-RA-8

R_LEGATO_SCA_0006	The Legato SCA Interface MUST support resuming a suspended MEF EVC based service.
Source	R-LSO-RA-8

R_LEGATO_SCA_0007	The Legato SCA Interface MUST support deleting an instantiated MEF EVC based service.
Source	R-LSO-RA-3

R_LEGATO_SCA_0008	The Legato SCA Interface MUST support querying an instantiated MEF EVC based service for obtaining service attributes.
Source	R-LSO-RA-3, R-LSO-RA-8

R_LEGATO_SCA_0009	The Legato SCA Interface MUST support querying all instantiated MEF EVC based services for obtaining attributes of all services.
Source	R-LSO-RA-3, R-LSO-RA-8

9 Use Cases

This section captures EVC-based service use cases. Figure 2 identifies the different use cases an Operator may perform with respect to Service Configuration and Activation across the LEGATO interface.

9.1 Use Case Diagram

The Use Cases defined in this section are specialized Use Cases for MEF 6.2 EVC-based MEF EVC based services. While the generalized Use Cases (e.g., Create Service) may apply to any MEF defined services, the specialized Use Cases (e.g., Create MEF EVC based service) are specific to the scope of this document. The relationship between the generalized Use Cases and the specialized Use Cases is through an include association. Generalized Use Cases may include several specialized Use Cases.

9.1.1 SCA MEF EVC based Service Use Cases

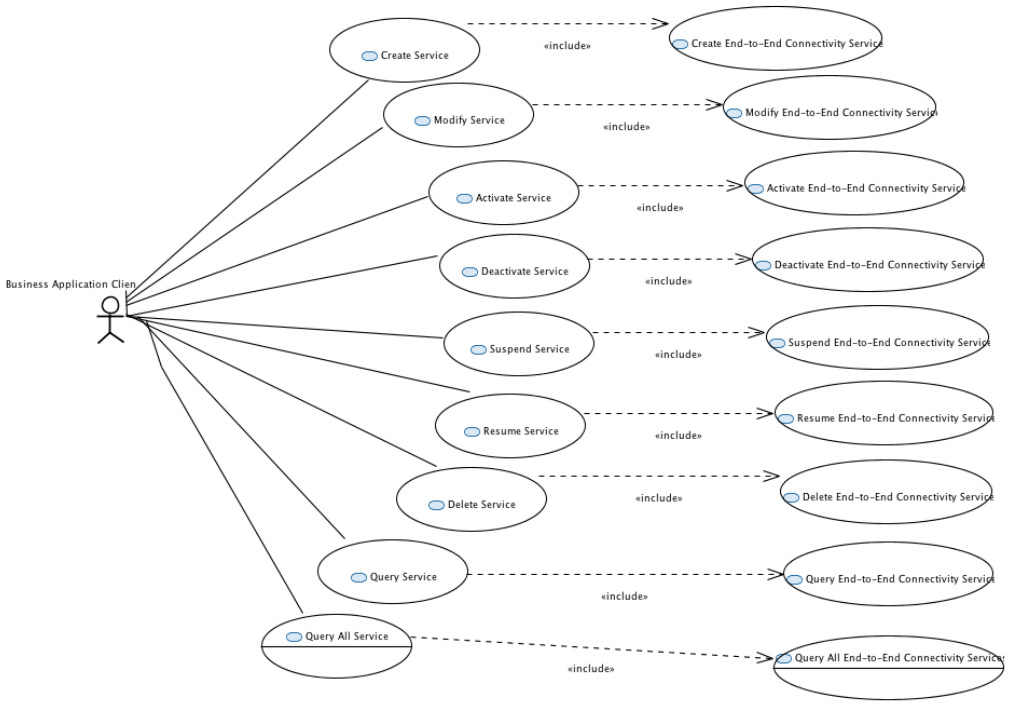


Figure 2 - MEF EVC based Service Use Cases

9.2 Use Case Tables

A separate 'validate' use case is not defined for the interface. That is because the protocol implementation is required to support an intermediate step where a change in service can be validated. Please section 8.6 of RFC 6241 for details. The same applies to the assumption of a single writer. The implementation has to make sure that when an operator creates or modifies a service, it first issues an exclusive lock on the changes that can be made. The lock can be partial if the implementation supports it, or complete if it does not support partial lock. Partial implies the lock is on a certain portion of the change, while complete lock means no part of the service can be modified.

Use Case Id	UC_LEGATO_SCA_0001
Use Case Name	Create MEF EVC based service
Description	This Use Case encompasses creating a new MEF EVC based service instance.
Actor(s)	Business Application, Service Orchestration Function
Pre-Conditions	1. The service attribute values have been determined. 2. The network resources required to support the service

	may be available. 3. The service is not active.
Process Steps	
Post-Conditions	1. The service is instantiated with the set of service attribute values after the values have been validated. 2. The service is not active. 3. Network resources may or may not be available. 4. Admin state is LOCKED and service state is PENDING.
Alternative Paths	
Exceptions	There is a chance that when the service is activated, the service might fail because of network resources. That can happen if the resource being targeted gets consumed sometime between the service being created and activated. It might also happen that the request is illegal or cannot be applied. When it does happen, an exception will be raised. Supported exceptions: • InvalidInput • InternalError • NotImplemented • CommLoss • AccessDenied • UnableToComply
Assumptions	None
Business Process	See MEF 50 Table 15
Reference	N/A
Requirement	R_LEGATO_SCA_0001

Use Case Id	UC_LEGATO_SCA_0002
Use Case Name	Modify MEF EVC based service
Description	This Use Case encompasses modifying an instantiated MEF EVC based service.
Actor(s)	Business Application, Service Orchestration Function
Pre-Conditions	1. The service attribute values to modify are known. 2. The network resource required to support the change in service are available. However, there is still a chance that when the service is applied, it might fail because of network resource limitation. An exception would be raised if the resource is not available for any reason. 3. The service is already active. 4. In some cases it may be required that the service is suspended before modification can be made.
Process Steps	
Post-Conditions	1. The service attribute values have been verified before being commited. 2. The service is not active with the changed attributes. The

	changes will be applied in a separate commit step.
Alternative Paths	
Exceptions	• EntityNotFound • InvalidInput • NotInValidState • InternalError • NotImplemented • CommLoss • AccessDenied • UnableToComply
Assumptions	None
Business Process	See MEF 50 Table 15
Reference	N/A
Requirement	R_LEGATO_SCA_0002

Use Case Id	UC_LEGATO_SCA_0003
Use Case Name	Activate MEF EVC based service
Description	This Use Case encompasses activating an instantiated MEF EVC based services.
Actor(s)	Business Application, Service Orchestration Function
Pre-Conditions	1. The service is instantiated. The service attributes are validated and the network resources are available. 2. The service may or may not be in active state.
Process Steps	
Post-Conditions	1. The service is activated. 2. Request will be ignored if the service is already in active state. 3. Admin state is UNLOCKED and service state is ACTIVE.
Alternative Paths	
Exceptions	• EntityNotFound • InvalidInput • NotInValidState • InternalError • NotImplemented • CommLoss • AccessDenied • UnableToComply
Assumptions	None
Business Process	See MEF 50 Table 15
Reference	N/A
Requirement	R_LEGATO_SCA_0003

Use Case Id	UC_LEGATO_SCA_0004

Use Case Name	Deactivate MEF EVC based service
Description	This Use Case encompasses deactivating an activated MEF EVC based service.
Actor(s)	Business Application, Service Orchestration Function
Pre-Conditions	1. The service may or may not be in active state.
Process Steps	
Post-Conditions	**1.** The service is deactivated. 2. Request will be ignored if the service is not in active state. 3. Resources remain allocated to the service and are in inactive state. 4. Admin state is LOCKED and service state is INACTIVE.
Alternative Paths	
Exceptions	• EntityNotFound • InvalidInput • NotInValidState • InternalError • NotImplemented • CommLoss • AccessDenied • UnableToComply
Assumptions	None
Business Process	See MEF 50 Table 15
Reference	N/A
Requirement	R_LEGATO_SCA_0004

Use Case Id	UC_LEGATO_SCA_0005
Use Case Name	Suspend MEF EVC based service
Description	This Use Case encompasses suspending an activated MEF EVC based service.
Actor(s)	Business Application, Service Orchestration Function
Pre-Conditions	1. The service is activated.
Process Steps	
Post-Conditions	1. The service is suspended, but is not deleted. The network resources that were reserved for the service remain with the service and are not available for use by other services. 2. Admin state is LOCKED and service state is ACTIVE.
Alternative Paths	
Exceptions	• EntityNotFound • InvalidInput • NotInValidState • InternalError • NotImplemented

	• CommLoss • AccessDenied • UnableToComply
Assumptions	None
Business Process	See MEF 50 Table 15
Reference	N/A
Requirement	R_LEGATO_SCA_0005

Use Case Id	UC_LEGATO_SCA_0006
Use Case Name	Resume MEF EVC based service
Description	This Use Case encompasses resuming a suspended MEF EVC based service.
Actor(s)	Business Application, Service Orchestration Function
Pre-Conditions	1. The service is suspended. The network resources that were reserved for the service remain with the service and are not available for use by other services.
Process Steps	
Post-Conditions	1. The service is activated. 2. Admin state is UNLOCKED and service state is ACTIVE.
Alternative Paths	
Exceptions	• EntityNotFound • NotInValidState • InternalError • NotImplemented • CommLoss • AccessDenied • UnableToComply
Assumptions	None
Business Process	See MEF 50 Table 15
Reference	N/A
Requirement	R_LEGATO_SCA_0006

Use Case Id	UC_LEGATO_SCA_0007
Use Case Name	Delete MEF EVC based service
Description	This Use Case encompasses deleting an instantiated MEF EVC based service.
Actor(s)	Business Application, Service Orchestration Function
Pre-Conditions	1. The service is instantiated and is in deactivated state.
Process Steps	
Post-Conditions	1. The service instance is removed, and the network resources associated with the service are released and are available for use by other services. 2. The changes are committed as a separate step.
Alternative Paths	

Exceptions	• EntityNotFound • InvalidInput • NotInValidState • InternalError • NotImplemented • CommLoss • AccessDenied • UnableToComply
Assumptions	None
Business Process	See MEF 50 Table 15
Reference	N/A
Requirement	R_LEGATO_SCA_0007

Use Case Id	UC_LEGATO_SCA_0008
Use Case Name	Query MEF EVC based service
Description	This Use Case encompasses querying an instatiated MEF EVC based service to obtain attributes.
Actor(s)	Business Application, Service Orchestration Function
Pre-Conditions	1. The service is instantiated.
Process Steps	
Post-Conditions	1. The service attribute values have been obtained.
Alternative Paths	
Exceptions	• EntityNotFound • InvalidInput • InternalError • NotImplemented • CommLoss • AccessDenied • UnableToComply
Assumptions	None
Business Process	See MEF 50 Table 15
Reference	N/A
Requirement	R_LEGATO_SCA_0008

Use Case Id	UC_LEGATO_SCA_0009
Use Case Name	Query All MEF EVC based services
Description	This Use Case encompasses querying all instatiated MEF EVC based services to obtain attributes.
Actor(s)	Business Application, Service Orchestration Function
Pre-Conditions	1. All services are instantiated.
Process Steps	
Post-Conditions	1. The service attribute values have been

	obtained for all services.
Alternative Paths	
Exceptions	• InternalError • NotImplemented • CommLoss • AccessDenied • UnableToComply
Assumptions	None
Business Process	See MEF 50 Table 15
Reference	N/A
Requirement	R_LEGATO_SCA_0009

10 Traceability Matrices

10.1 Use Case to Requirements

Use Case Id	Use Case Name	Requirements
UC_LEGATO_SCA_0001	Create MEF EVC based service	R_LEGATO_SCA_0001
UC_LEGATO_SCA_0002	Modify MEF EVC based service	R_LEGATO_SCA_0002
UC_LEGATO_SCA_0003	Activate MEF EVC based service	R_LEGATO_SCA_0003
UC_LEGATO_SCA_0004	Deactivate MEF EVC based service	R_LEGATO_SCA_0004
UC_LEGATO_SCA_0005	Suspend MEF EVC based service	R_LEGATO_SCA_0005
UC_LEGATO_SCA_0006	Resume MEF EVC based service	R_LEGATO_SCA_0006
UC_LEGATO_SCA_0007	Delete MEF EVC based service	R_LEGATO_SCA_0007
UC_LEGATO_SCA_0008	Query MEF EVC based service	R_LEGATO_SCA_0008
UC_LEGATO_SCA_0009	Query all MEF EVC based services	R_LEGATO_SCA_0009

Requirement to Use Case relationships are same as shown in Sec 10.1 and hence not repeated.

11 Realized Classes

Figure 3 illustrates the simplified overview of objected classes and their relationships for EVC services as described in MEF 7.3. Realized classes are those classes from the MEF 7.3 static Information Model which are exposed over the SCA Legato Interface.

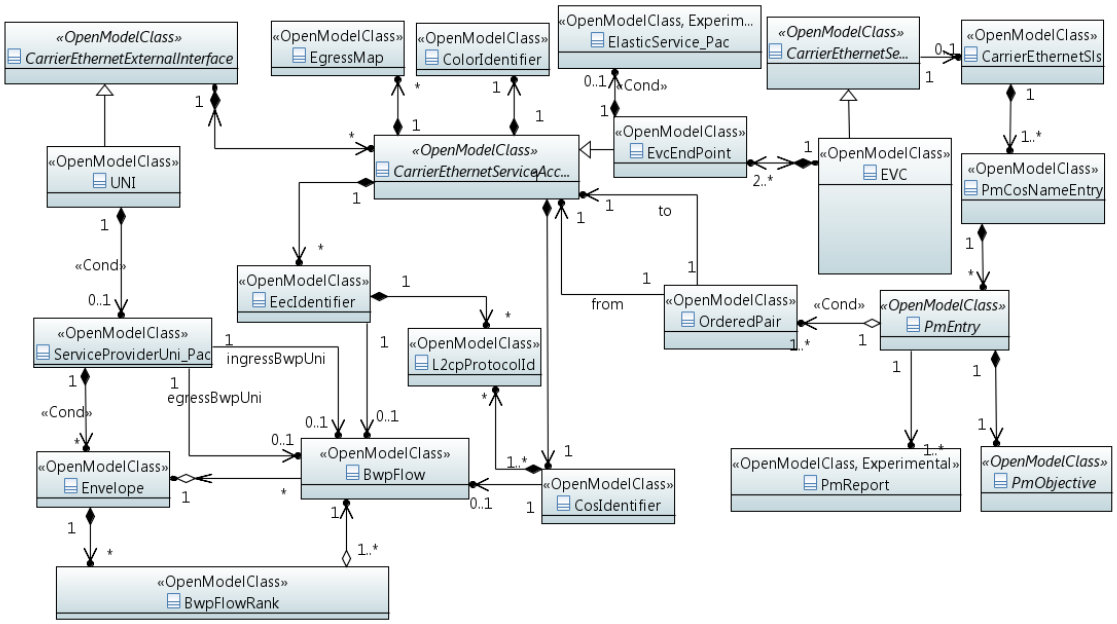


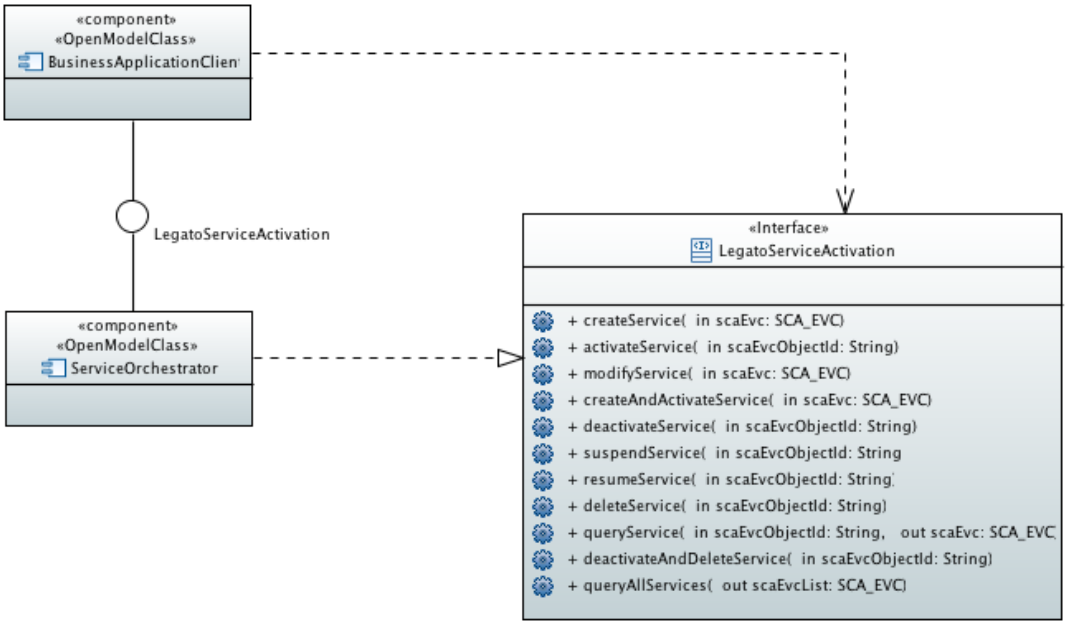
Figure 3 - EVC Service Overview

11.1 Class Diagrams and Class Tables

This section defines the SCA Legato interface class diagrams and presents the detailed class definitions for the SCA realized classes. The SCA classes are realizations of the MEF 7.3 static service model (UML version 270). Static service classes (e.g., EVC) are defined as part of the static model in MEF 7.3, and the realized classes (e.g., SCA_EVC) are defined in this interface profile. The SCA realized classes are named "SCA_<MEF 7.3 Service Model Class Name>". Realized classes may be pruned (i.e. attributes removed) or refactored (i.e. multiplicity changed) to match the implementation. In the realized classes, the defined relationships between the classes are visualized as the pointers within the class.

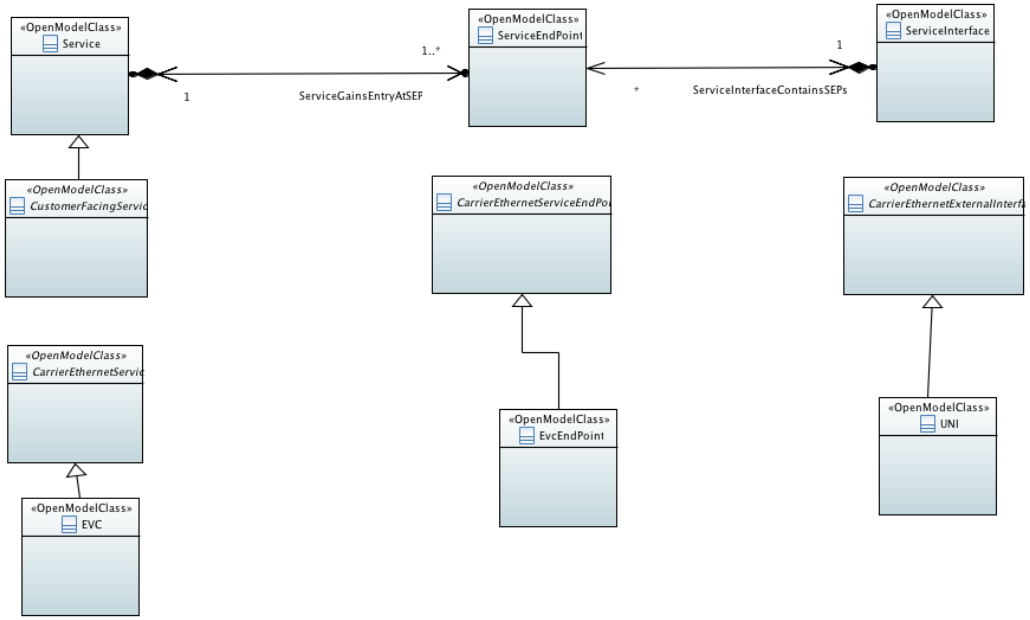
Editors's note: Notifications are for future phase of this document, they are not currently supported over the SCA interface; Support is mandatory for all attributes from implementation perspective but their use is optional.
Editor's note: In the class tables 'valueRange: no range contraint' should be interpreted as "value range addressed via type and there are no additional contraints on the values".

11.1.1 SCA Legato



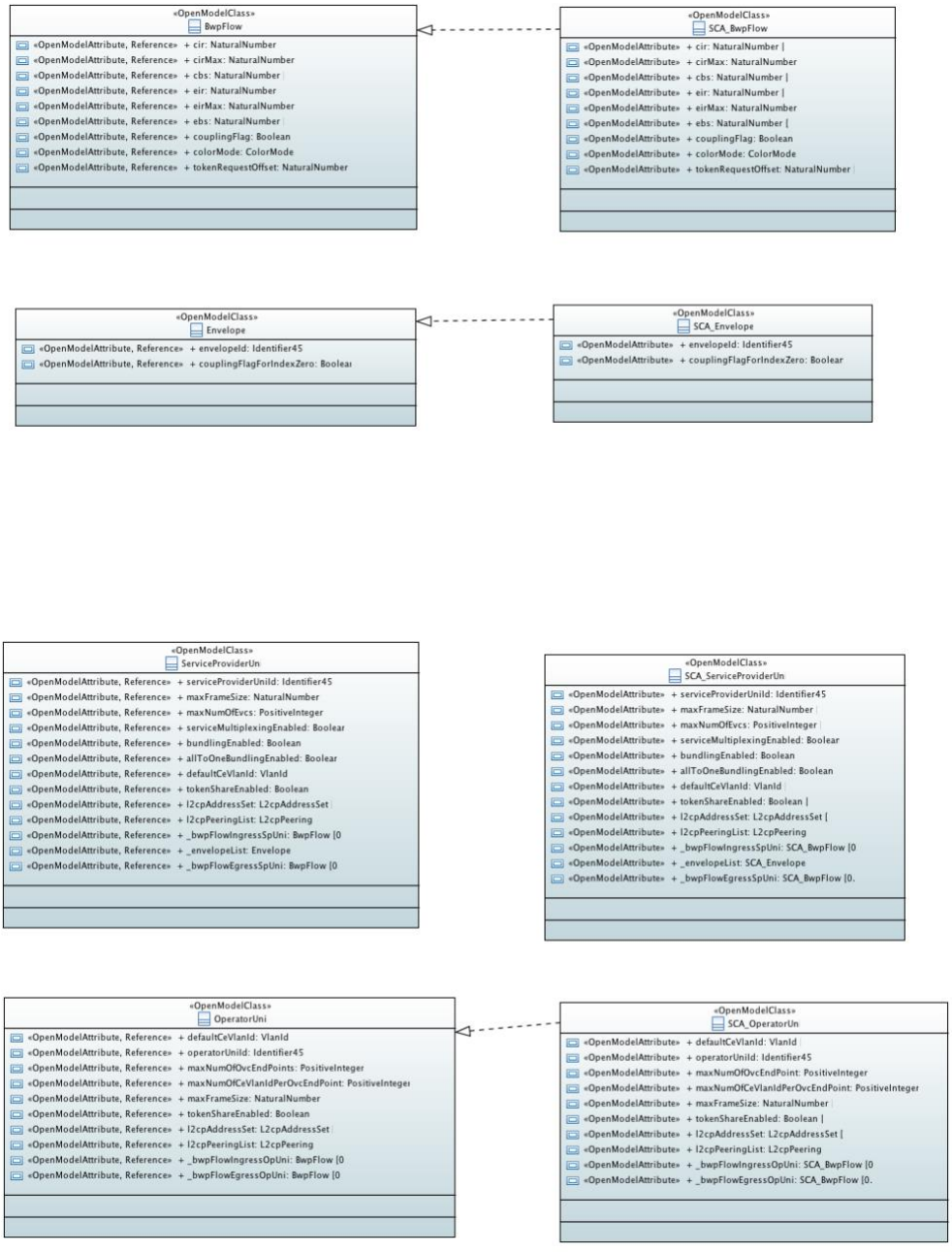
11.1.2 SCA_BasicServiceClasses

MEF 7.3 classes include CarrierEthernetService, CarrierEthernet ServiceAccessPoint and CarrierEthernetServiceInterface. For MEF 6.2 Services the relevant sub-classess are EVC, EVCEndPoint and UNI. Hence, this Interface Profile specification is using those clasess to realize SC_EVC, SCA_EVCEndPoint and SCA_UNI.



11.1.3 SCA_BandwidthProfile

MEF 6.2 Services are specified to use Ingress Bandwidth Profile per Class of Service Identifier and Egress Bandwidth Profile per Egrees Equivalence Class. Hence, an instance of BandwidthProfile Class with Parameters for each BwpFlow in a given Envelope is present for the EVC at a given UNI, i.e., EVCEndPoint Class.



11.1.3.1 SCA_BwpFlow

The BwpFlow object class represents the Bandwidth Profile Flow which includes the bandwidth profile parameters such as CIR, CIR Max, EIR, EIR Max, CBS, EBS, Coupling Flag, Color Mode, etc. The BwpFlow object class is associated with UNI (via OperatorUni_Pac or ServiceProviderUni_Pac), ENNI (via EnniService_Pac), VUNI, CosIdentifier, EecIdentifier, and Envelope, BwpFlowRank.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
cir	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Committed Information Rate that limits the average rate of frames that will be declared Green. In bits per second.
cirMax	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the maximum Committed Information Rate that limits the rate of tokens added to the committed token bucket. In bits per second.
cbs	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Committed Burst Size that limits the maximum number of bytes available for a burst of frames that will be declared Green, in bytes,
eir	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Excess Information Rate that limits the average rate of frames that will be declared Yellow, in bits per second.
eirMax	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Maximum Excess Information Rate that Limits the rate of tokens added to the excess token bucket, in bits per second.
ebs	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Excessive Burst Size that limits the maximum number of bytes available for a burst of frames that will be declared Yellow, in bytes.
couplingFlag	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Coupling Flag that Determines if overflow Green tokens can be used as Yellow tokens. Value 0 for NO and value 1 for YES.
colorMode	ColorMode	1	OpenModelAttribute	This attribute denotes the Color

			• AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	Mode that Indicates whether the Color Identifier of the frame is considered by the Bandwidth Profile Algorithm.
tokenRequestOffset	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Adjusts the number of tokens requested for each external interface frame.

Table 4 SCA_Bwpflow class

11.1.3.2 SCA_Envelope

The Envelope object class represents the UNI/ENNI service attribute Envelope, which is a bandwidth profile parameter that consists of an envelope ID and an envelope coupling flag (0) which controls conversion of unused green tokens into yellow tokens in the bandwidth profile algorithm. The Envelope object class is associated with UNI (via OperatorUni_Pac or ServiceProviderUni_Pac), ENNI (via EnniService_Pac), BwpFlow, and BwpFlowAndRank, etc.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
envelopeId	Identifier45	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is a string that identifies the Envelope.
couplingFlagForIndexZero	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the coupling flag for index zero. 0 for NO and 1 for YES (overflow Green tokens can be used as Yellow tokens)

Table 5 SCA_Envelope class

11.1.3.3 SCA_ServiceProviderUni

This Service ProviderUni_Pac object class groups the UNI service attributes (or their values) that are applicable to EVC. It is a conditional package offers a specific service attributes set unique to the Service Provider management. It is associated with Envelope(s), BwpFlow(s), etc.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
serviceProviderUniId	Identifier45	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	The Operator UNI ID allows the SP/SO and Operator to uniquely identify the UNI for operations purposes.
maxFrameSize	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This value limits the length of frames carried by an EVC/OVC that associates an EVC/OVC End Point. the value is less than or equal to the value agreed between the Service Provider and the Operator.
maxNumOfEvcs	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute limits the number of EVCs (therefore the EVC End Points) the UNI can support.
serviceMultiplexingEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes whether the service multiplexing is enabled or not. When this attribute value is enabled, there can be multiple EVCs at the UNI. This attribute can be enabled only when All-to-one bundling is disabled.
bundlingEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes whether the bundling is enabled or not. When it is enabled, it allows more than one CE-VLAN IDs mapped to an EVC at a UNI. It enabled only when All to one bundling is disabled.
allToOneBundlingEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes whether the All-to-One bundling is enabled or not. When a UNI has All to One Bundling Enabled, all CE-VLAN IDs MUST map to a single EVC at the UNI. This attribute can be enabled only when Service Multiplexing and Bundling are disabled.
defaultCeVlanId	VlanId	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute defines the CE-VLAN ID assigned to the untagged service frames and priority tagged service frames. MEF 10.3 named it untagged and priority tagged CE VLAN ID, while MEF 26.2 named it default CE VLAN ID. The value usually the same.
tokenShareEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes whether the token share is enabled or not. When the value is Enabled, at least one Envelope at the UNI/ENNI must be able to have two or more Bandwidth Profiles mapped to it.
l2cpAddressSet	L2cpAddressSet	1	OpenModelAttribute • AVC: NA • isInvariant: false	This attribute represents the L2CP Address Set. It specifies the subset of the Bridge Reserved Addresses

			• valueRange: no range constraint • support: MANDATORY	that are filtered (i.e. L2CP Frames with this destination address are Peered or Discarded but not Passed) at a L2CP Decision Point. The value agreed between the SP and the SO is equal to or a superset of the value agreed between the SO and the Operator. Note CTA is a superset of CTB, which is a super-set of CTB-2.
l2cpPeeringList	L2cpPeering	0..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the L2CP Peering defined in MEF 45 when applied to the UNI/ENNI. The value agreed between the SP and the SO is equal to or a superset of the value agreed between the SO and the Operator.
_bwpFlowIngressSpUni	SCA_BwpFlow	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the ServiceProviderUni_Pac and the ingress BwpFlow.
_envelopeList	SCA_Envelope	0..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the ServiceProviderUni_Pac and the Envelope(s).
_bwpFlowEgressSpUni	SCA_BwpFlow	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the ServiceProviderUni_Pac and the egress BwpFlow.

Table 6 SCA_ServiceProviderUni class

11.1.3.4 SCA_OperatorUni

This OperatorUni_Pac object class groups the UNI service attributes (or their values) that are applicable to OVC. It is a conditional package offers a specific service attributes set unique to the Operator management. It is associated with Envelope(s), BwpFlow(s), etc.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

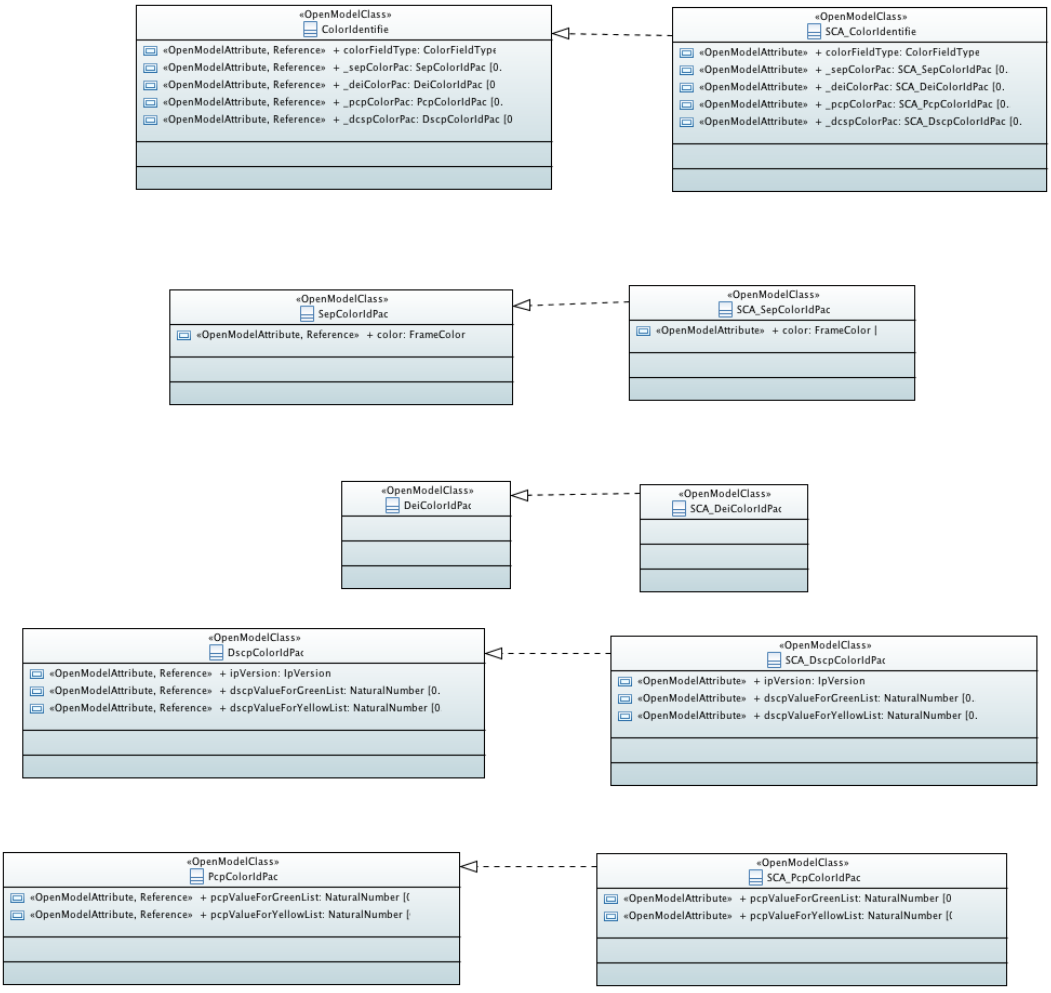
Attribute Name	Type	Mult.	Stereotypes	Description
defaultCeVlanId	VlanId	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is the CE-VLAN ID assigned to untagged service frames and priority tagged service frames. MEF 10.3 named it untagged and priority tagged CE VLAN ID, while MEF 26.2 named it default CE VLAN ID.

operatorUniId	Identifier45	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	The Operator UNI ID allows the SP/SO and Operator to uniquely identify the UNI for operations purposes.
maxNumOfOvcEndPoint	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute provides an upper bound on the number of OVC End Points that are associated by each OVC that the can support at the UNI or ENNI. For ENNI, this upper bound applies to the sum of the number OVC End Points that are not in a VUNI plus the number of OVC End Points that are in a VUNI.
maxNumOfCeVlanIdPerOvcEndPoint	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute specifies the largest number of CE- VLAN ID values that can map to an OVC End Point in an OVC End Point Map Service Attribute at the UNI.
maxFrameSize	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This value limits the length of frames carried by an EVC/OVC that associates an EVC/OVC End Point. This is agreed between the Service Provider and the Operator.
tokenShareEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes whether the token share is enabled or not. When the value is Enabled, at least one Envelope at the UNI/ENNI must be able to have two or more Bandwidth Profiles mapped to it.
l2cpAddressSet	L2cpAddressSet	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute specifies the subset of the Bridge Reserved Addresses that are filtered (i.e. L2CP Frames with this destination address are Peered or Discarded but not Passed) at a L2CP Decision Point. The value agreed between the SP and the SO is equal to or a superset of the value agreed between the SO and the Operator. Note CTA is a superset of CTB, which is a super-set of CTB-2.
l2cpPeeringList	L2cpPeering	0..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the L2CP Peering defined in MEF 45 when applied to the UNI/ENNI. The value agreed between the SP and the SO is equal to or a superset of the value agreed between the SO and the Operator.
_bwpFlowIngressOpUni	SCA_BwpFlow	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the OperatorUni_Pac and an ingress BwpFlow.

_bwpFlowEgressOpUni	SCA_BwpFlow	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the OperatorUni_Pac and an egress BwpFlow.

Table 7 SCA_OperatorUni class

11.1.4 SCA_ColorIdentifier



11.1.4.1 SCA_ColorIdentifier

The ColorIdentifier object class represents the Color Identifier. The Color Identifier Service Attribute is a pair of the form <F, M> where F is a field in the ingress EI Frame and M is a mapping between each possible value of the field F and a Color. The ColorIdentifier object class is associated with CarrierEthernetService Access Point (EvcEndPoint or OvcEndPoint), in addition to the different field F, such as SapColor_Pac, PcpColor_Pac, DeiColor_Pac, and DscpColor_Pac, etc.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
colorFieldType	ColorFieldType	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute determines which conditional package (among End Point, PCP, DEI or DSCP) to apply to the Color Identifier.
_sepColorPac	SCA_SepColorIdPac	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the ColorIdentifier and the SapColor_Pac (representing the choice that maps EVC End Point or OVC End Point to Color).
_deiColorPac	SCA_DeiColorIdPac	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the ColorIdentifier and the DeiColor_Pac (representing the choice that maps Vlan tag DEI to Color).
_pcpColorPac	SCA_PcpColorIdPac	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the ColorIdentifier and the PcpColor_Pac (representing the choice that maps Vlan tag PCPs to Color).
_dcspColorPac	SCA_DscpColorIdPac	0..2	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the ColorIdentifier and the DscpColor_Pac (representing the choice that maps DSCP values to Color).

Table 8 SCA_ColorIdentifier class

11.1.4.2 SCA_SepColorIdPac

The SepColorIdPac represents the Color Identifier that maps to the EVC End Point or the OVC End Point to Color.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description

color	FrameColor	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the color of the ingress EI frame, green or yellow.

Table 9 SCA_SepColorIdPac class

11.1.4.3 SCA_DeiColorIdPac

The DeiColorIdPac object class represents the Color Identifier that maps the vlan tag (S tag or C tag) DEI value to Color.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

11.1.4.4 SCA_DscpColorIdPac

The DscpColoridPac object class represents the Color Identifier that maps DSCP (IPv4 or IPv6) value to Color.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
ipVersion	IpVersion	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes which IP version is used. It can be IPv4, or IPv6, or both IPv4 and IPv6.
dscpValueForGreenList	NaturalNumber	0..64	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute provides a list DSCP values map to the green ingress EI frames.
dscpValueForYellowList	NaturalNumber	0..64	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute provides a list DSCP values map to the yellow ingress EI frames.

Table 10 SCA_DscpColorIdPac class

11.1.4.5 SCA_PcpColorIdPac

The PcpColorIdPac object class represents the Color Identifier that maps vlan tag (S tag or C tag) PCP value to Color.

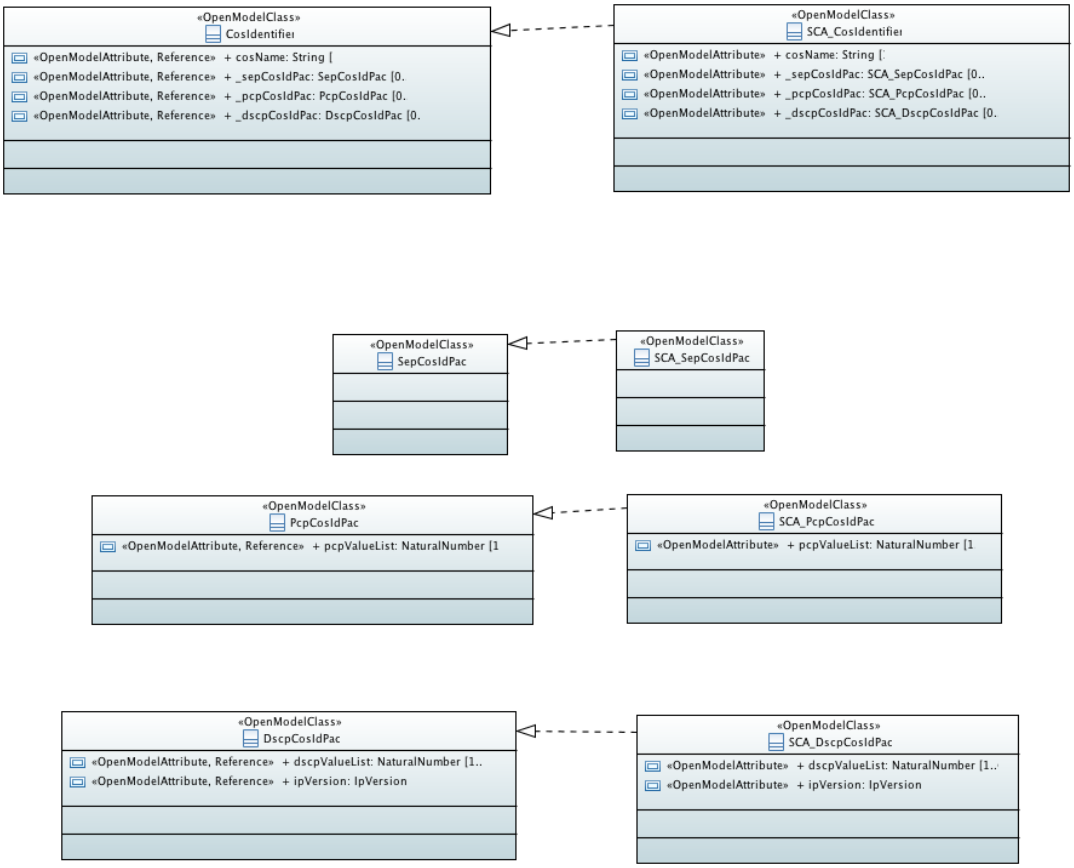
Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
pcpValueForGreenList	NaturalNumber	0..8	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute provides a list PCP values map to the green ingress EI frames.
pcpValueForYellowList	NaturalNumber	0..8	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute provides a list PCP values map to the yellow ingress EI frames.

Table 11 SCA_PcpColorIdPac class

11.1.5 SCA_CosIdentifier



11.1.5.1 SCA_CosIdentifier

The CosIdentifier object class represents the Class of Service Identifier. Each ingress EI Frame mapped to the given EVC/OVC End Point has a single Class of Service. The Class of Service can be determined from inspection of the content of the ingress EI Frame. It is associated with

the SapCosId_Pac, or the PcpCosId_Pac, or the DscpCosId_Pac (representing mapped to EVC/OVC End Point, or PCP, or DSCP respectively). The BwpFlow is associated to the CosIdentifier (representing Bandwidth Profile per Class of Service Identifier). The CosIdentifier is also associated with L2cpProtocolIdentifier(s).

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
cosName	String	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Class of Service name.
_sepCosIdPac	SCA_SepCosIdPac	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the CosIdentier and the SapCosId_Pac (representing the CoS Identifier of the form <F, M, P> when F is the EVC End Point or OVC End Point).
_pcpCosIdPac	SCA_PcpCosIdPac	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the CosIdentier and the PcpCosId_Pac (representing the CoS Identifier of the form <F, M, P> when F is the PCP field).
_dscpCosIdPac	SCA_DscpCosIdPac	0..2	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the CosIdentier and the DespCosId_Pac (representing the CoS Identifier of the form <F, M, P> when F is the DSCP field).

Table 12 SCA_CosIdentifier class

11.1.5.2 SCA_SepCosIdPac

The SapCosId_Pac represents the CoS Identifier that maps to the EVC End Point or the OVC End Point. The value of this attribute is a triple of the form <F, M, P> where F is a protocol field in the ingress EI Frame, M is a map that maps each possible value of the field F to a Class of Service Name and P is a map of Layer 2 Control Protocol types as determined by the Protocol Identifier to Class of Service Names. This is when F is the EVC/OVC End Point.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA

- support: MANDATORY

11.1.5.3 SCA_PcpCosIdPac

The PcpCosId_Pac object class represents CoS Identifier that maps to PCP. The value of this attribute is a triple of the form <F, M, P> where F is a protocol field in the ingress EI Frame, M is a map that maps each possible value of the field F to a Class of Service Name and P is a map of Layer 2 Control Protocol types as determined by the Protocol Identifier to Class of Service Names. This is when F is PCP of S-Tag or C-Tag.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
pcpValueList	NaturalNumber	1..8	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is a list of PCP values the CoS Identifier is mapping to.

Table 13 SCA_PcpCosIdPac class

11.1.5.4 SCA_DscpCosIdPac

The DscpCosId_Pac object class represents CoS Identifier that maps to IP DSCP. The value of this attribute is a triple of the form <F, M, P> where F is a protocol field in the ingress EI Frame, M is a map that maps each possible value of the field F to a Class of Service Name and P is a map of Layer 2 Control Protocol types as determined by the Protocol Identifier to Class of Service Names. This is when F is DSCP, either IPv4 or IPv6, or both.

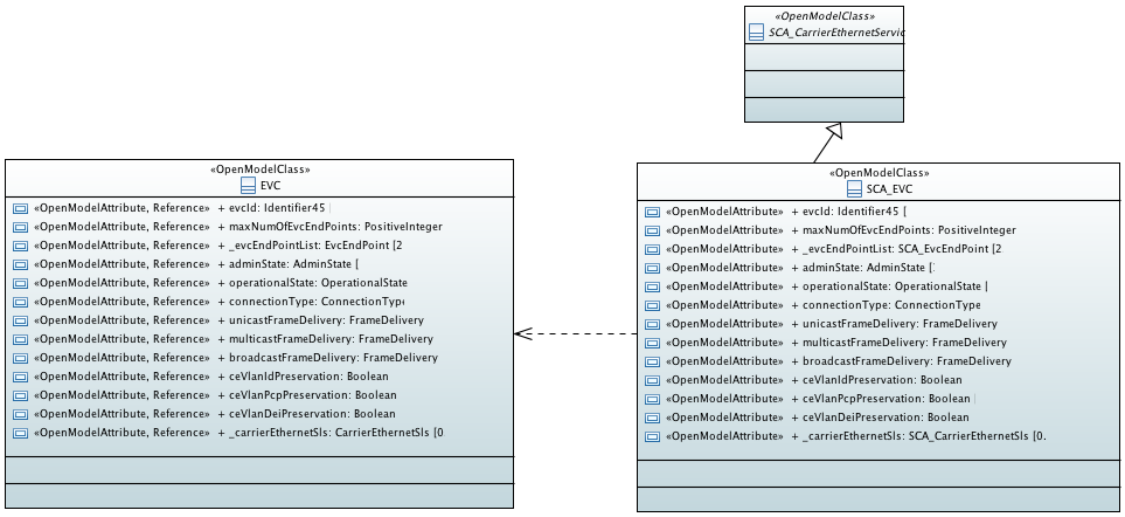
Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
dscpValueList	NaturalNumber	1..64	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is a list of DSCP values that the CoS Identifier is mapping to.
ipVersion	IpVersion	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the IP version for the DSCP.

Table 14 SCA_DscpCosIdPac class

11.1.6 SCA_EVC



11.1.6.1 SCA_CarrierEthernetService

This CarrierEthernetService object class represents the Carrier Ethernet Services, i.e., the EVC service and the OVC service. It is an abstract class and the super class of EVC and OVC, containing all common attributes of EVC and OVC, including common associations with other object classes, such as a CarrierEthernetSls (representing Service Level Specification), etc.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
adminState	AdminState	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the administrative state of the EVC or the OVC service. The values supported are Locked and Unlocked.
operationalState	OperationalState	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the operational state of the EVC or the OVC service, as working "Enabled" or not working "Disabled".
connectionType	ConnectionType	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the connection type of EVC or OVC. The values are point to point, multipoint and rooted multipoint.
unicastFrameDelivery	FrameDelivery	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint	This attribute denotes the unicast frame delivery service describes which frames are delivered to which EIs and the fields in a frame that are carried transparently.

			• support: MANDATORY	
multicastFrameDelivery	FrameDelivery	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the multicast frame delivery service describes which frames are delivered to which EIs and the fields in a frame that are carried transparently.
broadcastFrameDelivery	FrameDelivery	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the broadcast frame delivery service describes which frames are delivered to which EIs and the fields in a frame that are carried transparently.
ceVlanIdPreservation	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute describes a relationship between the format and certain field values of the frame at one External Interface and the format and certain field values of the corresponding frame at another External Interface.
ceVlanPcpPreservation	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute describes a relationship between the format and certain field values of the frame at one External Interface and the format and certain field values of the corresponding frame at another External Interface.
ceVlanDeiPreservation	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute can be used to preserve the value of the CE-VLAN DEI field in VLAN Tagged Service Frames across an EVC.
_carrierEthernetSls	SCA_CarrierEthernetSls	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute presents the relationship between an EVC/OVC and a service level specification.

Table 15 SCA_CarrierEthernetService class

11.1.6.2 SCA_EVC

The EVC is a subclass of CarrierEthernetService object class. It represents the MEF defined EVC service with all EVC service attributes, as well as its association with other object classes.. It is associated with two or more EvcEndPoint(s), a CarrierEthernetSls (representing Service Level Specification), etc.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

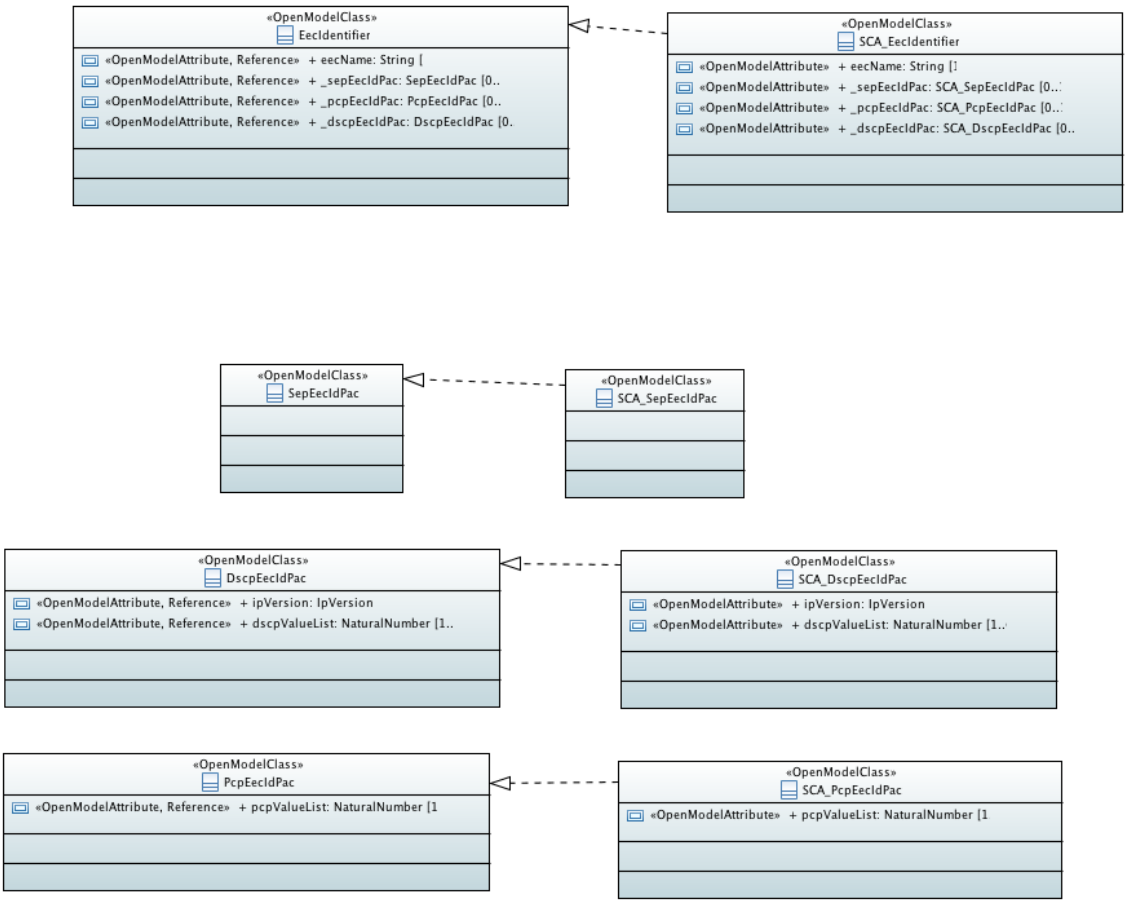
Attribute Name	Type	Mult.	Stereotypes	Description

evcId	Identifier45	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	The EVC ID is an arbitrary string administered by the Service Provider that is used to identify an EVC within the CEN.
maxNumOfEvcEndPoints	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute specifies the maximum number of EVC End Points allowed for an EVC. Depending on the connectionType, the number is different. For point-to-point, the number is 2. For other connectionType, it is >=2.
_evcEndPointList	SCA_EvcEndPoint	2..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attributes is from the relationship between EVC and EVC End Point. In MEF 10.3, the relationship was between the EVC and UNIs. This model changes the relationship to align with MEF 26.2.
adminState	AdminState	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the administrative state of the EVC or the OVC service. The values supported are Locked and Unlocked.
operationalState	OperationalState	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the operational state of the EVC or the OVC service, as working "Enabled" or not working "Disabled".
connectionType	ConnectionType	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the connection type of EVC or OVC. The values are point to point, multipoint and rooted multipoint.
unicastFrameDelivery	FrameDelivery	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the unicast frame delivery service describes which frames are delivered to which EIs and the fields in a frame that are carried transparently.
multicastFrameDelivery	FrameDelivery	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the multicast frame delivery service describes which frames are delivered to which EIs and the fields in a frame that are carried transparently.
broadcastFrameDelivery	FrameDelivery	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the broadcast frame delivery service describes which frames are delivered to which EIs and the fields in a frame that are carried transparently.
ceVlanIdPreservation	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint	This attribute describes a relationship between the format and certain field values of the frame at one External Interface and the

			• support: MANDATORY	format and certain field values of the corresponding frame at another External Interface.
ceVlanPcpPreservation	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute describes a relationship between the format and certain field values of the frame at one External Interface and the format and certain field values of the corresponding frame at another External Interface.
ceVlanDeiPreservation	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute can be used to preserve the value of the CE-VLAN DEI field in VLAN Tagged Service Frames across an EVC.
_carrierEthernetSls	SCA_CarrierEthernetSls	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute presents the relationship between an EVC/OVC and a service level specification.

Table 16 SCA_EVC class

11.1.7 SCA_EecIdentifier



11.1.7.1 SCA_EecIdentifier

The EecIdentifier object class represents the Egress Equivalence Class Identifier. Each egress EI Frame mapped to the given EVC/OVC End Point has a single Egress Equivalence Class. The Egress Equivalence Class can be determined from inspection of the content of the egress EI Frame. It is associated with the SapCosId_Pac, or the PcpCosId_Pac, or the DscpCosId_Pac (representing mapping to EVC/OVC End Point, or PCP, or DSCP respectively). The BwpFlow is associated to the EecIdentifier (representing Bandwidth Profile per Equivalence Class Identifier). The EecIdentifier is also associated with L2cpProtocolIdentifier(s).

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
eecName	String	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Egress Equivalence Class name.
_sepEecIdPac	SCA_SepEecIdPac	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the EecIdentifier and an SapEecId_Pac (representing the Egress Equivalence Class Identifier of the form <F, M, P> when F is the EVC End Point or OVC End Point).
_pcpEecIdPac	SCA_PcpEecIdPac	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the EecIdentifier and an PcpEecId_Pac (representing the Egress Equivalence Class Identifier of the form <F, M, P> when F is the PCP field).
_dscpEecIdPac	SCA_DscpEecIdPac	0..2	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the EecIdentifier and an DscpEecId_Pac (representing the Egress Equivalence Class Identifier of the form <F, M, P> when F is the DSCP field).

Table 17 SCA_EecIdentifier class

11.1.7.2 SCA_SepEecIdPac

The SepEecIdPac object class represents the Egress Equivalence Class Identifier to the EVC End Point or the OVC End Point. The value of the OVC End Point Egress Equivalence Class Identifier is a triple of the form <F, M, P> where F is a protocol field in the egress EI Frame, M

is a map that maps each possible value of the field F to an Egress Equivalence Class and P is a map of L2CP type to Egress Equivalence Class. This is when F is the EVC/OVC End Point.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

11.1.7.3 SCA_DscpEecIdPac

The DscpEecIdPac object class represents the Egress Equivalence Class Identifier to IP DSCP. The value of the OVC End Point Egress Equivalence Class Identifier is a triple of the form <F, M, P> where F is a protocol field in the egress EI Frame, M is a map that maps each possible value of the field F to an Egress Equivalence Class and P is a map of L2CP type to Egress Equivalence Class. This is when F is DSCP of IPv4 or IPv6 or both.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
ipVersion	IpVersion	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes which IP version is used. It can be IPv4, or IPv6, or both IPv4 and IPv6.
dscpValueList	NaturalNumber	1..64	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute provides a list of DSCP values map to the same Egress Equivalence Class Name.

Table 18 SCA_DscpEecIdPac class

11.1.7.4 SCA_PcpEecIdPac

The PcpEecIdPac object class represents the Egress Equivalence Class Identifier to PCP. The value of the OVC End Point Egress Equivalence Class Identifier is a triple of the form <F, M, P> where F is a protocol field in the egress EI Frame, M is a map that maps each possible value of the field F to an Egress Equivalence Class and P is a map of L2CP type to Egress Equivalence Class. This is when F is PCP of S-Tag or C-Tag.

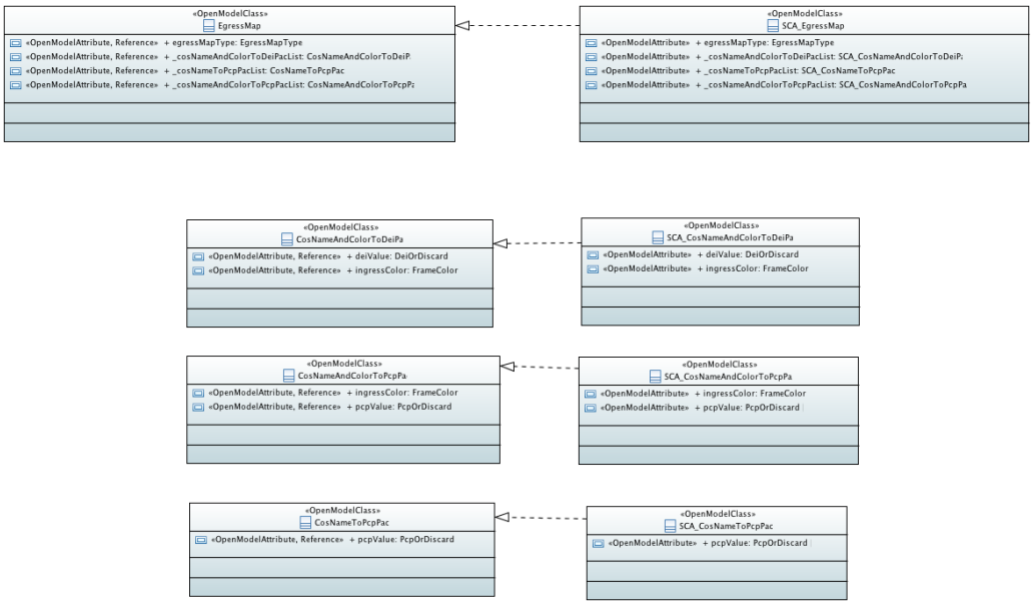
Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
pcpValueList	NaturalNumber	1..8	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute provides a list of PCP values that map to the Egress Equivalence Class Name.

Table 19 SCA_PcpEecIdPac class

11.1.8 SCA_EgressMap



11.1.8.1 SCA_EgressMap

The EgressMap object class represents the Egress Map that is a set of mappings that determine the content of the S-Tag or C-Tag of an egress EI Frame. It is associated with EvcEndPoint or OvcEndPoint.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
egressMapType	EgressMapType	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute determines which form to take to apply for egress frame color indication, among CoS name and Ingress Color to PCP, or CoS Name and Ingress Color to DEI, or CoS Name to PCP, along with which Tag (S-Tag or C-Tag) to apply.

_cosNameAndColorToDeiPacList	SCA_CosNameAndColorToDeiPac	0..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relatioship between the EgressMap and the CosNameAndColorToDei_Pac (representing the attribute set for using CoS Name and ingress color to egress DEI mapping).
_cosNameToPcpPacList	SCA_CosNameToPcpPac	0..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relatioship between the EgressMap and the CosNameAndColorToDei_Pac (representing the attribute set for using CoS Name to egress PCP mapping).
_cosNameAndColorToPcpPacList	SCA_CosNameAndColorToPcpPac	0..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relatioship between the EgressMap and the CosNameAndColorToDei_Pac (representing the attribute set for using CoS Name and ingress color to egress PCP mapping).

Table 20 SCA_EgressMap class

11.1.8.2 SCA_CosNameAndColorToDeiPac

The CosNameAndColorToPeiPac object class represents the Egress Map that maps from CoS Name and Ingress Color to DEI.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
deiValue	DeiOrDiscard	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the egress frame DEI value (S tag or C tag is from vlanTag attribute), including the ingress color indication.
ingressColor	FrameColor	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the ingress frame color as one of the determined factor for Egress Map.

Table 21 SCA_CosNameAndColorToDeiPac class

11.1.8.3 SCA_CosNameAndColorToPcpPac

The CosNameAndColorToPcpPac object class represents the Egress Map that maps from CoS Name and Ingress Color to PCP.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
ingressColor	FrameColor	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the ingress frame color as one of the determined factor for Egress Map.
pcpValue	PcpOrDiscard	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the egress frame PCP value (S tag or C tag is from vlanTag attribute), mapping from ingress CoS name and ingress frame color.

Table 22 SCA_CosNameAndColorToPcpPac class

11.1.8.4 SCA_CosNameToPcpPac

The CosNameToPcpPac object class represents the Egress Map that maps from CoS Name to PCP.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
pcpValue	PcpOrDiscard	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the egress frame PCP value (S tag or C tag is from vlanTag attribute), mapping from ingress CoS Name and ingress frame color.

Table 23 SCA_CosNameToPcpPac class

11.1.9 SCA_EvcEndPoint

11.1.9.1 SCA_CarrierEthernetServiceAccessPoint

The CarreirEthernetServiceAccessPoint represents the Carrier Ethernet Service Access Point, i.e., the EVC End Point or the OVC End Point. This is an abstract class and the super class of EvcEndPoint and OvcEndPoint. It contains the common attributes of EvcEndPoint and OvcEndPoint, as well as all common associations with the other object classes, such as a CarrierEthernetExternalInterface (i.e., UNI or ENNI), CosIdentifier(s), EecIdentifier(s), a ColorIdentifier, EgressMap(s), a CarrierEthernetService (i.e, EVC or OVC), etc.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
adminState	AdminState	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the administrative state of EVC End Point or OVC End Point. The values supported are Locked and Unlocked.
operationalState	OperationalState	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the operational state of the EVC End Point or the OVC End Point, as working "Enabled" or not working "Disabled".
cosMappingType	CosOrEecMappingType	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is for selecting which CoS mapping type, SAP (Service Access Point) based, or PCP based or DSCP based.
sourceMacAddressLimit	SourceMacAddressLimit	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint	This attribute limits the number of source MAC Addresses that can be used in ingress EI Frames mapped to the EVC End Point or the OVC

			• support: MANDATORY	End Point of all types over a time interval.
eecMappingType	CosOrEecMappingType	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is for selecting which EEC mapping type, SAP (Service Access Point) based, or PCP based or DSCP based.
_egressMapList	EgressMap	0..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the EVC/OVC End Point and the Egress Map(s).
_eecIdentifierList	EecIdentifier	0..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the EVC/OVC End Point and the Egress Equivalence Class Identifier(s).
_coloridentifier	ColorIdentifier	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the EVC/OVC End Point and a Color Identifier.
_cosIdentifierList	CosIdentifier	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the EVC/OVC End Point and the Class of Service Identifier(s).

Table 24 SCA_CarrierEthernetServiceAccessPoint class

11.1.9.2 SCA_EvcEndPoint

The EvcEndPoint is a subclass of CarrierEthernetServiceAccessPoint. It represents the EVC End Point (EVC per UNI), provides all EVC End Point service attributes, as well as all associations with the other object classes, such as an EVC, a UNI, CosIdentifier(s), EecIdentifier(s), a ColorIdentifier, an EgressMap, etc.

Applied stereotypes:

- Preliminary
- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

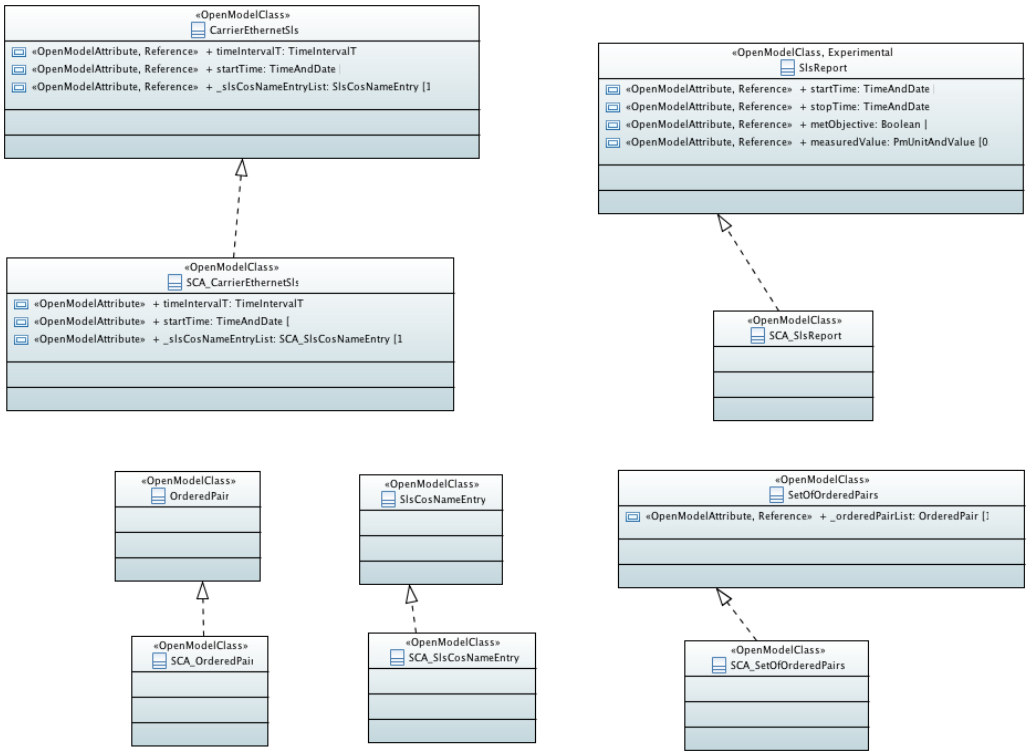
Attribute Name	Type	Mult.	Stereotypes	Description
evcEndPointId	Identifier90	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute name is adapted from MEF 26.2. MEF 10.3 uses UNI EVC ID. This is defined to be the concatenation of UNI ID and the EVC ID.
evcEndPointRole	EvcEndPointRole	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint	This attribute denotes the role of the EVC End Point for the EVC. The value is ROOF or LEAF. MEF 10.3 addresses the UNI Role in

			• support: MANDATORY	EVC attribute UNI List. This is changed so that the role is the attribute of EVC End Point, to be aligned to MEF 26.2.
evcEndPointMap	VlanIdListing	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute provides the list of CE-VLAN IDs those map to the EVC. MEF 10.3 and MEF 6.2 list this attriubte (CE-VLAN ID/EVC map) as UNI service attribute while MEF 26.2 decided to move this on as endpoint service attribute, just as MEF 10.1 and MEF 6.1 did. Decided to move this one to endpoint to be consistent. To be consistent, changing its name to EvcEntPointMap (MEF 26.2 lists as OVC Endpoint Map).
subscriberMegMipEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Subscriber MEG MIP is enabled or not. When the value of the Subscriber MEG MIP Service Attribute is Enabled, the CEN MUST instantiate a Subscriber Level MIP.
testMegEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the test MEG is enabled or not. When the value of the Test MEG Service Attribute is Enabled, the CEN MUST meet the mandatory requirements in Section 7.5 of MEF 30.1. that apply to the Test MEG
_evc	EVC	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the EVC End Point and an EVC.
adminState	AdminState	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the administrative state of EVC End Point or OVC End Point. The values supported are Locked and Unlocked.
operationalState	OperationalState	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the operational state of the EVC End Point or the OVC End Point, as working "Enabled" or not working "Disabled".
cosMappingType	CosOrEecMappingType	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is for selecting which CoS mapping type, SAP (Service Access Point) based, or PCP based or DSCP based.
sourceMacAddressLimit	SourceMacAddressLimit	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute limits the number of source MAC Addresses that can be used in ingress EI Frames mapped to the EVC End Point or the OVC End Point of all types over a time

				interval.
eecMappingType	CosOrEecMappingType	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is for selecting which EEC mapping type, SAP (Service Access Point) based, or PCP based or DSCP based.
_egressMapList	EgressMap	0..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the EVC/OVC End Point and the Egress Map(s).
_eecIdentifierList	EecIdentifier	0..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the EVC/OVC End Point and the Egress Equivalence Class Identifier(s).
_coloridentifier	ColorIdentifier	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the EVC/OVC End Point and a Color Identifier.
_cosIdentifierList	CosIdentifier	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the EVC/OVC End Point and the Class of Service Identifier(s).

Table 25 SCA_EvcEndPoint class

11.1.10 SCA_SLS



11.1.10.1 SCA_CarrierEthernetSls

This CarrierEthernetSls represents Carrier Ethernet Service Level Specification that provides a list of Performance Metrics where each item in the list includes the parameters and performance objective for the given Performance Metric. It is associated with EVC or OVC.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
timeIntervalT	TimeIntervalT	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute sets the time interval to evaluate the performance for the SLS. All performances of this SLS use the same time interval T, which itself may not be constrained, e.g., 1 month.
startTime	TimeAndDate	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the date and time for the start of the SLS. It is the beginning of the first Time Interval T.

_slsCosNameEntryList	SCA_SlsCosNameEntry	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the CarrierEthernetSls and CosNameEntry(s) representing CN (CoS Name) entries as lists of 4-tuples of the form <CoS_Name, Δt, C, n> as defined in MEF 26.2 (MEF 10.3 covered the descriptions but not as this format).

Table 26 SCA_CarrierEthernetSls class

11.1.10.2 SCA_SlsReport

The PmReport object class represents the collected and processed Performance result (or report) for a time period T. Some performance metric may have percentage result and some may have value result. Refer to MEF 35.1.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
startTime	TimeAndDate	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	this attribute denotes the start time of the time interval T.
stopTime	TimeAndDate	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	this attributes denotes the stop time of the Time Interval T.
metObjective	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes whether the PM Objective being met for this Time Interval T.
resultInValue	PmUnitAndValue	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	this attribute is a pair of <Unit, Value> , e.g., the <Unit=%, value= 99> for 99%, or <Unit=ms, Value=2> for 2 ms.

Table 27 SCA_SlsReport class

11.1.10.3 SCA_OrderedPair

The OrderedPair object class is an ordered pair of (EVC/OVC) end points for a specific PM, for one way direction. It is associated with a PmEntry and two CarrierEthernetServiceAccessPoint(s) (EVC End Points or OVC End Points, one as "from" and one as "to" for indication of "order" or direction).

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA

- objectDeletionNotification: NA
- support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
_fromcarrierethernetserviceaccesspoint	SCA_CarrierEthernetServiceAccessPoint	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between OrderedPair and a "from" CarrierEthernetServiceAccessPoint (EVC End Point or OVC End Point).
_tocarrierethernetserviceaccesspoint	SCA_CarrierEthernetServiceAccessPoint	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between OrderedPair and a "to"CarrierEthernetServiceAccessPoint (EVC End Point or OVC End Point).

Table 28 SCA_OrderedPair class

11.1.10.4 SCA_SlsCosNameEntry

The PmCosNameEntry object class represents the CoS Name entry consisting a list of 4-tuples of the form <CoS_Name, Δt, C, n>, where CoS_Name as Class of Service Name, Δt as a small time interval, C as a threshold, and n to identify consecutive Δt for high loss interval. The PmCosNameEntry object class is associated with EVC or OVC, and PmEntry(s).

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
cosName	String	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Class of Service Name.
delta_t	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Δt, a time interval much smaller than T (SLS time period). E.g., 10 seconds.
threshold_C	Real	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the threshold for PM, used to determine whether a given time interval delta t has high loss.
consecutiveInterval_n	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes n, used to identify how many consecutive Δ*t* intervals must have high loss to trigger a change in Availability.
_pmentry	invalid	0..*	OpenModelAttribute • AVC: NA • isInvariant: false	This attribute represents the relationship between PmCosNameEntry and PmEntry(s).

			• valueRange: no range constraint • support: MANDATORY	In MEF 26.2 this is called PM, as one parameter of the 4-tuple of the CN. Refer to MEF 26.2 section 12.12. It contains the specific performance metric, a list of parameter values specific to the definition of the performance metric, and the PM Objective.

Table 29 SCA_SlsCosNameEntry class

11.1.10.5 SCA_SetOfOrderedPairs

Only Group Availability PM may have more than one sets of Ordered Pairs.

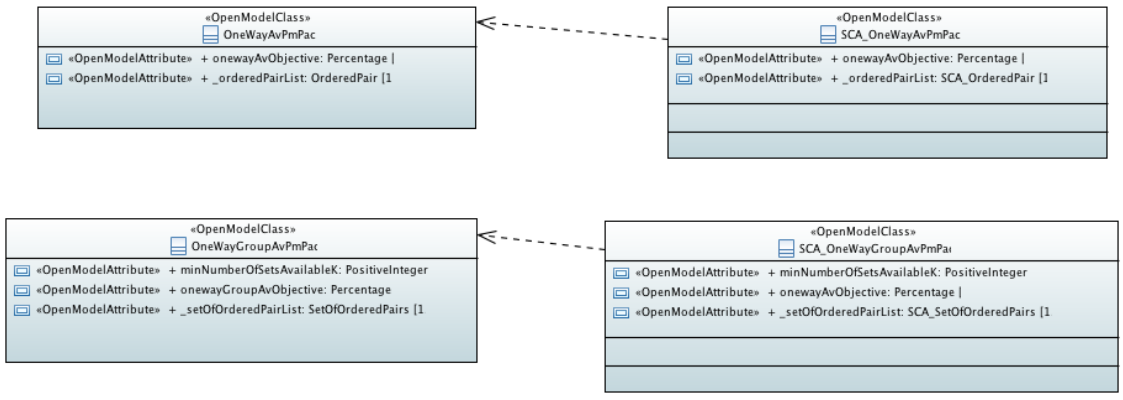
Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
_orderedpair	SCA_OrderedPair	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes a set of ordered pairs.

Table 30 SCA_SetOfOrderedPairs class

11.1.11 SCA_SLS_OneWayAvail



11.1.11.1 SCA_OneWayAvPmPac

The OneWayAvPm object class represents the One Way Availability PM. All attributes are from the super class. This object class is created just for clarity.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA

- objectDeletionNotification: NA
- support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
_orderedPairList	SCA_OrderedPair	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	

Table 31 SCA_OneWayAvPmPac class

11.1.11.2 SCA_OneWayGroupAvPmPac

The OneWayGroupAvPm object class represents the One Way Group Availability PM for a single EVC/OVC.

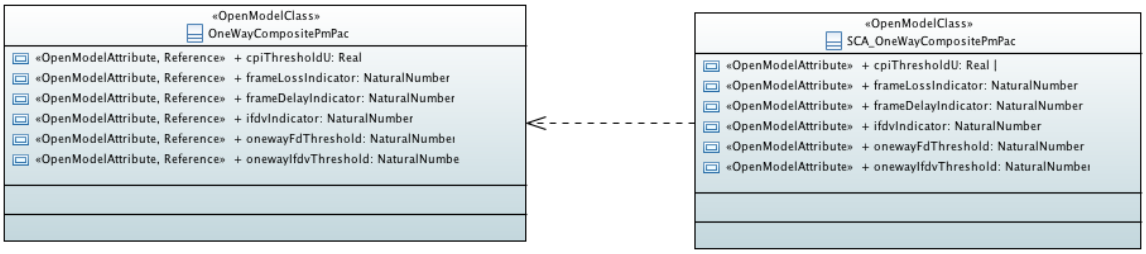
Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
minNumberOfSetsAvailableK	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is the minimum number of service interfaces (UNI or ENNI) to be available of the group availability performance metric.
onewayAvObjective	Percentage	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute sets the one way availability objective.
_setOfOrderedPairList	SCA_SetOfOrderedPairs	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	

Table 32 SCA_OneWayGroupAvPmPac class

11.1.12 SCA_SLS_OneWayCpm



11.1.12.1 SCA_OneWayCompositePmPac

The OneWayCompositePm object class represents the One Way Composite PM. Refer to MEF 10.3.1. MEF 26.2 doesn't include it.

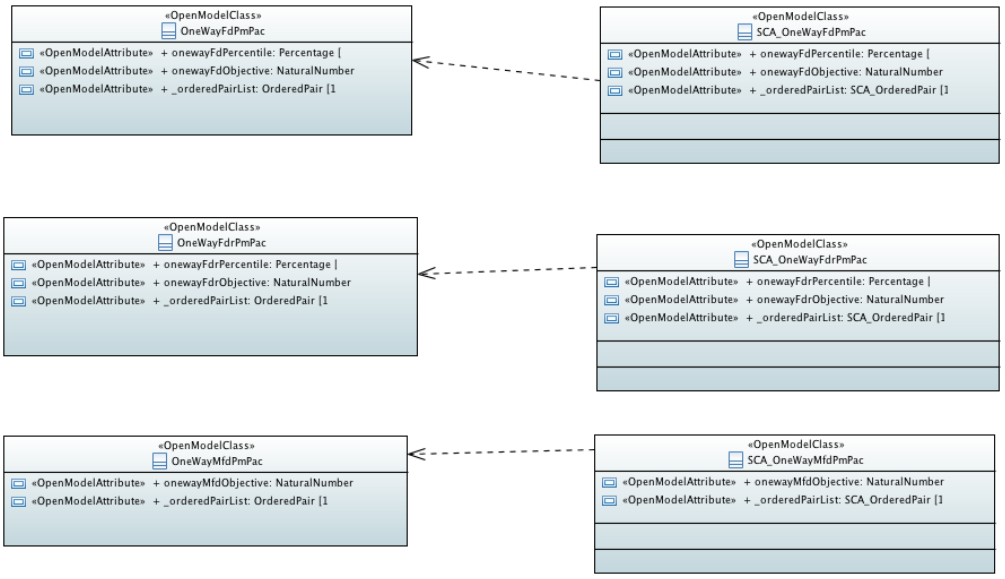
Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
cpiThresholdU	Real	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is the cpi threshold of the composite performance metric.
frameLossIndicator	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is the frame loss indicator of the composite performance metric.
frameDelayIndicator	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is the frame delay indicator of the composite performance metric.
ifdvIndicator	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is the ifdv indicator of the composite performance metric.
onewayFdThreshold	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is the one way frame delay threshold of the composite performance metric.
onewayIfdvThreshold	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is the one way IFDV threshold of the composite performance metric.

Table 33 SCA_OneWayCompositePmPac class

11.1.13 SCA_SLS_OneWayFd



11.1.13.1 SCA_OneWayFdPmPac

The OneWayFdPm object class represents the One Way Frame Delay PM. All attributes are from the super class. This object class is created just for clarity.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
onewayFdPercentile	Percentage	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute sets the one way frame delay percentile.
onewayFdObjective	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute sets the one way frame delay objective.
_orderedPairList	SCA_OrderedPair	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	

Table 34 SCA_OneWayFdPmPac class

11.1.13.2 SCA_OneWayFdrPmPac

The OneWayFdrPm object class represents the One Way Frame Delay Range PM. All attributes are from the super class. This object class is created just for clarity.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
onewayFdrPercentile	Percentage	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute sets the one way frame delay range percentile.
onewayFdrObjective	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute sets the one way frame delay range objective.
_orderedPairList	SCA_OrderedPair	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	

Table 35 SCA_OneWayFdrPmPac class

11.1.13.3 SCA_OneWayMfdPmPac

The OneWayMfdPm object class represents the One Way Mean Frame Delay PM. All attributes are from the super class. This object class is created just for clarity.

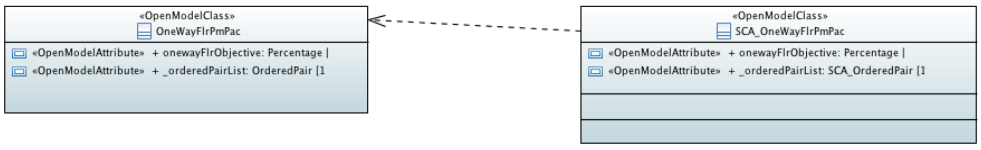
Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
onewayMfdObjective	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute sets the one way mean frame delay objective.
_orderedPairList	SCA_OrderedPair	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	

Table 36 SCA_OneWayMfdPmPac class

11.1.14 SCA_SLS_OneWayFl



11.1.14.1 SCA_OneWayFlrPmPac

The OneWayFlrPm object class represents the One Way Frame Loss Ratio PM. All attributes are from the super class. Defining this objThis object class is created just for clarity.ect class just for clarity.

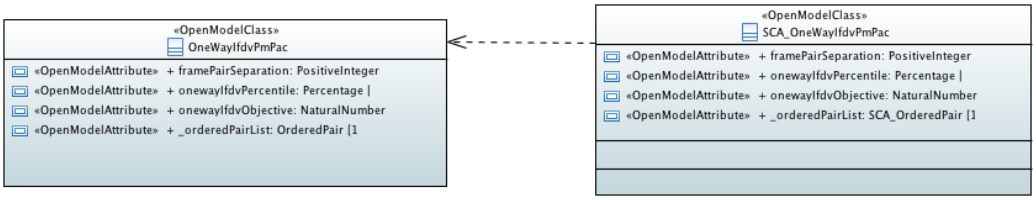
Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
onewayFlrObjective	Percentage	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute sets the one way frame loss ratio objective.
_orderedPairList	SCA_OrderedPair	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	

Table 37 SCA_OneWayFlrPmPac class

11.1.15 SCA_SLS_OneWayIfdv



11.1.15.1 SCA_OneWayIfdvPmPac

The OneWayIfdvPm object class represents the One Way Inter Frame Delay Variation PM.

Applied stereotypes:

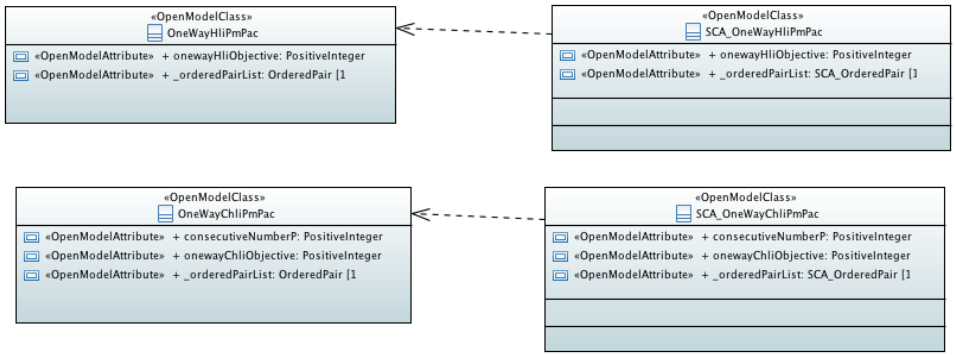
- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
framePairSeparation	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is the frame pair separation of the IFDV performance metric.
onewayIfdvPercentile	Percentage	1	OpenModelAttribute • AVC: NA • isInvariant: false	This attribute sets the one way IFDV percentile. This attribute sets the one way

			• valueRange: no range constraint • support: MANDATORY	IFDV percentile
onewayIfdvObjective	NaturalNumber	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute sets the one way IFDV objective.
_orderedPairList	SCA_OrderedPair	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	

Table 38 SCA_OneWayIfdvPmPac class

11.1.16 SCA_SLS_Resliency



11.1.16.1 SCA_OneWayHliPmPac

The OneWayHliPm object class represents the One Way High Loss Interval PM. All attributes are from the super class. This object class is created just for clarity.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
onewayHliObjective	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute sets the one way high loss interval objective.
_orderedPairList	SCA_OrderedPair	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	

Table 39 SCA_OneWayHliPmPac class

11.1.16.2 SCA_OneWayChliPmPac

The OneWayChliPm object class represents the One Way Consecutive High Loss Interval PM. All attributes are from the super class. Defining this object class just for clarity.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
consecutiveNumberP	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is the minimum integer number of Δt 's in the (sliding) window (with 0 < p < n) to qualify as a CHLI.
onewayChliObjective	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute sets the one way consecutive high loss interval objective.
_orderedPairList	SCA_OrderedPair	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	

Table 40 SCA_OneWayChliPmPac class

11.1.17 SCA_UNI

11.1.17.1 SCA_CarrierEthernetExternalInterface

This CarrierEthernetExternalInterface object class represents the Carrier Ethernet External Interface, i.e., the UNI and ENNI. It is an abstract class and the super class of UNI and ENNI, providing all common service attributes of UNI and ENNI, as well as all common associations with the other object classes, such as CarrierEthernetServiceAccessPoint(s) (EvcEndPoint or OvcEndPoint), Envelope(s), BwpFlow(s), etc.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
adminState	AdminState	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the administrative state of the UNI or the ENNI. The values supported are Locked and Unlocked.
operationalState	OperationalState	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the operational state of the UNI or the ENNI, as working "Enabled" or not working "Disabled".
physicalLayerList	PhysicalLayer	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is a list of physical layers, one for each physical link implementing the UNI or ENNI. Different physical links can use different physical layers. The Physical Layer for each physical link implementing the UNI or ENNI MUST be one of the PHYs listed in IEEE Std 802.3 – 2012 but excluding 1000BASE-PX-D and 1000BASE-PX-U.
syncModeList	SyncModePerLink	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is a list with one item for each of the physical links. When the value of an item is "Enabled," the bits transmitted from the CEN to the CE on the physical link corresponding to the item can be used by the CE as a bit clock reference. MEF 10.3 and MEF 26.2 just stated that when enabled, the quality must also be specified but didn't say how.
numberOfLinks	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute specifies the number of links at the Ethernet Service Interface (UNI or ENNI)
frameFormat	EthernetFrameFormat	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is a set of Ethernet frame formats. It is an Ethernet frame and is defined to consist of the first bit of the Destination MAC Address through the last bit of the Frame Check Sequence. UNI frames use untagged or C-VLAN tagged, while ENNI Frames use S-VLAN tags.
linkAggregation	InterfaceResiliency	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the Link Aggregation for a UNI or an ENNI. Its value is one of None, 2-Link Active/Standby, All Active, or Other. In MEF 10.3 it is called UNI Resiliency. the value of All Active is added in MEF 10.3.2.
portConvsIdToAggLinkMapList	ConversationIdToAggregationLinkMap	0..*	OpenModelAttribute • AVC: NA • isInvariant: false	This attribute is applicable only when the UNI or ENNI resiliency attribute has the value of All Active. Its value is a Port

			• valueRange: no range constraint • support: MANDATORY	Conversation ID to Aggregation Link Map as defined in IEEE Std 802.1AX – 2014.
linkOamEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Link OAM is enabled or not at the UNI or the ENNI. When the value of the Link OAM attribute is Enabled, Link OAM must be run on all physical links in the UNI/ENNI.
lagLinkMegEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Link Aggregation MEG is enabled or not at the UNI or the ENNI. When the value is Enabled, the Service Provider or the CEN Operator must operate the LAG Link MEG on each link in the UNI or the ENNI.

Table 41 SCA_CarrierEthernetExternalInterface class

11.1.17.2 SCA_UNI

The UNI object class is a subclass of CarrierEthernetExternalInterface object class. It represents the UNI. UNI may be managed by Service Provider or by Operator, for EVC service or for OVC service. Therefore an UNI instance may contain ServicProviderUni_Pac and/or OperatorUni_Pac which consists of different attribute set, or different values for some service attributes. The bandwidth profile parameters (Envelope(s), BwpFlow(s) are associated with the UNI indirectly via the ServiceProviderUni_Pac and the OperatorUni_Pac.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

Attribute Name	Type	Mult.	Stereotypes	Description
uniMegEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes whether the UNI MEG is enabled or not. When the value is Enabled, the CEN MUST meet the mandatory requirements in MEF 30.1 that apply to the UNI MEG
elmiEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes whether the ELMI is enabled or not. When the value is Enabled, the CEN MUST meet the mandatory requirements in MEF 16 that apply to the UNI-N.
_serviceProviderUni	SCA_ServiceProvider Uni	0..1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the UNI and a ServiceProviderUni_Pac. A UNI has to have at least one of the ServiceProviderUni_Pac or OperatorUni_Pac to be included. It is possible to have both included.

_operatorUniList	SCA_OperatorUni	0..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the relationship between the UNI and an OperatorUni_Pac. A UNI has to have at least one of the ServiceProviderUni_Pac or OperatorUni_Pac to be included. It is possible to have both included.
adminState	AdminState	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the administrative state of the UNI or the ENNI. The values supported are Locked and Unlocked.
operationalState	OperationalState	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the operational state of the UNI or the ENNI, as working "Enabled" or not working "Disabled".
physicalLayerList	PhysicalLayer	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is a list of physical layers, one for each physical link implementing the UNI or ENNI. Different physical links can use different physical layers. The Physical Layer for each physical link implementing the UNI or ENNI MUST be one of the PHYs listed in IEEE Std 802.3 – 2012 but excluding 1000BASE-PX-D and 1000BASE-PX-U.
syncModeList	SyncModePerLink	1..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is a list with one item for each of the physical links. When the value of an item is "Enabled," the bits transmitted from the CEN to the CE on the physical link corresponding to the item can be used by the CE as a bit clock reference. MEF 10.3 and MEF 26.2 just stated that when enabled, the quality must also be specified but didn't say how.
numberOfLinks	PositiveInteger	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute specifies the number of links at the Ethernet Service Interface (UNI or ENNI)
frameFormat	EthernetFrameFormat	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is a set of Ethernet frame formats. It is an Ethernet frame and is defined to consist of the first bit of the Destination MAC Address through the last bit of the Frame Check Sequence. UNI frames use untagged or C-VLAN tagged, while ENNI Frames use S-VLAN tags.
linkAggregation	InterfaceResiliency	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute represents the Link Aggregation for a UNI or an ENNI. Its value is one of None, 2-Link Active/Standby, All Active, or Other. In MEF 10.3 it is called UNI

				Resiliency. the value of All Active is added in MEF 10.3.2.
portConvsIdToAggLinkMapList	ConversationIdToAggregationLinkMap	0..*	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is applicable only when the UNI or ENNI resiliency attribute has the value of All Active. Its value is a Port Conversation ID to Aggregation Link Map as defined in IEEE Std 802.1AX – 2014.
linkOamEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Link OAM is enabled or not at the UNI or the ENNI. When the value of the Link OAM attribute is Enabled, Link OAM must be run on all physical links in the UNI/ENNI.
lagLinkMegEnabled	Boolean	1	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the Link Aggregation MEG is enabled or not at the UNI or the ENNI. When the value is Enabled, the Service Provider or the CEN Operator must operate the LAG Link MEG on each link in the UNI or the ENNI.

Table 42 SCA_UNI class

11.2 Data Types

Editor's Note: The following list of data types are unchanged from MEF 7.3 static Information Model

11.2.1 AggLinkDepth

This is a pair of <Vlan ID, link number> indicating an ingress EI frame with this Vlan ID is mapped to the specific link with the link number.

Attribute Name	Type	Mult.	Access	Stereotypes	Description
vlanId	VlanId	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	The ingress frame Vlan ID.
linkNumber	NaturalNumber	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	The link number of the aggregation link.

11.2.2 ConversationIdToAggrgationLinkMap

This is a Port Conversation ID to Aggregation Link Map as defined in IEEE Std 802.1AX – 2014.

Attribute Name	Type	Mult.	Access	Stereotypes	Description

conversationId	NaturalNumber	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	The conversation ID is a Vlan ID or 0 for untagged or priority tagged frame..
LinkId	NaturalNumber	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	The link ID of the aggregation link.

11.2.3 Identifier45

Unique by network administrative domain, containing no more than 45 characters and non-null RFC 3579 Display String but not contain the characters 0x00 through 0x1f.

Attribute Name	Type	Mult.	Access	Stereotypes	Description
identifier	String	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	non-null RFC2579 Display String (<=45) but not contain the characters 0x00 through 0x1f

11.2.4 L2cpPeering

This is a list specifies the L2CP Protocol Identifier and the Destination Address in use by the protocol entity.

Attribute Name	Type	Mult.	Access	Stereotypes	Description
l2cpProtocol	String	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	Name of a Protocol, e.g., LACP, ELMI, etc.
procotolId	L2cpProtocolId	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is a L2CP Protocol Identifier.
destinationAddress	NaturalNumber	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is a Mac Address.

11.2.5 MepLevelAndDirection

This complex data type includes MEG LEVEL and MEP direction.

Attribute Name	Type	Mult.	Access	Stereotypes	Description
level	NaturalNumber	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is the MEG level, value between 0..7.

direction	MepDirection	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is MEP direction, Up or Down.

11.2.6 NaturalNumber

An integer >=0

Attribute Name	Type	Mult.	Access	Stereotypes	Description
naturalNum	Integer	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is an integer >=0.

11.2.7 Percentage

Data type for percentage, 0%-100%.

Attribute Name	Type	Mult.	Access	Stereotypes	Description
percentage	Real	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is a real number between 0 and 1.

11.2.8 PhysicalLayerPerLink

A link may consist of one or more physical ports. This data type includes the link ID and the physical port associated to the link Id.

Attribute Name	Type	Mult.	Access	Stereotypes	Description
linkId	String	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is the link ID.
physicalLayer	PhysicalLayer	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is the physical layer. IEEE802.3 (2012) defined.

11.2.9 PmUnitAndValue

This data type provides the pair of <unit, value> where the unit can be ms (for frame delay), number (for HLI), and value is the correspondent value for that unit.

Attribute Name	Type	Mult.	Access	Stereotypes	Description
unit	PmUnit	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint	This attribute denotes the "unit", e.g., %, millisecond, etc.

				• support: MANDATORY	
value	NaturalNumber	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the value corresponding to the unit, i.e., 99 (with unit %), 5 (with millisecond).

11.2.10 PositiveInteger

An integer >0

Attribute Name	Type	Mult.	Access	Stereotypes	Description
positiveInt	Integer	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute is an integer >0.

11.2.11 SourceMacAddressLimit

This limits the number of source MAC Addresses that can be used in ingress external interface frames mapped to the End Point of all types over a time interval.

Attribute Name	Type	Mult.	Access	Stereotypes	Description
limit	NaturalNumber	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the limit.
timeInterval	NaturalNumber	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes the time interval.

11.2.12 SyncModePerLink

A link may consist of one or more physical ports. This data type includes the link ID and the sync mode of the physical port associated to the link Id.

Attribute Name	Type	Mult.	Access	Stereotypes	Description
linkId	String	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is the link ID of the link in the Aggregation Link.
syncModeEnabled	Boolean	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This attribute denotes whether the Synchronous Mode is enabled (on the link with the Link ID).

11.2.13 TimeAndDate

This data type is for Time and Date.

Attribute Name	Type	Mult.	Access	Stereotypes	Description
year	PositiveInteger	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This denotes the year.
month	PositiveInteger	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This denotes the month.
day	PositiveInteger	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This denotes the day.
hour	NaturalNumber	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This denotes the hour.
minute	NaturalNumber	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This denotes the minute.
second	NaturalNumber	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This denotes the second.

11.2.14 TimeIntervalT

Time interval T for PM. E.g., 1 month, 20 days, 2 weeks, etc.

Attribute Name	Type	Mult.	Access	Stereotypes	Description
unit	TimeIntervalUnit	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	Month, week, day, hour, etc.
number	NaturalNumber	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This denotes the value (for the unit), e.g., 1 (month), 20 (day), etc.

11.2.15 VlanId

This is for VLAN ID from 1 to 4094

Attribute Name	Type	Mult.	Access	Stereotypes	Description
vid	PositiveInteger	1	RW	OpenModelAttribute • AVC: NA	This is the Vlan ID value.

				• isInvariant: false • valueRange: no range constraint • support: MANDATORY	

11.2.16 VlanIdListing

The list VLAN IDs, either when type==LIST, or when type==EXCEPT (which means the VLAN IDs except the listed). When type==ALL, the vlanId list is not applicable.

Attribute Name	Type	Mult.	Access	Stereotypes	Description
type	VlanIdMappingType	1	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	Can be LIST, or ALL, or EXCEPT.
vlanId	VlanId	0..*	RW	OpenModelAttribute • AVC: NA • isInvariant: false • valueRange: no range constraint • support: MANDATORY	This is a list of Vlan IDs.

11.3 Enumerations

Editor's Note: The following list of data types are unchanged from MEF 7.3 static Information Model.

11.3.1 AdminState

This enumeration is for Administrative states. Refer to MEF 7.2 and Q840.1.

Contains Enumeration Literals:

- UNLOCK:
- LOCK:

11.3.2 AvailableMegLevel

This enumeration is for available MEG level, can be either NONE or value 0..7

Contains Enumeration Literals:

- NONE:
- 0:
- 1:
- 2:
- 3:
- 4:
- 5:
- 6:
- 7:

11.3.3 AvailableStatus

This enumeration is for Availability status. Refer to MEF 7.2 and Q840.1.

Contains Enumeration Literals:

- IN_TEST:
- FAILED:
- DEGRADED:
- NOT_INSTALLED:

11.3.4 ColorFieldType

This enumeration is for selecting which frame field being used for color indication.

Contains Enumeration Literals:

- PCP:
- DEI:
- SAP:
- DSCP:

11.3.5 ColorMode

This enumeration indicates whether the Color Identifier of the Service Frame is considered by the Bandwidth Profile Algorithm.

Contains Enumeration Literals:

- COLOR_AWARE:
- COLOR_BLIND:

11.3.6 ConnectionType

This is for EVC connection types, including point to point, multi-point and rooted multi-point.

Contains Enumeration Literals:

- POINT_TO_POINT:
- MULTIPOINT:
- ROOTED_MULTIPOINT:

11.3.7 CosOrEecMappingType

This lists the Class of Service identifier type, or the Equivalence Class Identifier type.

Contains Enumeration Literals:

- END_POINT:
- PCP:
- DSCP:
- NONE:

11.3.8 DeiOrDiscard

This lists the DEI value for color or discard.

Contains Enumeration Literals:

- DISCARD:
- 0:
- 1:

11.3.9 EgressMapType

This lists the Egress Map types, either CoS Name to PCP, or CoS Name and Ingress Color to PCP, or CoS Name and Ingress Color to DEI.

Contains Enumeration Literals:

- CN_PCP:
- CC_PCP:
- CC_DEI:

11.3.10 EthernetFrameFormat

This is a single value read only attribute. Keep this in the info model just because MEF 10.3 lists it as a service attribute.

Contains Enumeration Literals:

- ETHERNET:

11.3.11 EvcEndPointRole

The value indicates how external interface frames mapped to the EVC End Point can be forwarded.

Contains Enumeration Literals:

- ROOT:
- LEAF:

11.3.12 FrameColor

Frame color is either Green or Yellow.

Contains Enumeration Literals:

- GREEN:
- YELLOW:

11.3.13 FrameDelivery

Service frame delivery defined in MEF 10.3. When the value is conditionally, the specific condition has to be addresses by the users. What conditions should be supported are not in the scope.

Contains Enumeration Literals:

- DISCARD:
- CONDITIONALLY:
- UNCONDITIONALLY:

11.3.14 InterfaceResiliency

The method for protection, if any, against a physical link failure.

Contains Enumeration Literals:

- NONE:
- 2_LINK_ACTIVE_STANDBY:
- ALL_ACTIVE:
- OTHER:

11.3.15 IpVersion

This enumeration lists the IP versions, including IPv4, IPv6 and both.

Contains Enumeration Literals:

- IPV4:
- IPV6:
- IPV4_AND_IPV6:

11.3.16 L2cpAddressSet

This lists the L2CP Address Set. Refer to MEF 45.

Contains Enumeration Literals:

- CTA:
- CTB:
- CTB2:

11.3.17 L2cpIdMappingType

This lists the L2CP identifier types, either EtherType, or EtherType + Subtype, or LLC Address.

Contains Enumeration Literals:

- ETHERTYPE:
- LLC:
- ETHERTYPE_SUBTYPE:

11.3.18 MepDirection

This is for MEP direction, either Down MEP or Up MEP.

Contains Enumeration Literals:

- DOWN:
- UP:

11.3.19 OperationalState

This enumeration is for Operational states. Refer to MEF 7.2 and Q840.1.

Contains Enumeration Literals:

- ENABLE:
- DISABLE:

11.3.20 PcpOrDiscard

This enumeration lists one of PCP values or DISCARD.

Contains Enumeration Literals:

- DISCARD:
- 0:
- 1:
- 2:
- 3:
- 4:
- 5:
- 6:
- 7:

11.3.21 PhysicalLayer

IEEE802.3 (2012) defined list excluding 1000BASE-PX-D and 1000BASE-PX-U. NONE is added with further MEF 10.3 discussion, for supporting logical interfaces.

Contains Enumeration Literals:

- 10BASE2:
- 10BASE5:
- 10BASE_F:
- 10BASE_FB:
- 10BASE_FL:
- 10BASE_FP:
    - For connecting Repeater. Make sense for UNI?
- 10BASE_T:
- 10BASE_TE:
- 10BROAD36:
- 10PASS_TS:
- 100BASE_BX10:
- 100BASE_FX:
- 100BASE_LX10:
- 100BASE_T:
- 100BASE_T2:
- 100BASE_T4:
- 100BASE_TX:

- 100BASE_X:
- 1000BASE_BX10:
- 1000BASE_CX:
    - Jump cable assembly. Make sense for UNI?
- 1000BASE_KX:
    - For electrical backplane. Make sense for UNI?
- 1000BASE_LX:
- 1000BASE_LX10:
- 1000BASE_PX10:
- 1000BASE_PX20:
- 1000BASE_SX:
- 1000BASE_T:
- 1000BASE_X:
- 10GBASE_CX4:
- 10GBASE_E:
- 10GBASE_ER:
- 10GBASE_EW:
- 10GBASE_KR:
    - Backplane. Make sense for UNI/ENNI?
- 10GBASE_KX4:
    - Backplane. Make sense for UNI/ENNI?
- 10GBASE_L:
- 10GBASE_LR:
- 10GBASE_LRM:
- 10GBASE_LW:
- 10GBASE_LX4:
- 10GBASE_PR:
- 10GBASE_PRX:
- 10GBASE_R:
- 10GBASE_S:
- 10GBASE_SR:
- 10GBASE_SW:
- 10GBASE_T:
- 10GBASE_W:
- 10GBASE_X:
- 100GBASE_R:
- 100GBASE_CR10:
- 100GBASE_ER4:
- 100GBASE_LR4:
- 100GBASE_SR10:
- 40GBASE_R:
- 40GBASE_CR4:
- 40GBASE__FR:
- 40GBASE_KR4:

- 40GBASE_LR4:
- 40GBASE_SR4:
- 1BASE5:
- 2BASE_TL:
- 1G_EPON:
    - For UNI/ENNI?
- 10G_EPON:
- 10_1G_EPON:
- 10_10G_EPON:
- OTHER:
- NONE:

11.3.22 PmUnit

PM Unit, used for pairing with Value in data type PmUnitAndValue. Can be second, millisecond, micro second, etc.

Contains Enumeration Literals:

- SECOND:
- MILLISECOND:
- MICROSECOND:
- NUMBER:

11.3.23 SVlanIdControl

This lists the S Vlan ID Control, either FULL or PARTIAL.

Contains Enumeration Literals:

- FULL:
- PARTIAL:

11.3.24 TaggedL2cpProcessing

Either 802.1 compliant or not. Refer to MEF 45.

Contains Enumeration Literals:

- 802.1_COMPLIANT:
- 802.1_NON_COMPLIANT:

11.3.25 TimeIntervalUnit

Time interval unit, e.g., month, day, week, hour, etc.

Contains Enumeration Literals:

- YEAR:
- MONTH:
- WEEK:
- DAY:

- HOUR:
- MINUTE:
- SECOND:

11.3.26 VlanIdMappingType

Vlan ID types, ALL for all vlan IDs, LIST for a list of Vlan IDs, EXCEPT for all Vlan IDs except the listed.

Contains Enumeration Literals:

- ALL:
- EXCEPT:
- LIST:

11.3.27 VlanIdPreservation

This is for Vlan ID Preservation. RETAIN covers only the direction from UNI to ENNI while PRESERVE covers both directions. Refer to MEF 26.2.

Contains Enumeration Literals:

- PRESERVE:
- RETAIN:
- STRIP:

11.3.28 VlanTag

This is for Vlan Tag type, i.e., S-tag or C-tag.

Contains Enumeration Literals:

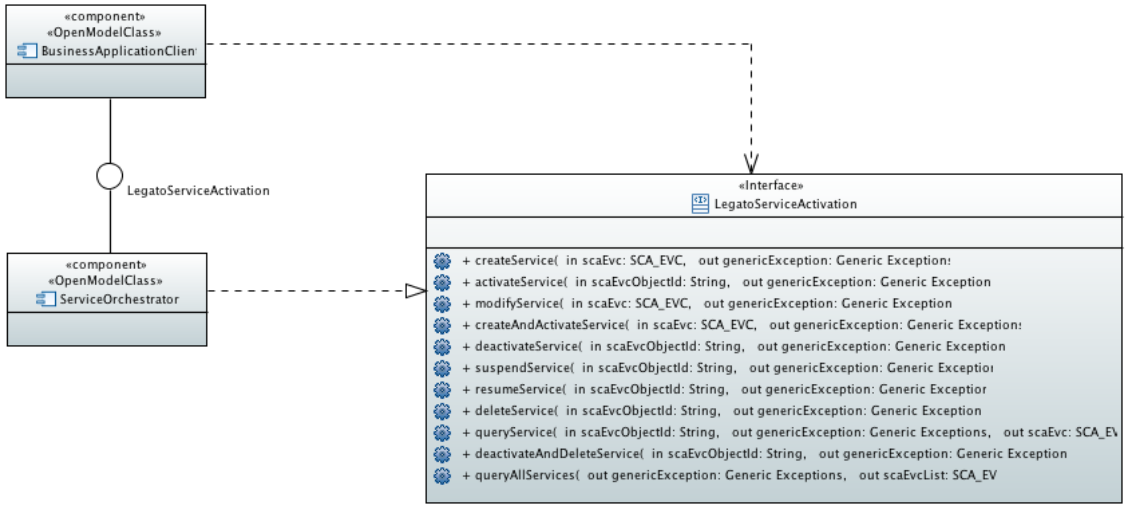
- S_TAG:
- C_TAG:

12 Service Interfaces & Operations

This section defines the SCA Legato Interface and the association operations with their parameters.

12.1 Interface Component Diagram

The figure below illustrates the SCA Legato Interface Component Diagram. The Legato interface, defined in the MEF LSO RA, resides northbound from the Service Orchestrator providing services to the Business Application Clients.



12.2 Components

12.2.1 BusinessApplicationClient

A Business Application Client uses the Legato interface to request the instantiation of Connectivity Services based on the needs of the Business Applications.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

12.2.2 ServiceOrchestrator

A Service Orchestrator implements the Service Orchestration Function (SOF) as defined by the MEF LSO RA.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

12.3 Interfaces

12.3.1 LegatoServiceActivation

The Legato interface, defined in the MEF LSO RA, resides northbound from the Service Orchestrator providing services to the Business Application Clients. The Legato Service Activation interface focuses on management and control functions to perform Service Configuration and Activation (SCA) processes across the Legato interface. MEF 50 defines the Process Elements and Process Flow for the Service Configuration and Activation stage of the

Service Operations Lifecycle. The MEF LSO Reference Architecture includes Order Fulfillment Orchestration and Service Control Orchestration which expand on the MEF 50 Service Configuration and Activation processes with greater LSO detail. Phase 1 of this Specification includes MEF EVC based services defined in MEF 6.2 and MEF 10.3.

Applied stereotypes:

- OpenModelInterface
    - support: MANDATORY

12.4 Operations

This section defines the operations and parameters for the identified SCA Use Cases.

12.4.1 createService

This operation allows creating a new MEF EVC based service up to the activation state.
Applied stereotypes:

- OpenModelOperation
    - isOperationIdempotent:false
    - isAtomic:invalid
    - support:MANDATORY

Parameter Name	Type	Direction	Multi.	Stereotypes	Description
scaEvc	SCA_EVC	in	1	OpenModelParameter • valueRange: no range constraint • support: MANDATORY	This parameter represents the EVC-based service to create.

Supported Exceptions:

- InvalidInput
- InternalError
- NotImplemented
- CommLoss
- AccessDenied
- UnableToComply

12.4.2 activateService

This operation allows activating an instantiated MEF EVC based service.
Applied stereotypes:

- OpenModelOperation
    - isOperationIdempotent:false
    - isAtomic:invalid

- support:MANDATORY

Parameter_Name	Type	Direction	Multi.	Stereotypes	Description
scaEvcObjectId	String	in	1	OpenModelParameter • valueRange: no range constraint • support: MANDATORY	This parameter represents the objectID of the EVC service.

Supported Exceptions:

- EntityNotFound
- InvalidInput
- NotInValidState
- InternalError
- NotImplemented
- CommLoss
- AccessDenied
- UnableToComply

12.4.3 deactivateService

This operation supports deactivating or disconnecting an activated MEF EVC based service.
Applied stereotypes:

- OpenModelOperation
  - isOperationIdempotent:false
  - isAtomic:invalid
  - support:MANDATORY

Parameter_Name	Type	Direction	Multi.	Stereotypes	Description
scaEvcObjectId	String	in	1	OpenModelParameter • valueRange: no range constraint • support: MANDATORY	This parameter represents the objectID of the EVC service.

Supported Exceptions:

- EntityNotFound
- InvalidInput
- NotInValidState
- InternalError
- NotImplemented
- CommLoss
- AccessDenied
- UnableToComply

12.4.4 deleteService

This operation supports deleting an instantiated MEF EVC based service.

Applied stereotypes:

- OpenModelOperation
  - isOperationIdempotent:false
  - isAtomic:invalid
  - support:MANDATORY

Parameter_Name	Type	Direction	Multi.	Stereotypes	Description
scaEvcObjectId	String	in	1	OpenModelParameter • valueRange: no range constraint • support: MANDATORY	This parameter represents the objectID of the EVC service.

Supported Exceptions:

- EntityNotFound
- InvalidInput
- NotInValidState
- InternalError
- NotImplemented
- CommLoss
- AccessDenied
- UnableToComply

12.4.5 modifyService

This operation allows configuring an existing MEF EVC based service, whether in the created state (instantiated but not activated) or activated state.
Applied stereotypes:

- OpenModelOperation
  - isOperationIdempotent:false
  - isAtomic:invalid
  - support:MANDATORY

Parameter_Name	Type	Direction	Multi.	Stereotypes	Description
scaEvc	SCA_EVC	in	1	OpenModelParameter • valueRange: no range constraint • support: MANDATORY	This parameter represents the EVC-based service to modify.

Supported Exceptions:

- EntityNotFound
- InvalidInput
- NotInValidState
- InternalError
- NotImplemented
- CommLoss
- AccessDenied
- UnableToComply

12.4.6 queryAllServices

This operation supports querying all instantiated MEF EVC based services.
Applied stereotypes:

- OpenModelOperation
  - isOperationIdempotent:false
  - isAtomic:invalid
  - support:OPTIONAL

Parameter_Name	Type	Direction	Multi.	Stereotypes	Description
scaEvcList	SCA_EVC	out	0..*	OpenModelParameter • valueRange: no range constraint • support: MANDATORY	This parameter represents the list of instantiated EVC services.

Supported Exceptions:

- InternalError
- NotImplemented
- CommLoss
- AccessDenied
- UnableToComply

12.4.7 queryService

This operation supports querying an instantiated MEF EVC based service for obtaining service attributes and parameters.
Applied stereotypes:

- OpenModelOperation
  - isOperationIdempotent:false
  - isAtomic:invalid
  - support:MANDATORY

Parameter_Name	Type	Direction	Multi.	Stereotypes	Description
scaEvcObjectId	String	in	1	OpenModelParameter • valueRange: no range constraint • support: MANDATORY	This parameter represents the objectID of the EVC service.
scaEvc	SCA_EVC	out	0..1	OpenModelParameter • valueRange: no range constraint • support: MANDATORY	This parameter represents the instantiated EVC service.

Supported Exceptions:

- EntityNotFound
- InvalidInput
- InternalError

- NotImplemented
- CommLoss
- AccessDenied
- UnableToComply

12.4.8 resumeService

This operation supports resuming a suspended MEF EVC based service.
Applied stereotypes:

- OpenModelOperation
  - isOperationIdempotent:false
  - isAtomic:invalid
  - support:MANDATORY

Parameter_Name	Type	Direction	Multi.	Stereotypes	Description
scaEvcObjectId	String	in	1	OpenModelParameter • valueRange: no range constraint • support: MANDATORY	This parameter represents the objectID of the EVC service.

Supported Exceptions:

- EntityNotFound
- NotInValidState
- InternalError
- NotImplemented
- CommLoss
- AccessDenied
- UnableToComply

12.4.9 suspendService

This operation supports suspending an activated MEF EVC based service.
Applied stereotypes:

- OpenModelOperation
  - isOperationIdempotent:false
  - isAtomic:invalid
  - support:MANDATORY

Parameter_Name	Type	Direction	Multi.	Stereotypes	Description
scaEvcObjectId	String	in	1	OpenModelParameter • valueRange: no range constraint • support: MANDATORY	This parameter represents the objectID of the EVC service.

Supported Exceptions:

- EntityNotFound

- InvalidInput
- NotInValidState
- InternalError
- NotImplemented
- CommLoss
- AccessDenied
- UnableToComply

13 State Diagrams

This section defines the SCA Legato Interface state machine. The SCA state machine defines the states and transitions a service may be in (or follow) for behavioral operations of configuration and activation.

13.1 State Machine Diagram

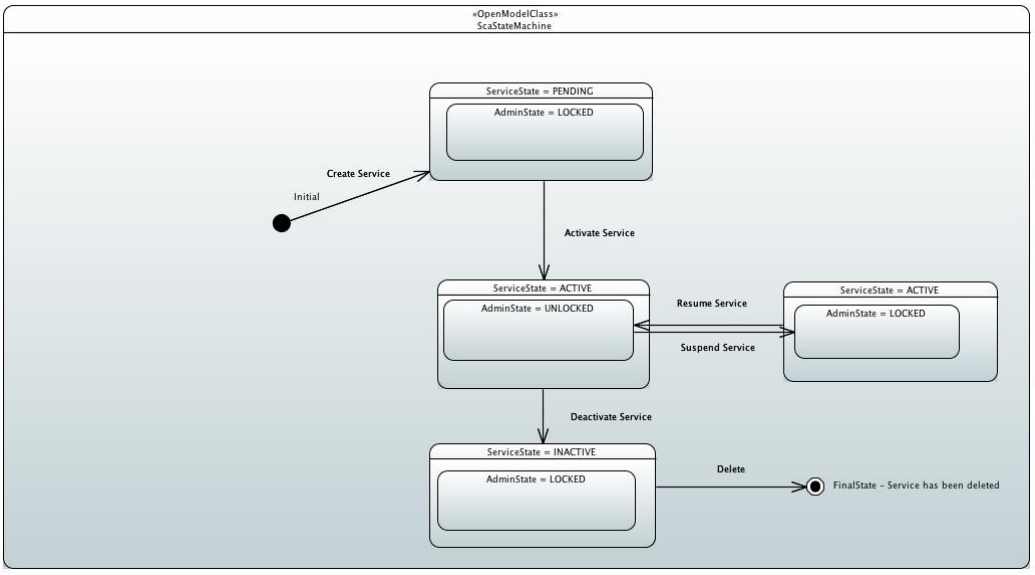


Figure 4 - State Machine Diagram

13.1.1 ScaStateMachine

This diagram represents state transitions for the SCA Interface.

Applied stereotypes:

- OpenModelClass
  - objectCreationNotification: NA
  - objectDeletionNotification: NA
  - support: MANDATORY

13.2 States

This section defines the states within the State Machine Diagram.

13.2.1 ServiceState = PENDING

The service has been created and thus is instantiated. The associated resources in the network are created, but they may or may not be active. It is allowable for a system to not support the PENDING state and to reject any operation that attempts to put an service into the PENDING state.
AdminState = LOCKED
The effect of the admin state being locked and the service state being pending is that no traffic is flowing through the network.

13.2.2 ServiceState = ACTIVE

The service has been activated. All the required resources associated to the service have been activated in the network.
AdminState = UNLOCKED
The effect of the admin state being unlocked and the service state being active is that service traffic may flow through the network.

13.2.3 ServiceState = ACTIVE

The service remains in an active state even though the admin state has transitioned to locked. The effect is that all associated resources in the network remain allocated to the service, and all associated capabilities remain turned on (i.e. monitoring, etc.). The ports associated to the UNIs are administratively locked to ensure that traffic does not flow through the network.
AdminState = LOCKED
The effect of admin state being locked and service state being active is that service traffic is not flowing through the network

13.2.4 ServiceState = INACTIVE

The effect of the service transitioning to inactive implies that all resources remain allocated to the service, but certain capabilities may be turned off (i.e. monitoring), or certain resources may be replaced or temporarily taken out of service for test.
AdminState = LOCKED
The effect of admin state being LOCKED and the service state being inactive is that service traffic is not flowing through the network

14 References

[1] IETF RFC 2119, Key words for use in RFCs to Indicate Requirement Levels, March 1997.

[2] MEF 6.2, EVC Ethernet Services Definitions Phase 3, August 2014.

[3] MEF 7.3, CE Management Information Model, July 2016.

[4] MEF 10.3, Ethernet Services Attributes Phase 3, October 2013.

[5] MEF 50, Carrier Ethernet Service Lifecycle Process Model, December 2014.

[6] MEF x, Lifecycle Service Orchestration (LSO): Reference Architecture and Framework, Draft, October 2015.

[7] OMG Unified Modeling Language™ (OMG UML), Superstructure, Version 2.3, May 2010, http://www.omg.org/spec/UML/2.3/Superstructure.

[8] OMG Unified Modeling Language™ (OMG UML), Infrastructure, Version 2.3, May 2010, http://www.omg.org/spec/UML/2.3/Infrastructure.

Appendix A Backwards compatibility to MEF 6.1 Service

MEF 6.2 [2] has provided guidance to identifying parameter values such that Subscriber sees similar behavior as for a MEF 6.1 Service. See Appendix B in MEF 6.2 [2].