Service Operations
Specification
MEF 54

Ethernet Interconnection Point (EIP): An ENNI Implementation Agreement

March 2016

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Disclaimer

The information in this publication is freely available for reproduction and use by any recipient and is believed to be accurate as of its publication date. Such information is subject to change without notice and the MEF Forum (MEF) is not responsible for any errors. The MEF does not assume responsibility to update or correct any information in this publication. No representation or warranty, expressed or implied, is made by the MEF concerning the completeness, accuracy, or applicability of any information contained herein and no liability of any kind shall be assumed by the MEF as a result of reliance upon such information.

The information contained herein is intended to be used without modification by the recipient or user of this document. The MEF is not responsible or liable for any modifications to this document made by any other party.

The receipt or any use of this document or its contents does not in any way create, by implication or otherwise:

a) any express or implied license or right to or under any patent, copyright, trademark or trade secret rights held or claimed by any MEF member company which are or may be associated with the ideas, techniques, concepts or expressions contained herein; nor

b) any warranty or representation that any MEF member companies will announce any product(s) and/or service(s) related thereto, or if such announcements are made, that such announced product(s) and/or service(s) embody any or all of the ideas, technologies, or concepts contained herein; nor

c) any form of relationship between any MEF member companies and the recipient or user of this document.

Implementation or use of specific Metro Ethernet standards or recommendations and MEF specifications and guidelines will be voluntary, and no company shall be obliged to implement them by virtue of participation in the MEF Forum. The MEF is a non-profit international organization accelerating industry cooperation on Metro Ethernet technology. The MEF does not, expressly or otherwise, endorse or promote any specific products or services.

© MEF Forum 2016. All Rights Reserved.

 © MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Table of Contents

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

List of Figures

List of Tables

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

1. List of Contributing Member Companies

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
AT&T
CenturyLink
Frontier
TelePacific
University of New Hampshire Interoperability Lab
Verizon
Veryx Technologies
Windstream

Table 1 – Contributing Member Companies

2. Abstract

This document is intended to act as an Implementation Agreement for any Operator interested in connecting their Carrier Ethernet network to another Operator using an Ethernet ENNI.

This Implementation Agreement draws heavily from MEF 26.1 “External Network Network Interface (ENNI),” and MEF 33 “Ethernet Access Services Definitions,” but it doesn't amend, change, or supersede them in any fashion. Rather, this document allows Operators to follow practical guidelines to help them efficiently evolve their networks to meet full MEF E-Access capabilities – either all at once, or in a series of steps.

In addition, this Implementation Agreement documents the results of a series of ENNI testing performed between a sample of US based Operators. The test results are intended to help Operators understand and overcome a myriad of issues they may expect to encounter when embarking on the establishment of ENNIs with an Operator adjacent to their footprint. Specifically, when each Operator has different Ethernet Interconnection capabilities and configurations.

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. Emphasis is on new terms created in this document.

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Term	Definition	Reference
All to One Bundling	A UNI Service Attribute in which all CE-VLAN IDs are mapped to a single EVC.	MEF 10.3
Bandwidth Profile	A characterization of the lengths and arrival times for Service Frames at a reference point. Can also be a characterization of the lengths and arrival times for ENNI Frames at a reference point.	MEF 10.3
Bundling	A UNI Service Attribute in which more than one CE-VLAN ID can be mapped to an EVC.	MEF 10.3
CBS	Committed Burst Size	MEF 10.3
CE	Customer Edge	MEF 10.3
CEN	Carrier Ethernet Network. A network from a Service Provider or network Operator supporting the MEF service and architecture models.	MEF 10.3
CE-VLAN CoS	Customer Edge VLAN CoS	MEF 10.3
CE-VLAN CoS Preservation	An EVC Service Attribute that, when Enabled, requires an egress Service Frame resulting from an ingress Service Frame that contains a CE-VLAN CoS to have the identical CE-VLAN CoS.	MEF 10.3
CE-VLAN ID	Customer Edge VLAN ID	MEF 10.3
CE-VLAN ID Preservation	An EVC Service Attribute that, when Enabled, requires an egress Service Frame resulting from an ingress Service Frame to have an identical CE-VLAN ID.	MEF 10.3
CE-VLAN ID/EVC Map	An association of CE-VLAN IDs with EVCs at a UNI.	MEF 10.3
CE-VLAN Tag	Customer Edge VLAN Tag	MEF 10.3
CF	Coupling Flag	MEF 10.3
CfC	Call for Comments (MEF Voting Process)	This Document
CHLI	Consecutive High Loss Interval	MEF 10.3
CIR	Committed Information Rate	MEF 10.3
CIRmax	The Bandwidth Profile parameter that limits the rate of tokens added to the committed token bucket.	MEF 10.3
Class of Service Identifier	The mechanism and/or values of the parameters in the mechanism to be used to identify the Class of Service Name that applies to a Service Frame.	MEF 10.3
Class of Service Name	A designation given to one or more sets of performance objectives and associated parameters by the Service Provider.	MEF 23.1

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Term	Definition	Reference
CM	Color Mode	MEF 10.3
Color Identifier	The mechanism and/or values of the parameters in the mechanism used to identify the Color that applies to the Service Frame at a given UNI.	MEF 23.1
Color Mode	The Bandwidth Profile parameter that indicates whether the color-aware or color-blind property is employed by the Bandwidth Profile. It takes a value of "color-blind" or "color-aware" only.	MEF 10.3
Color-aware	A Bandwidth Profile property where the level of compliance for each Service Frame is dependent on the value of the Frame's Color Identifier.	MEF 10.3
Color-blind	A Bandwidth Profile property where the level of compliance for each Service Frame is not dependent on the value of the Frame's Color Identifier.	MEF 10.3
Committed Burst Size	The Bandwidth Profile parameter that limits the maximum number of bytes available for a burst of Service Frames sent at the UNI line rate that will be declared Green by the Bandwidth Profile.	MEF 10.3
Committed In-formation Rate	The Bandwidth Profile parameter that limits the average rate in bits per second of Service Frames that will be declared Green by the Bandwidth Profile.	MEF 10.3
CoS	Class of Service	MEF 10.3
CoS Name	A parameter used in Performance Metrics that specifies the Class of Service Name for the metric	MEF 10.3
Coupling Flag	The Bandwidth Profile parameter that determines whether or not overflow tokens not used for Service Frames declared Green can be used as Yellow tokens.	MEF 10.3
Customer Edge	Equipment on the Subscriber side of the UNI.	MEF 10.3
Customer Edge VLAN Class of Service	The Priority Code Point bits in the IEEE Std 802.1Q – 2011 Customer VLAN Tag in a Tagged Service Frame.	MEF 10.3
Customer Edge VLAN ID	The identifier derivable from the content of a Service Frame that allows the Service Frame to be mapped to an EVC at the UNI.	MEF 10.3
Customer Edge VLAN Tag	The IEEE Std 802.1Q – 2011 Customer VLAN Tag in a Tagged Service Frame.	MEF 10.3
Data Service Frame	A Service Frame that is neither a Layer 2 Control Protocol Service Frame nor a SOAM Service Frame	MEF 10.3

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Term	Definition	Reference
DEI	Drop Eligible Indicator	IEEE 802.1Q
DSCP	Differentiated Services Code Point	RFC 2474
DTE	Data Termination Equipment	IEEE 802.3 2012
EBS	Excess Burst Size	MEF 10.3
Egress Bandwidth Profile	A Service Attribute that specifies the length and arrival time characteristics of egress Service Frames at the egress UNI.	MEF 10.3
Egress Equivalence Class Identifier	The mechanism and/or values of the parameters in the mechanism that can be used to specify an Egress Band-width Profile Flow for egress Service Frames.	MEF 10.3
Egress Service Frame	A Service Frame sent from the Service Provider network to the CE.	MEF 10.3
EIP	Ethernet Interconnect Point	This document
EIR	Excess Information Rate	MEF 10.3
EIR max	The Bandwidth Profile parameter that limits the rate of tokens added to the excess token bucket.	MEF 10.3
E-LMI	Ethernet Local Management Interface	MEF 16
ENNI	External Network Network Interface	MEF 4, MEF 26.1
Envelope	A set of Bandwidth Profile Flows in which each Band-width Profile Flow is assigned a unique rank between 1 (lowest) and (highest).	MEF 10.3
ESMC	Ethernet Synchronization Message Channel	ITU G.8264
Ethernet Interconnect Point	A physical location where two or more Operators connect their Ethernet networks by establishing either an ENNI (MEF 33) or a non-standard NNI	This document
Ethernet Virtual Connection	An association of two or more UNIs that limits the exchange of Service Frames to UNIs in the Ethernet Virtual Connection.	MEF 10.3
EVC	Ethernet Virtual Connection	MEF 10.3
EVC Maximum Service Frame Size	An EVC Service Attribute that specifies the maximum size of a Service Frame allowed for that EVC.	MEF 10.3

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Term	Definition	Reference
Excess Burst Size	The Bandwidth Profile parameter that limits the maximum number of bytes available for a burst of Service Frames sent at the UNI line rate that will be declared Yellow by the Bandwidth Profile.	MEF 10.3
Excess Information Rate	The Bandwidth Profile parameter that limits the average rate in bits per second of Service Frames that will be declared Yellow by the Bandwidth Profile.	MEF 10.3
FD	Frame Delay	MEF 10.3
FDR	Frame Delay Range	MEF 10.3
Frame	Short for Ethernet frame.	MEF 10.3
Frame Delay	The time elapsed from the transmission at the ingress UNI of the first bit of the corresponding ingress Service Frame until the reception of the last bit of the Service Frame at the egress UNI.	MEF 10.3
Frame Delay Range	The Frame Delay Performance minus the minimum Service Frame delay.	MEF 10.3
High Loss Interval	A small time interval contained in *T* with a high frame loss ratio.	MEF 10.3
HLI	High Loss Interval	MEF 10.3
IFDV	Inter-Frame Delay Variation	MEF 10.3
IA	Implementation Agreement	This document
Information Rate	The average bit rate of Ethernet service frames at the measurement point starting with the first MAC address bit and ending with the last FCS bit.	ITU Y.1564
Ingress Band-width Profile	A characterization of ingress Service Frame arrival times and lengths at the ingress UNI and a specification of disposition of each Service Frame based on its level of compliance with the characterization.	MEF 10.3
Ingress Service Frame	A Service Frame sent from the Customer Equipment into the Service Provider network.	MEF 10.3
Inter-Frame Delay Variation	The difference between the one-way delays of a pair of selected Service Frames.	MEF 10.3
L2CP Service Frame	Layer 2 Control Protocol Service Frame	MEF 10.3
LAG	Link Aggregation Group	IEEE Std 802.1AX – 2008
Layer 2 Control Protocol Service Frame	A Service Frame that could be used in a recognized Layer 2 Control Protocol.	MEF 10.3
Non Standard NNI	Any interconnection between two Operators that uses a specification other than MEF 33.	This document

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Term	Definition	Reference
NNI	Network-to-Network Interface	Industry term
Operator	The company who owns the Ethernet Service. **Operator** provides connectivity services to the **Service Provider** that in turn provides the UNI-to-UNI (end-to-end service) to the **Subscriber**	MEF 26.1
PCP	Priority Code Point	IEEE Std 802.1Q – 2011
Performance Metric	A quantitative characterization of Service Frame delivery quality.	MEF 10.3
Point-to-Point EVC	An EVC with exactly 2 UNIs.	MEF 10.3
Priority Tagged Service Frame	A Service Frame with a TPID = 0x8100 following the Source Address and the corresponding VLAN ID value is 0x000 in the tag following the TPID.	MEF 10.3
Service Frame	The first bit of the Destination MAC Address through the last bit of the Frame Check Sequence of an IEEE 802.3 Packet transmitted across the UNI.	MEF 10.3
Service Level Specification	The technical specification of the service level being offered by the Service Provider to the Subscriber.	MEF 10.3
Service Multiplexing	A UNI Service Attribute in which the UNI can be in more than one EVC instance.	MEF 10.3
Service Provider	The organization providing Ethernet Service(s).	MEF 10.3
SLS	Service Level Specification	MEF 10.3
SOAM Service Frame	A Service Frame whose MAC Destination Address does not indicate it to be an L2CP Service Frame and whose Ethertype = 0x8902.	MEF 10.3
Subscriber	The organization purchasing and/or using Ethernet Services.	MEF 10.3
Tagged Service Frame	A Service Frame that is either a VLAN Tagged Service Frame or a Priority Tagged Service Frame.	MEF 10.3
TCI	Tag Control Information	IEEE Std 802.1Q – 2011
TPID	Tag Protocol Identifier	IEEE Std 802.1Q – 2011
UNI	User Network Interface	MEF 10.3
UNI Line Rate	The MAC data rate at the UNI.	MEF 10.3
UNI Maximum Service Frame Size	A UNI Service Attribute that specifies the maximum size of a Service Frame allowed at the UNI.	MEF 10.3

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Term	Definition	Reference
Untagged Service Frame	A Service Frame with the two bytes following the Source Address field containing neither the value 0x8100 nor the value 0x88a8	MEF 10.3
User Network Interface	The physical demarcation point between the responsibility of the Service Provider and the responsibility of the Sub-scriber	MEF 10.3
VLAN Tagged Service Frame	A Service Frame with a TPID = 0x8100 following the Source Address and the corresponding VLAN ID value is not 0x000 in the tag following the TPID	MEF 10.3

Table 2 – Terminology and Acronyms

4. Scope

The motivation for this Project is:

- Help Operators understand why they should move to MEF E-Access Services
- Help Operators understand they are on a journey (whether they realize it, or not) to transform their network to Ethernet
- Help Operators understand what hurdles they can expect on their journey towards MEF E-Access Services
- Help Operators understand how to move to MEF E-Access Services
- Help Operators understand the interim steps they can take to put them on a path towards full MEF E-Access compliance if getting to MEF E-Access Services is not obtainable in one step
- To accelerate the ease and speed at which Operators can interconnect their current networks to support MEF standard services
- To facilitate the technology transition from TDM to Ethernet worldwide
- To encourage increased deployment of MEF Ethernet services across a wider base of network.

A pictorial representation of the current Ethernet interconnection marketplace is largely composed of two types of Interconnections: "NNIs" and "ENNIs" as per Figure 1 below. The term "NNI" (Network-to-Network Interface) is a generic term for any connection between two networks. There is wide interpretation to its meaning and it is not affiliated with any specific standards, specific configurations, or specific transport types. Conversely, the term "ENNI" (Ethernet Network Network Interface) is specifically defined by the MEF and is not open to interpretation. The ENNI can only be an Ethernet Interconnection between two networks with the specifications and configurations as per MEF E-Access (MEF 26.1, MEF 33, MEF 51).

The importance of Figure 1 and Figure 2 cannot be overemphasized. In summary, there is a global movement away from multiple legacy technologies including TDM, Frame Relay and ATM towards Ethernet, yet most Operators (TDM and/or Ethernet) aren't even aware of

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

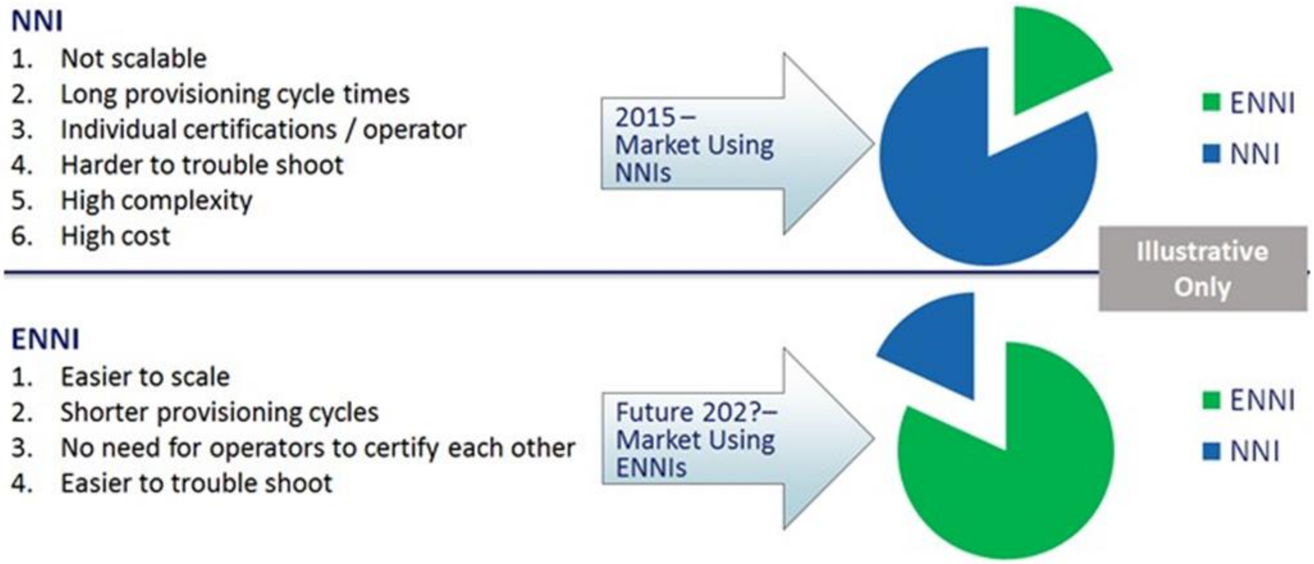


Figure 1 – Interconnect Readiness

their need to move to a standardized way of connecting their current network to other Operators. Moreover, Operators may not understand the great flexibility of Ethernet services and the added complexity required at Operator interconnections. The current process many Operators are using to interconnect with Ethernet is not scalable, and does not support the complexity and features required for emerging the new technologies (S-Tag encapsulation at the ENNI, multi-Operator ENNIs, etc.). When Operators interconnect in a non-standard method both the processes for ordering services and the Ethernet services supported will be impacted. In addition, non-standard interconnects will affect other operational functions including fault and performance.

The objective is to create an Implementation Agreement that is used in establishing a new EIP (Ethernet Interconnect Point). In subsequent projects, associated "quote to cash" business processes will be developed. This project will include:

- An "Implementation Agreement" of how the CENs will interconnect based on existing MEF specifications. This will involve developing a list of most commonly supportable configurations for existing networks, and a list of corresponding attributes. The desired goal is full MEF compliant interconnects; the required output from this project will be to identify the acceptable minimum set of capabilities that allow the interconnects to support the MEF services in the identified Use Cases.
- Project will use test cases from existing MEF ATS (Abstract Test Suite), other CE 2.0 test cases, and create new ones developed at University of New Hampshire Interoperability Lab (UNH IOL) specifically for interoperability testing. The test cases will be used for lab verification of MEF Services and attributes supported in the included Use Cases, for adherence to the Implementation Agreement (does not include verification of performance objectives in real networks.)

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

An important detail to nail down is what is the list of "existing MEF Specifications" that will be used in this project as the basis for the EIP and our documentation of Service Attributes and test cases. The initial concept of EIP is based around the industry target provided by MEF CE 2. 0 compliance to MEF E-Access Services; the CE 2.0 compliance was based on the documents approved at the time and referred to within the document set.

Description of Set of Specifications / **Rationale for their use**	**Access Services**	**End-to-end Service**	**ENNI Interface**	**SOAM-FM**	**Test cases for Access Services**	**Test cases for ENNI**	**Issues**
2012 Set of MEF Service and Attribute Specifications This is the target from the point in time the MEF 2.0 certification suite was created (2012); a stable industry target that Equipment Vendors and Service Providers have been measured against since	MEF 33; refers to MEF 6.1 (services), MEF 10.2 (attributes), 20 (UNI type 2), MEF 23.1 (CoS), MEF 26.1 (ENNI), MEF 30 (SOAM-FM)	MEF 6.1	MEF 26.1	MEF 30	MEF 34; CE 2.0 test cases	MEF 37 (covers MEF 26); CE 2.0 test cases	some holes (L2CP); but consensus is to go with this set of documents for IA; address remaining issues as needed, but caution against using documents that are too new for products to be available.

Table 3 – Existing MEF Specifications Used in this Document

5. Introduction

TDM technologies have dominated the global telecommunications landscape for decades. However, there are inconsistent instances of TDM across the globe. While US and Canada

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

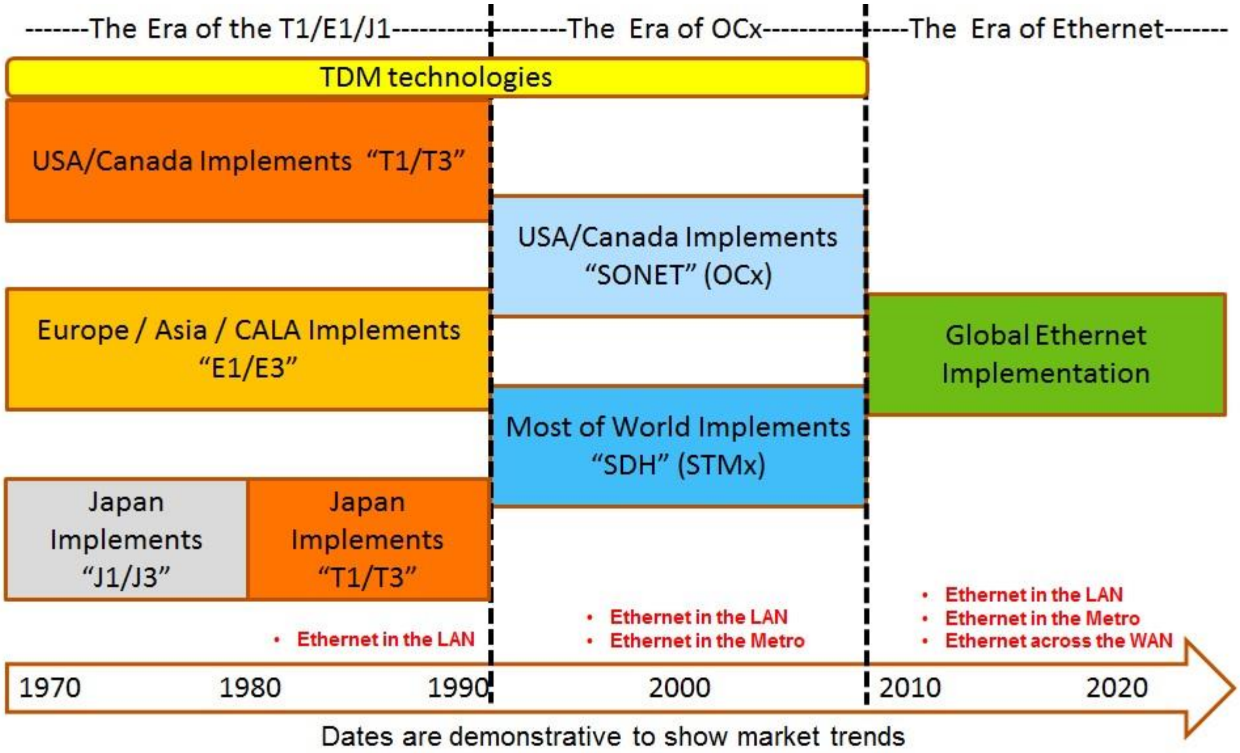


Figure 2 – History of TDM

deployed "T1" services, much of the world deployed "E1." Furthermore, while TDM developed new technologies to enable more bandwidth, US and Canada deployed SONET technology while most of the world deployed SDH technology.

The telecommunications industry has now entered the Era of Ethernet networking, and for the first time in history, a globally recognized standard for networking is unfolding (Figure 2 below). What's most remarkable is the same technology is used in a LAN, Metro, or WAN. Never before in the history of telecom has a single technology been so universal for both customers (Subscribers), and Operators (Carriers). While the specific dates below are debatable, the trend is not.

The global Ethernet market is now estimated to be approximately $50B and rapidly growing, and this market is divided into thousands of individual Operators across the globe. The importance of interconnection for global businesses has never been greater, but covering a world-wide footprint requires interconnecting these Operators with the high-speed, cost effective bandwidth that MEF Ethernet services can provide. To forward that goal, the MEF has developed a number of specifications to standardize the way Operators can interconnect their CENs, starting with the External Network Network Interface (ENNI, MEF 26) in 2010, the Ethernet Access Services Definition (E-Access, MEF 33) in 2012, MEF Carrier Ethernet 2.0 Certification (2013), and continuing with MEF 51 (OVC Services Definitions). This sustained effort has paved the path toward standardized "plug-and-play" interconnection, but the progress in the marketplace has been modest to date. While a small number of Operators have gone to the effort and expense to achieve the full MEF certification for interconnection

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

– CE 2.0 Certification for E-Access Services, the rate of such certifications per quarter has remained modest and the trend is flat.

As a result, the interconnection process between Operators is still dominated by the slow and costly need to survey, evaluate, negotiate, configure, and test each new Operator's network before it is connected. The Operators leading this project now understand the reasons behind this slow adoption of the MEF E-Access specification, and this Implementation Agreement is designed to help the industry identify, and overcome these obstacles, resulting in more Operators moving to E-Access compliance and at a quicker rate than witnessed today.

5.1 Factors Contributing to Slow MEF E-Access Adoption

The premise of this project is that the following factors contribute significantly to the above picture:

1. Operators invested heavily in their Ethernet network infrastructure before the first version of MEFs E-Access services were defined in MEF 33 (~2012), and therefore, their network infrastructure may not have the functionality to fully meet the new specifications. Specifically, they may need to upgrade their network hardware, which could be a multi-million-dollar investment depending on the size of the Operator. (Older hardware may not support key features need to be instituted like S-Tag encapsulation at the ENNI, Color Awareness, CoS mapping, CE-VLAN ID preservation, etc.)

2. In addition to network equipment, back office IT systems require substantial investment (multi-million depending on the size of the Operator) to accommodate the new features required for E-Access. Specifically, the quote-to-cash IT systems upgrades to support selling services across an ENNI could be a costly investment depending on the Operator. For example, IT systems now need to track multiple TPID values for the S-Tag (0x8100 and / or 0x88a8).

3. Operators may also have built out their first scalable Ethernet networks using Ethernet over SONET/ SDH to leverage their previous investment in TDM technology. These platforms lack the functionality or upgrade path to enable MEF E-Access capabilities over a switched network.

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

The current market might be portrayed as a mixture of the following models:

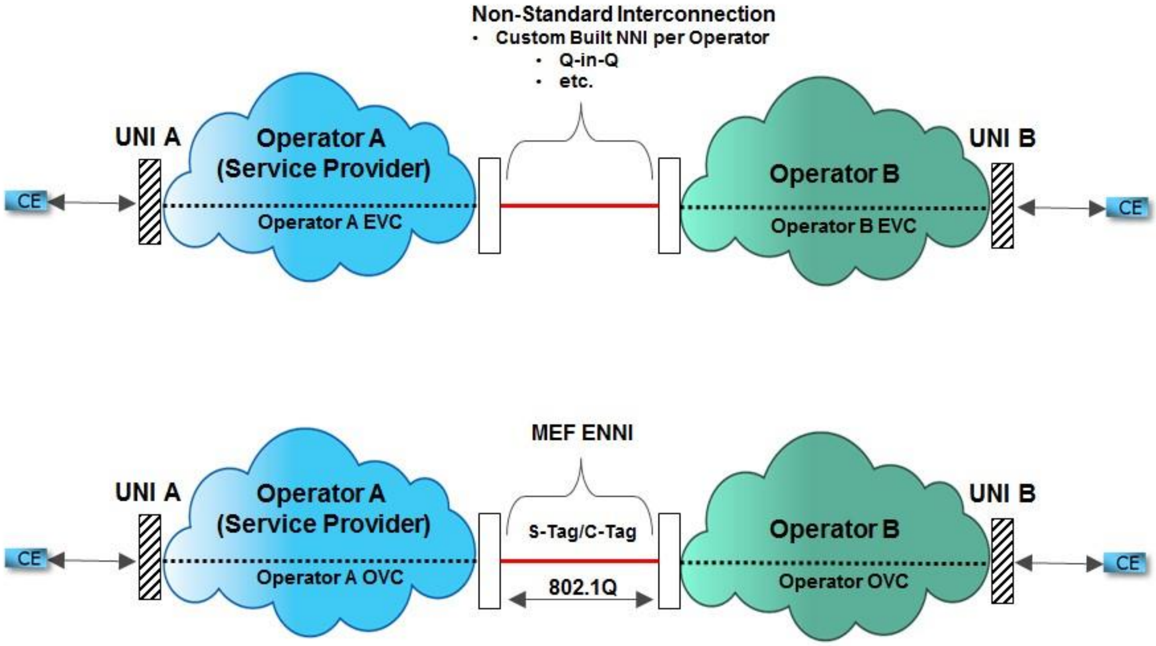


Figure 3 – Current Marketplace Interconnect Models

The non-standard model (such as "Q-in-Q, etc.") represents networks using a "double C-tag" interconnection, while the standard interconnection model represents the MEF E-Access Services target. It is clear that both models will co-exist in the marketplace for many years, while the relative populations will slowly change. The goal of this Implementation Agreement is to facilitate more rapid, systematic network interconnection strategies in such a mixed environment.

5.2 Examples and Importance of TPIDS

As referenced in the examples below, Operators who have disparate TPID values cannot create MEF ENNIs. They are forced to use non-standard interconnections that require a great amount of testing and configuration between the two carriers. Each time the Operator wants to create a new interconnection with one of the hundreds of other Operators touching their footprint they need to start the process over again. Furthermore, if an Operator has a customer (Subscriber) who has locations in two or more Operator footprints, the inconsistent implementations of interconnections can cause their network to not pass traffic correctly.

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

In Figure 4 below, Operator 5 moved to using a standard S-Tag encapsulation at the ENNI (TPID 0x88a8) but the other Operators adjacent to its footprint did not. While Operator 5 moved to the new correct "industry standard" they are now isolated from connecting to the Operators around them. Operator 5 is now an "Island" and cannot interconnect with other Operators to create end-to-end services. In this instance moving to the standard actually diminished their capacity to expand their Ethernet service.

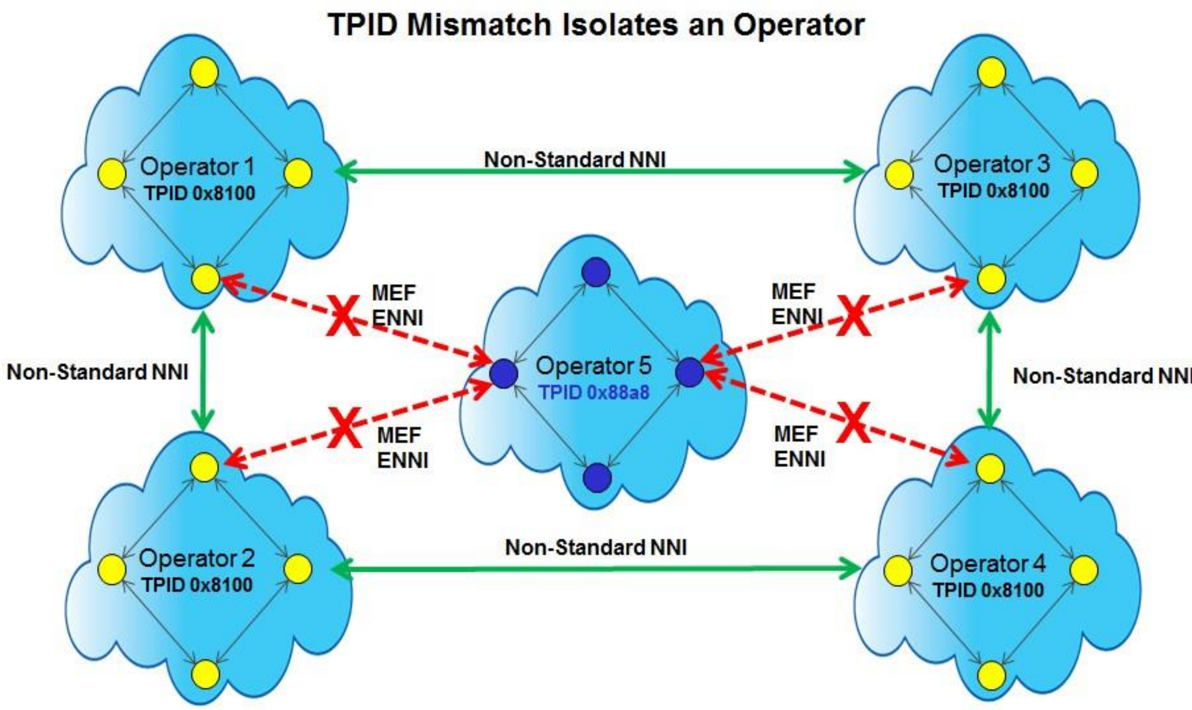


Figure 4 – TPID Mismatch Isolation

In Figure 5 below both Operator 5 and Operator 3 have moved to the new MEF standard and can now interconnect in an industry standard fashion and enjoy the benefits of E-Access Services. However, they are still unable to connect with all the other Operators using non-standard interconnections.

In Figure 6 below Operator 5 is able to create both MEF ENNIs and non-standard interconnections with the Operators adjacent to its footprint. Operator 5 has become "bi-lingual" and has the greatest capacity to conduct business with either the thousands of Operators who use non-standard interconnections, or the few who have moved to ENNIs. This is the best position for an Operator to be in while the market makes the transition to all Ethernet. Over time, as more and more Operators adopt the MEF standard, Operators will eventually stop creating non-standard interconnections.

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

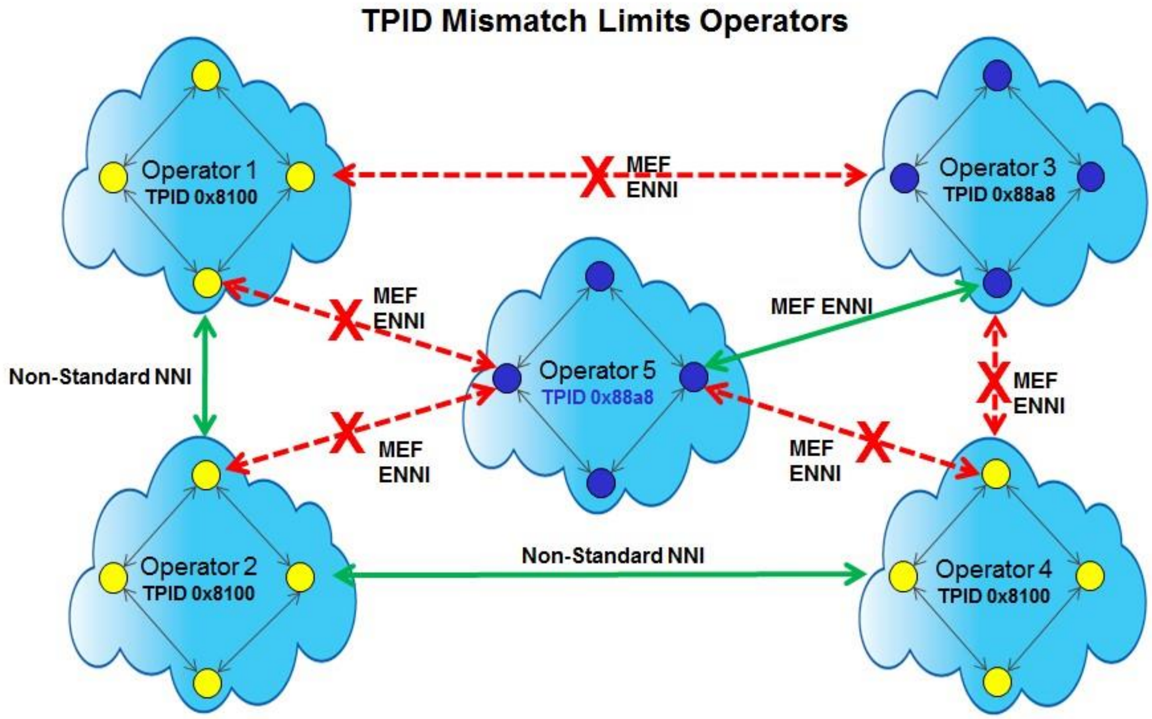


Figure 5 – TPID Limiting Operator

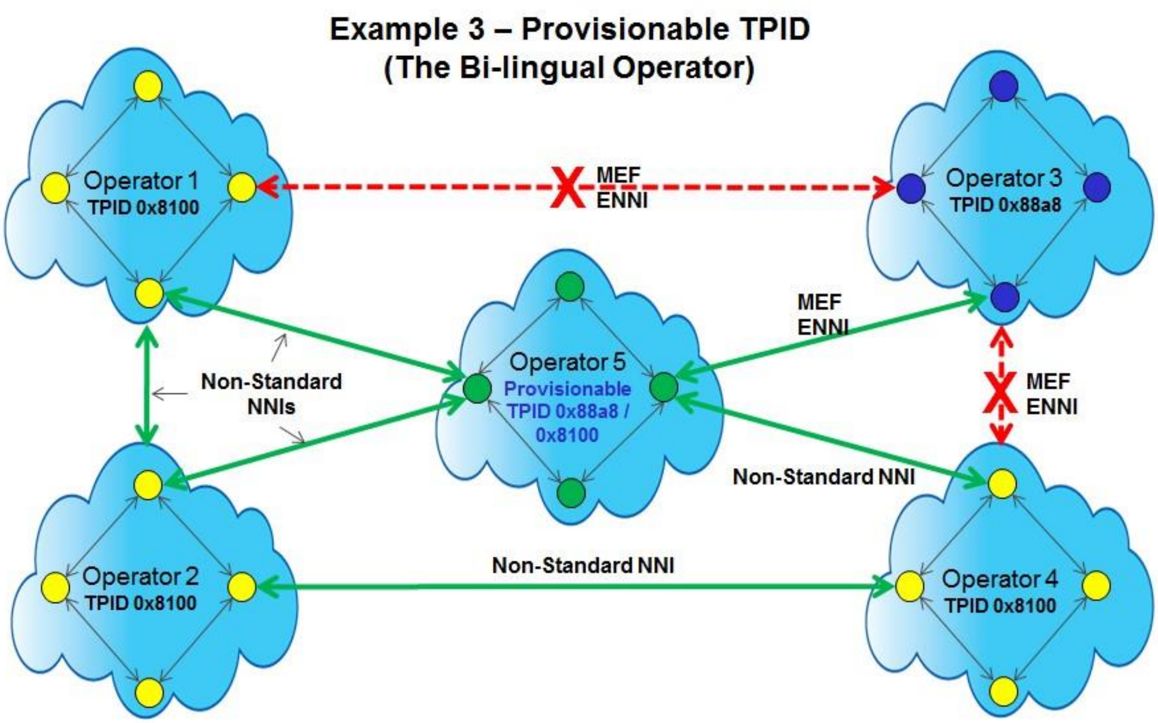


Figure 6 – Provisionable TPID - Bi-Lingual Operator

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

5.3 Learning About Interoperability from Actual Implementations

The MEF vision for Subscribers is a marketplace of many interconnected Operators offering MEF standardized services that interoperate predictably, and can be compared using common terminology and measurement standards. However, with the current rate of MEF E-Access compliance, this vision is unlikely to be realized in the near future, leaving Operators today mired in the slow interconnect processes on the left of the continuum shown above in Figure 1.

As an alternative, this project has proposed to learn from interconnecting a representative portion of participating Operator's networks in a laboratory environment, to achieve the following objectives:

1. How to determine the maximum level of support for MEF services achievable given the constraints of networks that may only meet a subset of Ethernet Access Services Definition requirements.
2. Examine the challenges of using other MEF specifications such as Service OAM - Fault Management (MEF 30.1) in cross - Operator deployments.
3. How to best inter-work MEF services from two Operators when there are mismatches in MEF Service Attributes values (such as CBS values, MTU values, CIR only with CIR/EIR services, different CoS levels, different S-VLAN TPID values)

As Ethernet has evolved from a LAN to MAN to WAN services, Operators have been required to upgrade their backbones and IT support systems to keep pace. Figure 7 below attempts to provide a representation of how TPIDs and tagging have altered over time. While the goal of this project is to help Operators reach full E-Access compliance, it's evident the current global marketplace contains thousands of Operators that fit into one of the 4 stages below. This project is creating a new stage, shown as "3.5", that helps Operators who cannot reach Stage 4 (full E-Access compliance) in one step due to costs. While there is no market data that accurately places the thousands of global Operators into the stages below, it is the belief of the Operators leading this project that most fall into Stage 3.

Stage 3.5 allows for basic interconnection but does not allow Operators to take full advantage of the functionality that MEF E-Access brings (stage 4).

Each phase of the EIP project will use the rapid prototyping model to validate and refine an initial set of Use Cases, Service Attribute specifications, and Test Cases until the project feels that Stage 3.5 is ready for final documentation and a Letter Ballot. The series of Implementation Agreements will document the repeated cycle of:

- Use Case development
- Service Attribute values specification, and constrained ranges
- Test case development based on the expected Use Case functionality
- Laboratory testing with representative Operator networks in the IOL lab to verify the expected Use Case functionality and interoperability
- Feedback of lab testing results for refinement of Use Cases and Test Cases.

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

5.4 Illustrative Example of the Rapid Prototyping Process

To illustrate an example of the procedure in the above bullets:

Take the example of how to determine if a specific requirement, like 2-member LAG protection (active/standby) of the ENNI should be part of the Implementation Agreement (IA) (it is optional for the MEF 26.1 specification).

- A draft of the Use Case with Service attributes might initially include this 2- member LAG as a proposed requirement for the IA due to the need for high reliability on a 10G ENNI and the number of customers affected by an outage.
- A test case would be developed to test LAG between the Operators equipment in the Interop Test lab, to see how difficult it was to get this LAG configuration to work between different equipment vendors.
- The results of testing various combinations, and lessons learned, would be summarized to the project team, and then the team would vote in a Call for Comments (CfC) ballot whether to include that Use Case requirement in the IA going forward.
- The results of the testing (summarized for privacy) and the CfC vote on the issue become part of the ongoing documentation of the IA. Each Use Case requirement decision in the IA would be documented with testing results and a CfC vote.

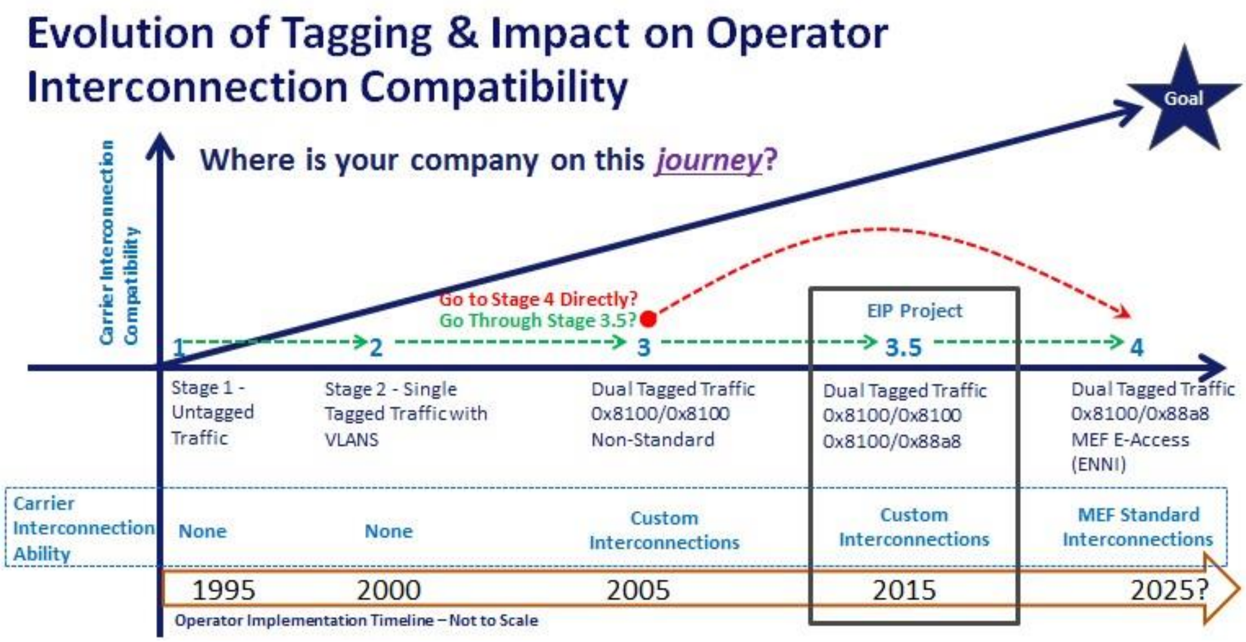


Figure 7 – Network Interconnection Evolution (TPID and Tagging Evolution Examples)

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

6. Use Cases and Scenarios

This IA will continue to evolve over time as new Use Cases are tested. The first use case is an EPL service created between two Operators. See Section 7 for a complete list of test cases and Appendix 1 for details of test cases.

6.1 Use Case 1 – Topology and Services Supported

The University of New Hampshire's Interoperability Lab, in Durham, NH, has created an industry first test-bed allowing 6 large Operators to perform interconnection testing. All 6 Operators are being tested with each other with rapid feedback being fed directly to their respective Labs via a secure connection. Only the University of New Hampshire knows the results of each provider's test and facilitates the role of an independent and neutral tester.

The participating companies are active contributors on the EIP project and each Operator used their respective CE equipment to re-create their actual network configurations in the Lab. More information about the trial can be found at: http://www.mef.net/eipproject

University of New Hampshire's Interoperability Lab

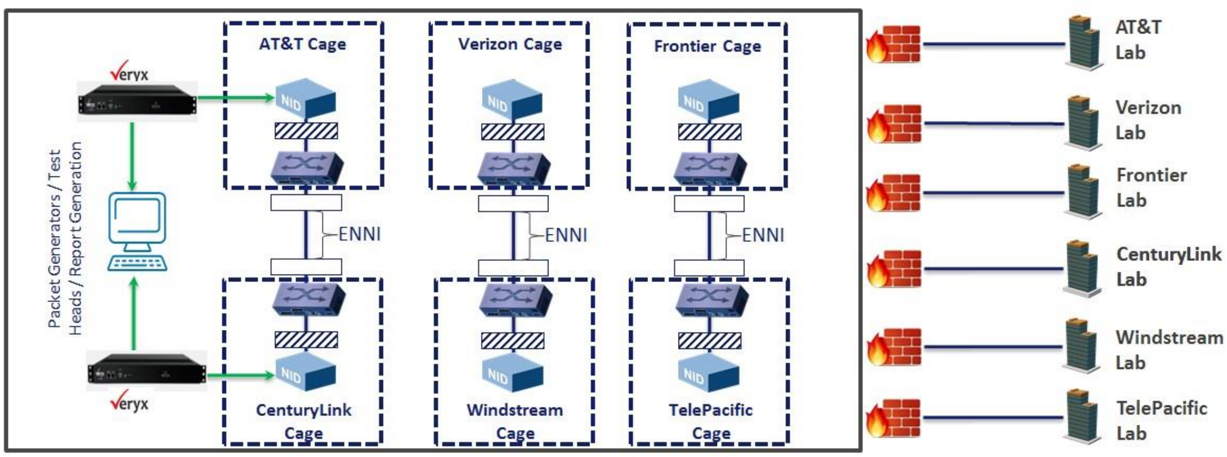


Figure 8 – University of New Hampshire's Interoperability Lab (Full test matrix not depicted)

Specifically, the testing at the UNH Lab is representative of what customers (Subscribers) want in the real world - an Ethernet Private Line connecting two locations located in two different carriers (Operator's) network's as per Figure 9 below.

6.1.1 Topology

EIP UC-1 Phase 1 supports **point-to-point** Carrier Ethernet services traversing exactly two Operator domains. The Service Provider delivering the Carrier Ethernet service to the Subscriber is also one of the two Operators.

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

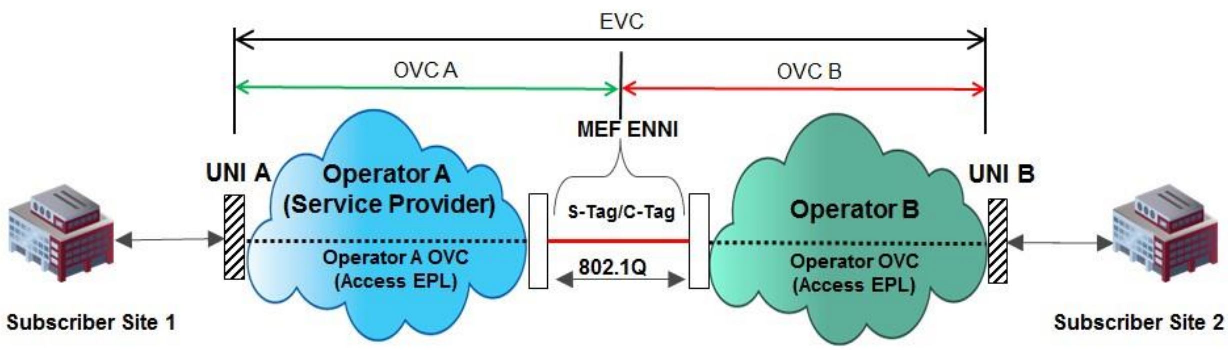


Figure 9 – High Level Diagram of Use Case 1, Phase 1

6.1.2 Services

The end-to-end Carrier Ethernet service supported in Phase 1 is **EPL (port based)** - in other words, the EIP UC-1 Phase 1 supports a Service Provider delivering a **MEF EPL Service** between the two Subscriber sites.

The EPL is comprised of only two **Access EPLs -** one in each Operator domain. While only one EPL is shown in the diagram for clarity, this Use Case will support multiple EPL instances across the same ENNI.

7. Test Cases

Section 7 provides the high level list of test cases for Phase 1 of the EIP project. The details of the test cases are located in Appendix 1 of this guideline (included in CfC#1).

7.1 Service Configuration Test Cases

- Test Case 1 – Frame Format
  - Verifies that the frame format specified in IEEE Std 802.3 – 2012 and VLAN Tags as defined in IEEE Std 802.1Q-2014 are supported
- Test Case 2 – Service Mapping and CE-VLAN ID Preservation
  - Verifies that the EIP solution supports all-to-one bundling with CE-VLAN ID preservation enabled
- Test Case 3 – CE-VLAN CoS Preservation
  - Verifies that the EIP solution supports CE-VLAN CoS preservation enabled
- Test Case 4 – Unicast, Multicast, Broadcast Frame Delivery
  - Verifies the unconditional delivery of unicast, multicast and broadcast frames
- Test Case 5 – Service and ENNI Maximum Frame Size – Minimum Supported Value
  - Verifies the support of Service and ENNI maximum frame sizes of at least 1522 bytes and 1526 bytes, respectively

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

- Test Case 6 – Service and ENNI Maximum Frame Size - Maximum Supported Value
  - Verifies the maximum Service and ENNI Maximum Frame Size values supported
- Test Case 7 – Service and ENNI Frames exceeding the maximum size allowed for the service
  - Verifies that the receiving Operator network discards frames whose length exceed the configured Maximum Frame Size at the UNI and/or at the ENNI
- Test Case 8 – Service OAM Connectivity Check Messages (CCM) transparency
  - Verifies that the EIP solution is configurable to forward Subscriber CCM frames at MEG levels 5 & 6
- Test Case 9 – Service OAM Multicast Loopback Messages (LBM) transparency
  - Verifies that the EIP solution is configurable to forward Subscriber multicast LBM frames at MEG levels 5 & 6
- Test Case 10 – Service OAM Unicast Loopback Messages (LBM/LBR) transparency
  - Verifies that the EIP solution is configurable to forward Subscriber unicast LBM and LBR frames at MEG levels 5 & 6
- Test Case 11 – Service OAM LinkTrace Messages (LTM/LTR) transparency
  - Verifies that the EIP solution is configurable to forward Subscriber LTM and LTR frames at MEG levels 5 & 6

7.2 Future Service Configuration Test Cases

- Test Case 14 – Ingress Bandwidth Profile per CoS ID – Committed Information Rate
  - Verifies that when an Ingress Bandwidth Profile per CoS ID is applied at the UNI or at the ENNI, the amount of traffic delivered at the egress UNI or ENNI is within the CIR tolerance range of the calculated amount of traffic accepted at the ingress UNI or ENNI, during a time interval *t*
- Test Case 15 – Ingress Bandwidth Profile per CoS ID – Committed Burst Size
  - Verifies that when an Ingress Bandwidth Profile per CoS ID is applied at the UNI or at the ENNI, the amount of Green traffic delivered at the egress UNI or ENNI is within the CBS tolerance range of the calculated amount of traffic accepted at the ingress UNI or ENNI, during a time interval *t*
- Test Case 16 – Service Performance with constant traffic
  - Verifies that the EIP solution meets the performance objectives defined in MEF 23.1 for Performance Tier 1, CoS Label H, while carrying constant traffic
- Test Case 17 – Service Performance with bursty traffic
  - Verifies that the EIP solution meets the performance objectives defined in MEF 23.1 for Performance Tier 1, CoS Label H, while carrying bursty traffic

7.3 L2CP Testing and Results

L2CP is a highly complex issue with great variability amongst carriers (Operators) and we decided to perform testing to provide insights for the industry. Many customers will use

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

routers as their CPE and therefore diminish the importance of the service needing to forward L2CP frames. However, some customers are still looking for a native layer 2 Ethernet handoff that will require detailed information regarding L2CP behavior. Preliminary testing of L2CP, based on MEF 45, has started in this first phase of the EIP project. L2CP testing is planned to be completed during the subsequent phases of the project, and the testing is being done in alignment with the flow charts depicted in MEF 45 figure 6 and 7. A high level example of L2CP testing at the UNI is depicted in the figure 10 below. Test Cases 12 and 13 were dedicated to L2CP Option 1 and Option 2 as follows:

- Test Case 12 – L2CP Handling – Option 1
    - Verifies that the EIP solution is configurable to support MEF 45 EPL Option 1 requirements
- Test Case 13 – L2CP Handling – Option 2
    - Verifies that the EIP solution is configurable to support MEF 45 EPL Option 2 requirements

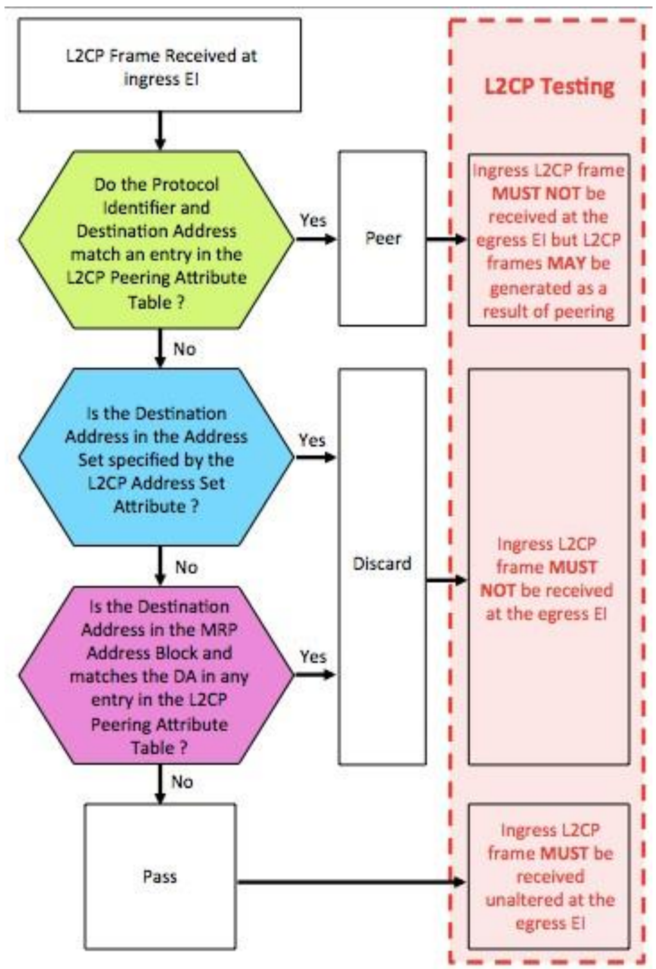


Figure 10 – High Level Diagram of Use Case 1, Phase 1

A detailed table of the complete L2CP testing results can be found in Appendix II in this guideline.

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

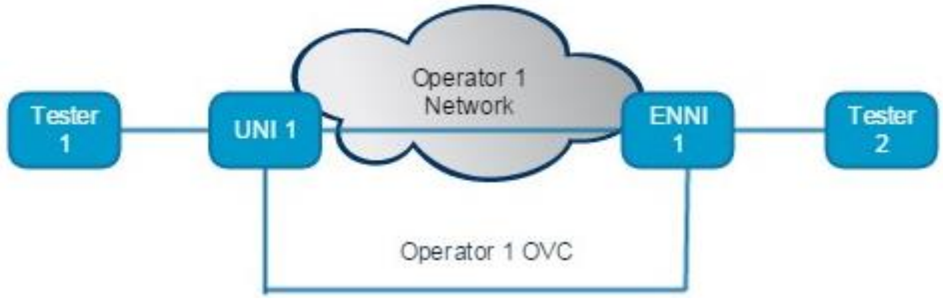


Figure 11 – Operator 1 OVC Verification

8. Testing Environment

Each EIP test case is to be executed in a three step process. Step 1 verifies the Operator 1 OVC from the UNI to the ENNI and from the ENNI to the UNI; whereas step 2 verifies the Operator 2 OVC from the UNI to the ENNI and from the ENNI to the UNI. Step 1 and step 2 may be executed in parallel.

Once the first two steps are verified, the two Operator networks are directly interconnected at the ENNI and step 3 is executed. Step 3 verifies the end-to-end EVC service composed of the two Operators OVCs. The following figures provide high level interconnection views of the three step process:

8.1 Testing Summary

The testing at UNH yielded clear and immediate results. As predicted, the most salient technical challenge to overcome when interconnecting Operator Ethernet networks is ensuring that the TPID of the outer tags mapped at the ENNI match at the EIP. There was no way to configure an Ethernet service operating with a TPID value of 0x8100 to work with an Ethernet network operating with a TPID value of 0x88a8 and vice-versa. As you'll see in some of the other results, some Ethernet attributes can be altered to allow specific Operator interconnection, but TPID values must match. See Figure 13 below.

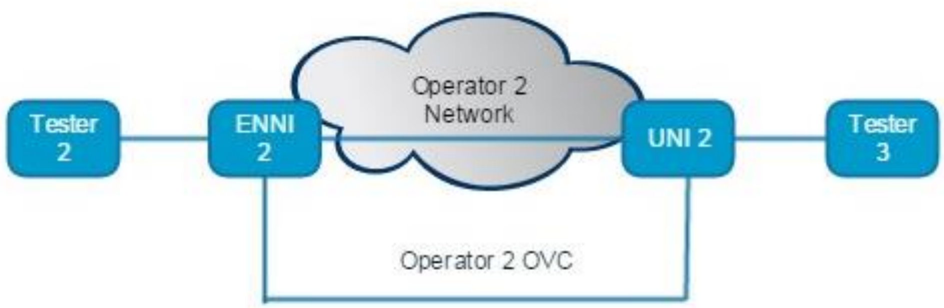


Figure 12 – Operator 2 OVC Verification

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

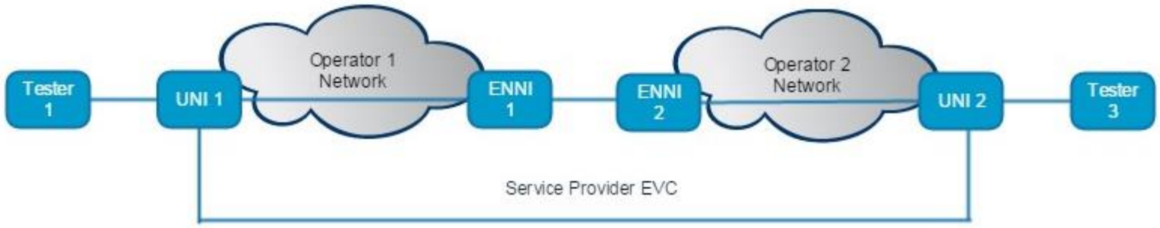


Figure 13 – Service Provider EVC Verification

We discovered that different equipment can have subtle differences in the way it handles TPIDs. For example, all the gear tested properly handled both TPID values (0x8100 and 0x88a8), but one vendor may treat the TPID differently, under certain circumstances, (ingress vs. egress, etc.). Even a single vendor may sometimes inspect a frame on ingress, but not care about the TPID value on egress at the ENNI. This can explain why some Operators may find inexplicable, and unpredictable, Ethernet failures when creating Interconnections. It's incumbent upon the Operator to know how their equipment handles TPID values on ingress and egress – whether single tagged, or dual tagged. Therefore, our testing has led us to reinforce MEF's guideline to purchase equipment that is CE 2.0 certified for E-Access.

As seen in Figure 14, the 11 test cases conducted at the UNH Lab all passed regardless if the Operators were all using TPID 0x8100 or all using 0x88a8. Armed with this knowledge, an Operator can now take the next step on their journey towards creating a MEF ENNI (Per Figure 7). If they are only capable of supporting TPID 0x8100, they can move to stage 3.5 (in Figure 7). If an Operator is capable of supporting 88a8, they can move to Stage 4, but it

Test Cases	Results with All Operators Using TPID 88A8	Results with All Operators Using TPID 8100	Results with Some Operators Using TPID 88a8 and Some Using 8100
1 - Frame Format	Passed	Passed	Failed
2 - Service Mapping and CE-VLAN ID Preservation	Passed	Passed	Failed
3 - CE-VLAN CoS Preservation	Passed	Passed	Failed
4 - Unicast, Multicast, Broadcast Frame Delivery	Passed	Passed	Failed
5 - Service and ENNI Maximum Frame Size – Minimum Value Supported	Passed	Passed	Failed
6 - Service and ENNI Maximum Frame Size – Maximum Value Supported	Passed	Passed	Failed
7 - Service and ENNI Frames Exceeding the Maximum Size Supported	Passed	Passed	Failed
8 - Service OAM CCM Transparency	Passed	Passed	Failed
9 - Service OAM Multicast LBM Transparency	Passed	Passed	Failed
10 - Service OAM Unicast LBM/LBR Transparency	Passed	Passed	Failed
11 - Service OAM LTM/LTR Transparency	Passed	Passed	Failed

Figure 14 – Summary of Test Results

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

is highly recommended they ensure they understand what stage their neighboring Operators are at because they may need to remain "Bilingual" for a period of time as per Figure 6.

Each Operators "next step" may look slightly different. Some Operators may just be making the transition from single tagging to dual tagging (Stage 2 to Stage 3). It's not the stage that's important, but rather an Operator's understanding of where they are on their interconnection journey, and that they begin planning their next step. This EIP project hopes to continue more testing of more complex interconnection configurations in 2016.

9. Compliance Levels – More Detail Regarding Test Results

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 [Rx]. Items that are RECOMMENDED (contain the words SHOULD or SHOULD NOT) will be labeled as [Dx]. Items that are OPTIONAL (contain the words MAY or OPTIONAL) will be labeled as [Ox].

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 [1]. 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 [Rx], [Dx] or [Ox] is not normative.

Based upon the testing we are able to make the following statements to assist Operators on their journey to creating standardized MEF ENNIs.

For two Operators interconnected at an EIP to deliver EPL service to a customer the following statements are applicable:

1. Both Operators must use the same TPID for outer tag at the EIP, either 0x8100 or 0x88a8 using different TPIDs for outer tag results in dropped traffic at the EIP (Demonstrated in Test Case 1)
2. Both Operators must support the frame format specified in IEEE Std. 802.3-2012 at the UNI (Demonstrated in Test Case 1)
3. Both Operators must support all-to-one bundling with CE-VLAN preservation enabled (Demonstrated in Test Case 2)
4. Both Operators must support CE-VLAN CoS preservation (Demonstrated in Test Case 3)
5. Both Operators must support the unconditional delivery of unicast, multicast, and broadcast frames (Demonstrated in Test Case 4)
6. Both Operators must support the min MTU size of 1522 at UNI and min MTU size of 1526 at ENNI (Demonstrated in Test Case 5)
7. Service Provider must inform the customer of the lower MTU size of both Operators; this will be the MTU size supported in end-to-end service (Demonstrated in Test Case 6)
8. Each Operator must discard frames whose length exceeds the configured OVC MTU size (Demonstrated in Test Case 7)

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

9. Both Operators must forward Subscriber CCM frames at MEG level 5 & 6 (Demonstrated in Test Case 8)
10. Both Operators must forward Subscriber multicast LBM frames at MEG level 5 & 6 (Demonstrated in Test Case 9)
11. Both Operators must forward Subscriber unicast LBM and LBR frames at MEG level 5 & 6 (Demonstrated in Test Case 10)
12. Both Operators must forward Subscriber unicast LTM and LTR frames at MEG level 5 & 6 (Demonstrated in Test Case 11)

10. Other Implementation Obstacles and Recommendations on how to Overcome

10.1 Implementation Obstacles and Remediation – Tested in Lab

Given the inherent variability in the 6 Operators at the UNH Lab we immediately encountered obstacles that were preventing us from interconnecting. For example, some Operators are color-aware, and some color blind, and some Operators offer CIR only and some offer CIR and EIR values. Realizing that we'd need to use the "crawl, walk, run" approach we employed the following tactics to hurdle these obstacles.

Number	Obstacle Encountered	Remediation	Result
1	One Operator is Color Blind and the Other Operator is Color Aware	We used CIR only service; and not EIR	All frames are either marked green or red – no need for color awareness
2	One Operator has an MTU size larger than the Other Operator	We sent traffic with the minimum MTU supported	Picking the minimum MTU ensured that all the Operators passed all their frames in both directions (ingress and egress)
3	How do you ensure that both Operators use the same value for the Outer VLAN at the Interconnect Point?	During the testing UNH, UNH tester selected the VLAN value for outer tag and communicated it to both Operators; each Operator configured the outer VLAN value	Since both Operators have assigned the same outer VLAN value ("21" for example) the frames flowed across the ENNI (or Non-Standard Interconnection) to the other Operator
4	Operators did not support the same set of CIR speeds so how do we deliver requested CIR for customer EPL service?	UNH tested common set of customer EPL CIR supported by both Operators access services	Customer gets the requested CIR, or a CIR that's acceptable for their needs

Table 4 – Implementation Obstacles – Tested in Lab

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

10.2 Possible Implementation Obstacles and Remediation – Not Tested in Lab

Given the extraordinarily high level of technical expertise assembled for this project, we were able to make some general assumptions about how an Operator can overcome some common obstacles. Note we did not have time to test these assumptions in this round of testing, but the EIP team felt we'd be remiss if we didn't share this information now with the industry.

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Number	Obstacle	Remediation	Expected Results
1	One of the Operators does not support the CIR required by the customer	This Operator should use the next higher CIR they support so the requested EPL bandwidth is delivered to the customer	Customer gets the required CIR
2	Customer desires an EPL service with the bandwidth profile of certain CIR (C) and EIR (E); one of the Operators supports EIR but the other does not	Operator who does not support EIR should provision the service with CIR = (C + E)	Customer gets EPL with CIR (C) and EIR (E)
3	Operators desire to support Color Aware service at EIP	Both Operators must support the same Color Aware mechanism at EIP (DEI or .1p bit of the outer tag); this applies to EIP based on 0x88a8 TPID or 0x8100 TPID	There are other requirements needed for Color Aware service; however, the matching Color Aware mechanism at the EIP is a must
4	CoS offerings differ for each Operator (one of the Operators is Service Provider)	The Service Provider is responsible for the end-to-end service to the customer. Service Provider reviews Access Provider CoS options and chooses the appropriate Access Provider CoS offering to deliver end-to-end service.	The requested end-to-end CoS offering to the customer is delivered.
5	How to overcome the impact of the additional 4-bytes due to the S-tagging at the EIP on bandwidth delivered for the customer's EPL service?	Policer values at the ENNI must be appropriately set to compensate for the additional 4 bytes, or an Operator could increase the CIR values at the EIP.	Customer gets the requested CIR
6	The Operator's CBS values did not match at their respective UNIs for a given EPL CIR	Operators can agree to use the same CBS values, or they can use shapers to shape their traffic at the EIP to conform with the bandwidth profile used by the peer Operator	Operator traffic flows correctly with fewer dropped frames

Table 5 – Implementation Obstacles – Not Tested in Lab

11. Other EIP Items to Consider

As Operators continue their journey towards standardized interconnections (ENNI) there are other non-technical items they will want to consider. This section of the document is meant to act as a "thought provoker" to help ensure **all** aspects of Ethernet Interconnections are being considered.

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

11.1 EIP Location Planning – Where to Build?

Generally speaking, Operators will build Interconnections for one of two reasons: Customer demand, or TDM shut down. In either case, Operators should study their networks and determine where the demand is and what their existing Fiber plant and Ethernet capabilities are in the area where they wish to build an Interconnect. Note many times high-speed TDM services are delivered on fiber that can be repurposed to support Ethernet Interconnections. And as demand for TDM-based services continues to diminish, the likelihood of having "spare" fiber in an area saturated with TDM increases. Strategic planning, network grooming, and capacity planning can negate the need to lay new fiber.

11.2 How Many EIPs Do We Need?

If an Operator's network is **not** constrained by regulatory restrictions such as LATA boundaries, the answer is a matter of distance and the level of Service Level Specifications (SLS) the Operator wants to support. Operators should review the MEFs Service Level Specifications and corresponding "Performance Tiers" to determine how many EIPs are needed. Generally speaking, the better the performance desired, the more EIPs an Operator will need to build to reduce the distance data will need to travel to reach off-net locations. If an Operator's network **is** constrained by LATA boundaries, and there are rules in place to prevent Ethernet traffic from leaving a LATA, it's likely an Operator may need to build an EIP at every LATA that has customers who need to reach off-net locations.

11.3 How Does an Operator Determine What Ethernet Services Are Available for Off-Net Locations?

Unlike TDM-based services, there is no third party, industry-wide database that can be used to determine Ethernet capabilities for off-net locations. The most popular way for making these determinations is by independent mutual cooperation between Operators. By way of illustration, AT&T uses an internal group called "Access Management" whose primary purpose is to create Interconnection agreements with other Operators. This team populates internal databases that can be used by AT&T to support off-net sales. One of the tricky parts to this is the need to determine the entire path of COs an EVC must pass through to reach the customer. However, this way of doing business is not optimal, and there are several MEF efforts being worked to make this easier including the SOC's "Ethernet Serviceability" Project, Product Catalog Project, and LSO Project. There is agreement in the MEF that determining off-net availability will be addressed in the future via APIs.

11.4 What Should an Operator Know About Ordering Ethernet Services?

There is great variability in the global market regarding how Ethernet Operators order services from each other. Using AT&T as an example, they have many different ways, processes, and systems to conduct its Ethernet business. This is a result of the variability seen in the market with the Operators they want/need to conduct business with on behalf of their customers. By way of illustration, some larger companies prefer to send an ASR (Access

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Service Request) directly from their systems to AT&T's. Some Operators require a site survey before an order will be accepted (known as a "service inquiry"), some Operators fill out an ASR and email to them, and some Operators are still faxing orders. This variability drives cost and complexity into a business, and underscores the need for the industry to move to a commonly accepted ordering process that is highly automated. The MEF's LSO project can be used as the starting point to move the industry into the future. In the meantime, Operators need to know the ASR form, understand the fields, and determine how to send it to other Operators.

11.5 "Special Construction," "Entrance Facility," and "Inside Wire" – What Does an Operator Need to Know?

No Implementation Agreement would be complete without the mention of "Special Construction," "Entrance Facility," and "Inside Wire." They are three terms loathed by customers, sales teams, and Product Managers around the globe. As an Ethernet Operator you'll need to know the terms and know how to pay for and/or correctly bill your customers.

- Special Construction Charge – The construction cost in order to get your Ethernet network (typically fiber) to the closest network termination point nearest to your customer (typically a manhole, or vault). This charge could range from a few hundred dollars to a few million depending on the distance and terrain covered.
- Entrance Facility Charge – The construction cost in order to get your Ethernet network extended from your closest point (manhole) into the customer's building's MPOE (Minimum point of Entry).
- Inside Wire Charge – The construction charge to get your Ethernet network extended from the buildings MPOE to your customers CPE.

Typically, these are all one-time costs that Operators incur when they need to lay new fiber to reach a customer, and are typically passed on to the end user customer (Subscriber). Some Operators insist customers pay these charges upfront, and some Operators can set up financing that will allow customers to pay for these costs over time. As more and more fiber is laid in the market, the need for these charges will, thankfully, diminish over time.

11.6 Physical Equipment

Operators will need to understand their physical Ethernet network equipment to ensure it's capable of supporting an EIP and at which stage as per Figure 7. The state of the hardware can determine if a non-standard interconnection using dual C-Tags (0x8100/0x8100) will be used, or if a standard ENNI can be constructed using a C-Tag and an S-Tag (0x8100/0x88a8). Further investigation will uncover compliance to other E-Access attributes such as Color Awareness, C-VLAN preservation, etc. Operators should specifically check to ensure they have 4 key questions in mind:

1. What does my network switch chassis support?
2. What do the network cards in my chassis support?
3. What version of operating system is my network gear using and does it support my needs?

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

4. What distance will my data travel to reach the other Operator's switch at the other side of the Interconnection – are short range or long range optics needed, and/or some kind of repeater?

12. References

MEF Forum, MEF 26.1 Technical Specification “External Network Network Interface (ENNI)-Phase 2,” January 2012

MEF Forum, MEF 33 Technical Specification “Ethernet Access Services Definition,” January 2012

MEF Forum, MEF 12.2 Technical Specification “Carrier Ethernet Network Architecture Framework Part 2: Ethernet Services Layer,” May 2014

MEF Forum, MEF 10.3 Technical Specification “Ethernet Service Attributes Phase 3,” October 2013

MEF Forum, MEF 4 Technical Specification “Metro Ethernet Architecture Framework – Part 1: Generic Framework,” May 2004

RFC 2474 “Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers,” 1998

ITU-T Y.1564 “Ethernet service activation test methodology,” 03/2011

ITU-T G.8264/Y.1364 “Distribution of timing information through packet networks,” 05/2014

IEEE Std 802.1AX-2008, IEEE Standard for Local and metropolitan area networks-Link Aggregation, 3 November 2008

IEEE 802.1Q -2011, IEEE Standard for Local and Metropolitan Area Networks-Media Access Control (MAC) Bridges and Virtual Bridged Local Area Networks, 2011

IEEE Std 802.3-2012, IEEE Standard for Ethernet, 28 December 2012 (normative)

MEF Forum, MEF 10.1 Technical Specification “Ethernet Services Attributes Phase 1,” November 2006

MEF Forum, MEF 23.1 Implementation Agreement “Carrier Ethernet Class of Service – Phase 2,” January 2012

MEF Forum, MEF 16 Technical Specification “Ethernet Local Management Interface (E-LMI),” January 2006

MEF Forum, MEF 6.1 Technical Specification “Ethernet Services Definitions – Phase 2,” April 2008

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

MEF Forum, MEF 10.2 Technical Specification "Ethernet Services Attributes Phase 2," 27 October 2009

MEF Forum, MEF 20 Technical Specification "User Network Interface (UNI) Type 2 Implementation Agreement," July 2008

MEF Forum, MEF 30 Technical Specification "Service OAM Fault Management Implementation Agreement," January 2011

MEF Forum, MEF 34 Technical Specification "Abstract Test Suite for Ethernet Access Services," February 2012

MEF Forum, MEF 37 Technical Specification "Abstract Test Suite for ENNI," January 2012

MEF Forum, MEF 6.2 Technical Specification "EVC Ethernet Services Definitions Phase 3," August 2013

MEF Forum, MEF 45 Technical Specification "Multi-CEN L2CP," August 2013

MEF Forum, MEF 30.1 Technical Specification "Service OAM Fault Management Implementation Agreement: Phase 2," April 2013

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

13. Acknowledgements

This document was prepared by contributions from the following members of the MEF Service Operations Committee:

- Dan Blemings, AT&T (Lead Editor)
- Elzbieta Napierala, AT&T (Editor)
- John Siwko, AT&T (Editor)
- Steve Holmgren, AT&T (Editor)
- Bruce Eldridge, CenturyLink (Editor)
- Lisa Partridge, Frontier (Editor)
- Bill Bjorkman, MEF (Editor)
- Lee Jorissen, TelePacific (Editor)
- Tim Sheehan, University of New Hampshire Interoperability Lab (Editor Test Cases)
- Steve Cole, Verizon (Editor)
- Michael Lefevre, Windstream (Editor)
- Isabelle Morency, Veryx Technologies (Editor Test Cases)

Member Company	Participant in IOL Test Trial
Alcatel Lucent (Equipment and Personnel)	Yes

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

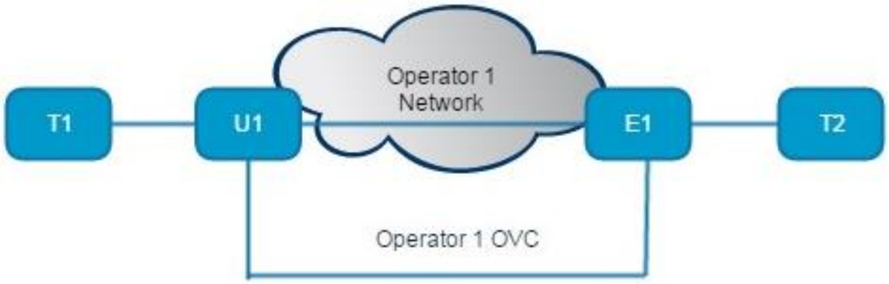
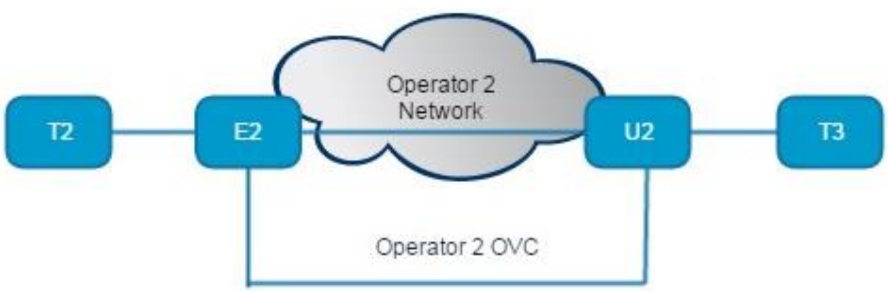
AT&T (Personnel)	Yes
CenturyLink (Personnel)	Yes
Ciena (Equipment and Personnel)	Yes
Cisco (Equipment and Personnel)	Yes
Canoga Perkins (Equipment and Personnel)	Yes
Juniper (Equipment and Personnel)	Yes
Frontier (Personnel)	Yes
RAD (Equipment and Personnel)	Yes
TelePacific (Personnel)	Yes
University of New Hampshire Interoperability Lab (Equipment, Personnel, and Facility)	Yes
Verizon (Personnel)	Yes
Veryx (Equipment and Personnel)	Yes
Windstream (Personnel)	Yes

14. Appendix I – Test Cases for EIP Use Case 1 Phase 1

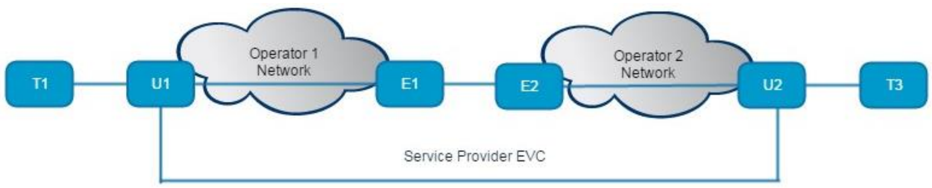
This appendix contains a series of test cases to verify the service configuration and service performance of the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1.

Test Case 1 – Frame Format		
Interconnection Partners	Operator 1 Name:	Operator 2 Name:
Requirements	• At the UNI, the frame format MUST be as specified in IEEE Std 802.3-2012 • An ENNI Frame can have zero or more VLAN tags. When an ENNI Frame has a single tag, that tag is an S-Tag. • When an ENNI Frame has two tags, the outer tag is an S-Tag and the next tag is a C-Tag as defined in IEEE Std 802.1Q-2014	
References	EIP Use Case 1 – Service Attribute Values and Ranges	
Test Purpose	Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports the frame format specified in IEEE Std 802.3-2012 and VLAN Tags as defined in IEEE Std 802.1Q-2014	
Step 1	Operator 1 – OVC Verification [UNI U1 to ENNI E1]	

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

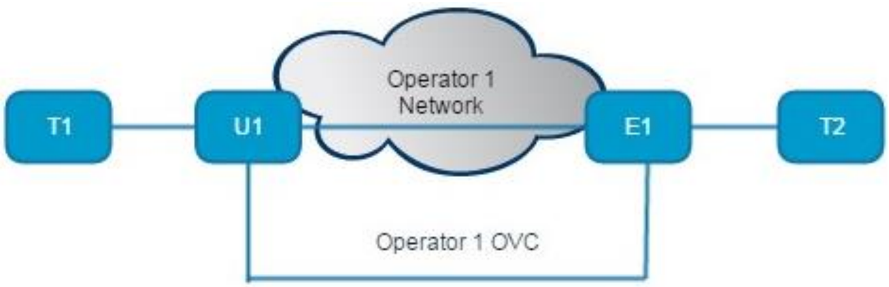
Test Bed and Service Mapping Step 1	 <table><tr><td colspan="2">UNI U1</td></tr><tr><td>1, 2…4095*</td><td>OVC End Point</td></tr><tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr><tr><td colspan="2">ENNI E1</td></tr><tr><td>100</td><td>OVC End Point</td></tr></table>
Test Procedure Step 1	1.1 Tester T1 transmits C-tagged, untagged and priority tagged frames to the Operator 1 UNI U1
	1.2 Tester T2 verifies that all the transmitted frames are received at the Operator 1 ENNI E1, encapsulated in the outer tag mapped at the ENNI E1, and that the outer tag TPID value is 88a8
	1.3 Tester T2 transmits C-tagged, untagged and priority tagged frames, encapsulated in the outer tag mapped at the ENNI E1, to the Operator 1 ENNI E1
	1.4 Tester T1 verifies that all the transmitted frames are received at the Operator 1 UNI U1 without the outer tag and that the TPID value of the tagged frames is 0x8100
Step 2	Operator 2 – OVC Verification [UNI U2 to ENNI E2]
Test Bed and Service Mapping Step 2	 <table><tr><td colspan="2">UNI U2</td></tr><tr><td>1, 2…4095*</td><td>OVC End Point</td></tr><tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr><tr><td colspan="2">ENNI E2</td></tr><tr><td>100</td><td>OVC End Point</td></tr></table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td rowspan="4">Test Procedure Step 2</td><td>2.1</td><td>Tester T3 transmits C-tagged, untagged and priority tagged frames to the Operator 2 UNI U2</td></tr>
<tr><td>2.2</td><td>Tester T2 verifies that all the transmitted frames are received at the Operator 2 ENNI E2, encapsulated in the outer tag mapped at the ENNI E2, and that the outer tag TPID value is 0x88a8</td></tr>
<tr><td>2.3</td><td>Tester T2 transmits C-tagged, untagged and priority tagged frames, encapsulated in the outer tag mapped at the ENNI E2, to the Operator 2 ENNI E2</td></tr>
<tr><td>2.4</td><td>Tester T3 verifies that all the transmitted frames are received at the Operator 2 UNI U2 without the outer tag, and that the TPID value of the tagged frames is 0x8100</td></tr>
<tr><td>Step 3</td><td colspan="2">Service Provider EVC [UNI U1 to UNI U2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 3</td><td colspan="2">

<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
</table></td></tr>
<tr><td rowspan="5">Test Procedure Step 3</td><td>3.1</td><td>Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly</td></tr>
<tr><td>3.2</td><td>Tester T1 transmits C-tagged, untagged and priority tagged frames to the Operator 1 UNI U1</td></tr>
<tr><td>3.3</td><td>Tester T3 verifies that all the transmitted frames are received at the Operator 2 UNI U2 and that the TPID value of the tagged frames is 8100</td></tr>
<tr><td>3.4</td><td>Tester T3 transmits C-tagged, untagged and priority tagged frames to the Operator 2 UNI U2</td></tr>
<tr><td>3.5</td><td>Tester T1 verifies that all the transmitted frames are received at the Operator 1 UNI U1 and that the TPID value of the tagged frames is 8100</td></tr>
<tr><td>Test Result</td><td colspan="2">Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports the frame format specified in IEEE Std 802.3-2012 and VLAN Tags as defined in IEEE Std 802.1Q-2014 as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5</td></tr>
<tr><td>Test Traffic and Frame Size</td><td colspan="2">• At the UNI: 10 x 80-byte unicast C-tagged frames, 10 x 80-byte unicast priority tagged frames and 10 x 80-byte unicast untagged frames
• At the ENNI: 10 x 84-byte unicast C-tagged frames encapsulated in the outer tag mapped at the ENNI, 10 x 84-byte unicast priority tagged frames encapsulated in the outer tag mapped at the ENNI and 10 x 84-byte unicast untagged frames encapsulated in the outer tag mapped at the ENNI</td></tr>
<tr><td>Comment</td><td colspan="2">Any nonconformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 such as the TPID of the outer tag, will be clearly identified and described in the test report</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

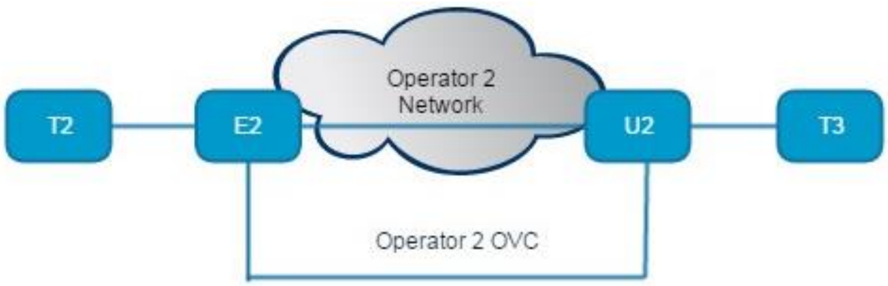
Test Case 2 – Service Mapping and CE-VLAN ID Preservation		
Interconnection Partners	Operator 1 Name:	Operator 2 Name:
Requirements	• The CE-VLAN ID/EVC map **MUST** map all CE-VLAN IDs • All-to-one bundling **MUST** be enabled • CE-VLAN ID preservation **MUST** be enabled • The OVC End Point map **MUST** align to the CE-VLAN ID/EVC map • The OVC CE-VLAN ID preservation attribute **MUST** align to the EVC CE-VLAN ID preservation attribute	
References	EIP Use Case 1 – Service Attribute Values and Ranges	
Test Purpose	Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 sup-ports all-to-one bundling with CE-VLAN ID preservation enabled	
Step 1	Operator 1 – OVC Verification [UNI U1 to ENNI E1]	
Test Bed and Service Map-ping Step 1		

UNI U1	
1, 2…4095*	OVC End Point
* Mapping at the UNI U1 includes untagged and priority tagged frames	
ENNI E1	
100	OVC End Point

Test Procedure Step 1		
	1.1	Tester T1 transmits untagged, priority tagged, and C-tagged frames with all CE-VLAN IDs to the Operator 1 UNI U1
	1.2	Tester T2 verifies that all the transmitted frames are received at the Operator 1 ENNI E1, encapsulated in the outer tag mapped at the ENNI E1, and that all CE-VLAN IDs are preserved
	1.3	Tester T2 transmits untagged, priority tagged, and C-tagged frames with all CE-VLAN IDs, encapsulated in the outer tag mapped at the ENNI E1, to the Opera-tor 1 ENNI E1
	1.4	Tester T1 verifies that all the transmitted frames are received at the Operator 1 UNI U1 without the outer tag and that all CE-VLAN IDs are preserved
Step 2	Operator 2 – OVC Verification [UNI U2 to ENNI E2]	

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Test Bed and Service Mapping Step 2



UNI U2	
1, 2…4095*	OVC End Point
* Mapping at the UNI U2 includes untagged and priority tagged frames	

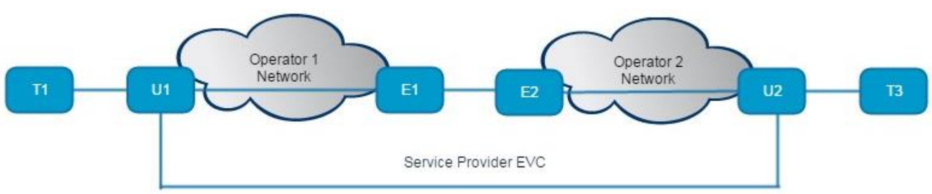
ENNI E2	
100	OVC End Point

Test Procedure Step 2

2.1	Tester T3 transmits untagged, priority tagged, and C-tagged frames with all CE-VLAN IDs to the Operator 2 UNI U2
2.2	Tester T2 verifies that all the transmitted frames are received at the Operator 2 ENNI E2, encapsulated in the outer tag mapped at the ENNI E2, and that all CE-VLAN IDs are preserved
2.3	Tester T2 transmits untagged, priority tagged, and C-tagged frames with all CE-VLAN IDs, encapsulated in the outer tag mapped at the ENNI E2, to the Opera-tor 2 ENNI E2
2.4	Tester T3 verifies that all the transmitted frames are received at the Operator 2 UNI U2 without the outer tag, and that all CE-VLAN IDs are preserved

Step 3 — Service Provider EVC [UNI U1 to UNI U2]

Test Bed and Service Mapping Step 3

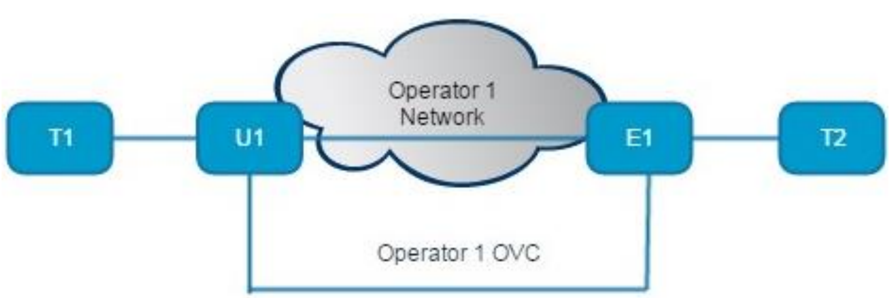


UNI U1	
1, 2…4095*	EVC
* Mapping at the UNI U1 includes untagged and priority tagged frames	

UNI U2	
1, 2…4095*	EVC
* Mapping at the UNI U2 includes untagged and priority tagged frames	

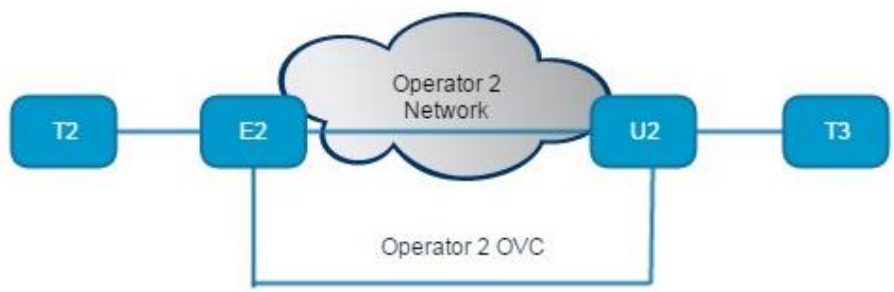
© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Test Procedure Step 3	3.1	Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly
	3.2	Tester T1 transmits untagged, priority tagged, and C-tagged frames with all CE-VLAN IDs to the Operator 1 UNI U1
	3.3	Tester T3 verifies that all the transmitted frames are received at the Operator 2 UNI U2 and that all CE-VLAN IDs are preserved
	3.4	Tester T3 transmits untagged, priority tagged, and C-tagged frames with all CE-VLAN IDs to the Operator 2 UNI U2
	3.5	Tester T1 verifies that all the transmitted frames are received at the Operator 1 UNI U1 and that all CE-VLAN IDs are preserved
Test Result	Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports all-to-one bundling with CE-VLAN ID preservation enabled as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5	
Test Traffic and Frame Size	• At the UNI: 10 x 80-byte unicast C-tagged frames of each CE-VLAN ID, 10 x 80-byte unicast priority tagged frames and 10 x 80-byte unicast untagged frames • At the ENNI: 10 x 84-byte unicast C-tagged frames of each CE-VLAN ID encapsulated in the outer tag mapped at the ENNI, 10 x 84-byte unicast priority tagged frames encapsulated in the outer tag mapped at the ENNI and 10 x 84-byte unicast untagged frames encapsulated in the outer tag mapped at the ENNI	
Comment	Any nonconformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 will be clearly identified and described in the test report	

Test Case 3 – CE-VLAN CoS Preservation		
Interconnection Partners	Operator 1 Name:	Operator 2 Name:
Requirements	• The CE-VLAN CoS preservation **MUST** be enabled for the EVC • The CE-VLAN CoS ID parameters and values of the OVC **MUST** align to the CE-VLAN CoS preservation parameters and values of the EVC	
References	EIP Use Case 1 – Service Attribute Values and Ranges	
Test Purpose	Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports CE-VLAN CoS preservation enabled	
Step 1	Operator 1 – OVC Verification [UNI U1 to ENNI E1]	
Test Bed and Service Mapping Step 1		

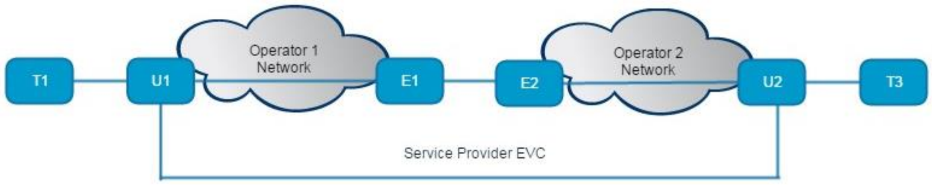
UNI U1	
1, 2…4095*	OVC End Point

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

	* Mapping at the UNI U1 includes untagged and priority tagged frames **ENNI E1** 100 — OVC End Point
Test Procedure Step 1	1.1 Tester T1 transmits C-tagged frames with all CE-VLAN CoS (PCP bits with values 0-7), to the Operator 1 UNI U1
	1.2 Tester T2 verifies that all the transmitted frames are received at the Operator 1 ENNI E1, encapsulated in the outer tag mapped at the ENNI E1, and that all CE-VLAN CoS are preserved
	1.3 Tester T2 transmits C-tagged frames with all CE-VLAN CoS (PCP bits with values 0-7), encapsulated in the outer tag mapped at the ENNI E1, to the Operator 1 ENNI E1
	1.4 Tester T1 verifies that all the transmitted frames are received at the Operator 1 UNI U1 without the outer tag and that all CE-VLAN CoS are preserved
Step 2	Operator 2 – OVC Verification [UNI U2 to ENNI E2]
Test Bed and Service Mapping Step 2	 **UNI U2** 1, 2…4095* — OVC End Point * Mapping at the UNI U2 includes untagged and priority tagged frames **ENNI E2** 100 — OVC End Point
Test Procedure Step 2	2.1 Tester T3 transmits C-tagged frames with all CE-VLAN CoS (PCP bits with values 0-7), to the Operator 2 UNI U2
	2.2 Tester T2 verifies that all the transmitted frames are received at the Operator 2 ENNI E2, encapsulated in the outer tag mapped at the ENNI E2, and that all CE-VLAN CoS are preserved
	2.3 Tester T2 transmits C-tagged frames with all CE-VLAN CoS (PCP bits with values 0-7), encapsulated in the outer tag mapped at the ENNI E2, to the Operator 2 ENNI E2
	2.4 Tester T3 verifies that all the transmitted frames are received at the Operator 2 UNI U2 without the outer tag, and that all CE-VLAN CoS are preserved

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

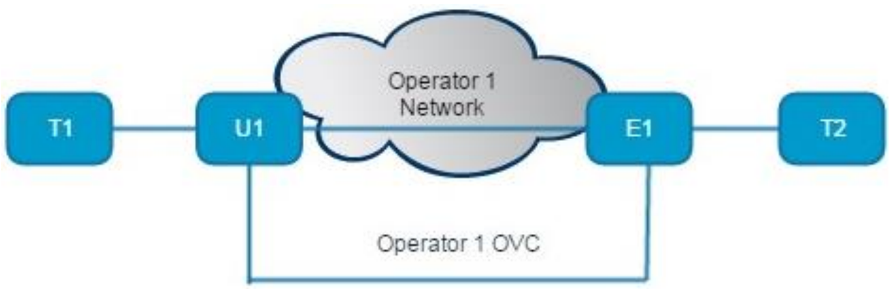
<table>
<tr><td>Step 3</td><td colspan="2">Service Provider EVC [UNI U1 to UNI U2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 3</td><td colspan="2">



<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
</table>

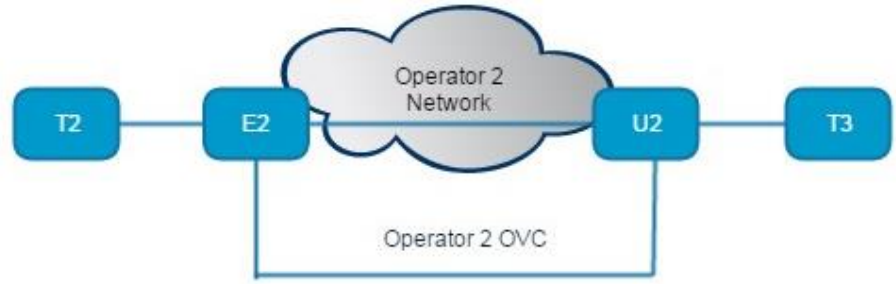
</td></tr>
<tr><td rowspan="5">Test Procedure Step 3</td><td>3.1</td><td>Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly</td></tr>
<tr><td>3.2</td><td>Tester T1 transmits C-tagged frames with all CE-VLAN CoS (PCP bit 0-7), to the Operator 1 UNI U1</td></tr>
<tr><td>3.3</td><td>Tester T3 verifies that all the transmitted frames are received at the Operator 2 UNI U2 and that all CE-VLAN CoS are preserved</td></tr>
<tr><td>3.4</td><td>Tester T3 transmits C-tagged frames with all CE-VLAN CoS (PCP bit 0-7), to the Operator 2 UNI U2</td></tr>
<tr><td>3.5</td><td>Tester T1 verifies that all the transmitted frames are received at the Operator 1 UNI U1 and that all CE-VLAN CoS are preserved</td></tr>
<tr><td>Test Result</td><td colspan="2">Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports CE-VLAN CoS preservation enabled as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5</td></tr>
<tr><td>Test Traffic and Frame Size</td><td colspan="2">• At the UNI: 10 x 80-byte unicast C-tagged frames of each CE-VLAN CoS
• At the ENNI: 10 x 84-byte unicast C-tagged frames of each CE-VLAN CoS encapsulated in the outer tag mapped at the ENNI</td></tr>
<tr><td>Comment</td><td colspan="2">Any nonconformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 will be clearly identified and described in the test report</td></tr>
</table>

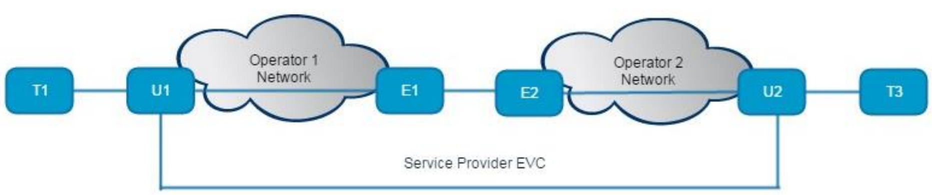
© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><th colspan="4">Test Case 4 – Unicast, Multicast, and Broadcast Frame Delivery</th></tr>
<tr><td>Interconnection Partners</td><td colspan="2">Operator 1 Name:</td><td>Operator 2 Name:</td></tr>
<tr><td>Requirements</td><td colspan="3">• Unicast, multicast, and broadcast frame delivery MUST be unconditional</td></tr>
<tr><td>References</td><td colspan="3">EIP Use Case 1 – Service Attribute Values and Ranges</td></tr>
<tr><td>Test Purpose</td><td colspan="3">Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports the unconditional delivery of unicast, multicast, and broadcast frames.</td></tr>
<tr><td>Step 1</td><td colspan="3">Operator 1 – OVC Verification [UNI U1 to ENNI E1]</td></tr>
<tr><td>Test Bed and Service Mapping Step 1</td><td colspan="3">

<table>
<tr><th colspan="2">UNI U1</th></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><th colspan="2">ENNI E1</th></tr>
<tr><td>100</td><td>OVC End Point</td></tr>
</table></td></tr>
<tr><td rowspan="4">Test Procedure Step 1</td><td>1.1</td><td colspan="2">Tester T1 transmits C-tagged frames with unicast, multicast, and broadcast destination addresses, up to the CIR configured at the UNI, to the Operator 1 UNI U1</td></tr>
<tr><td>1.2</td><td colspan="2">Tester T2 verifies that all the transmitted unicast, multicast, and broadcast frames are received at the Operator 1 ENNI E1, encapsulated in the outer tag mapped at the ENNI E1</td></tr>
<tr><td>1.3</td><td colspan="2">Tester T2 transmits C-tagged frames with unicast, multicast, and broadcast destination addresses, encapsulated in the outer tag mapped at the ENNI E1, up to the CIR configured at the ENNI, to the Operator 1 ENNI E1</td></tr>
<tr><td>1.4</td><td colspan="2">Tester T1 verifies that all the transmitted unicast, multicast, and broadcast frames are received at the Operator 1 UNI U1 without the outer tag</td></tr>
<tr><td>Step 2</td><td colspan="3">Operator 2 – OVC Verification [UNI U2 to ENNI E2]</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

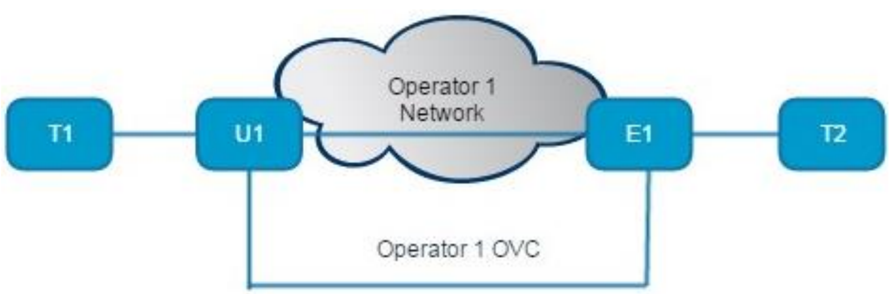
<table>
<tr><td>Test Bed and Service Mapping Step 2</td><td colspan="2">


<table>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">ENNI E2</td></tr>
<tr><td>100</td><td>OVC End Point</td></tr>
</table>
</td></tr>
<tr><td rowspan="4">Test Procedure Step 2</td><td>2.1</td><td>Tester T3 transmits C-tagged frames with unicast, multicast, and broadcast destination addresses, up to the CIR configured at the UNI to the Operator 2 UNI U2</td></tr>
<tr><td>2.2</td><td>Tester T2 verifies that all the transmitted unicast, multicast, and broadcast frames are received at the Operator 2 ENNI E2, encapsulated in the outer tag mapped at the ENNI E2</td></tr>
<tr><td>2.3</td><td>Tester T2 transmits C-tagged frames with unicast, multicast, and broadcast destination addresses, encapsulated in the outer tag mapped at the ENNI E2, up to the CIR configured at the ENNI, to the Operator 2 ENNI E2</td></tr>
<tr><td>2.4</td><td>Tester T3 verifies that all the transmitted unicast, multicast, and broadcast frames are received at the Operator 2 UNI U2 without the outer tag</td></tr>
<tr><td>Step 3</td><td colspan="2">Service Provider EVC [UNI U1 to UNI U2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 3</td><td colspan="2">


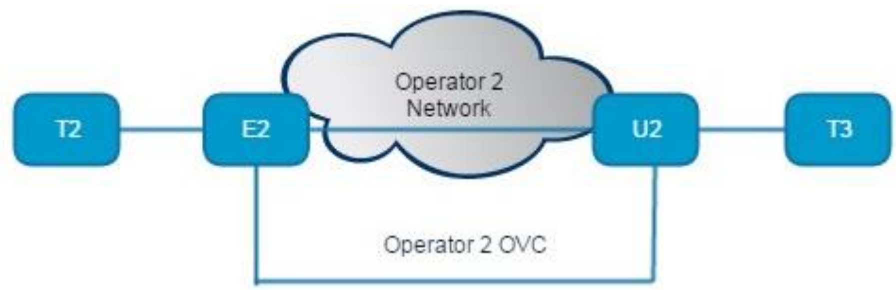
<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
</table>
</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Test Procedure Step 3	3.1	Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly
	3.2	Tester T1 transmits C-tagged frames with unicast, multicast, and broadcast destination addresses, up to the CIR configured at the UNI to the Operator 1 UNI U1
	3.3	Tester T3 verifies that all the transmitted unicast, multicast, and broadcast frames are received at the Operator 2 UNI U2
	3.4	Tester T3 transmits C-tagged frames with unicast, multicast, and broadcast destination addresses, up to the CIR configured at the UNI to the Operator 2 UNI U2
	3.5	Tester T1 verifies that all the transmitted unicast, multicast, and broadcast frames are received at the Operator 1 UNI U1
Test Result	Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports the unconditional delivery of unicast, multicast, and broadcast frames as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5	
Test Traffic and Frame Size	• At the UNI: 10 x 80-byte unicast C-tagged frames, 10 x 80-byte multicast C-tagged frames, and 10 x 80-byte broadcast C-tagged frames • At the ENNI: 10 x 84-byte unicast C-tagged frames encapsulated in the outer tag mapped at the ENNI, 10 x 84-byte multicast C-tagged frames encapsulated in the outer tag mapped at the ENNI and 10 x 84-byte broadcast C-tagged frames encapsulated in the outer tag mapped at the ENNI	
Comment	Any nonconformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 will be clearly identified and described in the test report	

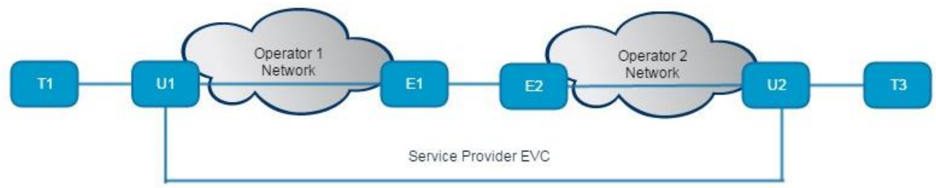
Test Case 5 – Service and ENNI Maximum Frame Size – Minimum Supported Value		
Interconnection Partners	Operator 1 Name:	Operator 2 Name:
Requirements	• The UNI Maximum Frame Service Size **MUST** be at least 1522 bytes • The EVC Maximum Frame Service Size **MUST** be at least 1522 bytes • The ENNI MTU Size **MUST** be at least 1526 bytes • The OVC MTU Size **MUST** be at least 1526 bytes	
References	EIP Use Case 1 – Service Attribute Values and Ranges	
Test Purpose	Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports Service and ENNI maximum frame sizes of at least 1522 bytes and 1526 bytes respectively	
Step 1	Operator 1 – OVC Verification [UNI U1 to ENNI E1]	
Test Bed and Service Mapping Step 1		

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td></td><td><table><tr><td colspan="2">UNI U1</td></tr><tr><td>1, 2…4095*</td><td>OVC End Point</td></tr><tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr><tr><td colspan="2">ENNI E1</td></tr><tr><td>100</td><td>OVC End Point</td></tr></table></td></tr>
<tr><td rowspan="4">Test Procedure Step 1</td><td>1.1</td><td>Tester T1 transmits C-tagged frames of 1522 bytes to the Operator 1 UNI U1</td></tr>
<tr><td>1.2</td><td>Tester T2 verifies that all the transmitted frames are received at the Operator 1 ENNI E1, encapsulated in the outer tag mapped at the ENNI E1</td></tr>
<tr><td>1.3</td><td>Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E1, of size 1526 bytes to the Operator 1 ENNI E1</td></tr>
<tr><td>1.4</td><td>Tester T1 verifies that all the transmitted frames are received at the Operator 1 UNI U1 without the outer tag</td></tr>
<tr><td>Step 2</td><td colspan="2">Operator 2 – OVC Verification [UNI U2 to ENNI E2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 2</td><td colspan="2">

<table><tr><td colspan="2">UNI U2</td></tr><tr><td>1, 2…4095*</td><td>OVC End Point</td></tr><tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr><tr><td colspan="2">ENNI E2</td></tr><tr><td>100</td><td>OVC End Point</td></tr></table></td></tr>
<tr><td rowspan="4">Test Procedure Step 2</td><td>2.1</td><td>Tester T3 transmits C-tagged frames of 1522 bytes to the Operator 2 UNI U2</td></tr>
<tr><td>2.2</td><td>Tester T2 verifies that all the transmitted frames are received at the Operator 2 ENNI E2, encapsulated in the outer tag mapped at the ENNI E2</td></tr>
<tr><td>2.3</td><td>Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E2, of size 1526 bytes to the Operator 2 ENNI E2</td></tr>
<tr><td>2.4</td><td>Tester T3 verifies that all the transmitted frames are received at the Operator 2 UNI U2 without the outer tag</td></tr>
</table>

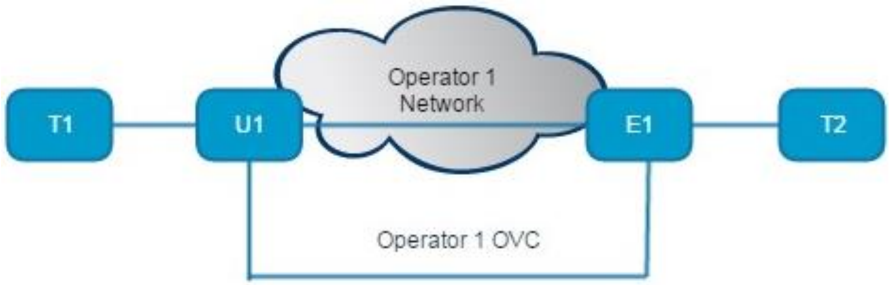
© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

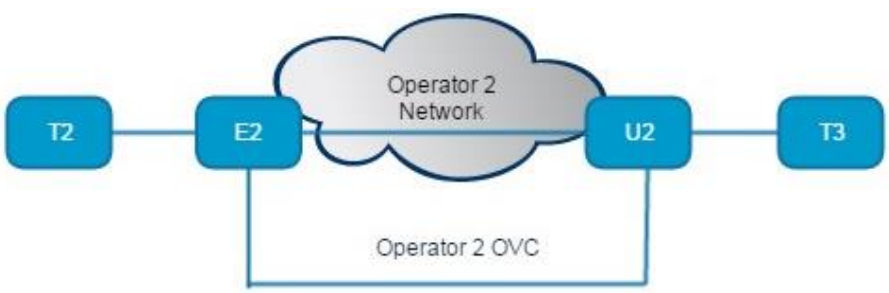
<table>
<tr><td>Step 3</td><td colspan="2">Service Provider EVC [UNI U1 to UNI U2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 3</td><td colspan="2">

<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
</table></td></tr>
<tr><td rowspan="5">Test Procedure Step 3</td><td>3.1</td><td>Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly</td></tr>
<tr><td>3.2</td><td>Tester T1 transmits C-tagged frames of 1522 bytes to the Operator 1 UNI U1</td></tr>
<tr><td>3.3</td><td>Tester T3 verifies that all the transmitted frames are received at the Operator 2 UNI U2</td></tr>
<tr><td>3.4</td><td>Tester T3 transmits C-tagged frames of 1522 bytes to the Operator 2 UNI U2</td></tr>
<tr><td>3.5</td><td>Tester T1 verifies that all the transmitted frames are received at the Operator 1 UNI U1</td></tr>
<tr><td>Test Result</td><td colspan="2">Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports Service and ENNI maximum frame sizes of at least 1522 bytes and 1526 bytes respectively as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5</td></tr>
<tr><td>Test Traffic and Frame Size</td><td colspan="2">• At the UNI: 10 x 1522-byte unicast C-tagged frames
• At the ENNI: 10 x 1526-byte unicast C-tagged frames encapsulated in the outer tag mapped at the ENNI</td></tr>
<tr><td>Comment</td><td colspan="2">Any nonconformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 will be clearly identified and described in the test report</td></tr>
</table>

<table>
<tr><td colspan="3">Test Case 6 – Service and ENNI Maximum Frame Size – Maximum Supported Value</td></tr>
<tr><td>Interconnection Partners</td><td>Operator 1 Name:</td><td>Operator 2 Name:</td></tr>
<tr><td>Requirements</td><td colspan="2">• The UNI Maximum Frame Service Size MUST be at least 1522 bytes
• The EVC Maximum Frame Service Size MUST be at least 1522 bytes
• The ENNI MTU Size MUST be at least 1526 bytes
• The OVC MTU Size MUST be at least 1526 bytes</td></tr>
<tr><td>References</td><td colspan="2">EIP Use Case 1 – Service Attribute Values and Ranges</td></tr>
<tr><td>Test Purpose</td><td colspan="2">Verify the maximum Service and ENNI Maximum Frame Size values supported by the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td>Step 1</td><td colspan="2">Operator 1 – OVC Verification [UNI U1 to ENNI E1]</td></tr>
<tr><td>Test Bed and Service Mapping Step 1</td><td colspan="2">

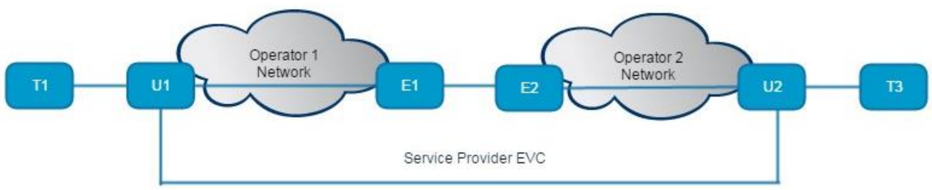
<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">ENNI E1</td></tr>
<tr><td>100</td><td>OVC End Point</td></tr>
</table></td></tr>
<tr><td>Test Procedure Step 1</td><td>1.1</td><td>Operator 1 configures the Maximum Frame Size at the UNI U1 and ENNI E1 equal to the maximum supported values</td></tr>
<tr><td></td><td>1.2</td><td>Tester T1 transmits C-tagged frames of size equal to the configured UNI Maximum Service Frame Size to the Operator 1 UNI U1</td></tr>
<tr><td></td><td>1.3</td><td>Tester T2 verifies that all the transmitted frames are received at the Operator 1 ENNI E1, encapsulated in the outer tag mapped at the ENNI E1</td></tr>
<tr><td></td><td>1.4</td><td>Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E1, of size equal to the configured Maximum ENNI Frame Size to the Operator 1 ENNI E1</td></tr>
<tr><td></td><td>1.5</td><td>Tester T1 verifies that all of the transmitted frames are received at the Operator 1 UNI U1, without the outer tag</td></tr>
<tr><td>Step 2</td><td colspan="2">Operator 2 – OVC Verification [UNI U2 to ENNI E2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 2</td><td colspan="2">

<table>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
</table></td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

	ENNI E2	
	100	OVC End Point
Test Procedure Step 2	2.1	Operator 2 configures the Maximum Frame Size at the UNI U2 and ENNI E2 equal to the maximum supported values
	2.2	Tester T3 transmits C-tagged frames of size equal to the configured UNI Maximum Service Frame Size to the Operator 2 UNI U2
	2.3	Tester T2 verifies that all the transmitted frames are received at the Operator 2 ENNI E2, encapsulated in the outer tag mapped at the ENNI E2
	2.4	Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E2, of size equal to the configured Maximum ENNI Frame Size to the Operator 2 ENNI E2
	2.5	Tester T3 verifies that all of the transmitted frames are received at the Operator 2 UNI U2, without the outer tag
Step 3	Service Provider EVC [UNI U1 to UNI U2]	

Test Bed and Service Mapping Step 3



UNI U1	
1, 2…4095*	EVC
* Mapping at the UNI U1 includes untagged and priority tagged frames	

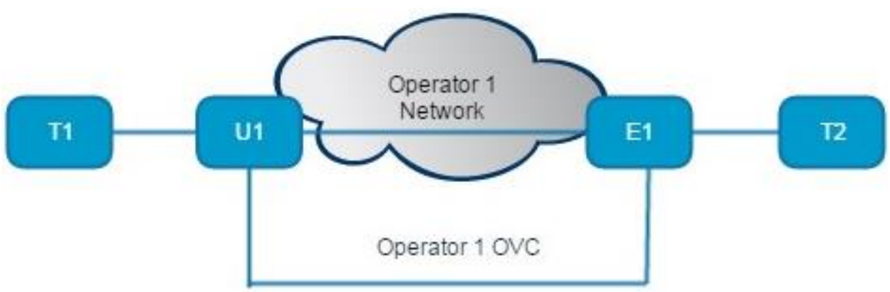
UNI U2	
1, 2…4095*	EVC
* Mapping at the UNI U2 includes untagged and priority tagged frames	

Test Procedure Step 3	3.1	Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly
	3.2	Tester T1 transmits C-tagged frames of size equal to the configured UNI Maximum Service Frame Size to the Operator 1 UNI U1
	3.3	Tester T3 verifies that all of the transmitted frames are received at the Operator 2 UNI U2
	3.4	Tester T3 transmits C-tagged frames of size equal to the configured UNI Maximum Service Frame Size to the Operator 2 UNI U2
	3.5	Tester T1 verifies that all of the transmitted frames are received at the Operator 1 UNI U1
Test Result	Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports the maximum Service and ENNI maximum frame size as verified in steps 1.3, 1.5, 2.3, 2.5, 3.3, and 3.5	
Test Traffic and Frame Size	• At the UNI: 10 unicast C-tagged frames of each size specified in the test procedure • At the ENNI: 10 unicast C-tagged frames encapsulated in the outer tag mapped at the ENNI of each size specified in the test procedure	

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Comment	Any nonconformance observed in either step 1.3, 1.5, 2.3, 2.5, 3.3, or 3.5 will be clearly identified and described in the test report

Test Case 7 – Service and ENNI Frames Exceeding the Maximum Size Allowed for the Service

Interconnection Partners	Operator 1 Name:	Operator 2 Name:
Requirements	• When an ENNI Frame or a Service Frame is larger than the OVC MTU Size of the OVC associating the OVC End Point to which it is mapped, the receiving Operator for this frame **MUST** discard it, and the operation of a Bandwidth Profile, if any, that applies to this frame is not defined • An ingress Tagged Service Frame that is mapped to the EVC and whose length exceeds the EVC Maximum Service Frame Size **SHOULD** be discarded • An ingress Untagged Service Frame that is mapped to the EVC and whose length exceeds the EVC Maximum Service Frame Size minus 4 **SHOULD** be discarded	
References	EIP Use Case 1 – Service Attribute Values and Ranges	
Test Purpose	Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 discards frames whose length exceed the configured Maximum Frame Size at the UNI and/or at the ENNI	
Step 1	Operator 1 – OVC Verification [UNI U1 to ENNI E1]	
Test Bed and Service Mapping Step 1		

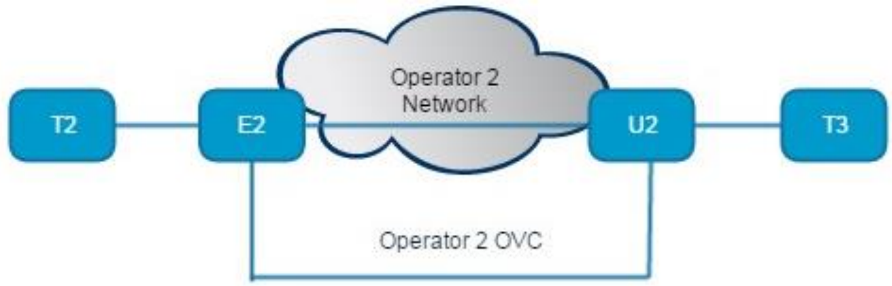
UNI U1	
1, 2…4095*	OVC End Point
* Mapping at the UNI U1 includes untagged and priority tagged frames	
ENNI E1	
100	OVC End Point

Test Procedure Step 1	1.1	Operator 1 configures the Maximum Frame Size at UNI U1 and ENNI E1
	1.2	Tester T1 transmits C-tagged frames whose size exceed the configured UNI Maximum Service Frame Size, to the Operator 1 UNI U1
	1.3	Tester T2 verifies that none the transmitted frames are received at the Operator 1 ENNI E1
	1.4	Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E1, whose size exceed the configured Maximum ENNI Frame Size, to the Operator 1 ENNI E1
	1.5	Tester T1 verifies that none of the transmitted frames are received at the Operator 1 UNI U1

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Step 2	Operator 2 – OVC Verification [UNI U2 to ENNI E2]

Test Bed and Service Mapping Step 2

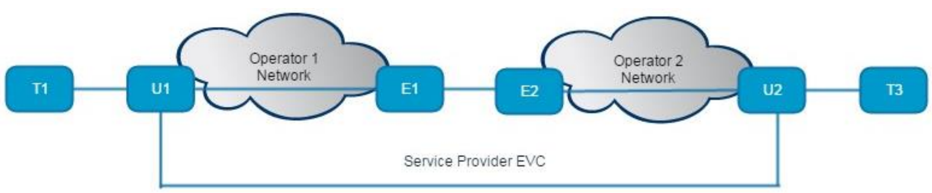


UNI U2	
1, 2…4095*	OVC End Point
* Mapping at the UNI U2 includes untagged and priority tagged frames	
ENNI E2	
100	OVC End Point

Test Procedure Step 2		
	2.1	Operator 2 configures the Maximum Frame Size at UNI U2 and ENNI E2
	2.2	Tester T3 transmits C-tagged frames whose size exceed the configured UNI Maximum Service Frame Size, to the Operator 2 UNI U2
	2.3	Tester T2 verifies that none the transmitted frames are received at the Operator 2 ENNI E2
	2.4	Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E2, whose size exceed the configured Maximum ENNI Frame Size, to the Operator 2 ENNI E2
	2.5	Tester T3 verifies that none of the transmitted frames are received at the Operator 2 UNI U2

Step 3	Service Provider EVC [UNI U1 to UNI U2]

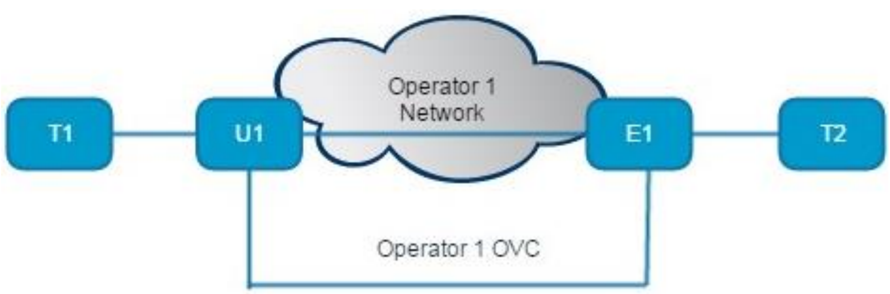
Test Bed and Service Mapping Step 3



UNI U1	
1, 2…4095*	EVC
* Mapping at the UNI U1 includes untagged and priority tagged frames	
UNI U2	
1, 2…4095*	EVC
* Mapping at the UNI U2 includes untagged and priority tagged frames	

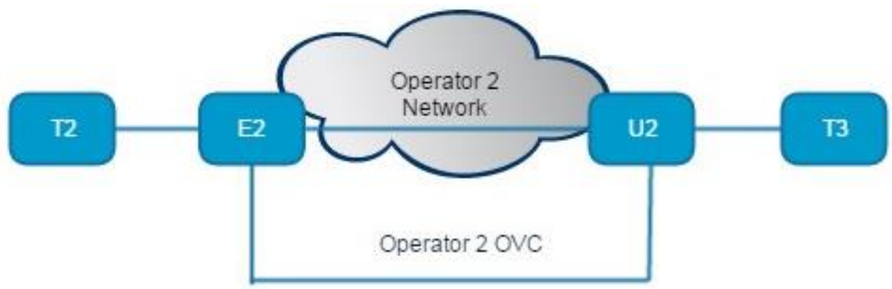
© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

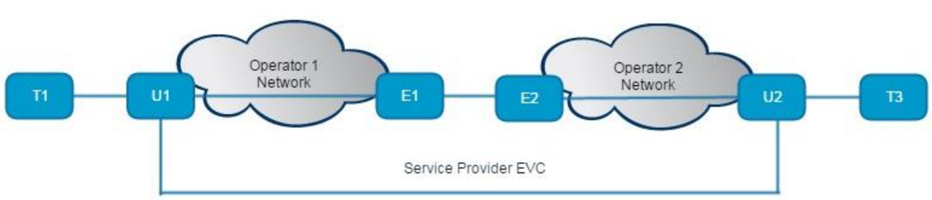
Test Procedure Step 3	3.1	Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly
	3.2	Tester T1 transmits C-tagged frames whose size exceed the configured UNI Maximum Service Frame Size, to the Operator 1 UNI U1
	3.3	Tester T3 verifies that none of the transmitted frames are received at the Operator 2 UNI U2
	3.4	Tester T3 transmits C-tagged frames whose size exceed the configured UNI Maximum Service Frame Size, to the Operator 2 UNI U2
	3.5	Tester T1 verifies that none the transmitted frames are received at the Operator 1 UNI U1
Test Result	Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 discards frames whose length exceed the configured Maximum Frame Size at the UNI and/or at the ENNI as verified in steps 1.3, 1.5, 2.3, 2.5, 3.3 and 3.5	
Test Traffic and Frame Size	• At the UNI: 10 unicast C-tagged frames of each size specified in the test procedure • At the ENNI: 10 unicast C-tagged frames encapsulated in the outer tag mapped at the ENNI of each size specified in the test procedure	
Comment	Any nonconformance observed in either step 1.3, 1.5, 2.3, 2.5, 3.3, or 3.5 will be clearly identified and described in the test report	

Test Case 8 – Service OAM Connectivity Check Messages (CCM) Transparency		
Interconnection Partners	Operator 1 Name:	Operator 2 Name:
Requirements	• Access EPL and EPL Services **MUST** be configurable to tunnel all SOAM frames at the default Test and Subscriber MEG levels as defined in MEF 30, section 7.1	
References	EIP Use Case 1 – Service Attribute Values and Ranges	
Test Purpose	Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 is configurable to tunnel CCM frames at MEG level 5 & 6	
Step 1	Operator 1 – OVC Verification [UNI U1 to ENNI E1]	
Test Bed and Service Mapping Step 1		

UNI U1	
1, 2…4095*	OVC End Point
* Mapping at the UNI U1 includes untagged and priority tagged frames	

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td></td><td colspan="2"><table><tr><th colspan="2">ENNI E1</th></tr><tr><td>100</td><td>OVC End Point</td></tr></table></td></tr>
<tr><td rowspan="4">Test Procedure Step 1</td><td>1.1</td><td>Tester T1 transmits untagged or C-tagged CCM frames at MEG level 5 & 6 to the Operator 1 UNI U1</td></tr>
<tr><td>1.2</td><td>Tester T2 verifies that all the transmitted CCM frames at MEG level 5 & 6 are received at the Operator 1 ENNI E1, encapsulated in the outer tag mapped at the ENNI E1</td></tr>
<tr><td>1.3</td><td>Tester T2 transmits untagged or C-tagged CCM frames at MEG level 5 & 6, encapsulated in the outer tag mapped at the ENNI E1, to the Operator 1 ENNI E1</td></tr>
<tr><td>1.4</td><td>Tester T1 verifies that all the transmitted CCM frames at MEG level 5 & 6 are received at the Operator 1 UNI U1, without the outer tag</td></tr>
<tr><td>Step 2</td><td colspan="2">Operator 2 – OVC Verification [UNI U2 to ENNI E2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 2</td><td colspan="2">

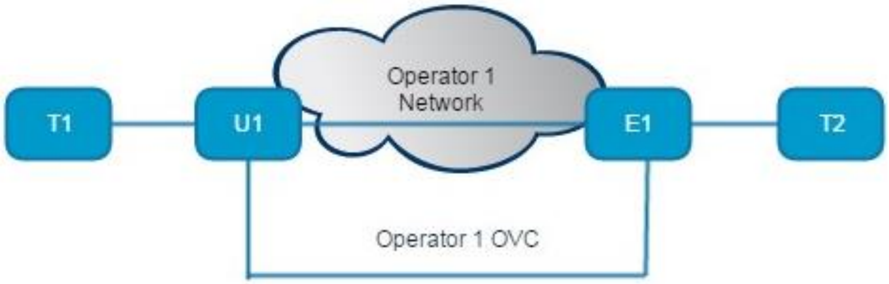
<table><tr><th colspan="2">UNI U2</th></tr><tr><td>1, 2…4095*</td><td>OVC End Point</td></tr><tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr><tr><th colspan="2">ENNI E2</th></tr><tr><td>100</td><td>OVC End Point</td></tr></table></td></tr>
<tr><td rowspan="4">Test Procedure Step 2</td><td>2.1</td><td>Tester T3 transmits untagged or C-tagged CCM frames at MEG level 5 & 6 to the Operator 2 UNI U2</td></tr>
<tr><td>2.2</td><td>Tester T2 verifies that all the transmitted CCM frames at MEG level 5 & 6 are received at the Operator 2 ENNI E2, encapsulated in the outer tag mapped at the ENNI E2</td></tr>
<tr><td>2.3</td><td>Tester T2 transmits untagged C-tagged CCM frames at MEG level 5 & 6, encapsulated in the outer tag mapped at the ENNI E2, to the Operator 2 ENNI E2</td></tr>
<tr><td>2.4</td><td>Tester T3 verifies that all the transmitted CCM frames at MEG level 5 & 6 are received at the Operator 2 UNI U2, without the outer tag</td></tr>
<tr><td>Step 3</td><td colspan="2">Service Provider EVC [UNI U1 to UNI U2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 3</td><td colspan="2">
</td></tr>
</table>

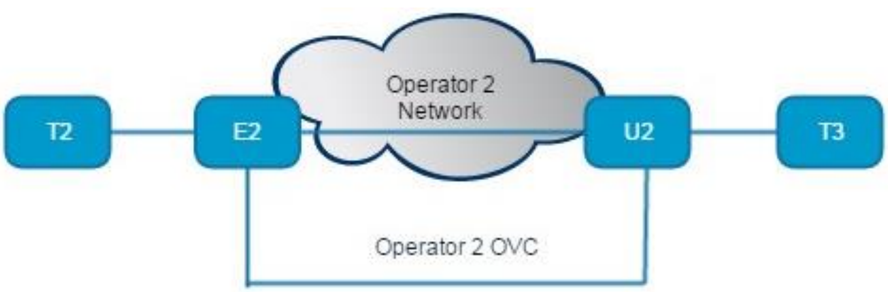
© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td></td><td><table><tr><td colspan="2">UNI U1</td></tr><tr><td>1, 2…4095*</td><td>EVC</td></tr><tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr><tr><td colspan="2">UNI U2</td></tr><tr><td>1, 2…4095*</td><td>EVC</td></tr><tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr></table></td></tr>
<tr><td>Test Procedure Step 3</td><td><table><tr><td>3.1</td><td>Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly</td></tr><tr><td>3.2</td><td>Tester T1 transmits untagged or C-tagged CCM frames at MEG level 5 & 6 to the Operator 1 UNI U1</td></tr><tr><td>3.3</td><td>Tester T3 verifies that all the transmitted CCM frames at MEG level 5 & 6 are received at the Operator 2 UNI U2</td></tr><tr><td>3.4</td><td>Tester T3 transmits untagged or C-tagged CCM frames at MEG level 5 & 6 to the Operator 2 UNI U2</td></tr><tr><td>3.5</td><td>Tester T1 verifies that all the transmitted CCM frames at MEG level 5 & 6 are received at the Operator 1 UNI U1</td></tr></table></td></tr>
<tr><td>Test Result</td><td>Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 is configurable to tunnel CCM frames at MEG level 5 & 6 as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5</td></tr>
<tr><td>Test Traffic and Frame Size</td><td>• At the UNI: 10 untagged or C-tagged CCM frames of each MEG level (untagged frames are preferred)
• At the ENNI: 10 untagged or C-tagged CCM frames of each MEG level encapsulated in the outer tag mapped at the ENNI (untagged frames are preferred)</td></tr>
<tr><td>Comment</td><td>Any nonconformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 will be clearly identified and described in the test report</td></tr>
</table>

<table>
<tr><th colspan="3">Test Case 9 – Service OAM Multicast Loopback Messages (LBM) Transparency</th></tr>
<tr><td>Interconnection Partners</td><td>Operator 1 Name:</td><td>Operator 2 Name:</td></tr>
<tr><td>Requirements</td><td colspan="2">• Access EPL and EPL Services MUST be configurable to tunnel all SOAM frames at the default Test and Subscriber MEG levels as defined in MEF 30, section 7.1</td></tr>
<tr><td>References</td><td colspan="2">EIP Use Case 1 – Service Attribute Values and Ranges</td></tr>
<tr><td>Test Purpose</td><td colspan="2">Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 is configurable to tunnel multicast LBM frames at MEG level 5 & 6</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

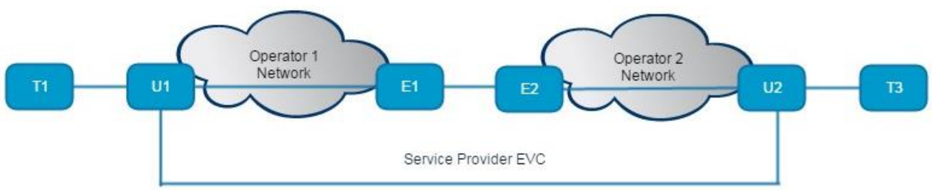
<table>
<tr><td>Step 1</td><td colspan="2">Operator 1 – OVC Verification [UNI U1 to ENNI E1]</td></tr>
<tr><td>Test Bed and Service Mapping Step 1</td><td colspan="2">


<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">ENNI E1</td></tr>
<tr><td>100</td><td>OVC End Point</td></tr>
</table>
</td></tr>
<tr><td rowspan="4">Test Procedure Step 1</td><td>1.1</td><td>Tester T1 transmits untagged or C-tagged multicast LBM frames at MEG level 5 & 6 to the Operator 1 UNI U1</td></tr>
<tr><td>1.2</td><td>Tester T2 verifies that all the transmitted multicast LBM frames at MEG level 5 & 6 are received at the Operator 1 ENNI E1, encapsulated in the outer tag mapped at the ENNI E1</td></tr>
<tr><td>1.3</td><td>Tester T2 transmits untagged or C-tagged multicast LBM messages at MEG level 5 & 6, encapsulated in the outer tag mapped at the ENNI E1, to the Operator 1 ENNI E1</td></tr>
<tr><td>1.4</td><td>Tester T1 verifies that all the transmitted multicast LBM frames at MEG level 5 & 6 are received at the Operator 1 UNI U1, without the outer tag</td></tr>
<tr><td>Step 2</td><td colspan="2">Operator 2 – OVC Verification [UNI U2 to ENNI E2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 2</td><td colspan="2">


<table>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">ENNI E2</td></tr>
<tr><td>100</td><td>OVC End Point</td></tr>
</table>
</td></tr>
</table>

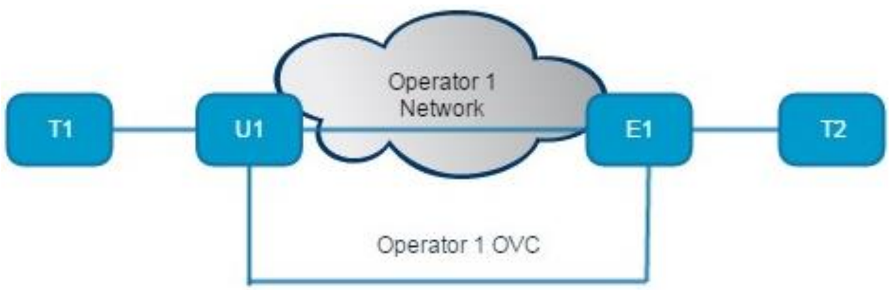
© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td rowspan="4">Test Procedure Step 2</td><td>2.1</td><td>Tester T3 transmits untagged or C-tagged multicast LBM frames at MEG level 5 & 6 to the Operator 2 UNI U2</td></tr>
<tr><td>2.2</td><td>Tester T2 verifies that all the transmitted multicast LBM frames at MEG level 5 & 6 are received at the Operator 2 ENNI E2, encapsulated in the outer tag mapped at the ENNI E2</td></tr>
<tr><td>2.3</td><td>Tester T2 transmits untagged or C-tagged multicast LBM frames at MEG level 5 & 6, encapsulated in the outer tag mapped at the ENNI E2, to the Operator 2 ENNI E2</td></tr>
<tr><td>2.4</td><td>Tester T3 verifies that all the transmitted multicast LBM frames at MEG level 5 & 6 are received at the Operator 2 UNI U2, without the outer tag</td></tr>
<tr><td>Step 3</td><td colspan="2">Service Provider EVC [UNI U1 to UNI U2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 3</td><td colspan="2">



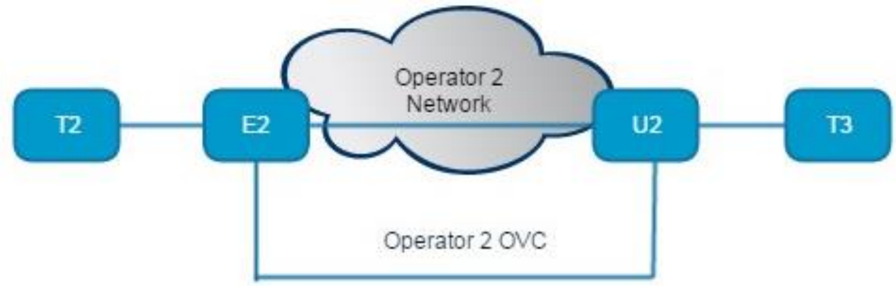
<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
</table>
</td></tr>
<tr><td rowspan="5">Test Procedure Step 3</td><td>3.1</td><td>Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly</td></tr>
<tr><td>3.2</td><td>Tester T1 transmits untagged or C-tagged multicast LBM frames at MEG level 5 & 6 to the Operator 1 UNI U1</td></tr>
<tr><td>3.3</td><td>Tester T3 verifies that all the transmitted multicast LBM frames at MEG level 5 & 6 are received at the Operator 2 UNI U2</td></tr>
<tr><td>3.4</td><td>Tester T3 transmits untagged or C-tagged multicast LBM frames at MEG level 5 & 6 to the Operator 2 UNI U2</td></tr>
<tr><td>3.5</td><td>Tester T1 verifies that all the transmitted multicast LBM frames at MEG level 5 & 6 are received at the Operator 1 UNI U1</td></tr>
<tr><td>Test Result</td><td colspan="2">Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 is configurable to tunnel multicast LBM frames at MEG level 5 & 6 as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5</td></tr>
<tr><td>Test Traffic and Frame Size</td><td colspan="2">• At the UNI: 10 untagged or C-tagged multicast LBM frames of each MEG level (untagged frames are preferred)
• At the ENNI: 10 untagged or C-tagged multicast LBM frames of each MEG level encapsulated in the outer tag mapped at the ENNI (untagged frames are preferred)</td></tr>
<tr><td>Comment</td><td colspan="2">Any nonconformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 will be clearly identified and described in the test report</td></tr>
</table>

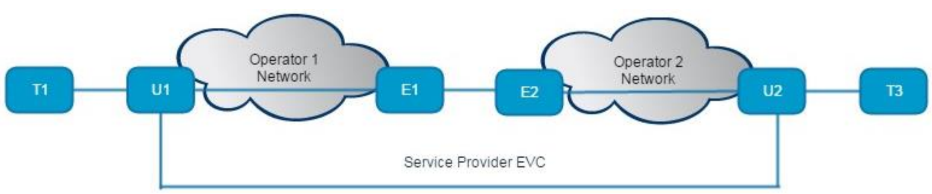
© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><th colspan="3">Test Case 10 – Service OAM Unicast Loopback Messages (LBM/LBR) Transparency</th></tr>
<tr><td>Interconnection Partners</td><td>Operator 1 Name:</td><td>Operator 2 Name:</td></tr>
<tr><td>Requirements</td><td colspan="2">Access EPL and EPL Services MUST be configurable to tunnel all SOAM frames at the default Test and Subscriber MEG levels as defined in MEF 30, section 7.1</td></tr>
<tr><td>References</td><td colspan="2">EIP Use Case 1 – Service Attribute Values and Ranges</td></tr>
<tr><td>Test Purpose</td><td colspan="2">Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 is configurable to tunnel unicast LBM and LBR frames at MEG level 5 & 6</td></tr>
<tr><td>Step 1</td><td colspan="2">Operator 1 – OVC Verification [UNI U1 to ENNI E1]</td></tr>
<tr><td>Test Bed and Service Mapping Step 1</td><td colspan="2">

<table>
<tr><th colspan="2">UNI U1</th></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><th colspan="2">ENNI E1</th></tr>
<tr><td>100</td><td>OVC End Point</td></tr>
</table></td></tr>
<tr><td rowspan="4">Test Procedure Step 1</td><td>1.1</td><td>Tester T1 transmits untagged or C-tagged unicast LBM and LBR frames at MEG level 5 & 6 to the Operator 1 UNI U1</td></tr>
<tr><td>1.2</td><td>Tester T2 verifies that all the transmitted unicast LBM and LBR frames at MEG level 5 & 6 are received at the Operator 1 ENNI E1, encapsulated in the outer tag mapped at the ENNI E1</td></tr>
<tr><td>1.3</td><td>Tester T2 transmits untagged or C-tagged unicast LBM and LBR frames at MEG level 5 & 6, encapsulated in the outer tag mapped at the ENNI E1, to the Operator 1 ENNI E1</td></tr>
<tr><td>1.4</td><td>Tester T1 verifies that all the transmitted unicast LBM and unicast LBR frames at MEG Level 5 & 6 are received at the Operator 1 UNI U1, without the outer tag</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

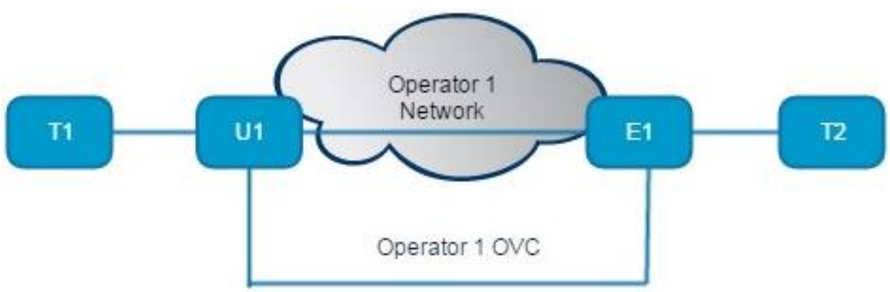
<table>
<tr><td>Step 2</td><td colspan="2">Operator 2 – OVC Verification [UNI U2 to ENNI E2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 2</td><td colspan="2">


<table>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">ENNI E2</td></tr>
<tr><td>100</td><td>OVC End Point</td></tr>
</table>
</td></tr>
<tr><td rowspan="4">Test Procedure Step 2</td><td>2.1</td><td>Tester T3 transmits untagged or C-tagged unicast LBM and LBR frames at MEG level 5 & 6 to the Operator 2 UNI U2</td></tr>
<tr><td>2.2</td><td>Tester T2 verifies that all the transmitted unicast LBM and LBR frames at MEG level 5 & 6 are received at the Operator 2 ENNI E2, encapsulated in the outer tag mapped at the ENNI E2</td></tr>
<tr><td>2.3</td><td>Tester T2 transmits untagged or C-tagged unicast LBM and LBR frames at MEG level 5 & 6, encapsulated in the outer tag mapped at the ENNI E2, to the Operator 2 ENNI E2</td></tr>
<tr><td>2.4</td><td>Tester T3 verifies that all the transmitted unicast LBM and LBR frames at MEG level 5 & 6 are received at the Operator 2 UNI U2, without the outer tag</td></tr>
<tr><td>Step 3</td><td colspan="2">Service Provider EVC [UNI U1 to UNI U2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 3</td><td colspan="2">


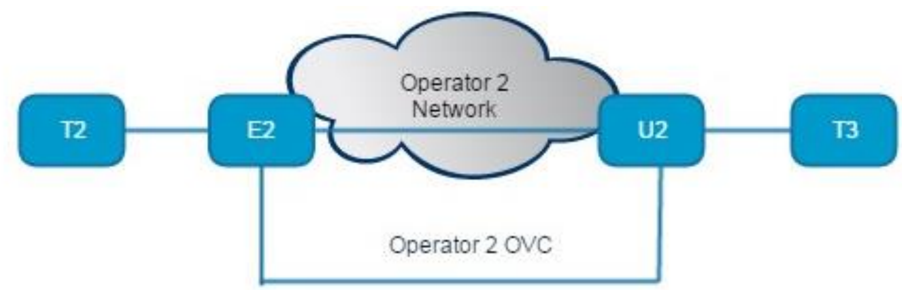
<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
</table>
</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Test Procedure Step 3	3.1	Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly
	3.2	Tester T1 transmits untagged or C-tagged unicast LBM and LBR frames at MEG level 5 & 6 to the Operator 1 UNI U1
	3.3	Tester T3 verifies that all the transmitted unicast LBM and LBR frames at MEG level 5 & 6 are received at the Operator 2 UNI U2
	3.4	Tester T3 transmits untagged or C-tagged unicast LBM and LBR frames at MEG level 5 & 6 to the Operator 2 UNI U2
	3.5	Tester T1 verifies that all the transmitted unicast LBM and LBR frames at MEG level 5 & 6 are received at the Operator 1 UNI U1
Test Result	Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 is configurable to tunnel unicast LBM and LBR frames at MEG level 5 & 6 as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5	
Test Traffic and Frame Size	• At the UNI: 10 untagged or C-tagged unicast LBM frames of each MEG level and 10 untagged or C-tagged unicast LBR frames of each MEG level (untagged frames are preferred) • At the ENNI: 10 untagged or C-tagged unicast LBM frames of each MEG level encapsulated in the outer tag mapped at the ENNI and 10 untagged or C-tagged unicast LBR frames of each MEG level encapsulated in the outer tag mapped at the ENNI (untagged frames are preferred)	
Comment	Any nonconformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 will be clearly identified and described in the test report	

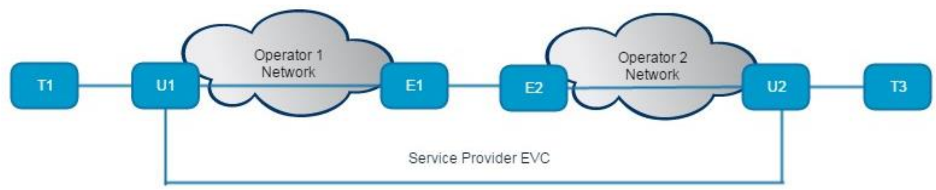
Test Case 11 – Service OAM LinkTrace Messages (LTM/LTR) Transparency		
Interconnection Partners	Operator 1 Name:	Operator 2 Name:
Requirements	• Access EPL and EPL Services **MUST** be configurable to tunnel all SOAM frames at the default Test and Subscriber MEG levels as defined in MEF 30, section 7.1	
References	EIP Use Case 1 – Service Attribute Values and Ranges	
Test Purpose	Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 is configurable to tunnel unicast LTM and LTR frames at MEG level 5 & 6	
Step 1	Operator 1 – OVC Verification [UNI U1 to ENNI E1]	
Test Bed and Service Mapping Step 1		

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td></td><td colspan="2">
<table>
<tr><th colspan="2">UNI U1</th></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><th colspan="2">ENNI E1</th></tr>
<tr><td>100</td><td>OVC End Point</td></tr>
</table>
</td></tr>
<tr><td rowspan="4">Test Procedure Step 1</td><td>1.1</td><td>Tester T1 transmits untagged or C-tagged LTM and LTR frames at MEG level 5 & 6 to the Operator 1 UNI U1</td></tr>
<tr><td>1.2</td><td>Tester T2 verifies that all the transmitted LTM and LTR frames at MEG level 5 & 6 are received at the Operator 1 ENNI E1, encapsulated in the outer tag mapped at the ENNI E1</td></tr>
<tr><td>1.3</td><td>Tester T2 transmits untagged or C-tagged LTM and LTR messages at MEG level 5 & 6, encapsulated in the outer tag mapped at the ENNI E1 to the Operator 1 ENNI E1</td></tr>
<tr><td>1.4</td><td>Tester T1 verifies that all the transmitted LTM and LTR frames at MEG level 5 & 6 are received at the Operator 1 UNI U1</td></tr>
<tr><td>Step 2</td><td colspan="2">Operator 2 – OVC Verification [UNI U2 to ENNI E2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 2</td><td colspan="2">


<table>
<tr><th colspan="2">UNI U2</th></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
<tr><th colspan="2">ENNI E2</th></tr>
<tr><td>100</td><td>OVC End Point</td></tr>
</table>
</td></tr>
<tr><td rowspan="4">Test Procedure Step 2</td><td>2.1</td><td>Tester T3 transmits untagged or C-tagged LTM and LTR frames at MEG level 5 & 6 to the Operator 2 UNI U2</td></tr>
<tr><td>2.2</td><td>Tester T2 verifies that all the transmitted LTM and LTR frames at MEG level 5 & 6 are received at the Operator 2 ENNI E2, encapsulated in the outer tag mapped at the ENNI E2</td></tr>
<tr><td>2.3</td><td>Tester T2 transmits untagged or C-tagged LTM and LTR frames at MEG level 5 & 6, encapsulated in the outer tag mapped at the ENNI E2, to the Operator 2 ENNI E2</td></tr>
<tr><td>2.4</td><td>Tester T3 verifies that all the transmitted LTM and LTR frames at MEG level 5 & 6 are received at the Operator 2 UNI U2 without the outer tag</td></tr>
</table>

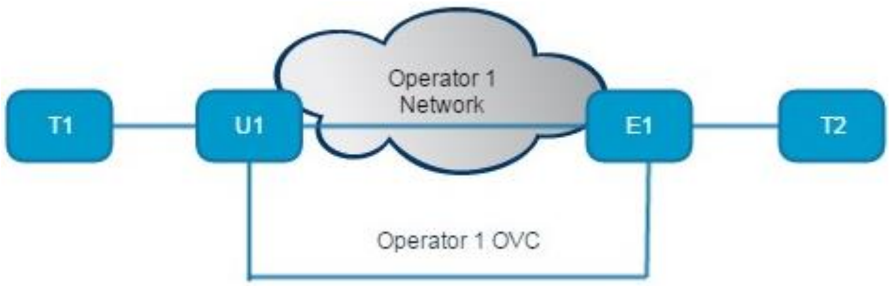
© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

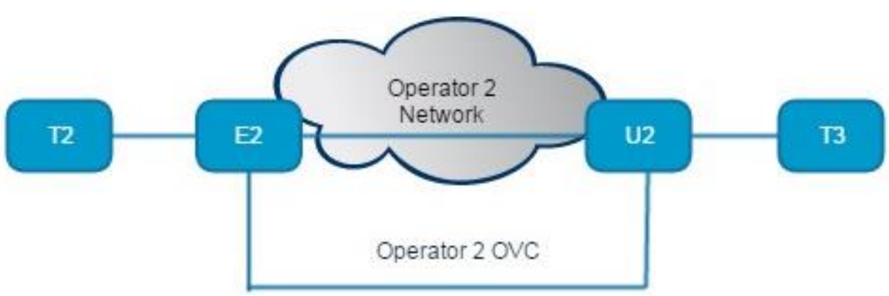
<table>
<tr><td>Step 3</td><td colspan="2">Service Provider EVC [UNI U1 to UNI U2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 3</td><td colspan="2">

<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
</table></td></tr>
<tr><td rowspan="5">Test Procedure Step 3</td><td>3.1</td><td>Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly</td></tr>
<tr><td>3.2</td><td>Tester T1 transmits untagged or C-tagged LTM and LTR frames at MEG level 5 & 6 to the Operator 1 UNI U1</td></tr>
<tr><td>3.3</td><td>Tester T3 verifies that all the transmitted LTM and LTR frames at MEG level 5 & 6 are received at the Operator 2 UNI U2</td></tr>
<tr><td>3.4</td><td>Tester T3 transmits untagged or C-tagged LTM and LTR frames at MEG level 5 & 6 to the Operator 2 UNI U2</td></tr>
<tr><td>3.5</td><td>Tester T1 verifies that all the transmitted LTM and LTR frames at MEG level 5 & 6 are received at the Operator 1 UNI U1</td></tr>
<tr><td>Test Result</td><td colspan="2">Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 is configurable to tunnel LTM and LTR frames at MEG level 5 & 6 as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5</td></tr>
<tr><td>Test Traffic and Frame Size</td><td colspan="2">At the UNI: 10 untagged or C-tagged LTM frames of each MEG level and 10 untagged or C-tagged LTR frames of each MEG level (untagged frames are preferred)
At the ENNI: 10 untagged or C-tagged LTM frames of each MEG level encapsulated in the outer tag mapped at the ENNI and 10 untagged or C-tagged LTR frames of each MEG level encapsulated in the outer tag mapped at the ENNI (untagged frames are preferred)</td></tr>
<tr><td>Comment</td><td colspan="2">Any nonconformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 will be clearly identified and described in the test report</td></tr>
</table>

<table>
<tr><td colspan="3">Test Case 12 – L2CP Handling – Option 1</td></tr>
<tr><td>Interconnection Partners</td><td>Operator 1 Name:</td><td>Operator 2 Name:</td></tr>
<tr><td>Requirements</td><td colspan="2">Support of MEF 45 EPL Option 1</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td>References</td><td colspan="2">EIP Use Case 1 – Service Attribute Values and Ranges</td></tr>
<tr><td>Test Purpose</td><td colspan="2">Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports MEF 45 EPL Option 1 requirements</td></tr>
<tr><td>Step 1</td><td colspan="2">Operator 1 – OVC Verification [UNI U1 to ENNI E1]</td></tr>
<tr><td>Test Bed and Service Mapping Step 1</td><td colspan="2">

<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">ENNI E1</td></tr>
<tr><td>100</td><td>OVC End Point</td></tr>
</table></td></tr>
<tr><td rowspan="5">Test Procedure Step 1</td><td>1.1</td><td>Configure the Operator 1 OVC service to support MEF 45 EPL Option 1</td></tr>
<tr><td>1.2</td><td>Tester T1 transmits untagged frames of each Layer 2 Control Protocol defined in MEF 45 to the Operator 1 UNI U1</td></tr>
<tr><td>1.3</td><td>For each Layer 2 Control Protocol, tester T2 verifies if the frames are either Filtered (not received at the Operator 1 ENNI E1) or Passed (received encapsulated in the outer tag mapped at the Operator 1 ENNI E1)</td></tr>
<tr><td>1.4</td><td>Tester T2 transmits untagged frames of each Layer 2 Control Protocol defined in MEF 45 encapsulated in the outer tag mapped at the ENNI E1 to the Operator 1 ENNI E1</td></tr>
<tr><td>1.5</td><td>For each Layer 2 Control Protocol, tester T1 verifies if the frames are either Filtered (not received at the Operator 1 UNI U1) or Passed (received without the outer tag at the Operator 1 UNI U1)</td></tr>
<tr><td>Step 2</td><td colspan="2">Operator 2 – OVC Verification [UNI U2 to ENNI E2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 2</td><td colspan="2">
</td></tr>
</table>

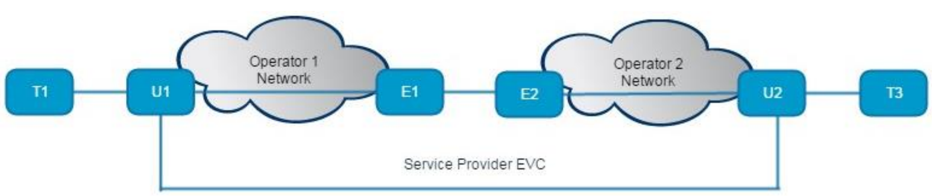
© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

UNI U2	
1, 2…4095*	OVC End Point
* Mapping at the UNI U2 includes untagged and priority tagged frames	
ENNI E2	
100	OVC End Point

Test Procedure Step 2	2.1	Configure the Operator 2 OVC service to support MEF 45 EPL Option 1
	2.2	Tester T3 transmits untagged frames of each Layer 2 Control Protocol defined in MEF 45 to the Operator 2 UNI U2
	2.3	For each Layer 2 Control Protocol, tester T2 verifies if the frames are either Filtered (not received at the Operator 2 ENNI E2) or Passed (received encapsulated in the outer tag mapped at the Operator 2 ENNI E2)
	2.4	Tester T2 transmits untagged frames of each Layer 2 Control Protocol defined in MEF 45 encapsulated in the outer tag mapped at the ENNI E2 to the Operator 2 ENNI E2
	2.5	For each Layer 2 Control Protocol, tester T3 verifies if the frames are either Filtered (not received at the Operator 2 UNI U2) or Passed (received without the outer tag at the Operator 2 UNI U2)

Step 3	Service Provider EVC [UNI U1 to UNI U2]

Test Bed and Service Mapping Step 3



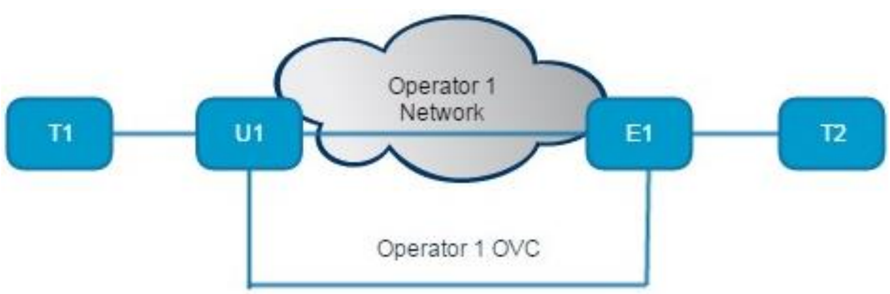
UNI U1	
1, 2…4095*	EVC
* Mapping at the UNI U1 includes untagged and priority tagged frames	
UNI U2	
1, 2…4095*	EVC
* Mapping at the UNI U2 includes untagged and priority tagged frames	

Test Procedure Step 3	3.1	Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly
	3.2	Configure the Service Provider EVC to support MEF 45 EPL Option 1
	3.3	Tester T1 transmits untagged frames of each Layer 2 Control Protocol defined in MEF 45 to the Operator 1 UNI U1
	3.4	For each Layer 2 Control Protocol, tester T3 verifies if the frames are either Filtered (not received at the Operator 2 UNI U2) or Passed (received at the Operator 2 UNI U2)

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

	3.5	Tester T3 transmits untagged frames of each Layer 2 Control Protocol defined in MEF 45 to the Operator 2 UNI U2
	3.5	For each Layer 2 Control Protocol, tester T1 verifies if the frames are either Filtered (not received at Operator 1 UNI U1) or Passed (received at the Operator 1 UNI U1)
Test Result	Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports MEF 45 EPL Option 1 requirements as verified in steps 1.3, 1.5, 2.3, 2.5, 3.4, and 3.6	
Test Traffic and Frame Size	• At the UNI: 10 untagged frames of each of each Layer 2 Control Protocol defined in MEF 45 • At the ENNI: 10 untagged of each Layer 2 Control Protocol defined in MEF 45 encapsulated in the outer tag mapped at the ENNI	
Comment	Any nonconformance observed in either step 1.3, 1.5, 2.3, 2.5, 3.4, or 3.6 will be clearly identified and described in the test report	

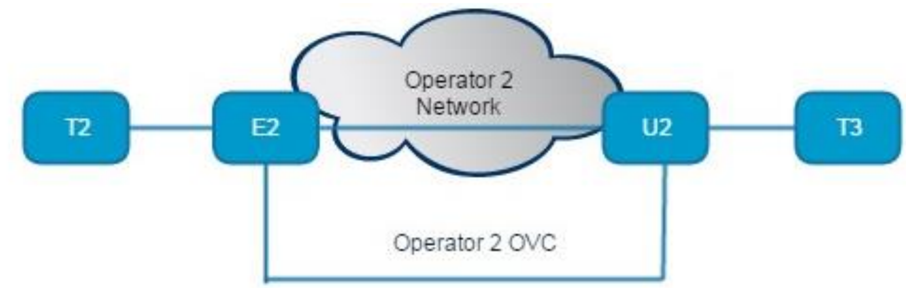
<table>
<tr><th colspan="3">Test Case 13 – L2CP Handling – Option 2</th></tr>
<tr><td>Interconnection Partners</td><td>Operator 1 Name:</td><td>Operator 2 Name:</td></tr>
<tr><td>Requirements</td><td colspan="2">• Support of MEF 45 EPL Option 2</td></tr>
<tr><td>References</td><td colspan="2">EIP Use Case 1 – Service Attribute Values and Ranges</td></tr>
<tr><td>Test Purpose</td><td colspan="2">Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports MEF 45 EPL Option 2 requirements</td></tr>
<tr><td>Step 1</td><td colspan="2">Operator 1 – OVC Verification [UNI U1 to ENNI E1]</td></tr>
<tr><td>Test Bed and Service Mapping Step 1</td><td colspan="2">



<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">ENNI E1</td></tr>
<tr><td>100</td><td>OVC End Point</td></tr>
</table>

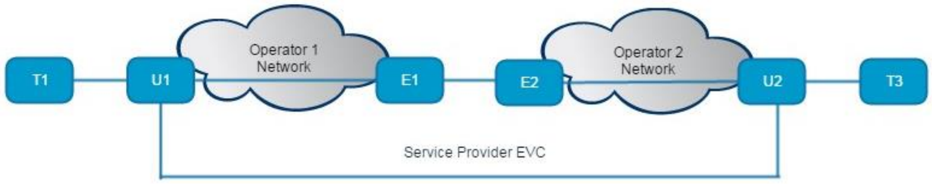
</td></tr>
<tr><td rowspan="2">Test Procedure Step 1</td><td>1.1</td><td>Configure the Operator 1 OVC service to support MEF 45 EPL Option 2</td></tr>
<tr><td>1.2</td><td>Tester T1 transmits untagged frames of each Layer 2 Control Protocol defined in MEF 45 to the Operator 1 UNI U1</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td></td><td>1.3</td><td>For each Layer 2 Control Protocol, tester T2 verifies if the frames are either Filtered (not received at the Operator 1 ENNI E1) or Passed (received encapsulated in the outer tag mapped at the Operator 1 ENNI E1)</td></tr>
<tr><td></td><td>1.4</td><td>Tester T2 transmits untagged frames of each Layer 2 Control Protocol defined in MEF 45 encapsulated in the outer tag mapped at the ENNI E1 to the Operator 1 ENNI E1</td></tr>
<tr><td></td><td>1.5</td><td>For each Layer 2 Control Protocol, tester T1 verifies if the frames are either Filtered (not received at the Operator 1 UNI U1) or Passed (received without the outer tag at the Operator 1 UNI U1)</td></tr>
<tr><td>Step 2</td><td colspan="2">Operator 2 – OVC Verification [UNI U2 to ENNI E2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 2</td><td colspan="2">

<table>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">ENNI E2</td></tr>
<tr><td>100</td><td>OVC End Point</td></tr>
</table></td></tr>
<tr><td>Test Procedure Step 2</td><td>2.1</td><td>Configure the Operator 2 OVC service to support MEF 45 EPL Option 2</td></tr>
<tr><td></td><td>2.2</td><td>Tester T3 transmits untagged frames of each Layer 2 Control Protocol defined in MEF 45 to the Operator 2 UNI U2</td></tr>
<tr><td></td><td>2.3</td><td>For each Layer 2 Control Protocol, tester T2 verifies if the frames are either Filtered (not received at the Operator 2 ENNI E2) or Passed (received encapsulated in the outer tag mapped at the Operator 2 ENNI E2)</td></tr>
<tr><td></td><td>2.4</td><td>Tester T2 transmits untagged frames of each Layer 2 Control Protocol defined in MEF 45 encapsulated in the outer tag mapped at the ENNI E2 to the Operator 2 ENNI E2</td></tr>
<tr><td></td><td>2.5</td><td>For each Layer 2 Control Protocol, tester T3 verifies if the frames are either Filtered (not received at the Operator 2 UNI U2) or Passed (received without the outer tag at the Operator 2 UNI U2)</td></tr>
<tr><td>Step 3</td><td colspan="2">Service Provider EVC [UNI U1 to UNI U2]</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

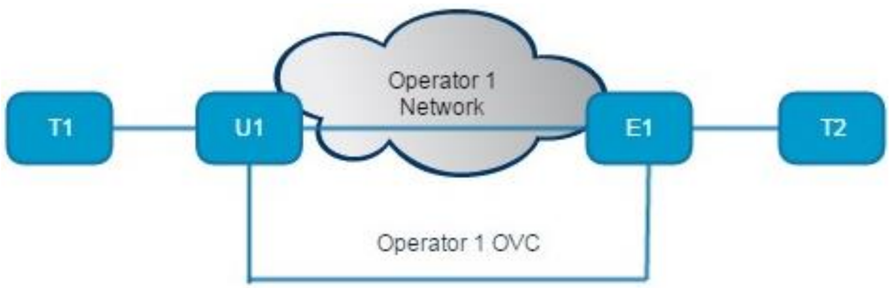
<table>
<tr><td>Test Bed and Service Mapping Step 3</td><td colspan="2">

<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="2">UNI U2</td></tr>
<tr><td>1, 2…4095*</td><td>EVC</td></tr>
<tr><td colspan="2">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
</table></td></tr>
<tr><td rowspan="6">Test Procedure Step 3</td><td>3.1</td><td>Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly</td></tr>
<tr><td>3.2</td><td>Configure the Service Provider EVC to support MEF 45 EPL Option 2</td></tr>
<tr><td>3.3</td><td>Tester T1 transmits untagged frames of each Layer 2 Control Protocol defined in MEF 45 to the Operator 1 UNI U1</td></tr>
<tr><td>3.4</td><td>For each Layer 2 Control Protocol, tester T3 verifies if the frames are either Filtered (not received at the Operator 2 UNI U2) or Passed (received at the Operator 2 UNI U2)</td></tr>
<tr><td>3.5</td><td>Tester T3 transmits untagged frames of each Layer 2 Control Protocol defined in MEF 45 to the Operator 2 UNI U2</td></tr>
<tr><td>3.6</td><td>For each Layer 2 Control Protocol, tester T1 verifies if the frames are either Filtered (not received at Operator 1 UNI U1) or Passed (received at the Operator 1 UNI U1)</td></tr>
<tr><td>Test Result</td><td colspan="2">Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports MEF 45 EPL Option 2 requirements as verified in steps 1.3, 1.5, 2.3, 2.5, 3.4, and 3.6</td></tr>
<tr><td>Test Traffic and Frame Size</td><td colspan="2">• At the UNI: 10 untagged frames of each of each Layer 2 Control Protocol defined in MEF 45
• At the ENNI: 10 untagged of each Layer 2 Control Protocol defined in MEF 45 encapsulated in the outer tag mapped at the ENNI</td></tr>
<tr><td>Comment</td><td colspan="2">Any nonconformance observed in either step 1.3, 1.5, 2.3, 2.5, 3.4, or 3.6 will be clearly identified and described in the test report</td></tr>
</table>

<table>
<tr><th colspan="3">Test Case 14 – Ingress Bandwidth Profile per CoS ID – Committed Information Rate</th></tr>
<tr><td>Interconnection Partners</td><td>Operator 1 Name:</td><td>Operator 2 Name:</td></tr>
<tr><td>Requirements</td><td colspan="2">• The CoS ID for Data Service Frame MUST be per EVC
• The Ingress Bandwidth profile (BWP) per CoS ID MUST specify CIR > 0, CBS > 0, EIR = 0, EBS = 0, CF = X, CM = X
• The Ingress BWP per OVC EP at the UNI MUST align to the Ingress BWP Per Cos ID
• The Ingress BWP per OVC EP at the ENNI MUST specify CIR > 0, CBS > 0, EIR = 0, EBS = 0, CF = X,</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

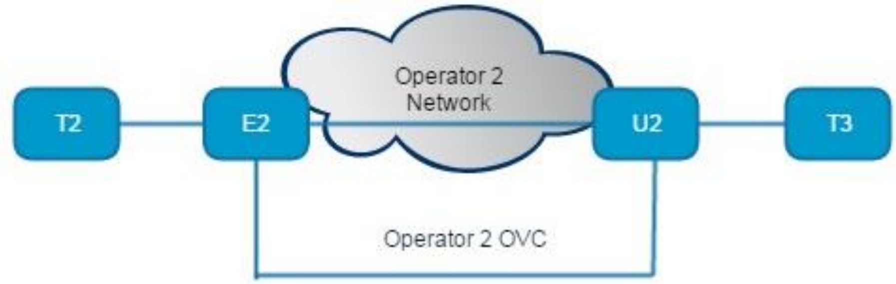
	CM = X
References	EIP Use Case 1 – Service Attribute Values and Ranges
Test Purpose	Verify that when an Ingress BWP per CoS ID with CIR > 0, CBS > 0, EIR = 0, and EBS = 0 is applied at the UNI or at the ENNI, of the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1, the amount of Green traffic delivered at the egress UNI or ENNI is within +/- 2% of the calculated amount of traffic accepted as Green at the ingress during a time interval *T*, provided that the ingress traffic is offered at a constant rate greater than CIR
Step 1	Operator 1 – OVC Verification [UNI U1 to ENNI E1]
Test Bed and Service Mapping Step 1	(see diagram and mapping table below)

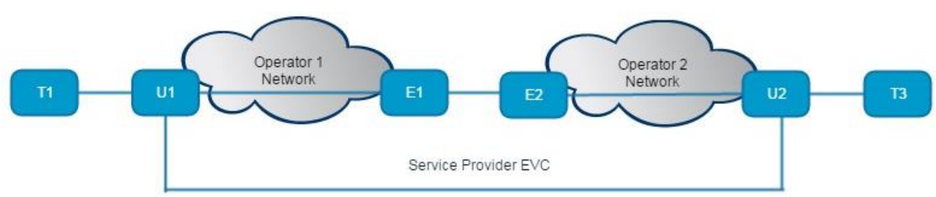


UNI U1					
1, 2…4095*			OVC End Point		
* Mapping at the UNI U1 includes untagged and priority tagged frames					
ENNI E1					
100			OVC End Point		
UNI U1 & ENNI E1 Ingress BWP					
CIR	CBS	EIR	CBS	CM	CF
>0Mbps	>0B	0Mbps	0B	X	X

Test Procedure Step 1	1.1	Tester T1 transmits C-tagged frames of size *S* at a constant rate greater than the CIR to the Operator 1 UNI U1 during a time interval *T*
	1.2	Tester T2 measures the number of C-tagged frames encapsulated in the outer tag mapped at ENNI E1, delivered at the Operator 1 ENNI E1 and verifies that the amount of received Green traffic is within +/- 2% of the calculated amount of traffic accepted as Green over the time interval *T*
	1.3	Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E1, of size *S* at a constant rate greater than CIR to the Operator 1 ENNI E1 during a time interval *T*
	1.4	Tester T1 measures the number of C-tagged frames delivered at the Operator 1 UNI U1 and verifies that the amount of received Green traffic is within +/- 2% of the calculated amount of traffic accepted as Green over the time interval *T*
Step 2		Operator 2 – OVC Verification [UNI U2 to ENNI E2]

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td>Test Bed and Service Mapping Step 2</td><td>


<table>
<tr><td colspan="6">UNI U2</td></tr>
<tr><td colspan="3">1, 2…4095*</td><td colspan="3">OVC End Point</td></tr>
<tr><td colspan="6">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="6">ENNI E2</td></tr>
<tr><td colspan="3">100</td><td colspan="3">OVC End Point</td></tr>
<tr><td colspan="6">UNI U2 & ENNI E2 ingress BWP</td></tr>
<tr><td>CIR</td><td>CBS</td><td>EIR</td><td>CBS</td><td>CM</td><td>CF</td></tr>
<tr><td>>0Mbps</td><td>>0B</td><td>0Mbps</td><td>0B</td><td>X</td><td>X</td></tr>
</table>
</td></tr>
<tr><td>Test Procedure Step 2</td><td>
<table>
<tr><td>2.1</td><td>Tester T3 transmits C-tagged frames of size S at a constant rate greater than the CIR to the Operator 2 UNI U2 during a time interval T</td></tr>
<tr><td>2.2</td><td>Tester T2 measures the number of C-tagged frames encapsulated in the outer tag mapped at ENNI E2, delivered at the Operator 2 ENNI E2 and verifies that the amount of received Green traffic is within +/- 2% of the calculated amount of traffic accepted as Green over the time interval T</td></tr>
<tr><td>2.3</td><td>Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E2, of size S at a constant rate greater than CIR to the Operator 2 ENNI E2 during a time interval T</td></tr>
<tr><td>2.4</td><td>Tester T3 measures the number of C-tagged frames delivered at the Operator 2 UNI U2 and verifies that the amount of received Green traffic is within +/- 2% of the calculated amount of traffic accepted as Green over the time interval T</td></tr>
</table>
</td></tr>
<tr><td>Step 3</td><td>Service Provider EVC [UNI U1 to UNI U2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 3</td><td>


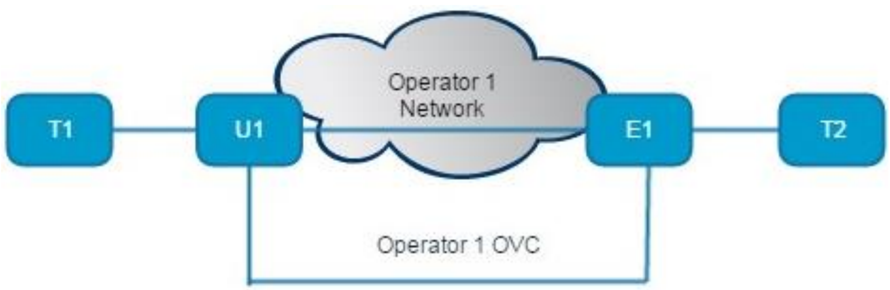
<table>
<tr><td colspan="2">UNI U1</td></tr>
<tr><td>1, 2…4095*</td><td>OVC End Point</td></tr>
<tr><td colspan="2">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
</table>
</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td></td><td>
<table>
<tr><td colspan="6">UNI U2</td></tr>
<tr><td colspan="3">1, 2…4095*</td><td colspan="3">OVC End Point</td></tr>
<tr><td colspan="6">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="6">UNI U1 & UNI U2 Ingress BWP</td></tr>
<tr><td>CIR</td><td>CBS</td><td>EIR</td><td>CBS</td><td>CM</td><td>CF</td></tr>
<tr><td>>0Mbps</td><td>>0B</td><td>0Mbps</td><td>0B</td><td>X</td><td>X</td></tr>
</table>
</td></tr>
<tr><td>Test Procedure Step 3</td><td>
<table>
<tr><td>3.1</td><td>Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly</td></tr>
<tr><td>3.2</td><td>Tester T1 transmits C-tagged frames of size S at a constant rate greater than the CIR to the Operator 1 UNI U1 during a time interval T</td></tr>
<tr><td>3.3</td><td>Tester T3 measures the number of C-tagged frames delivered at the Operator 2 UNI U2 and verifies that the amount of received Green traffic is within +/- 2% of the calculated amount of traffic accepted as Green over the time interval T</td></tr>
<tr><td>3.4</td><td>Tester T3 transmits C-tagged frames of size S at a constant rate greater than CIR to the Operator 2 UNI U2 during a time interval T</td></tr>
<tr><td>3.5</td><td>Tester T1 measures the number of C-tagged frames delivered at the Operator 1 UNI U1 and verifies that the amount of received Green traffic is within +/- 2% of the calculated amount of traffic accepted as Green over the time interval T</td></tr>
</table>
</td></tr>
<tr><td>Test Result</td><td>Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports Ingress BWP per CoS ID with CIR>0, CBS>0, EIR=0, and EBS=0 as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5</td></tr>
<tr><td>Test Traffic and Frame Size</td><td>
• At the UNI: C-tagged frames of size S, where S can be a fixed frame size or an EMIX as defined in MEF 48, at a rate function of the tested CIR at the UNI (fixed frame size is preferred)
• At the ENNI: C-tagged frames of size S encapsulated in the outer tag mapped at ENNI, where S can be a fixed frame size or an EMIX as defined in MEF 48, at a rate function of the tested CIR at the ENNI (fixed frame size is preferred)
</td></tr>
<tr><td>Comment</td><td>
• Any nonconformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 will be clearly identified and described in the test report
• The BWP is measured in terms of Service Frame or ENNI Frame traffic where the Service Frame or ENNI Frame consists of the first bit of the Destination MAC Address through the last bit of the Frame Check Sequence
• The length of the time interval T must be such that the number of bytes in CBS is negligible compared to the total volume of traffic received over the duration of the test
• Where the BWP verification is executed from the UNI to the ENNI or from the ENNI to the UNI, appending or removing the outer Tag mapped at the ENNI adds or eliminates four bytes per frame. These need to be subtracted or added when calculating the amount of traffic (in bytes) delivered to the egress UNI or ENNI
• The +/- 2% CIR tolerance accounts for small fluctuations due to the MEF BWP algorithm implementation across different chipsets
• With fixed frame sizes, the test case is to be run 3 times; with 80-byte, 600-byte and 1500-byte frames
</td></tr>
</table>

Test Case 15 – Ingress Bandwidth Profile per CoS ID – Committed Burst Size

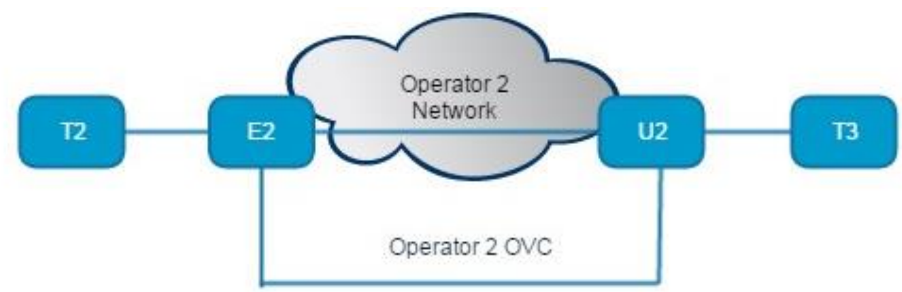
© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td>Interconnection Partners</td><td>Operator 1 Name:</td><td>Operator 2 Name:</td></tr>
<tr><td>Requirements</td><td colspan="2">The CoS ID for Data Service Frame MUST be per EVC
The Ingress Bandwidth profile (BWP) per CoS ID MUST specify CIR > 0, CBS > 0, EIR = 0, EBS = 0, CF = X, CM = X
The Ingress BWP per OVC EP at the UNI MUST align to the Ingress BWP Per Cos ID
The Ingress BWP per OVC EP at the ENNI MUST specify CIR > 0, CBS > 0, EIR = 0, EBS = 0, CF = X, CM = X</td></tr>
<tr><td>References</td><td colspan="2">EIP Use Case 1 – Service Attribute Values and Ranges</td></tr>
<tr><td>Test Purpose</td><td colspan="2">Verify that when an Ingress BWP per CoS ID with CIR > 0, CBS > 0, EIR = 0, and EBS = 0 is applied at the UNI or at the ENNI, of the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1, the amount of Green traffic delivered at the egress UNI or ENNI is within +/- 3 frames or +/- 5% of the calculated amount of traffic accepted as Green at the ingress during a time interval T, provided that the ingress traffic is offered as a pattern of repeated bursts and idle periods where each burst B is longer than necessary to empty the token bucket and each idle period I is longer than necessary to fill the token bucket.</td></tr>
<tr><td>Step 1</td><td colspan="2">Operator 1 – OVC Verification [UNI U1 to ENNI E1]</td></tr>
<tr><td>Test Bed and Service Mapping Step 1</td><td colspan="2">


<table>
<tr><td colspan="6">UNI U1</td></tr>
<tr><td colspan="3">1, 2…4095*</td><td colspan="3">OVC End Point</td></tr>
<tr><td colspan="6">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="6">ENNI E1</td></tr>
<tr><td colspan="3">100</td><td colspan="3">OVC End Point</td></tr>
<tr><td colspan="6">UNI U1 & ENNI E1 Ingress BWP</td></tr>
<tr><td>CIR</td><td>CBS</td><td>EIR</td><td>CBS</td><td>CM</td><td>CF</td></tr>
<tr><td>>0Mbps</td><td>>0B</td><td>0Mbps</td><td>0B</td><td>X</td><td>X</td></tr>
</table>
</td></tr>
<tr><td rowspan="2">Test Procedure Step 1</td><td>1.1</td><td>Tester T1 transmits C-tagged frames of size S using an input traffic pattern of repeated bursts and idle periods where each burst B is longer than necessary to empty the token bucket and each idle period I is longer than necessary to fill the token bucket, to the Operator 1 UNI U1 during a time interval T</td></tr>
<tr><td>1.2</td><td>Tester T2 measures the number of C-tagged frames encapsulated in the outer tag mapped at ENNI E1 delivered at the Operator 1 ENNI E1 and verifies that the amount of received Green traffic is within +/- 3 frames or +/-</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

		5% of the calculated amount of traffic accepted as Green over the time interval *T*
	1.3	Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E1, of size *S* using an input traffic pattern of repeated bursts and idle periods where each burst *B* is longer than necessary to empty the token bucket and each idle period *I* is longer than necessary to fill the token bucket, to the Operator 1 ENNI E1 during a time interval *T*
	1.4	Tester T1 measures the number of C-tagged frames delivered at the Operator 1 UNI U1 and verifies that the amount of received Green traffic is within +/- 3 frames or +/- 5% of the calculated amount of traffic accepted as Green over the time interval *T*
Step 2	Operator 2 – OVC Verification [UNI U2 to ENNI E2]	
Test Bed and Service Mapping Step 2	(see diagram and mapping table below)	



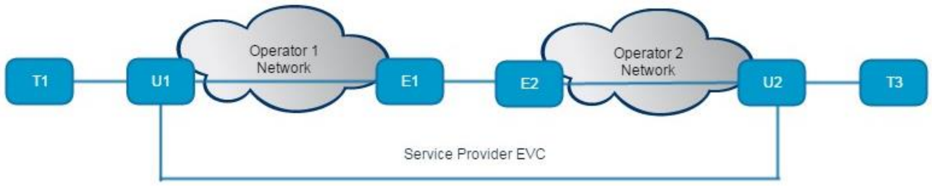
UNI U2					
1, 2…4095*			OVC End Point		
* Mapping at the UNI U2 includes untagged and priority tagged frames					
ENNI E2					
100			OVC End Point		
UNI U2 & ENNI E2 ingress BWP					
CIR	CBS	EIR	CBS	CM	CF
>0Mbps	>0B	0Mbps	0B	X	X

Test Procedure Step 2	2.1	Tester T3 transmits C-tagged frames of size *S* using an input traffic pattern of repeated bursts and idle periods where each burst *B* is longer than necessary to empty the token bucket and each idle period *I* is longer than necessary to fill the token bucket, to the Operator 2 UNI U2 during a time interval *T*
	2.2	Tester T2 measures the number of C-tagged frames encapsulated in the outer tag mapped at ENNI E2 delivered at the Operator 2 ENNI E2 and verifies that the amount of received Green traffic is within +/- 3 frames or +/- 5% of the calculated amount of traffic accepted as Green over the time interval *T*
	2.3	Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E2, of size *S* using an input traffic pattern of repeated bursts and idle periods where each burst *B* is longer than necessary to empty the token bucket and each idle period *I* is longer than necessary to fill the token bucket, to the Operator 2 ENNI E2 during a time interval *T*
	2.4	Tester T3 measures the number of C-tagged frames delivered at the Operator 2 UNI U2 and verifies that the amount of received Green traffic is within +/- 3 frames or +/- 5% of the calculated amount of traffic accepted as Green over the time interval *T*

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Step 3	Service Provider EVC [UNI U1 to UNI U2]

Test Bed and Service Mapping Step 3



UNI U1	
1, 2…4095*	OVC End Point
* Mapping at the UNI U1 includes untagged and priority tagged frames	

UNI U2	
1, 2…4095*	OVC End Point
* Mapping at the UNI U2 includes untagged and priority tagged frames	

UNI U1 & UNI U2 Ingress BWP					
CIR	CBS	EIR	CBS	CM	CF
>0Mbps	>0B	0Mbps	0B	X	X

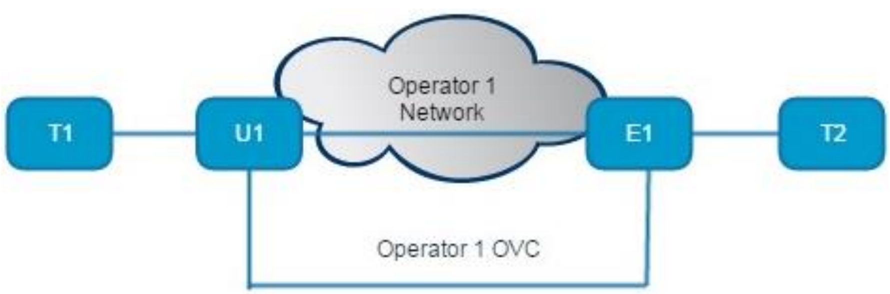
Test Procedure Step 3

3.1	Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly
3.2	Tester T1 transmits C-tagged frames of size *S* using an input traffic pattern of repeated bursts and idle periods where each burst *B* is longer than necessary to empty the token bucket and each idle period *I* is longer than necessary to fill the token bucket, to the Operator 1 UNI U1 during a time interval *T*
3.3	Tester T3 measures the number of C-tagged frames delivered at the Operator 2 UNI U2 and verifies that the amount of received Green traffic is within +/- 3 frames or +/- 5% of the calculated amount of traffic accepted as Green over the time interval *T*
3.4	Tester T3 transmits C-tagged frames of size *S* using an input traffic pattern of repeated bursts and idle periods where each burst *B* is longer than necessary to empty the token bucket and each idle period *I* is longer than necessary to fill the token bucket, to the Operator 2 UNI U2 during a time interval *T*
3.5	Tester T1 measures the number of C-tagged frames delivered at the Operator 1 UNI U1 and verifies that the amount of received Green traffic is within +/- 3 frames or +/- 5% of the calculated amount of traffic accepted as Green over the time interval *T*

Test Result	Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 supports Ingress BWP per CoS ID with CIR>0, CBS>0, EIR=0, and EBS=0 as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5
Test Traffic and Frame Size	• At the UNI: C-tagged frames of size *S*, where *S* can be a fixed frame size or an EMIX as defined in MEF 48, at a rate function of the tested CIR and CBS at the UNI (fixed frame size is preferred) • At the ENNI: C-tagged frames of size *S* encapsulated in the outer tag mapped at ENNI, where *S* can be a fixed frame size or an EMIX as defined in MEF 48, at a rate function of the tested CIR and CBS at the ENNI (fixed frame size is preferred)
Comment	• Any nonconformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 will be clearly identified and de-

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

	scribed in the test report • The BWP is measured in terms of Service Frame or ENNI Frame traffic where the Service Frame or ENNI Frame consists of the first bit of the Destination MAC Address through the last bit of the Frame Check Sequence • Where the BWP verification is executed from the UNI to the ENNI or from the ENNI to the UNI, appending or removing the outer Tag mapped at the ENNI adds or eliminates four bytes per frame. These need to be subtracted or added when calculating the amount of traffic (in bytes) delivered to the egress UNI or ENNI • The +/- 3 frames or +/- 5% CBS tolerance accounts for small fluctuations due to the MEF BWP algorithm implementation across different chipsets • With fixed frame sizes, the test case is to be run 3 times; with 80-byte, 600-byte and 1500-byte frames

Test Case 16 – Service Performance with Constant Traffic		
Interconnection Partners	Operator 1 Name:	Operator 2 Name:
Requirements	• The CoS ID for Data Service Frame **MUST** be per EVC • The OVC Service Level Specification **MUST** support MEF 23.1 PT-1 performance objectives for CoS H • The EVC performance **MUST** support MEF 23.1 PT-1 performance objectives for CoS H	
References	EIP Use Case 1 – Service Attribute Values and Ranges	
Test Purpose	Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 meets the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service while carrying constant traffic.	
Step 1	Operator 1 – OVC Verification [UNI U1 to ENNI E1]	
Test Bed and Service Mapping Step 1		

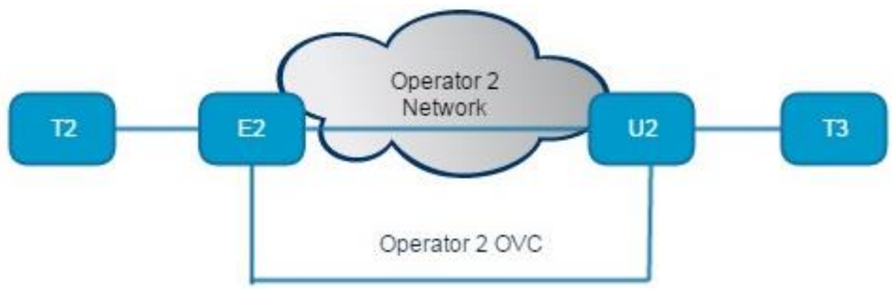
UNI U1					
1, 2…4095*			OVC End Point		
* Mapping at the UNI U1 includes untagged and priority tagged frames					
ENNI E1					
100			OVC End Point		
UNI U1 & ENNI E1 Ingress BWP					
CIR	CBS	EIR	CBS	CM	CF

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

	>0Mbps	>0B	0Mbps	0B	X	X	

Test Procedure Step 1	1.1	Tester T1 transmits C-tagged frames of size *S* at a constant rate equal to CIR to the Operator 1 UNI U1 during a time interval *T*
	1.2	Tester T2 measures the Information Rate, the Frame Delay, and the Frame Loss Ratio and calculates the Mean Frame Delay, the Inter-Frame Delay Variation and the Frame Delay Range and verifies that the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service are met
	1.3	Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E1 of size *S* at a constant rate equal to CIR to the Operator 1 ENNI E1 during a time interval *T*
	1.4	Tester T1 measures the Information Rate, the Frame Delay, and the Frame Loss Ratio and calculates the Mean Frame Delay, the Inter-Frame Delay Variation and the Frame Delay Range and verifies that the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service are met
Step 2	Operator 2 – OVC Verification [UNI U2 to ENNI E2]	

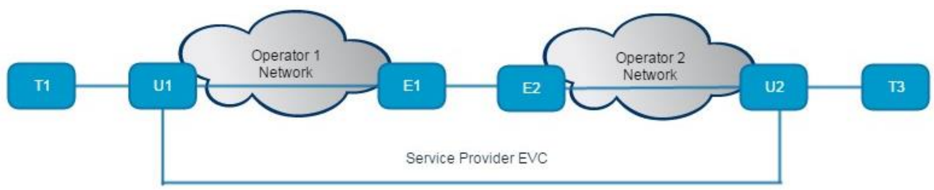
Test Bed and Service Mapping Step 2



UNI U2					
1, 2…4095*			OVC End Point		
* Mapping at the UNI U2 includes untagged and priority tagged frames					
ENNI E2					
100			OVC End Point		
UNI U2 & ENNI E2 ingress BWP					
CIR	CBS	EIR	CBS	CM	CF
>0Mbps	>0B	0Mbps	0B	X	X

Test Procedure Step 2	2.1	Tester T3 transmits C-tagged frames of size *S* at a constant rate equal to CIR to the Operator 2 UNI U2 during a time interval *T*
	2.2	Tester T2 measures the Information Rate, the Frame Delay, and the Frame Loss Ratio and calculates the Mean Frame Delay, the Inter-Frame Delay Variation, and the Frame Delay Range and verifies that the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service are met
	2.3	Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E2 of size *S* at a constant rate equal to CIR to the Operator 2 ENNI E2 during a time interval *T*

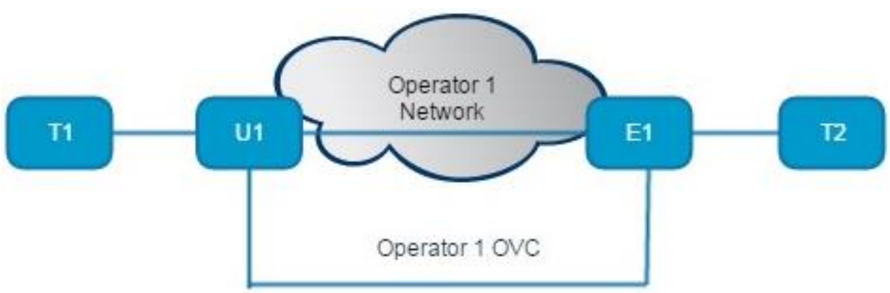
© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td></td><td>2.4</td><td>Tester T3 measures the Information Rate, the Frame Delay, and the Frame Loss Ratio and calculates the Mean Frame Delay, the Inter-Frame Delay Variation, and the Frame Delay Range and verifies that the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service are met</td></tr>
<tr><td>Step 3</td><td colspan="2">Service Provider EVC [UNI U1 to UNI U2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 3</td><td colspan="2">


<table>
<tr><td colspan="6">UNI U1</td></tr>
<tr><td colspan="3">1, 2…4095*</td><td colspan="3">OVC End Point</td></tr>
<tr><td colspan="6">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="6">UNI U2</td></tr>
<tr><td colspan="3">1, 2…4095*</td><td colspan="3">OVC End Point</td></tr>
<tr><td colspan="6">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="6">UNI U1 & UNI U2 Ingress BWP</td></tr>
<tr><td>CIR</td><td>CBS</td><td>EIR</td><td>CBS</td><td>CM</td><td>CF</td></tr>
<tr><td>>0Mbps</td><td>>0B</td><td>0Mbps</td><td>0B</td><td>X</td><td>X</td></tr>
</table>
</td></tr>
<tr><td rowspan="5">Test Procedure Step 3</td><td>3.1</td><td>Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly</td></tr>
<tr><td>3.2</td><td>Tester T1 transmits C-tagged frames of size S at a constant rate equal to CIR to the Operator 1 UNI U1 during a time interval T</td></tr>
<tr><td>3.3</td><td>Tester T3 measures the Information Rate, the Frame Delay, and the Frame Loss Ratio and calculates the Mean Frame Delay, the Inter-Frame Delay Variation, and the Frame Delay Range and verifies that the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service are met</td></tr>
<tr><td>3.4</td><td>Tester T3 transmits C-Tagged frames of size S at a constant rate equal to CIR to the Operator 2 UNI U2 during a time interval T</td></tr>
<tr><td>3.5</td><td>Tester T1 measures the Information Rate, the Frame Delay, and the Frame Loss Ratio and calculates the Mean Frame Delay, the Inter-Frame Delay Variation, and the Frame Delay Range and verifies that the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service are met</td></tr>
<tr><td>Test Result</td><td colspan="2">Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 meets the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service while carrying constant traffic as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5.</td></tr>
<tr><td>Test Traffic and Frame Size</td><td colspan="2">• At the UNI: C-tagged frames of size S, where S can be a fixed frame size or an EMIX as defined in MEF 48, at a rate function of the tested CIR at the UNI (fixed frame size is preferred)</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

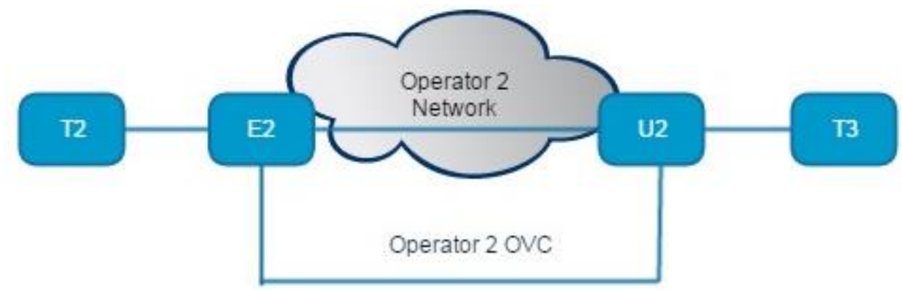
	• At the ENNI: C-tagged frames of size S encapsulated in the outer tag mapped at ENNI, where S can be a fixed frame size or an EMIX as defined in MEF 48, at a rate function of the tested CIR at the ENNI (fixed frame size is preferred)
Comment	• Any non-conformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 will be clearly identified and described in the test report • The performance objectives for PT-1 CoS H are as follows: FD ≤ 10 ms, MFD ≤ 7 ms, IFDV ≤ 3 ms, FDR ≤ 5 ms, FLR ≤ 0.01% • The performance attributes must be measured and calculated as defined in MEF 10.2 section 6.9

Test Case 17 – Service Performance with Bursty Traffic		
Interconnection Partners	Operator 1 Name:	Operator 2 Name:
Requirements	• The CoS ID for Data Service Frame **MUST** be per EVC • The OVC Service Level Specification **MUST** support MEF 23.1 PT-1 performance objectives for CoS H • The EVC performance **MUST** support MEF 23.1 PT-1 performance objectives for CoS H	
References	EIP Use Case 1 – Service Attribute Values and Ranges	
Test Purpose	Verify that the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 meets the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service while carrying bursty traffic	
Step 1	Operator 1 – OVC Verification [UNI U1 to ENNI E1]	
Test Bed and Service Mapping Step 1		

UNI U1					
1, 2…4095*			OVC End Point		
* Mapping at the UNI U1 includes untagged and priority tagged frames					
ENNI E1					
100			OVC End Point		
UNI U1 & ENNI E1 Ingress BWP					
CIR	CBS	EIR	CBS	CM	CF
>0Mbps	>0B	0Mbps	0B	X	X

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Test Procedure Step 1	1.1	Tester T1 transmits C-tagged frames of size *S* at an average rate up to CIR, using a test traffic profile which exercises both configured CIR and CBS at the same time, to the Operator 1 UNI U1 during a time interval *T*
	1.2	Tester T2 measures the Frame Delay and the Frame Loss Ratio and calculates the Mean Frame Delay, the Inter-Frame Delay Variation, and the Frame Delay Range and verifies that the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service are met
	1.3	Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E1, of size *S* at an average rate up to CIR, using a test traffic profile which exercises both configured CIR and CBS at the same time, to the Operator 1 ENNI E1 during a time interval *T*
	1.4	Tester T1 measures the Frame Delay and the Frame Loss Ratio and calculates the Mean Frame Delay, the Inter-Frame Delay Variation, and the Frame Delay Range and verifies that the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service are met
Step 2	Operator 2 – OVC Verification [UNI U2 to ENNI E2]	
Test Bed and Service Mapping Step 2	(see diagram and mapping table below)	

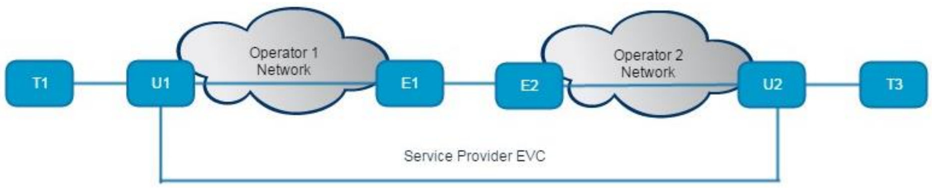


UNI U2					
1, 2…4095*			OVC End Point		
* Mapping at the UNI U2 includes untagged and priority tagged frames					
ENNI E2					
100			OVC End Point		
UNI U2 & ENNI E2 ingress BWP					
CIR	CBS	EIR	CBS	CM	CF
>0Mbps	>0B	0Mbps	0B	X	X

Test Procedure Step 2	2.1	Tester T3 transmits C-tagged frames of size *S* at an average rate up to CIR, using a test traffic profile which exercises both configured CIR and CBS at the same time, to the Operator 2 UNI U2 during a time interval *T*
	2.2	Tester T2 measures the Frame Delay and the Frame Loss Ratio and calculates the Mean Frame Delay, the Inter-Frame Delay Variation, and the Frame Delay Range and verifies that the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service are met
	2.3	Tester T2 transmits C-tagged frames encapsulated in the outer tag mapped at the ENNI E2, of size *S* at an average rate up to CIR, using a test traffic profile which exercises both configured CIR and CBS at the same time, to the Operator 2 ENNI E2 during a time interval *T*

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

<table>
<tr><td></td><td>2.4</td><td>Tester T3 measures the Frame Delay and the Frame Loss Ratio and calculates the Mean Frame Delay, the Inter-Frame Delay Variation, and the Frame Delay Range and verifies that the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service are met</td></tr>
<tr><td>Step 3</td><td colspan="2">Service Provider EVC [UNI U1 to UNI U2]</td></tr>
<tr><td>Test Bed and Service Mapping Step 3</td><td colspan="2">



<table>
<tr><td colspan="6">UNI U1</td></tr>
<tr><td colspan="3">1, 2…4095*</td><td colspan="3">OVC End Point</td></tr>
<tr><td colspan="6">* Mapping at the UNI U1 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="6">UNI U2</td></tr>
<tr><td colspan="3">1, 2…4095*</td><td colspan="3">OVC End Point</td></tr>
<tr><td colspan="6">* Mapping at the UNI U2 includes untagged and priority tagged frames</td></tr>
<tr><td colspan="6">UNI U1 & UNI U2 Ingress BWP</td></tr>
<tr><td>CIR</td><td>CBS</td><td>EIR</td><td>CBS</td><td>CM</td><td>CF</td></tr>
<tr><td>>0Mbps</td><td>>0B</td><td>0Mbps</td><td>0B</td><td>X</td><td>X</td></tr>
</table>

</td></tr>
<tr><td rowspan="5">Test Procedure Step 3</td><td>3.1</td><td>Disconnect tester T2 from ENNI E1 and from ENNI E2 and interconnect them directly</td></tr>
<tr><td>3.2</td><td>Tester T1 transmits C-tagged frames of size S at an average rate up to CIR, using a test traffic profile which exercises both configured CIR and CBS at the same time, to the Operator 1 UNI U1 during a time interval T</td></tr>
<tr><td>3.3</td><td>Tester T3 measures the Frame Delay and the Frame Loss Ratio and calculates the Mean Frame Delay, the Inter-Frame Delay Variation, and the Frame Delay Range and verifies that the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service are met</td></tr>
<tr><td>3.4</td><td>Tester T3 transmits C-tagged frames of size S at an average rate up to CIR, using a test traffic profile which exercises both configured CIR and CBS at the same time, to the Operator 2 UNI U2 during a time interval T</td></tr>
<tr><td>3.5</td><td>Tester T1 measures the Frame Delay and the Frame Loss Ratio and calculates the Mean Frame Delay, the Inter-Frame Delay Variation, and the Frame Delay Range and verifies that the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service are met</td></tr>
<tr><td>Test Result</td><td colspan="2">Test case passes if the Carrier Ethernet solution specified in the EIP Use Case 1 Phase 1 meets the performance objectives defined in MEF 23.1 for Performance Tier 1, High Class of Service while carrying bursty traffic as verified in steps 1.2, 1.4, 2.2, 2.4, 3.3, and 3.5</td></tr>
</table>

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

Test Traffic and Frame Size	• At the UNI: C-tagged frames of size *S*, where *S* can be a fixed frame size or an EMIX as defined in MEF 48, at a rate function of the tested CIR and CBS at the UNI (fixed frame size is preferred) • At the ENNI: C-tagged frames of size *S* encapsulated in the outer tag mapped at ENNI, where *S* can be a fixed frame size or an EMIX as defined in MEF 48, at a rate function of the tested CIR and CBS at the ENNI (fixed frame size is preferred)
Comment	• Any non-conformance observed in either step 1.2, 1.4, 2.2, 2.4, 3.3, or 3.5 will be clearly identified and described in the test report • The performance objectives for PT-1 CoS H are as follows: FD ≤ 10 ms, MFD ≤ 7 ms, IFDV ≤ 3 ms, FDR ≤ 5 ms, FLR ≤ 0.01% • The performance attributes must be measured and calculated as defined in MEF 10.2 section 6.9

15. Appendix II – Detailed L2CP Information – Based Upon Testing

The results shown below are from the Rapid Prototype testing of Test case 13 "L2CP Handling – Option 2" of this Ethernet Interconnection Points – Implementation Agreement. These results are from two of the Operators' ENNI solutions tested in a standalone fashion.

L2CP Handling Option 2					Oper A		Oper B	
	Destination Address	802.1Q Assignment	L2CP	Protocol Identifier	1.3	1.5	1.3	1.5
	01-80-C2-00-00-00	Nearest Customer Bridge	STP/RSTP/MSTP	LLC address 0x42	FWD	FWD	FILTER	FWD
	01-80-C2-00-00-00	Nearest Customer Bridge	LACP/LAMP	Ethertype: 0x8809 Subtypes: 0x01, 0x02	FWD	FWD	FILTER	FWD
	01-80-C2-00-00-00	Nearest Customer Bridge	LLDP	Ethertype: 0x88CC	FWD	FWD	FILTER	FWD
	01-80-C2-00-00-00	Nearest Customer Bridge	VDP	Ethertype: 0x8940 Subtypes: 0x0001	FWD	FWD	FILTER	FWD
	01-80-C2-00-00-00	Nearest Customer Bridge	Port-based Network Access Control	Ethertype: 0x888E	FWD	FWD	FILTER	FWD
	01-80-C2-00-00-00	Nearest Customer Bridge	MIRP	Ethertype: 0x8929	FWD	FWD	FILTER	FWD
	01-80-C2-00-00-01	IEEE MAC Specific Control Protocols	Pause	Ethertype: 0x8808 Subtypes:	FILTER	FILTER	FILTER	FWD

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.

			0x0001				
01-80-C2-00-00-01	IEEE MAC Specific Control Protocols	PFC	Ethertype: 0x8808 Subtypes: 0x0101	FWD	FWD	FILTER	FWD
01-80-C2-00-00-01	IEEE MAC Specific Control Protocols	Multipoint MAC Control	Ethertype: 0x8808 Subtypes: 0x0002-0x0006	FWD	FWD	FILTER	FWD
01-80-C2-00-00-01	IEEE MAC Specific Control Protocols	Organization Specific Extensions	Ethertype: 0x8808 Subtypes: 0xFFFE	FWD	FWD	FILTER	FWD
01-80-C2-00-00-02	IEEE 802 Slow Protocols	LACP/LAMP	Ethertype: 0x8809 Subtypes: 0x01, 0x02	FWD	FWD	FILTER	FWD
01-80-C2-00-00-02	IEEE 802 Slow Protocols	Link OAM	Ethertype: 0x8809 Subtype: 0x03	FWD	FWD	FILTER	FWD
01-80-C2-00-00-02	IEEE 802 Slow Protocols	ESMC	Ethertype: 0x8809 Subtype: 0x0A	FWD	FWD	FILTER	FILTER
01-80-C2-00-00-03	Nearest non-TPMR Bridge	LACP/LAMP	Ethertype: 0x8809 Subtypes: 0x01, 0x02	FWD	FWD	FILTER	FWD
01-80-C2-00-00-03	Nearest non-TPMR Bridge	Port Authentication	Ethertype: 0x888E	FWD	FWD	FILTER	FWD
01-80-C2-00-00-03	Nearest non-TPMR Bridge	LLDP	Ethertype: 0x88CC	FWD	FWD	FILTER	FWD
01-80-C2-00-00-03	Nearest non-TPMR Bridge	PE-CSP	Ethertype: 0x8940 Subtypes: 0x0002	FWD	FWD	FILTER	FWD
01-80-C2-00-00-03	Nearest non-TPMR Bridge	Port-based Network Access Control	Ethertype: 0x888E	FWD	FWD	FILTER	FWD
01-80-C2-00-00-04	IEEE MAC Specific Control Protocols			FWD	FWD	FILTER	FWD

© MEF Forum 2016. Any reproduction of this document, or any portion thereof, shall contain the following statement: "Reproduced with permission of MEF Forum." No user of this document is authorized to modify any of the information contained herein.