Ethernet Service Specification

Abstract

This document provides a recommendation on how to use MTOSI Service Management activation interfaces for the provisioning of broadband Ethernet services. There are three types of services that are identified: 1) Broadband Ethernet Access (BEA), 2) Broadband Aggregation and Backhaul (BAB), and 3) Broadband Ethernet Multicast (BEM). These services are defined using Metro Ethernet Forum (MEF) service constructs such as User Network Interface (UNI), External Network-to-Network Interface (ENNI), Virtual User Network Interface (VUNI), and Operator Virtual Connection (OVC). An example of an Ethernet Service Definition and associated Service Template are provided for the provisioning of a Broadband Ethernet Access lines service.

Table of Contents

1 Introduction

1.1 Network Architecture

Ethernet has proven itself in the LAN Enterprise market over the last few decades, with now more than 90% of terminations being on Ethernet ports. [**Error! Reference source not found.**].Ethernet is simple, cost effective, and provides flexible and scalable bandwidth options. With recent Carrier Grade enhancements, including Ethernet OAM and Protection Switching, Ethernet is viewed as the logical and acclaimed choice for the replacement of TDM and other legacy services in the Metro market; it provides the capability to support bandwidth-intensive voice, video, and data applications while offering incremental migration options.

In the consumer triple-play market, service providers are migrating their more traditional ATM networks to Ethernet; Broadband Access is being delivered over Ethernet enabled DSLAM/xPON networks, with Ethernet switches performing the aggregation and backhaul function. The Broadband Forum has defined specifications for migration to Ethernet based DSL networks [**Error! Reference source not found.**] and GPON networks [**Error! Reference source not found.**], taking into account network architectures and deployment considerations. The diagram below depicts a GPON access and aggregation network, as defined in TR-156.

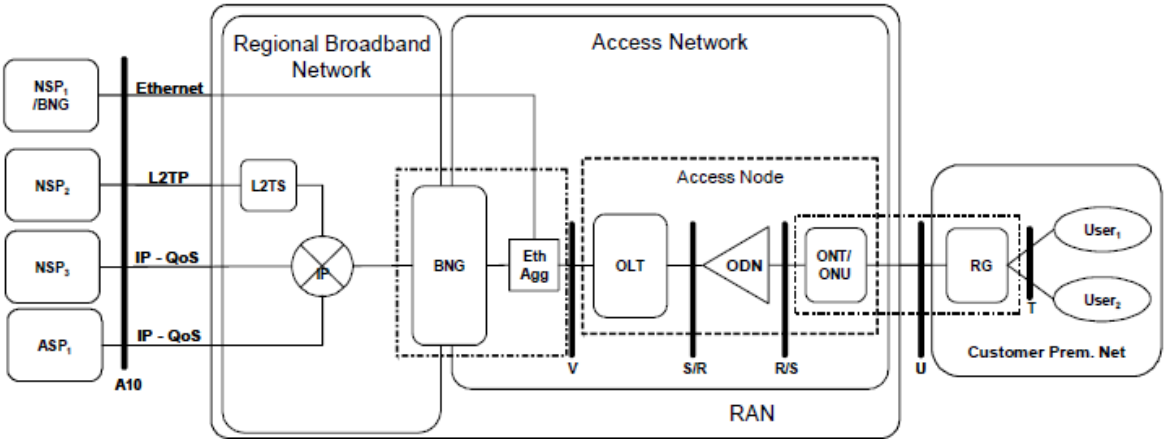

Figure 1 – Network Architecture for Ethernet-based GPON Aggregation

1.2 VLAN Schemes

For both DSL and GPON access networks, the Broadband Forum defines different approaches for connecting users through both the Ethernet based access and aggregation networks using Virtual Local Area Network (VLAN) identifiers to separate services or residential subscribers. The approach taken by the service provider may depend on their existing network architecture, their migration path to Ethernet, and the services being offered. No particular VLAN scheme is preferred over another. The focus of this specification is on a *VLAN per Subscriber* model

1.2.1 VLAN per Subscriber Connectivity Scenario

In the VLAN per Subscriber model, commonly known as 1:1 (implying 1 VLAN per subscriber), the subscriber is given connectivity to the IP network over a single VLAN for all subscriber services. Each subscriber endpoint (e.g. xDSL modem) is identified by a C-VLAN tag, which usually identifies the subscriber's port on the DSLAM, or ONT. For scalability purposes, the traffic of each DSLAM could be further encapsulated using a second provider VLAN, or S-VLAN. The S-VLAN tag may identify the DSLAM/OLT (see IEEE 802.1ad). It can be added either by the DSLAM/OLT itself (i.e. X-DSLAM in figure below), or the Ethernet Aggregation switch (i.e. Ethernet Switch closest to X-DSLAM). There is only one multicast VLAN, or MC-VLAN, that is shared by all subscribers for IPTV.

In this scenario all of the customer services are terminated on a single Broadband Network Gateway, or BNG (i.e. Edge Node in figure below). The BNG in this scenario is usually a Broadband Remote Access Server (BRAS).This scenario is often referred to as a "consolidated architecture"

The following diagram [**Error! Reference source not found.**] depicts a typical "VLAN per Subscriber" network architecture:

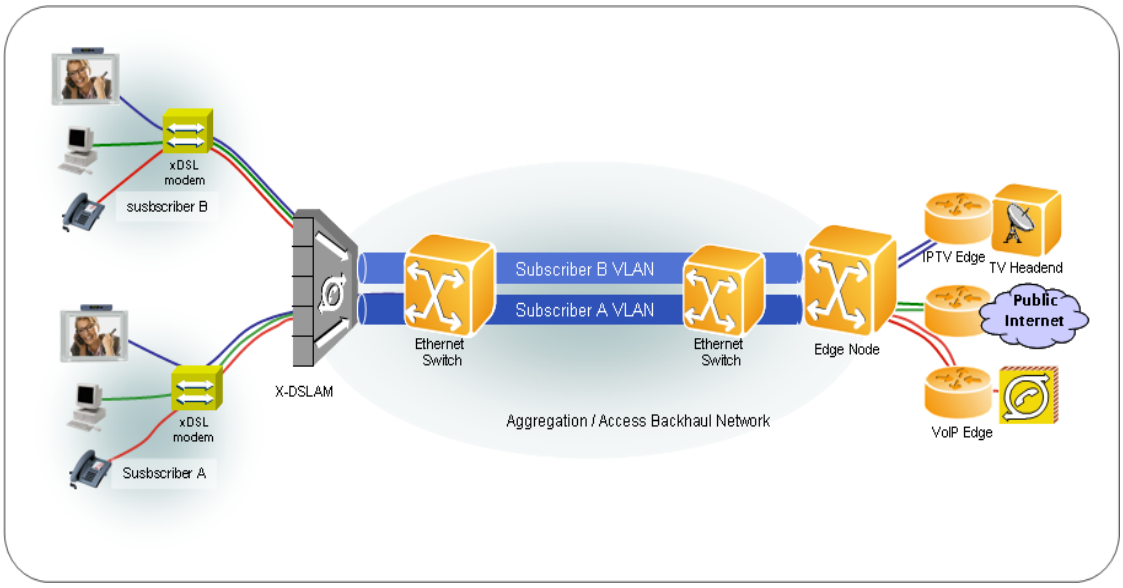

Figure 2 - VLAN per Subscriber

1.2.2 VLAN per Service Connectivity Scenario

In the VLAN per Service model, commonly known as N:1 (i.e. “N” subscribers per VLAN) there is a separate VLAN for each service class: High-Speed Internet access (HSI), Voice over IP (VoIP), and Video. In this model, all subscribers’ traffic for a given service class has the same VLAN across the network. The subscriber services get mapped as individual IPoE / PPPoE sessions at the Broadband Network Gateways (i.e. Edge Nodes in figure below). A shared multi-cast VLAN is used for Broadcast Video.

The following diagram [**Error! Reference source not found.**] depicts a typical “VLAN per Service” scenario:

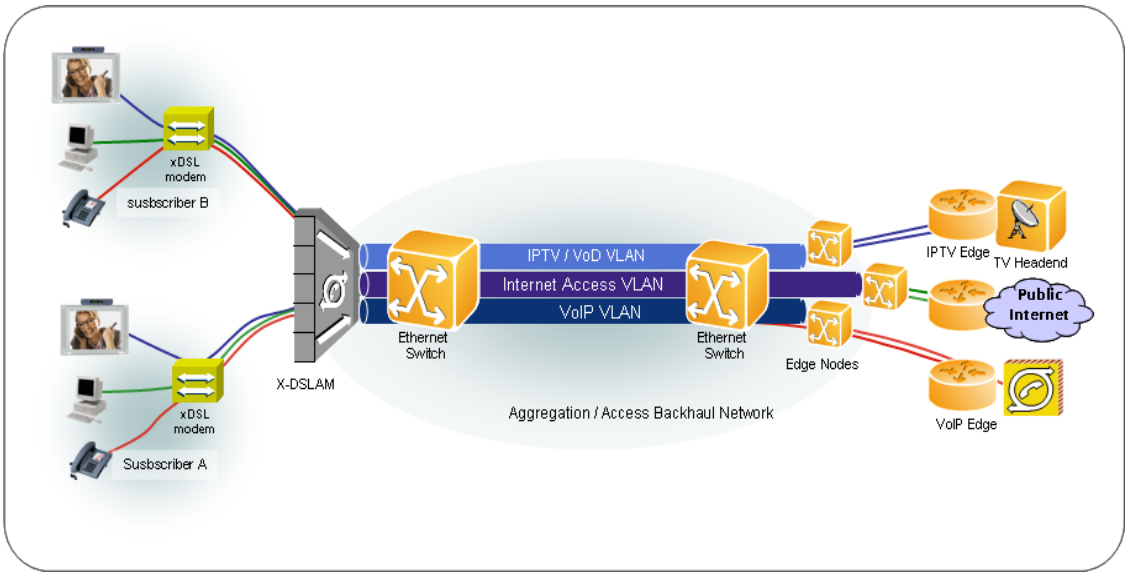

Figure 3 - VLAN per Service

The residential services are first aggregated by an Ethernet Switch (i.e. the switch closest to the X-DSLAM), that then backhauls the traffic to Broadband Network Gateways (Edge Nodes). The BNG may be a Service Router (BSR), or Broadband Remote Access Server (BRAS). This approach requires that all subscriber and service provisioning be carried out on the Access Node.

1.2.3 VLAN per Subscriber / VLAN per Service Connectivity Scenario

In the hybrid VLAN per Service / VLAN per Subscriber model, there is a combination of S-VLAN tagged service classes, and C-VLAN tagged subscriber services. The tagging options are those that are described separately above. Both IPoE and PPPoE sessions are supported.

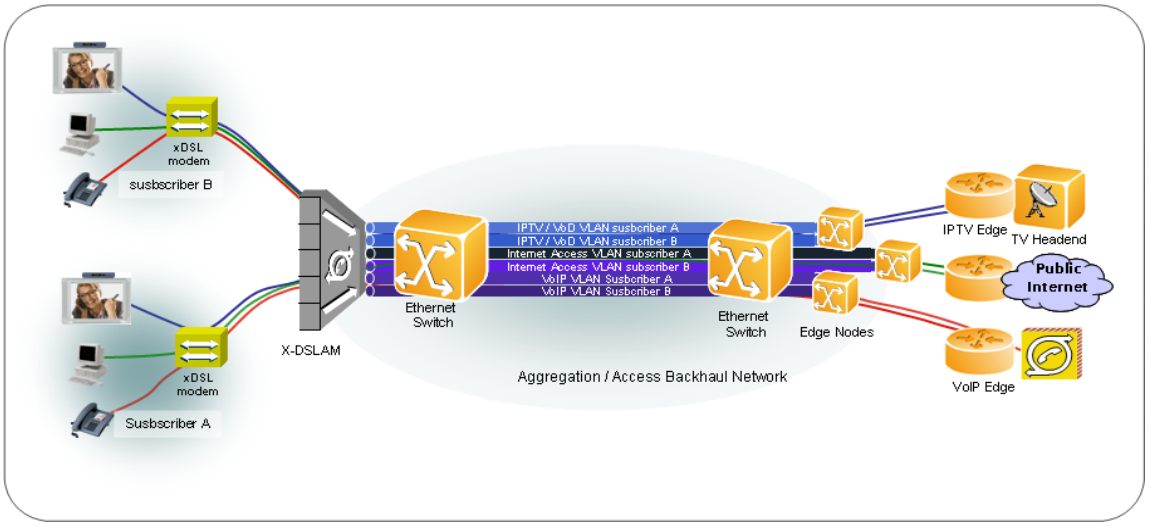

Figure 4 - VLAN Per Service / VLAN Per Subscriber

1.3 Broadband Ethernet Services

In addition to the changing network architectures and protocols, new business models are emerging that support wholesale Ethernet services in both the access and aggregation & backhaul networks. These Ethernet services are not directly "sold" to the residential customer, but are in support of the triple-play services, and may be sold either directly, or indirectly, to the Network Service Provider (NSP). They provide connectivity to the IP network and application service providers (ASP).

The following reference architecture, provided by the Communications Alliance [**Error! Reference source not found.**], serves as a framework for the services defined in this document.

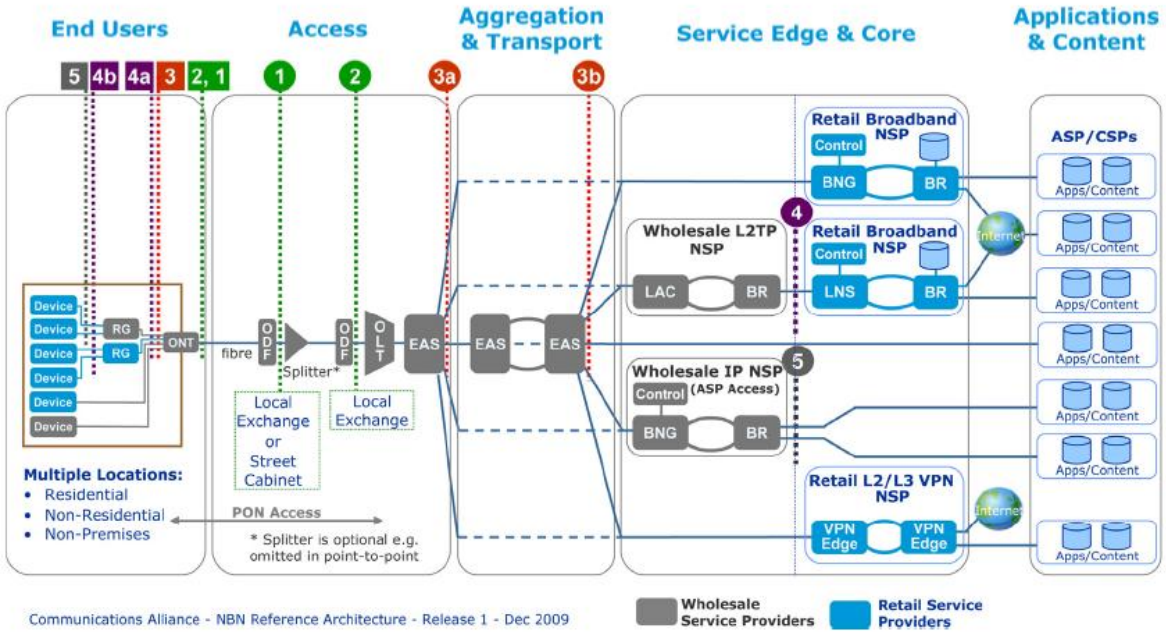

Figure 5 – Communications Alliance – NBN Reference Architecture

This document defines 3 general categories of services based upon the above architecture:

1. **Broadband Ethernet Access Line (BEA)** - A point-to-point Ethernet service between service point boundaries “3” and “3a”. Similar to a Metro Ethernet Forum (MEF) EVPL, but between a UNI (at 3) of a single subscriber endpoint and an ENNI (at 3a) aggregating traffic between multiple subscriber endpoints. The BEA service supports the delivery of HSI, VoIP, and VoD services to residential customers.
2. **Broadband Ethernet Multicast Service (BEM)** - A rooted multipoint Ethernet service between service point boundaries “3” and “3a”. This is similar to the MEF EVPTREE, but with multiple UNI leaves rooted at the ENNI. The BEM supports the delivery of video broadcast services to residential customers.
3. **Broadband Aggregation & Backhaul Service (BAB)** - A point-to-point tunnel that aggregates Ethernet access lines and transports them between service point boundaries “3a” and “3b” - i.e., from the access network to the service edge network.

2 Scope

This document is the result of an analysis done by the TIP Service Management team on supporting Ethernet service provisioning over MTOSI 2.x service management interfaces. The focus is on the following types of Ethernet services: 1) Broadband Ethernet Access Line, 2) Broadband Aggregation & Backhaul, and 3) Broadband Ethernet Multicast Services.

The Metro Ethernet Forum (MEF) has to date only defined Ethernet services in the context of the Enterprise and Wireless Backhaul markets. These services are based on Ethernet Virtual Connections (EVCs) that are an association of two or more User Network Interfaces (UNI). See the Appendix for more information on MEF services, and specifications **Error! Reference source not found.**, **Error! Reference source not found.**.

The BEA, BAB, and BEM Ethernet services have been defined using MEF constructs; however, they are based on constructs defined in completed and ongoing projects within MEF as well as extensions that are not yet defined in MEF:

1) Operator Virtual Connections (OVCs) [**Error! Reference source not found.**] for UNI to ENNI (External Network-to-Network Interface), or ENNI-to-ENNI services
2) Virtual UNI (VUNI) at the ENNI [add ref: MEF x – letter ballot to complete in Jan 2011]
3) Endpoint type within a VUNI [add same reference as for VUNI – letter ballot in Jan 2011]. Future work in MEF might include extending the type of endpoints within a VUNI.
4) SNI [MEF 4, **Error! Reference source not found.**]. The SNI as an interface is identified but not specified within MEF specifications. Also, future work in MEF might include VUNI in an SNI

It is to be noted that MEF is currently working on defining OVC based services with initial focus on Point-to-Point UNI to ENNI OVCs. Future work in MEF might include other types and also ENNI to ENNI OVCs.

This TM FORUM Ethernet Services Specifications document has been executed jointly with members of the TM FORUM and colleagues from the MEF. The resulting services described in this document are not currently defined by the MEF, and we anticipate evolving this document as work continues to progress between the MEF and TM FORUM.

The following assumptions and constraints have been made:

- Business roles:
  - Ethernet access, aggregation, and backhaul providers
    - Broadband Ethernet Access provider **(BEA)** provides Ethernet access lines
    - Broadband Ethernet Aggregation & Backhaul provider **(BAB)** provides aggregation and backhaul services
    - If Ethernet access and Ethernet backhaul is provided by the same provider, then this is considered to be a Broadband Ethernet Network provider **(BEN)**
  - IP network service provider (**NSP**)
    - Provides IP connectivity from the subscriber's terminal to an IP network

        - May also provide application services as part of “triple-play” bundle
        - Typically will procure Ethernet Access and/or Backhaul services from wholesale provider, or internal transport organizational entity
    - Application Service Provider (ASP)
        - Provides consumer applications such as internet mail, messaging, IPTV, VoIP (e.g., Yahoo, U-Verse, Skype)
        - NSP may also provide application services
- Technologies & solutions deployed
    - Home network
        - Residential Gateway (RG)
        - DSL Modem
    - Access networks
        - GPON
        - IPDSLAM
    - Residential Gateway
        - Trusted -> managed by the service provider
        - Untrusted -> not managed
    - Session control protocol
        - PPPoE
        - IPoE
    - Connectivity Strategies
        - VLAN per subscriber

Note: The use of the term subscriber is primarily used in this document to refer to the entity that is a customer of the triple-play IP services offered by the Network Service Provider (NSP). However, in relation to the Ethernet Services described in the document, the subscriber is the NSP who has procured these services from the BEA and/or BAB.

3 MTOSI R2.0 Service Management

3.1 General Concepts – CFS/RFS

The TM FORUM Shared Information & Data Model (SID) categorizes services as being of two different types. A *Customer Facing Service* (CFS) is bound to a "product", and is "visible" to the customer in that it is directly *purchasable*. A *Resource Facing Service* (RFS) is linked to "resources", supports Customer Facing Services, and is "invisible" to the customer. (See **Error! Reference source not found.**)

Ethernet Services may be viewed as both CFS and RFS, depending on the scenario and the service provider perspective and associated OSS/BSS. The BEA and BAB service providers may sell "wholesale" Ethernet access, aggregation and backhaul services to the Network Service Provider. From the BEA/BAB perspectives, these are customer facing services, to which an SLA is associated. However, the NSP is selling triple-play services to his end customer, and thus the Ethernet Connectivity, from his perspective, is a resource facing service. Note: The Ethernet Connectivity Service is represented differently in the respective service provider OSS/BSS;

The following diagram illustrates this concept (simplified). The NSP offers triple-play IP services to his residential customers, represented by an IP CFS. Assume the NSP purchases both Ethernet Access and Aggregation & Backhaul from the BEA and BAB respectively; these are represented in the BEA/BAB domains as "products", which eventually get instantiated as Ethernet Access Line CFS and Ethernet Backhaul CFS. Each service provider (BEA/BAB) must then activate component RFS in order to provide their Ethernet services to the NSP. This is done in their separate, respective OSS/BSS domains.

1. Triple-Play Service CFS
   VoIP, Video, Data offered by NSP
2. ETH Connectivity RFS
   Ethernet Connectivity from RG to BRAS or SER
3. NSP Network Resources
   Resources associated to ethernet connectivity – RG/BRAS
4. BEA / BAB Products
   NSP procures products through supplier management process
5. BEA / BAB CFS
   Represent ethernet access line and backhaul services
6. BEA / BAB RFS
   Represent type of resource connectivity that is used to support service
7. BEA / BAB Network Resources
   Actual resources that are consumed to provide service

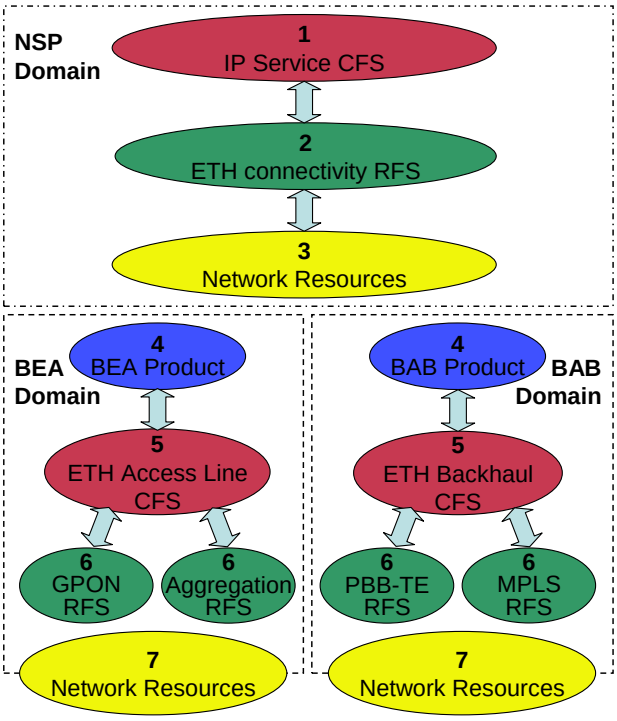

Figure 6 – Example of Ethernet Service CFS/RFS

It is important to understand the relationships between CFS, RFS, Logical Resources, and Physical Resources from each provider's perspective (NSP, BEA, and BAB) in order to fully understand the services being specified in this document.

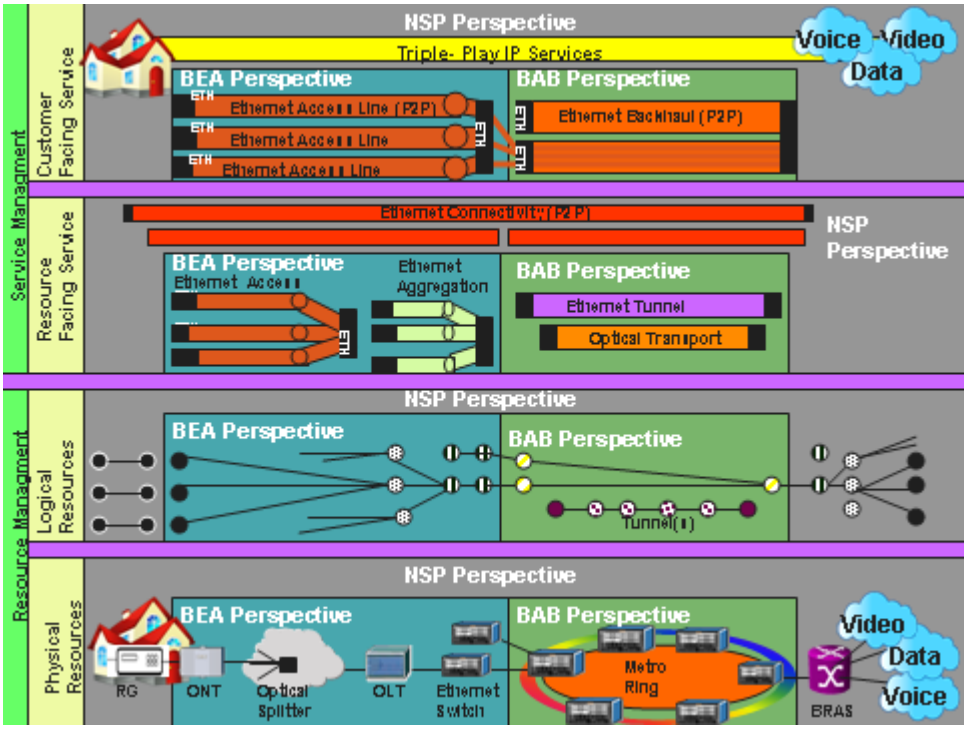

Figure 7 – Ethernet Service Provider Perspectives

- Network Service Provider
  - Business relationship with residential customer
    - Offers Triple-Play Services which are represented as CFS
  - Business relationships with BEA / BAB providers
    - Has an RFS to represent each Broadband Ethernet Access Line purchased from the BEA provider, and one for per Backhaul Service provided by the BAB, if applicable.
    - Alternately there could be one RFS to represent combined BEA / BAB services
  - Network resources
    - Owns 1 or more BNGs (Edge Nodes).
    - Sees any “logical” resources associated with the Residential Gateway (if managed), and the BNG, i.e. VLANs, logical ports, ACLs, etc.
    - Manages residential gateway (if trusted) and BNG, including all physical resources.
- Broadband Aggregation & Backhaul Provider
  - Business Relationships
    - Offers Ethernet Backhaul Service which is represented as CFS; depending on business relationships, could be sold to either the BEA, or the NSP
  - Network resources
    - The BAB manages a physical Ethernet/Optical metro network
    - Has various RFS to represent decomposition of Ethernet Backhaul CFS, i.e., Ethernet Tunnel, Optical Transport, MPLS Tunnel, etc.

- Broadband Ethernet Access Line Provider
  - Business Relationships
    - Offers Ethernet Access Lines which are represented as CFS. Could also offer a CFS to NSP that combines the BEA line with the Broadband Aggregation and Backhaul purchased from BAB.
  - Network resources
    - The BEA manages the physical GPON/DSL access network & 1st level aggregation
    - Has various RFS to represent decomposition of Ethernet Access Line CFS, i.e., GPON and DSLAM RFS, and Ethernet Aggregation RFS.
    - From a logical “resource” perspective, the BEA provider manages flow domain fragments (FDFr) and subnetwork connections (SNC), including their termination points

3.2 Service Management Interfaces

Service management capabilities were introduced in MTOSI R2.0, and are available in the MTOSI Service Activation *Document Delivery Package* (DDP). See MTOSI 2.0 for more information.

There are two “service activation” interfaces and a “service inventory” interface. Below is a brief description of these interfaces:

- *Service Activation Interface (SAI)* - Allows a CRM Operations System (OS), such as an Order Entry system, to request the activation of a given service, or set of services, that instantiate a given product based upon product related specifications. This interface links the product related information, such as the product specification, to the service domain via the service request.
- *Service Component Activation Interface (SCAI)* - Internal within the SM&O layer and allows for the activation of service components, or Resource Facing Services (RFSs) instances given specific service specifications. The SCAI, contrary to the SAI, has no knowledge of the product domain
- *Manage Service Inventory (MSI)* – This interface allows a requesting Service Inventory OS to retrieve service objects from a target OS. These objects include: “CFS”, “RFS”, “SAP”, “SAP Specification”, “ServiceCatalog”, “ServiceDefinition”, “ServiceTemplate”, and “ServiceSpecCharacteristic”

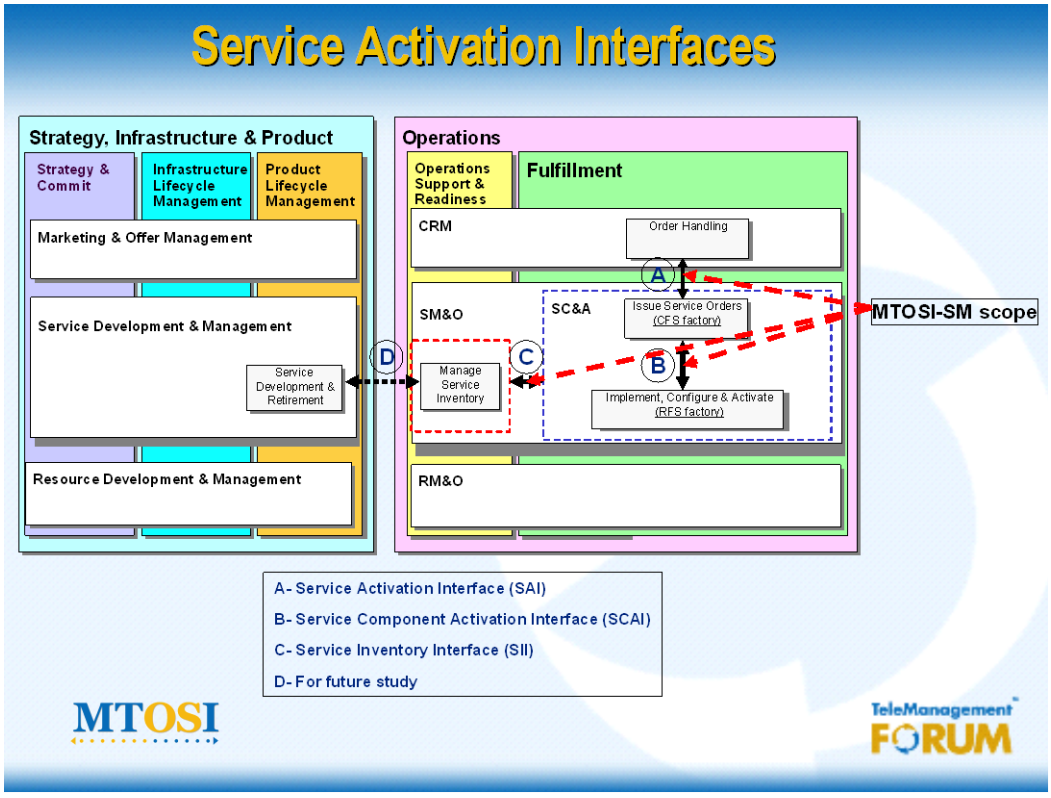

Figure 8 - MTOSI R2.0 Service Interfaces

3.3 Mapping MEF Concepts to TM FORUM

The MEF does not make the distinction between “services” and “resources” as does the TM FORUM with the eTOM, SID, and interface solution sets. Some of the MEF “service” characteristics are perhaps more appropriately implemented as “resource” characteristics, and some could potentially be implemented as both service and resource characteristics. The level at which they are placed may depend on the information received in the service order, the differing levels of responsibilities of service provider OSS, and the level to which equipment vendors supply service management solutions. This document only recommends the usage of MEF defined characteristics, and does not attempt to enforce usage one way or another.

The MEF introduced the notion of an “Ethernet Layer Connection” [See **Error! Reference source not found.**] which represents a transport entity used to convey ETH Layer PDUs among endpoints.The EVC and OVC are intended to be service constructs, with associated UNI/ENNI interfaces as service demarcation points.

The diagram below illustrates the various network domains (NSP, BAB, BEA, and Customer). The top half of the diagram shows the relationship between TMF Services (CFS/SAP) and MEF Services (OVC/UNI/ENNI). The bottom half of the diagram illustrates the relationship between TMF Resources (CPTP/FP/TL/FDFr) and constructs that the MEF uses that are similar (FP/EC). The EC gets represented in the TM FORUM resource model as a sequence of *topological links* and *flow domain fragments.*

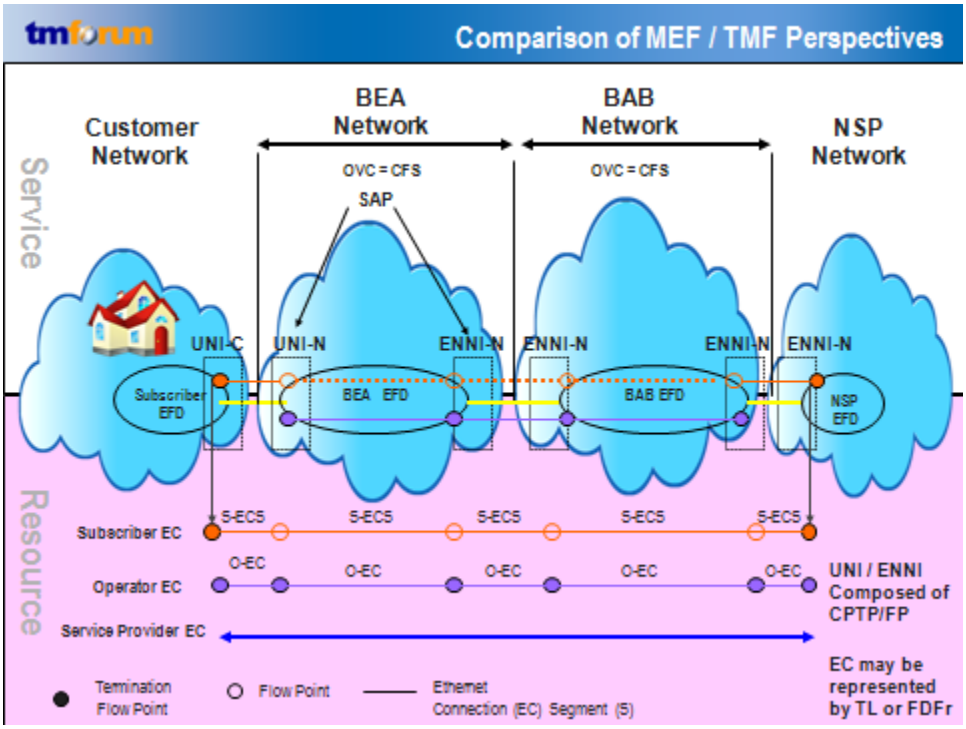

Figure 9 – Comparison of MEF / TM FORUM Perspectives

4 Broadband Ethernet Services

4.1 Overview

In this scenario, the BEA provider is assumed to be selling Broadband Ethernet Access Lines based upon a VLAN per Subscriber model. It is assumed that the BEA provider has also implemented a Provider Bridge (802.1ad) encapsulation scheme and using one S-VLAN per access node. The BAB is selling an Ethernet Aggregation & Backhaul Service that bundles multiple S-TAGGED flows into a single tunnel. Note: **Error! Reference source not found.**6 provides for S-VID bundling at OVC endpoints for an ENNI-ENNI service.

The following diagram represents the services offered as viewed from a customer facing perspective:

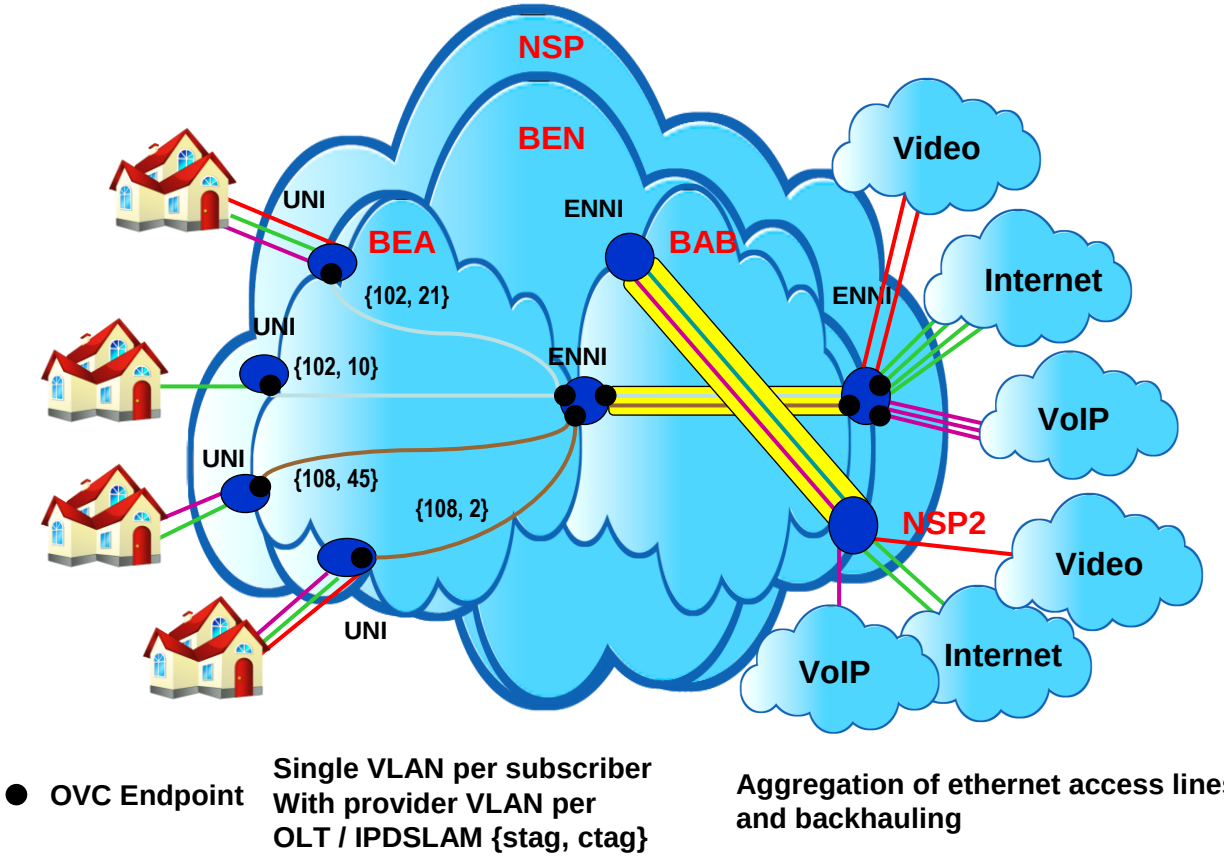

Figure 10 – Broadband Ethernet Services – VLAN per Subscriber

Contrary to traditional MEF Enterprise services, the services defined here are not represented by EVCs, as an EVC is defined to be an association of UNIs. In the case of BEA, the Ethernet Access Lines are represented by OVCs that associate the subscriber UNI with an ENNI [MEF26] between the BEA and BAB providers. In the example above, each Ethernet Access Line is identified by the combination {S-VID, C-VID}, where S-VIDs = [102, 108] and C-VIDs = [21, 10, 45, 2].]. At the ENNI between BEA and BAB, the services are identified by S-tags only. At the ENNI between BAB and NSP the NSP will use both C-tag and S-tag to uniquely identify the subscriber endpoint.

The BAB provider may be providing backhaul services to multiple NSPs, carrying traffic that potentially may come from multiple BEA providers. The "tunnels" are represented in yellow and represent single service instances, transporting 1 or more services identified by S-tags, for a specific NSP. BAB services are ENNI-to-ENNI, where the interface is to the BEA on the left-hand side, and to the NSP on the right, connecting to the BNG. Even though the BAB service is aggregating individual Ethernet Access Lines, it has its own distinct SLA and service definition.

4.2 Operator Virtual Connections

With a closer look into the "clouds", we can see the BEA and BAB services as operator virtual connections (OVCs) with OVC endpoints. To understand the logic of the figure below, let's start with the customer who has the residential gateway on the left side of the diagram.

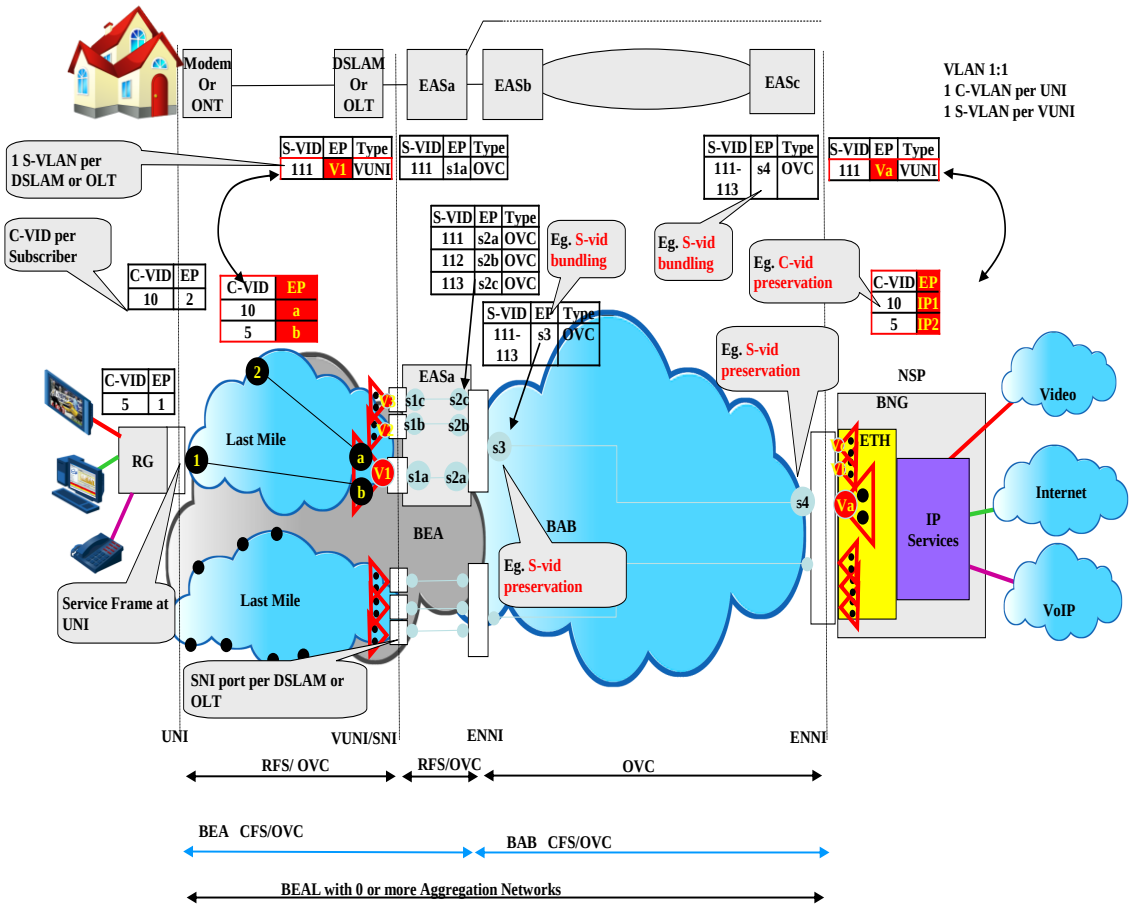

Figure 11 – Broadband Ethernet Services – OVC's

The traffic "mappings" to OVC endpoints will be as follows:

- In the above scenario, the customer's triple-play traffic may arrive untagged, priority tagged, or tagged. In the case of untagged and priority tagged frames, the access node will add a C-VID (i.e., C-VID = 5 in this case). In the case of tagged traffic, the incoming tag will be translated to the C-VID provisioned on the access node. In the case where the incoming tag is the same as the provisioned tag, the RG is considered to be "trusted".

- Assume there is an OVC with endpoints "1" and "b" that represent the access line {111,5}

- Traffic with C-VID = 5 gets mapped to endpoint "1". On the other end of the OVC, C-VID = 5 gets mapped to "b".

- The endpoint "b" gets mapped to the VUNI endpoint "V1" that is on the ENNI-N in the BEA domain. It is assumed that there is 1 VUNI per S-VLAN, and that in this case there is one S-VLAN per access node. In this case V1 is for S-VLAN 111. (VUNI's V2 and V3 will also get associated to the same ENNI-N).

- On the Ethernet aggregation switch, S-VID = 111 gets mapped to the OVC endpoint S3, as well as the S-VIDs 112, and 113. This is the ENNI-N in the BAB domain.

- On the other end of the BAB OVC, the S-VIDS are mapped to S4 at the ENNI with the NSP.

- On the BNG there is one VUNI per S-VLAN, similar to the VUNI in the BEA network, with C-VLANS mapping to the individual S-VLANS in the direction towards subscriber. In the direction towards the IP service platforms, the C-VIDs are mapped to the relevant IP Services.

4.3 Broadband Resource Perspective

In order to better understand the service perspective and the association to the resource view, the following diagram gives a more detailed example of a GPON Access Network and an Ethernet Aggregation and Backhaul network. Each OLT is provisioned with a Provider S-VLAN tag, and all the ONTs connected to the OLT are given a unique subscriber C-VLAN tag. The subscriber services are provisioned on the BRAS by the NSP. The BEA sells Ethernet access lines with a unique {S-VID, C-VID} identifier. The backhaul service provided by the BAB may be identified by a "tunnel" id, which may correspond to a PBT tunnel; MPLS label switched path, or other technology specific identifier. However, this is optional as there may not be a "tunnel id". For example, if BAB has an E-o-SONET/SDH then there is no tunnel id in the encap and the S-VIDs are bundled in to a timeslot

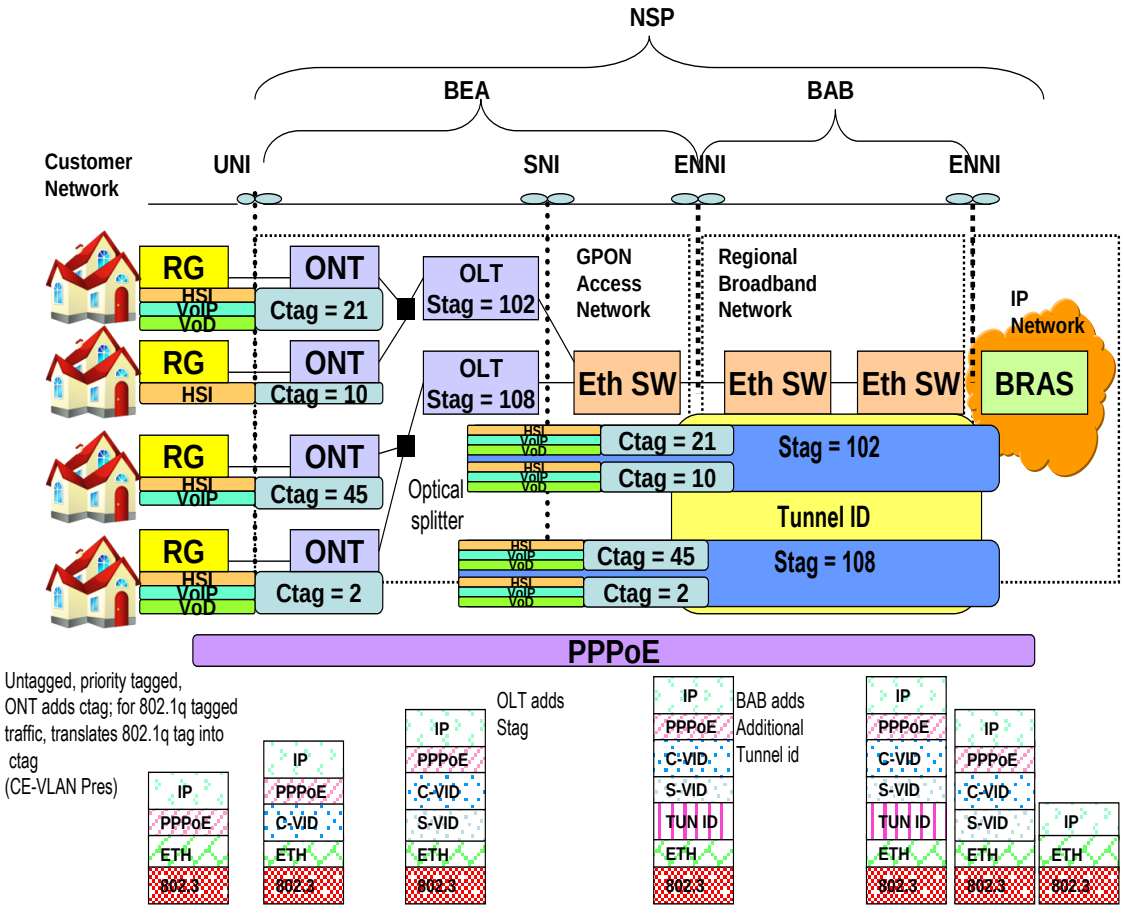

Figure 12 – GPON Access Example

4.4 Managing Broadband Services

In the context of the use case described in this document, it is assumed that each service provider (NSP, BEA, and BAB) has his own OSS/BSS systems. As the BEA and BAB are providing wholesale services, there is clearly a B2B exchange and purchase of product that occurs. This B2B interface is currently outside the scope of this project.

The management of the broadband services starts from the moment an order is received in either a BEA or BAB BSS system. The specifications defined in this document would allow the service provider's CRM to make product requests over the MTOSI Service Activation Interface that would be decomposed into CFSs. The service management OSS would then decompose the CFSs into service components; SM applications exposing SCAI would process requests for the instantiation of RFSs – for example an RFS for the access node and a separate RFS for the Ethernet aggregation node(s).

Although the MEF doesn't make the distinction between an OVC being in a "customer facing" perspective, or a "resource facing" perspective, it appears that one can map it according to the diagram below. Only the OVC as an RFS maps down to the "resource" layer, to a flow *domain fragment*, with flow points that correspond to OVC endpoints.

Given that the UNI and the ENNI have more *port- based* characteristics, they may or may not be provisioned as part of the service. For example, the customer port on the DSLAM most likely will be provisioned as part of the service, but the ENNI port, which will support multiple endpoints, will usually be provisioned as part of the infrastructure provisioning. Thus, even though the SAP will include the UNI/ENNI in its' naming structure, the actual provisioning may not include UNI/ENNI characteristics.

The *service definition* for the BEA service and the associated SAPs should contain all the service characteristics and their constraints, defaults, etc. in order to be able to fully map the service from the highest level CFS to the lowest level resources. The mapping logic will reside in the service management and resource management applications that must know how to retrieve the necessary information from inventory and other databases to perform the mappings and provision the associated resources in order to correctly provision the BEA / BAB services.

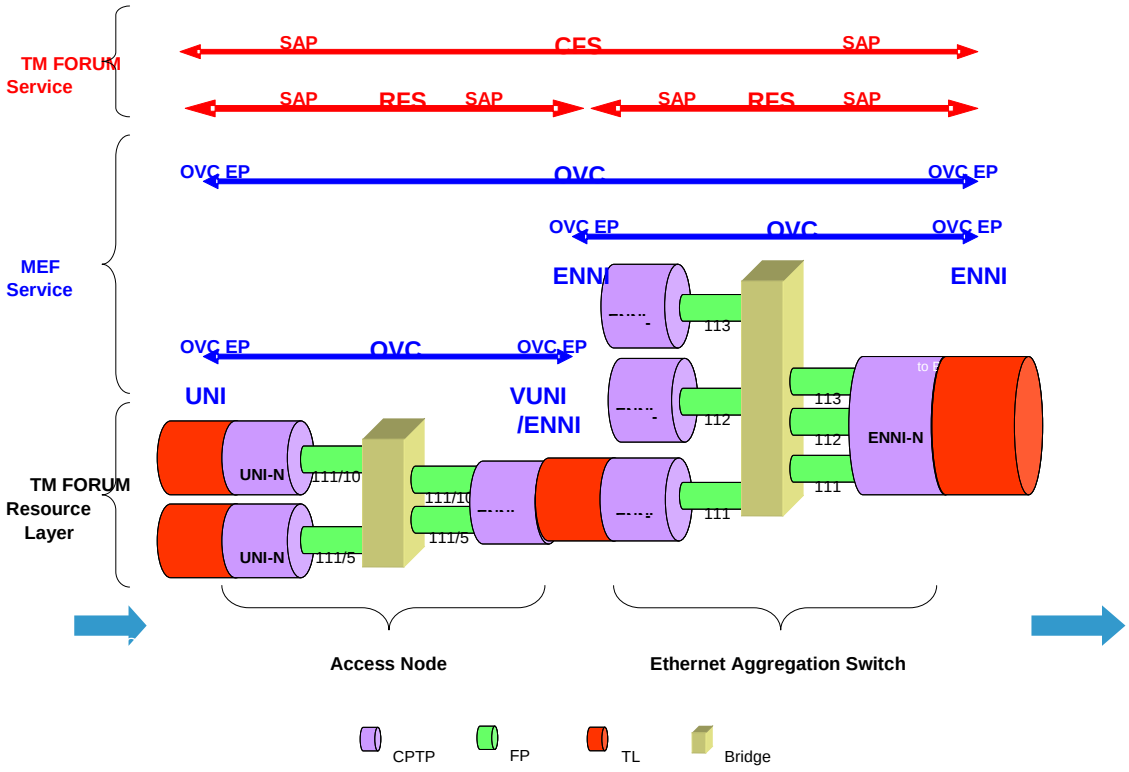

Figure 13 – Access Network Model

5 MTOSI-SM Information Model

5.1 General Overview

The MTOSI 2.0 Service Management Model can be found in the "Service Basic" DDP in the IA folder of the MTOSI Release solution set. There are 5 major concepts that will be used in this document for the purpose of describing Ethernet services. See terminology section for definitions [Terminology]

- Service Definition / Service Template
- Service Access Point
- Service Access Point Specification
- Service Spec Characteristic
- Service Spec Characteristic Value

5.2 Service Definition & Service Template

The abstract class **Service Specification** in the TM FORUM Shared Information & Data (SID) has been extended to support two new concepts introduced in the TIP Service Management interfaces:

- **Service Definition** Used during service design time to define the *ServiceSpecCharacteristics (SSCs)* of a service, their associated data types, and default values. SSCs are able to be globally set, which implies they may be defined in a service template; if not, the characteristics are passed in real-time over an activation interface

- **Service Template** Defines specific *ServiceSpecCharacteristicsValues* (SSCV) for the globally set *ServiceSpecCharacteristics* (SSC) that were defined in the Service Definition. The Service Template is checked against its associated Service Definition by verifying the presence of the *ServiceSpecCharacteristics* and the validity of the corresponding assigned ServiceSpecCharacteristicsValues**.** Only Service Templates that contain SSCs/SSCVs that are in conformance with their specification in the Service Definition are considered valid.

Both Service Activation interfaces make use of the Service Definition and Service Template concepts in the activation of CFS and RFS.

The Service Definition and Service Template further define the Service Specification through their respective associations, with the versions being identified through the *Service Spec Version*. The association class *Service Spec Relationship* allows for Service Specifications to contain other Service Specifications, which thus holds true for Service Definitions and Service Templates. The nesting of the Service Specification type, identified by the label *Involved Service Spec Types* allows for the grouping of Service Definition and Service Template types. For example, there may be a type of Service Definition for Ethernet Services, and contained within that type are E-LINE, E-LAN, and E-TREE Service Definitions.

The Service Catalog contains Service Definitions, Service Templates, and Sap Specifications which are part of the overall Service Inventory. The following figure illustrates the *Service Definition*, and *Service Template* concepts.

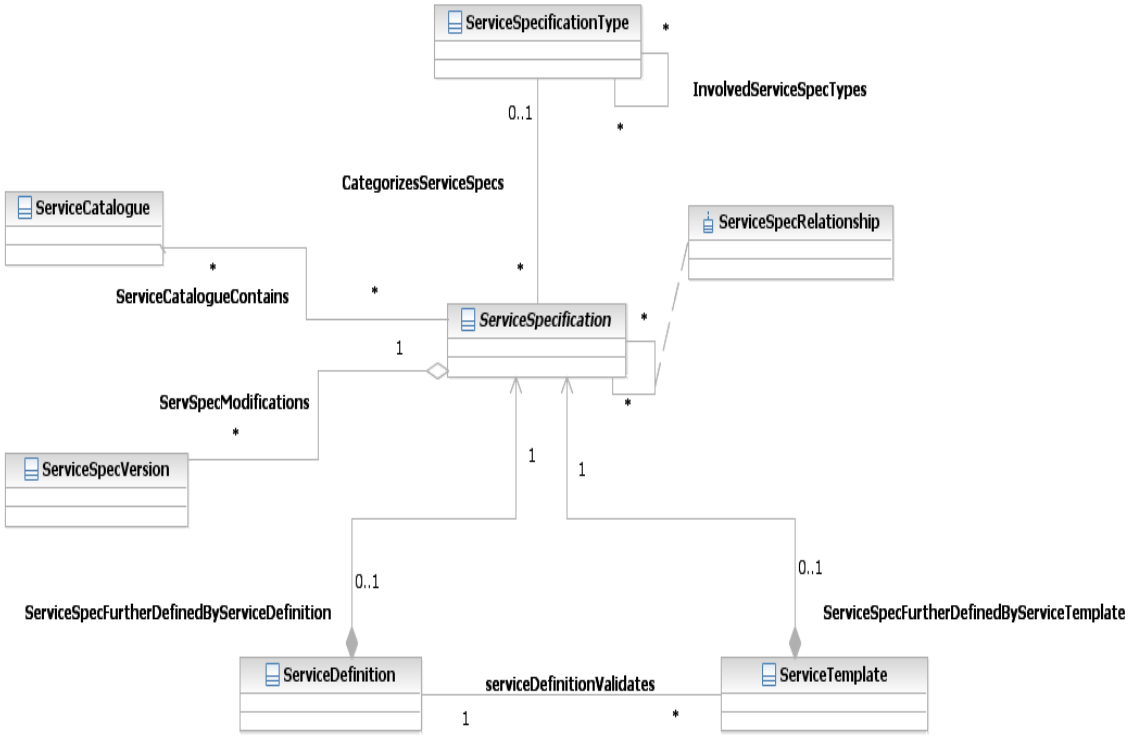

Figure 14 – Service Definitions and Service Templates

5.3 ServiceSpecCharacteristics and Values

ServiceSpecCharacteristic (SSC) is a concrete class type of entity. The same SSC can be associated with more than one Service Definition. The “name” attribute provides a label for any particular SSC. An SSC can be either an ‘atomic’ SSC or a ‘composite’ SSC, which is described through the *ServiceSpecCharRelationship:* An atomic SSC may be stand-alone, i.e., not contained in any composite SSC; or it may be contained in one or more composite SSCs. A composite SSC may contain a mixture of atomic and other composite SSCs.

The “valueType” attribute is used in an atomic SSC to indicate the type of data that SSC represents (e.g., String, Boolean, Integer, or Complex).

The “minCardinality” and “maxCardinality” optional attributes within the SSC indicate the number of occurrences that an SSC could have. For example, a minCardinality value of 0 would mean that it need not occur at all. A maxCardinality of 10 would mean that the SSC could occur up to 10 times. Within the Service Definition, each occurrence of that SSC may possibly have different associated values.

Service Spec Characteristics will be used to model MEF service characteristics when used over MTOSI service management interfaces. Note: some of the MEF characteristics will be defined as resource characteristics and mapped to the appropriate layered parameters.

ServiceSpecCharacteristicValue (SSCV) is used to assign specific values to atomic SSCs.

As pertains to use with a Service Definition, an atomic SSC may contain one or more SSCVs that a priori constrain (but may not completely determine) the values associated with that SSC for use with any Service Definition. The 1 to 0..n SSC-SSCV relationship indicates that more than one SSC value may be associated with an SSC. So, for example, for an SSC named “color” one may choose to have three values associated with it: {red, green, blue}.

The “valueType” attribute is used to indicate the type of data that SSC represents (e.g., StringBoolean, Integer, or Complex). The “value” attribute can be used to assign a value. This may be used to define default values. The “unitOfMeasure” attribute can be used to describe units of measure, such as Mbps. The “valueFrom” and “valueTo” attributes can be used to describe lower and upper bounds on a range of values, if desired and appropriate. The “rangeInterval” attribute can also be used to express a range of values.

Service Spec Characteristic Values will be used in conjunction with Service Spec Characteristics to define all MEF service characteristic values. For example: SSC = CIR, SSCV= 1000.

The following diagram from the TM FORUM Shared Information and Data (SID) model illustrates the *ServiceSpecCharacteristic* and the relationship to *ServiceSpecCharacteristicValues*.

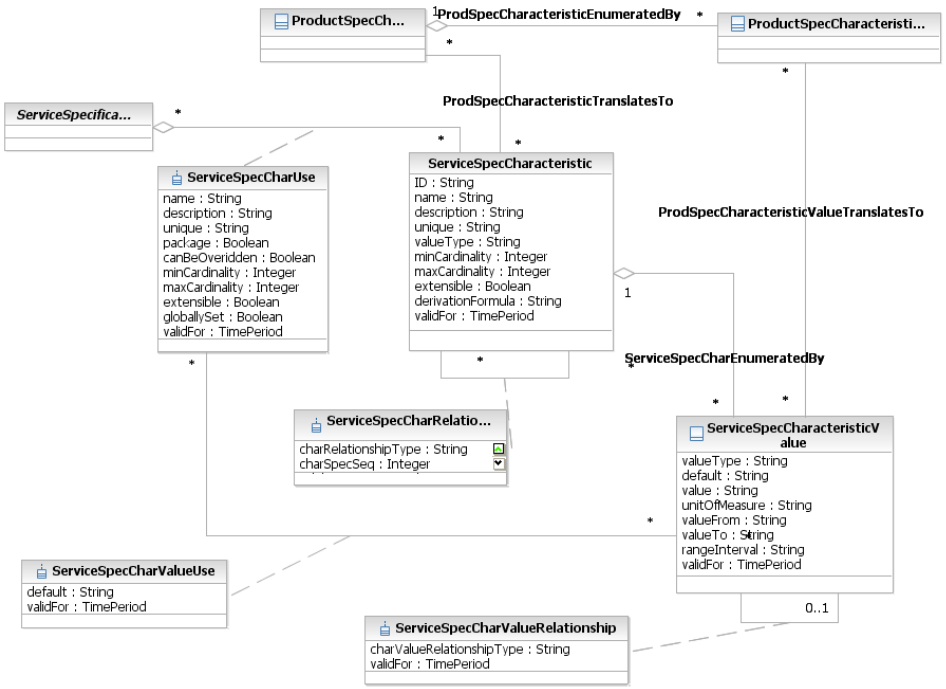

Figure 15 SID Service Spec Characteristics and Values

5.4 Service and Service Access Points

The service configuration and activation process involves the instantiation of both customer facing services, and associated resource facing services. The CFS and RFS are constructed based upon their respective *Service Definitions*, *ServiceTemplates,* and real-time Service Characteristic values passed over the activation interface, as well as the *Service Access Points* (SAPs).

The Service Access Point (SAP) represents a unique (logical and/or physical) resource where the Service can be accessed. A SAP is characterized by a SAP Specification. The *SAP Spec* defines a set of attributes and associated values that may be applied to one or more SAPs. The relationship between the *Service Specification* and the *Sap Specification* illustrates that for every Service Specification, there may be associated multiple *Sap Specifications.*

For example, given an Ethernet E-LINE Service Specification, there may be multiple *SAP Specifications* that correspond to various Bandwidth Profiles that can be applied to the SAP – one for GOLD, one for SILVER, and one for BRONZE. Likewise, there may be a single SAP Specification that is used for multiple Ethernet Service Specifications – E-LINE and E-LAN.

The following diagram illustrates the classes and relationships as required for Service Activation:

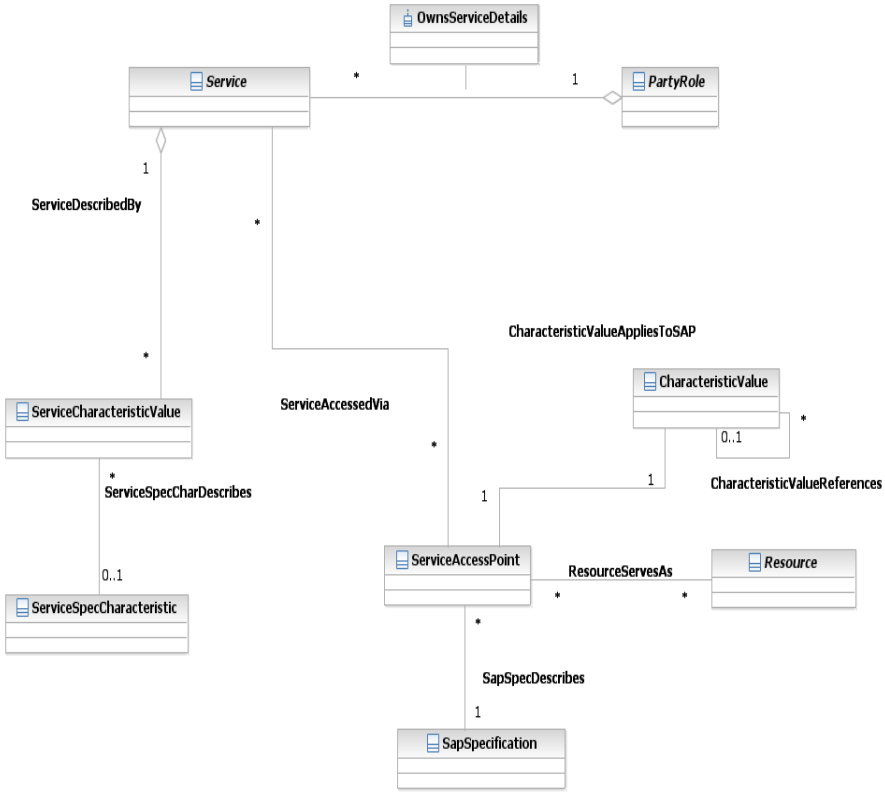

Figure 16 – Service and Service Access Points

6 Broadband Ethernet Access Service Specification

The following sections describe in detail how to create Ethernet Specifications for the **Broadband Ethernet Access Line Service**. It serves as an example from which one could derive the Broadband Aggregation & Backhaul Service Specifications. The set of ServiceSpecCharacteristics will be quite similar between the two services. What will vary for the most part are the values applied to the characteristics, and where the characteristics actually get applied (i.e. applying BW profile characteristics to a SAP vs. the Service itself representing an OVC. **Note:** The characteristics below are NOT intended to be a mapping of all MEF characteristics for UNIs, ENNIs, OVCs, and OVC endpoints. They map only those that are relevant to this scenario.

6.1 Broadband Ethernet - ServiceSpecCharacteristics (SSC)

The table below represents all the MEF characteristics required to define the BEA specifications, and hence to provision the associated services. For a full explanation of all the characteristics described below, see MEF 6.1 and MEF 10.2. The columns in the table represent the attributes in the serviceSpecCharacteristic, and are as follows:

- *SSC name* (from Common Service Info) Name of the characteristic
- *SSC description* (from Common Service Info) Description of the characteristic
- *SSC valueType* Providers the “type” for the characteristic – integer, string, boolean
- *containedBySSCRefList* Gives the list of names of composite SSCs containing this atomic SSC
- *containsSSCRefList* Gives the list of names of atomic SSCs contained within this composite SSC
- *derivationFormula*

Other SSC attributes that aren’t in the table, but may be implemented include: minCardinality, maxCardinality, extensible, and validFor.

The rows of the table that are shaded may be implemented as resource characteristics that are part of infrastructure provisioning and not passed over the MTOSI Service Management interfaces. This provisioning may happen using MTOSI resource management interfaces, proprietary interfaces, or directly via a management system. The provisioning of resource characteristics is outside of the scope of this document. The choice is up to the user.

Name	MEF Equivalent	Description	valueType	containedBy SSCRefList	SSCRefList
UNI Section	MEF 10.2				
UNI_Characteristics		Collection of all UNI SSCs	Complex		UNI_Id, UNI_Speed, UNI_Mode etc.
UNI_Id	UNI Identifier	Means to identify the UNI	String	UNI_Characteristics	
UNI_Speed	Speed	Port speed. For UNI most likely 10/100	String	UNI_Characteristics	
UNI_Mode	Mode	Port mode – Half duplex or Full duplex	String	UNI_Characteristics	
UNI_ServiceMux	Service Multiplexing	Indicates whether there is service multiplexing on the UNI	Boolean	UNI_Characteristics	
UNI_Bundling	Bundling	Indicates whether more than one CE-VLAN can be associated to an OVC	Boolean	UNI_Characteristics	
UNI_AllToOne	All To One Bundling	Indicates that all CE-VLANs are bundled to the same OVC	Boolean	UNI_Characteristics	
UNI_Mtu	UNI Maximum Transmission Unit Size	Maximum Transmission Unit	Integer	UNI_Characteristics	
CE-Vlan-id	CE-VLAN-ID	CE-VLAN Id for untagged or priority tagged traffic	Integer	UNI_Characteristics	
UNI_L2CP	L2 Control Processing – This complex characteristic represents a list of L2 control protocols with each one having an “action”	Table of L2 control protocol processing entries	Complex	UNI_Characteristics	UNI_L2CPProtocol UNI_L2CPAction

	specified				
UNI_L2CPProtocol		Name of L2 protocol	String	UNI_L2CP	
UNI_L2CPAction	Actions include: discard, peer, pass to EVC, or peer and pass to EVC	Action to take upon receipt of frames containing protocol	String	UNI_L2CP	
ENNI Section	MEF 26				
ENNI_Characteristics		The collection of all ENNI SSCs	Complex		
ENNI-Id	Operator ENNI Identifier	Means to identify the ENNI	String	ENNI_Characteristics	
ENNI_FrameFormat	Frame Format	Standard Ethernet Frame format with Stags/Ctags defined in accordance with 8021.ad	String	ENNI_Characteristics	
ENNI_NumPhyLinks	Number of Links	Number of physical links if ENNI supports LAG	Integer	ENNI_Characteristics	
ENNI_ProtectMech	Protection Mechanism	If ENNI supports protection, identifies the type of protection mechanism, i.e. LAG, EPSRing	String	ENNI_Characteristics	
ENNI_Mtu	ENNI Maximum Transmission Unit	Maximum Transmission Unit	Integer	ENNI_Characteristics	
ENNI_MaxNumOVCs	Maximum Number of OVCs	The maximum number of OVCs that the Operator can support at the ENNI	Integer		
ENNI_EPMapTable	Endpoint Map	The map that associates each S-Tagged ENNI Frame with a VUNI End Point.	N/A Complex	ENNI_Characteristics	EnniEPMapVID EnniEPName EnniEPType
ENNI_EPMapSVID	Endpoint Map	The map that associates each S-	Integer	EnniEPMapTable	

		Tagged ENNI Frame with a VUNI endpoint			
ENNI_EPName	Endpoint Map	VUNI EP ID	String	EnniEPMapTable	
ENNI_EPType	Endpoint Map	Endpoint Type -VUNI	String	EnniEPMapTable	
VUNI Options					
VUNI_Characteristics		The collection of all VUNI SSCs	Complex		
VUNI-Id	VUNI Identifier	Means to identify the VUNI	String	VUNI_Characteristics	
VUNI_RelVUNIEndpt	Related VUNI endpoint	Association of VUNI to an ENNI via a reference to the ENNI PTP	String	VUNI_Characteristics	
VUNI_RelOVCEndpts	Related OVC endpoints	OVC Endpoints contained within this VUNI	String	VUNI_Characteristics	
OVC Section	MEF 26				
OVC_Characteristics		The collection of all OVC SSCs	Complex		OVC_Id, OVC_CvidPres, etc
OVC-Id	OVC Identifier	Could be combination {stag, ctag}	Integer	OVC_Characteristics	
OVC_Type	OVC Type	For this scenario, the only valid type is Point-to-Point	String	OVC_Characteristics	
OVC_ CvidPres	CE-VLAN-ID Preservation	Maintain CE-VLAN id preservation throughout network	Boolean	OVC_Characteristics	
OVC_CvidCoSPres	CE-VLAN CoS Preservation	Maintain CE-VLAN CoS preservation throughout network	Boolean	OVC_Characteristics	
OVC_SvidPres	S-VLAN-ID Preservation	Maintain S-VLAN id	Boolean	OVC_Characteristics	

		preservation throughout network			
OVC_SvidCoSPres	S-VLAN CoS Preservation	Maintain S-VLAN CoS preservation throughout network	Boolean	OVC_Characteristics	
OVC_ColorForwarding	Color Forwarding	This implies provisioning same two-rate three color markers on both AN and EAS	Boolean	OVC_Characteristics	
OVC_MTU	OVC Maximum Transmission Unit Size	The maximum length in bytes allowed in a frame mapped to the an OVC End Point that is associated by the OVC	Integer	OVC_Characteristics	
OVC_Ucast	Unicast Service Frame Delivery	This attribute describes how ingress frames mapped to an OVC End Point with a unicast destination MAC address are delivered to the other External Interfaces with OVC End Points associated by the OVC	String	OVC_Characteristics	
OVC_Mcast	Multicast Service Frame Delivery	Similar description as for unicast, except multicast destination MAC address	String	OVC_Characteristics	
OVC_Bcast	Broadcast Service Frame Delivery	Similar description as for unicast, except broadcast destination MAC address	String	OVC_Characteristics	
SAP Section	MEF 10.2				

SAP_Characteristics			Complex		SAP_Id, CoSId
SAP-Id		SAP identifier	String	SAP_Characteristics	
CoS-Id		Composite Characteristic		SAP_Characteristics	CoSType, CoSClassifier, BWProfCoS
CoSType		802.1p, DiffServ	String	CoSId	
CoSClassifier		The value will depend on the type of classifier	String	CoSId	
BWProfile		BW Profile	Complex value identified by BWProfile name	CoSId	CIR, CBS, EIR, EBS,CM, CF
CIR		Committed Information Rate	Integer	BWProfile	
CBS		Committed Burst Size	Integer	BWProfile	
EIR		Excess Information Rate	Integer	BWProfile	
EBS		Excess Burst Size	Integer	BWProfile	
CM		Color Mode	String	BWProfile	
CF		Coupling Flag	Boolean	BWProfile	
CVLAN-Id		CVLAN for customer service	Integer	SAP_Characteristics	

Table 1- Ethernet Service Spec Characteristics

Broadband Ethernet Access Line - Service Definition (SD)

The Service Definition defines the service by providing the required service spec characteristics for the service, and their associated "value lists". These value lists define the constraints on the values, possible default values, units of measure, etc. The Service Definition also provides lists of product specifications and service catalogue references for which the SD is valid. The SD is also the place where the references to the SAP specs are provided.

The following example represents a Service Definition: [Note: not all attributes included, and some complex types are simplified]

1. *Name* Identifier of the SD
2. *Type* Identifies type of SD
3. *Version* Indicates the SD version number
4. *Product Spec Reference List* The list of product spec references for which this SD is valid
5. *Service Catalog Ref List* The list of service catalog references for which this SD is valid
6. ***describedByList*** The list of service characteristics describing the service*
7. *activationMode* Indicates whether the service is provisioned or signaled. In this case it is provisioned
8. *sdStatus* Service Definition status. This attribute can take on one of the values: DRAFT, STANDARD, or PROPRIETARY
9. *sapSpecificationRefList* A list of SAP specifications that define the types of SAPs allowed when accessing this service.
10. *dependencies* This would be for any pre- required for this service (if required).

The ***describedByList**** is a list of serviceSpecCharInUse which is composed of:

- sscRef
- sscUse
- valueList
- *sscUse* globallySet (not used for ServiceTemplates, only required for Service Definitions and indicates whether the characteristic may be set in the template or must be set over the interface)
- *sscUse minCardinality* (valid for both; the minimum number of times the attributes must occur)
- *sscUse maxCardinality* (valid for both; the maximum number of times the attributes may occur)
- *sscUse extensible*
- *sscUse validFor* (Indicates how long the value is valid).

The **valueList** is further decomposed as follows:

- **valueType, default, allowed values**, **unitOfMeasure, valueFrom, valueTo, rangeInterval**, validFor. Value contains all value in the table, including the ones that should be in range.

The following table represents an example of a Service Definition for a Broadband Ethernet Access Line Service as described in this document. Using the Service Definition, the Service Designer could then create Broadband Ethernet Access Service Specifications and Associated Service Templates that would then allow the Service Provisioner to Provision Ethernet Access Services in the BEA Network.

Service Definition	**Broadband Ethernet AccessLine service**
GENERAL Section	
Name	BEA Service Definition
Type	Ethernet Access Line
Version	V1.0
Product Spec Ref	EAL Product Offering
Service Catalog Ref	EAL Service
DescribedbyList	

		valueList			
	globallySet	**valueType**	**default**	**allowedvalues**	**measure**
[UNI Related Chars]					
UNI_Characteristics	no	Complex	BEA_UNI		
UNI-Id	no	String			
UNI_Speed	yes	String	100	10,100,1000	Mbps
UNI_Mode	yes	String	Full	Full, Half	
UNI_ServiceMux	yes	Boolean	False		
UNI_Bundling	yes	Boolean	True		
UNI_AllToOne	yes	Boolean	False		
UNI_MTU	yes	Integer	1522		
CE-Vlan-Id	yes	Integer	1		
UNI_L2CP		Complex	sscUse maxCardinality = *		
UNI_L2CPProtocol	yes	String			
UNI_L2CPAction	yes	String		discard, peer	

		valueList			
	globallySet	**valueType**	**default**	**allowedvalues**	**measure**
[ENNI Related Chars]					
ENNI_Characteristics	no	String	BEA_ENNI		
ENNI-Id	no				
ENNI_FrameFormat	yes	String	vidBasedDoubleTag	vidBasedDoubleTag portBasedDoubleTag	
ENNI_NumPhyLinks	yes	Integer		Integer value 1 of 2	
ENNI_ProtectMech	yes	String		LAG, None, or other	
ENNI_Mtu	yes	Integer	9216	>= 1526	
ENNI_MaxNumOVCs	yes	Integer			
ENNI_EPMapTable		Complex			
ENNI_EPMapSVID	no	Integer			
ENNI_EPName	no	String			
ENNI_EPType	no	String	VUNI		
[VUNI Related Chars]					
VUNI_Characteristics	no	String	BEA_VUNI		
VUNI-Id	no	String			
VUNI_RelVUNIEndpt	no	String			
VUNI_RelOVCEndpts	no	String			
[OVC Related Chars]					
OVC_Characteristics	no	Complex	BEA_OVC		
OVC-Id	no	Integer			
OVC_Type	no	String	Point-to-Point		
OVC_ CvidPres	yes	Boolean	True		

		valueList			
	globallySet	**valueType**	**default**	**allowedvalues**	**measure**
OVC_CvidCoSPres	yes	Boolean	True		
OVC_SvidPres	yes	Boolean	True		
OVC_SvidCoSPres	yes	Boolean	True		
OVC_ColorForwarding	yes	Boolean	True		
OVC_MTU	yes	Integer	1526		
OVC_Ucast	yes	String	Unconditionally		
OVC_Mcast	yes	String	Unconditionally		
OVC_Bcast	yes	String	Unconditionally		
Sap Related					
SAP_Characteristics	no	Complex	BEA_SAP		
SAP-Id	no	String			
CoS-Id	yes	Complex			
CoSType	yes	String			
CoSClassifier	yes	String			
BWProfile	yes	Complex			
CIR	yes	Integer			
CBS	yes	Integer			
EIR	yes	Integer			
EBS	yes	Integer			
CM	yes	String	Color-Aware		
CF	yes	Boolean	1		
CVLAN-Id	no	Integer			

Table 2 – Broadband Ethernet Access Line - Service Definition (SD)

Broadband Ethernet Access Line– Service Template

The following service template is based upon the characteristics as defined in the Broadband Ethernet Access Line Definition.

Service Template	Broadband Ethernet Access Line			
GENERAL Section				
Name	BEA Service Template			
Type	Ethernet Access Line Template			
Version	V1.0			
Product Spec Ref	EAL Product Offering			
Service Catalog Ref	EAL Service			
DescribedbyList				
sscRef	**sscUse**			
	canBeOverridden	**value**	**containsSSCVs**	**Comments**
UNI Related Chars				
UNI_Characteristics	no	**BEA_UNI**	BEA_L2CP_STP BEA_L2CP_Pause	Will only have one UNI profile
L2CP	no	BEA_L2CP_STP	STP, Discard	
L2CPProtocol	no	STP		
L2CPAction	no	Discard		
L2CP	no	BEA_L2CP_Pause	Pause, Discard	
L2CPProtocol	no	Pause		
L2CPAction	no	Discard		
L2CP	no	BEA_L2CP_LACP	LACP, Discard	
L2CPProtocol	no	LACP		
L2CPAction	no	Discard		
L2CP	no	BEA_L2CP_LinkOAM	LinkOAM, Peer	
L2CPProtocol	no	LinkOAM		

L2CPAction	no	Peer		
L2CP	no	BEA_L2CP_802.1X	802.1X, Discard	
L2CPProtocol	no	802.1X		
L2CPAction	no	Discard		
L2CP	no	BEA_L2CP_E-LMI	E-LMI, Discard	
L2CPProtocol	no	E-LMI		
L2CPAction	no	Discard		
L2CP	no	BEA_L2CP_LLCP	LLCP, Discard	
L2CPProtocol	no	LLCP		
L2CPAction	no	Discard		
ENNI Related Chars				
NumPhyLinks	yes	2		
ProtectMechanism	yes	LAG		
MaxNumOVCs	yes	40,940		
EnniEPMapTable		**BEA_ENNI**		
EnniEPMapSVID	yes	111		
EnniEPName	yes	VUNI_111		
EnniEPType	yes	VUNI		
EnniEPMapSVID	yes	112		
EnniEPName	yes	VUNI_112		
EnniEPType	yes	VUNI		
EnniEPMapSVID	yes	113		
EnniEPName	yes	VUNI_113		
EnniEPType	yes	VUNI		

Table 3 – Broadband Ethernet Access Line– Service Template

Broadband Ethernet Access Line - "Upstream" Sap Specification

The bandwidth profiles used per service may depend on the product being sold. Note: the 802.1p CoS markings represent the flows within the bandwidth, in this case. This allows for specification of priority queues based upon CoS, with policing on upstream and the downstream directions, if required.

Examples of upstream / downstream bandwidth specifications:

1. Data 768 Kbps upstream, and 2 Mbps downstream – Priority 2
2. VoD no upstream, and 10Mbps downstream- Priority 5 [down only]
3. Voice 5Mbps upstream, and 5 Mbps downstream – Priority 7

The following Sap Specification represents the "upstream" BW Sap Specification. The specification would be applied to the SAP (OVC endpoint) on the access node (DSLAM or ONT).

Sap Specification	Broadband Ethernet Access Line "Upstream" Sap BW Spec		
GENERAL Section			
Name	BEA "Upstream" BW Sap Specification		
Type	Ethernet Access Line BW Sap Specification		
DescribedbyList			
sscRef	**sscUse**		
	canBeOverridden	**value**	**containsSSCV**
SAP Related Chars			
SAP_Characteristics	no	SAP_Upstream	CoS_UpVoice CoS_UpData
CoSId	no	CoS_UpVoice	802.1p, 7 , BW_UpVoice
CoSType	no	802.1p	
CoSClassifier	no	7	
BWProfile	no	BW_UpVoice	5000, 128, 7500, 128
CIR	yes	5000	
CBS	yes	128	
EIR	yes	0	
EBS	yes	0	
CoSId	no	CoS_UpData	802.1p, 2, BW_UpDate
CoSType	no	802.1p	
CoSClassifier	no	2	
BWProfile	no	BW_UpData	768, 128, 1500, 128
CIR	yes	768	
CBS	yes	128	
EIR	yes	1500	
EBS	yes	128	

Table 4 – Broadband Ethernet Access Line - "Upstream" Sap Template

Broadband Ethernet Access Line - "Downstream" Sap Specification

The following represents the "downstream" Bandwidth specification. The downstream specification would be applied to the SAP (OVC endpoint) on the VUNI. This would correspond to a connection point on Ethernet Access Switch.

Sap Specification	Broadband Ethernet AccessLine "Downstream" BW Specification
GENERAL Section	
Name	BEA "Downstream" BW Specification
Type	Ethernet Access Line BW Specification
DescribedbyList	

	canBeOverridden	**value**	**containsSSCV**
SAP Related Chars			
SAP_Characteristics	No	SAP_Downstream	CoS_DownVoice CoS_DownData_ CoSDownVoD
CoS-Id	no	CoS_DownVoice	802.1p, 7 , BW_DownVoice
CoSType	no	802.1p	
CoSClassifier	no	7	
BWProfile	no	BW_DownVoice	5000, 128, 7500, 128
CIR	yes	5000	
CBS	yes	128	
EIR	yes	0	
EBS	yes	0	
Cos-Id		CoS_DownData	802.1p, 2, BW_DownData
CoSType	no	802.1p	
CoSClassifier	no	2	

	canBeOverridden	**value**	**containsSSCV**
BWProfile	N/A	BW_DownData	2000, 128, 3000, 128
CIR	yes	2000	
CBS	yes	128	
EIR	yes	3000	
EBS	yes	128	
CoS-Id	no	CoS_DownVoD	802.1p, 5, BW_DownVoD
CoSType	no	802.1p	
CoSClassifier	no	5	
BWProfile	no	BW_DownVoD	10000, 128, 15000, 128
CIR	yes	10000	
CBS	yes	128	
EIR	yes	15000	
EBS	yes	128	

Table 5 – Broadband Ethernet Access Line - "Downstream" Sap Template

6.2 Broadband Ethernet Access Line - General Service Activation

Once the Service Definition and Service Template are defined, Service Activation over the MTOSI-SM Interfaces can be used. There are two possible activation methods which in essence result in either “pass by value” or “pass by reference”. In the first method, the activation OS has knowledge of all the service characteristics / values and passes them directly over the interface to the target OS. In the second model, it is the target OS who has knowledge of all the service characteristics / values (as defined in the templates), and the activation OS is simply referencing them over the activation interface. In this example, we are showing the “pass by reference” method, which assumes there are service templates (as defined above) that exist and may be referenced.

Also, the activation method may depend on the state of the network and the types of services being provisioned. For example, the first time activation is occurring on the ENNI/VUNI, these characteristics may be required for provisioning, but not for subsequent activation requests. However, on the other side (in the GPON case), it may be required to provision the UNI and the OVC for every subscriber as we have a single VLAN per subscriber model. The provisioning model needs to be flexible to handle all different possibilities and configurations.

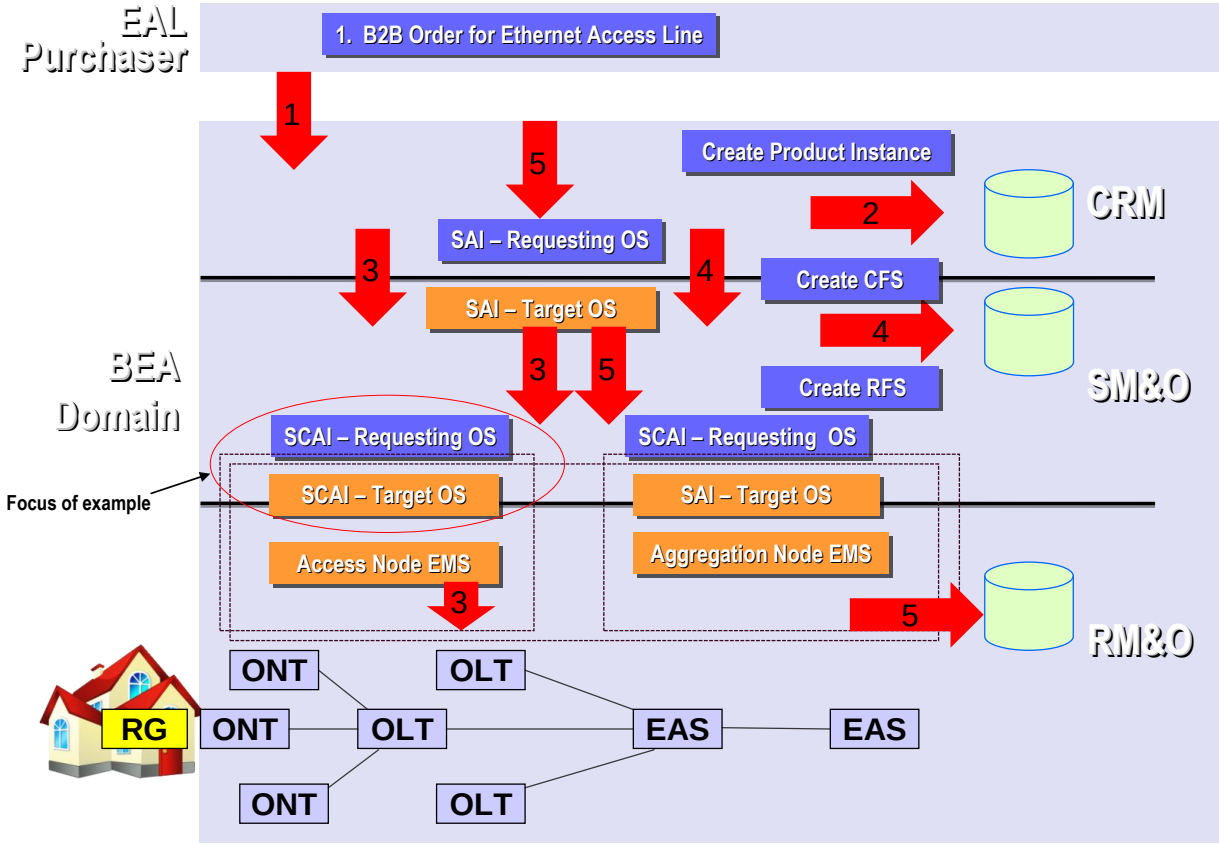

Figure 17 – General OSS/BSS Process Flow
Broadband Ethernet Access Services

The provisioning process is as follows:

1. NSP, or other provider, places an order for a broadband Ethernet Access Line from the BEA provider
2. The BEA, handles the order, and amongst other activities at the CRM layer creates a Product instance
3. The BEA CRM application sends an MTOSI SAI “feasibilityCheck” request to the SM&O service management application to determine the feasibility of being able to support the product instance – internally at the SM&O layer, there is also a “feasbilityCheck” to both the “Access Node” and “Ethernet Access Service” management systems [if implemented] to see if the resources are available, or can support the product instance. For example, DSL may not be available in the area requested.
4. At the point the CFS object has been created, and it is known whether the service request can be fulfilled or not. It is possible to perhaps “reserve” resources for future provisioning, but for the sake of this example, we will go straight to the provisioning request.
5. By this time the ONT/DSL modem has been installed on the customer site, and the resource inventory data base has been updated. [Note: It is also possible to even “pre-provision”, and most likely that the service provider will “pre-provision” the Ethernet access line service before the access node is installed such that once it is installed the service will be up and running.]
6. The “provisionRequest” operation will be issued over the SAI, presenting the customer’s ONT/DSLAM port as the UNI, the customer CVLAN and the provider SVLAN, the combination of which will give the unique identifier {stag, ctag} of the Ethernet access line. Note: input into the SAI operation is: Product Info, Subscriber List, User List – so the info stated must be passed as product info.
7. In turn, the service management application issues the SCAI “provisionService” operations to provision the RFS. These will result in the creation of the RFS and the provisioning of the associated OLT/ONT (or DSLAM) resources on the access network, and the Ethernet access switches in the EAN.

Note, it is the responsibility of NSP to ensure the provisioning of the residential modems and gateways.

The following example is based upon the Service Component Activation Interface (SCAI) for the Access Node. If we refer back to the “Internal View of the BEA” in Broadband Ethernet Services, there is an OVC between the ONT / Customer port on DSLAM [with the SAP being the GPON ONT Ethernet port + OVC Endpoint] and the OLT / DSLAM Network port [with the SAP being the ENNI/VUNI +OVC Endpoint]. As the MEF has not defined this scenario, or the SNI, we will use the ENNI as defined for the sake of our example.

The MTOSI-SM SCAI “provisionService” operation takes as input:

1. **rfsCreateData** this is a structure that is based on the ResourceFacingServiceType and contains all the required elements to create the service. See below

The **rfsCreateData** has the following format:

[The following fields are taken from commonServiceInfo]

- **name** Name of the RFS. For the sake of the example, the service will be named by the {Stag, Ctag} combination.
- **userLabel** An alternative service identifier (optional)
- **owner** A service owner (optional)
- **aliasNameList** Other names for the service (optional)

[The following fields are taken from Service]

- **serviceTemplateRef** This will be the MTOSI name of the BEA Service Template
- **subscriberRef** This is normally for the SAI, and refers to a Subscriber known at the CRM layer. However, it may be passed down, if required, and associated to the actual Ethernet Access Line. (optional)
- **userRefList** This is normally for the SAI, and refers to a List of Users of the Service known at the CRM layer. However, they may be passed down, if required, and associated to the actual Ethernet Access Line. (optional)
- **cfsRef** A reference to the Customer Facing Service
- **sapRefList** In MTOSI 2.0 this is a list SAP names. We changed this in 2.1 to be the actual SAP objects which would contain the references to the Upstream/Downstream SAP specs and in the case of the UNI, a describedByList of characteristics for that particular SAP that would indicated a CE-VLAN-ID
- **describedByList** A set of serviceSpecCharacteristics passed over the interface that characterize the service. The values for these SSC either override those specified in templates, or specify values for SSC that were defined as “globally defined = no”.

The ***describedByList**** is a list of serviceCharacteristicValueType which is composed of:

- Value The value to be associated to the service characteristic
- validFor This is optional and will not be used in the example.
- sscRef The serviceSpecCharacteristic to which the value refers

A SAP (Service Access Point) represents a set of parameters associated (directly or indirectly) with a unique (logical and/or physical) resource where the single Service can be accessed. In the case of the Broadband Ethernet Services under considerations, the SAPs correspond to the OVC endpoints, which are the connection endpoints of the virtual connection relative to the UNI/VUNIs which contain them.

The SAP includes the commonServiceInfo of which at least the name below should appear:

1. *Name* Identifier of the SAP
2. *Type* Identifies type – UNI, VUNI
3. AdminState [optional – depends on capabilities of equipment]
4. ServiceState [optional – depends on capabilities of equipment]
5. OperState [optional – depends on capabilities of equipment]
6. subscriberRef Reference to subscriber – optional
7. userRef Reference to user – optional
8. sapSpecRef Reference to the BW Specification.
9. describedByList Set of SSCs/SSCVs. For the UNI, the CVLAN-Id would be provided here

For the GPON ONT / DSLAM Customer UNI, this will be the “Upstream” Template, and for the OLT / DSLAM Network UNI, this will be the “Downstream” Template.

Thus, to summarize the RFS Create Data would have the following format for the activation of the Broadband Ethernet Access Line over the SCAI:

	Broadband Ethernet AccessLine – RFS Create Data
GENERAL Section	
name	BEA – Network Service {110,5}
owner	BEA Service Provider
serviceTemplateRef	Reference to BEA General Service Template
subscriberRef	John K. Smith
cfsRef	BEA – Customer Service {110,5}
sapRefList	A SAP object for each OVC endpoint containing the following:
Name	UNI_SAP_{110,5}
Type	UNI
SapSpecRef	BEA_Upstream
DescribedByList	SSC=CVLAN-Id, SSCV= 5
Name	SAP_{110,5}
Type	VUNI_SAP_{110,5}
SapSpecRef	BEA_Downstream
DescribedByList	SSC=VUNI_Id SSCV=VUNI_111, SSC= VUNI_RelOVCEndpts, SSCV= {111,5}
DescribedbyList	
OVC related chars	
{111,5}	OVC-Id
[GPON_ONT1_Eth1 + {110,5}] [GPON_OLT1_Net1 + {110,5}]	ListOVCEndPoints

Table 6 – Broadband Ethernet Access Line – RFS Create Data

7 Appendix

7.1 MEF Services – Overview

Three different service types are defined in MEF 6.1 for Metro Ethernet Services.

7.1.1 E-LINE Service Type

- Provides a point-to-point Ethernet Virtual Connection (EVC) between two User Network Interfaces (UNIs).
- MEF defines two E-Line type services: Ethernet Private Line (EPL) and Ethernet Virtual Private Line (EVPL). These are analogous to frame relay, ATM or Private Line Services. These services may be created for instance to provide internet access connectivity between a customer location and an internet access provider PoP.

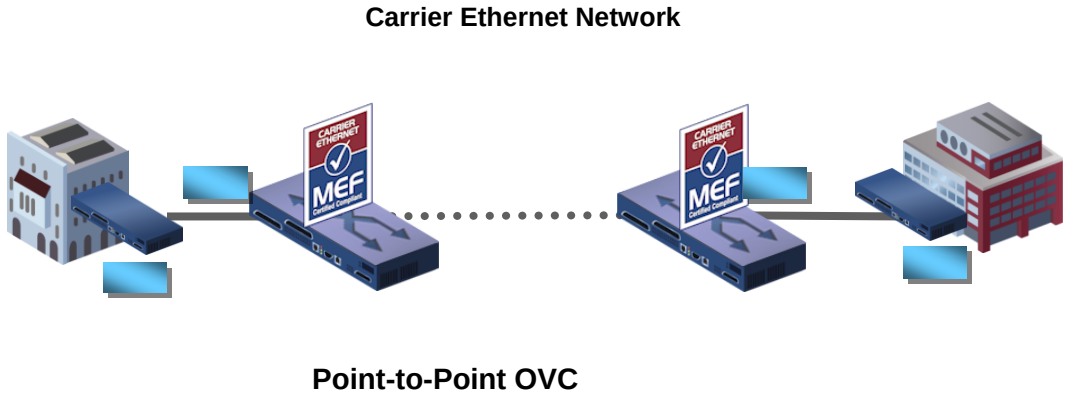

Figure 18 – Metro Ethernet Forum E-LINE Service Type

7.1.2 E-LAN Service Type

- Provides a multi-point connectivity between sites, i.e. between two or more UNIs which are connected via a multi-point OVC.
- MEF defines two E-LAN type services: Ethernet Private LAN and Ethernet Virtual Private LAN. These services may be used to create Transparent Ethernet LAN services or Multi-point Layer 2 Private Networks.

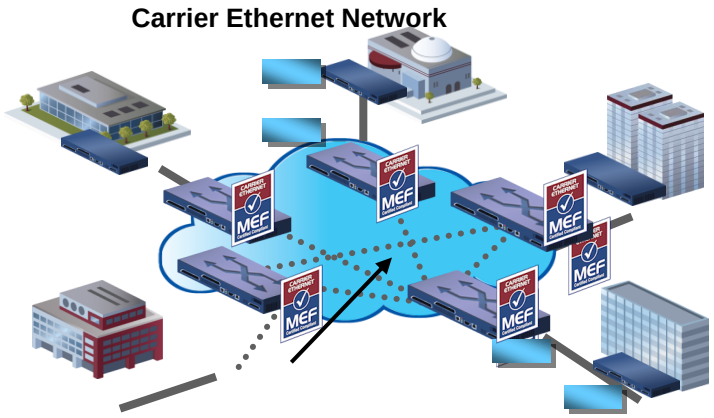

Figure 19 – Metro Ethernet Forum E-LAN Service Type

7.1.3 E-TREE Service Type

- Provides a rooted multi-point Ethernet Virtual Connection. This service only supports communication between the leaves and the root of the tree. Direct communication between the leaves is not supported.
- MEF defines two E-TREE type services: Ethernet Private Tree (EP-Tree) and Ethernet Virtual Private Tree (EVP-Tree).

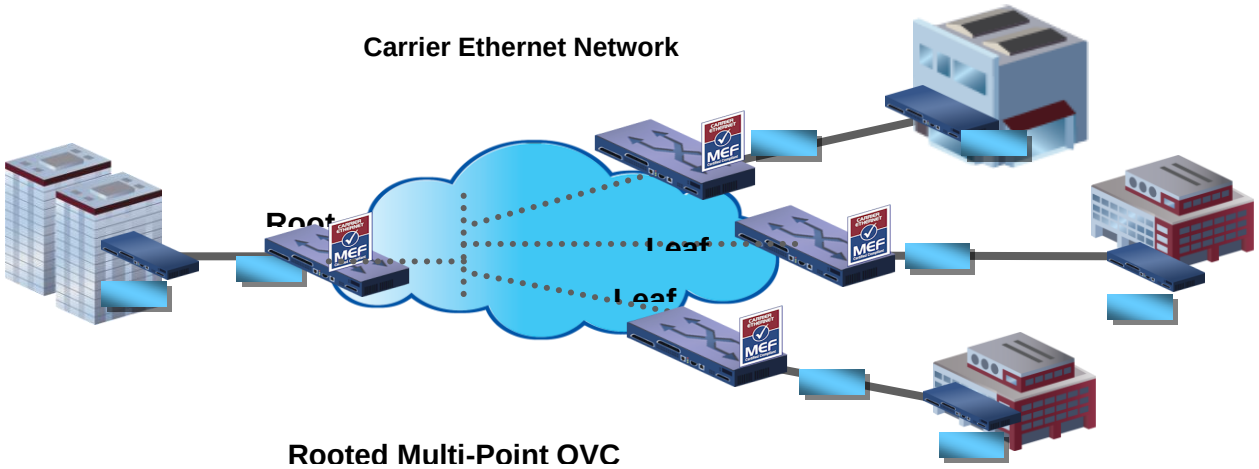

Figure 20 – Metro Ethernet Forum E-TREE Service Type

8 Administrative Appendix

8.1 Document History

Version Number	Date Modified	Modified by:	Description of changes
1.0	12/21/2010	Jessie Jewitt	Original version

8.2 Acknowledgments

First Name	Last Name	Company
Steve	Fratini	Telcordia
Olga	Havel	Amartus
Francois	Le Roux	Fujitsu
Menachem	Malkosh	Ecitele
Andrew	Mayer	Telcordia
Pedro	Nunes	Nokia-Siemens Networks
Raghu	Ranganathan	Ciena
Ana	Robnick	Iskratel
Ralph	Santitoro	Fujistsu
Camilo	Tiago	Nokia-Siemens Networks
Bernd	Zeuner	Deutsche Telekom

8.3 How to comment on this document

Comments and requests for information must be in written form and addressed to the contact identified below:

Jessie	Jewitt	Ciena
Phone:	650-714-2593	
Fax:		
e-mail:	jjewitt@ciena.com	

Please be specific, since your comments will be dealt with by the team evaluating numerous inputs and trying to produce a single text. Thus we appreciate significant specific input. We are looking for more input than wordsmith" items, however editing and structural help are greatly appreciated where better clarity is the result.