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Allegro, Interlude and Legato Fault Management and Performance Monitoring BR&UC

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1 List of Contributing Members

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

2 Abstract

This document defines the Business Requirements and Use Cases to support Performance Monitoring at the Allegro, Interlude and Legato Interface Reference Points (IRPs). The requirements and use cases contained in this document support Service Performance and Fault Management. Information contained within this specification will be utilized by both the Buyer/Client and Seller/Server for the development of a suite of automated APIs based interaction.

3 Release Notes

This document is currently under review and until that review is complete it is subject to change.

4 Terminology and Abbreviations

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

Term	Definition	Reference
API	Application Programming Interface	MEF 55.1 [6]
TCA	Threshold Crossing Alert	This document.
UBCUBC(k)	Upper Bin Count (k)	MEF 35.1 [4]

Table 1 - Abbreviations

Term	Definition	Reference
Alarm	A specific type of notification concerning detected faults or abnormal conditions.	ITU - T M.3703
Alert	Synonymous to *Alarm* in the scope of this document	This document.
Application Programming Interface	In the context of LSO, API describes one of the Management Interface Reference Points based on the requirements specified in an Interface Profile, along with a data model, the protocol that defines operations on the data and the encoding format used to encode data according to the data model.	MEF 55.1 [6]
Event	A specific occurrence or a change in state that is noteworthy to the system administrator.	ITU - T Rec. X.734 [10]
Message	Typically defined as a unit of information exchanged between components or services in a distributed system. In context of this standard, we scope this definition to aa unit of information, that is a manifestation on an event, exchanged between producer and consumer using event drive architectural pattern.	This document
Notification	In general, a mechanism used to inform the recipient about certain event in the system. In context of this document notification is a synchronous communication from the observed system towards recipient.	This document.
On - Demand	FM/PM Job actions that are initiated for a limited time to carry out the FM/PM Job or measurements.	This document.
Passive	PM/FM Job action to support the collection and reporting of network and service statistics/faults. The statistics collections include but are not limited to telemetry associated with an interface, (Net/Application) Flow, VLAN, bridging/Ethernet, IP, TCP, UDP layers.	This document.
PM Metric	A metric that is measured or calculated as a part of Performance Monitoring.	MEF W105 [7]
Proactive	FM/PM Job actions that are carried on continuously to permit timely reporting of fault and/or performance status.	This document.

Term	Definition	Reference
Threshold Crossing Alert	Mechanism used to monitor and notify when specific thresholds or performance limits are exceeded or crossed	This document.
Use Case	A Use Case within a UML represents one 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 [8]

299 **Table 2 - Terminology**

5 Compliance Levels

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

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

A paragraph preceded by **[Cra]<** specifies a conditional mandatory requirement that **MUST** be followed if the condition(s) following the "<" have been met. For example, "**[CR1] <** [D38]" indicates that Conditional Mandatory Requirement 1 must be followed if Desirable Requirement 38 has been met. A paragraph preceded by **[CDb]<** specifies a Conditional Desirable Requirement that **SHOULD** be followed if the condition(s) following the "<" have been met. A paragraph preceded by **[Coc]<** specifies a Conditional Optional Requirement that **MAY** be followed if the condition(s) following the "<" have been met.

6 Numerical Prefix Conventions

This document uses the prefix notation to indicate multiplier values as shown in Table 3.

Decimal		**Binary**	
Symbol	**Value**	**Symbol**	**Value**
k	10^3	Ki	2^{10}
M	10^6	Mi	2^{20}
G	10^9	Gi	2^{30}
T	10^{12}	Ti	2^{40}
P	10^{15}	Pi	2^{50}
E	10^{18}	Ei	2^{60}
Z	10^{21}	Zi	2^{70}
Y	10^{24}	Yi	2^{80}

Table 3 - Numerical Prefix Conventions

7 Scope

This specification defines the process in multiple functional areas at the Allegro, Interlude and Legato Interface Reference Points (IRPs). The use cases detailed in this document are intended to support all network services including, but not limited to Carrier Ethernet, IP/IPVPN, SD - WAN and L1CS.

The scope of the project for the initial release is the ability for Seller/Server system to perform the lifecycle management operations in each of the functional areas specified above. The following Use Case categories are included in the scope of this specification:

- Fault Management
- Performance Monitoring Profile Management
- Performance Monitoring Jobs, Notifications and Collection
- Passive Statistics Collection
- Threshold Crossing Alert Profile Management
- Alarm Management
- Streaming Management

Note: TCA Threshold Values are not set via the API. They are configured by the Seller and TCAs are subscribed to by the Buyer.

8 Introduction

The requirements and use cases are the same for the Allegro, Interlude and Legato Interface Reference Point (IRPs). There are no differences identified within this document between them. The requirements and Use Cases within this document will be used to develop an API specification and Developer's Guide.

NOTE: The use cases and business requirements in this document assume a two - actor relationship based on the set of actors in the LSO architecture. The names of the relationship are specific to the Interface Reference Point. For both Allegro and Interlude there is a Buyer and Seller. For Allegro the Buyer is the Customer and the Seller is the Service Provider. For Interlude the Buyer is the Service Provider and the Seller is the Partner. In the case of the Legato IRP, given this is within a single Service Provider or Partner, the relationship is Client and Seller/Server, where the Business Application (BA) is the Client, and the Service Orchestration Functionality (SOF) is the Seller/Server.

These Use Cases are intended to allow the Buyer/Client to perform tasks related to SOAM including receiving alarms and warnings, creating on - demand and proactive FM/PM Jobs, retrieving FM/PM results for the Jobs, and receiving notifications when FM/PM results are available.

Fault Management

- Fault Job
  - Buyer/Client requested Fault Job.
- Fault Notifications
  - Notifications for Fault Jobs.
  - Buyer/Client Subscription to Fault Job Notifications.
  - Seller/Server generation of Fault Job Notifications.
- Fault Management Results
  - Buyer/Client retrieves FM Job results in one of two formats as indicated in the request.
  - Results are in the API.
  - Results are in a referenced file.
  - Buyer/Client retrieves a list of Fault Management Jobs that have results using filter criteria.

Performance Monitoring

- Performance Monitoring Profiles

372 - Buyer/Client requests Performance Monitoring Profile creation, modification, and
373 deletion.

374 - Seller/Server notifies the Buyer/Client when Performance Monitoring Profile
375 changes occur.

376 • On - Demand Performance Monitoring

377 - Buyer/Client requests On - Demand Performance Monitoring Job for a given ser-
378 vice including all attributes of the Job.

379 - Buyer/Client requests modification of an On - Demand Performance Monitoring
380 Job for a given service including all modified attributes of the Job.

381 - Buyer/Client requests cancellation of an On - Demand Performance Monitoring Job
382 for a given service .

383 - Buyer/Client requests suspension of an On - Demand Performance Monitoring Job
384 for a given service.

385 - Buyer/Client requests resumption of an On - Demand Performance Monitoring Job
386 for a given service.

387 - Seller/Server notifies the Buyer/Client when results of the PM Job are ready.

388 - Buyer/Client retrieves a list of Performance Monitoring Jobs.

389 - Buyer/Client retrieves a Performance Monitoring Job by Performance Monitoring
390 Job ID, including results of the Job.

391 • Proactive Performance Monitoring

392 - Buyer/Client requests a Proactive Performance Monitoring Job for a given service
393 including all attributes of the Job.

394 - Buyer/Client requests modification of an Proactive Performance Monitoring Job
395 for a given service including all modified attributes of the Job

396 - Buyer/Client requests cancellation of a Proactive Performance Monitoring Job for
397 a given service.

398 - Buyer/Client requests suspension of a Proactive Performance Monitoring Job for a
399 given service.

400 - Buyer/Client requests resumption of a Proactive Performance Monitoring Job for a
401 given service.

402 - Seller/Server notifies Buyer/Client when results of the Performance Monitoring Job
403 are ready.

- Buyer/Client retrieves a list of Performance Monitoring Jobs.
- Buyer/Client retrieves a Performance Monitoring Job by Performance Monitoring Job ID , including results of the Job.

- Passive Statistics Monitoring
  - Buyer/Client requests a Passive Statistics Monitoring Job for a given service including all attributes of the Job.
  - Buyer/Client requests a modification to a Passive Statistics Monitoring Job for a given service including all attributes of the Job.
  - Buyer/Client requests a cancellation of a Passive Statistics Monitoring Job for a given service.
  - Buyer/Client requests a Passive Statistics Monitoring Job is suspended.
  - Buyer/Client requests a Passive Statistics Monitoring Job is resumed.
  - Seller/Server notifies Buyer/Client when results of the Passive Monitoring Statistics Collection is ready.
  - Buyer/Client retrieves a Passive Statistics Monitoring Job collection.
  - Buyer/Client retrieves a Passive Statistics Job by Passive Statistics Job ID, including results of the Job.
- Performance Monitoring Job Notifications
  - Buyer/Client subscription/unsubscription to PM Job Notifications.
  - Seller/Server generation of PM Job Notifications.
- Performance Monitoring Results
  - Buyer/Client retrieves a list of Performance Monitoring Jobs.
  - Buyer/Client retrieves PM Job results in one of four (*JSON XML*, *AVRO*, *CSV*) formats as indicated in the request.
  - Results are in the API as payload, or retrieved as an attachment in a form of a Url to an external file.
  - Buyer/Client subscribes to streaming Performance Monitoring.
  - Buyer/Client receives streaming Performance Monitoring data where Seller/Server make it available to the agreed streaming topic.

9 Use Cases Summary

The following section provides a use case summary with use case name, use case description and corresponding reference section where detailed use case procedures are provided.

UC #	Use Case Name	Use Case Description	Reference Section
	Fault Management Use Cases		
1	Create Fault Management Job	A request is initiated by the Buyer/Client to perform a FM Job on a Service.	10.1.1
2	Modify Fault Management Job	A request is initiated by the Buyer/Client to modify a FM Job on a Service.	10.1.2
3	Cancel Fault Management Job	A request is initiated by the Buyer/Client to cancel an existing FM Job on a Service.	10.1.3
4	Suspend Fault Management Job	A request is initiated by the Buyer/Client to suspend an existing FM Job on a Service.	10.1.4
5	Resume Fault Management Job	A request is initiated by the Buyer/Client to resume a suspended existing FM Job on a Service.	10.1.5
6	Subscribe to Fault Management Job Notifications	A request is initiated by the Buyer/Client to subscribe to notifications for an existing FM Job on a Service.	10.1.6
7	Generation of Fault Management Job Notifications	The Seller/Server generates and sends FM Job Notifications to subscribed Buyer/Client.	10.1.7
8	Unsubscribe from Fault Management Job Notifications	A request is initiated by the Buyer/Client to unsubscribe from FM Job Notifications.	10.1.8
9	List Fault Management Reports	A request initiated by the Buyer/Client to the Seller/Server to list the Fault Measurement Reports based on filtered criterion.	10.1.9
10	Collect Fault Management Report	A request initiated by the Buyer/Client to the Seller/Server to collect a Fault Measurement Report.	10.1.10
Performance Monitoring Profiles Use Cases			

UC #	Use Case Name	Use Case Description	Reference Section
11	Create Performance Monitoring Profile	A request initiated by the Buyer/Client to the Seller/Server to create a PM Profile.	11.1.1
12	Retrieve Performance Monitoring Profile List	A request initiated by the Buyer/Client to the Seller/Server to retrieve a list of PM Profiles.	11.1.2
13	Retrieve Performance Monitoring Profile by Identifier	A request initiated by the Buyer/Client to the Seller/Server to retrieve a PM Profile.	11.1.3
14	Modify Performance Monitoring Profile	A request initiated by the Buyer/Client to the Seller/Server to modify a PM Profile.	11.1.4
15	Delete Performance Monitoring Profile	A request initiated by the Buyer/Client to the Seller/Server to delete a PM Profile.	11.1.5
16	Subscribe to Performance Monitoring Profile Notifications	A request initiated by the Client to the Seller/Server to subscribe to PM Profile Notifications.	11.1.6
17	Performance Monitoring Profile Notification	A PM Profile Notification is initiated by the Seller/Server to a subscribed Buyer/Client.	11.1.7
18	Unsubscribe from Performance Monitoring Profile Notifications	A request initiated by the Buyer/Client to unsubscribe from PM Profile Notifications.	11.1.8
Performance Monitoring Job, Collection and Notifications Use Cases			
19	Create Performance Monitoring Job	A request initiated by the Buyer/Client to create a PM Job.	11.2.1
20	Modify Performance Monitoring Job	A request initiated by the Client to the Seller/Server to modify a PM Job.	11.2.2
21	Cancel Performance Monitoring Job	A request initiated by the Client to the Seller/Server to cancel a PM Job.	11.2.3
22	Suspend Performance Monitoring Job	A request initiated by the Client to the Seller/Server to suspend a PM Job.	11.2.4

UC #	Use Case Name	Use Case Description	Reference Section
23	Resume Performance Monitoring Job	A request initiated by the Client to the Seller/Server to resume a PM Job.	11.2.5
24	Retrieve Performance Monitoring Job List	A request initiated by the Buyer/Client to retrieve a PM Job List based on a filtered criterion.	11.2.6
25	Retrieve Performance Monitoring Job by ID	A request initiated by the Buyer/Client to retrieve a PM Job based on a unique identifier, ID.	11.2.7
26	Subscribe to Performance Monitoring Job/Collection Notifications	A request initiated by the Buyer/Client to subscribe to PM Job/Collection Notifications.	11.2.8
27	Unsubscribe from Performance Monitoring Job/Collection Notifications	A request initiated by the Buyer/Client to unsubscribe from PM Job/Collection Notifications.	11.2.9
28	Performance Monitoring Job/Collection Notification	A PM Job/Collection Notifications is initiated by the Seller/Server to a subscribed Buyer/Client.	11.2.10
29	List Performance Measurement Reports	A request initiated by the Buyer/Client to the Seller/Server to list the Performance Measurement Reports based on a filtered criterion.	11.2.11
30	Collect Performance Measurement Report	A request initiated by the Buyer/Client to the Seller/Server to collect a Performance Measurement Report.	11.2.12
Threshold Crossing Alert Profile Management Use Cases (not in scope)			
31	Create TCA Profile	A request is initiated by the Buyer/Client to create a TCA Profile.	12.1.1
32	Modify TCA Profile	A request is initiated by the Buyer/Client to modify a TCA Profile.	12.1.2
33	Delete TCA Profile	A request is initiated by the Buyer/Client to delete a TCA Profile.	12.1.3

UC #	Use Case Name	Use Case Description	Reference Section
34	Retrieve List of TCA Profiles	A request is initiated by the Buyer/Client to retrieve a list of TCA Profiles.	12.1.4
35	Retrieve TCA Profile by Identifier	A request is initiated by the Buyer/Client to retrieve a TCA Profile.	12.1.5
Passive Performance Monitoring Job			
36	Create Passive Performance Monitoring Job	A request initiated by the Buyer/Client to create a Statistics Collection Job.	13.1.1
37	Modify Passive Performance Monitoring Job	A request initiated by the Buyer/Client to the Seller/Server to modify a Passive PM Job.	13.1.2
38	Cancel Passive Performance Monitoring Job	A request initiated by the Client to the Seller/Server to cancel a Statistics Collection Job.	13.1.3
39	List Passive Statistics Reports	A request initiated by the Buyer/Client to the Seller/Server to list the Passive Statistics Reports based on a filtered criteria.	13.1.4
40	Collect Passive Statistics Reports	A request initiated by the Buyer/Client to the Seller/Server to collect a Statistics Collection Report.	13.1.5
Streaming (Topics) Use Cases			
41	Retrieve Topic by Identifier	A request is initiated by the Buyer/Client to retrieve a Topic that match the provided filter criteria.	14.2.1
42	Retrieve Available Topic List	A request is initiated by the Buyer/Client (Subscriber) to retrieve a Topic list.	14.2.2
43	Retrieve Subscribed Topic List	A request is initiated by the Buyer/Client (Subscriber) to retrieve a Topic list which the Subscriber is currently subscribed.	14.2.3
Subscriber/Publisher Streaming Use Cases			

UC #	Use Case Name	Use Case Description	Reference Section
44	Subscribe to Topic	A request is initiated by the Buyer/Client (Subscriber) to subscribe to a Topic.	14.2.4
45	Unsubscribe from a Topic	A request is initiated by the Buyer/Client (Subscriber) to unsubscribe from a Topic.	14.2.5
46	Publish Topic Message	A Seller/Server (Publisher) publishes a Topic/Message to Buyers/Sellers (Subscriber(s)).	14.2.6
47	Retrieve Topic/Messages	A Buyer/Client retrieves the Topic/Message that it is subscribed to.	14.2.7
Alarm Management Use Cases			
48	Create Alarm	A request is made by Seller/Server to create an Alarm based on an event.	15.1.1
49	Retrieve Alarm List	A request is initiated by the Buyer/Client to retrieve a list of Alarms.	15.1.2
50	Retrieve Alarm by Identifier	A request is initiated by the Buyer/Client to retrieve an identified Alarm.	15.1.3
51	Subscribe to Alarms	A request initiated by the Buyer/Client to the Seller/Server to subscribe to Alarms.	15.1.4
52	Unsubscribe from Alarms	A request initiated by the Client to unsubscribe from Alarms.	15.1.5
53	Stateful TCA Notifications	A TCA Profile lifecycle Notification is initiated by the Seller/Server to a subscribed Client.	15.1.6
54	Stateless TCA Notifications	A TCA Profile lifecycle Notification is initiated by the Seller/Server to a subscribed Client.	15.1.7
Retrieve PM Data from PM Database			
55	Retrieve PM Data from PM Database	A request initiated by the Buyer/Client to retrieve PM	16

UC #	Use Case Name	Use Case Description	Reference Section
		data from a database that contains PM data.	

437 **Table 4 - Use Case Summary**

10 Fault Management Use Cases

This section provides a comprehensive set of Use Cases needed to support Fault Management Job. These Use Cases are based on business process standards of interactivity between Client and Seller/Server.

10.1 Fault Management Job, Collection and Notification Use Cases

The Buyer/Client can request that the Seller/Server perform FM Job on a Service. Examples of FM Job are Link Trace or Loopback using FM protocols (i.e., BFD, Y.1731). A FM Job will typically run as part of a troubleshooting or diagnostic process. The following sub - section defines use cases for the Fault Management Job. Included are the ability for a client to initiate a Fault Management Job and retrieve the results of the Job. The use cases also provide the ability for the Client to subscribe and unsubscribe to Fault Management Notifications.

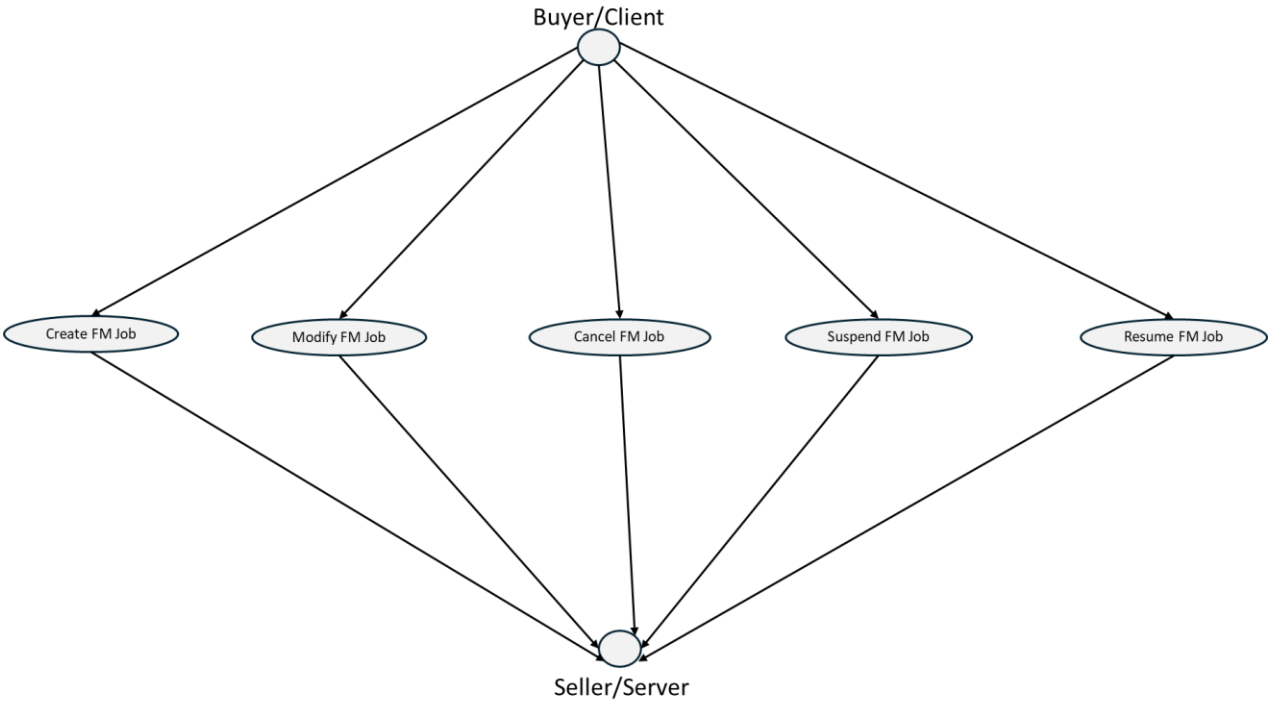
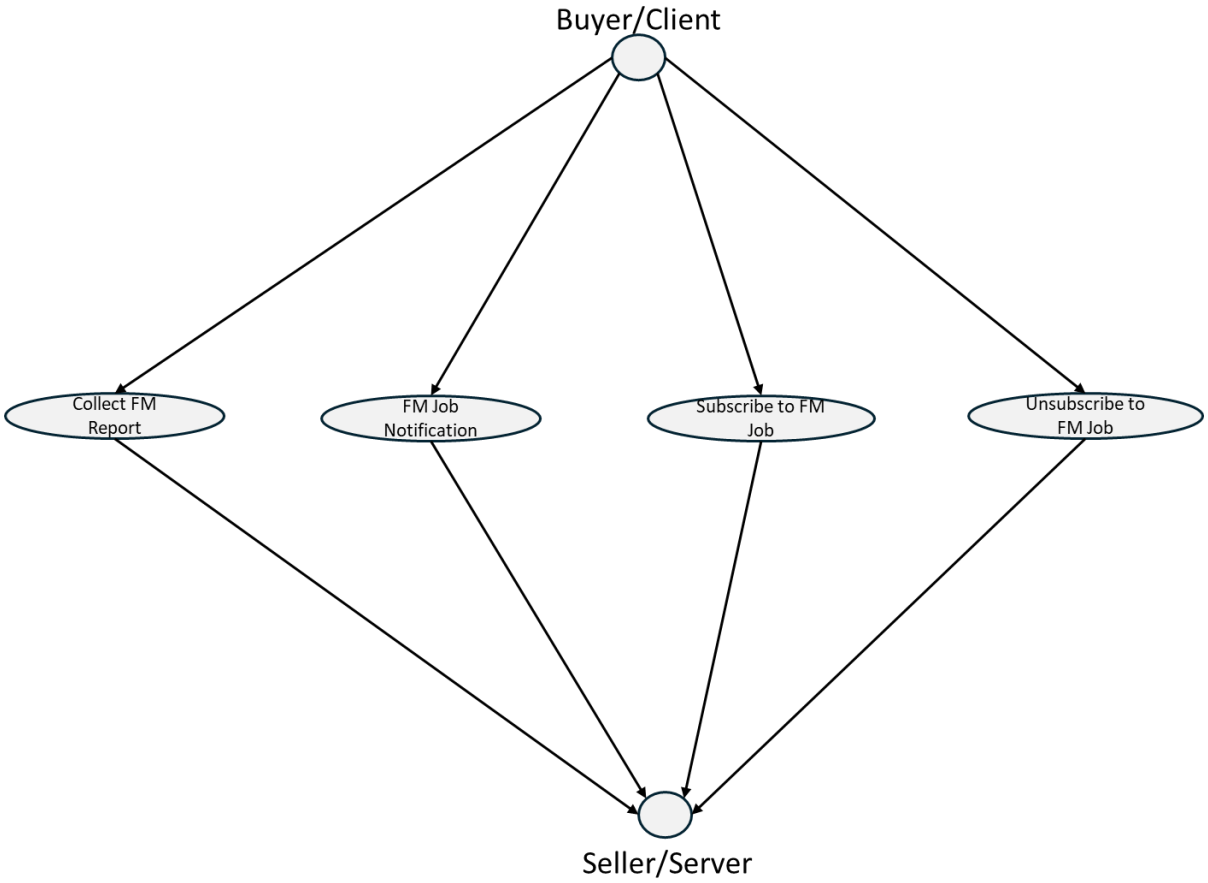


Figure 1 - Fault Management Job Use Cases



451

452 **Figure 2 - Fault Management Job Notification and Collection Use Cases**

453 ### 10.1.1 Create Fault Management Job Use Case

Field	Description
Use Case Number	1
Use Case Name	Create Fault Management Job
Description	A request is initiated by the Buyer/Client to perform a FM Job on a Service.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to request a FM Job on a Service in the Seller/Server system.

Field	Description
Process Steps	1. The Buyer/Client creates a FM Job request using the attributes show in Table FM Job Attribute. **[R1]** The Buyer/Client's Create FM Job request **MUST** contain the following attributes: • Job Type (On - Demand, Proactive, Passive) • Output Format • Granularity • Reporting Period • Result Format • Schedule Definition • Service Specific Attributes • Service ID to request Service report. **[O1]** The Buyer/Client's Create FM Job request **MAY** contain the following attributes: • Description • FM Job Priority 2. The Seller/Server responds with an acknowledgement and notifies the Buyer/Client when results are available. **[R2]** The Seller/Server sets the Creation Time and Job Identifier attribute. **[R3]** The Seller's/Server's response **MUST** echo back all Buyer/Client provided attributes. **[R4]** The FM Job Identifier supplied by the Seller/Server **MUST** be unique within the Seller/Server's network.
Post - Conditions	1. The Buyer/Client receives a Response, including a FM Job ID. 2. The Seller/Server initiates a FM Job. 3. If the Seller/Server supports notifications and the Buyer/Client has registered for notifications, the Seller/Server notifies the Buyer/Client of commitment to provide the request. 4. The Seller/Server notifies the Buyer/Client when Job results are available. **[R5]** If the Buyer/Client registered for FM Notifications, the Seller/Server **MUST** notify the Buyer/Client when FM Job results are available.

Field	Description
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while constructing and persistently storing the FM Job.

454 **Table 5 - Create FMFM Job Use Case**

Attribute Name	Description	Value	Comments
Description	A textual description of the FM Job	String	Set by Buyer/Client
Creation Time	Time the Job was created	String	Set by Seller/Server
FM Job Identifier	The identifier of the management Job.	String	Set by the Seller/Server
FM Job Priority	The priority of the management Job. The way the management application will use the Job priority to schedule Job execution is application specific and out the scope.	Integer	Set by the Buyer/Client The priority is on a 1 - 10 scale with 1 being highest priority and 10 being lowest priority
FM Job Type	The type of FM Job	One of : *On - Demand* *Proactive* *Passive*	
Last Time Modified	The last time a FM Job was modified.	Date - Time	Set by Seller/Server
Output Format	The format of the output report	One of the following: *JSON* *XML* *AVRO* *CSV*	Set by Buyer/Client
Result Format	List of possible result formats that define how Seller/Server will deliver Fault Report to the Buyer/Client	One of the following: *Payload* *Attachment*	Payload Output Format for *Payload* is always *JSON*
Service Payload Specific Attributes	Attributes that are obtained from the applicable Service definition.		Set by Buyer/Client
Granularity	The sampling rate of the collection of fault indicators.	See Table 27	Set by Buyer/Client

Reporting Period	The time - period for the report.	See Table 27	
Schedule Definition	The definition of schedule attributes	See Table 7	
State	State of FM Job.	See Table 92.	
Tracking Record	A list of tracking records. Tracking records allow the tracking of modifications on the Job. The tracking records should not be embedded in the Job to allow retrieving the Job without the tracking records.	See Table 11.	

455 **Table 6 Fault- Fault Management Job Attributes**

Attribute Name	Description	Value	Comments
Start Time	The start time of the Schedule Definition.	String Format: Date – Time	Set by Buyer/Client
End Time	The end time of the Schedule Definition. If the attribute is empty the Schedule runs forever, not having a time constraint.	String Format: Date - Time	Set by Buyer/Client
Recurring Frequency	A recurring frequency to run a job within a day that is included in Schedule Definition, for example: every 5 minutes, 15 minutes, 30 minutes, 1 hour.	RecurringFrequency	Set by Buyer/Client
Hour Range	A list of time ranges within a specific day that the schedule will be active on, for example 08:00 - 12:00, 16:00 - 19:00.	List of Start Date/Time and End Date/Time	Set by Buyer/Client
Monthly Schedule Day of Week	The monthly schedule is used to define a schedule that is based on day of month recurrence.	MonthlyScheduleDayOfWeek	Set by Buyer/Client

Attribute Name	Description	Value	Comments
Weekly Schedule Day of Week	The weekly schedule is used to define a schedule that is based on the days of the week, e.g. a schedule that will be active only on Monday and Tuesday.	DayOfWeekRecurrence[1]	Set by Buyer/Client

456 **Table 7 - Schedule Definition Attributes**

457

Attribute Name	Description	Value	Comments
value	Integer value of recurring frequency.	Integer	Set by Buyer/Client
units	Units of recurring frequency.	RecurringFrequencyUnits Enum: • MINUTES • HOURS • DAYS • WEEKS • MONTHS	Set by Buyer/Client

458 **Table 8 - Recurring Frequency Definition Attributes**

459

Attribute Name	Description	Value	Comments
Day of Month Recurrence	Day of month recurrence.	DayOfMonthRecurrence[1]	Set by Buyer/Client

460 **Table 9 – Day of the Month Schedule Definition Attributes**

461

Attribute Name	Description	Value	Comments
Recurring Day Sequence	Recurring day sequence.	List of days: 0= Sunday 1= Monday 2= Tuesday 3= Wednesday 4 = Thursday 5 = Friday 6= Saturday	Set by Buyer/Client

462 **Table 10 - Day Of Week Recurrence Definition Attributes**

463

Attribute Name	Description	Value	Comments
Description	Allow the tracking of modifications of Performance Job, Profile or Report.	String	Set by Seller/Server
Creation Date	Date when record was created.	String	Set by Seller/Server
Identifier	Identifier of the Tracking Record.	String	
Related Object Identifier	Identifier of the FM Job or Report.	String	
Request	Request that created the Tracking Record	String	
System	Describes the system from which the action was done.	String	
User	Describes the user doing the action.	String	

464 **Table 11 - Tracking Record Attributes**

465 ### 10.1.2 Modify Fault Management Job Use Case

Field	Description
Use Case Number	2
Use Case Name	Modify Fault Management Job
Description	A request is initiated by the Buyer/Client to modify a FM Job on a Service.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Client is authorized to request a modification to an existing FM Job on a Service in the Seller/Server system. 2. The attributes that are intended to be modified by the Client will not break or disrupt the Service.

Field	Description
Process Steps	1. Buyer/Client creates a Modify FM Job request that includes the FM Job Identifier and the attributes to modify. **[R6]** The Buyer's/Client's Modify FM Job request **MUST** include the FM Job Identifier. **[R7]** The Buyer's/Client's Modify FM Job request **MUST** contain one or more of the following attributes: • Output Format • Granularity • Description • FM Job Priority • Reporting Period • • Schedule Definition • Service Payload Specific Attributes 2. The Seller/Server verifies that the requested attributes to be modified will not result in the Service being broken or disrupted. 3. The Seller/Server responds to the Modify FM Job request and if accepted updates the attribute(s). **[R8]** The Seller's/Server's response to the Buyer's/Client's Modify FM Job request **MUST** echo back the attributes in the Client's request. **[R9]** The Seller's/Server's response to the Buyer's/Client's Modify FM Job request **MUST** indicate if the request has been accepted or rejected.
Post - Conditions	1. The Buyer/Client receives a FM Job response. 2. The FM Job is modified with requested attributes changes. 3. If the Seller/Server supports notifications and the Buyer/Client has registered for notifications, the Seller/Server notifies the Buyer/Client of commitment to provide the request.
Alternative Paths	1. If errors occurred, the Seller/Server returns all identified errors in a reject response. 2. If the modification request cannot be serviced, the Seller/Server returns an error code with specific reason(s).

Table 12 - Modify Fault Management Job Use Case

10.1.3 Cancel Fault Management Job Use Case

Field	Description
Use Case Number	3
Use Case Name	Cancel Fault Management Job

Field	Description
Description	A request is initiated by the Buyer/Client to cancel an existing FM Job on a Service.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to request a cancellation of an existing FM Job on a Service in the Seller/Server system.
Process Steps	1. The Buyer/Client creates a Cancel FM Job request that includes the FM Job Identifier. **[R10]** The Buyer's/Client's Cancel FM Job request **MUST** include the FM Job Identifier. 2. The Seller/Server acknowledges the Buyer's/Client's Cancel FM Job request and indicates if the request has been accepted or declined in their response. *NOTE: Resources include, but are not limited to CPU allocation, memory, etc. required for supporting a PM Profile.* **[R11]** The Seller's/Server's response to the Buyer's/Client's Cancel FM Job request **MUST** indicate if the request is Accepted or Declined. **[R12]** If the Seller/Server accepts the Buyer's/Client's Cancel FM Job request, the Job **MUST** stop. **[R13]** If the Seller/Server declines the Client's Cancel FM Job request, the Job **MUST NOT** stop. **[R14]** If the Seller/Server declines the Client's Cancel FM Job request, they **MUST** provide a reason the request was declined.
Post - Conditions	1. The Buyer/Client receives a confirmation that the FM Job has been canceled. 2. All resources on the Seller/Server side associated with the FM Job are canceled. 3. All FM results generated prior to deletion remain available for collection.
Alternative Paths	1. If errors occurred, the Seller/Server returns all identified errors in a reject response, including error codes and specific reasons(s).

468 **Table 13 - Cancel Fault Management Job Use Case**

10.1.4 Suspend Fault Management Job Use Case

Field	Description
Use Case Number	4
Use Case Name	Suspend Fault Management Job
Description	A request is initiated by the Buyer/Client to suspend an existing FM Job on a Service.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Client is authorized to request a suspension of an existing FM Job on a Service in the Seller/Server system. 2. An existing FM Job is running on an existing Service. 3. FM Job is in condition/state which can be suspended.
Process Steps	1. The Client creates a Suspend FM Job request that includes the FM Job Identifier. **[R15]** The Client's Suspend FM Job request **MUST** include the Job Identifier. **[R16]** The FM Job **MUST** be in the In - Progress state to be Suspended. 2. The Seller/Server acknowledges the Client's Suspend FM Job request and indicates if the request has been accepted or declined in their response. **[R17]** The Seller/Server's response to the Client's Suspend FM Job request **MUST** indicate if the request is Accepted or Declined. **[R18]** If the Seller/Server accepts the Client's Suspend FM Job request, the Job **MUST** be suspended. **[R19]** If the Seller/Server declines the Client's Suspend FM Job request, the Job **MUST NOT** be suspended. **[R20]** If the Seller/Server declines the Client's Suspend FM Job request, they **MUST** provide a reason the request was declined.
Post - Conditions	1. If the Seller/Server encounters errors, they should return an error with explanation to the Client. 2. If the Client is subscribed to FM Job Notifications the Seller/Server transmits a Notification.
Alternative Paths	1. If errors occurred, the Seller/Server returns all identified errors in a reject response. 2. If the suspended request cannot be serviced, the Seller/Server returns an error code with specific reason(s).

Table 14 - Suspend Fault Management Job Use Case

10.1.5 Resume Fault Management Job Use Case

Field	Description
Use Case Number	5
Use Case Name	Resume Fault Management Job
Description	A request is initiated by the Buyer/Client to resume a suspended existing FM Job on a Service.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Client is authorized to request a resumption of an existing FM Job on a Service in the Seller/Server system. 2. An existing FM Job is in a Suspended state on an existing Service.
Process Steps	1. The Client creates a Resume FM Job request that includes the FM Job Identifier. **[R21]** The Client's Resume FM Job request **MUST** include the Job Identifier. **[R22]** The FM Job **MUST** be in the Suspended state. 2. The Seller/Server acknowledges the Client's Resume FM Job request and indicates if the request has been accepted or declined in their response. **[R23]** The Seller/Server's response to the Client's Resume FM Job request **MUST** indicate if the request is Accepted or Declined. **[R24]** If the Seller/Server accepts the Client's Resume FM Job request, the Job **MUST** be resumed and return to the In - Progress or Scheduled state. **[R25]** If the Seller/Server declines the Client's Resume FM Job request, the Job **MUST NOT** be resumed. **[R26]** If the Seller/Server declines the Client's Resume FM Job request, they **MUST** provide a reason the request was declined.
Post - Conditions	1. If the Seller/Server encounters errors, they should return an error with explanation to the Client. 2. If the Client is subscribed to FM Job Notifications the Seller/Server transmits a Notification.
Alternative Paths	1. If errors occurred, the Seller/Server returns all identified errors in a reject response. 2. If the resume request cannot be serviced, the Seller/Server returns an error code with specific reason(s).

Table 15 - Resume Fault Management Job Use Case

10.1.6 Subscribe to Fault Management Job Notifications Use Case

Field	Description
Use Case Number	6
Use Case Name	Subscribe to Fault Management Job Notifications
Description	A request is initiated by the Buyer/Client to subscribe to FM Job Notifications.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to subscribe to FM Job/Collection Notifications in the Seller/Server system. 2. The Seller/Server support FM Job/Collection Notifications.
Process Steps	1. The Client subscribes to FM Job Notifications by specifying the notification types and target addresses for the notifications to be sent to. **[R27]** The Client request **MUST** contain the following: • FM Job Notification Target Information • List of Job Notification Types 2. The Seller/Server responds to indicate acceptance of the request. **[R28]** The Seller/Server **MUST** respond to the Client's Register for FM Job Notifications request to indicate that the request was accepted or rejected. **[R29]** If the Seller/Server rejects the Client's Register for FM Job Notifications request, the response **MUST** include a reason for the rejection.
Post - Conditions	1. If the Seller/Server encounters errors, they should return an error with explanation to the Client.

Table 16 - Subscribe to Fault Management Job Notifications Use Case

Attribute	Description	Value	Definition
Notification Target Information	The detailed information on the technical API end - point address specifying where the Seller/Server is to send any FM Job Notifications. There can be multiple locations for one Buyer/Client.	String	This is the Callback target in the API

List of Notification Types	The types of notifications that the Buyer/Client wishes to receive.	List of one or more of: FM Job created FM Job state changed FM Job attribute value changed FM Report Ready FM Report Preparation Failed	This is a list of attributes

476 **Table 17 - Buyer/Client Request Attributes for Subscribe to Notifications**

477 ### 10.1.7 Generation of Fault Management Job Notifications Use Case

Field	Description
Use Case Number	7
Use Case Name	Generation of Fault Management Job Notifications
Description	The Seller/Server generates and sends FM Job Notifications to subscribed Buyer/Client.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Client has subscribed to FM Job Notifications.
Process Steps	1. The Seller/Server generates and sends FM Job Notifications to subscribed Buyer/Client(s). **[R30]** The Seller/Server FM Notifications **MUST** be sent to Buyer/Clients who have subscribed to FM Notifications. **[R31]** The Seller/Server FM Notifications **MUST** Not be sent to Buyer/Clients who have not subscribed to FM Notifications. **[R32]** The Seller/Server's FM Notification **MUST** include the attributes in Table 19 Fault- Fault Management Notification Attributes.
Post - Conditions	1. The Client has received the FM Job Notification sent by Seller/Server.
Alternative Paths	

478 **Table 18 FM- FM Job Notifications Use Case**

479

Attribute Name	Description	Value	Comments
FM Notification Type	The type of FM Notification	One of the following: • FM Job created, • FM Job modified,	Job notification occurs when a FM Job (i.e., Link Trace) is complete with results or changes state.

		• FM Job State change • FM Collection ready • FM Job Report Failed	
FM Notification Identifier	The identifier of the FM Notification	String	The FM Notification Identifier is assigned by the Seller/Server

480 **Table 19 Fault- Fault Management Notification Attributes**

481 ### 10.1.8 Unsubscribe from Fault Management Job Notifications Use Case

Field	Description
Use Case Number	8
Use Case Name	Unsubscribe from Fault Management Job Notifications
Description	A request is initiated by the Buyer/Client to unsubscribe from FM Job Notifications.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Client is authorized to request an unsubscribe from FM Job Notifications on a Service in the Seller/Server system.
Process Steps	1. The Client unsubscribes from FM Job Notifications by specifying the unique identifier of the listener.
Post - Conditions	1. The Seller/Server discontinues sending FM Job/Collection Notification Types to Client specific to Buyer/Client Unsubscribe request. 2. The Client is no longer receiving FM Job Notifications.
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while processing that prevents the Seller/Server from completing the request.

482 **Table 20 - Unsubscribe from Fault Management Job Use Case**

483 ### 10.1.9 List Fault Management Reports

Field	Description
Use Case Number	9
Use Case Name	List Fault Management Reports
Description	A request initiated by the Buyer/Client to the Seller/Server to list the Fault Management Reports based on a filtered criterion.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to retrieve a list of Fault Management Reports in the Seller/Server system.

Field	Description
Process Steps	1. The Buyer/Client submits a Retrieve List of Fault Management Reports request including filter criteria the Seller/Server should apply. 2. The Seller/Server receives the request and validates the request. 3. The Seller/Server determines if any Fault Management Reports match the filter criteria in the request. **[R33]** The Seller/Server **MUST** support the retrieval of a List of Fault Management Reports Use Case. **[R34]** Buyer/Client **MUST** support the retrieval of a List of Fault Management Reports Use Case. **[R35]** The Seller/Server's response to the Buyer's/Client's retrieve List of Fault Management Reports **MUST** include the following attributes as applicable: • Description • Report ID 4. If the Seller/Server validates the Buyer's/Client's request but finds no matching Fault Management Reports, the Seller/Server **MUST** return an empty list.
Post - Conditions	1. The Buyer/Client receives a list of all Fault Management Reports that match the Buyer's/Client's filtered selection criteria. 2. The Buyer/Client may initiate a finer granularity query to obtain detailed information for a specific Fault Management Reports based on unique identifier.

Table 21 - List Fault Management Reports Use Case

10.1.10 Collect Fault Management Reports

Field	Description
Use Case Number	10
Use Case Name	Collect Fault Management Report
Description	A request initiated by the Buyer/Client to the Seller/Server to collect a Fault Management Report.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to collect a Fault Measurement Report in the Seller/Server system.

Field	Description
Process Steps	1. The Buyer/Client submits a Retrieve Fault Management Report request to the Seller/Server. 2. The Seller/Server receives the request and validates the request. 3. The Seller/Server determines if a Fault Management Report matches the request. 4. The Seller/Server provides results: a. The Seller/Server's response includes the results from the specified report as payload in the envelope. b. The Seller/Server's response includes the results from the specified report as file in the attachment. c.
Post - Conditions	1. The Client receives the Fault Measurement Report that match the Client's selection criteria. 2. The Client receives the location of the file collection for the Fault Measurement Report. 3. If errors occurred, the Seller/Server returns all identified errors in a reject response.

Table 22 - Collect Fault Measurement Report Use Case

Attribute Name	Description	Value	Comments
FM Job Identifier	The identifier of the FM Job	String	Set by the Seller/Server
Report Identifier	The identifier of the FM Job Result Report	String	Set by the Seller/Server

Table 23 Fault- Fault Management Job Results

Table 24 - Retrieve Fault Management Results in Payload Attributes

[R36] The results regardless of the format **MUST** contain the FM results as specified with FM Job request.

11 Performance Monitoring Use Cases

The Use Cases for Performance Monitoring are defined in this section. The Service Level Specification describes the performance objectives for the performance of conformant traffic (i.e., frames, packets) that flow over a VC (i.e., EVC, IPVC, etc.). For example, objectives specified in the SLS might be specified for frame or packet delay (latency). The performance objectives specified in the SLS often form part of a Service Level Agreement (SLA), which can also specify penalties for the SP or Operator providing the service if the objectives are not met. The PM use cases are divided into the following specific operations: PM Profiles, PM Jobs, and PM Collections. There are three types of PM Jobs – Proactive, On - Demand and Passive.

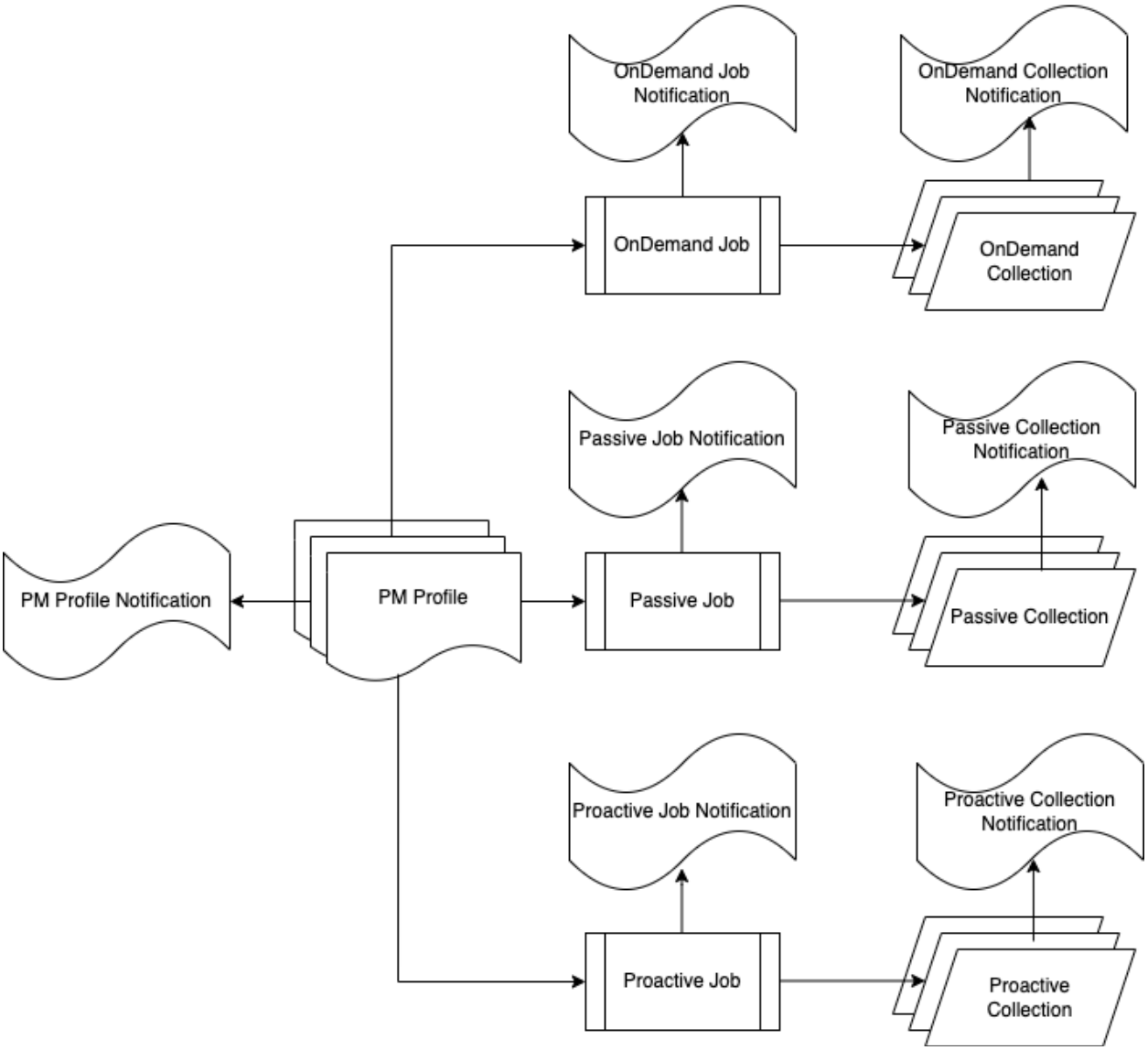


Figure 3 - Performance Monitoring Process Diagram

PM Profile provisioning is the lifecycle process of defining performance attributes of a PM Profile. A PM Profile Notification is defined such that a client can subscribe to PM Profile Notifications and be asynchronously informed when PM Profiles are created, modified, or deleted.

Jobs are responsible for the provisioning of measurement intervals, schedules, and performance objectives. Performance objectives are typically associated with an SLS but can be used for an On - Demand Job for making measurements as part of a troubleshooting procedure. There are three types of Jobs – Proactive, On - Demand and Passive, with the time schedule of the Job being the main difference between Proactive and On - Demand. Passive is discussed in detail later in section 14.2.. The Proactive PM Job is in support of provisioning an SLS between one or more ordered pairs. An individual PM Job is assigned to each ordered pair. An ordered pair is an association between two end points.

An On - Demand PM Job is typically a single run or non - continual run performed during service assurance. A Proactive PM Job is typically in support of a SLS measurement and will run for the lifetime of the service, while an On - Demand is a short duration performance management test. On - Demand PM Job has an end date while Proactive PM Job runs indefinitely for the lifetime of the service.

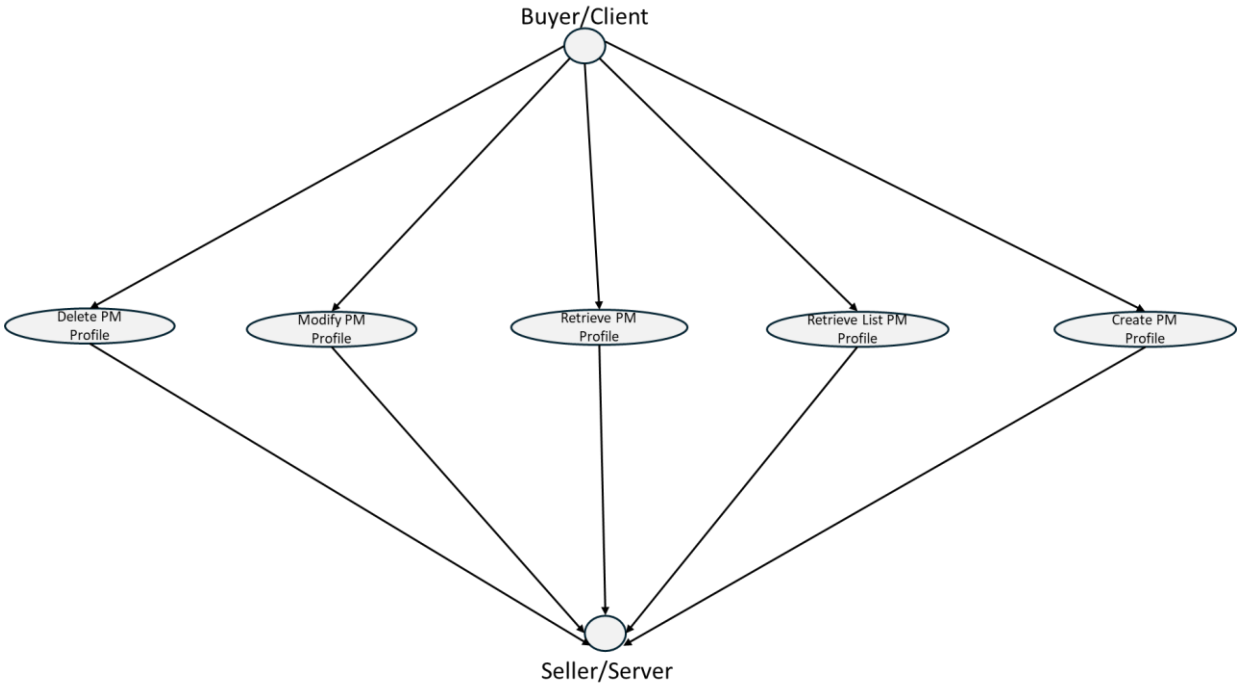
Proactive, On - Demand and Passive PM Jobs use PM Profiles for the provisioning lifecycle. The performance objectives include, but are not limited to frame/packet delay, frame/packet loss ratio, inter - frame/packet delay variation. A PM Profile of the same PM Job Type as the PM Job can be reused for PM Jobs or can be created for a specific Proactive, On - Demand or Passive PM Jobs. Proactive, On - Demand and Passive PM Jobs support Notifications. A client can subscribe to these respective Notifications and be asynchronously informed when a Job is created, canceled, or modified.

The Proactive, On - Demand and Passive Collections are where a client requests the retrieval of performance management reports. Proactive, On - Demand and Passive Collections support Notifications. A client can subscribe to these Notifications and be asynchronously notified when a Collection is ready for retrieval.

There are no restrictions on a Proactive and On - Demand PM Job running on the same Service. For example, a Proactive PM Job could be associated with SLA during Service Activation. While the Service is active a Service Assurance - based On - Demand PM Job may be requested to immediate (real - time) feedback purposes. A Passive PM Job can be associated with a Service or Entity (i.e., Interface, Port, VLAN). An Entity is defined as an object other than a Service that can be monitored and have associated telemetry.

11.1 Performance Monitoring Profiles Use Cases

This section defines the use cases that support Performance Monitoring (PM) Profiles. PM Profiles are a mechanism used to simplify the PM Job provisioning. Some attributes of a PM Job are defined in the PM Profiles which can be centralized and leveraged across multiple job requests. See Table 26 - Create Performance Monitoring Profile Attributes. A PM Profile can be used for multiple PM Jobs, or it can be for a specific PM Job.



548

549 **Figure 4 - Performance Monitoring Profile Use Cases**

550 The Buyer/Client can create, retrieve, modify, and delete PM Profiles. The Seller/Server is re-
551 sponsible for interpreting the Client PM Profile requests and performing any necessary intra -
552 Seller/Server and inter - Seller/Server communications to assure the Clients request are met.

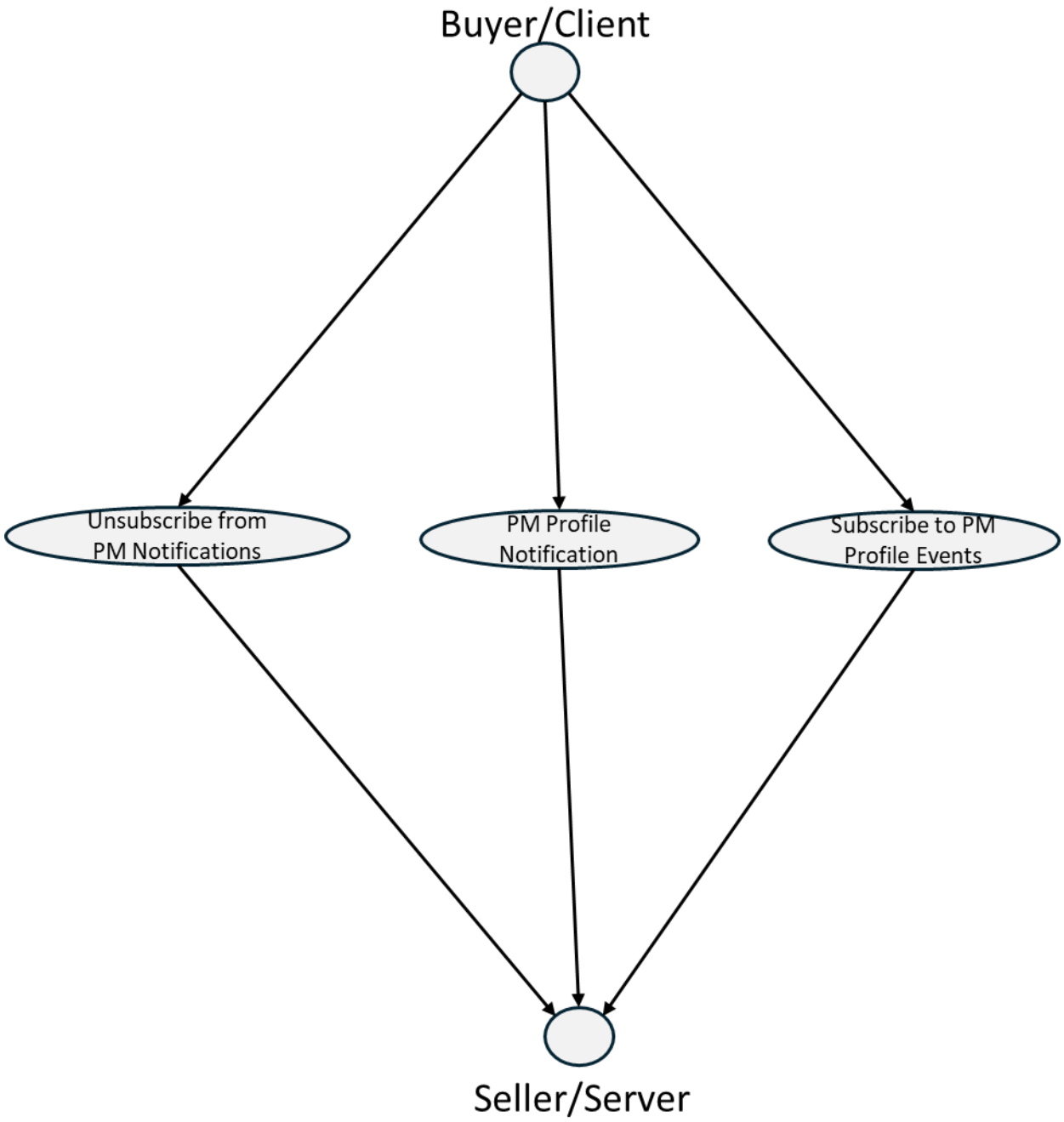


Figure 5 - Performance Monitoring Profile Notification Use Cases

The Buyer/Client can subscribe, unsubscribe to and from PM Profile Notifications. In the case of a Partner providing Profiles, the Service Provider will subscribe to PM Profile Notifications and the Partner will send corresponding Notifications. These scenarios are dependent upon the IRP on the operation of Notifications and actors. The Seller/Server (SOF) is responsible for providing PM Profile Notifications to the Client (BA) specified callback.

A Seller may allow a Buyer to create PM Profiles via the API. In this case, the Buyer uses the Create PM Profile request to create the profiles they require. If the Seller opts to not allow the

Buyer to create PM Profiles, then the Buyer has the ability to select from a set of PM Profiles that are created by the Seller through some means other than the API. The Buyer selects from the set of Seller-created PM Profiles and assigns it to the PM Job that the Buyer creates.

11.1.1 Create Performance Monitoring Profile Use Case

Field	Description
Use Case Number	11
Use Case Name	Create Performance Monitoring Profile
Description	A request initiated by the Buyer/Client to the Seller/Server to create a PM Profile.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. PM Profile with intended Profile does not exist. 2. The Buyer/Client is authorized to perform the request.
Process Steps	1. The Buyer/Client determines what PM objectives will be needed. **[R37]** The Buyer's/Client's Create PM Profile request **MUST** contain the following attributes: • PM Job Type • Granularity • Reporting Period • Output Format • Result Format **[O2]** The Buyer's/Client's Create PM Profile **MAY** contain the following attributes: • Description • PM Job Priority 2. The Seller/Server receives request and determines if the PM Profile is valid.
Post - Conditions	1. PM profile is allocated and available. 2. Service returns PM Profile ID. 3. The PM Profile is available for PM Job provisioning.
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while constructing and persistently storing the PM profile. 2. The Seller/Server returns a specific error message that the requested PM Job will collect to too much data.

Table 25 - Create Performance Monitoring Profile Use Case

Attribute Name	Description	Value	Comments
Description	A textual description of the PM Job	String	Set by Buyer/Client
PM Profile ID	Unique identifier of existing Performance Management Profile.	*String*	Set by Seller/Server

Attribute Name	Description	Value	Comments
PM Job Type	The type of PM Job	One of the following: *Proactive* *OnDemand* *Passive*	Set by Buyer/Client
PM Job Priority	The priority of the management Job. The way the management application will use the Job priority to schedule Job execution is application specific and out the scope.	Integer	Set by the Buyer/Client The priority is on a 1 - 10 scale with 1 being highest priority and 10 being lowest priority
Reporting Period	The attribute that defines how often a PM report is generated	String	
Last Time Modified	The last time a PM Profile was modified.	Date - Time	Set by Seller/Server
Granularity	The sampling rate of the collection of performance indicators.	See Table 27.	Set by Buyer/Client
State	State of PM Profile.	See Table 92	Set by Seller/Server
Output Format	The format of the output report	One of the following: *JSON* *XML* *AVRO* *CSV*	Set by Buyer/Client
Result Format	List of possible result formats that define how Seller/Server will deliver Performance Report to the Buyer/Client	One of the following: *Payload* *Attachment*	Payload Output Format for *Payload* is always *JSON*
Tracking Record	A list of tracking records. Tracking records allow the tracking of modifications to the PM Profile. The tracking records should not be embedded in the PM Profile to allow retrieving the PM Profile without the tracking records.	See Table 11.	Set by Seller/Server.

567 **Table 26 - Create Performance Monitoring Profile Attributes**

568 The Buyer/Client may have the ability to create new PM Profiles or may choose from a "catalog"
569 of PM Profiles made available by the Seller/Server.

570

Attribute Name	Description	Value	Comments
Granularity	The duration	String enumeration one of the following: • *10 milliseconds* • *100 milliseconds* • *1 second* • *10 seconds* • *1 minute* • *5 minutes* • *15 minutes* • *30 minutes* • *1 hour* • *24 hours* • *1 month* • *1 year*	

571 **Table 27 - - Granularity Attributes**

572 ### 11.1.2 Retrieve Performance Monitoring Profile List Use Case

Field	Description
Use Case Number	12
Use Case Name	Retrieve Performance Monitoring Profile List
Description	A request initiated by the Buyer/Client to the Seller/Server to retrieve a list of PM Profiles.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to perform the query.

Field	Description
Process Steps	1. The Buyer/Client submits a Retrieve List of PM Profile request including filter criteria for profile the Seller/Server should apply. 2. The Seller/Server receives the request and validates the request. 3. The Seller/Server determines if any PM Profiles match the filter criteria in the request. **[R38]** The Seller/Server **MUST** support the retrieval of a PM Profile List Use Case. **[R39]** The Buyer/Client **MUST** support the retrieval of a PM Profile List Use Case. **[R40]** The Seller/Server's response to the Buyer's/Client's retrieve List of PM Profiles **MUST** include the following attribute as applicable: • PM Profile ID **[R41]** If the Seller/Server validates the Buyer's/Client's request but finds no matching PM Profiles, the Seller/Server **MUST** return an empty list.
Post - Conditions	1. The Buyer/Client receives a list of all PM Profiles that match the Client's filtered selection criteria. 2. The Buyer/Client may initiate a request to obtain detailed information for a specific PM Profile based on unique identifier.
Alternative Paths	1. If errors occurred, the Seller/Server returns all identified errors in a reject response. 2. If the quantity of the records requested to be returned exceeds a Seller/Server policy, the Seller/Server must choose to respond with either: a. An empty list and message that indicates the result set is too large and submit a new more specific filtered query or b. A response that indicates the result is too large and includes a subset of the matching PM Profiles. 3. If the query does not find any matching records, then the Seller/Server responds with an indication of this result by sending an empty list with a success code.

Table 28 - Retrieve PMPM Profile List Use Case

11.1.3 Retrieve Performance Monitoring Profile by Profile Identifier Use Case

Field	Description
Use Case Number	13
Use Case Name	Retrieve Performance Monitoring Profile by Profile ID
Description	A request initiated by the Buyer/Client to the Seller/Server to retrieve a PM Profile.
Actors	Buyer/Client, Seller/Server

Field	Description
Pre - Conditions	1. The Buyer/Client is authorized to perform the query.
Process Steps	1. The Buyer/Client submits a PM Profile request with Profile ID. 2. The Seller/Server receives the request and validates the request. 3. The Seller/Server returns the PM Profile. **[R42]** The Seller/Server **MUST** support the retrieval of a PM Profile Use Case. **[R43]** The Buyer/Client **MUST** support the retrieval of a PM Profile Use Case.
Post - Conditions	1. The Buyer/Client receives the PM Profile. Returned response includes all attribute of the PM Profile.
Alternative Paths	1. If errors occurred, the Seller/Server returns all identified errors in a reject response.

Table 29 - Retrieve PM Profile Use Case

11.1.4 Modify Performance Monitoring Profile Use Case

Field	Description
Use Case Number	14
Use Case Name	Modify Performance Monitoring Profile
Description	A request initiated by the Buyer/Client to the Seller/Server to modify a PM Profile that the Buyer created.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. A PM Profile exists in the Seller/Server's system. 2. The Seller/Server verifies that the Buyer/Client is authorized to modify the PM Profile. 3. There is no PM Job associated to the PM Profile. The verification process for checking if a PM Profile is not being used is the responsibility of the Seller/Server implementation.
Process Steps	1. The Buyer/Client initiates a modify request for PM Profile with specific attributes to modify. **[O3]** The Buyer/Client **MAY** modify all Buyer/Client settable attributes. 2. The Seller/Server validates the modification request and provides a response with PM Profile with modifications. **[O4]** The Seller/Server **MAY** support modification of one or more attributes which are technology or non - technology specific. An example of a non - technology specific attribute would be a time interval attribute.
Post - Conditions	1. Seller/Server initiates the modification process and notifies Buyer/Client with a success message.

Field	Description
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while processing that prevents the Seller/Server from completing the modification.

Table 30 - Modify Performance Monitoring Profile Use Case

11.1.5 Delete Performance Monitoring Profile Use Case

Field	Description
Use Case Number	15
Use Case Name	Delete Performance Monitoring Profile
Description	A request initiated by the Buyer/Client to the Seller/Server to delete a PM Profile that the Buyer created.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. A PM Profile exists in Seller/Server's system. 2. The Seller/Server verifies that the Buyer/Client is authorized to delete the PM Profile. 3. There is no PM Job associated to the PM Profile. The verification process for checking if a PM Profile is not being used is the responsibility of the Seller/Server implementation.
Process Steps	1. The Buyer/Client initiates a delete request for PM Profile with unique identifier. 2. The Seller/Server validates the PM Profile exists, deletes the PM Profile, and all the PM Profile associated resources. *NOTE: Resources include, but are not limited to CPU allocation, memory, etc. required for supporting a PM Profile.* 3. The Seller/Server provides a response indicating the PM Profile has been deleted. **[O5]** The Seller/Server **MAY** support the deletion of a PM Profile Use Case. **[O6]** The Buyer/Client **MAY** support the deletion of a PM Profile Use Case.
Post - Conditions	1. Seller/Server deletes the PM Profile and notifies Buyer/Client with a success message.
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while processing that prevents the Seller/Server from completing the deletion.

Table 31 - Delete PMPM Profile Use Case

11.1.6 Subscribe to Performance Monitoring Profile Notifications Use Case

Field	Description
Use Case Number	16
Use Case Name	Subscribe to Performance Monitoring Profile Notifications
Description	A request initiated by the Buyer/Client to the Seller/Server to subscribe to PM Profile Notifications.

Field	Description
Actors	Buyer/Client, Seller/Server,
Pre - Conditions	1. The Buyer/Client is authorized to subscribe to PM Profile Notifications in the Seller/Server system. 2. The Seller/Server support notifications.
Process Steps	1. The Buyer/Client sends the Subscribe for PM Profile Notifications to the Seller/Server specifying where to send notifications and which PM Profile Notification Types to include in notifications. PM Profile Notification Types include: • PM Profile Created • PM Profile Modified • PM Profile Deleted 2. The Seller/Server receives the Subscribe request for PM Profile Notifications. 3. The Seller/Server records which PM Profile Notifications to send, where to send such notifications for this Buyer/Client. 4. The Seller/Server returns an acknowledgement to the Buyer/Client. **[O7]** The Seller/Server **MAY** support subscription to PM Profile Notifications Use Case. **[O8]** The Buyer/Client **MAY** support subscription to PM Profile Notifications Use Case.
Post - Conditions	1. The Seller/Server is aware of where to send notifications.
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while processing that prevents the Seller/Server from completing the request.

581 **Table 32 - Subscribe to Performance Monitoring Profile Notifications Use Case**

Attribute Name	Description	Value	Comments
Notification Target Information	The detailed information on the technical API end - point address specifying where the Seller/Server is to send any PM Profile Notifications. There can be multiple locations for one Buyer/Client.	String	This is the Callback target in the API
List of Notification Types	The types of notifications that the Buyer/Client wishes to receive.	List of one or more of: • PM Profile Created. • PM Profile Modified. • PM Profile Deleted.	This is a list of attributes

582 **Table 33 - Subscribe to PM Profile Notifications Attributes**

583 ### 11.1.7 Performance Monitoring Profile Notifications Use Case

Field	Description
Use Case Number	17
Use Case Name	Performance Monitoring Profile Notification
Description	A PM Profile Notification is initiated by the Seller/Server to a subscribed Buyer/Client.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Seller/Server supports PM Profile Notifications. 2. The Buyer/Client has subscribed to PM Profile Notifications.
Process Steps	1. The Seller/Server sends the notifications to the location(s) registered by the Buyer/Client. **[O9]** The Seller/Server **MAY** support PM Profile Notifications Use Case. **[O10]** The Buyer/Client **MAY** support PM Profile Notifications Use Case.
Post - Conditions	1. The Seller/Server has sent related PM Profile Notification.

584 **Table 34 - Performance Monitoring Profile Notifications Use Case**

585 ### 11.1.8 Unsubscribe from Performance Monitoring Profile Notifications Use Case

Field	Description
Use Case Number	18
Use Case Name	Unsubscribe from Performance Monitoring Profile Notifications
Description	A request initiated by the Buyer/Client to unsubscribe from PM Profile Notifications.
Actors	Buyer/Client, Seller/Server

Field	Description
Pre - Conditions	1. The Buyer/Client has previously subscribed to PM Profile Notifications. 2. The Buyer/Client is authorized to unsubscribe to PM Profile Notifications in the Seller/Server system. 3. The Seller/Server support PM Profile Notifications.
Process Steps	1. The Buyer/Client sends the Unsubscribe from PM Profile Notifications to the Seller/Server specifying which PM Profile Notifications the Buyer/Client is unsubscribing from listening. 2. The Seller/Server receives the Unsubscribe request for PM Profile Notifications. 3. The Seller/Server discontinues PM Profile Notifications to Buyer/Client specific to Unsubscribe request. 4. The Seller/Server returns an acknowledgement to the Buyer/Client. **[O11]** The Seller/Server **MAY** support unsubscribing from PM Profile Notifications Use Case. **[O12]** The Buyer/Client **MAY** support unsubscribing from PM Profile Notifications Use Case.
Post - Conditions	1. The Service discontinues sending PM Profile Notifications to Buyer/Client specific to Buyer/Client Unsubscribe request.
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while processing that prevents the Seller/Server from completing the request.

Table 35 - Unsubscribe from Performance Monitoring Profile Notifications Use Case

11.2 Performance Monitoring Job, Collection and Notification Use Cases

A Performance Monitoring Job is where the client specifies the performance monitoring objectives specific to each measurement point which could be an ordered pair (i.e., two UNIs) or an entity (i.e., port). An ordered pair is an association between two end points. A PM Job has start and stop times specified in the schedule definition. In the cases of the Proactive PM Job, the stop time is null.

NOTE: A customer could have multiple services each with an associated PM Job. Each PM Job would have its associated measurement point(s).

For the cases where the SLS is an attribute of the VC (Virtual Circuit) a Proactive PM Job is created by the VC provisioning process. This uses the same process as described for the Create PM Job request. The remaining functions described in this document are supported via standard processes. The PM Job implemented at MEF LSO Allegro/Interlude/Legato is specific to an implementation that is using an Allegro/Interlude/Legato Performance Management Provisioning process.

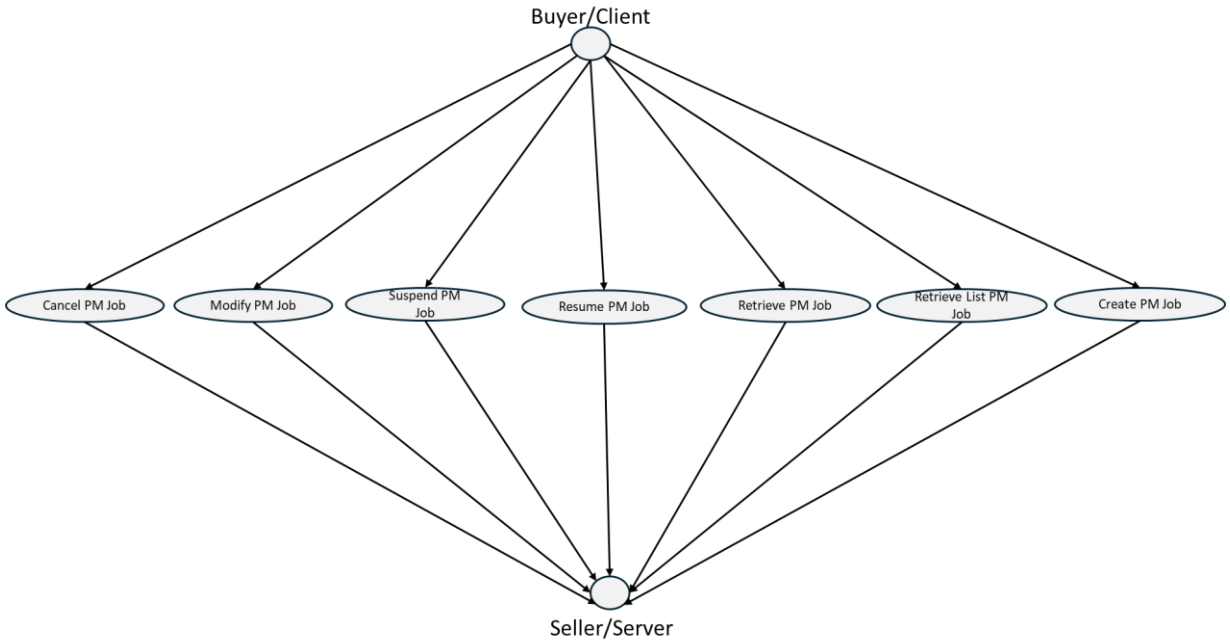


Figure 6 - Performance - Performance Monitoring Job Use Cases

The Buyer/Client can create, retrieve, modify, suspend, resume, and cancel PM Jobs. The PM Jobs result in Performance Management collections that will provide the Buyer/Client with performance objective results. A PM Profile does not need to be used if the Buyer/Client decides to communicate all attributes associated with a PM Job. The Seller/Server is responsible for interpreting the PM Job requests and performing the necessary intra - SOF and inter - SOF communications to assure the Buyer/Client requests are met.

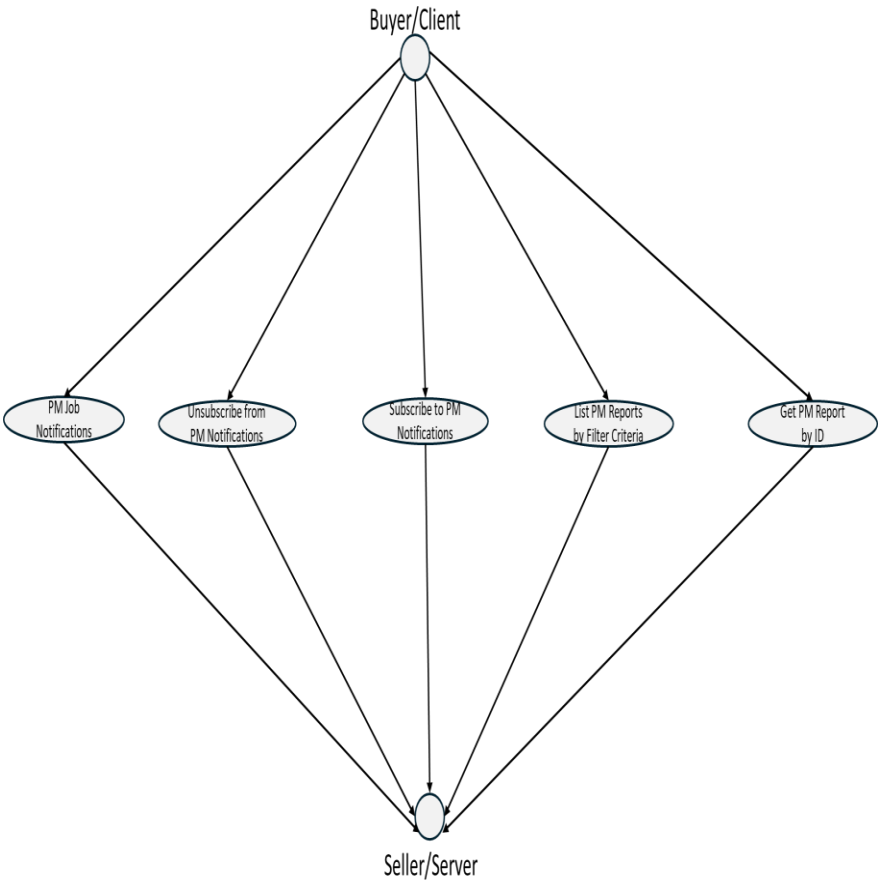


Figure 7 - Performance - Performance Monitoring Job Notification and Collection Use Cases

Note: These Use Cases shown in Figure 7 also apply to Collect PM Reports.

The Buyer/Client can subscribe, unsubscribe to and from PM Job/Collection Notifications. The Seller/Server is responsible for providing PM Job/Collection Notifications to the Buyer/Client specified callback. The Buyer/Client can perform Performance Management collections based on previously requested PM Jobs. The Collect Performance Management Use Case is responsible for the report(s) collection which will have the actual results of the performance measurement attributes specified in the Create Performance Monitoring Job Use Case. There is a Use Case for retrieving PM Job which will have the performance measurement objectives and schedule attributes.

11.2.1 Create Performance Monitoring Job Use Case

Field	Description
Use Case Number	19
Use Case Name	Create Performance Monitoring Job
Description	A request initiated by the Buyer/Client to create a PM Job.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to create a PM Job from the Seller/Server.

Field	Description
Process Steps	1. The Buyer/Client determines the performance objectives, measurement interval and needed attributes as specified in PM Job payload which is specific to each service technology and not covered in this document. 2. The Buyer/Client initiates and submits a PM Job request that contains a Schedule Definition. **[R44]** The Buyer's/Client's Create PM Job **MUST** support the following attributes: • PM Job Type (only present when no PM Profile ID is referenced) • Reporting Period (only present when no PM Profile ID is referenced) • Granularity (only present when no PM Profile ID is referenced) • PM Profile ID (if used) • Output Format • Result Format • Service Specific Attributes (Payload) • Schedule Definition **[R45]** If the Buyer/Client request includes a Service, it **MUST** contain the following: • Service ID From (Envelope) • Service ID To (Envelope) **[R46]** If the Buyer/Client request includes an Entity, it **MUST** contain an Entity Identifier. **[O13]** The Buyer's/Client's Create PM Job **MAY** contain the following attributes: • Description • PM Job Priority **[O14]** A PM Job can be scheduled as reoccurring. 3. The Seller/Server validates the PM Job request and responds with PM Job including a unique identifier, in the response. **[R47]** The Seller/Server **MUST** assign a Job Identifier to the PM Job that is unique within the network. **[R48]** The PM Job Identifier supplied by the Seller/Server **MUST** be unique within the Seller/Server's network. **[R49]** The PM Job **MUST** use the attributes included in the Buyer's/Client's Create PM Job request.

Field	Description
Post - Conditions	1. The Buyer/Client receives a Response, including a PM Job ID. 2. The Seller/Server initiates a PM Job either immediately or as scheduled. 3. If the Seller/Server supports notifications and the Buyer/Client has registered for notifications, the Seller/Server notifies the Buyer/Client of PM Job creation. 4. The Seller/Server notifies the Buyer/Client when Job results are available if the Buyer/Client subscribed to these specific notifications. **[R50]** If the Buyer/Client registered for PM Job/Collection Notifications, the Seller/Server **MUST** notify the Buyer/Client when PM Job results are available.
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while processing that prevents the Seller/Server from creating the PM Job.

625 **Table 36 - Create PMPM Job Use Case**

626

Attribute Name	Description	Value	Comments
Description	The description of a PM Job	String	Set by Buyer/Client
Buyer Job ID	Identifier of the job understood and assigned by the Buyer/Client.	String	Set by Buyer/Client
PM Profile Identifier	The referenced PM Profile for this PM Job	String	Set by Buyer/Client Note: the table contains attributes that are not needed given they are in the Profile. Note: PM Profile is NOT mandatory when creating a PM Job. If the PM Profile is not provided the attributes specified in the PM Profile must be provided by the Buyer/Client.

Attribute Name	Description	Value	Comments
PM Job Type	The type of PM Job	One of the following: *Proactive* *OnDemand* *Passive*	This is only provided when a PM Profile ID is not specified.
PM Job Priority	The priority of the management Job. The way the management application will use the Job priority to schedule Job execution is application specific and out the scope.	Integer	Set by the Buyer/Client The priority is on a 1 - 10 scale with 1 being highest priority and 10 being lowest priority This is only provided when a PM Profile ID is not specified.
Consuming Application Indicator	The identifier of the application that consumes performance indicators.	String	Set by the Buyer/Client
Producing Application Identifier	The identifier of the application that produces performance indicators.	String	Set by Buyer/Client
Service ID To	The Service ID at the To side of the Service.	String	
Service ID From	The Service ID at the From side of the Service.	String	
Entity ID	The identifier of the Entity being monitored.	String	
Schedule Definition	The definition of schedule attributes	See Table 7.	Set by Buyer/Client
Service Payload Specific Attributes	List of payload specific attributes	JSON object	Set by Buyer/Client
Granularity	The sampling rate of the collection of performance indicators.	See Table 27.	Set by Buyer/Client

Attribute Name	Description	Value	Comments
Reporting Periodreport.Result Format	List of possible result formats that define how Seller/Server will deliver Performance Report to the Buyer/Client	One of the following: *Payload* *Attachment*	Payload Output Format for *Payload* is always *JSON*
Output Format	The format of the attachment output report	One of the following: *XML* *AVRO* *CSV* *JSON*	Set by the Buyer/Client

627 **Table 37 - Create Performance Monitoring Job Attributes**

628 ### 11.2.2 Modify Performance Monitoring Job Use Case

Field	Description
Use Case Number	20
Use Case Name	Modify Performance Monitoring Job
Description	A request initiated by the Client to the Seller/Server to modify a PM Job.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to modify a PM Job in the Seller/Server system. PM Job is in Scheduled or Suspended state.

Field	Description
Process Steps	1. The Buyer/Client submits a modify PM Job request with unique PM Job Identifier and specific attribute or set of attributes for modification. **[R51]** The Buyer's/Client's Modify PM Job request **MUST** include the PM Job Identifier. **[O15]** A PM Job can be scheduled as reoccurring. **[O16]** The Buyer's/Client's Modify PM Job request **MAY** include any of the following attributes as defined in Table 37:: • Description • Reporting Period • Schedule Definition • Granularity • Job Priority • Result Format • Output format • Consuming Application ID • Producing Application ID • Service Specific Attributes 2. The Seller/Server receives the request and validates the request. **[R52]** The Seller/Server **MUST** support PM Job modifications. 3. The Seller/Server determines if the PM Job can be modified. 4. The Seller/Server returns the modified PM Job response.
Post - Conditions	1. The Buyer/Client receives a PM Job response. 2. The PM Job is modified with requested attributes changes. 3. If the Seller/Server supports notifications and the Buyer/Client has registered for notifications, the Seller/Server notifies the Buyer/Client of commitment to provide the request.

Field	Description
Alternative Paths	1. If errors occurred, the Seller/Server returns all identified errors in a reject response. 2. If the modification request cannot be serviced, the Seller/Server returns an error code with specific reason(s).

Table 38 - Modify Performance Monitoring Job Use Case

11.2.3 Cancel Performance Monitoring Job Use Case

Field	Description
Use Case Number	21
Use Case Name	Cancel Performance Monitoring Job
Description	A request initiated by the Client to the Seller/Server to cancel a PM Job.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to cancel a PM Job in the Seller/Server system.
Process Steps	1. The Buyer/Client submits a cancel PM Job request with PM Job unique identifier. **[R53]** The Buyer's/Client's Cancel PM Job request **MUST** include the PM Job Identifier. 2. The Seller/Server receives the request and validates the request. **[R54]** If the PM Job is In – Progress, Suspended, or Scheduled the Seller/Server **MUST** allow the Client to cancel the PM Job. 3. The Seller/Server determines if any PM Job exists and can be canceled. 4. The Seller/Server cancels the PM Job.
Post - Conditions	1. The Buyer/Client receives an asynchronous confirmation that the PM Job has been canceled. 2. All resources on the Seller/Server side associated with the PM Job are canceled. 3. All measurement results generated prior to cancellation remain available for collection by the unique Job ID.
Alternative Paths	1. If errors occurred, the Seller/Server returns all identified errors in a reject response, including error codes and specific reasons(s).

Table 39 - Cancel PM Job Use Case

11.2.4 Suspend PMPM Job Use Case

Field	Description
Use Case Number	22
Use Case Name	Suspend Performance Monitoring Job
Description	A request initiated by the Client to the Seller/Server to suspend a PM Job.
Actors	Buyer/Client, Seller/Server

Field	Description
Pre - Conditions	1. The Buyer/Client is authorized to suspend a PM Job in the Seller/Server system.
Process Steps	1. The Buyer/Client creates a Suspend PM Job request that includes the PM Job Identifier. **[R55]** The Buyer/Client's Suspend PM Job request **MUST** include the PM Job Identifier. **[R56]** The PM Job **MUST** be in the In - Progress state. *Note: in the case of a short running job, it may not be possible to suspend a job.* 2. The Seller/Server validates the Buyer/Client's Suspend PM Job request and suspends the PM Job. **[R57]** The Seller/Server's response to the Buyer/Client's Suspend PM Job request **MUST** indicate if the request is Accepted or Declined. **[R58]** If the Seller/Server accepts the Buyer/Client's Suspend PM Job request, the PM Job **MUST** be suspended and move to the Suspended state. **[R59]** If the Seller/Server declines the Buyer/Client's Suspend PM Job request, the PM Job **MUST NOT** be suspended. **[R60]** If the Seller/Server declines the Buyer/Client's Suspend PM Job request, they **MUST** provide a reason the request was declined.
Post - Conditions	1. The Buyer/Client receives a synchronous confirmation that the PM Job has been suspended. During a suspended state reports are not being generated. 2. All resources on the Seller/Server side associated with the PM Job are suspended.
Alternative Paths	1. If errors occurred, the Seller/Server returns all identified errors in a reject response, including error codes and specific reasons(s).

Table 40 - Suspend Performance Monitoring Job Use Case

11.2.5 Resume Performance Monitoring Job Use Case

Field	Description
Use Case Number	23
Use Case Name	Resume Performance Monitoring Job
Description	A request initiated by the Buyer/Client to the Seller/Server to resume a PM Job.

Field	Description
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to resume a PM Job in the Seller/Server system.
Process Steps	1. The Buyer/Client creates a Resume PM Job request that includes the PM Job Identifier. **[R61]** The Buyer/Client's Resume PM Job request **MUST** include the PM Job Identifier. **[R62]** The PM Job **MUST** be in the Suspended state. 2. The Seller/Server validates the Buyer/Client's Resume PM Job request and resumes the PM Job. **[R63]** The Seller/Server's response to the Buyer/Client's Resume PM Job request **MUST** indicate if the request is Accepted or Declined. **[R64]** If the Seller/Server accepts the Buyer/Client's Resume PM Job request, the PM Job **MUST** be resumed and return to the In – Progress or Scheduled state. **[R65]** If the Seller/Server declines the Buyer/Client's Resume PM Job request, the PM Job **MUST NOT** be resumed. **[R66]** If the Seller/Server declines the Buyer/Client's Resume PM Job request, they **MUST** provide a reason the request was declined. 3. The Seller/Server determines if a given PM Job exists and can be resumed. 4. The Seller/Server resumes the PM Job.
Post - Conditions	1. The Buyer/Client receives a confirmation that the PM Job has been resumed. 2. All resources on the Seller/Server side associated with the PM Job are resumed.
Alternative Paths	1. If errors occurred, the Seller/Server returns all identified errors in a reject response, including error codes and specific reasons(s).

635 **Table 41 - Resume Performance Monitoring Job Use Case**

636 ### 11.2.6 Retrieve List of Performance Monitoring Jobs Use Case

Field	Description
Use Case Number	24
Use Case Name	Retrieve Performance Monitoring Job List

Field	Description
Description	A request initiated by the Buyer/Client to retrieve a PM Job List based on a filtered criterion.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to perform the query.

Field	Description
Process Steps	1. The Buyer/Client submits a Retrieve List of PM Job request. 2. The Buyer's/Client's Retrieve List of PM Jobs request may contain zero or more of the filter attributes. • Creation Time Lesser Than • Creation Time Greater Than • Granularity • Reporting Period • Schedule Definition • Consuming Application Indicator • Job Priority • Buyer Job ID • Job Type • PM Profile Reference • Producing Application ID • State 3. The Seller/Server receives the request and validates the request. 4. The Seller/Server determines if any PM Jobs match the filter criteria in the request. 5. The Seller/Server returns a list of summarized PM Job instances. 6. The Seller/Server's response to the Buyer's/Client's retrieve List of PM Jobs includes the following attributes as applicable: • Job Identifier • Creation Time • Granularity • Reporting Period • Schedule Definition • Consuming Application Indicator • Job Priority • Description • Buyer Job ID • Job Type • PM Profile Reference • Producing Application ID • State • Service ID From/To or Entity ID 2. If the Seller/Server validates the Buyer's/Client's request but finds no matching PM Jobs, the Seller/Server **MUST** return an empty list.

Field	Description
Post - Conditions	1. The Buyer/Client receives a list of all PM Jobs that match the Buyer's/Client's filtered selection criteria. 2. The Buyer/Client may initiate a finer granularity query to obtain detailed information for a specific PM Job based on unique identifier.
Alternative Paths	1. If errors occurred, the Seller/Server returns all identified errors in a reject response. 2. If the quantity of the records requested to be returned exceeds a Seller/Server policy, the Seller/Server must choose to respond with either: a. An empty list and message that indicates the result set is too large and submit a new more specific filtered query or b. A response that indicates the result is too large and includes a subset of the matching PM Jobs. 3. If the query does not find any matching records, then the Seller/Server responds with an indication of this result by sending an empty list with a success code.

637 **Table 42 - Retrieve PM Job List Use Case**

638 ### 11.2.7 Retrieve PM Job by Job Identifier

Field	Description
Use Case Number	25
Use Case Name	Retrieve Performance Monitoring Job by ID
Description	A request initiated by the Buyer/Client to retrieve a PM Job based on a unique identifier, ID.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to perform the query.
Process Steps	1. The Buyer/Client creates a Retrieve PM Job by Job Identifier request. **[R67]** The Buyer/Client's Retrieve PM Job by Job Identifier request **MUST** contain the PM Job Identifier. 2. The Seller/Server validates the Buyer/Client's request and returns the details on the PM Job but not the results of the PM Job. **[R68]** The Seller/Server's response **MUST** contain all the PM Job attributes.
Post - Conditions	1. The Buyer/Client receives a PM Job that match the Buyer's/Client's filtered selection criteria.
Alternative Paths	1. If errors occurred, the Seller/Server returns all identified errors in a reject response.

639 **Table 43 - Retrieve PM Job Use Case**

11.2.8 Subscribe to Performance Monitoring Job/Collection Notifications Use Case

Field	Description
Use Case Number	26
Use Case Name	Subscribe to Performance Monitoring Job/Collection Notifications
Description	A request initiated by the Buyer/Client to the Seller/Server to subscribe to PM Job/Collection Notifications.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to subscribe to PM Job/Collection Notifications in the Seller/Server system. 2. The Seller/Server support PM Job/Collection Notifications.
Process Steps	1. The Buyer/Client sends the Subscribe for PM Job/Collection Notifications as shown in table below to the Seller/Server specifying where to send notifications and which PM Job/Collection Notification Types to include in notifications. **[R69]** The Buyer/Client's Subscribe to PM Job/Collection Notifications request **MUST** include the attributes defined in Subscribe to PM Job Notifications Attributes Table. 2. The Seller/Server receives the Subscribe request for PM Job/Collection Notifications. 3. The Seller/Server records which PM Job/Collection Notifications to send, where to send such notifications for this Client. 4. The Seller/Server returns an acknowledgement to the Client.
Post - Conditions	1. The Seller/Server is aware of where to send PM Job/Collection Notifications.
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while processing that prevents the Seller/Server from completing the request.

Table 44 - Subscribe to PM Job/Collection Notifications

Attribute Name	Description	Value	Comments
Notification Target Information	The detailed information on the technical API end - point address specifying where the Seller/Server is to send any PM Job Notifications. There can be multiple locations for one Buyer/Client.	String	This is the Callback target in the API

Attribute Name	Description	Value	Comments
List of Notification Types	The types of notifications that the Buyer/Client wishes to receive.	List of one or more of: • PM Job Created • PM Job Attributes Modified • PM Job State Change • PM Job Results Available • PM Report Preparation Failed	This is a list of attributes

Table 45 - Subscribe to PMPM Job Notifications Attributes

11.2.9 Unsubscribe from PM Job Notifications Use Case

Field	Description
Use Case Number	27
Use Case Name	Unsubscribe from Performance Monitoring Job/Collection Notifications
Description	A request initiated by the Client to unsubscribe from PM Job/Collection Notifications.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client has previously subscribed to PM Job/Collection Notifications. 2. The Buyer/Client is authorized to unsubscribe from PM Job/Collection Notifications in the Seller/Server system. 3. The Seller/Server support PM Job/Collection Notifications.
Process Steps	1. The Buyer/Client sends the Unsubscribe for PM Job/Collection Notifications to the Seller/Server specifying which PM Notification Types the Buyer/Client is unsubscribing from listening. 2. The Seller/Server receives the Unsubscribe request for PM Job/Collection Notifications. 3. The Seller/Server discontinues PM Job/Collection Notification Types to Buyer/Client specific to Unsubscribe request. 4. The Seller/Server returns an acknowledgement to the Buyer/Client.
Post - Conditions	5. The Seller/Server discontinues sending PM Job/Collection Notification Types to Client specific to Buyer/Client Unsubscribe request.
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while processing that prevents the Seller/Server from completing the request.

Table 46 - Unsubscribe from Performance Monitoring Job/Collection Notifications Use Case

11.2.10 Generation of Performance Monitoring Job/Collection Notifications

Field	Description
Use Case Number	28
Use Case Name	Performance Monitoring Job/Collection Notification
Description	A PM Job/Collection Notifications is initiated by the Seller/Server to a subscribed Buyer/Client.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Seller/Server supports PM Job/Collection Notifications. 2. The Client has subscribed to PM Job/Collection Notifications.
Process Steps	1. The Seller/Server sends the PM Job/Collection Notifications to the location(s) registered by the Buyer/Client. **[R70]** The Seller/Server **MUST** send PM Job Created, PM Job Attribute Changed, PM Job State Changed, and PM Collection Notifications (Table 45) to a Buyer/Client who has subscribed to notifications. **[R71]** The Seller/Server **MUST NOT** send PM Job Created, PM Job Attribute Changed, PM Job State Changed, and PM Collection Notifications to a Buyer/Client who has not subscribed to notifications. **[R72]** The Seller/Server **MUST** include the following attributes in the PM Job State Change Notification: • Job Identifier • PM Job State – See Table 95. • Report Identifier for Collection Notification
Post - Conditions	1. The Seller/Server has sent related PM Job/Collection Notification.

Table 47 – PM Job/Collection Notifications Use Case

11.2.11 List Performance Measurement Reports

Field	Description
Use Case Number	29
Use Case Name	List Performance Measurement Reports
Description	A request initiated by the Buyer/Client to the Seller/Server to list the Performance Measurement Reports based on a filtered criterion.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to retrieve a list of Performance Measurement Reports in the Seller/Server system.

Field	Description
Process Steps	1. The Buyer/Client submits a Retrieve List of Performance Measurement Reports request including filter criteria the Seller/Server should apply. **[O17]** The Buyer's/Client's Retrieve List of Performance Measurement Reports request **MAY** contain none or more of the following attributes as filter criteria as defined in Table 37 and the following attributes: • Creation Time less than • Creation Time greater than • PM Job Type • PM Job ID • Granularity • Reporting Timeframe • Output Format • Result Format • Service Specific Payload • Service ID/Entity ID • State 2. The Seller/Server receives the request and validates the request. 3. The Seller/Server determines if any Performance Measurement Reports match the filter criteria in the request. **[R73]** The Seller/Server **MUST** support the retrieval of a List of Performance Measurement Reports Use Case. **[R74]** Buyer/Client **MUST** support the retrieval of a List of Performance Measurement Reports Use Case. **[R75]** The Seller/Server's response to the Buyer's/Client's retrieve List of Performance Measurement Reports **MUST** include the following attributes.. • Description • Report ID 4. If the Seller/Server validates the Buyer's/Client's request but finds no matching Performance Measurement Reports, the Seller/Server **MUST** return an empty list.

Field	Description
Post - Conditions	1. The Buyer/Client receives a list of all Performance Measurement Reports that match the Buyer's/Client's filtered selection criteria. 2. The Buyer/Client may initiate a finer granularity query to obtain detailed information for a specific Performance Measurement Reports based on unique identifier.

649 **Table 48 - List Performance Measurement Reports Use Case**

650 ### 11.2.12 Collect Performance Measurement Report

Field	Description
Use Case Number	30
Use Case Name	Collect Performance Measurement Report
Description	A request initiated by the Buyer/Client to the Seller/Server to collect a Performance Measurement Report. *NOTE: This use case covers the two scenarios where the PM Job is explicitly called and where the SLS is passed within the Service Order activations. In either case, a PM Job is created.* *Retrieving a report after a PM Job and/or Service have been canceled is beyond the scope of this document and is dependent on the implementation.*
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to collect a Performance Measurement Report in the Seller/Server system.

Field	Description
Process Steps	1. The Buyer/Client submits a Collect Performance Measurement Report request using the PM Report identifier **[R76]** The Buyer request MUST include the following: • Performance Report ID *NOTE: Service identifier (attribute of envelope) should be used to list all reports available for a given service ID. These reports could be described with some details (e.g., reporting period) to help client understand which reports to query. Selected report ids can then be used to query the content.* **[R77]** The Seller **MUST** support at least one of the two methods of retrieving results mentioned below. a. The Buyer/Client submits a Retrieve Results in Service Payload request to the Seller/Server. **[R78]** The Retrieve Results in Service Payload request **MUST** include the following attributes shown in Table - Retrieve Results in Performance Job Create: • Report Format = Payload (always JSON format) b. The Buyer/Client submits a Retrieve Results as Attachment request to Seller/Server. **[R79]** The Retrieve Results in Attachment request **MUST** include the following attributes shown in Table 50 in Performance Job Create: • Report Format = Attachment • Output Format = JSON/AVRO/CSV/XML 2. .The Seller/Server receives the request and validates the request. a. The Seller/Server's response includes the results from the specified report as payload in the envelope. b. The Seller/Server's response includes the results as an attachment.
Post - Conditions	1. The Client receives the Performance Measurement Report that match the Client's selection criteria. *NOTE: In some cases of late events, the same collection queried twice may return different results.* 2. If errors occurred, the Seller/Server returns all identified errors in a reject response.
Alternative Paths	1. The Client receives the call location where the file collection for the Performance Measurement Report.

651 **Table 49 - Collect Performance Measurement Report Use Case**

Attribute Name	Description	Value	Comments
Report Identifier	The identifier of the PM Job Result Report	String	Set by the Seller/Server
PM Job Attributes	The initial PM Job attributes set including Service Identifier.	See Table 37.Table 37 - Create Performance Monitoring Job Attributes	
Results which are technology/service specific.			

Table 50 - Performance Monitoring Job Results

Table 50 shows the attributes of Performance Job define how Performance Report will be collected. .

Attribute Name	Description	Value	Comments
Result Format	The format of the results that are retrieved	One of: *Payload* *Attachment*	Set by the Buyer/Client
Output Format	The type of file attached to the API Envelope	One of: • *XML* • *AVRO* • *CSV* • *JSON*	Set by the Buyer/Client If Result Format = *Payload*, Output Format is always *JSON*

Table 51 - Retrieve Results Attributes

Table 51 shows the attributes that are valid when the Buyer/Client .requested to collect Report Data as Attachment The File Transfer Data is set by the Seller/Server.

Field Name	Field Format	Field Description
File Location	String ($uri)	File location.
Retention Period	Date/Time	A Data/Time to retain the file(s) until.

Table 52 - File Transfer Data Attributes

[R80] The results regardless of the format **MUST** contain the PM Metric results as specified with PM Job request using the Output Format attribute.

12 Threshold Crossing Alerts Use Cases

Threshold Crossing Alerts are a mechanism for configuring alerts to be generated when a specific performance metric that is being measured is not met. The use of TCAs requires a coordination with a Proactive, On - Demand and/or Passive PM Performance Management Job configurations. A Proactive and/or On - Demand PM Job is associated with a specific service. Therefore, a TCA Profile could be used as an identifier within a PM Job invocations.

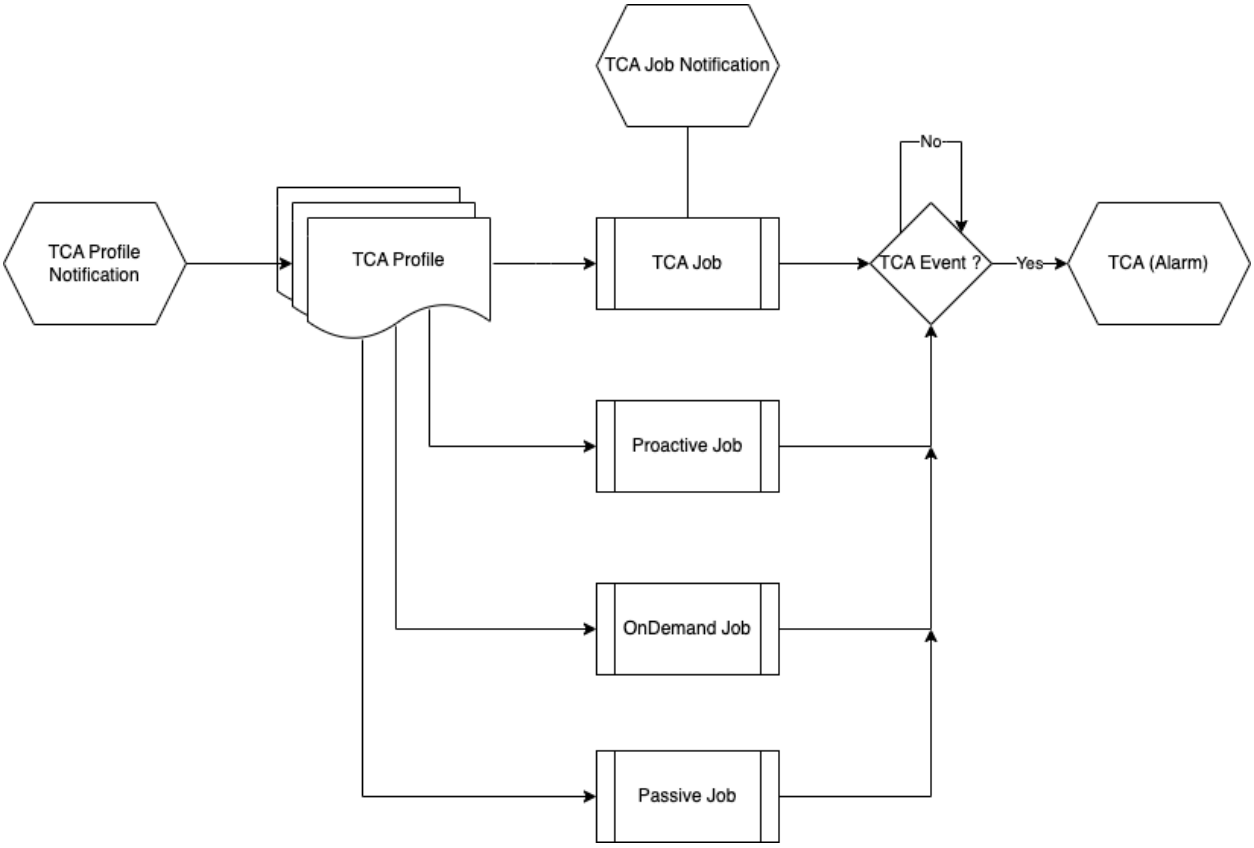


Figure 8 - Threshold Crossing Alert Process Diagram

TCA Profiles provide a mechanism for reuse of TCAs across multiple clients. A TCA Profile will have the performance measurement, performance objective and TCA type as part of the profile attributes.

Performance thresholds, and corresponding Threshold Crossing Alerts (TCAs), can be configured for certain performance metrics, and used to detect when service performance is degraded beyond a given pre - configured level. A PM Job refers to a specific PM Metric and TCA Profile. When the measured performance in a Measurement Interval for that Job reaches or exceeds the configured threshold level, a TCA can be generated.

This section provides a comprehensive set of Use Cases needed to support Threshold Crossing Alert (TCA) Management.

TCAs can be used as a warning notification of possible service degradation, thus allowing more timely action to further investigate or address the problem. For example, if the maximum One - way Frame/Packet Delay threshold was set to 10 milliseconds, and a One - way Frame/Packet Delay value was measured at more than 10 milliseconds, a TCA would be generated.

There are two types of TCA reporting: stateless and stateful. The stateless TCA reporting treats each Measurement Interval separately. When using stateless TCA reporting, each TCA Function has a single configured threshold. As soon as the threshold is reached or crossed in a Measurement Interval for a given performance metric, a TCA is generated. The definitions of TCA attributes and operation are detailed in [4] and [7].

Stateful TCA reporting is another option for how TCAs are generated, that can reduce the total number of TCAs. The intent is to provide a notification when a degradation is first encountered, followed by another when the problem is resolved (i.e., clear threshold). This contrasts with Stateless TCA reporting, in which TCAs are generate continuously for as long as the degradation lasts.

In the case of Stateless TCA reporting a Damping Factor is used to suppress new TCAs. The Damping Factor Value defines consecutive PM Metric Calculation Intervals where the PM Metric Value is equal to or greater than the TCA Performance Threshold Value and the new TCAs are suppressed for that number of PM Metric Calculation Intervals.

These Use Cases are based on business process standards of interactivity between Client (Subscriber) and Seller/Server (Publisher) of TCA management.

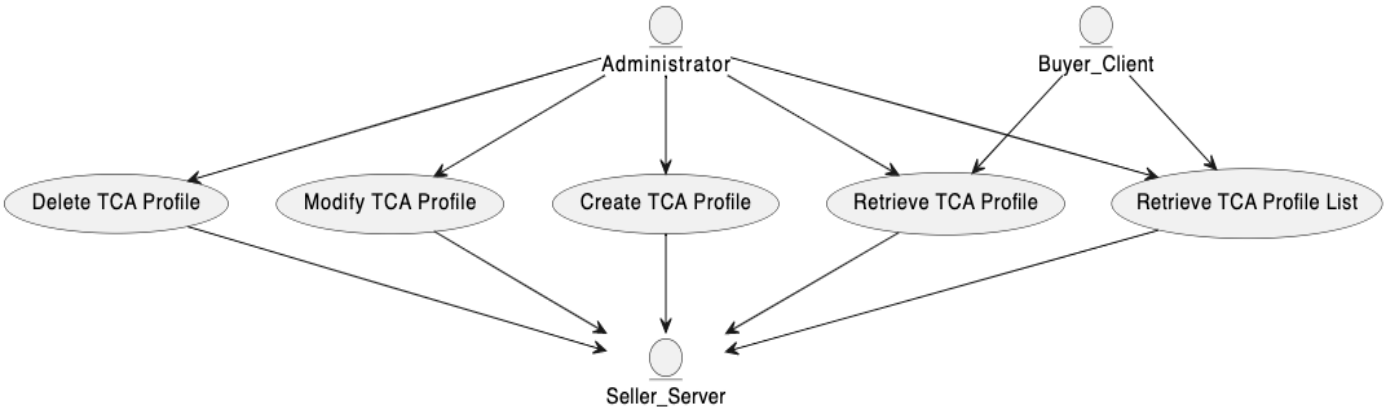
Threshold Crossing Alert Profiles are provided by the Seller/Server to the Buyer/Client based on PM measurements. Threshold Crossing Alert (TCA) Profiles include the following use cases:

- Create TCA Profile
- Modify TCA Profile
- Delete TCA Profile
- Retrieve TCA Profile List
- Retrieve TCA Profile

Note: Creation, modification, deletion, and retrieval of TCA Profiles is not supported at this time. This section is provided as informative text only.

12.1 Threshold Crossing Alert Profile Management Use Cases

This section defines the use cases that support Performance Management Threshold Crossing Alert Profile Management. The client of TCAs is the BA or Buyer.



714

715 **Figure 9 - TCA Profile Use Cases**

716 The diagram above has an Administrator role which is responsible for lifecycle of TCA Profiles.
717 A Client can subscribe to TCA Profile Notifications. A TCA Profile Notification is transmitted
718 when a TCA Profile is created, deleted, or modified.

719 ### 12.1.1 Create TCA Profile

Field	Description
Use Case Number	31
Use Case Name	Create TCA Profile
Description	A request is initiated by the Administrator to create a TCA Profile.
Actors	Administrator, Seller/Server
Pre - Conditions	1. The Client is authorized to create Threshold Crossing Alert Profiles in the Seller/Server system.

Field	Description
Process Steps	1. The Client determines the performance metrics, attribute values and TCA values. The TCA attributes and corresponding values are based on the TCA Type. **[R81]** For a Stateful TCA, the Buyer/Client **MUST** include the following attributes in their request: • TCA Reporting Type = Stateful • TCA Performance Threshold Value • Stateful Window Threshold Set • Stateful Window Threshold Clear • Stateful Window Size **[R82]** For a Stateless TCA, the Buyer/Client **MUST** include the following attributes in their request: • TCA Reporting Type = Stateless • TCA Performance Threshold Value **[R83]** For a Stateless TCA with the Damping Factor, the Buyer/Client **MUST** include the following attributes in their request: • TCA Reporting Type = Stateless • TCA Performance Threshold Value • Stateless Damping Factor 2. The Client initiates and submits a request with metrics, attribute values and TCA values. 3. The Seller/Server validates the request based on business rules. 4. The Seller/Server responds with an acknowledgement of the request that includes the TCA Profile Identifier. **[R84]** The Seller/Server's response **MUST** echo all Buyer/Client provided attributes and include the TCA Profile Identifier. **[R85]** The TCA Profile Identifier supplied by the Seller/Server **MUST** be unique within the Seller/Server's network.
Post - Conditions	1. The Client receives a Response, including a unique identifier along with the TCA Profile and all attributes. 2. The Seller/Server will take up action and send necessary request through set of system to create the TCA Profile.

Field	Description
Alternative Paths	1. The Seller/Server will return an error message if an error is encountered during processing. 2. The Seller/Server returns an error message if any mandatory attributes are missing.

720 **Table 53 - Create TCA Profile Use Case**

Attribute Name	Description	Value	Comments
Description	A textual description of the TCA Profile	String	Set by Buyer/Client
TCA Profile Identifier	An identifier of the TCA Profile	String	Set by Seller/Server
Creation Time	Time the TCA Profile is created.	String	Set by Seller/Server
TCA Reporting Type	The type of TCA Reporting.	One of: *Stateful* *Stateless*	Set by Buyer/Client
TCA Performance Threshold Value	The PM Metric Value (i.e., Frame Loss Ratio Threshold) for a set of intervals	Number	Set by Buyer/Client
Stateful Window Threshold	The number of Performance Metric Calculation Intervals, within the TCA Window Size, for which the Performance Metric value must be at or above the TCA Performance Threshold to generate a SET-TCA, when using Stateful TCA Reporting.	Number	Set by Buyer/Client
Stateful Window Size	The number of consecutive Performance Metric Calculation Intervals in a sliding window that are used to evaluate whether to generate a SET-TCA or CLEAR-TCA, when using Stateful TCA Reporting.	Number	Set by Buyer/Client
Stateless Damping Factor	The number of consecutive intervals where the PM Metric Value is equal to or greater than the TCA Performance Threshold Value and the new TCAs are suppressed for that number of intervals	Number	Set by Buyer/Client

Attribute Name	Description	Value	Comments
Number of PM Metric Calculation Intervals	Numeric value	Integer	The number of PM Metric Calculation Intervals in the hopping window in which the PM Metric Value ≥ the TCA Performance Threshold Value

721 **Table 54 - TCA Profile Attributes**

Attribute Name	Description	Value	Comments
Description	A description of the threshold.	String	Set by Buyer/Client
Name	A word, term, or phrase by which a Performance threshold is known and distinguished from other thresholds.	String	Set by Buyer/Client
Threshold Rule	A Performance Threshold contains a set of Performance threshold rules of different conditions (Raise, Clear) and different severities.	ThresholdRule[]	Set by Buyer/Client

722 **Table 55 - Threshold Create Attributes**

Attribute Name	Description	Value	Comments
Description	A description of Threshold Rule.	String	Set by Buyer/Client
Name	A name of the rule	String	Set by Buyer/Client
Performance Alarm Specification Threshold Crossing Description	A description of the Performance Alarm Specification	String	Set by Buyer/Client
Threshold Rule Condition	A concrete threshold may have two possible values: “Raise” – threshold was crossed or “Clear” – a threshold ceased crossing.	One of : Raise Clear	
Threshold Rule Severity	The Severity of the Threshold Rule	One of: Critical Major Minor Warning	
Consequence	The steps that occur after the TCA is raised	String	
Measurement	The PM metric that is measured	String	

Attribute Name	Description	Value	Comments
Performance Alarm Specification	The applicable Performance Alarm Specification	String	

723 **Table 56 – Threshold Rule Create Attributes**

724 ### 12.1.2 Modify TCA Profile

Field	Description
Use Case Number	32
Use Case Name	Modify TCA Profile
Description	A request is initiated by the Buyer/Client to modify a TCA Profile.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Client is authorized to modify Threshold Crossing Alert Profiles in the Seller/Server system. 2. The TCA Profile is not currently assigned to a PM Job by any Client. *Determination of current use of a TCA Profile requires the Seller/Server to monitor the use of all TCA Profiles which is an internal process and is beyond the scope of this document.*

Field	Description
Process Steps	1. The Client sends a Modify TCA Profile request that includes the attributes to be modified. **[R86]** If the TCA Reporting Type is Stateful, the Client's Modify TCA Profile **MUST** include one or more of the following attributes: • TCA Performance Threshold Value • Stateful Window Threshold Set • Stateful Window Threshold Clear • Stateful Window Size Note: The TCA Reporting Type of a TCA Profile cannot be changed. **[R87]** If the TCA Reporting Type is Stateless, the Client's Modify TCA Profile **MUST** include one or more of the following attributes: • TCA Performance Threshold Value • Stateless Damping Factor Note: The attributes above are the only attributes that may be modified. 2. The Seller/Server responds with an indication if they accept or decline the modification request. **[R88]** The Seller/Server's response **MUST** indicate if the Modify TCA Profile is successful, or an error occurred.
Post - Conditions	1. The Client receives a Response and modified TCA Profile. 2. The Seller/Server will take up action and send necessary request through set of system to modify the TCA Profile.
Alternative Paths	1. The Seller/Server will return an error message if an error is encountered during processing. 2. The Seller/Server returns an error message if any mandatory attributes are missing.

Table 57 - Modify TCA Profile Use Case

12.1.3 Delete TCA Profile

Field	Description
Use Case Number	33
Use Case Name	Delete TCA Profile
Description	A request is initiated by the Buyer/Client to delete a TCA Profile.
Actors	Client, Seller/Server
Pre - Conditions	1. The Client is authorized to delete a Threshold Crossing Alert Profile in the Seller/Server system. 2. The TCA Profile is not currently be used by any Client.

Field	Description
Process Steps	1. The Buyer/Client sends a Delete TCA Profile request that includes the TCA Profile Identifier. **[R89]** The Buyer/Client's Delete TCA Profile **MUST** include the TCA Profile Identifier. 2. The Seller/Server responds with an indication if they accept or decline the delete request. **[R90]** The Seller/Server's response **MUST** indicate if the Delete TCA Profile is successful, or an error has occurred. 3. If the Seller/Server encounters errors, they should return an error with explanation to the Buyer/Client.
Post - Conditions	1. The Buyer/Client receives a Response indicating the successful deletion of the TCA Profile. 2. The Seller/Server will take up action and send necessary request through set of system to delete the TCA Profile.
Alternative Paths	1. The Seller/Server will return an error message if an error is encountered during processing.

727 **Table 58 - Delete TCA Profile Use Case**

728 ### 12.1.4 Retrieve List of TCA Profiles

Field	Description
Use Case Number	34
Use Case Name	Retrieve TCA Profile List
Description	A request is initiated by the Administrator (Client) to retrieve a list of TCA Profiles.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Client is authorized to retrieve Threshold Crossing Alert Profiles in the Seller/Server system.

Field	Description
Process Steps	1. The Buyer/Client sends a Retrieve List of TCA Profiles request that includes filter criteria. **[R91]** The Buyer/Client's Retrieve List of TCA Profiles **MUST** include none or more of the following attributes: • TCA Performance Threshold Value • Stateful Window Threshold Set • Stateful Window Threshold Clear • Stateful Window Size • Stateless Damping Factor 2. The Seller/Server's response includes a list of TCA Profile Identifiers that match the filter criteria sent by the Buyer/Client. **[R92]** The Seller/Server's response **MUST** include a list of TCA Profiles that match the filter criteria. **[R93]** The list returned by the Seller/Server **MUST** contain the TCA Profile Identifier for each matching TCA Profile. **[R94]** If the Buyer/Client's Retrieve List of TCA Profiles is validated but no matching TCA Profiles are found, the Seller/Server **MUST** return an empty list. 3. If the Seller/Server encounters errors, they should return an error with explanation to the Buyer/Client.
Post - Conditions	1. The Client receives a Response, including a set of TCA Profiles based on the filtering criteria.
Alternative Paths	1. The Seller/Server will return an error message if an error is encountered during processing.

729 **Table 59 - Retrieve TCA Profile List Use Case**

730 ### 12.1.5 Retrieve TCA Profile by Identifier

Field	Description
Use Case Number	35
Use Case Name	Retrieve TCA Profile by Identifier
Description	A request is initiated by the Buyer/Client to retrieve a TCA Profile.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Client is authorized to retrieve Threshold Crossing Alert Profiles in the Seller/Server system.

Field	Description
Process Steps	1. The Buyer/Client sends a Retrieve TCA Profile by Identifier request that includes the TCA Profile Identifier. **[R95]** The Buyer/Client's Retrieve TCA Profile by Identifier **MUST** include the TCA Profile Identifier. 2. The Seller/Server's response includes the attributes for a TCA Profile that matches the TCA Profile Identifier specified by the Buyer/Client. **[R96]** The Seller/Server's response to the Buyer/Client's Retrieve TCA Profile by Identifier **MUST** include all attributes. **[R97]** The Seller/Servier's response to the Buyer/Client's Retrieve TCA Profile by Identifier MUST include the following attributes if the TCA Reporting Type is Stateful: • TCA Reporting Type – Stateful • TCA Performance Threshold Value • Stateful Window Threshold Set • Stateful Window Threshold Clear • Stateful Window Size **[R98]** The Seller/Server's response to the Buyer/Client's Retrieve TCA Profile by Identifier **MUST** include the following attributes if the TCA Reporting Type is Stateless: • TCA Reporting Type = Stateless • TCA Performance Threshold Value **[R99]** The Seller/Server's response to the Buyer/Client's Retrieve TCA Profile by Identifier **MUST** include the following attributes if the TCA Reporting Type is Stateless with the Damping Factor: • TCA Reporting Type = Stateless • TCA Performance Threshold Value • Stateless Damping Factor 3. If the Seller/Server encounters errors, they should return an error with explanation to the Buyer/Client.
Post - Conditions	1. The Client receives a Response, including a unique TCA Profile.

Field	Description
Alternative Paths	1. The Seller/Server will return an error message if an error is encountered during processing. 2. The Seller/Server returns an error message if any mandatory attributes are missing.

731 **Table 60 - Retrieve TCA Profile Use Case**

732

13 Passive Statistics Use Cases

The following section details the set of use cases needed to support the collection and reporting of network and service performance (i.e., bandwidth utilization) and error statistics. The statistics collections include but are not limited to telemetry associated with an interface, (Net/Application) Flow, VLAN, bridging/Ethernet, IP, TCP, UDP layers.

The statistics measured in this section are outside the realm of measuring and reacting to performance objectives. Example statistics are errored frames in and out, packet utilization in and out. These are individually enabled and measured without an objective. This is opposed to such SLS attributes as packet loss ratio, packet transfer delay. Performance objectives are associated with a Service Level Specification (SLS). In some cases, these are statistics that do not need to be configured, but are enabled and ready for collection on an interface, VLAN, etc.

The representation of a unique identifier can be associated with a service, or entity. An entity could be a port, interface, VLAN, etc. An entity may or may not be associated with an existing service. An entity will have a unique identifier that needs to be reference as part of a Job. As an example, a Buyer/Client may be aware of a UNI Service ID and request that a given VLAN ID be monitored on the UNI.

13.1 Passive Statistics Collection Use Cases

This section defines the set use cases that are associated with the creation and management of a Passive PM Job. There are two types of statistics collections, real - time and historical. A real - time request is a snapshot of the current statistics being requested. The main difference between real - time and historical statistics collection is the start and stop times. A historical request requires a specified query filter with such attributes as start time and end time. Suspend and Resume use cases are described in sections 11.2.4 and 11.2.5.

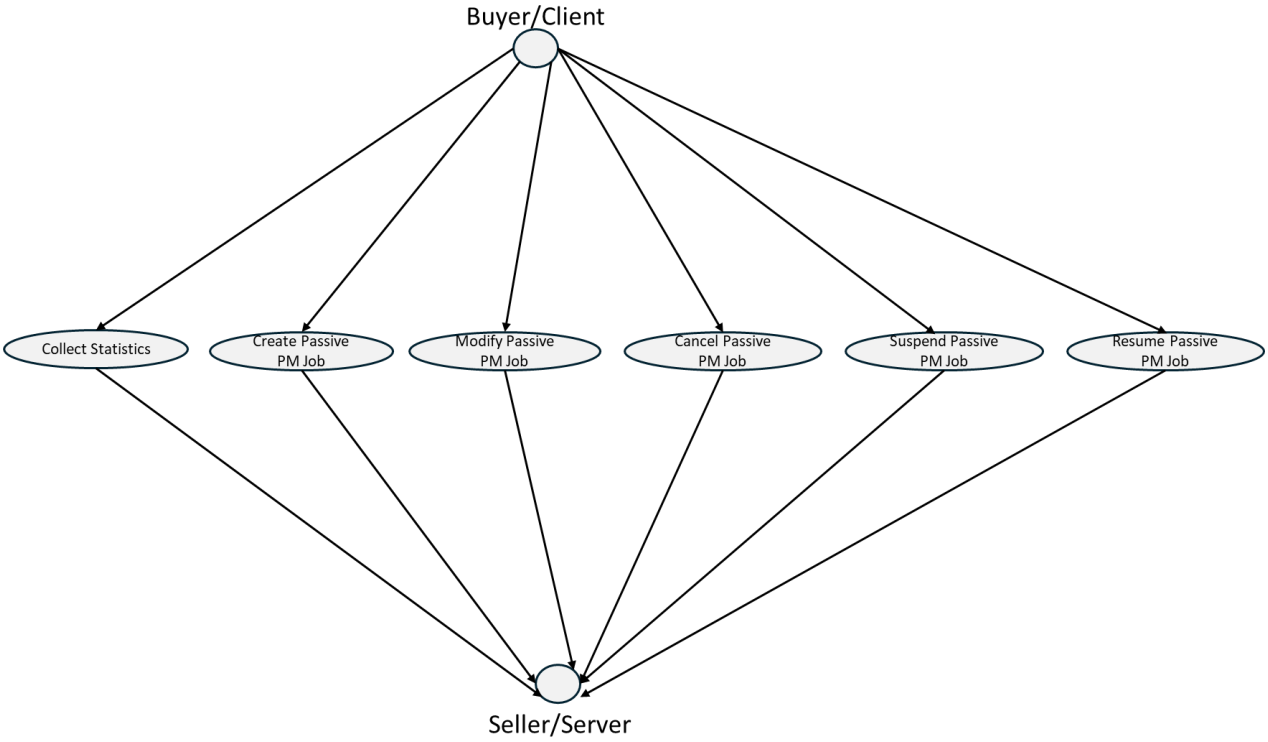


Figure 10 - Passive Statistics Job and Collection Use Cases

The Client can retrieve specified statistics. The Seller/Server will respond to the query request with the statistics per attribute.

13.1.1 Create Passive Performance Monitoring Job Use Case

Field	Description
Use Case Number	36
Use Case Name	Create Passive Performance Monitoring Job
Description	A request initiated by the Buyer/Client to create a Statistics Collection Job.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to create a Passive PM Job from the Seller/Server.

Field	Description
Process Steps	1. The Buyer/Client determines the statistics, measurement interval that will be used in initiate a Passive PM Job. 2. The Buyer/Client initiates and submits a Passive PM Job request that contains a Service Identifier or Entity Identifier, Performance Indicator Specification (Service Specific Attributes) and Schedule Definition. **[R100]** The Buyer's/Client's Create Passive PM Collection Job **MUST** provide the following attributes: • PM Profile ID (optional) • Job Type = Passive • Reporting Period • Service Specific Attributes (Payload) • Service ID From (Envelope) (not provided if Entity ID is specified) • Service ID To (Envelope) (not provided if Entity ID is specified) • Entity ID (not provided if Service ID is specified) • Schedule Definition • Granularity • Output Format • Result Format Note: PM Profile ID is not required if the Create PM Job defines all Profile attributes. **[O18]** The Buyer's/Client's Passive PM Collection Job **MAY** contain the following attributes: • Description • PM Job Priority 3. The Seller/Server validates the Passive PM Job request and responds with Statistics Collection Job including a unique identifier, ID in response. **[R101]** The Seller/Server **MUST** assign a Passive PM Job Identifier to the Passive PM Job that is unique within the network. **[R102]** The Passive PM Job Identifier supplied by the Seller/Server **MUST** be unique within the Seller/Server's network. **[R103]** The Passive PM Job **MUST** use the attributes included in the Buyer's/Client's Create Passive PM Collection Job request.

Field	Description
Post - Conditions	1. The Buyer/Client receives a Response, including a Passive PM Collection Job Identifier. 2. The Seller/Server initiates a Passive PM Job. 3. If the Seller/Server supports notifications and the Buyer/Client has registered for notifications, the Seller/Server notifies the Buyer/Client of commitment to provide the request. 4. The Seller/Server notifies the Buyer/Client when Job results are available. **[R104]** If the Buyer/Client registered for PM Notifications, the Seller/Server **MUST** notify the Buyer/Client when Passive PM Collection Job results are available.
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while processing that prevents the Seller/Server from creating the Passive PM Collection Job.

763 **Table 61 - Create Passive PM Job Use Case**

764 ### 13.1.2 Modify Passive PM Job Use Case

Field	Description
Use Case Number	37
Use Case Name	Modify Passive Performance Monitoring Job
Description	A request initiated by the Buyer/Client to the Seller/Server to modify a Passive PM Job.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to modify a Passive PM Job in the Seller/Server system. 2. The Passive PM Job is in a Suspended state or is in the Scheduled state.

Field	Description
Process Steps	1. The Buyer/Client creates a Modify Statistics Collection Job request that includes the Statistics Collection Job Identifier and the attribute(s) to be modified. **[R105]** The Buyer's/Client's Modify Statistics Collection Job request MUST include the Statistics Collection Job Identifier. **[O19]** The Buyer's/Client's Modify Statistics Collection Job request MAY include one or more of the following attributes: • Granularity • Reporting Period • Job Priority • Service Specific Attributes • Schedule Definition • Consuming Application Identifier • Producing Application Identifier • Result Format • Output Format • Description 2. The Seller/Server receives the request and validates the request. **[R106]** The Seller/Server **MUST** support Statistics Collection Job modifications. 3. The Seller/Server determines if specified Statistics Collection Job can be modified. 4. The Seller/Server returns an immediate response.
Post - Conditions	1. The Buyer/Client receives a Statistics Collection Job immediate response. 2. The Statistics Collection Job is modified with requested attributes changes. 3. If the Seller/Server supports notifications and the Buyer/Client has registered for notifications, the Seller/Server notifies the Buyer/Client of update to state of Statistics Collection Job.
Alternative Paths	1. If the modification request cannot be serviced, the Seller/Server returns an error code with specific reason(s).

765 **Table 62 - Modify Passive Performance Monitoring Job Use Case**

766 ### 13.1.3 Cancel Passive Performance Monitoring Job Use Case

Field	Description
Use Case Number	38
Use Case Name	Cancel Passive PM Job

Field	Description
Description	A request initiated by the Client to the Seller/Server to cancel a Statistics Collection Job.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to cancel a Passive PM Job in the Seller/Server system. 2. The Passive PM Job is in an In-Progress, Scheduled, or Suspended state.
Process Steps	1. The Buyer/Client submits a Cancel Statistics Collection Job request with Statistics Collection Job unique identifier. **[R107]** The Buyer's/Client's Cancel Statistics Collection Job request **MUST** include the Statistics Collection Job Identifier. 2. The Seller/Server receives the request and validates the request. 3. The Seller/Server determines if the Statistics Collection Job specified by Identifier exists and can be canceled. 4. The Seller/Server cancels the Statistics Collection Job.
Post - Conditions	1. The Buyer/Client receives a confirmation that the Statistics Collection Job has been canceled. 2. All resources on the Seller/Server side associated with the Statistics Collection Job are canceled.
Alternative Paths	1. If the cancellation request cannot be serviced, the Seller/Server returns an error code with specific reason(s).

Table 63 - - Cancel Passive Performance Monitoring Job Use Case

13.1.4 List Passive Statistics Reports

Field	Description
Use Case Number	39
Use Case Name	List Passive Statistics Reports
Description	A request initiated by the Buyer/Client to the Seller/Server to list the Passive Statistics Reports based on a filtered criteria.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to retrieve a list of Performance Measurement Reports in the Seller/Server system.

Field	Description
Process Steps	2. The Buyer/Client submits a Retrieve List of Performance Measurement Reports request including filter criteria the Seller/Server must apply. 3. The Seller/Server receives the request and validates the request. 4. The Seller/Server determines if any Performance Measurement Reports match the filter criteria in the request. **[R108]** The Seller/Server **MUST** support the retrieval of a List of Performance Measurement Reports Use Case. **[R109]** Buyer/Client **MUST** support the retrieval of a List of Performance Measurement Reports given a PM Job Identifier as filter criteria. **[R110]** The Seller/Server's response to the Buyer's/Client's retrieve List of Performance Measurement Reports **MUST** include all applicable attributes associated with the Performance Management Job but not the results of that job. **[R111]** If the Seller/Server validates Buyer's/Client's request but finds no matching Performance Measurement Reports, the Seller/Server **MUST** return an empty list.
Post - Conditions	1. The Buyer/Client receives a list of all Performance Measurement Reports that match the Buyer's/Client's filtered selection criteria. 2. The Buyer/Client may initiate a finer granularity query to obtain detailed information for a specific Performance Measurement Report based on unique identifier.

769 **Table 64 - List Performance Measurement Reports Use Case**

770 ### 13.1.5 Collect Passive Statistics Report

Field	Description
Use Case Number	40
Use Case Name	Collect Passive Statistics Report
Description	A request initiated by the Buyer/Client to the Seller/Server to collect a Statistics Collection Report.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to collect a Statistics Collection Report in the Seller/Server system.

Field	Description
Process Steps	1. The Buyer/Client submits a Retrieve Statistics Collection Report request as for Results in Payload or Results as Attachment. The Client sends the Report identifier used in the request to identify the Report to collect. **[R112]** The Seller **MUST** support at least one of the two methods of retrieving results mentioned above. **[O20]** The Seller **MAY** support multiple methods of retrieving results. 2. Retrieve Result: The Buyer/Client submits a Retrieve Results in Payload request to the Seller/Server. **[R113]** The Retrieve Results in Payload request **MUST** include the following attributes shown in Table 51 in Passive Statistics Job Create: • Report Format = Payload (Output Type always JSON format) 3. The Buyer/Client submits a Retrieve Results as Attachment request to Seller/Server. **[R114]** The Retrieve Results in Attachment request **MUST** include the following attributes shown in Table 51 in Passive Statistics Job Create: • Report Format = Attachment • Output Type 4. The Seller/Server receives the request and validates the request. 5. The Seller/Server's response includes the results from the report as payload in the envelope. **[R115]** The Seller/Server **MUST** provide the specified result in the API payload. 6. The Seller/Server's response includes the results from the specified report as an Attachment. **[R116]** The Seller/Server **MUST** provide the specified results as an attachment.

Field	Description
Post - Conditions	1. The Client receives the location where the file collection for the Statistics Collection Report is stored in Attachment mode only. 2. The Client receives the Statistics Collection Report that match the Client's filtered selection criteria. *NOTE: In some cases of late events, the same collection queried twice may return different results.* 3. If errors occurred, the Seller/Server returns all identified errors in a reject response.

771 **Table 65 - Collect Statistics Report Use Case**

772

14 Streaming Use Cases

Buyer/Clients may desire to receive streaming telemetry. Event streaming is the practice of capturing data in real - time from event sources like databases, sensors, mobile devices, cloud services, and software applications in the form of streams of events; storing these event streams durably for later retrieval; manipulating, processing, and reacting to the event streams in real - time as well as retrospectively; and routing the event streams to different destination technologies as needed.

Buyer/Clients subscribe to streaming telemetry using similar mechanisms as they use for Notifications. Because the streaming telemetry is provided in real - time or near real - time, the existing PM Notifications and retrieval is not expected to support streaming. Instead, it is expected that streamed telemetry will use some other mechanism to deliver results. While it is outside of the scope of this document to define how API implementations support streaming, discussions on binary implementations such as Kafka are thought to have the potential to support the requirements defined within this document.

The available telemetry that may be streamed are described as Topics within this document. The Buyer/Client can retrieve a list of available Topics, a list of Topics they have subscribed to, and a specific Topic. The Buyer/Client is then able to select a Topic and subscribe to that Topic. Streaming telemetry is sent by the Seller/Server to the Buyer/Client for the Topic as Messages.

Streaming is an implementation of a specific Pub/Sub pattern. A major characteristic of streaming is the events are in most cases being produced, ingested, and consumed at a high rate. An Event Driven Architecture (EDA) is needed to implement a streaming service and corresponding API. A general EDA is shown in the figures below. The architecture has three main components – Event Producer, Broker, and Event Consumer.

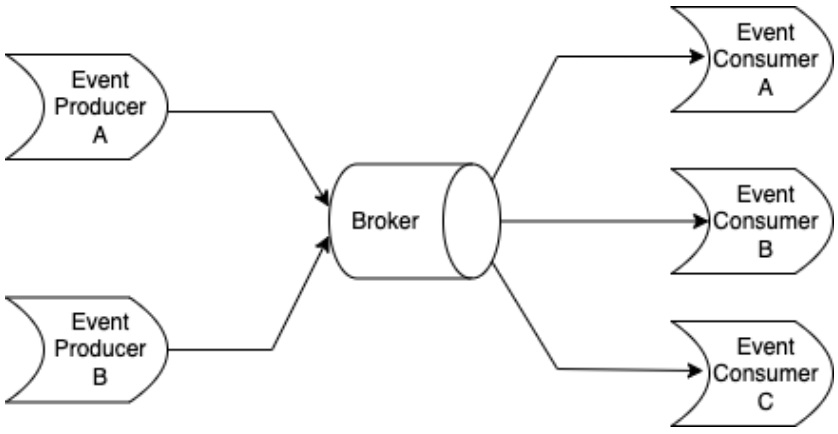
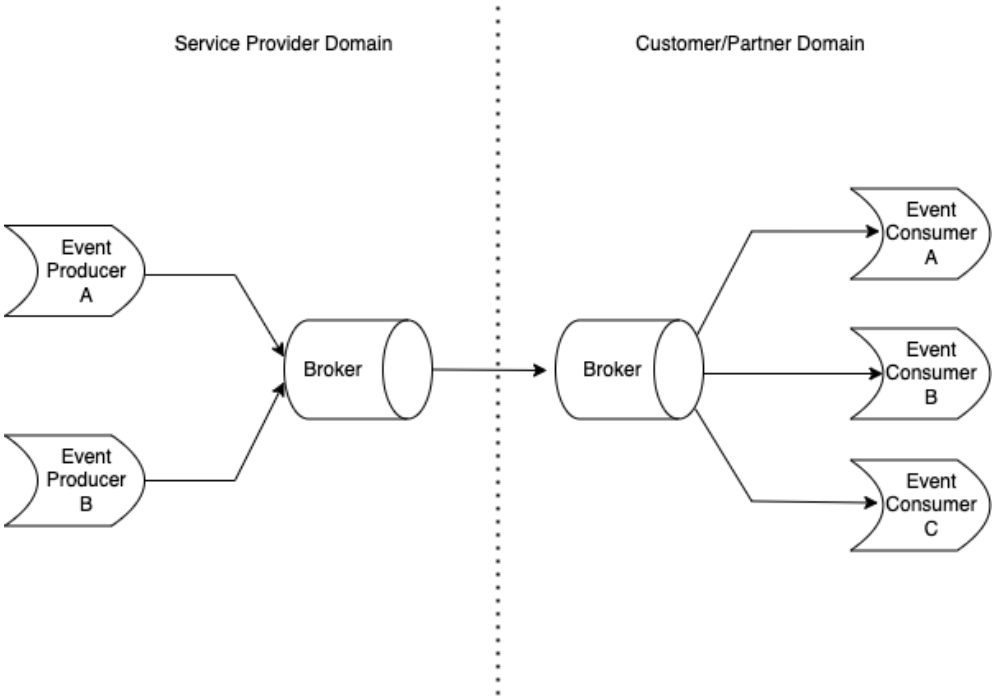


Figure 11 - Event Driven Architecture

A similar architecture between LSO Domains occurs with a Broker - to - Broker communication path is illustrated below.



799

800 **Figure 12 - Broker - to - Broker Event Driven Architecture**

801 The Legato IRP provides a demarcation between the Event Producer/Event Ingestion and the cor-
802 responding Event Consumers. The EDA requires a mechanism for the Event Consumer to sub-
803 scribe to a specific topic. The Event Producer will send the asynchronous Events to the Event
804 Ingestion where the set of Event Consumers will receive the subscribed Events.

805 The major goal of the use cases defined for streaming will be in the development of a streaming
806 API. The streaming API will enable streaming of events using the EDA push technology and pro-
807 vide a subscription mechanism. The API will need to support multiple types of streaming events,
808 including, but not limited to generic events, platform events.

809 ## 14.1 Streaming (Topics) Use Cases

810 The following sub - section defines use cases for the Topic management. Use cases are provided
811 for a Consumer to get a list of available topics to listen to, Consumer to get their subscribed topic
812 list and Consumer to get their specific subscriber topic.

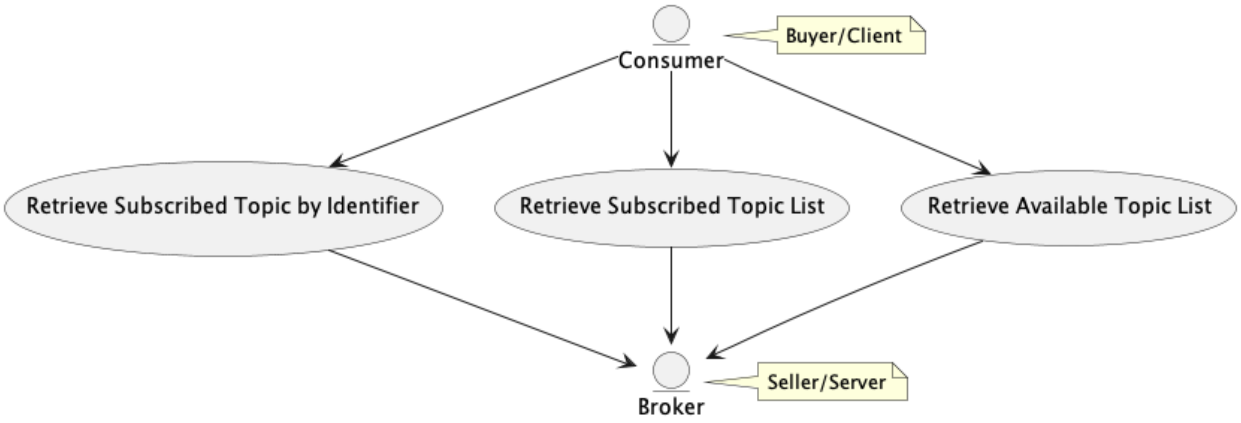


Figure 13 - Streaming (Topics) Use Cases

14.2 Subscribe/Publish Streaming Use Cases

The following sub - section defines use cases for the subscribe and publish streaming use cases. The Consumer can subscriber and unsubscribe to/from a Topic. The Consumer can retrieve potentially missed Topics due to a loss of communication based on an unfiltered or filtered query. The Publisher can publish Topics.

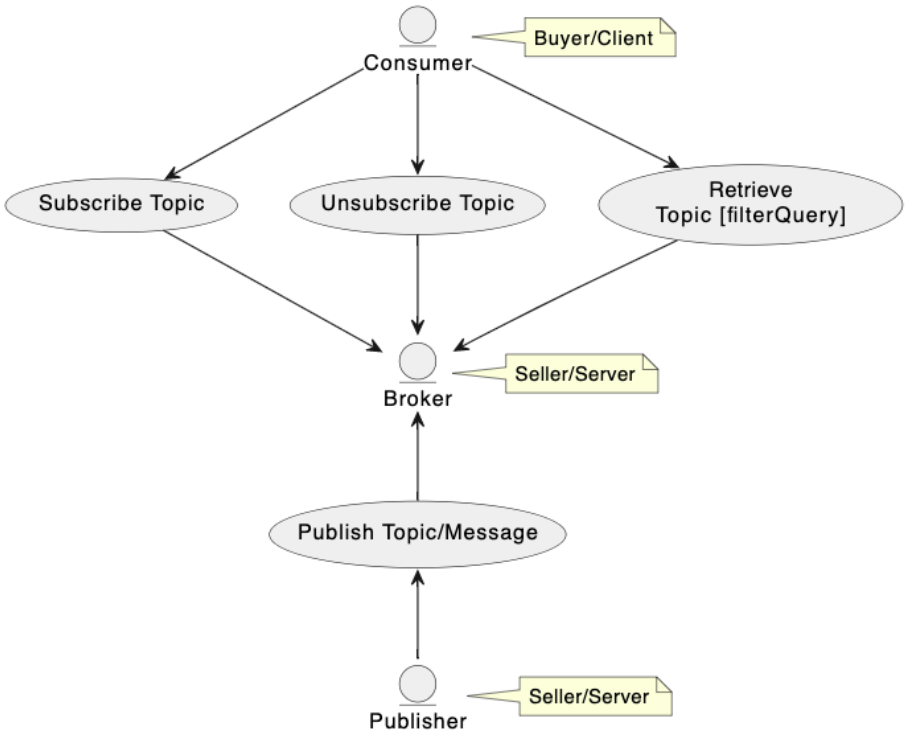


Figure 14 - Subscriber/Publish Streaming Use Cases

The communications between a Publisher and Consumer are not direct, but through a Broker. The Broker is responsible for the distribution of Topics with respective Messages to the set of Consumers that have subscribed to the specific Topic.

826 ### 14.2.1 Retrieve Topic by Identifier Use Case

Field	Description
Use Case Number	41
Use Case Name	Retrieve Topic by Identifier
Description	A request is initiated by the Buyer/Client (Subscriber) to retrieve a Topic that match the provided filter criteria.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Client is authorized to perform a Topic query.
Process Steps	1. The Buyer/Client submits a Retrieve Topic by Topic Identifier request that includes the Topic Identifier. **[R117]** The Buyer/Client's Retrieve Topic by Topic Identifier **MUST** contain the Topic Identifier. **[R118]** The Topic Identifier supplied by the Seller/Server **MUST** be unique within the Seller/Server's network. 2. The Seller/Server validates the Buyer/Client's Retrieve Topic by Topic Identifier and returns the attributes in Topics Attribute table.
Post - Conditions	1. The Buyer/Client receives a Topic that match the Topic Identifier specified in the request.
Alternative Paths	1. If errors are encountered, the Seller/Server returns all identified errors in a reject response. 2. If the quantity of records exceeds a Seller/Server's policy, the Seller/Server must choose to respond with either: a. An empty list and message that indicates the result set is too large and submit a new more specific query b. A response that indicates the result is too large and includes a subset of the matching Topics. 3. If the query does not find any matching records, then the Seller/Server responds with an indication of this result by sending an empty list with a success code.

827 **Table 66 - Get Subscriber Topic Use Case**

Field Name	Field Value	Field Format	Field Description
Topic Identifier	The Seller/Server assigned Topic Identifier	String	Set by the Seller/Server
Topic Category	A description of the area that the Topic covers.	One of: Layer 1 Ethernet IP SD - WAN Computing Storage Memory	Agreed to by the Buyer/Client and Seller/Server during on - boarding. The enumeration may include additional items as agreed to by the Buyer/Client and Seller/Server.

Field Name	Field Value	Field Format	Field Description
Service Specific Attributes	Defined per the Service Specification		Set by the Seller/Server Describes the Topic Attributes that are returned for the Topic.

Table 67 - Topic Attributes

14.2.2 Retrieve Available Topic List Use Case

Field	Description
Use Case Number	42
Use Case Name	Retrieve Available Topic List
Description	A request is initiated by the Buyer/Client (Subscriber) to retrieve a Topic list.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to retrieve a list of available Topics that the Seller/Server supports.
Process Steps	1. The Buyer/Client submits a Retrieve Available Topic List request with that contain any filter criteria. **[O21]** The Buyer's/Client's Retrieve Available Topic List request **MAY** contain filter criteria of the Topic Category. 2. The Seller/Server validates the Buyer's/Client's request and responds with a list of Topics that the Buyer/Client are available and that match the filter criteria. **[R119]** If there are no Topics that match the filter criteria, the Seller/Server **MUST** return an empty list.
Post - Conditions	1. The Buyer/Client receives a Response with the list of or Available Topics.
Alternative Paths	1. If errors are encountered, the Seller/Server returns all identified errors in a reject response. 2. If the quantity of records exceeds a Seller/Server's policy, the Seller/Server must choose to respond with either: a. An empty list and message that indicates the result set is too large and submit a new more specific query. b. A response that indicates the result is too large and includes a subset of the matching Topics. 3. If the query does not find any matching records, then the Seller/Server responds with an indication of this result by sending an empty list with a success code.

Table 68 - Retrieve Available Topic List Use Case

14.2.3 Retrieve Subscribed Topic List Use Case

Field	Description
Use Case Number	43

Field	Description
Use Case Name	Retrieve Subscribed Topic List
Description	A request is initiated by the Buyer/Seller (Subscriber) to retrieve a Topic list which the Subscriber is currently subscribed.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to retrieve a Subscriber Topic List in the Seller/Server system.
Process Steps	1. The Buyer/Client submits a Get Subscriber Topic List request with that contain any filter criteria. **[O22]** The Client's Retrieve Subscribed Topic List request **MAY** contain filter criteria of the Topic Category. 2. The Seller/Server validates the Buyer's/Client's request and responds with a list of Topics that the Buyer/Client has subscribed to and that match the filter criteria. **[R120]** The Seller/Server's response **MUST** include a list of Topics that the Client has subscribed to and match the filter criteria. **[R121]** If there are no Topic Identifiers that match the filter criteria, the Seller/Server **MUST** return an empty list.
Post - Conditions	1. The Buyer/Client receives a Response with the list of Subscriber Topics currently subscribed to as in Table 71.
Alternative Paths	1. If errors are encountered, the Seller/Server returns all identified errors in a reject response. 2. If the quantity of records exceeds a Seller/Server's policy, the Seller/Server must choose to respond with either: a. An empty list and message that indicates the result set is too large and submit a new more specific query. b. A response that indicates the result is too large and includes a subset of the matching Topics. 3. If the query does not find any matching records, then the Seller/Server responds with an indication of this result by sending an empty list with a success code.

832 **Table 69 - Get Subscribed Topic List Use Case**

833 ### 14.2.4 Subscribe to Topic Use Case

Field	Description
Use Case Number	44
Use Case Name	Subscribe to Topic
Description	A request is initiated by the Buyer/Client (Subscriber) to subscribe to a Topic.
Actors	Buyer/Client, Seller/Server

Field	Description
Pre - Conditions	1. The Client is authorized to request an Available Topic List in the Seller/Server system.
Process Steps	1. The Buyer/Client requests a subscribe to a specific Topic. **[R122]** The Buyer/Client's Subscribe to Topic request **MUST** include the attributes (with exception of those set by Seller/Server) shown in Subscribe Topic Attributes Table 71. **[R123]** The Seller/Server validates the Buyer/Client's request and responds with an indication of whether the request was accepted or declined. 2. If accepted the response includes the Stream Identifier as shown in Subscribe Topic Attributes table. **[R124]** The Seller/Server's response to the Buyer/Client's Subscribe to Topic request **MUST** indicate if the request was accepted or declined. **[R125]** If declined, the Seller/Server **MUST** include the reason the request was declined. **[R126]** If accepted, the Seller/Server **MUST** include the Stream Identifier in their response and start streaming the PM reports to the Buyer/Client.
Post - Conditions	1. The Buyer/Client receives subscription confirmation that includes all necessary details that will allow for consumption of message from the topic.
Alternative Paths	1. If errors are encountered, the Seller/Server returns all identified errors in a reject response.

834 **Table 70 - Subscribe to Topic Use Case**

Field Name	Field Value	Field Format	Field Description
Topic Identifier		String	Set by the Seller/Server. The Seller/Server assigned Topic Identifier
Stream Identifier		String	Set by Seller/Server. Unique identifier for each stream.
Description		String	An explanatory of the stream.

Field Name	Field Value	Field Format	Field Description
Title		String	The title of the stream.
Priority		String	Priority of stream.
ipAddress		String	IP Address for callback.
Port		String	Port for callback.
Protocol		String	Protocol for callback.

835 **Table 71 - Subscribed or Available to Topic Attributes**

836 ### 14.2.5 Unsubscribe from Topic Use Case

Field	Description
Use Case Number	45
Use Case Name	Unsubscribe from a Topic
Description	A request is initiated by the Buyer/Client (Subscriber) to unsubscribe from a Topic.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Client is authorized to unsubscribe from a Topic in the Seller/Server system.
Process Steps	1. The Client submits an Unsubscribe to Topic request that includes the Subscription Name. **[R127]** The Client's Unsubscribe to Topic request **MUST** contain the Subscription Name that is to be unsubscribed. 2. The Seller/Server Validates the Client's request and responds with an indication whether the request was accepted or declined. **[R128]** The Seller/Server's response to the Client's Unsubscribe to Topic request **MUST** indicate if the request was accepted or declined. **[R129]** If declined, the Seller/Server **MUST** include the reason the request was declined. **[R130]** If accepted, the Seller/Server **MUST** stop streaming the PM reports to the Client.
Post - Conditions	1. The Client receives a Response indicating a Topic has been unsubscribed from. 2. The Client will no longer receive any Messages from the specified Topic.
Alternative Paths	1. The Seller/Server will return an error message if an error is encountered during processing. 2. The Seller/Server returns an error message if any mandatory attributes are missing.

837 **Table 72 - Unsubscribe from a Topic Use Case**

838 ### 14.2.6 Publish Topic Message Use Case

Field	Description
Use Case Number	46
Use Case Name	Publish Topic Message
Description	A Seller/Server (Publisher) publishes a Topic/Message to Buyers/Sellers (Subscriber(s)).
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Client is authorized to subscribe to Topics in the Seller/Server system.
Process Steps	**[R131]** The Seller/Server **MUST** publish Topic Messages to Buyer/Clients who have subscribed to the Topic. **[R132]** The Topic Message **MUST** contain the attributes shown in Publish Topic Attributes table. **[R133]** The Seller/Server **MUST NOT** publish Topic Messages to Buyer/Clients who have not subscribed to the Topic. **[R134]** The Seller/Server **MAY** stop publishing Topic Messages to a Buyer/Client if no acknowledgement is received from the Buyer/Client. 1. It is recommended that if the Seller/Server opts to stop publishing Topic Messages to a Buyer/Client, that they make this decision based on multiple messages that receive no acknowledgement rather than a single message. **[R135]** The Buyer/Client receives the Topic Message.
Post - Conditions	1. The Client receives a Topic/Message with all attributes.

839 **Table 73 - Publish Topic Use Case**

Attribute Name	Description	Value	Comments
Stream Identifier	The Seller/Server assigned unique identifier.	String	Set by the Seller/Server
Event ID	The identifier of the Notification.	String	Set by Seller/Server
Event Time	Time of the Event occurrence.	Date - Time	Set by Seller/Server
Event Type	The type of Notification.	String	Set by Seller/Server
Correlation ID	The correlation ID for this Event.	String	Set by Seller/Server

Attribute Name	Description	Value	Comments
Priority	A priority.	String	Set by Seller/Server
Message	Actual event		

Table 74 - Publish Topic Message Attributes

14.2.7 Retrieve Topic Message Use Case

Field	Description
Use Case Number	47
Use Case Name	Retrieve Topic/Messages
Description	A Buyer/Client retrieves the Topic/Message that it is subscribed to.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Client is authorized to request a Topic in the Seller/Server system.
Process Steps	1. The Buyer/Client submits a Retrieve Topic Message request that includes the Stream Identifier and a range of Event Dates. **[O23]** The Buyer/Client's Retrieve Topic Message **MAY** include the Stream Identifier and a range of Event Dates. **[O24]** The Buyer/Client's Retrieve Topic Message **MAY** include other attributes from Table 74. 2. The Seller/Server returns a list of Topic Messages that match the filter criteria provided by the Buyer/Client. **[R136]** The Seller/Server's response **MUST** include a list of Topic Messages including all attributes that are shown in Table 74 that match the filter criteria. 3. If the Seller/Server finds no Topic Messages that match the filter criteria, they **MUST** return an empty list.
Post - Conditions	1. The Client receives a Message with all attributes.

Table 75 - Retrieve Messages from a Topic Use Case

15 Alarm Management Use Cases

An alarm is defined in ITU - T X.733 [3] as a notification of a specific event. An alarm may or may not represent an error. Not all alarms are an indication of a failure.

Alarms are specific types of notifications concerning detected faults or abnormal conditions. An important criterion by which failures of communications resources are to be reported is the level to which the fault degrades the quality of the service that was originally requested by (or promised to) the service user. Malfunctions will range in severity from Warning, where there is no impact upon the quality of service offered to the user, to Critical, where it is no longer possible to provide the service requested by (or promised to) the service user. The level of severity can be described generically, and criteria specified based upon the level of degradation that the fault causes to the service: Critical, Major, Minor or Warning.

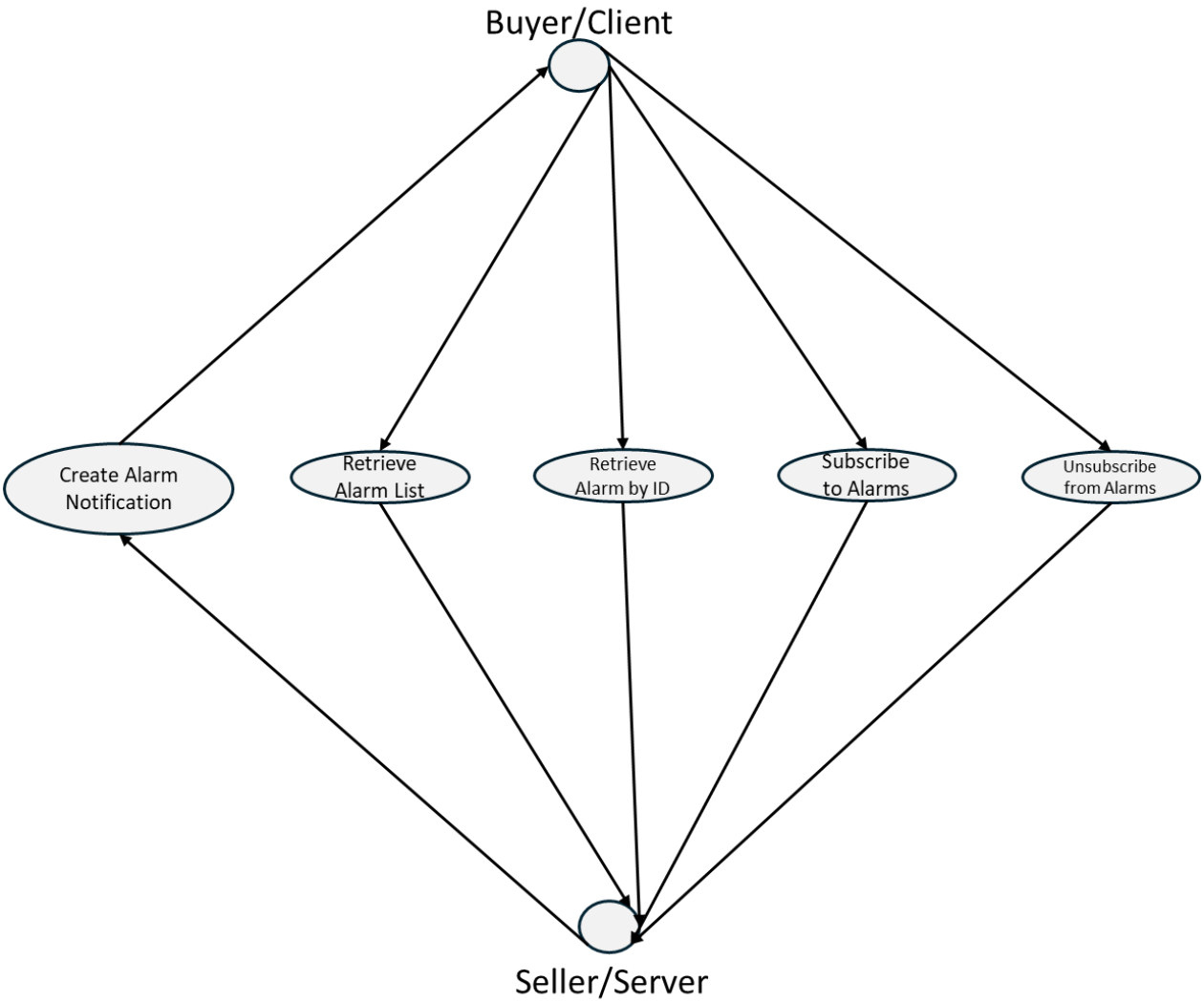
This section provides a set of Use Cases needed to support Alarm Management.

These Use Cases are based on business process standards of interactivity between Buyer/Client and Seller/Server of Alarm management. The Alarm resource should be represented by the information model defined in ITU - T X.733 [3].

15.1 Alarm Management Use Cases

This section defines the use cases that support Alarm Management Use Cases. Alarms are used to inform the listening client that a Threshold Crossing Alert or other fault has occurred. The alarm indicates a TCA has been crossed, which is independent of the state of the service. The service will have its own operational state.

NOTE: Given the interaction between a TCA and an Alarm there is likely an interaction between intra - SOF functional components. For example, a TCA is a combination of a Performance Management functional component and Fault Management functional component where thresholds can be provisioned.



869

870 **Figure 15 - Alarm Management Use Cases**

871 The Client can retrieve and subscribe to alarms. The Seller/Server will send Create Alarm Notifi-
872 cations to the Buyer/Client.

873 ### 15.1.1 Create Alarm

Field	Description
Use Case Number	48
Use Case Name	Create Alarm
Description	A Seller/Server sends a Create Alarm Notification to the Buyer/Client based on an event that has occurred.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Seller/Server has determined that an Event (i.e., TCA) has occurred and can be mapped and communicated to subscribers with an Alarm.

Field	Description
Process Steps	1. The Seller/Server determines the set of Clients (Subscribers) that are listening for Alarms. 2. The Seller/Server generates and communicates the Alarm to all Buyer/Clients who have subscribed to Alarm Notifications.
Post - Conditions	1. The Client(s) receives an Alarm indicating the event has occurred. 2. The Client will take up action upon the Alarm.
Alternative Paths	

874 **Table 76 - Create Alarm Use Case**

Attributes	Description	Type	Comments
Description	This resource represents an alarm supporting the information model defined in ITU - T X.733.	String	
Alarm Identifier	Provides the identifier of the alarm.	String	
Alarm Changed Time	Indicates the last date and time when the alarm is changed on the alarm - owning system. Any change to the alarm whether coming from the alarmed resource is changing this time.	Date - Time	
Alarm Cleared Time	Indicates the time (as a date + time) at which the alarm is cleared at the source.	Date - Time	

Attributes	Description	Type	Comments
Alarm Reporting Time	Indicates the time (as a date + time) at which the alarm was reported by the owning OSS. It might be different from the alarmRaisedTime. For instance, if the alarm list is maintained by an EMS, the alarmRaisedtime would be the time the alarm was detected by the NE, while the alarmReportingTime would be the time this alarm was stored in the alarm list of the EMS.	Date - Time	
Alarm Raised Time	The time that an alarm was raised. This time may differ from the Alarm Reported Time	Date - Time	
Alarm Type	Categorize the alarm. Should be one of the values defined in X.733 8.1.1 or 3GPP TS 32.111 - 2 Annex A: Communications Alarm Processing Error Alarm Environmental Alarm Quality of Service Alarm Equipment Alarm Integrity Violation Operational Violation Physical Violation Security Service or Mechanism Violation Time Domain Violation	String	
Alarmed Object Type	The type (class) of the managed object associated with the event.	String	The Alarmed Object Type will change based on the type of service.
External Alarm Identifier	An identifier of the alarm in the source system.	String	

Attributes	Description	Type	Comments
Is Root Cause	Indicates whether the alarm is a root cause alarm.	Boolean	
Perceived Severity	Lists the possible severities that can be allocated to an Alarm. The values are consistent with ITU - T Recommendation X.733. Once an alarm has been cleared, its perceived severity is set to 'cleared' and can no longer be set.	One of: Critical Major Minor Warning	
Planned Outage Indicator	Indicates that the Managed Object (related to this alarm) is in planned outage (in planned maintenance, or out - of - service).	String	
Probable Cause	Provides the probable cause of the alarm. The values are consistent with ITU - T Recommendation X.733 or 3GPP TS 32.111 - 2 Annex B.	One of values from X.733	
Reporting System Identifier	Reporting system identity.	String	The Reporting System Identifier could be the Seller or could be a system within the Seller
Service Affecting	Indicates whether the alarm affects service or not.	Boolean	
Source System Identifier	Source system identity.	String	The Source System Identifier could be the Seller or could be a system within the Seller
State	Defines the alarm state during its life cycle	One of: Unacknowledged Acknowledged Cleared	

Attributes	Description	Type	Comments
Affected Service	Affected services. (An array of Service unique identifiers.	Identifier []	
Alarmed Object	Identifies the managed object instance associated with the alarm.	Identifier	
Comment	Indicates the comments entered on the alarm.	See Table 78.	Comments are sent to the Buyer via the API. How comments are entered by the Seller is beyond the scope of this document
Correlated Alarm	Correlated alarms.	Identifier []	
Parent Alarm	Unique identifier of a related entity.	Identifier	

875 **Table 77 – Alarm Create and Alarm Attributes**

876 **[R137]** An Alarm MUST contain the following:

877 • Alarm Identifier

878 • Alarm Reporting Time

879 • Alarm type

880 • State

881 • Perceived Severity

882

Attributes	Description	Type	Comments
Comment	Indicates the text of the comment.	String []	
System Identifier	Indicates the system identifier on which the Seller/Server set the comment.	String	
Time	Indicates the time commenting the alarm.	Date - Time	

Attributes	Description	Type	Comments
User Identifier	Indicates the user commenting the alarm.	String	

883 **Table 78 - Comment Attributes**

884 ### 15.1.2 Retrieve Alarm List

Field	Description
Use Case Number	49
Use Case Name	Retrieve Alarm List
Description	A request is initiated by the Buyer/Client to retrieve a list of Alarms.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to retrieve alarms from the Seller/Server system. 2. The Seller/Server is supporting the retrieval of alarms.
Process Steps	1. The Buyer/Client determines the filter criteria for the Retrieve Alarm List request. **[R138]** The Buyer request MUST contain 0 or more of the attributes shown in Table 80. 2. The Buyer/Client communicates a Retrieve Alarm List request to the Seller/Server. **[R139]** The Seller/Server **MUST** support the Retrieve Alarm List Use Case. **[R140]** The Buyer/Client **MUST** support the Retrieve Alarm List Use Case.
Post - Conditions	1. The Buyer/Client has a list of alarms
Alternative Paths	1. The Seller/Server will return an error message if an error is encountered during processing.

885 **Table 79 - Retrieve Alarm List Use Case**

Attributes	Description	Type	Comments
Alarm Identifier	The unique identifier of the Alarm	String	
Description	This resource represents an alarm supporting the information model defined in ITU - T X.733.	String	

Attributes	Description	Type	Comments
Alarm Changed Start Time	Indicates the last date and time when the alarm is changed on the alarm - owning system. Any change to the alarm whether coming from the alarmed resource or triggered by a change from the client is changing this time.	Date - Time	
Alarm Changed End Time	Indicates the last date and time when the alarm is changed on the alarm - owning system. Any change to the alarm whether coming from the alarmed resource or triggered by a change from the client is changing this time.	Date - Time	
Alarm Cleared Start Time	Indicates the time (as a date + time) at which the alarm is cleared at the source.	Date - Time	
Alarm Cleared End Time	Indicates the time (as a date + time) at which the alarm is cleared at the source.	Date - Time	
Alarm Reporting Start Time	Indicates the time (as a date + time) at which the alarm was reported by the owning OSS. It might be different from the time that the alarm is raised. For instance, if the alarm list is maintained by an EMS, the alarmRaisedTime would be the time the alarm was detected by the NE, while the alarmReportingTime would be the time this alarm was stored in the alarm list of the EMS.	Date - Time	

Attributes	Description	Type	Comments
Alarm Reporting End Time	Indicates the time (as a date + time) at which the alarm was reported by the owning OSS. It might be different from the alarmRaisedTime. For instance, if the alarm list is maintained by an EMS, the alarmRaisedtime would be the time the alarm was detected by the NE, while the alarmReportingTime would be the time this alarm was stored in the alarm list of the EMS.	Date - Time	
Alarm Type	Categorize the alarm. Should be one of the values defined in X.733 8.1.1 or 3GPP TS 32.111 - 2 Annex A: Communications Alarm Processing Error Alarm Environmental Alarm Quality of Service Alarm Equipment Alarm Integrity Violation Operational Violation Physical Violation Security Service or Mechanism Violation Time Domain Violation	String	
Alarmed Object Type	The type (class) of the managed object associated with the event.	String	
Perceived Severity	Lists the possible severities that can be allocated to an Alarm. The values are consistent with ITU - T Recommendation X.733. Once an alarm has been cleared, its perceived severity is set to 'cleared' and can no longer be set.	String	

Attributes	Description	Type	Comments
Planned Outage Indicator	Indicates that the Managed Object (related to this alarm) is in planned outage (in planned maintenance, or out - of - service).	String	
Reporting System Identifier	Reporting system identity.	String	
Service Affecting	Indicates whether the alarm affects service or not.	Boolean	
State	Defines the alarm state during its life cycle	String	
Affected Service	Affected services. (An array of Service unique identifiers.	Identifier []	
Correlated Alarm	Correlated alarms.	Identifier []	

Table 80 – Retrieve Alarm List Filter Criteria

[R141] If the request is successful, the Seller response **MUST** contain the following:

- Alarm Identifier
- Description
- Alarm Reporting Time
- Alarm Type
- Alarm Severity
- State

[O25] The Seller response **MAY** contain any of the remaining attributes in Table 80.

15.1.3 Retrieve Alarm by Identifier

Field	Description
Use Case Number	50
Use Case Name	Retrieve Alarm by Identifier
Description	A request is initiated by the Buyer/Client to retrieve an identified Alarm.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to retrieve alarms from the Seller/Server system. 2. The Seller/Server is supporting the retrieval of alarms.

Field	Description
Process Steps	1. The Buyer/Client determines the identifier of the Alarm to retrieve detailed information on. 2. The Buyer/Client communicates a Retrieve Alarm by Identifier request to the Seller/Server. **[R142]** The Seller/Server **MUST** support the Retrieve Alarm by Identifier Use Case. **[R143]** The Buyer/Client **MUST** support the Retrieve Alarm by Identifier Use Case. **[R144]** The Buyer/Client Retrieve Alarm by Identifier **MUST** include the Alarm Identifier. **[R145]** The Buyer/Client Retrieve Alarm by Identifier **MUST NOT** include any other attributes.
Post - Conditions	2. The Buyer/Client has a list of alarms
Alternative Paths	2. The Seller/Server will return an error message if an error is encountered during processing.

896 **Table 81 - Retrieve Alarm List Use Case**

897

Attributes	Description	Type	Comments
Description	This resource represents an alarm supporting the information model defined in ITU - T X.733.	String	
Alarm Identifier	Provides the identifier of the alarm	String	
Alarm Changed Time	Indicates the last date and time when the alarm is changed on the alarm - owning system. Any change to the alarm whether coming from the alarmed resource or triggered by a change from the client is changing this time.	Date - Time	
Alarm Cleared Time	Indicates the time (as a date + time) at which the alarm is cleared at the source.	Date - Time	

Attributes	Description	Type	Comments
Alarm Reporting Time	Indicates the time (as a date + time) at which the alarm was reported by the owning OSS. It might be different from the alarmRaisedTime. For instance, if the alarm list is maintained by an EMS, the alarmRaisedtime would be the time the alarm was detected by the NE, while the alarmReportingTime would be the time this alarm was stored in the alarm list of the EMS.	Date - Time	
Alarm Raised Time	The time that an alarm was raised. This may differ from the Alarm Reported Time.	Date - time	
Alarm Type	Categorize the alarm. Should be one of the values defined in X.733 8.1.1 or 3GPP TS 32.111 - 2 Annex A: Communications Alarm Processing Error Alarm Environmental Alarm Quality of Service Alarm Equipment Alarm Integrity Violation Operational Violation Physical Violation Security Service or Mechanism Violation Time Domain Violation	String	
Alarmed Object Type	The type (class) of the managed object associated with the event.	String	
External Alarm Identifier	An identifier of the alarm in the source system.	String	
Is Root Cause	Indicates whether the alarm is a root cause alarm.	Boolean	

Attributes	Description	Type	Comments
Perceived Severity	Lists the possible severities that can be allocated to an Alarm. The values are consistent with ITU - T Recommendation X.733. Once an alarm has been cleared, its perceived severity is set to 'cleared' and can no longer be set.	One of: Critical Major Minor Warning	
Planned Outage Indicator	Indicates that the Managed Object (related to this alarm) is in planned outage (in planned maintenance, or out - of - service).	String	
Probable Cause	Provides the probable cause of the alarm. The values are consistent with ITU - T Recommendation X.733 or 3GPP TS 32.111 - 2 Annex B.	One of values from X.733	
Reporting System Identifier	Reporting system identity.	String	
Service Affecting	Indicates whether the alarm affects service or not.	Boolean	
Source System Identifier	Source system identity.	String	
Specific Problem	Provides more specific information about the alarm.	String	
State	Defines the alarm state during its life cycle	One of: Unacknowledged Acknowledged Cleared	
Affected Service	Affected services. (An array of Service unique identifiers.	Identifier	
Alarmed Object	Identifies the managed object instance associated with the alarm.	Identifier	
Comment	Indicates the comments entered on the alarm.	See Table 78.	
Correlated Alarm	Correlated alarms.	Identifier	

Attributes	Description	Type	Comments
Parent Alarm	Unique identifier of a related entity.	Identifier	

898 **Table 82 – Retrieve Alarm by Identifier Alarm Attributes**

899 ### 15.1.4 Subscribe to Alarms Use Case

Field	Description
Use Case Number	51
Use Case Name	Subscribe to Alarms
Description	A request initiated by the Buyer/Client to the Seller/Server to subscribe to Alarms.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to subscribe to Alarms in the Seller/Server system. 2. The Seller/Server support Alarms.
Process Steps	1. The Buyer/Client sends the Subscribe for Alarms as shown in table below to the Seller/Server specifying where to send Alarm notifications and which Alarm Notification Types to include in notifications. **[R146]** The Buyer/Client's Subscribe to Alarm Notifications request **MUST** include the Notification Target Attribute. 3. The Seller/Server receives the Subscribe request for Alarm Notifications. 4. The Seller/Server records which Alarm Notifications to send, where to send such notifications for this Client. 5. The Seller/Server returns an acknowledgement to the Client that includes a Register Notification Identifier.
Post - Conditions	1. The Seller/Server is aware of where to send Alarm Notifications.
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while processing that prevents the Seller/Server from completing the request.

900 **Table 83 - Subscribe to Alarm Notifications**

Attribute Name	Description	Value	Comments
Notification Target Information	The detailed information on the technical API end - point address specifying where the Seller/Server is to send any PM Job Notifications. There can be multiple locations for one Buyer/Client.	String	This is the Callback target in the API

Attribute Name	Description	Value	Comments
List of Notification Types	The types of notifications that the Buyer/Client wishes to receive.	List of one or more of: • Alarm Create Event • Alarm Attribute Value Change Event • Alarm State Change Event • Alarm Delete Event • Acknowledge Alarms Create Event • Acknowledge Alarm State Change Event • Un - Acknowledge Alarms Create Event • Un - Acknowledge Alarms State Change Event • Clear Alarms Create Event • Comment Alarms Create Event • Comment Alarms State Change Event • Group Alarms Create Event • Group Alarms State Change Event • Ungroup Alarms Create Event • Ungroup Alarms State Change Event	This is a list of attributes

901 **Table 84 - Subscribe to Alarms Attributes**

902 ### 15.1.5 Unsubscribe from Alarms Use Case

Field	Description
Use Case Number	52
Use Case Name	Unsubscribe from Alarms
Description	A request initiated by the Client to unsubscribe from Alarms.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client has previously subscribed to Alarm Notifications. 2. The Buyer/Client is authorized to unsubscribe from Alarm Notifications in the Seller/Server system. 3. The Seller/Server support Alarm Notifications.
Process Steps	1. The Buyer/Client sends the Unsubscribe from Alarm Notifications to the Seller/Server specifying which Alarm Notification Types the Buyer/Client is unsubscribing from listening. 2. The Seller/Server receives the Unsubscribe request for Alarm Notifications. 3. The Seller/Server discontinues Alarm Notification Types to Buyer/Client specific to Unsubscribe request. 4. The Seller/Server returns an acknowledgement to the Buyer/Client.
Post - Conditions	1. The Seller/Server discontinues sending Alarm Notification Types to Client specific to Buyer/Client Unsubscribe request.
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while processing that prevents the Seller/Server from completing the request.

903 **Table 85 - Unsubscribe from Alarms Use Case**

904 ### 15.1.6 Stateful TCA Alarm

Field	Description
Use Case Number	53
Use Case Name	Stateful TCA Alarm
Description	A Stateful TCA Alarm is initiated by the Seller/Server to a subscribed Client.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Seller/Server supports Stateful TCA Alarms. 2. The Client has subscribed to Stateful TCA Alarms.

Field	Description
Process Steps	1. For a Stateful TCA alarm, the Seller/Server generates a Stateful TCA Alarm to a Buyer/Client that include the attributes shown in Stateful TCA Alarm table. **[R147]** When sending an alarm for a TCA Reporting Type of Stateful, the Seller/Server alarm **MUST** include the attributes in Stateful TCA Alarm table. **[R148]** When sending an alarm for a TCA Reporting Type of Stateful, the TCA Type **MUST** be STATEFUL - SET when the alarm is for a TCA - SET event. **[R149]** When sending an alarm for a TCA Reporting Type of Stateful, the TCA Type **MUST** be STATEFUL - CLEAR when the alarm is for a TCA - CLEAR event.
Post - Conditions	1. The Seller/Server has sent related Stateful TCA Notification.

905 **Table 86 - Stateful TCA Notification (Alarm) Use Case**

906 The Stateful TCA notification includes a STATEFUL-SET or a STATEFUL-CLEAR in addition
907 to the State of Unacknowledged, Acknowledged, and Cleared shown previously in the document.
908

Field Name	Field Value	Field Format	Field Description
Alarm Raised Time	Date and Time in UTC	Date - Time	Time of the event, in UTC. For Stateful SET - TCA and CLEAR - TCA this is the time of the completion of the PM Metric Calculation Interval for which the PM Metric Value triggered the TCA to be generated.
Performance Metric Name	Payload Specific Attributes	String	Human readable text for the Performance Metric for which the TCA Function was configured.
TCA Performance Threshold Value	Numeric value	Integer	The configured TCA Performance Threshold Value for the Performance Metric.
SET - TCA Window Threshold Value	Numeric value	Integer	The value of the SET - TCA Window Threshold. Only used for SET - TCA notification messages.
CLEAR - TCA Window Threshold Value	Numeric value	Integer	The value of the CLEAR - TCA Window Threshold. Only used for CLEAR - TCA notification messages.

Field Name	Field Value	Field Format	Field Description
TCA Window Size Value	Numeric value	Integer	The number of PM Metric Calculation Intervals included in the sliding window for the SET - TCA or CLEAR - TCA process.
PM Metric Value	Numeric values for PM Metric Calculation Interval	Number []	
TCA Type	STATEFUL - SET, or STATEFUL - CLEAR	String	The type of TCA, i.e., STATEFUL - SET or STATEFUL - CLEAR

909 **Table 87 - Stateful TCA Notification (Alarm) Attributes**

910 ### 15.1.7 Stateless TCA Alarm

Field	Description
Use Case Number	54
Use Case Name	Stateless TCA Alarm
Description	A Stateless TCA lifecycle alarm is initiated by the Seller/Server to a subscribed Client.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Seller/Server supports Stateless TCA alarms. 2. The Client has subscribed to alarms.
Process Steps	1. For a Stateless TCA alarm, the Seller/Server generates a TCA Alarm to a Buyer/Client who has subscribed to TCA Alarms that include the attributes shown in TCA Stateless Reporting Attributes table. **[R150]** When sending an alarm for a TCA Reporting Type of Stateless, the Seller/Server notification **MUST** include the attributes in TCA Stateless Reporting Attributes table. **[R151]** If the Damping Factor is included in the TCA Profile, the TCA Alarm **MUST** include the attributes shown in Damping Factor TCA Reporting Attributes table.
Post - Conditions	1. The Seller/Server has sent related Stateless TCA Notification.

911 **Table 88 - Stateless TCA Notification Use Case**

Field Name	Field Value	Field Format	Field Description
Alarm Raised time	Date and Time in UTC	Date - Time	Time of the event, in UTC. This is the time of the end of the PM Metric Calculation Interval for which the TCA is generated.
Performance Metric Name	Service Payload Specific Attributes	String	Human readable text for Performance Metric for which the TCA Function was configured.
TCA Performance Threshold Value	Numeric value	Number	The TCA Performance Threshold Value
Performance Metric Value	Numeric value	Number	The PM Metric Value for the PM Metric Calculation
Damping Factor	Numeric value	Integer	The value that identifies the number of PM Metric Calculation Intervals included in the Damping Factor process.
Number of PM Metric Calculation Intervals	Numeric value	Integer	The number of PM Metric Calculation Intervals in the hopping window in which the PM Metric Value ≥ the TCA Performance Threshold Value

912 **Table 89 - Stateless TCA Notification Attributes**

913

914 # 16 Retrieve PM from a PM Database

915

Field	Description
Use Case Number	55
Use Case Name	Retrieve PM data from a PM database
Description	A request initiated by the Buyer/Client to retrieve PM data from a PM database.
Actors	Buyer/Client, Seller/Server
Pre - Conditions	1. The Buyer/Client is authorized to retrieve PM data from a database in the Seller/Server system. 2. The Seller/Server supports retrieval from a PM database.
Process Steps	1. The Buyer/Client sends the Retrieve PM data from a PM database request to the Seller/Server specifying the Service ID or Entity ID, the PM Metrics to retrieve, and the time period of the PM data that is being retrieved.. 2. The Seller/Server receives the Retrieve PM data from a PM database request. 3. The Seller/Server returns the requested PM data to the Buyer/Client.
Post - Conditions	1. The Buyer/Client has the PM data that they requested
Alternative Paths	1. The Seller/Server returns an error message if an error is encountered while processing that prevents the Seller/Server from completing the request.

916 **Table 90 – Retrieve PM Data from a PM Database Use Case**

917

Attribute Name	Description	Value	Comments
Service Identifier	The identifier of the service for which PM data is being retrieved	String	
Entity Identifier	The identifier of the entity for which PM data is being retrieved	String	
Granularity	The sampling rate of the collection of fault indicators.	See Table 27	Set by Buyer/Client
Service Specific Payload Data	A list of one or more PM metrics that the Buyer/Client wish to retrieve	List of PM metrics	These are service or entity specific
Output Format	The format of the output report	One of the following: *JSON* *XML* *AVRO* *CSV*	Set by Buyer/Client
Result Format	List of possible result formats that define how Seller/Server will	One of the following:	Payload Output Format

Attribute Name	Description	Value	Comments
	deliver Fault Report to the Buyer/Client		for *Payload* is always *JSON*
Start Time	The earliest time period for which PM data is requested	Date/time	
End Time	The latest time-period for which PM data is requested	Date/time	

Table 91 – Retrieve PM Data from a PM Database Attributes

[R152] If the Buyer/Client desires to retrieve PM data for a service they **MUST** include the Service Identifier in the Retrieve PM Data from a PM Database request.

[R153] If the Buyer/Client desires to retrieve PM data for an entity they **MUST** include the Entity Identifier in the Retrieve PM Data from a PM Database request.

[R154] In addition to the Service or Entity Identifier, a Retrieve PM Data from a PM Database request MUST contain the following:

- Service Specific Payload
- Start Time
- End Time

17 Process Flows

This section of the document defines the process flows and states within the Fault Management Job and Performance Monitoring Job process flows.

17.1 Fault Management Job

The Fault Management Job Process Flow and states are shown in this section.

17.1.1 Fault Management Job Process Flow

The Fault Management Job Process Flow is shown in Figure 16.

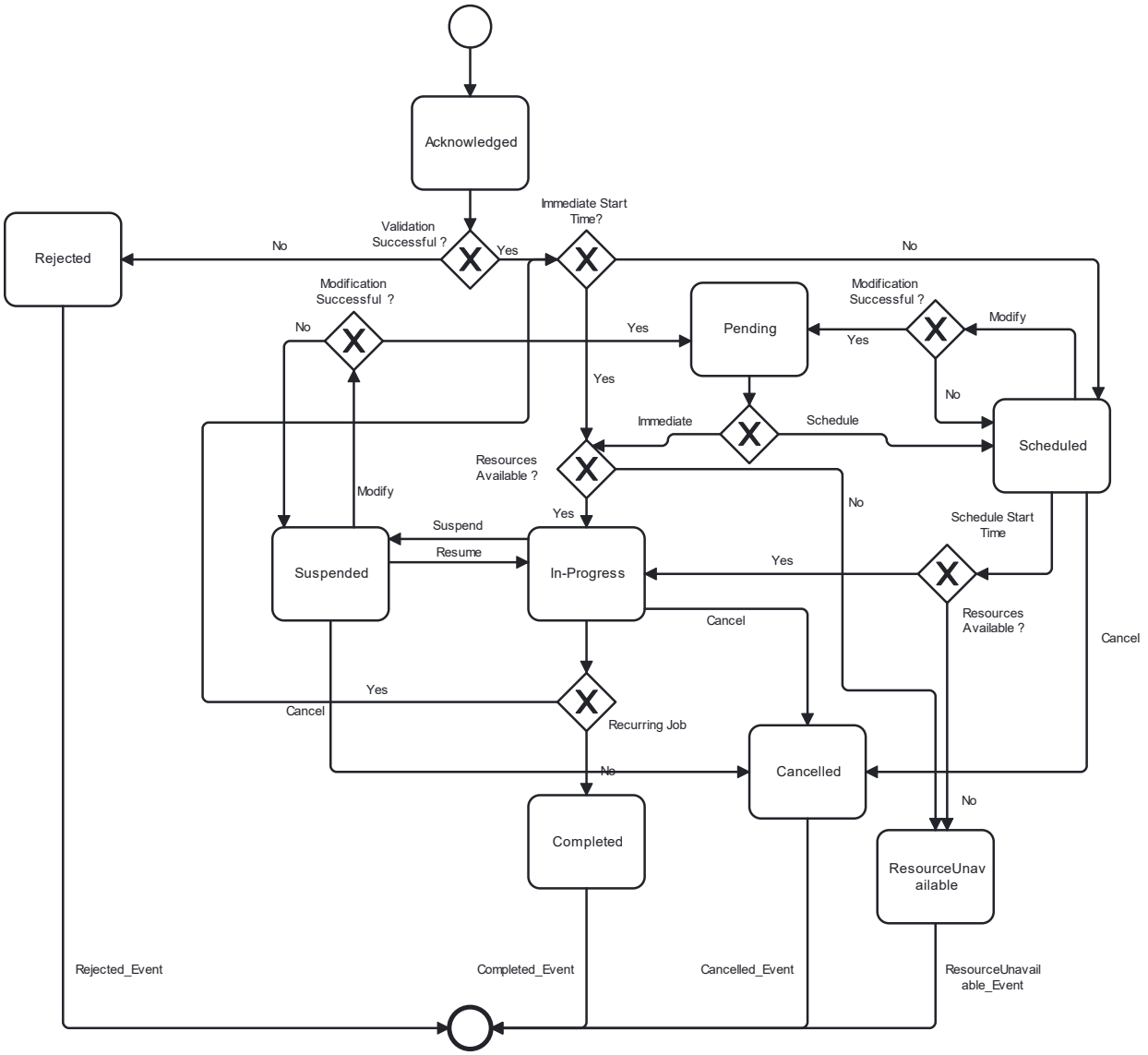


Figure 16 - Fault Management Job Process Flow

939 ### 17.1.2 Fault Management Job States

940 The Fault Management Job states are defined in Table 92.

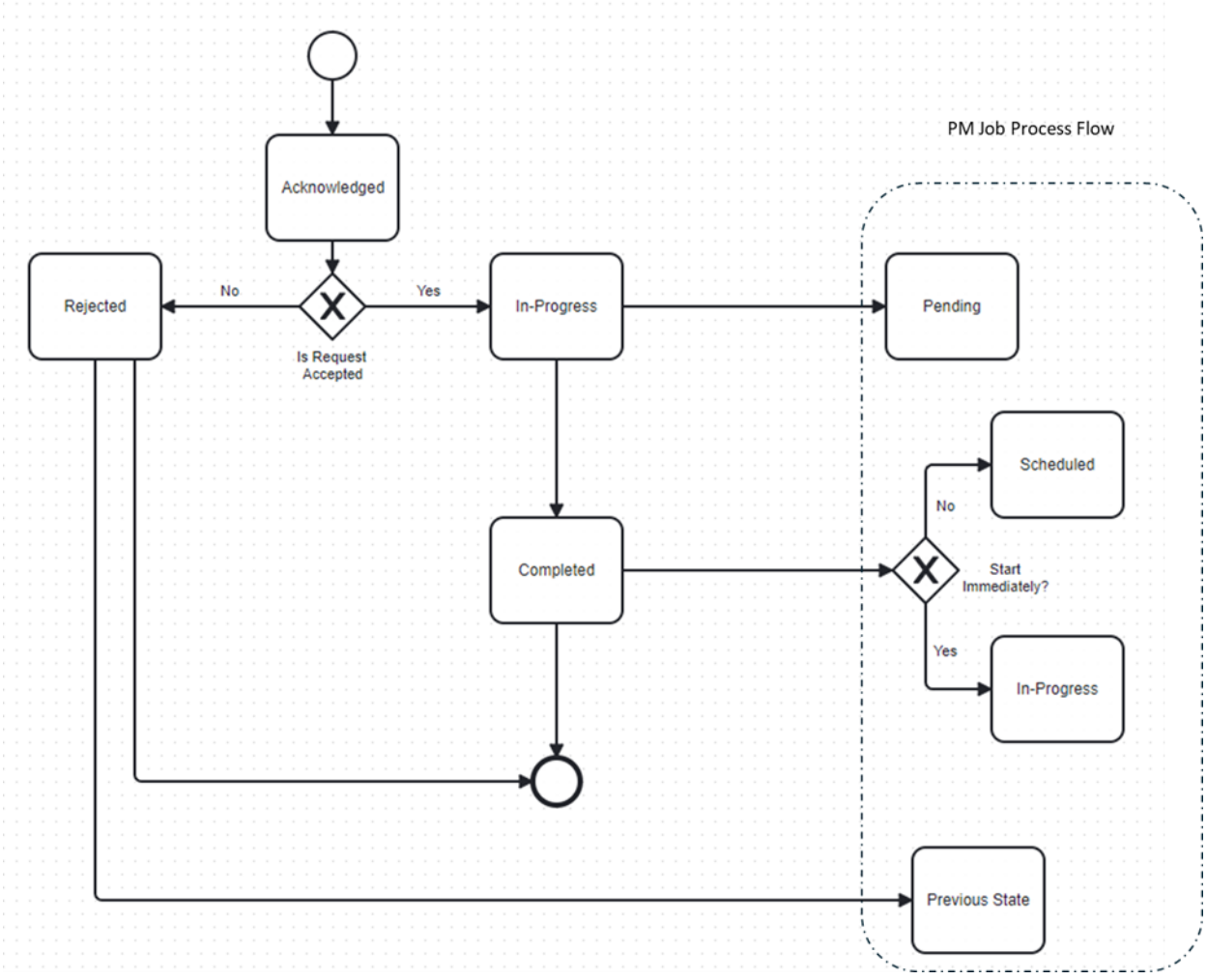
State	Description
Acknowledged	A FM Job request has been received by the Seller/Server and has passed basic validation. FM Job Identifier is assigned in the Acknowledged state. The request remains in the Acknowledged state until all validations as applicable are completed. If the attributes are validated the request determines if the start time is immediate or scheduled. If immediate, the FM Job moves to the In - Progress state. If scheduled, the FM Job moves to the Scheduled state. If all attributes are not validated, the request moves to the Rejected state.
Cancelled	A FM Job that is In - Progress, Scheduled or Suspended is canceled.
Completed	A FM Job is Completed. NOTE: All results from FM Job must persist in order for a collection of results.
In - Progress	A FM Job is running. Upon completion of the Job, a determination if the FM Job is a one - time Job or is recurring. If the FM Job is a one - time Job, the state of the FM Job moves to the Completed state. If the PM Job is recurring, the FM Job circles back to determine if it has an immediate start time or a scheduled start time. If a Suspend FM Job request is accepted, the Job moves to the Suspended state. If a Modify FM Job request is accepted, the Job moves to the Pending state. If a Cancel FM Job request is accepted, the Job moves to the Cancelled state.
Pending	A Modify FM Job request has been accepted by the Seller/Server. The FM Job remains in the Pending state while updates to the Job are completed. Once updates are complete, the Job returns to the In - Progress or Scheduled state if modified.
Resources Unavailable	A state representing that FM Job resources are currently unavailable.
Rejected	A create FM Job fails validation and is rejected with error indications by the Seller/Server.
Scheduled	A FM Job is created that does not have an immediate start time. The FM Job stays in the

	Scheduled state until the start time is reached. The FM Job then moves to In - Progress.
Suspended	A Suspend FM Job request is accepted by the Seller/Server. The Job remains in the Suspended state until a Resume FM Job request is accepted by the Seller/Server at which time the Job returns to the In - Progress state.

941 **Table 92 - Fault Management Job States**

942 ### 17.1.3 Modify Fault Management Job Process Flow

943 The Modify Fault Management Job process flow is described in this section.



944

945 **Figure 17 - Modify Fault Management Job Process Flow**

946 ### 17.1.4 Modify Fault Management Job States

947 The Modify Fault Management Job states are defined in this section.

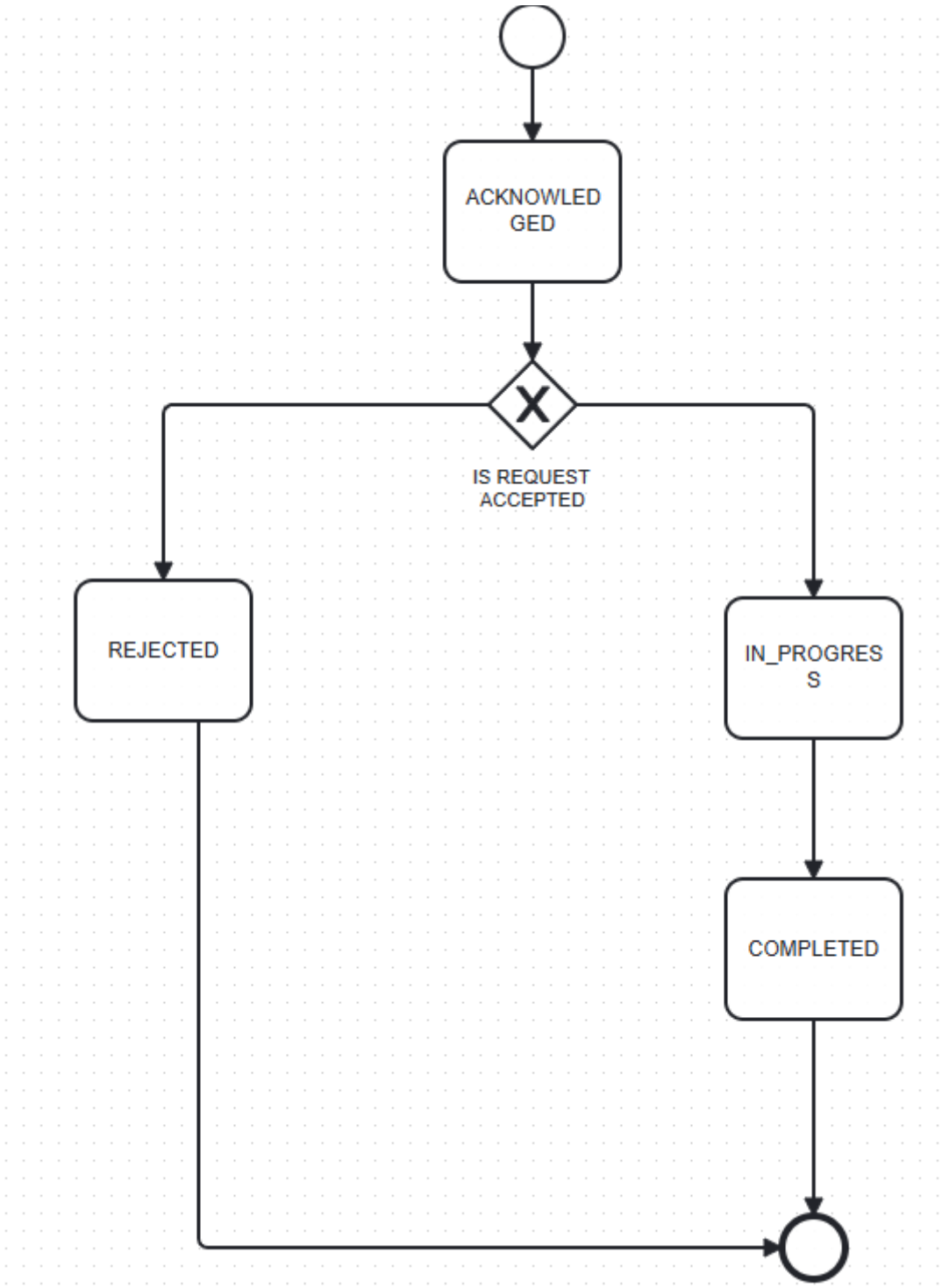
948

State	Description
Acknowledged	A Modify FM Job request has been received by the Seller/Server and has passed basic validation. The request remains in the Acknowledged state until all validations as applicable are completed. If the attributes are validated the request moves to the In-Progress state. If not all attributes are valid, the request moves to the Rejected state.
Completed	The Modify FM Job is Completed.
In-Progress	The Modify FM Job request has been validated and accepted by the Seller/Server and is in-progress.
Rejected	The Modify FM Job has failed validation and been rejected by the Seller/Server.

949 **Table 93 - Modify Fault Monitoring Job States**

950 ### 17.1.5 Cancel Fault Management Job Process Flow

951 The Cancel Fault Management Job process flow is described in this section.



952

953 **Figure 18 - Cancel - Cancel Fault Management Job Process Flow**

954 ### 17.1.6 Cancel Fault Management Job States

955 The Cancel FM Job states are defined in this section.

State	Description
Acknowledged	A Cancel PM Job request has been received by the Seller/Server and has passed basic validation.
Completed	The Cancel PM Job request has been completed by the Seller/Server.
In-Progress	The Cancel PM Job request has been validated and accepted by the Seller/Server.
Rejected	The Cancel PM Job has failed validation and been Rejected by the Seller/Server.

Table 94 - Cancel - Cancel Fault Management Job States

17.2 Performance Monitoring Job

The Performance Monitoring Job Process Flow and states are shown in this section. The general flow for the PM Process is show in Figure 19 - Performance - Performance Monitoring Overall Process Flow.

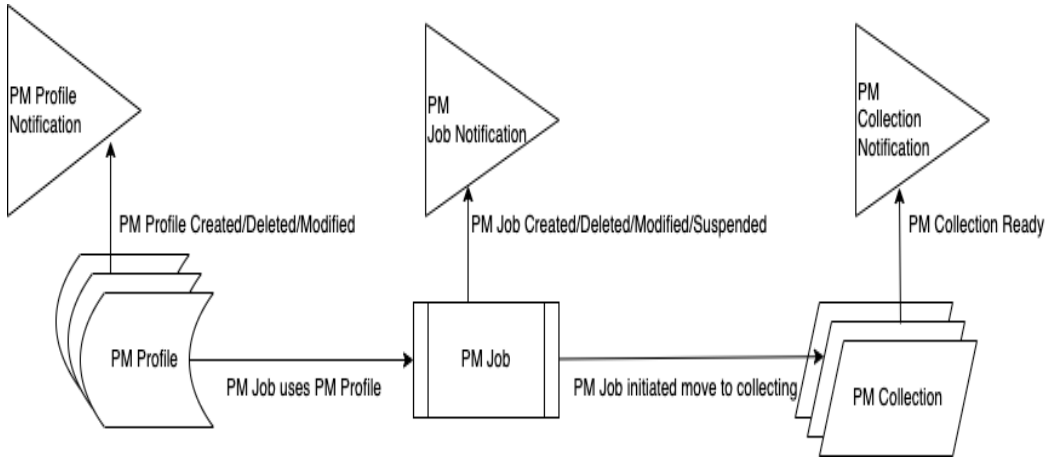
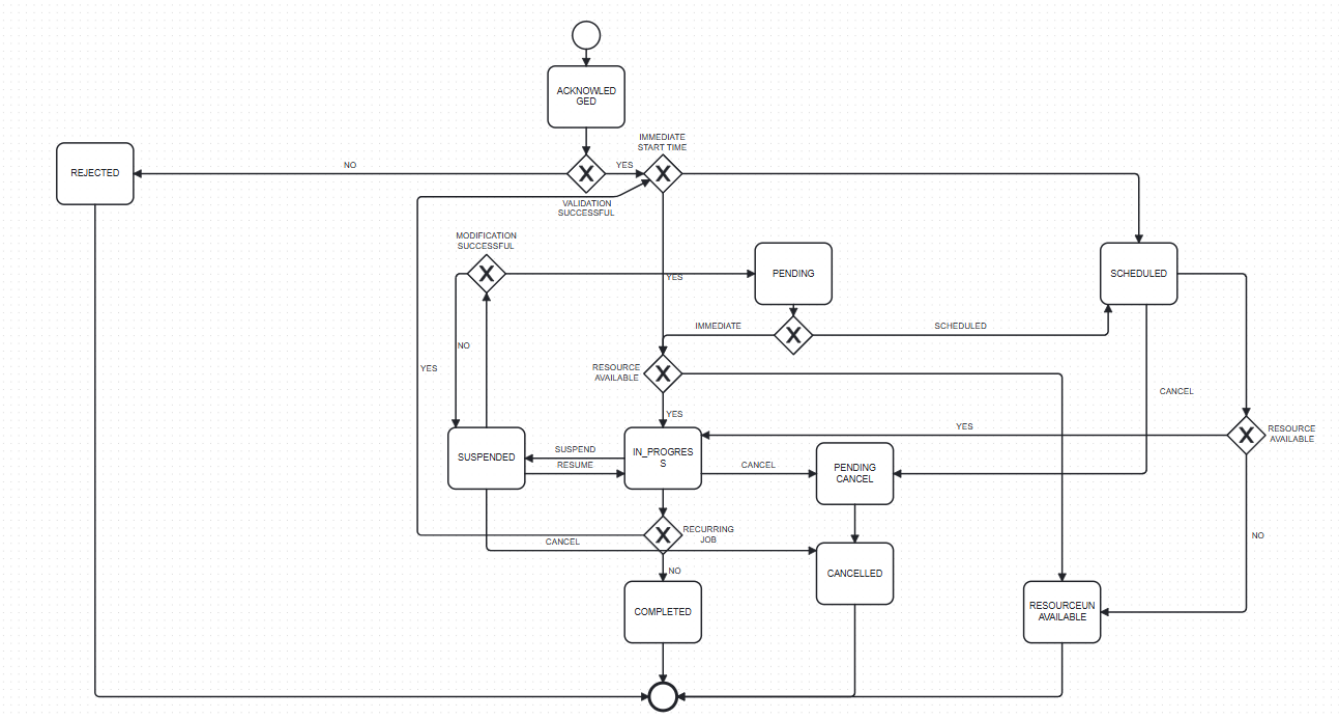


Figure 19 - Performance - Performance Monitoring Overall Process Flow

964 ### 17.2.1 Performance Monitoring Job Process Flow



965

966 **Figure 20 - Performance Monitoring Job Lifecycle Process Flow**

967 **[O26]** In case job is running e.g., once a day for a short period of time, it may be
968 difficult to change its state. If action arrives when PM job is running, it is rec-
969 ommended to run until the end and only afterwards action should be applied.

970 ### 17.2.2 Performance Monitoring Job States

971 The PM Job states are defined in Table 92.

972

State	Description
Acknowledged	A PM Job request has been received by the Seller/Server and has passed basic validation. PM Job Identifier is assigned in the Acknowledged state. The request remains in the Acknowledged state until all validations as applicable are completed. If the attributes are validated the request determines if the start time is immediate or scheduled. If immediate, the PM Job moves to the In - Progress state. If scheduled, the PM Job moves to the Scheduled state. If not all attributes are not validated, the request moves to the Rejected state.

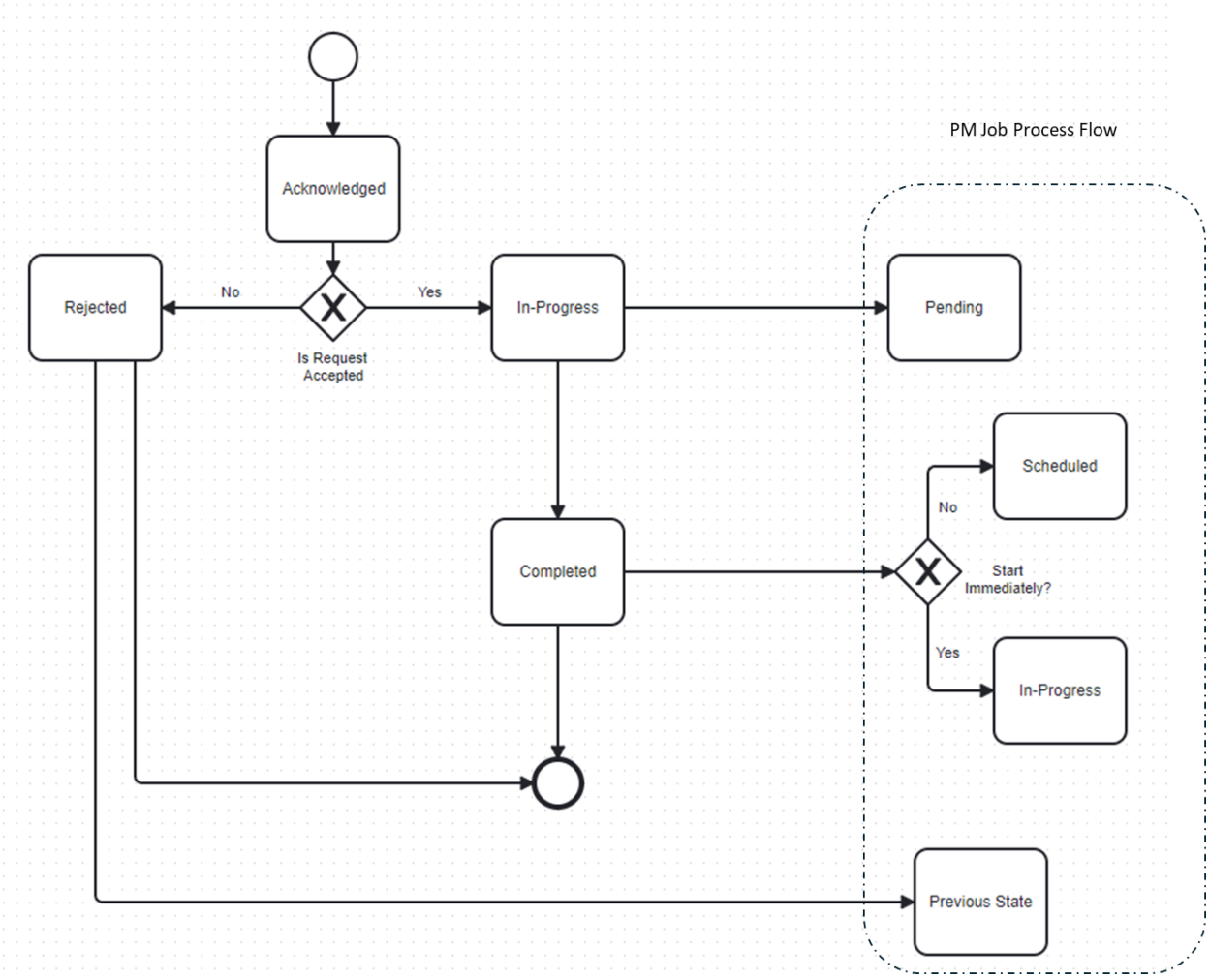
Cancelled	A Performance Monitoring Job that was In-Progress, Suspended, or Scheduled is cancelled.
Completed	A PM Job is Completed. NOTE: All results from PM Job must persist for a collection of results.
In - Progress	A PM Job is running. Upon completion of the Job, a determination if the PM Job is a one - time Job or is recurring. If the PM Job is a one - time Job, the state of the PM Job moves to the Completed state. If the PM Job is recurring, the PM Job circles back into In - Progress to determine if it has an immediate start time or a Scheduled if it has a scheduled start time. If the PM Job has a scheduled start time, it moves back to the Scheduled state. If not, it returns to In-Progress. If a Suspend PM Job request is accepted, the Job moves to the Suspended state. If a Modify PM Job request is accepted, the Job moves to the Pending state. If a Cancel PM Job request is accepted, the Job moves to the Cancelled state.
Pending	A Modify PM Job request has been accepted by the Seller/Server. The PM Job remains in the Pending state while updates to the Job are completed. Once updates are complete, the Job returns to the In – Progress or Scheduled, state.
Pending Cancel	A Cancel Performance Monitoring Job request has been accepted by the Seller/Server. The Performance Monitoring Job remains Pending Cancel while resources used by the Job are being released. Once updates are complete, the Job moves to the Cancelled status.
Resources Unavailable	A PM Job state where adequate resources are currently unavailable.
Rejected	A Create PM Job fails validation and is rejected with Rejection Indicators by the Seller/Server.
Scheduled	A PM Job is created that does not have an immediate start time. The PM Job stays in the Scheduled state until the start time is reached. The PM Job then moves to In - Progress.
Suspended	A Suspend PM Job request is accepted by the Seller/Server. The Job remains in the Suspended state until a Resume PM Job request

	is accepted by the Seller/Server at which time the Job returns to the In - Progress state.

973 **Table 95 - Performance Monitoring Profile/Job States**

974 ### 17.2.3 Modify Performance Monitoring Job Process Flow

975 The Modify PM Job process flow is described in this section.



976

977 **Figure 21 - Modify Performance Monitoring Job Process Flow**

978 ### 17.2.4 Modify Performance Monitoring Job States

979 The Modify PM Job states are defined in this section.

980

State	Description
Acknowledged	A Modify PM Job request has been received by the Seller/Server and has passed basic validation. The request remains in the Acknowledged state until all validations as applicable are completed. If the attributes are validated

	the request moves to the Accepted state. If not all attributes are valid, the request moves to the Rejected state.
Completed	The Modify PM Job is Completed.
In-Progress	The Modify PM Job request has been validated and accepted by the Seller/Server and is in-progress.
Rejected	The Modify PM Job has failed validation and been rejected by the Seller/Server.

981 **Table 96 - Modify Performance Monitoring Job States**

982 ### 17.2.5 Cancel Performance Monitoring Job Process Flow

983 The Cancel PM Job process flow is described in this section.

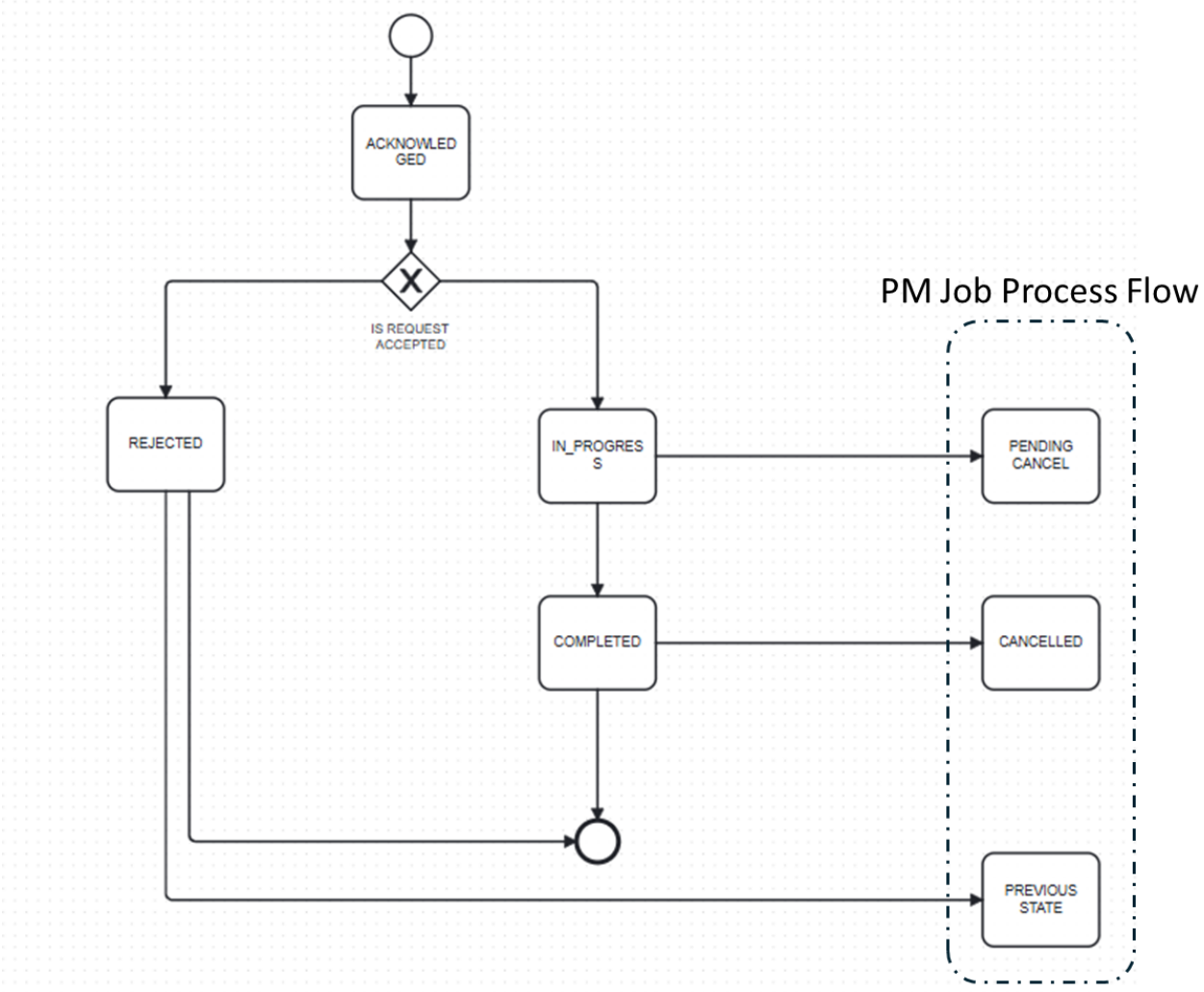


Figure 22 - Cancel Performance Monitoring Job Process Flow

State	Description
Acknowledged	A Cancel PM Job request has been received by the Seller/Server and has passed basic validation.
Completed	The Cancel PM Job request has been completed by the Seller/Server.
In-Progress	The Cancel PM Job request has been validated and accepted by the Seller/Server.
Rejected	The Cancel PM Job has failed validation and been Rejected by the Seller/Server.

Table 97 - Cancel Performance Monitoring Job States

18 References

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

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[10] International Telecommunication Union. (1992). *ITU - T Rec. X.734 (09/92) Information technology – Open Systems Interconnection – Systems Management: Event report management function*. Retrieved from https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T - REC - X.734 - 199209 - I!!PDF - E&type=items

Appendix A Performance Management Options for Proactive Provisioning

The following section discusses the two use case paths for SLS provisioning over the Legato interface. The information provided is to assist in the future API design and development. The first option is the SLS is provisioning with the Legato Service Order request given it is embedded as an attribute within the service request. An example of this is with MEF Carrier Ethernet Services. In this case the EVC or OVC has an attribute for Service Level Specification.

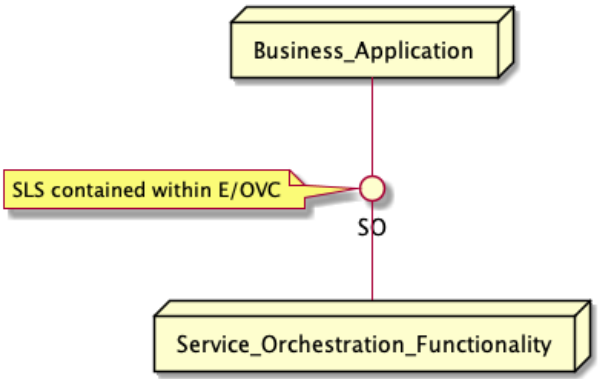

Figure 23 - SLS Activation via E/OVC Service Ordering Example

The second option for SLS activation is where the Business Application is responsible for making the SLS request as a Performance Management activation outside of the earlier mention Service Management activation.

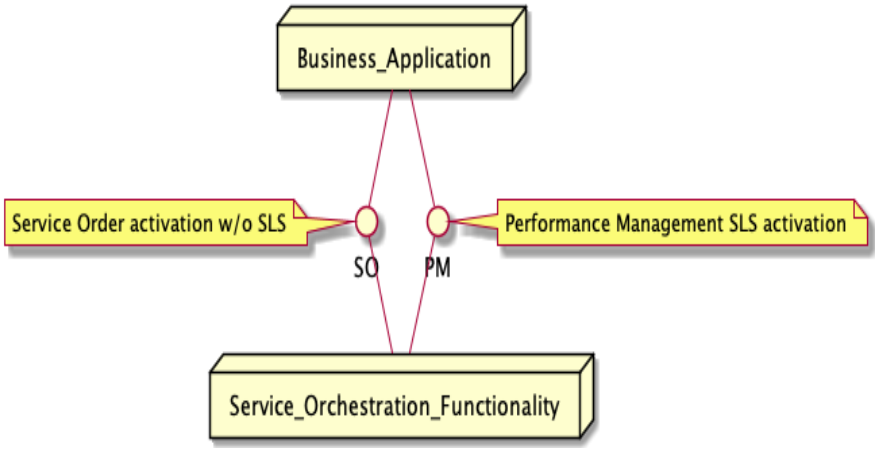

Figure 24 - SLS Activation via Legato Example

Appendix B Event Streaming – Events, Notifications, TCAs and Streams

As defined in the terminology section an event is a significant occurrence or change in system state that is important from the perspective of system administration. Other systems might be informed about these events using notifications.

From the data modeling perspective, a notification is a representation of an event that is exchanged between interested parties. A specific type of notification is Threshold Crossing Alert that is used to notify that a specific threshold or performance limit was crossed or exceeded.

The information about various types of events is available through classical pull model or using event streaming paradigm. It is worth noting that in context of pull model the term notification has a specific meaning. In essence a Notification is a certain synchronous push communication pattern that is associated with certain event that are related to the lifecycle of the object exposed via MEF APIs. It is worth noting that the volume of notifications in this context is rather low. In this document, an example of such object which uses Notifications to inform about lifecycle events is PM Job. In the reminder of this section, we will use term Message to indicate event notification exchanged through event streaming mechanisms.

An Event Streaming is a data integration and processing paradigm that deals with the ordered stream of events in real time. Event streaming platforms typically use publish and subscribe pattern. A published message (created by producer) is broadcasted to all registered subscribers (clients). Event streaming can be realized by centralized (for example Apache Kafka) or decentralized platforms. In the first case, the message exchange depends on central broker system that decouples producers and consumers, ensures reliable delivery, fault tolerance, and scalability of the solution. Broker centric architectures allow for temporal decoupling. In other words, client consumes messages asynchronously on its own pace and do not need to be active when producer pushes new messages. Certain platforms support event stream rewind that allows for subsequent processing of already consumed messages. In the latter case the communicating parties communicates directly instead of relying on central entity. This might result in simpler architectures or performance improvements. However, depending on a specific solution this might also lead to a data loss in case notification client is not available.

The choice of a particular technical solution to support event streaming might be dictated by various internal or external factors like for example a technical capability of interacting parties or security constraints. Important factors are the data volume patterns and required delivery guarantees.

Appendix C Data Formats

The collection of performance measurements because of a Performance Management Job must support multiple formats. There are reasons for different formatting of collected performance data. One reason is that the amount of collected data may be large whereby compressing the information is required. The following data formats are listed as examples – *JSON, Avro* and *Protobuf.*

C.1 JSON Formatted Data

JSON (JavaScript Object Notation, is an open standard file format and data interchange format that uses human - readable text to store and transmit data objects consisting of attribute–value pairs and arrays (or other serializable values). It is a common data format with diverse uses in electronic data interchange, including that of web applications with Seller/Servers.

C.2 Avro Formatted Data

Avro is an open - source data serialization system that helps with data exchange between systems, programming languages, and processing frameworks. Avro helps define a binary format for your data, as well as map it to the programming language of your choice.

C.3 Protobuf Formatted Data

Protocol Buffers (Protobuf) is a free and open - source cross - platform data format used to serialize structured data. It is useful in developing programs to communicate with each other over a network or for storing data. The method involves an interface description language that describes the structure of some data and a program that generates source code from that description for generating or parsing a stream of bytes that represents the structured data.

Appendix D Performance Metrics, Statistics and Reporting

This document discusses various types of performance and fault measurement techniques. An important distinction is performance and fault measurements configured and collected versus general statistics configuration and collection.

Performance measurements configured and collected for supporting Service Level Specifications are typically done using synthetic or test frames/packets injected into the bearer plane and used to measure performance metrics such as frame/packet loss, frame/packet transfer delay and inter - frame/packet delay variation.

Appendix E Streaming Additional Attributes

The following section provides additional streaming attributes that should be considered by the Buyer/Client and Seller/Server. The attributes are specific to the system or technology solution and therefore are not called out in the business requirements and use cases. These set of attributes could be part of a pre - configuration discussion or an on - boarding process. See

Field Name	Field Format	Field Description
loadInterval	Integer	Measurement interval in milliseconds.
segmentSize	<Integer,Units>	Size of substructure log.
recordRetention[9]	TimePeriod	Time period to persist the records for retrieval. The Seller/Server provides a period to persistently retain records.
recordContent[9]	String	Identifies the structure of the content. Defines the streaming type – i.e., WebSockets.
logRecordStrategy[9]	LogRecordStrategy Enum: • WHOLE_ENTITY_ON_CHANGE, • CHANGE_ONLY, • WHOLE_ENTITY_PERIODIC	Defines how the log records will be implemented by the Seller/Server or requested by the Buyer/Client. The Seller/Server provides a log record strategy for logging. The Buyer/Client can also request a methodology.
logStorageStrategy[9]	LogStorageStrategy Enum: • COMPACTED, • TRUNCATED, • FULL_HISTORY, • FULL_HISTORY_WITH_PERIODIC_BASELINE.	Defines how the log storage will be implemented by the Seller/Server or requested by Buyer/Client. The Seller/Server provides a log storage strategy for logging. The Buyer/Client can also request a methodology.

Table 98 - Streaming On - boarding Attributes

Appendix F Acknowledgements

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