MEF

Service Operations Specification

MEF 52

Carrier Ethernet Performance Reporting Framework

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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
Allstream
CableLabs
Centurylink
Comcast
Ericsson
Fujitsu
InfoVista
Oracle
PCCW Global
Pulsecom
RAD
Time Warner Cable
T-Mobile USA

Table 1 Contributing Member Companies

2. Abstract

This specification documents a Carrier Ethernet service performance reporting framework in which Carrier Ethernet Network (CEN) Operators provide their Subscribers with access to Key Performance Indicators (KPIs) and statistics reporting through a standardized interface. The performance reporting framework includes, but is not limited to, System Architecture, KPI performance metrics, Information Model, Business Process Flows, Use Cases, Reporting Interface and Sequence diagrams (interaction behavior).

3. Terminology and Acronyms

This section defines the terms used in this document. In many cases, the normative definitions to terms are found in other documents. In these cases, the third column is used to provide the reference that is controlling, in other MEF or external documents.

Term	Definition	Reference
Access Provider	A CEN Operator that offers the Ethernet Access Service type.	MEF 33
Application Programming Interface (API)	An Application Programming Interface (API) specifies how software components should interact with each other and exchange data. The APIs may allow access to libraries that include perform specific functions or provide access to remote software entities via Remote Procedure Calls (RPCs) or other types of protocols. Common APIs include Hypertext Transfer Protocol (HTTP) request messages which support SOAP & REST based formats. The structure of response messages is usually defined in an Extensible Markup Language (XML) or JavaScript Object Notation (JSON) format.	This document
Availability	A measure of the percentage of time that a service is useable.	MEF 10.3
Carrier Ethernet Network (CEN)	A network from a Service Provider or network operator supporting the MEF service and architecture models.	MEF 12.1
CEN Operator	A CEN Operator is the administrative entity of a Carrier Ethernet Network	MEF 23.1
CPO	Class of Service Performance Objective	MEF 23.1
ETH OAM System	A system implementing a Ethernet SOAM PM solution within the Element Management Layer.	This document
eTOM	Enhanced Telecom Operations Map	TMF GB921
Frame Delay Range	The Frame Delay Performance minus the minimum Service Frame delay	MEF 10.3
Geographic Area	A predefined Carrier Ethernet service area defined by location information	This document
HTTP	Hypertext Transfer Protocol	
Information Model	An Information Model (as opposed to a Data Model) is an abstraction and only provides a high level view of things of interest (i.e., information) to the business. It aids in understanding the scope and breadth of the business, rather than the depth. An Information Model is a way of representing and structuring information that has advantages over other common artifacts such as a glossary, descriptive document, database or source code. A common Information Model will streamline the processes associated with information exchange, both within a business (e.g., Enterprise) and between the business and its external stakeholders. The MEF uses UML Class Diagrams to model Information Models	TMF GB922

Term	Definition	Reference
JSON	JavaScript Object Notation	This document
KPI	Key Performance Indicator	
Maintenance Domain (MD)	The network or the part of the network for which faults in connectivity can be managed. This term is equivalent to an OAM Domain, as defined by MEF 17 and used in MEF 30.1.	MEF 35.1
Maintenance Entity (ME)	A point-to-point relationship between two MEPs	MEF 35.1
Maintenance Entity Group (MEG)	A set of MEPs, each configured with the same MEG ID and MEG Level, established to verify the integrity of a single service instance.	MEF 35.1
MEG End Point (MEP)	MEG End Point (MEP) is an actively managed SOAM entity associated with a specific service instance that can generate and receive SOAM PDUs and track any responses. It is an end point of a single MEG, and is an end-point of a separate Maintenance Entity (ME) for each of the other MEPs in the same Maintenance Entity Group (MEG)	MEF 35.1
PM	Performance Management	TMF PM BA [18]
PM Consuming Application	Application that consumes Performance measurement by sending interface commands to PM producing application	TMF PM BA [18]
PM Producing Application	Any application performing Performance measurements and generating Performance measurement results to be consumed by either itself or another consuming application. A PM application can be both a Consuming Application as well as a Producing Application	TMF PM BA [18]
Process	A Process describes a systematic, sequenced set of functional activities that deliver a specified result. In other words, a Process is a sequence of related activities or tasks required to deliver results or outputs.	TMF GB921CP
Process Element	Process Elements can be considered as the building blocks or components, which are used to 'assemble' end-to-end business Processes. A BPMN Process Element defines a process performed in an organization.	TMF GB921CP

Term	Definition	Reference
Process Flow	A Process Flow graphically represents the behavior of Process Elements in an "end-to-end" or "through" Process view across the business (i.e., Enterprise). Such Process Flows are not constrained to bridge across the entire Enterprise, they can have any scope that is meaningful and helpful to analyze (e.g., Service Activation Testing). Thus, Process Flows examine some specific scenario in which the processes achieve an overall business purpose. The MEF is using the BPMN2 notation for documenting Process Flows.	TMF GB921CP
Service Level Agreement (SLA)	A Service Level Agreement (SLA) is the contract between the Subscriber or Operator and Service Provider specifying the agreed to service level commitments and related business agreements	MEF 33
Service Performance Reporting	Service Performance Reporting provides the necessary functionality required to generate reports about the performance of the Service Provider's services. These reports may be generated as part of normal periodic operations (e.g., proactively schedule), or may be as a result of a specific analysis request (e.g., on-demand). Report types include near real-time, historical view, and trend analysis.	TMF PM BA [18]
Service Provider	The organization providing UNI to UNI Ethernet Service(s).	MEF 33
Subscriber	The organization purchasing and/or using Ethernet Services.	MEF 33
Unified Modeling Language (UML)	The Unified Modeling Language (UML) is a unified model for object oriented analysis and design	OMG UML
Use Case	In the UML, a Use Case represents one particular type of a system's behavior based on stimuli from an external source (i.e., an actor). A system may have several Use Cases that define all its behavior.	OMG UML

Table 2 Terminology and Acronyms

4. Scope

This specification defines a Carrier Ethernet Service Performance Reporting Framework in which Carrier Ethernet Network (CEN) Operators provide their Subscribers with access to KPI performance data and statistics through a standardized interface. The reporting framework specification consists of a high-level service performance reporting architecture, Information Model, Use Case definitions, and business Process Flows. The specific KPIs exposed via the standardized interface are defined by the MEF 10.3 and MEF

35.1 specifications and modeled in the MEF 7.2 Carrier Ethernet Information Model. This framework will support both one-way and two-way KPI metric reporting.

Two types of business interfaces are specified: Business-to-Subscriber and Business-to-Business. The Business-to-Subscriber interface defines an interface between the Service Provider and Subscriber (or Carrier Ethernet Subscriber), which provides Carrier Ethernet service performance reporting at the EVC level and Class of Service (CoS) level. The Business-to-Business interface defines an interface between the Service Provider and a CEN Operator which provides Carrier Ethernet service performance reporting on the OVC level and Class of Service (CoS) level. Both interface types are specified using common industry web service API specifications and options to download historical reports.

5. Compliance Levels

The requirements that apply to the functionality of this document are specified in the following sections. Items that are REQUIRED (contain the words MUST or MUST NOT) will be labeled as [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. 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.

6. Introduction

MEF 35.1 [9] defines the Service OAM Performance Monitoring Implementation Agreement, in which a Service Provider is required to implement EVC and/or OVC circuit performance measurements across a defined Maintenance Domain (or OAM Domain). MEF 35.1 defines the performance metrics (e.g., Frame Delay, Inter-Frame Delay Variation, Frame Loss Ratio, Availability) and measurement methods (PM Sessions and PM Functions) to obtain the values for the metrics at the Network Layer. MEF 7.2 [2] defines a Carrier Ethernet Information Model, or management model, for these performance metrics. The management model can be extended to an EMS-to-NE interface, for provisioning and monitoring the Network Layer. For example, the EMS-to-NE interface is used to setup Service OAM Performance Monitoring and then gather the measurements that are occurring in the network on a continual (proactive) basis.

Currently, a Subscriber signs a Service Level Agreement (SLA) with a Service Provider with specified CPOs on EVC level Availability, Frame Delay, Inter-Frame Delay Variation, and Frame Loss Ratio. Normally, the Subscriber needs to open a ticket when they find performance degradations or service outages, and the Service Provider uses the ticket to do investigation on historical performance data in their own network and then sends feedback and results to the Subscriber. This ticket based performance process may take

considerable time for the Subscriber, and is not efficient for identifying root cause or troubleshooting quickly, due to performance ME gap caused by handoff demarcation (PE belongs to Service Provider, while CE belongs to Subscriber network). Furthermore, the Service Provider and Subscriber may use different schemes and scale for performance measurement, which also may cause challenges in SLA enforcement, because the Subscriber and Service Provider may not agree with each other on data conciseness and calculation. This same model can be extended between a Service Provider and an Access provider when a Service Provider signs a SLA with an Access Provider for OVC level performance objectives.

The proposed near real-time Carrier Ethernet service performance reporting framework aims to improve inefficient ticket-based SOAM performance reporting schemes and related problems described above. Through the service performance reporting framework interface specification, Service Providers are required to implement a secure authenticated Business-to-Subscriber portal to each Subscriber, for example, through a web based portal, for reporting EVC circuit performance at a given short interval (for example, every 15 minutes). The Subscriber can read or check performance based on circuit ID at near real-time. The service performance reporting framework interface specification also requires Access Providers to implement a secure Business-to-Business interface for reporting OVC circuit performance where the Service Provider can read or check performance based on circuit ID at near real-time.

7. Architecture

This section defines a generic architectural reference model that describes six functional entities: Client, Performance Reporting Server, Performance Database, Performance Collector, OAM Domain and Network Elements, as shown in Figure 1. The architecture complies with Service OAM Fault Management Implementation Agreement in MEF 30.1 [7] and supports both EVC and OVC level performance reporting. Each functional entity is described in Table 3.
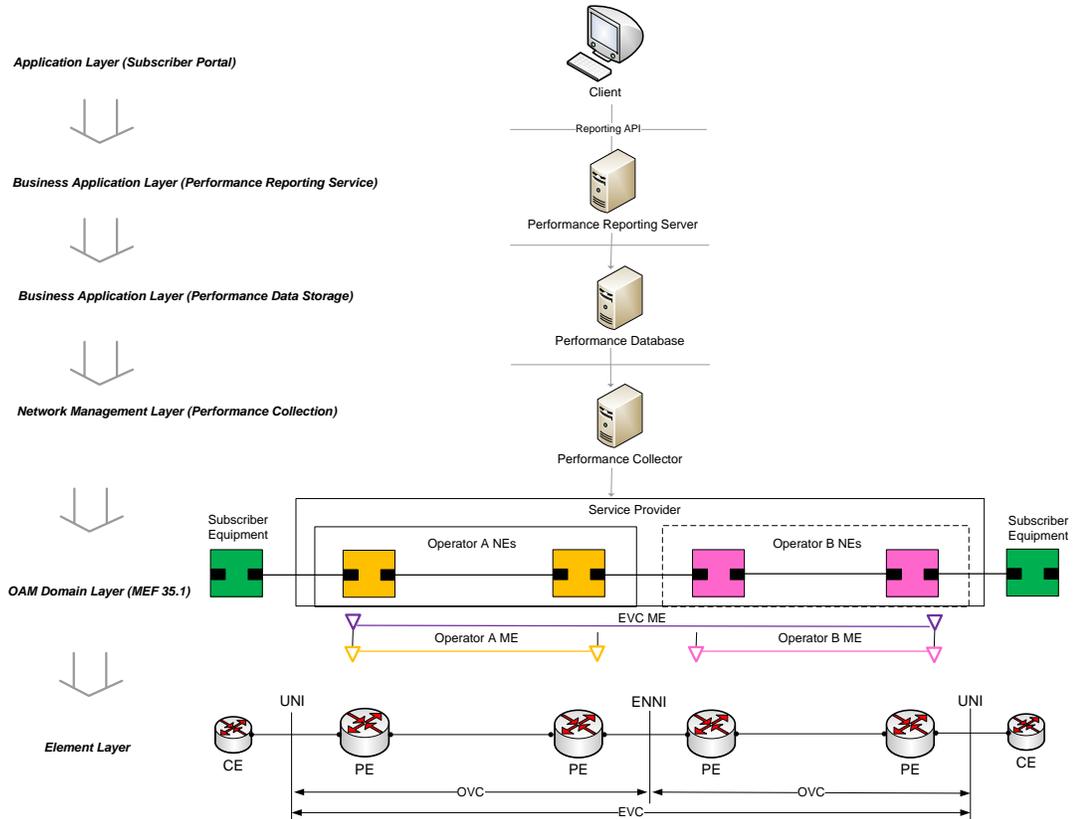
Figure 1 – Carrier Ethernet Service Performance Reporting Example Architecture
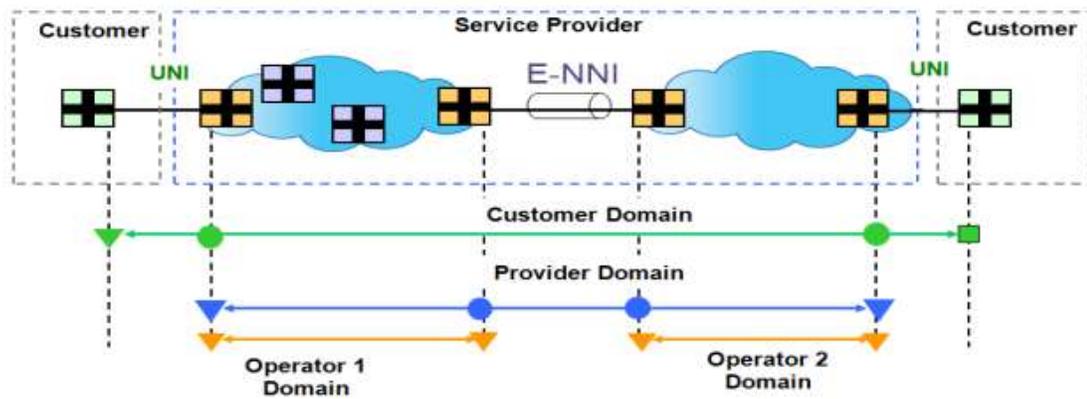
Figure 2 – MEF Hierarchical OAM Domain

Functional Entity	Description

Client	The Client is in the Subscriber domain, who orders an EVC service from the Service Provider, or in the Service Provider domain, who orders an OVC service from a CEN Operator, as shown in **Error! Reference source not found.**. The Client can uery and get performance reports from the Service Provider or CEN operator.
Performance Reporting Server	The Performance Reporting Server provides an interface with the Client to expose the KPI measurements stored in the Per-formance Database, which supports Business-to-Subscriber and Business-to-Business communication channels. The Perfor-mance Reporting Server implements the PM Consuming Appli-cation.
Performance Database	The Performance Database stores and manages EVC/OVC KPI performance data.
Performance Collector	The Performance Collector resides in the Service Provider Do-main or CEN Operator domain, and triggers periodic perfor-mance measurements on provisioned EVC or OVC through the ETH OAM system, respectively. The Performance Collector processes performance data as KPI metrics and stores into the Performance Database. The Performance Collector implements both the PM Producing and PM Consuming Applications. The Performance Collector serves as the PM Consuming Applica-tion for the OAM Domain while serving as the PM Producing Application for the Performance Reporting Server.
OAM Domain	The OAM Domain implements ETH OAM Performance Moni-toring functions in the Carrier Ethernet Network defined in MEF 35.1. The OAM Domain implements the PM Producing Application since the OAM Domain is where the KPI meas-urements are generated.
Network Elements	The Network Elements are the physical and/or virtual resources which contain the individual MEPs which implements ETH OAM Performance Monitoring functions in the Carrier Ethernet Network defined in MEF 35.1.

Table 3 Functional Entity Descriptions

The Carrier Ethernet Performance Reporting Framework follows the hierarchical OAM domain model defined in MEF 30.1, as shown in **Error! Reference source not found.**. he supported Carrier Ethernet services include Ethernet Virtual Connection (EVC) and Operator Virtual Connection (OVC). The EVC based services include EPL, EVPL, EP-LAN, EVP-LAN, EP-TREE and EVP-TREE as defined in MEF 6.2. The OVC based services include Access EPL and Access EVPL as defined in MEF 33.

[R1] A Service Provider **MUST** provide performance reporting per EVC to its Subscriber.

[R2] A CEN Operator **MUST** provide performance reporting per OVC to the Service Provider.

[R3] A Service Provider **MUST** aggregate all OVC performance that belongs to an associated EVC, and report EVC level performance to its Subscriber.

[R4] A Service Provider **MUST** provide reporting on periodic KPI performance per EVC defined in an SLA. The minimum reporting interval is defined based on the agreement between Service Provider and Subscriber.

A CEN Operator **MUST** provide reporting on periodic performance per OVC defined in an SLA. The minimum reporting interval is defined based on the agreement between CEN operator and Service Provider. The minimum measurement interval for OVC within the CEN Operator domain and for EVC within the Service Provider domain should be equal to or lower than the minimum reporting interval of the associated OVC within the CEN Operator domain and the EVC within the Service Provider domain.

[R5] Carrier Ethernet Performance Reporting Framework **MUST** support both One-Way and Two-Way KPI performance metrics, and include the following definitions and calculation methodologies in MEF 10.3 and MEF 35.1.

- One-way Frame Delay Performance

- One-way Frame Delay Range Performance

- One-way Mean Frame Delay Performance

- One-way Inter-Frame Delay Variation Performance

- One-way Frame Loss Ratio Performance

- One-way Availability Performance

- One-way Resiliency Performance expressed as High Loss Intervals

- One-way Resiliency Performance expressed as Consecutive High Loss Intervals

- One-way Group Availability Performance

- Two-way Frame Delay Performance

- Two-way Frame Delay Range Performance

- Two-way Mean Frame Delay Performance

- • Two-way Inter-Frame Delay Variation Performance

- • Two-way Frame Loss Ratio Performance

- • Two-way Availability Performance

[R6] A Service Provider **MUST** provide a Business-to-Subscriber interface to the Subscriber for EVC-based Performance reporting.

[R7] A Service Provider **MUST** provide the Subscriber a secure interface with content encryption and user authentication to query and get associated EVC performance data.

[R8] A CEN Operator **MUST** provide a Business-to-Business interface to the Service Provider for OVC-based Performance reporting.

[R9] The CEN Operator **MUST** provide the Service Provider a secure interface with content encryption and user authentication to query and get associated OVC performance data.

The interface is defined in the Interface Definition Section.

[R10] A CEN Operator **MUST** store periodic OVC performance data and create KPI performance reports based on OVC KPI metrics defined in an SLA.

[R11] The Service Provider interface **MUST** encode all data communications in JSON format for structuring data.

[R12] The CEN Operator interface **MUST** encode all data communications in JSON format for structuring data.

[R13] The Service Provider interface **MUST** use Transport Layer Security (TLS) / Secure Sockets Layer (SSL) to guarantee secure data transfer.

[R14] The CEN Operator interface MUST use Transport Layer Security (TLS) / Secure Sockets Layer (SSL) to guarantee secure data transfer.

[D1] A Service Provider **SHOULD** retain periodic performance data based on KPI metrics defined in an SLA, and the retention period for performance data be agreed among all parties involved in delivering the EVC or OVC service.

[D2] MEF recommends 18 months retention period for performance data, including an EVC or OVC that has been terminated.A CEN Operator **SHOULD** provide periodic reporting on CoS performance per OVC based on KPI performance metrics defined in an SLA.

[D3] A Service Provider **SHOULD** aggregate performance data per CoS of all OVCs which belong to an EVC, and provide periodic per EVC per CoS performance reporting based on KPI performance metrics defined in an SLA.

[D4]   A Service Provider **SHOULD** retain periodic performance data per EVC per CoS and create KPI performance report based on KPI metrics defined in an SLA.

[D5]   The Service Provider **SHOULD** provide reporting on CoS performance per EVC based on KPI performance metrics defined in an SLA.

[D6]   A CEN Operator **SHOULD** retain periodic CoS performance data per OVC and create KPI performance reports based on KPI metrics defined in an SLA.

[O1]   A Service Provider **MAY** report periodic performance data of all EVCs within a geographic area based on KPI performance metrics defined in an SLA.

[O2]   A CEN Operator **MAY** report periodic performance data of all OVCs within a geographic area based on KPI performance metrics defined in an SLA.

[O3]   A Service Provider **MAY** retain periodic EVC performance data within a geographic area and create KPI performance report of the geographic area based on KPI metrics defined in an SLA.

[O4]   If a Service Provider reports EVC performance data within a geographic area, the Service Provider **MAY** provide Subscriber a secure private interface to query and get associated EVC performance data of the geographic area.

[O5]   A CEN Operator **MAY** retain periodic OVC performance data within a geographic area and create KPI performance report of the geographic area based on KPI metrics defined in an SLA.

[O6]   If the CEN Operator reports OVC performance data within a geographic area, the CEN Operator **MAY** provide the Service Provider a secure private interface to query and get associated OVC performance data of the geographic area.

8. Use Cases

This section contains high-level Carrier Ethernet Performance Reporting Use Cases, based on the UML Use Case diagram syntax. Performance Data Measurement and Performance Data Storage Management are not within the project scope for performance reporting. Figure 3 illustrates the set of Use Cases.
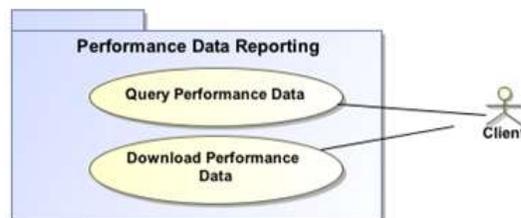
Figure 3 – Carrier Ethernet Performance Reporting Use Cases

8.1 Performance Data Reporting Use Cases

Query Performance Data

Use Case #	1
Use Case Name	Query Performance Data
Description	When the Performance Reporting Server receives a query from a Client on Performance Measurement Data on an existing EVC if in the Service Provider Domain or an OVC if in the CEN Operator Domain, the Performance Reporting Server returns the associated entries of the current ETH OAM measurement data or historical ETH OAM measurement data based on the requested time interval.
Actors	Client
Assumption	Client creates a performance query with single or multiple EVC or OVC IDs using web services API to the Performance Reporting Server.
Pre-Conditions	1. Client authentication and authorization has been performed. 2. Performance Reporting Server implements web-services API interface and monitors Client requests.
Process Steps	1. Client sends query on ETH SOAM PM data with single or multiple EVC or OVC ID(s) to Performance Reporting Server with time interval; 2. Performance Reporting Server returns ETH SOAM PM data results to Client.
Post-Conditions	If use case is successful, ETH SOAM PM Data of queried EVC or OVC is returned to Client.
Alternative Paths	1. Performance Reporting Server encounters an error (e.g., Authorization error) 2. Requested EVC or OVC does not exist

Table 4 Query Performance Data Descriptions

Download Performance Data

Use Case #	2
Use Case Name	Download Performance Data

Description	When the Performance Reporting Server receives Performance Data Download Requests from a Client on an existing EVC if in the Service Provider Domain or an OVC if in the CEN Operator Domain, the Performance Reporting Server returns the associated file of historical ETH OAM measurement data based on the requested time interval.
Actors	Client
Assumption	Client sends file download request to the Performance Reporting Server.
Pre-Conditions	1. Client authentication and authorization has been performed. 2. Performance Reporting Server implements web services API interface and monitors Client requests.
Process Steps	1. Client sends request to download ETH SOAM PM data with single or multiple EVC or OVC ID(s) to the Performance Reporting Server with time interval; 2. Performance Reporting Server returns performance data file to the requesting Client.
Post-Conditions	If use case is successful, the ETH SOAM PM performance data file of queried EVC or OVC is returned to the Client.
Alternative Paths	1. Performance Reporting Server encounters an error (e.g., Authorization error) 2. Requested EVC or OVC does not exist

Table 5 Download Performance Data Descriptions

9. Business Process Flow

This section defines a business process flow for the Carrier Ethernet Performance Reporting framework, which includes the process flow of OVC performance reporting from CEN operator to Service Provider, and EVC performance reporting from Service Provider to Subscriber.

The MEF Carrier Ethernet Service Lifecycle Process Model Service Operations Guidelines document [11] illustrates a generalized Process Flow for Performance Monitoring and Management showing the Subscriber, Service Provider and Access Provider stakeholders and the associated Business Processes each owns. Refer to that document for the Performance Management high-level general business process flow diagram for Carrier Ethernet services.

Figure 4 illustrates a more detailed business process flow diagram for the Carrier Ethernet Performance Reporting Framework. Both the Business-to-Subscriber and Business-to-Business interactions are shown with a messaging interface, where the web service API is realized. The Service Provider Process Flow is detailed and can also be extended to the Access Provider/CEN Operator when delivering the OVC to the Service Provider. The Service Provider Process Flow has two parallel tracks, one for (external) Subscriber facing processes and one for (internal) service facing processes. The shaded Process Element is not in scope but included for context.
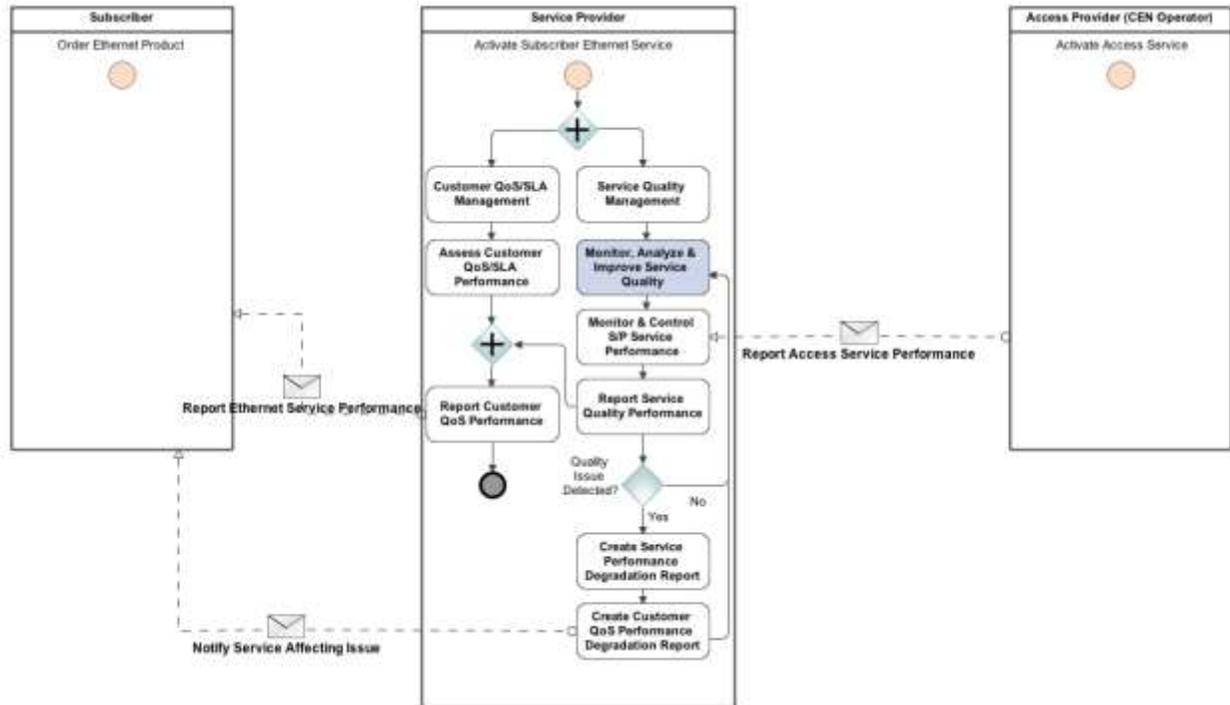
Figure 4 – Carrier Ethernet Performance Reporting Business Process Flow
Refer to Appendix II for a detailed description of each Business Process activity.

10. Information Model

This section specifies the Information Model used in the Carrier Ethernet Performance Reporting Framework. The performance metrics measured within the OAM Domain of Figure 1 and collected by the Performance Collector are specified in the Carrier Ethernet Management Information Model Performance Monitoring Class Diagram defined in MEF 7.2, as shown in Figure 5. The classes highlighted in gray represent configuration in the PM Solution [9] and are used in scope for the Carrier Ethernet Performance Reporting Framework too.
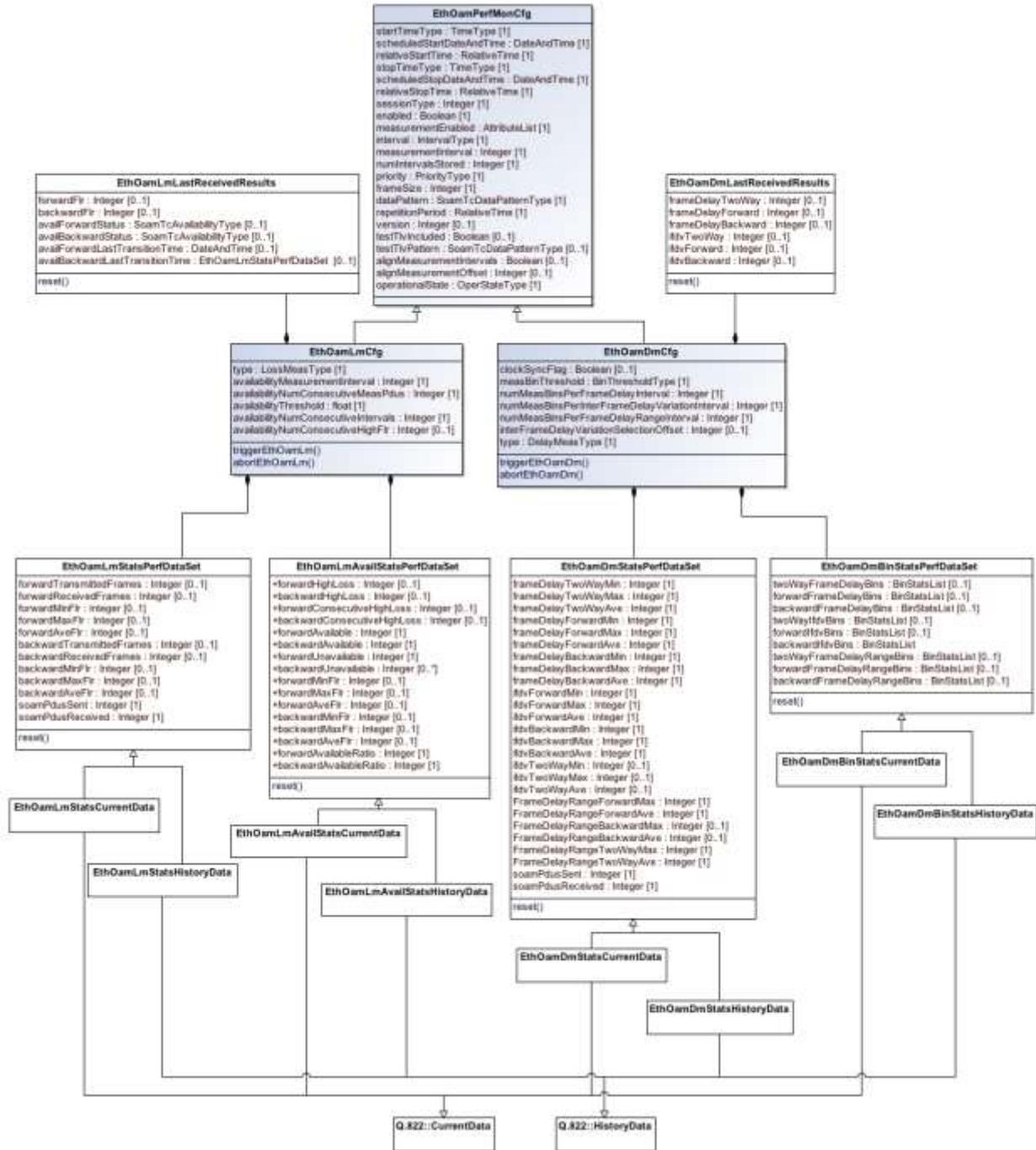
Figure 5 – Carrier Ethernet Management Information Model Performance Monitoring [2]

The following figures represent objects and attributes defined in the TMF SID, Performance Business Entities [19], and are included to support the framework interface to a Client.

Figure 6 – Measurement Job Class Diagram [19]

Figure 6 illustrates objects in the Measurement Job Class Diagram including

- ManagementJob

- MeasurementJob

- PerformanceIndicatorGroupSpecification

- PerformanceIndictorSpecification

- TrackingRecord

- MonitoredObjectCriteria

- ScheduleDefinition

- ProtocolTransferData

- FileTransferData

The objects are defined as follows:

A management job (ManagementJob object) is an abstract class that represents a management activity that may consist of several steps but is performed as a single logical unit. It can be a one-time activity or a recurring activity. If it is a recurring activity, a schedule definition (ScheduleDefinition object) is attached to the management job.

A PM measurement job (MeasurementJob object) is the administrative entity defined by Performance Collector to perform a periodic performance measurement activities defined in the Use Cases section. The performance measurement activities may be production of measurements, collection of measurements or PM objective monitoring (scheduled evaluation of thresholds). MeasurementJob is one type of ManagementJob.

In each of these cases, the PM measurement job will include the following:

- A set of requested performance indicators

- A network/service scope defining a subset of the network or a subset of the service catalog

- Scheduling parameters

- Specific activity parameters, related to collection, production or objective monitoring

A performance indicator specification (PerformanceIndicatorSpecification object) holds the definition of the requested performance indicator (e.g., KPI metrics) including its name, value type, collection type, description and units.

A performance indicator group specification (PerformanceIndicatorGroupSpecification object) is the logical group of the PerformanceIndicatorSpecification objects that compose a Performance Indicator Group. The performance indicator group specification has a name (string) and it can (optionally) hold the individual performance indicator specification objects.

A schedule definition (ScheduleDefinition object) is attached to the measurement job to define the job scheduling. This is an abstract and can be of the following types:

- MonthlyScheduleDayofMonthDefinition,
- MonthlyScheduleDayofWeekDefinition,
- WeeklyScheduleDefinition,
- RecurringScheduleDefinition,
- FixedScheduleDefinition,
- DateScheduleDefinition

A tracking record (TrackingRecord object) is used to log and audit the lifecycle of the measurement job. This allows the tracking of modifications on the measurement job. Whether the tracking records are stored with the measurement job or outside of it is implementation specific.

A monitored object criteria (MonitoredObjectCriteria object) is an abstract class. It is transformed to a datatype in the implementation, and has two subclasses as follows:

➢ MonitoredInstancesCriteria has a single attribute monitoredObjectInstances of type ObjectName containing the list of monitored instances. MonitoredInstances-Criteria is transformed to a datatype in the implementation.

➢ MonitoredClassCriteria has 2 attributes:

- monitoredObjectClass: (String, Optional) A monitored object class for specifying the set of instances that are referenced by a PM query.

- objectInstanceFilter: (Filter, Optional) A filter that can be used in conjunction with the monitored object class for specifying the set of instances that are referenced by a PM query.

A protocol transfer data (ProtocolTransferData object) defines the information required for a data transfer. It contains information needed for the data transfer, but it does not contain result information, i.e. the list of file produced is not part of this object or of its descendants. This object is an abstract class, and acts as a base class for all types of possible data transfers even if currently only File Transfer.

A file transfer data (FileTransferData object) is a type of ProtocolTransferData and defines the information required for a file based data transfer, including file location, fil format, compression type, packing type and retention duration.

Figure 7 – Performance Collector Class Diagram [19]

Figure 7 shows the Performance Collector Class Diagram. Most objects are defined according to the Measurement Job Class Diagram in Figure 6, with the exception of MeasurementProductionJob and MeasurementCollectionJob.

A measurement collection job (MeasurementCollectionJob object) is used to control the periodic collection of performance KPI results, implemented as a sub-entity of the PM measurement job (MeasurementJob).

In each of these cases, the MeasurementCollectionJob will include the following:

- A set of requested performance KPIs (e.g., One-way and/or Two-way Carrier Ethernet performance metrics);

- A network/service scope defining a subset of EVCs or OVCs;

- Specific performance measurement activity parameters, which are defined in EthOamLmCfg and EthOamDmCfg of Figure 5;

- Scheduling parameters (e.g., 15 min collection)

A measurement production job (MeasurementProductionJob object) is performance measurements production functionality which control the generation of performance KPI results. Production instructions are usually set in the set-up of a PM measurement job. This type of measurement job is not in scope.

10.1 JSON Models

The JSON schema for resource model for MeasurementCollectionJob is follows:

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "id": "http://metroethernetforum.org/",
  "type": "object",
  "properties": {
    "id": {
      "id": "http://metroethernetforum.org/id",
      "type": "string"
    },
    "creationTime": {
      "id": "http://metroethernetforum.org/creationTime",
      "type": "string"
    },
    "lastModifiedTime": {
      "id": "http://metroethernetforum.org/lastModifiedTime",
      "type": "string"
    },
    "adminState": {
      "id": "http://metroethernetforum.org/adminState",
      "type": "string"
    },
    "jobPriority": {
      "id": "http://metroethernetforum.org/jobPriority",
      "type": "string"
    },
    "executionState": {
      "id": "http://metroethernetforum.org/executionState",
      "type": "string"
    },
    "scheduleDefinition": {
      "id": "http://metroethernetforum.org/scheduleDefinition",
      "type": "object",
```

```
      "properties": {
        "type": {
          "id":                                              "
                http://metroethernetforum.org/scheduleDefinition/type",
          "type": "string"
        },
        "scheduleInfo": {
          "id":                                              "
                http://metroethernetforum.org/scheduleDefinition/schedul
                eInfo",
          "type": "object",
          "properties": {
            "scheduleDefinitionStartTime": {
              "id":"
                http://metroethernetforum.org/scheduleDefinition/schedul
                eInfo/scheduleDefinitionStartTime",
               "type": "string"
            },
            "scheduleDefinitionEndTime": {
             "id":"
                http://metroethernetforum.org/scheduleDefinition/schedul
                eInfo/scheduleDefinitionEndTime",
               "type": "string"
            }
          }
        }
      }
    },
    "consumingApplicationId": {
      "id": "http://metroethernetforum.org/consumingApplicationId",
      "type": "string"
    },
    "producingApplicationId": {
      "id": "http://metroethernetforum.org/producingApplicationId",
      "type": "string"
    },
    "granularity": {
      "id": "http://metroethernetforum.org/granularity",
      "type": "string"
    },
    "monitoredObjectsCriteria": {
      "id": "http://metroethernetforum.org/monitoredObjectsCriteria",
      "type": "object",
      "properties": {
        "type": {
          "id": "monitoredObjectsCriteria/type",
          "type": "string"
        },
        "monitoredObjectInfo": {
          "id":                                              "
            http://metroethernetforum.org/monitoredObjectsCriteria/moni
            toredObjectInfo",
          "type": "object",
          "properties": {
            "monitoredObjectClass": {
```

```
                "id":"
                  http://metroethernetforum.org/monitoredObjectsCriteria/m
                  onitoredObjectInfo/monitoredObjectClass",
                "type": "string"
              }
            }
          }
        }
      },
      "protocolTransferData": {
        "id": "http://metroethernetforum.org/protocolTransferData",
        "type": "object",
        "properties": {
          "transportProtocol": {
            "id":                                                    "
              http://metroethernetforum.org/protocolTransferData/transport
              Protocol",
            "type": "string"
          },
          "fileTransferData": {
            "id":                                                    "
              http://metroethernetforum.org/protocolTransferData/fileTrans
              ferData",
            "type": "object",
            "properties": {
              "fileLocation": {
                "id":"
                  http://metroethernetforum.org/protocolTransferData/fileTr
                  ansferData/fileLocation",
                "type": "string"
              },
              "fileFormat": {
                "id":                                                "
                  http://metroethernetforum.org/protocolTransferData/fileTr
                  ansferData/fileFormat",
                "type": "string"
              },
              "compressionType": {
                "id":"
                  http://metroethernetforum.org/protocolTransferData/fileTr
                  ansferData/compressionType",
                "type": "string"
              },
              "retentionDuration": {
                "id":"
                  http://metroethernetforum.org/protocolTransferData/fileTr
                  ansferData/retentionDuration",
                "type": "object",
                "properties": {
                  "units": {
                                        "id":"
                      http://metroethernetforum.org/protocolTransferData/fi
                      leTransferData/retentionDuration/units",
                      "type": "string"
                    },
                    "amount": {
```

```
                    "id":"
                    http://metroethernetforum.org/protocolTransferData/file
                    TransferData/retentionDuration/amount",
                      "type": "string"
                    }
                  }
                },
                "packingType": {
                  "id":"http://metroethernetforum.org/protocolTransferData/
                      fileTransferData/packingType",
                  "type": "string"
                }
              }
            }
          }
        },
        "reportingPeriod": {
          "id": "http://metroethernetforum.org/reportingPeriod",
          "type": "string"
        },
        "outputFormat": {
          "id": "http://metroethernetforum.org/outputFormat",
          "type": "string"
        },
        "performanceIndicatorGroup": {
          "id": "http://metroethernetforum.org/performanceIndicatorGroup",
          "type": "array",
          "items": [
            {
              "id":                                                       "
http://metroethernetforum.org/performanceIndicatorGroup/0",
              "type": "object",
              "properties": {
                "name": {
                  "id":                                                   "
http://metroethernetforum.org/performanceIndicatorGroup/0/name",
                  "type": "string"
                }
              }
            },
            {
              "id":                                                       "
http://metroethernetforum.org/performanceIndicatorGroup/1",
              "type": "object",
              "properties": {
                "name": {
                  "id":                                                   "
http://metroethernetforum.org/performanceIndicatorGroup/1/name",
                  "type": "string"
                }
              }
            }
          ]
        },
        "performanceIndicatorSpecification": {
          "id":                                                           "
http://metroethernetforum.org/performanceIndicatorSpecification",
```

```
              "type": "array",
              "items": [
                {
                  "id":                                                "
http://metroethernetforum.org/performanceIndicatorSpecification/0",
                  "type": "object",
                  "properties": {
                    "name": {
                      "id":                                            "
http://metroethernetforum.org/performanceIndicatorSpecification/0/name",
                      "type": "string"
                    }
                  }
                },
                {
                  "id":                                                "
                  http://metroethernetforum.org/performanceIndicatorSpecificati
                  on/1",
                  "type": "object",
                  "properties": {
                    "name": {
                      "id":                                            "
http://metroethernetforum.org/performanceIndicatorSpecification/1/name",
                      "type": "string"
                    }
                  }
                }
              ]
            }
          },
        "required": [
          "id",
          "creationTime",
          "lastModifiedTime",
          "adminState",
          "jobPriority",
          "executionState",
          "scheduleDefinition",
          "consumingApplicationId",
          "producingApplicationId",
          "granularity",
          "monitoredObjectsCriteria",
          "protocolTransferData",
          "reportingPeriod",
          "outputFormat",
          "performanceIndicatorGroup",
          "performanceIndicatorSpecification"
        ]
      }
```

The following is an example JSON Resource Model for MeasurementCollectionJob.

```
{
    "id":"collJob001",
    "creationTime":"11-26-2014 16:00:00 +0530",
    "lastModifiedTime":"11-26-2014 16:00:00 +0530",
```

```
      "adminState":"UNLOCKED",
      "jobPriority":"5",
      "executionState":"EXECUTING",
      "scheduleDefinition":{
         "type":"RecurringScheduleDefinition",
         "scheduleInfo":{
            "scheduleDefinitionStartTime":"11-26-2013 16:00:00 +0530",
            "scheduleDefinitionEndTime":"11-26-2014 16:00:00 +0530"
         }
      },
      "consumingApplicationId":"CONSUMER001",
      "producingApplicationId":"NE001",
      "granularity":"G_15MN",
      "monitoredObjectsCriteria":{
         "type":"MonitoredClassCriteria",
         "monitoredObjectInfo":{
            "monitoredObjectClass":"EVPL-2"
         }
      },
      "protocolTransferData":{
         "transportProtocol":"FILE_TRANSFER",
         "fileTransferData":{
            "fileLocation":"\\pm\\pmdata",
            "fileFormat":"JSON",
            "compressionType":"NO_COMPRESSION",
            "retentionDuration":{
               "units":"MINUTES",
               "amount":"180"
            },
            "packingType":"NO_PACKING"
         }
      },
      "reportingPeriod":"R_15MN",
      "outputFormat":"JSON",
      "performanceIndicatorGroup":[
         {
            "name":"TRANSPORT01"
         },
         {
            "name":"TRANSPORT02"
         }
      ],
      "performanceIndicatorSpecification":[
         {
            "name":"PM Metric 1"
         },
         {
            "name":"PM Metric n"
         }
      ]
   }
```

The following is an example JSON Resource Model for PerformanceIndicatorSpecification using the Carrier Ethernet Performance Monitoring metrics as illustrated in Figure 5.

```
{
   "performanceIndicatorSpecification":[
      {
```

```
            "name":"frameDelayTwoWayMin"
        },
        {
            "name":"frameDelayTwoWayMax"
        },
        {
            "name":"frameDelayTwoWayAve"
        },
        {
            "name":"frameDelayForwardMin"
        },
        {
            "name":"frameDelayForwardMax"
        },
        {
            "name":"frameDelayForwardAve"
        },
        {
            "name":"frameDelayBackwardMin"
        },
        {
            "name":"frameDelayBackwardMax"
        },
        {
            "name":"frameDelayBackwardAve"
        },
        {
            "name":"ifdvForwardMin"
        },
        {
            "name":"ifdvForwardMax"
        },
        {
            "name":"ifdvForwardAve"
        },
        {
            "name":"ifdvBackwardMin"
        },
        {
            "name":"ifdvBackwardMax"
        },
        {
            "name":"ifdvBackwardAve"
        },
        {
            "name":"ifdvTwoWayMin"
        },
        {
            "name":"ifdvTwoWayMax"
        },
        {
            "name":"ifdvTwoWayAve"
        },
        {
            "name":"frameDelayRangeForwardMax"
        },
        {
```

```
            "name":"frameDelayRangeForwardAve"
        },
        {
            "name":"frameDelayRangeBackwardMax"
        },
        {
            "name":"frameDelayRangeBackwardAve"
        },
        {
            "name":"frameDelayRangeTwoWayMax"
        },
        {
            "name":"frameDelayRangeTwoWayAve"
        },
        {
            "name":"forwardTransmittedFrames"
        },
        {
            "name":"forwardReceivedFrames"
        },
        {
            "name":"forwardMinFlr"
        },
        {
            "name":"forwardMaxFlr "
        },
        {
            "name":"forwardAveFlr "
        },
        {
            "name":"backwardTransmittedFrames"
        },
        {
            "name":"backwardReceivedFrames"
        },
        {
            "name":"backwardMinFlr"
        },
        {
            "name":"backwardMaxFlr "
        },
        {
            "name":"backwardAveFlr "
        },
        {
            "name":"forwardHighLoss"
        },
        {
            "name":"backwardHighLoss"
        },
        {
            "name":"forwardConsecutiveHighLoss"
        },
        {
            "name":"backwardConsecutiveHighLoss "
        },
        {
```

```
                    "name":"forwardAvailable"
                },
                {
                    "name":"backwardAvailable"
                },
                {
                    "name":"forwardUnavailable"
                },
                {
                    "name":"backwardUnavailable"
                },
                {
                    "name":"forwardMinFlr"
                },
                {
                    "name":"forwardMaxFlr"
                },
                {
                    "name":"forwardAveFlr"
                },
                {
                    "name":"backwardMinFlr"
                },
                {
                    "name":"backwardMaxFlr"
                },
                {
                    "name":"backwardAveFlr"
                },
                {
                    "name":"forwardMinFlr"
                },
                {
                    "name":"forwardAvailableRatio"
                },
                {
                    "name":"backwardAvailableRatio"
                }
            ]
        }
```

10.2 JSON File Format

This section defines the format of the file containing the measured and collected KPI metrics and transferred using the file transfer method specified in FileTransferData.

The measurement report file format contains the following definitions:

File Content Item	Description
measDataCollection	This is the top-level tag, which identifies the file as a collection of measurement data. The file content is made up of a header ("measFileHeader"), the collection of measurement result items ("measData"), and a measurement file footer ("measFileFooter").
measFileHeader	This is the measurement result file header to be inserted in each file. It includes a version indicator, the name, type and vendor name of the sending network node, and a time stamp ("collectionBeginTime").
measData	The "measData" construct represents the sequence of zero or more measurement result items contained in the file. It can be empty in case no measurement data can be provided. The individual "measData" elements can appear in any order.
measFileFooter	The measurement result file footer to be inserted in each file. It includes a time stamp, which refers to the end of the overall measurement collection interval that is covered by the collected measurement results being stored in this file.
fileFormatVersion	This parameter identifies the file format version applied by the sender. The format version defined in the present document shall be the abridged number and version of this document (see below). The abridged number and version of a document is constructed from its version specific full reference "MEF […] (yyyy-mm)"
senderName	The senderName uniquely identifies the Service Provider or CEN operator that assembled this measurement file by its Distinguished Name (DN).
vendorName	The "vendorName" identifies the vendor that provided the measurement file. The string may be empty (i.e. string size =0) if the "vendorName" is not configured in the sender.
collectionBeginTime	The "collectionBeginTime" is a time stamp that refers to the start of the first measurement collection interval (granularity period) that is covered by the collected measurement results that are stored in this file.
measInfo	The sequence of measurements, values and related information. It includes a list of measurement types ("measTypes") and the corresponding results ("measValues"), together with the time stamp ("measTimeStamp") and granularity period ("granularityPeriod") pertaining to these measurements.

File Content Item	Description
measInfoId	This attribute associates a tag name with the set of measurements defined by a *measInfo* property. This is an optional parameter that may be used to assign unique names to categories of measurements grouped together by measInfo elements. It allows parsing tools to easily isolate measurement sets by name.
measTimeStamp	Time stamp referring to the end of the granularity period.
jobId	The "jobId" represents the job with which measurement result contained in the file is associated.
granularityPeriod	Granularity period of the measurement(s) in seconds.
reportingPeriod	Reporting period of the measurement(s) in seconds.
measValues	This parameter contains the list of measurement results for the resource being measured. It includes an identifier of the resource ("measObjInstId"), the list of measurement result values ("measResults") and a flag that indicates whether the data is reliable ("suspectFlag").
measResults	This parameter contains the sequence of result values for the observed measurement types. The "measResults" sequence shall have the same number of elements, which follow the same order as the measTypes sequence. Normal values are INTEGERs and REALs. The NULL value is reserved to indicate that the measurement item is not applicable or could not be retrieved for the object instance.
suspectFlag	Used as an indication of quality of the scanned data. FALSE in the case of reliable data, TRUE if not reliable. The default value is "FALSE", in case the suspect flag has its default value it may be omitted.
timestamp	This tag carries the time stamp that refers to the end of the measurement collection interval (granularity period) that is covered by the collected measurement results that are stored in this file. The minimum required information within timestamp is year, month, day, hour, minute, and second.

The JSON data model representation for the file is defined in Appendix I.

11. Interface Definition

This section defines the generic interface between a Client and the Performance Reporting Server, including the Business-to-Subscriber interface between the Service Provider

and a Subscriber, and the Business-to-Business interface between a CEN Operator and Service Provider. The generic interface is specified as a web service API.

The main functionalities of the APIs are as follows:

1) **Query**: Query current and historical Performance Measurement Data properties of an EVC if in the Service Provider Domain or an OVC if in the CEN Operator Domain and return search results.

2) **File Download**: Download current and historical Performance Measurement Data properties of individual or all EVCs if in the Service Provider Domain, or individual or all OVCs if in the CEN Operator Domain.

To implement the above functionalities, a REST API is provided as a standardized definition for acquiring performance reporting services from Service Provider or CEN operator. The generic REST operations are shown in Table 8.

Operation on Entities	Uniform API Operation	Description
Query Entities	GET Resource	GET must be used to retrieve a representation of a resource.
Create Entity	POST Resource	POST must be used to create a new resource
Partial Update of an Entity	PATCH Resource	PATCH must be used to partially update a resource
Complete Update of an Entity	PUT Resource	PUT must be used to completely update a resource identified by its resource URI
Remove an Entity	DELETE Resource	DELETE must be used to

		remove a resource

Table 6 Generic REST Operations

Considering Use Cases in this Carrier Ethernet Performance Reporting Framework, only Query Entities is supported as operations between performance reporting server and Client. A Client can query a single EVC or OVC performance data entities associated with MeasurementCollectionJob ID or Ad Hoc Collection job ID. The Client is prohibited to Create, Update and Delete performance data entities.

GET /api/measurementCollectionJob/{ID}
Description :
This Uniform Contract operation is used to retrieve the representation of measurementCollectionJob using ID.
Collection of jobs can be retrieved via GET /API/<RESOURCE> with no {ID}

Behavior:
- 200 OK – request was successful
- 202 Accepted – The request has been accepted for processing, but the processing has not been completed for asynchronous operations.
- 404 Not Found.

Example:
REQUEST
GET /api/measurementCollectionJob/collJob001
Accept: application/json

RESPONSE
200
Content-Type: application/json

```
{
   "id":"collJob001",
   "creationTime":"11-26-2014 16:00:00 +0530",
   "lastModifiedTime":"11-26-2014 16:00:00 +0530",
   "adminState":"UNLOCKED",
   "jobPriority":"5",
   "executionState":"EXECUTING",
   "scheduleDefinition":{
      "type":"RecurringScheduleDefinition",
      "scheduleInfo":{
         "scheduleDefinitionStartTime":"11-26-2013 16:00:00 +0530",
         "scheduleDefinitionEndTime":"11-26-2014 16:00:00 +0530"
      }
   },
   "consumingApplicationId":"CONSUMER001",
   "producingApplicationId":"NE001",
   "granularity":"G_15MN",
   "monitoredObjectsCriteria":{
```

```
            "type":"MonitoredClassCriteria",
            "monitoredObjectInfo":{
                "monitoredObjectClass":"EVPL-2"
            }
        },
        "protocolTransferData":{
            "transportProtocol":"FILE_TRANSFER",
            "fileTransferData":{
                "fileLocation":"\\pm\\pmdata",
                "fileFormat":"JSON",
                "compressionType":"NO_COMPRESSION",
                "retentionDuration":{
                    "units":"MINUTES",
                    "amount":"180"
                },
                "packingType":"NO_PACKING"
            }
        },
        "reportingPeriod":"R_15MN",
        "outputFormat":"JSON",
        "performanceIndicatorGroup":[
            {
                "name":"TRANSPORT01"
            },
            {
                "name":"TRANSPORT02"
            }
        ],
        "performanceIndicatorSpecification":[
            {
                "name":"frameDelayTwoWayMin"
            },
            {
                "name":"frameDelayTwoWayMax"
            },
            {
                "name":"frameDelayTwoWayAve"
            },
            {
                "name":"frameDelayForwardMin"
            },
            {
                "name":"frameDelayForwardMax"
            },
            {
                "name":"frameDelayForwardAve"
            },
            {
                "name":"frameDelayBackwardMin"
            },
            {
                "name":"frameDelayBackwardMax"
            },
            {
                "name":"frameDelayBackwardAve"
            },
            {
```

```
        "name":"ifdvForwardMin"
    },
    {
        "name":"ifdvForwardMax"
    },
    {
        "name":"ifdvForwardAve"
    },
    {
        "name":"ifdvBackwardMin"
    },
    {
        "name":"ifdvBackwardMax"
    },
    {
        "name":"ifdvBackwardAve"
    },
    {
        "name":"ifdvTwoWayMin"
    },
    {
        "name":"ifdvTwoWayMax"
    },
    {
        "name":"ifdvTwoWayAve"
    },
    {
        "name":"frameDelayRangeForwardMax"
    },
    {
        "name":"frameDelayRangeForwardAve"
    },
    {
        "name":"frameDelayRangeBackwardMax"
    },
    {
        "name":"frameDelayRangeBackwardAve"
    },
    {
        "name":"frameDelayRangeTwoWayMax"
    },
    {
        "name":"frameDelayRangeTwoWayAve"
    },
    {
        "name":"forwardTransmittedFrames"
    },
    {
        "name":"forwardReceivedFrames"
    },
    {
        "name":"forwardMinFlr"
    },
    {
        "name":"forwardMaxFlr "
    },
    {
```

```
        "name":"forwardAveFlr "
    },
    {
        "name":"backwardTransmittedFrames"
    },
    {
        "name":"backwardReceivedFrames"
    },
    {
        "name":"backwardMinFlr"
    },
    {
        "name":"backwardMaxFlr "
    },
    {
        "name":"backwardAveFlr "
    },
    {
        "name":"forwardHighLoss"
    },
    {
        "name":"backwardHighLoss"
    },
    {
        "name":"forwardConsecutiveHighLoss"
    },
    {
        "name":"backwardConsecutiveHighLoss "
    },
    {
        "name":"forwardAvailable"
    },
    {
        "name":"backwardAvailable"
    },
    {
        "name":"forwardUnavailable"
    },
    {
        "name":"backwardUnavailable"
    },
    {
        "name":"forwardMinFlr"
    },
    {
        "name":"forwardMaxFlr"
    },
    {
        "name":"forwardAveFlr"
    },
    {
        "name":"backwardMinFlr"
    },
    {
        "name":"backwardMaxFlr"
    },
    {
```

```
            "name":"backwardAveFlr"
         },
         {
            "name":"forwardMinFlr"
         },
         {
            "name":"forwardAvailableRatio"
         },
         {
            "name":"backwardAvailableRatio"
         }
      ]
}
```

Retrieving all jobs – returns an array/list of measurementCollectionJobs
GET /api/measurementCollectionJob

Retrieving all jobs with AdminState as LOCKED
GET /api/measurementCollectionJob?adminState=LOCKED

Retrieve a job with ID, but only the attributes executionState & scheduleDefinition in response.
GET /api/measurementCollectionJob/1/executionState,scheduleDefinition

DELETE /api/measurementProductionJob/{ID}

Description:
This operation is used to delete any specified 'MeasurementProductionJob' by the job's id.

Behavior:
- 403 Forbidden.

DELETE /api/adhocCollection/{ID}

Description:
This operation is used to delete any specified 'adhocCollection' by the job's id.

Behavior:
- 403 Forbidden.

POST /api/measurementProductionJob/{ID}

Description:
This operation is used to create a new specified 'MeasurementProductionJob' by the job's id.

Behavior:
- 403 Forbidden.

POST /api/adhocCollection/{ID}

Description:
This operation is used to create a new specified 'adhocCollection' by the job's id.

Behavior:
- 403 Forbidden.

PUT /api/measurementProductionJob/{ID}

Description:
This operation is used to update a specified 'MeasurementProductionJob' by the job's id.

Behavior:
- 403 Forbidden.

PUT /api/adhocCollection/{ID}

Description:
This operation is used to update a new specified 'adhocCollection' by the job's id.

Behavior:
- 403 Forbidden.

PATCH /api/measurementProductionJob/{ID}

Description:
This operation is used to partially update a specified 'MeasurementProductionJob' by the job's id.

Behavior:
- 403 Forbidden.

PATCH /api/adhocCollection/{ID}

Description:
This operation is used to partially update a specified 'adhocCollection' by the job's id.

Behavior:
- 403 Forbidden.

12. References

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13. Acknowledgements

Appendix I JSON File Format (Informative)

This Appendix contains the file format for the performance report as specified in JSON.

I.1   JSON File

```
{
    "measurementCollecFile":{
        "fileHeader":{
            "fileFormatVersion":"",
            "vendorName":"",
            "dnPrefix":"",
            "fileSender":{
                "localDn":"",
                "elementType":""
            },
            "measCollec":{
                "beginTime":""
            }
        },
        "measData":[
            {
                "managedElement":{
                    "localDn":"",
                    "userLabel":"",
                    "swVersion":""
                }
            },
            {
                "measInfo":[
                    {
                        "job":{
                            "jobId":""
                        }
                    },
                    {
                        "granPeriod":{
                            "duration":"",
                            "endTime":""
                        }
                    },
                    {
                        "repPeriod":{
                            "duration":""
                        }
                    },
                    {
                        "measTypes":[
                            {
                                "name":""
                            },
                            {
                                "measValue":[
                                    {
                                        "suspect":false,
                                        "measObjLdn":"",
                                        "measResults":[
```

```
                                    1.3
                                 ]
                              }
                           ]
                        }
                     ]
                  }
               ]
            }
         ]
      },
      "fileFooter":{
         "measCollec":{
            "endTime":""
         }
      }
   }
}
```

I.2   JSON Schema File

```
{
  "$schema": "http://json-schema.org/draft-04/schema#",
  "id": "http://metroethernetforum.org",
  "type": "object",
  "properties": {
    "measurementCollecFile": {
      "id": "http://metroethernetforum.org/measurementCollecFile",
      "type": "object",
      "properties": {
        "fileHeader": {
          "id":
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                                    }
                                  }
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          "type": "object",
          "properties": {
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              "type": "object",
              "properties": {
                "endTime": {
                  "id":
"http://metroethernetforum.org/fileFooter/measCollec/endTime",
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              }
            }
          }
        }
      }
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Appendix II Process Elements and Messages used in the Business Process Flow (Informative)

Error! Reference source not found.Error! Reference source not found. introduces the ocess Elements used in the Process Flow and identifies those that are defined in [12] by listing the TMF eTOM Process Identifier.

Process Element	TMF eTOM Identifier	Carrier Ethernet Extension?	High Level Description
Service Quality Management	1.1.2.4	No	Managing, tracking, monitoring, analyzing, improving and reporting on the performance of specific services.
Monitor, Analyze & Improve Service Quality	1.1.2.4.1 (Monitor) 1.1.2.4.2 (Analyze) 1.1.2.4.3 (Improve)	No	Monitor received service quality information and undertake first-in detection.

Analyze and evaluate the service quality performance of specific services.

Restore the service quality to a normal operational state as efficiently as possible.

Note: These three business processes are not in scope for the Carrier Ethernet Performance Reporting Framework. |
Monitor & Control S/P Service Performance	1.1.4.4.1	No	Collect and analyze performance of services delivered by suppliers and partners.
Report Service Quality Performance	1.1.2.4.4	Yes	Monitor the status of service performance degradation reports, provide notifications of any changes and provide management reports.
Subscriber QoS/SLA Management	1.1.1.7	No	Monitoring, managing and reporting of delivered vs. contractual QoS, as defined in the enterprise's service descriptions, subscriber contracts or product catalog.
Assess Subscriber QoS/SLA Per-	1.1.1.7.1	No	Manage the overall assessment of the subscriber QoS/SLA performance.

formance			
Report Sub-scriber QoS Per-formance	1.1.1.7.3	Yes	Report on the subscriber's QoS/SLA performance.
Create Service Performance Degradation Re-port	1.1.2.4.5	Yes	Create a new service performance degradation report based on meas-urements occurring outside of con-figured thresholds. Threshold Cross-ing Alerts (TCAs) may detect such threshold violations.
Create Subscrib-er QoS Perfor-mance Degrada-tion Report	1.1.1.7.4	Yes	Create a new subscriber QoS per-formance degradation report. Report TCAs to subscriber portal.

Table 7 Carrier Ethernet Performance Reporting Process Elements

Refer to Appendix II for a detailed description of each Business Process activity. intro-duces the messages used in the Process Flow and identifies the originator and receiver of the message along with the behavior of the message sequence.

Message	**Originator**	**Receiver**	**High Level Description**
Report Access Service Per-formance	Access Pro-vider	Service Provider	Access Provider reports the Performance Metrics/KPI for the Access Service (OVC) which the Service Provider has purchased.
Report Ethernet Service Per-formance	Service Pro-vider	Subscriber	Service Provider reports the Performance Metrics/KPI for the Ethernet Service (EVC) which the Subscriber has purchased.
Notify Service Affecting Issue	Service Pro-vider	Subscriber	Service Provider notifies Subscriber via subscriber portal of service affecting condi-tion detected. This could include exposing TCAs to the portal or other near-real time degradation information.

Table 8 Carrier Ethernet Performance Reporting Process Flow Messages