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MEF 65

Simplified Transit E-Line Service

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1 List of Contributing Members

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

- AT&T
- Bell Canada
- CenturyLink
- Ciena
- Cisco
- Verizon

2 Abstract

This MEF Standard specifies a Simplified Transit E-Line (STEL) Service that constrains selected values of the ENNI Common Attributes, ENNI Service Attributes and Operator Ethernet Service Attributes specified in MEF 26.2 [5] to simplify ordering and provisioning for a common case of Transit E-Line Services defined in MEF 51.1 [7].

3 Terminology and Abbreviations

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.

In addition, terms defined in MEF 6.3 [3], MEF 10.4 [4], MEF 26.2 [5], and MEF 51.1 [7] are included in this document by reference, and are not repeated in the table below.

Term	Definition	Reference
Bundled STEL Service	A STEL Service with multiple S-VLAN ID values mapped to each OVC End Point.	This document
Simplified Transit E-Line Service	A Transit E-Line Service that constrains selected values of the ENNI Common Attributes, ENNI Service Attributes and Operator Ethernet Service Attributes.	This document
SP/SO Device	Equipment deployed by a Service Provider or a Super Operator at a Subscriber location.	This document
STEL ENNI	An ENNI that has an OVC End Point for a Simplified Transit E-Line Service, and for which the values of the ENNI Common Attributes and ENNI Service Attributes are constrained by the requirements in this Standard.	This document
STEL Service	Simplified Transit E-Line Service	This document
Unbundled STEL Service	A STEL Service with a single S-VLAN ID value mapped to each OVC End Point.	This document
Unconstrained ENNI	An ENNI that has an OVC End Point for a Simplified Transit E-Line Service, and that is not the STEL ENNI for that service.	This document

Table 1 – Terminology and Abbreviations

4 Compliance Levels

The key words "**MUST**", "**MUST NOT**", "**REQUIRED**", "**SHALL**", "**SHALL NOT**", "**SHOULD**", "**SHOULD NOT**", "**RECOMMENDED**", "**NOT RECOMMENDED**", "**MAY**", and "**OPTIONAL**" in this document are to be interpreted as described in BCP 14 (RFC 2119 [1], RFC 8174 [2]) when, and only when, they appear in all capitals, as shown here. All key words must be in bold text.

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

5 Introduction

MEF 10.4 [4] and MEF 26.2 [5] describe, respectively, frameworks for Subscriber Ethernet Services and Operator Ethernet Services. In brief, a Subscriber Ethernet Service is provided by a Service Provider (SP) to a Subscriber that deals only with the SP. The SP may implement the entire service or may use one or more Operators to implement some or all of the service. In the latter case, each Operator provides an Operator Ethernet Service to the SP. An Operator may recursively implement some or all of the service it is providing by using other Operators; in this case the Operator is known as a Super Operator (SO). Per MEF 26.2 [5], the term "SP/SO" is used when referring to either a Service Provider or Super Operator.

When a SP/SO does not have a presence or device at one or more Subscriber locations, the SP/SO will need to coordinate with the Operator providing access to each such Subscriber location in order to test, monitor or instantiate key Service Attributes of the Subscriber Ethernet Service. This coordination can be challenging. MEF 43 [6] and MEF 62 [8] provide methods of solving this challenge without requiring the SP/SO to deploy a device at the Subscriber's location:

- MEF 43 [6] defines an Access E-Line Service with Virtual NID (vNID) Functionality which provides the SP/SO with key capabilities it would have had if it placed its own equipment at the Subscriber's location, but does so using a "virtual NID" provided by the Operator implementing the Access E-Line Service.
- MEF 62 [8] defines a Managed Access E-Line Service (MAEL) Service which allows a SP/SO to monitor Subscriber Ethernet Services by utilizing a standard set of management capabilities, including Service OAM Fault Management, Service OAM Performance Management, and Latching Loopback in the MAEL Operator's network.

However, a SP/SO might prefer to deploy and manage a device of its own at the Subscriber location for multiple reasons including:

- The SP/SO desires control over Ethernet Subscriber Service functionality that is unconstrained by the Operator providing access to the Subscriber location.
- The Operator providing access to the Subscriber location does not support MEF 43 [6] or MEF 62 [8].
- The SP/SO desires to simplify ordering.
- The SP/SO desires to aggregate services for multiple Subscribers at a multi-tenant location onto a single Operator Service.

The equipment deployed by an SP or a SO at the Subscriber location is called a SP/SO Device. When the SP/SO places its own equipment at the Subscriber's location, it can use a Transit E-Line Service provided by an Operator to access and manage it. Note that this is a Transit E-Line Service since it provides a Point-to-Point OVC between two ENNIs. This document specifies a Simplified Transit E-Line (STEL) Service to address this scenario.

This Standard defines the STEL Service by constraining values of the ENNI Common Attributes, ENNI Service Attributes and Operator Ethernet Service Attributes beyond the constraints in MEF 51.1 [7]. The constraints are intended to simplify the ordering and provisioning of the transit service and move control of the Subscriber Ethernet Service into the SP/SO Device.

A STEL Service provides many benefits to the SP/SO, such as:

- The functionality required of the Operator providing access to the Subscriber location is reduced which simplifies both ordering and provisioning.
- The deployment of a SP/SO Device at or near the Subscriber location is facilitated, which provides the SP/SO with management functionality including control of the Subscriber Ethernet Service Attribute values that is unconstrained by the operator providing access to the Subscriber location.
- More than one Subscriber Ethernet Service is possible, and these services can be distributed across multiple UNIs on the SP/SO Device.

This document only imposes constraints on one of the two ENNIs used in the STEL Service. The constrained ENNI is known as the STEL ENNI, while the other is known as the Unconstrained ENNI. Typically, a SP/SO Device is deployed at the STEL ENNI. The STEL ENNI can only have OVC End Points for STEL Services. The Unconstrained ENNI can have OVC End Points for STEL and non-STEL Services.

Figure 1 illustrates an example of an SP (Operator B) using a STEL Service and then placing a SP/SO Device at the Subscriber branch location. In this example the SP/SO Device forms an Operator CEN (operated by the SP) that spans only that device, over which an Operator Service is conceptually instantiated (connecting the UNI to the STEL ENNI).

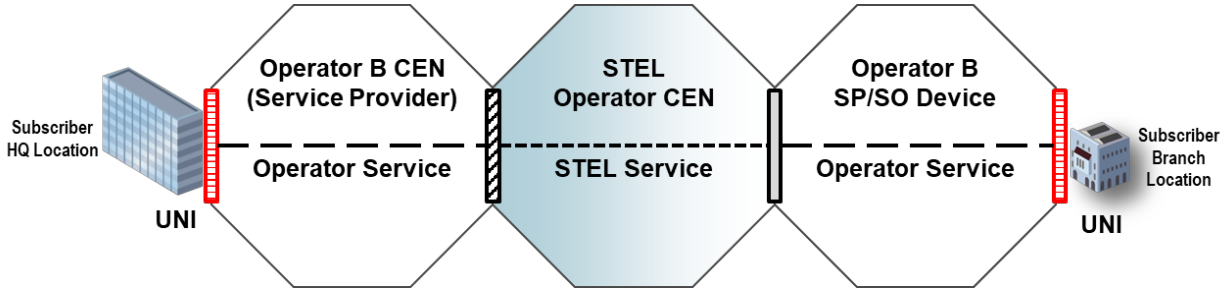

Figure 1 – STEL Service Example

Note that while Figure 1 illustrates the motivating use case, the use of a STEL Service within an Operator CEN does not restrict the type of services that can be used in neighboring Operator CENs, i.e., on the other side of the ENNIs associated by the STEL Service. In addition, it is not required that the neighboring CENs belong to the same Operator.

An Unbundled STEL Service has a single S-VLAN ID value mapped to the OVC End Point at the Unconstrained ENNI and at the STEL ENNI. A Bundled STEL Service has more than one S-VLAN ID value mapped to the OVC End Point at the Unconstrained ENNI and at the STEL ENNI.

Figure 2 below illustrates two additional examples of a STEL Service: one Bundled and one Unbundled.

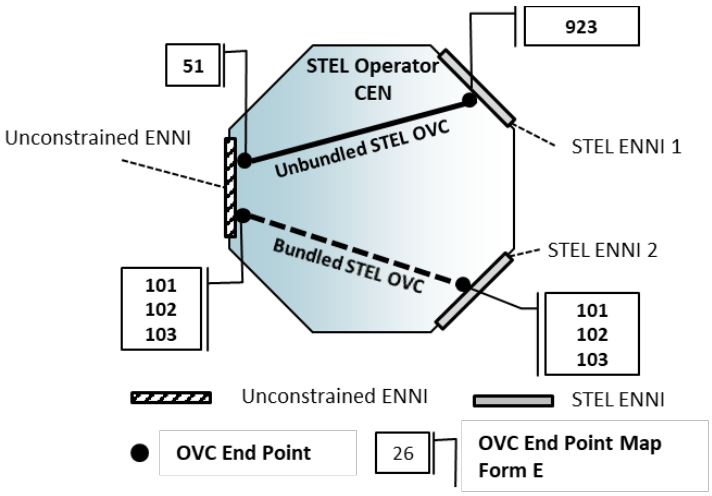

Figure 2 – Examples of STEL Services

STEL Services have the following key constraints which are intended to simplify the ordering and provisioning of the transit service and move control of the Subscriber Ethernet Service into the SP/SO Device:

- A Point-to-Point OVC type.
- A single Class of Service Name.
- The Ingress Bandwidth Profile is limited to Green and Red Color Declarations.
- OVC S-VLAN PCP and DEI Preservation are *Enabled*.
- One physical link at the STEL ENNI.
- STEL ENNI used by a single SP/SO.
- Only STEL Services at the STEL ENNI.
- OVC End Point MIP is *Disabled.*
- OVC End Point MEP List is *Empty.*

No constraints are placed on the number of S-VLAN IDs in the OVC End Point Map.

Section 6 contains the STEL Service definition.

Appendix A contains example use cases of STEL Services.

Appendix B describes how SOAM could be used for managing the use cases in Appendix A.

6 STEL Service Definition

This section defines the STEL Service by imposing requirements on Service Attribute values.

[R1] The mandatory requirements specified in MEF 51.1 [7] that apply to a Transit E-Line Service **MUST** be met by a STEL Service.

[D1] The recommendations specified in MEF 51.1 [7] that apply to a Transit E-Line Service **SHOULD** be met by a STEL Service.

6.1 STEL Service OVC Requirements

Table 2 contains the full set of OVC Service Attributes and associated requirements that define a STEL Service. The first column contains the OVC Service Attribute and the second column contains the requirements, if any. When the term 'No additional constraints' is used, it means that the requirements from the indicated MEF document apply.

OVC Service Attribute	STEL Service Requirements
OVC ID	No additional constraints from Table 18, MEF 51.1 [7]
OVC Type	No additional constraints from Table 18, MEF 51.1 [7] [R9] in Table 9 of MEF 51.1 [7] mandates that the value be *Point-to-Point*
OVC End Point List	**[R2]** For a STEL Service, exactly one of the two OVC End Points associated by the OVC **MUST** be at a STEL ENNI. **[R3]** For a STEL Service, exactly one of the two OVC End Points associated by the OVC **MUST** be at an Unconstrained ENNI.
Maximum Number of UNI OVC End Points	No additional constraints from Table 18, MEF 51.1 [7]
Maximum Number of ENNI OVC End Points	No additional constraints from Table 18, MEF 51.1 [7]
OVC Maximum Frame Size	No additional constraints from Table 18, MEF 51.1 [7]
OVC CE-VLAN ID Preservation	No additional constraints from Table 18, MEF 51.1 [7]
OVC CE-VLAN PCP Preservation	No additional constraints from Table 18, MEF 51.1 [7]
OVC CE-VLAN DEI Preservation	No additional constraints from Table 18, MEF 51.1 [7]
OVC S-VLAN PCP Preservation	**[R4]** For a STEL Service, the value of the OVC S-VLAN PCP Preservation Service Attribute **MUST** be *Enabled*.

OVC Service Attribute	STEL Service Requirements
OVC S-VLAN DEI Preservation	**[R5]** For a STEL Service, the value of the OVC S-VLAN DEI Preservation Service Attribute **MUST** be *Enabled*.
OVC List of Class of Service Names	**[R6]** For a STEL Service, the value of the OVC List of Class of Service Names Service Attribute **MUST** contain exactly one Class of Service Name. **[R7]** For a STEL Service, the value of the Class of Service Name in the OVC List of Class of Service Names Service Attribute **MUST NOT** be *Discard*.
OVC Service Level Specification	No additional constraints from Table 18, MEF 51.1 [7]
OVC Frame Delivery	No additional constraints from Table 18, MEF 51.1 [7]
OVC Available MEG Level	No additional constraints from Table 18, MEF 51.1 [7]
OVC L2CP Address Set	No additional constraints from Table 18, MEF 51.1 [7]

Table 2 – Requirements for OVC

6.2 STEL Service OVC End Point Requirements

Table 3 below specifies the requirements for STEL Service related to the OVC End Point Service Attributes. The requirements in Table 3 are applicable to the OVC End Point at the STEL ENNI and to the OVC End Point at the Unconstrained ENNI. The first column lists the OVC End Point Service Attribute and the second column specifies the requirements, if any. When the term 'No additional constraints' is used, it means that the requirements from the indicated MEF document apply.

OVC End Point Service Attribute	STEL Service Requirements
OVC End Point Identifier	No additional constraints from Table 19, MEF 51.1 [7]
OVC End Point External Interface Type	No additional constraints from Table 19, MEF 51.1 [7]
OVC End Point External Interface Identifier	No additional constraints from Table 19, MEF 51.1 [7]
OVC End Point Role	No additional constraints from Table 19, MEF 51.1 [7]
OVC End Point Map	**[D2]** The STEL Operator **SHOULD** support a value of the OVC End Point Map Service Attribute with two or more S-VLAN ID values. There are scenarios where having two or more S-VLAN ID values in the value of the OVC End Point Map is valuable to the SP/SO. See Appendix A.2 for an example.

OVC End Point Service Attribute	STEL Service Requirements
OVC End Point Class of Service Identifier	No additional constraints from Table 19, MEF 51.1 [7] As a consequence of [R6] and [R7] in this document and [R167] and [R168] in MEF 26.2 [5], the only possible value of this attribute is *F*=S-Tag PCP and *M* that maps all S-Tag PCP values (0-7) to the single CoS Name specified in the value of the OVC List of Class of Service Names Service Attribute.
OVC End Point Color Identifier	**[R8]** For a STEL Service, the value of *F* in the OVC End Point Color Identifier Service Attribute **MUST** be *S-Tag DEI*. The value of this Service Attribute has no effect in a STEL Service, so [R8] is provided to simplify service ordering.
OVC End Point Egress Map	No additional constraints from Table 19, MEF 51.1 [7] For a STEL Service the value of the OVC End Point Egress Map Service Attribute is *None* per MEF 26.2 [5] [R201] because [R4] and [R5] specify that both OVC S-Tag PCP and OVC S-Tag DEI are preserved and [R2] and [R3] of this document specify that both the ingress and egress OVC End Points are each at an ENNI.
OVC End Point Egress Equivalence Class Identifier	Per [R204] in MEF 26.2 [5], the value of *F* in the OVC End Point Egress Equivalence Identifier Service Attribute is *S-Tag PCP*. Per MEF 26.2 [5], Section 16.9.1.2 the map P is *null*. **[R9]** For a STEL Service, the value of *M* in the OVC End Point Egress Equivalence Identifier Service Attribute **MUST** map all S-Tag PCP values to a Single Egress Equivalence Class Name. [R9] is provided to simplify service ordering, but the value has no effect because the Egress Bandwidth Profile per Egress Equivalence Class Name Service Attribute is *Disabled* per [R11]
Ingress Bandwidth Profile per OVC End Point	No additional constraints from Table 19, MEF 51.1 [7]
Egress Bandwidth Profile per OVC End Point	No additional constraints from Table 19, MEF 51.1 [7]

OVC End Point Service Attribute	STEL Service Requirements
Ingress Bandwidth Profile per Class of Service Name	**[R10]** For a STEL Service, the value of Ingress Bandwidth Profile per Class of Service Name Service Attribute **MUST** be such that CIR = CIR_{max} > 0, CBS > 0, EIR = EIR_{max} = 0, EBS = 0, CF = 0 and CM = *Color-Blind*. [R10] means that the Ingress Bandwidth Profile per Class of Service Name will declare ingress ENNI Frames either Green or Red.
Egress Bandwidth Profile per Egress Equivalence Class Name	**[R11]** For a STEL Service, the value of the Egress Bandwidth Profile per Egress Equivalence Class Name Service Attribute for an OVC End Point **MUST** be an empty list. [R11] means that for both OVC End Points for the STEL Service there is no Egress Bandwidth Profile per Egress Equivalence Class Name.
OVC End Point Aggregation Link Depth	No additional constraints from Table 19, MEF 51.1 [7] This attribute does not apply at the OVC End Point at the STEL ENNI, because [R16][R16] prevents the ENNI Link Aggregation Common Attribute at the STEL ENNI from having the value of *All Active*.
OVC End Point Source MAC Address Limit	No additional constraints from Table 19, MEF 51.1 [7]
OVC End Point MIP	**[R12]** For a STEL Service, the value of the OVC End Point MIP Service Attribute **MUST** be *Disabled*
OVC End Point MEP List	**[R13]** For a STEL Service, the value of the OVC End Point MEP List Service Attribute **MUST** be an empty list

Table 3 – Requirements for OVC End Point

6.3 STEL Service ENNI Requirements

Any MEF 26.2 [5] compliant ENNI can be used as the Unconstrained ENNI for a STEL Service with no additional constraints imposed by this document. The rest of this subsection provides the requirements for the STEL ENNI.

[R14] Each OVC End Point in the STEL Operator CEN that is located at a STEL ENNI **MUST** be in an OVC that implements a STEL Service.

[R14] means that the Operator offering a STEL Service can support only STEL Services at the STEL ENNI.

[R15] If an ENNI is a STEL ENNI for a STEL Service, then it **MUST** be a STEL ENNI for all STEL Services that have an OVC End Point at that ENNI.

Table 4 below provides the requirements for the STEL ENNI for the ENNI Common Attributes. The first column lists the ENNI Common Attribute and the second column specifies the requirements, if any. When the term 'No additional constraints' is used, it means that the requirements from the indicated MEF document apply.

ENNI Common Attribute for STEL ENNI	**STEL Service Requirements**
ENNI Peering Identifier	No additional constraints from MEF 26.2 [5]
ENNI Physical Layer	No additional constraints from MEF 26.2 [5]
ENNI Frame Format	No additional constraints from MEF 26.2 [5]
ENNI Number of Links	**[R16]** For a STEL ENNI, the value of the ENNI Number of Links Common Attribute **MUST** be *1*.
ENNI Link Aggregation	[R11] in MEF 26.2 [5] requires the ENNI Link Aggregation Common Attribute value to be *None* when the value of the ENNI Number of Links Common Attribute is *1*.
ENNI Port Conversation ID to Aggregation Link Map	Not Applicable per Section 9.6 of MEF 26.2 [5]
ENNI MEG	**[R17]** For a STEL ENNI, the value of the ENNI MEG Common Attribute **MUST** be *Disabled*
ENNI LAG Link MEG	**[R18]** For a STEL ENNI, the value of the ENNI LAG Link MEG Common Attribute **MUST** be *Disabled*
ENNI Link OAM	**[R19]** For a STEL ENNI, the value of the ENNI Link OAM Common Attribute **MUST** be *Disabled*

Table 4 – STEL ENNI Common Attributes Requirements

This document imposes no additional constraints on MEF 26.2 [5] Operator Multilateral Attribute values.

Table 5 below provides the requirements for the STEL ENNI on the values of ENNI Service Attributes. The first column lists the ENNI Service Attribute, and the second column specifies the requirements if any. When the term 'No additional constraints' is used, it means that the requirements from the indicated MEF document apply.

ENNI Service Attributes for STEL ENNI	STEL Service Requirements
Operator ENNI Identifier	No additional constraints from MEF 26.2 [5]
S-VLAN ID Control	**[R20]** For a STEL ENNI, the value of the S-VLAN ID Control ENNI Service Attribute **MUST** be *Full*
Maximum Number of OVCs	No additional constraints from MEF 26.2 [5]
Maximum Number of OVC End Points per OVC	**[R21]** For a STEL ENNI, the value of the Maximum Number of OVC End Points per OVC Service Attribute **MUST** be *1*
ENNI Token Share	**[R22]** For a STEL ENNI, the value of the ENNI Token Share Service Attribute **MUST** be *Disabled*
ENNI Envelopes	No additional constraints from MEF 26.2 [5]

Table 5 – STEL ENNI Service Attributes Requirements

Note that [R20] combined with [R81] of MEF 26.2 means that there can be exactly one SP/SO using the STEL ENNI. Thus, the STEL Operator agrees to the values of the STEL ENNI Common Attributes, the Operator Multilateral Attributes and the STEL ENNI Service Attributes with this single SP/SO, as well as the values of the OVC End Point Service Attributes for all of the OVC End Points at the STEL ENNI in the STEL Operator CEN.

7 References

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

[2] IETF RFC 8174, *Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words*, May 2017

[3] MEF 6.3, *Subscriber Ethernet Services Definitions*, December 2019

[4] MEF 10.4, *Subscriber Ethernet Service Attributes*, December 2018

[5] MEF 26.2, *External Network Network Interface (ENNI) – Phase 3*, August 2016

[6] MEF 43, *Virtual NID (vNID) Functionality for E-Access Services*, April 2014

[7] MEF 51.1, *Operator Ethernet Services Definitions*, December 2018

[8] MEF 62, *Managed Access E-Line Service Implementation Agreement*, May 2018

Appendix A Use Cases (Informative)

The following use cases provide examples showing how an SP could support Subscriber Services when using a STEL Service.

A.1 Unbundled STEL Service

In this use case, the SP can use an Unbundled STEL Service to support each Subscriber Service at the SP/SO Device. The SP/SO Device at the Subscriber location can support one or more than one EVC, at one or more than one UNI. In Figure 3, STELs 1, 2, and 3 are each an example of an Unbundled STEL Service. The SP may be required to use an Unbundled STEL Service when the STEL Operator does not support more than one S-VLAN ID value being mapped to an OVC End Point.

Figure 3 shows an SP, Organization B, providing three Ethernet Services to a Subscriber. To access the three UNIs on the right, the SP uses three STEL Services provided by Organization A. The SP/SO has deployed a SP/SO Device at two Subscriber locations on the right. The three Subscriber Ethernet Services are:

- EVPL between UNI 1 and UNI 3 implemented with OVC B1, STEL 1 and OVC B4,
- EVPL between UNI 1 and UNI 4 implemented with OVC B2, STEL 2 and OVC B5, and
- EPL between UNI 2 and UNI 5 implemented with OVC B3, STEL 3 and OVC B6.

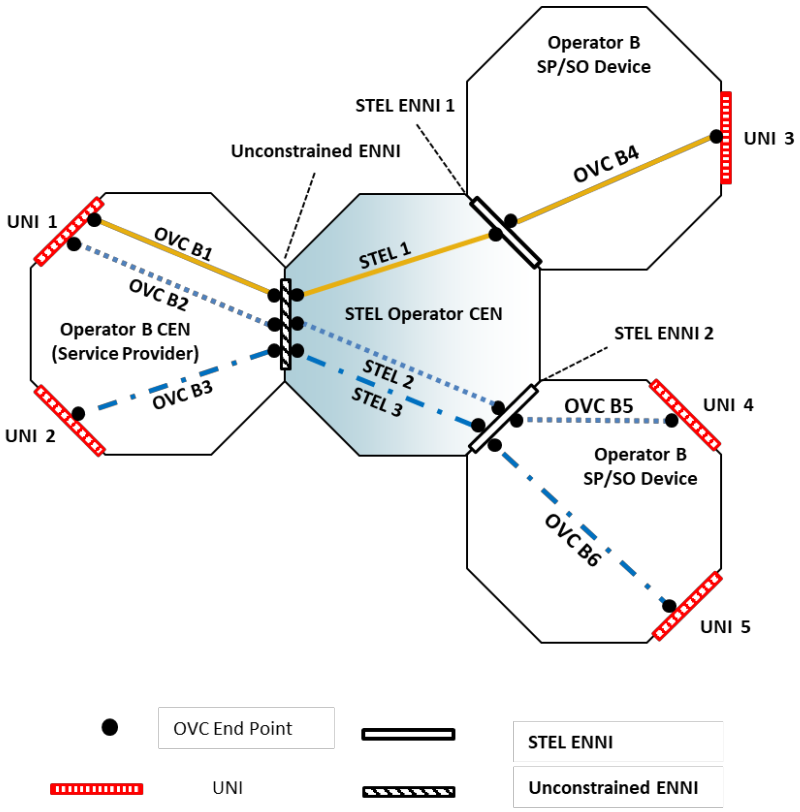

Figure 3 – Example of Unbundled STEL Services

A.2 Bundled STEL Service

In the example in Figure 4 there are three Subscriber Ethernet Services:

- EVPL between UNI 1 and UNI 3 implemented with OVC B1, STEL 1 and OVC B4,
- EVPL between UNI 1 and UNI 4 implemented with OVC B2, STEL 2 and OVC B5, and
- EPL between UNI 2 and UNI 5 implemented with OVC B3, STEL 2 and OVC B6.

Note that the Bundled STEL Service, STEL 2, is used to implement two Subscriber Ethernet Services.

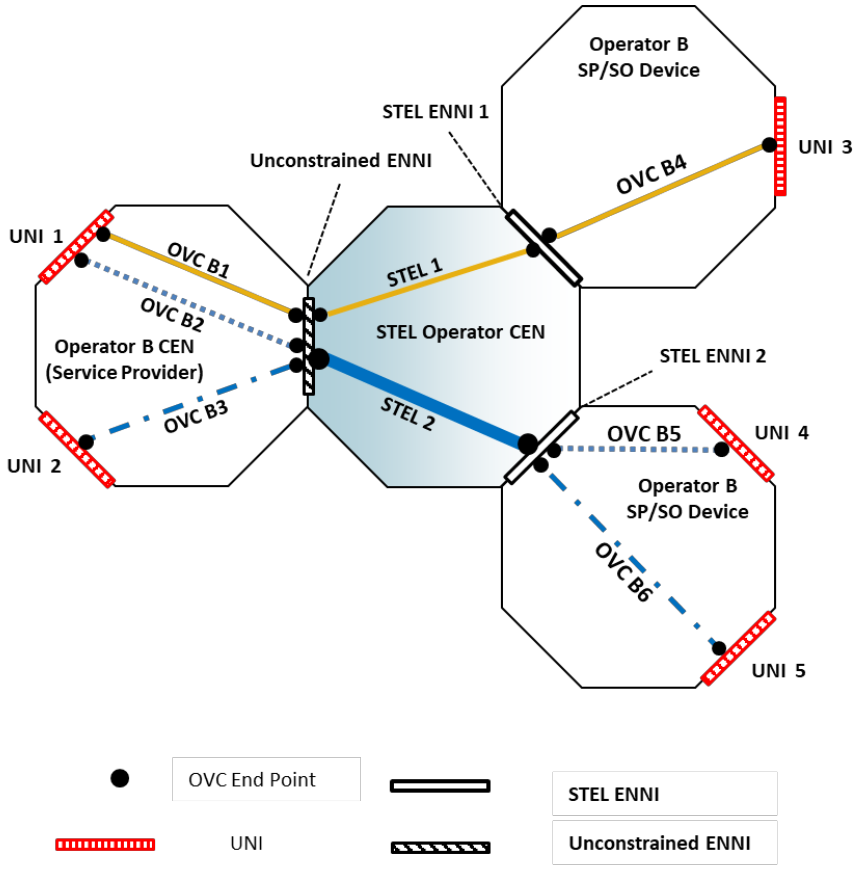

Figure 4 – Example of a Bundled STEL Service

Figure 5 shows an example of the use of a Bundled STEL Service to support the management of a SP/SO Device. In this example, the Bundled STEL Service supports an EVC between UNI A and UNI B by using S-Tag VLAN ID = 43. The Bundled STEL Service also carries SP/SO management information between the two ENNIs by using S-Tag VLAN ID = 255. Note that the STEL Operator need not know which S-Tag VLAN ID value is being used for the EVC and which S-Tag VLAN ID value is being used for managing the SP/SO Device.

The SP/SO is responsible for conveying management information between the management functionality and the ENNI and encapsulating/decapsulating said information to/from ENNI Frames with the proper value of the S-Tag VLAN ID (255 in this example). This process is represented

by a checkered line in Figure 5. The details of how this process is implemented by the SP/SO are beyond the scope of this Standard.

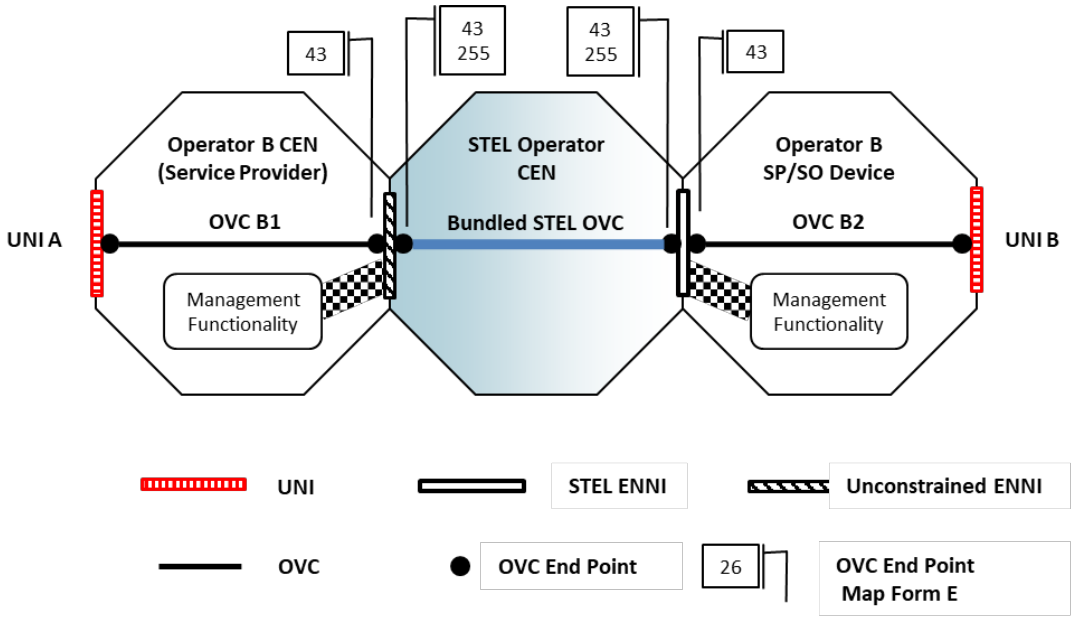

Figure 5 – Example of Managing the SP/SO Device with a Bundled STEL Service

Figure 6 shows an example of using an Unbundled STEL Service for managing the SP/SO Device. In this example, the lower Unbundled STEL Service is used to carry management information.

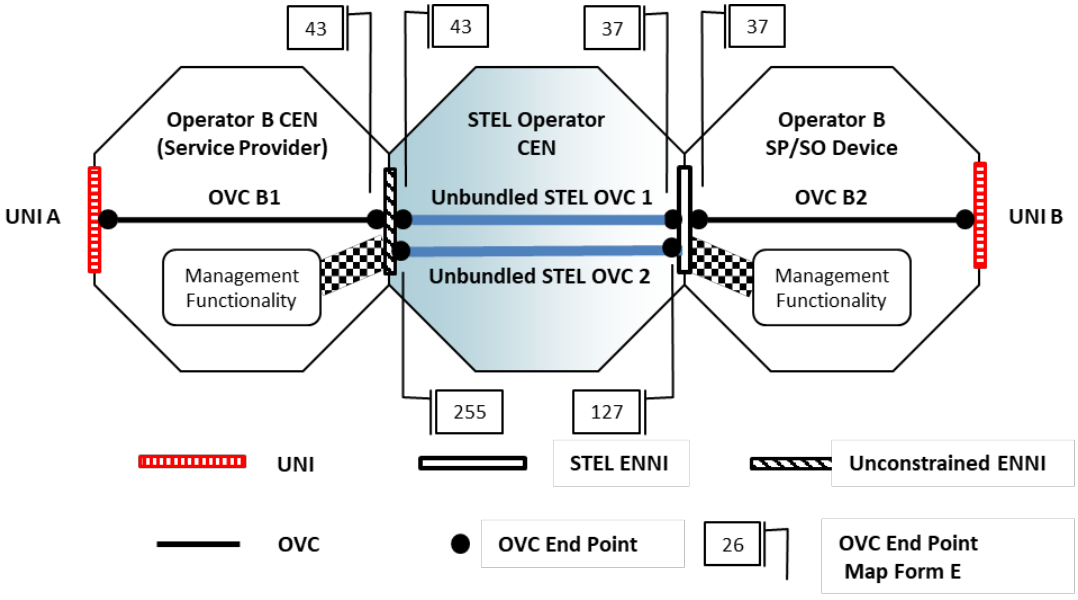

Figure 6 – Example of Managing the SP/SO Device with an Unbundled STEL Service

Appendix B Examples of SOAM with STEL Services (Informative)

Figure 7 depicts the use of SOAM for managing the use cases in Appendix A with the assumption that the SP has deployed a single SP/SO Device at the Subscriber location that connects the STEL ENNI to one or more UNIs. The Service Provider monitors the STEL OVC with an SP ME between a down MEP to the left of the Unconstrained ENNI and a down MEP to the right of the STEL ENNI. The only SOAM interaction between the Service Provider and the STEL Operator is the ENNI ME at the Unconstrained ENNI.

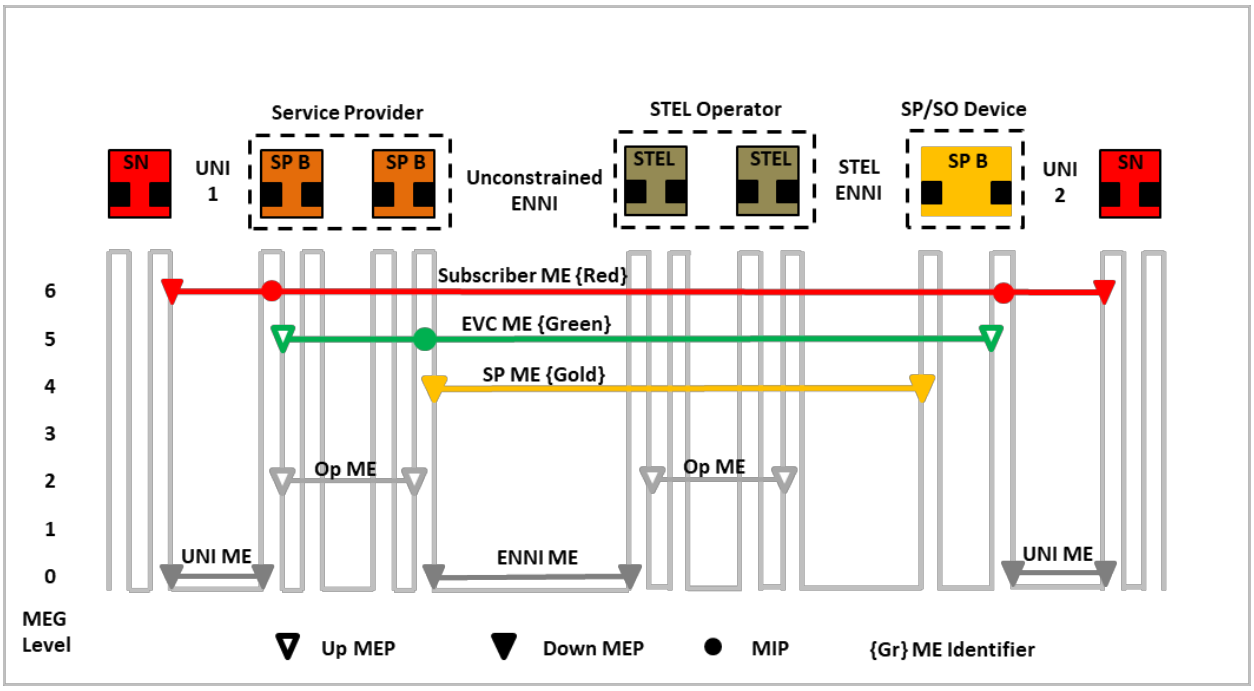

Figure 7 – Example of SOAM with a SP/SO Device

Figure 8 depicts a SOAM example for a slightly more complex case where the SP/SO Device at the Subscriber location consists of two separate physical boxes connected by some sort of physical link and the SP contracts with a Transit Operator C to reach the STEL Operator. The Service Provider monitors the STEL OVC with an SP ME using a down MEP to the left of the ENNI BC and a down MEP to the right of the STEL ENNI. The Service Provider has also chosen to add a MIP for the Subscriber ME and a MIP for the EVC ME in the SP/SO Devices. In this example there is no SOAM interaction between the Service Provider and the STEL Operator.

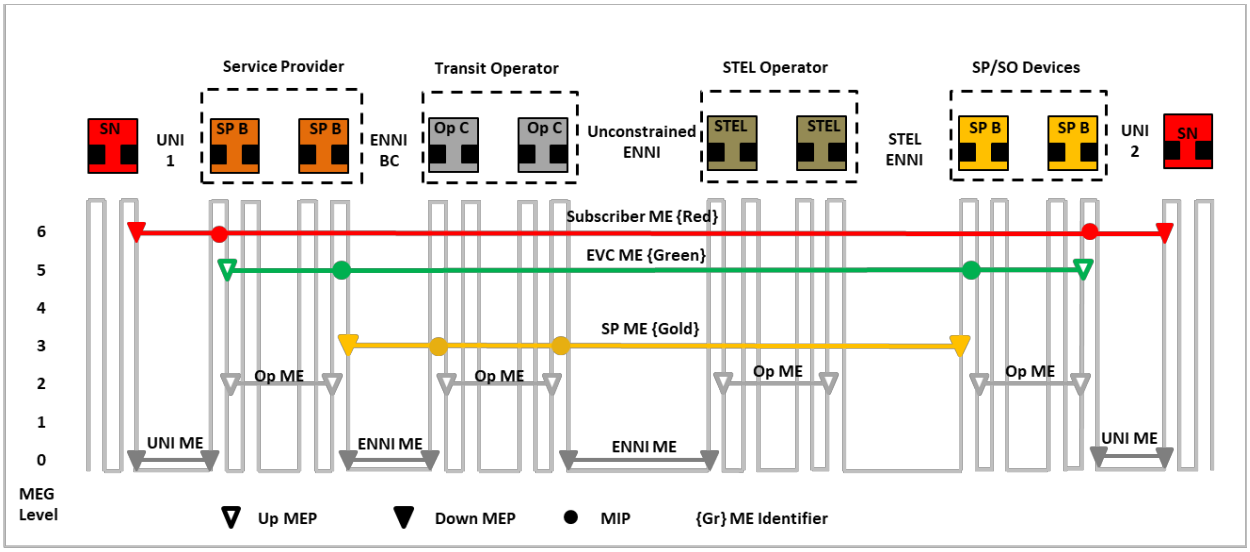

Figure 8 – Example of SOAM with Two SP/SO Devices