# MEF Standard

# MEF 76

# Service Control Business Requirements and Use Cases

## October 2022

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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.

- Cisco
- NEC/Netcracker
- Spirent
- Verizon

# 2 Abstract

This standard defines business requirements and use cases for modifying values of service attributes elastically.

The approach in this specification is generic and can be applied to any connectivity and cloud services.

# 3 Terminology and Abbreviations

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

| Term | Definition | Reference |
|---|---|---|
| **Elastic** | An adjective used to indicate the capability to modify an active service by changing the value of one or more Service Attributes within a short Maintenance Interval. In context of this document, this term indicates the ability to modify service attribute values based on a pre-existing agreement. | MEF 47.1 [3] |
| **Elastic Product** | A product with Elastic Attributes | This document |
| **Elastic Service** | A service with Elastic Attributes | This document |
| **Elastic Service Attribute** | A service attribute which is Elastic. | This document |
| **Maximum Request Density** | Maximum number of attribute modification requests in a pre-agreed duration that a Buyer is allowed to make. | This document |
| **Modification Maintenance Interval Limit** | Maximum time interval for the Seller's delivery of the attribute (s) modification requested by a Buyer. | This document |
| **Modification Request Contact** | The person requesting Elastic Attribute Modification from Seller. | This document |
| **Notification** | A message sent from the Seller to the Buyer to inform them of an event that has occurred in regard to a Service Attribute modification. The attributes that are contained within a Notification are specified within this document. | This document |
| **Product ID** | The product identifier | This document |
| **Request** | A message passed from one party to the other that initiates a process. | MEF80 [13] |
| **Response** | A message returned by the party receiving the Request. | MEF 80 [13] |
| **Service Attribute** | Specific information that is agreed between the provider and the user of the service that describes some aspect of the service behavior or capability. | MEF 10.4 [1] |
| **Service Control** | Dynamic modifications of a service within specific bounds described in policies that are established in advance. | MEF 55.1[5] |

**Table 1: Terminology and Abbreviations**

# 4 Compliance Levels

The key words "**MUST**", "**MUST NOT**", "**REQUIRED**", "**MUST**", "**MUST NOT**", "**SHOULD**", "**SHOULD NOT**", "**RECOMMENDED**", "**NOT RECOMMENDED**", "**MAY**", and "**OPTIONAL**" in this document are to be interpreted as described in BCP 14 (RFC 2119 [15] , RFC 8174 [17]) when, and only when, they appear in all capitals, as shown here. All key words MUST be in bold text.

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

# 5 Introduction

A Product Offering is the item offered for sale in Service Provider (SP) Product Catalog. For example, 1Gbps Ethernet UNI or 10Gbps Ethernet UNI is a Product Offering. A Product Order uses a Product Offering to define the Product to be delivered. A Product instance, which is assigned a Product Identifier, is established after completion of Product Order and placed into Product Inventory.

Delivering network connectivity (i.e., traffic) among service access points described by a set of service attributes (MEF 55.1[5]) is a connectivity service. The connectivity service transporting packets or frames between two locations may consist of one or more components. For example, E-Line transporting Ethernet frames between two customer locations is a service consisting of UNIs, EVC and EVC EPs.

Qualification, quoting and ordering of new products, product modifications, and product removal at the Sonata Interface Reference Point are described in MEF 55.1 [5]. When applied to modifications of a service associated with a Product, the Sonata interface reference point allows a Buyer to enquire about the feasibility of a change, obtain a quote that sets out how the change will affect the price of the Product, and ultimately to place an order for the change.

In some cases, a Buyer may desire a more streamlined process for simple product modifications, for example to allow them to quickly respond to customer traffic growth. In this case, they can pre-agree with the Seller on the set of product attributes that can be changed, the limits on such changes, and the corresponding impact on pricing. This pre-agreement is done using the same qualification, quoting and ordering process as for the product itself, using the Sonata Interface Reference Point.

The agreed-on modifications can then later be requested using the Allegro/Interlude interface reference point, without the need for a new quoting/ordering process. Provided the request is within the pre-agreed limits, the Seller can immediately enact it and can bill the Buyer according to the pre-agreed price. This is referred to as Service Control and Service Attributes that can be modified in this way are referred to as Elastic Service Attributes. The modification request of Elastic Service Attributes may need to be completed within a certain time interval (i.e., response time) by the Seller after it is scheduled to begin. This response time is called Change Duration Target (CDT) in MEF 47.1 [3].

This specification describes business pre-requisites and use cases for the Service Control of MEF Services between a Buyer and a Seller.

# 6 Reference Architecture

LSO architecture as described in MEF 55.1 [5] depicted in **Figure 1** defines Interface Reference Points among service management entities where the Service Control can be applied. For example, the Allegro interface between Customer Application and Service Orchestration Functionality (SOF) of a Service Provider (SP) and the Interlude interface between SOFs of a SP and a Partner (P) can be used for Service Control.

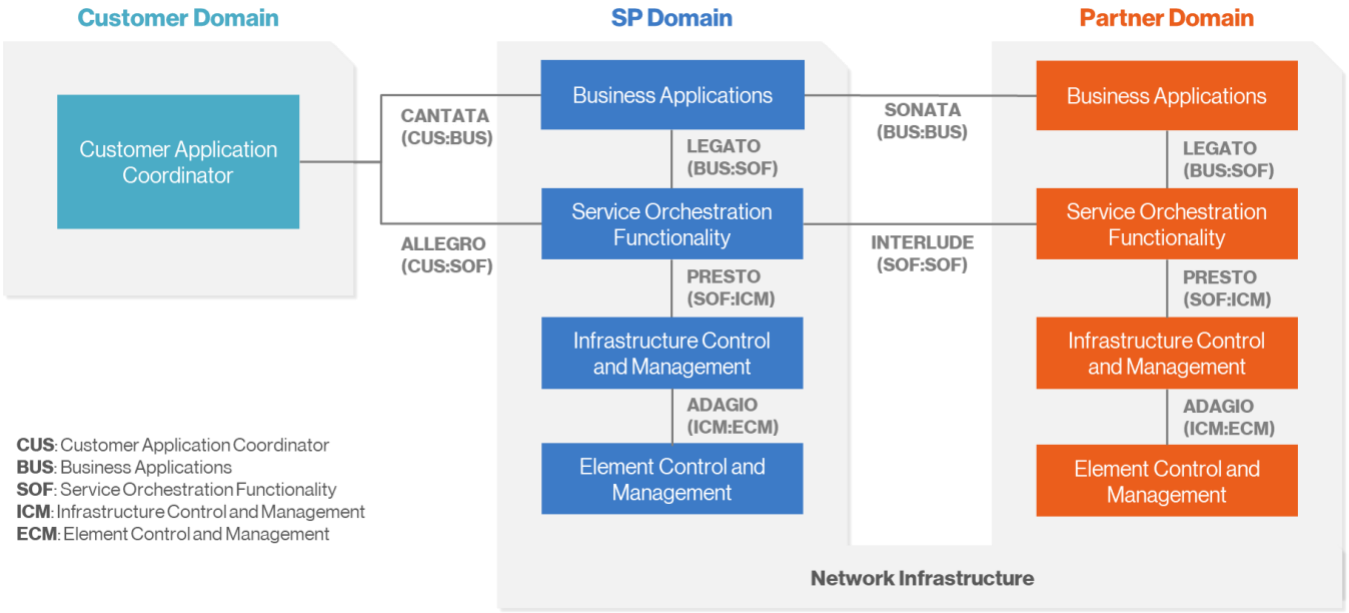


**Figure 1: LSO Reference Segment Architecture for Allegro and Interlude**

Figure 2 depicts an example for MEF Services provided by one Operator to another, Buyer and Seller. Products provided by the Seller to the Buyer are ordered using the LSO Sonata interface. Testing, performance measurements retrieval, service monitoring, and modifications to services provided by the Seller are performed over the LSO Interlude interface.

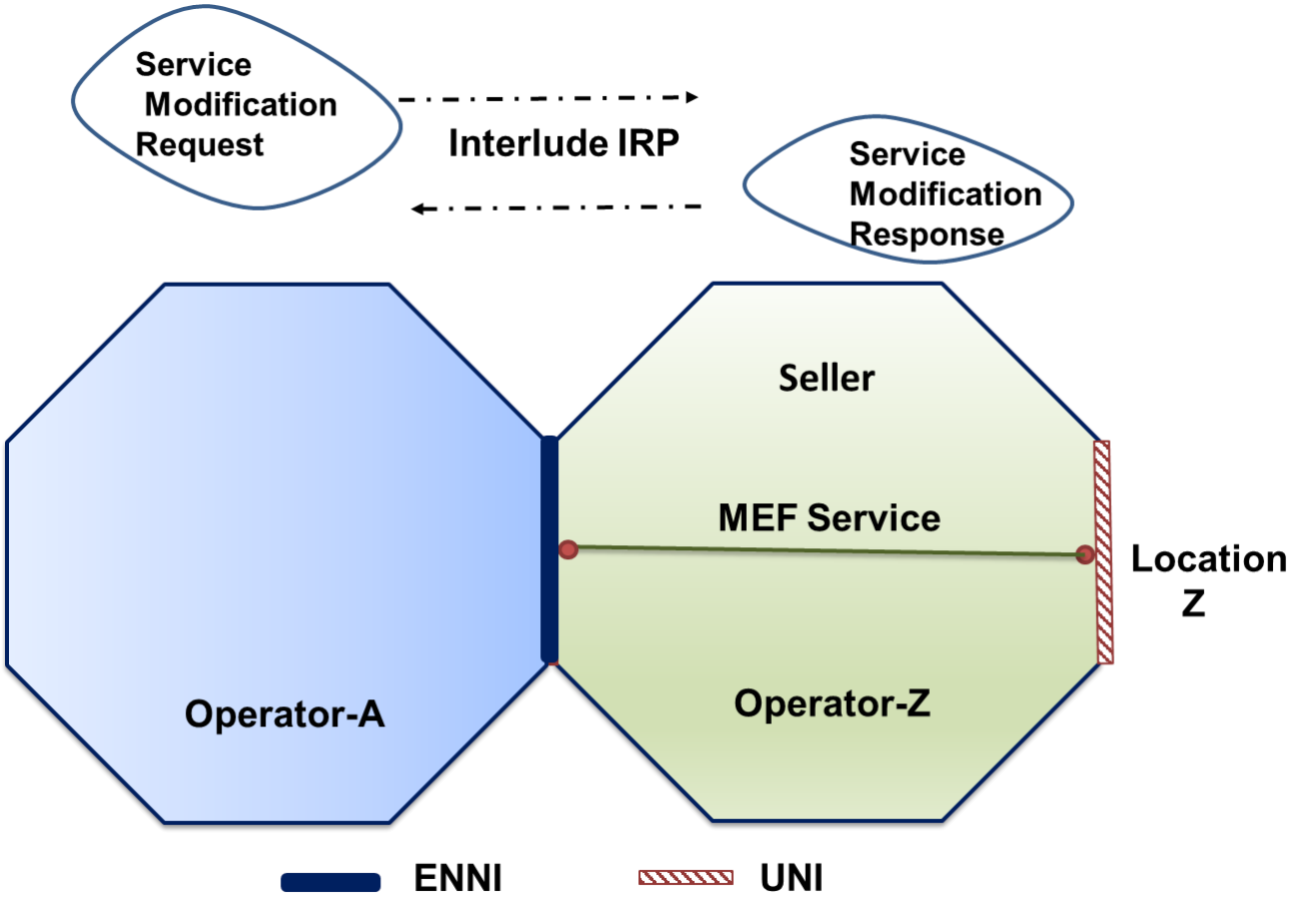


**Figure 2: An example for an MEF Service delivered by one Operator to another**

MEF Services provided by a Seller may have connectivity and application, or just a connectivity. The Service modification requests generated by the Buyer can be communicated over Allegro/Interlude to the Seller. Similarly, the Seller responses to the Buyer service modification requests can be communicated over Allegro/Interlude. Modifications of service attributes and its business impacts are expected to be governed by an agreement between the Buyer and the Seller.

In the following sections, business pre-requisites and use cases for Service Control are described. This specification is expected to be applicable to all MEF Services that are elastic.

# 7 Pre-requisites for Service Control

In order to enable Service Control for a service, a number of pre-requisites must be met, as described below.

Business level pre-requisites between the Buyer and the Seller to be captured as data elements of a service are:

- Services that are eligible for modification are agreed in advance between the Seller and the Buyer.
- An Elastic Service that the Seller provides to the Buyer is established prior to the service modification.
- Elastic Service Attributes and their values to be supported for a Service are identified in the agreement between the Buyer and the Seller during or prior to the order (see below).
- During the Buyer on-boarding process, items such as Service Level Objectives (SLOs), charges, and modifiable service attributes are agreed to between the Buyer and the Seller.
- Response time objective for the modification request of Elastic Service Attributes is identified in the agreement. The response time objective for some attributes could be longer than others. In a multiple attribute modification request, attributes with higher priorities can be modified first.

  There may be additional Service Level Objectives (SLOs) between the Buyer and the Seller described in Appendix-A.
- The modification of Elastic Service Attributes may or may not be service impacting. It is expected that the agreement between the Buyer and the Seller includes these constraints.
- Elastic Service IDs associated with a Product ID offered by Seller are retrievable prior to their modifications.
- Elastic Service Attribute Names and values for an Elastic Service in the agreement between the Buyer and the Seller are retrievable by the Buyer.
- The Buyer and Seller have agreed on a value for the Maximum Request Density, which consists of a time duration and a limit on the number of Service Attribute modification requests the Seller will accept during any time interval of that duration.

  This document identifies messages exchanged between the Buyer and the Seller. If there are additional operational steps required to modify attributes, they are out of scope of this document.

As mentioned above, one of the pre-requisites for service control is that the set of Elastic Service Attributes, and the set of values (or value ranges) that those attributes can be set to using an Attribute Modification Request, are agreed to between the Buyer and the Seller. As with any information about a service that is agreed between the Buyer and Seller, these themselves take the form of Service Attributes. An Elastic Service therefore has three categories of Service Attributes:

- Service Attributes whose value directly affects the behavior of the service. These are the "standard" set of Service Attributes common to any service, whether or not it is Elastic, such as those defined in MEF 10.4 [1], MEF 26.2 [2] or MEF 61.1 [7].

- Service Attributes that define which of the above Service Attributes are Elastic, i.e. which "standard" Service Attributes can have their values modified via Service Control. Examples of this category include the Subscriber UNI Elastic Behavior Service Attribute and the EVC EP Elastic Behavior Service Attributes, defined in MEF 47.1 [3] (sections 9.1.1.1 and 9.1.2.1 respectively) for Elastic Ethernet Services. Note that all Service Attribute values can be modified through the usual order process (see MEF 57.2 [6]); the set of Service Attributes whose values can be modified via Service Control is typically much smaller.

- Service Attributes that define the allowable values (or value ranges) that an Elastic Service Attribute can be set to using Service Control. Examples of this category include the Subscriber UNI Envelope Limits Service Attribute and the EVC EP Cos Name Ingress BWP Limits Service Attribute, defined in MEF 47.1 [3] (sections 9.1.1.2 and 9.1.2.2 respectively) for Elastic Ethernet Services.

Note that the last bullet is different from the set of values (or value ranges) that the Seller might support for a given Service Attribute, as listed in their Product Catalog. A Seller might support a wide range of different values that can be ordered, and the particular value selected might affect the price or availability of the product. However, the allowable values that can be set via Service Control once the service has been ordered and is operational is typically much smaller.

As an example, consider an EPL Service in which the EVC Maximum Frame Size is Elastic. There may be three applicable Service Attributes:

- The EVC Maximum Frame Size Service Attribute – this is the value of the maximum frame size itself, e.g. "1500 bytes". The initial value is selected at order time, and the value can subsequently be modified using Service Control.

- The EVC Elastic Behavior Service Attribute (hypothetical) – this would include "EVC Maximum Frame Size" in the value, to indicate that the service supports modifying the maximum frame size using Service Control. The value is specified at order time and cannot subsequently be modified (other than by another order).

- The EVC Maximum Frame Size Limits Service Attribute (hypothetical) – this would specify the minimum and maximum values that the maximum frame size could be set to using Service Control, e.g. minimum = 600 bytes, maximum = 2000 bytes. The value is specified at order time and cannot subsequently be modified (other than by another order).

Again, note that the last bullet describes the agreed limits on what the value can be set to for this service, using Service Control. The Seller might have other Product Offerings that support, for example, a maximum frame size up to 9000 bytes; but the EVC Maximum Frame Size Limits Service Attribute says that for this service, the Buyer and Seller have agreed that the value cannot exceed 2000 bytes, when set via an Attribute Modification Request.

# 8 Use Cases

This section describes Service Control use cases and process flows for each use case. The summary of use cases that are considered in this section as depicted in **Figure 3** are:

- Requesting Elastic modification and retrieval of Service Attribute values. Examples are:
    - Elastic modification and retrieval of Service Attribute values of Carrier Ethernet UNI in MEF 10.4 [1], Carrier Ethernet ENNI in MEF 26.2 [2], SD-WAN UNI in MEF 70.1 [11], Cloud UNI in MEF 68 [10], Cloud ENNI in MEF 68 [10], Cloud Application Interface in MEF 68 [10], L1 UNI in MEF 63 [8];
    - Elastic modification and retrieval of Service Attribute values of EVC in MEF 10.4 [1], SWVC in MEF 70.1 [11], IPVC in MEF 61.1 [7], Cloud VC in MEF 68 [10], L1 VC in MEF 63 [8]; and
    - Elastic modification and retrieval of Service Attribute values of EVC EP in MEF 10.4 [1], SWVC EP in MEF 70.1 [11], IPVC EP in MEF 61.1 [7], Cloud VC EP in MEF 68 [10], L1 VC EP in MEF 63 [8].
- Cancelling an elastic modification request scheduled for a date and time in the future.
- Registering and unregistering for Notifications.

Testing, monitoring, and requesting and retrieving performance measurements of Services are out of scope.


**Figure 3: Use Cases**

The Use Cases are grouped into three categories as shown in Figure 4:

- Retrieval of Service Attribute Values
- Retrieval of Service Attribute Value Ranges
- Modification of Elastic Service Attributes

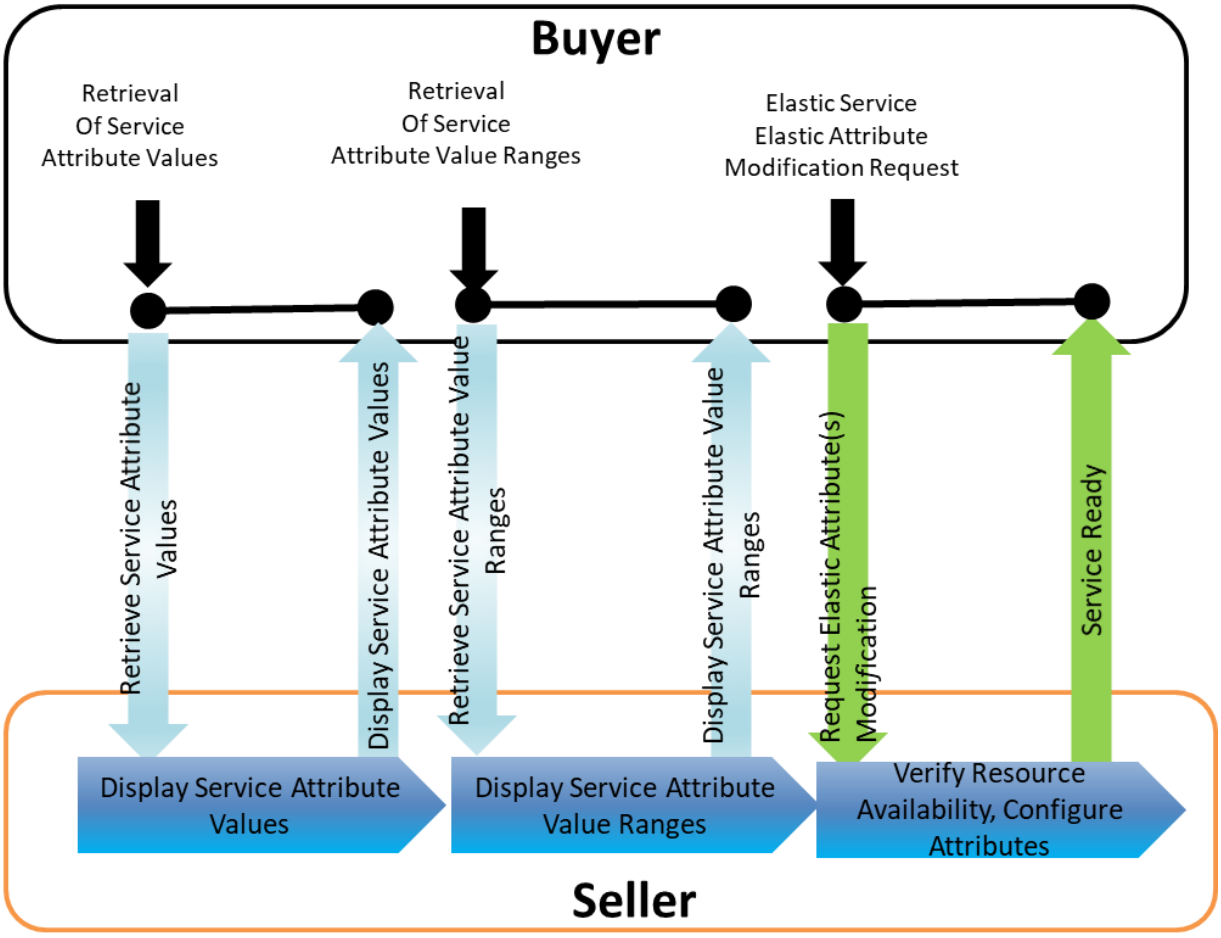


**Figure 4: Categorization of Service Control Use Cases**

The Use Cases in three categories are listed below.

| Use Case # | Use Case Name | Use Case Description |
|---|---|---|
| 1 | Retrieve Service Attribute Values | The Buyer requests the list of Service Attribute values. |
| 2 | Retrieve Service Attribute Value Ranges | The Buyer requests Service Attribute value ranges. |
| 3 | Immediate Modification of Elastic Service Attributes of an Elastic Service | The Buyer requests Immediate modification of Elastic Service Attributes of an Elastic Service from the Seller. |
| 4 | Scheduled Modification of Elastic Service Attributes of an Elastic Service | The Buyer requests Scheduled modification of Elastic Service Attributes of an Elastic Service from the Seller. |
| 5 | Retrieve Elastic Service Attribute Modification Request List | The Buyer requests the list of Elastic Service Attribute Modification Requests that match the provided filter criteria. |

| | | |
|---|---|---|
| 6 | Retrieve Elastic Service Attribute Modification by Attribute Modification Request Identifier | The Buyer requests detailed information related to an Elastic Service Attribute Modification Request based on an Attribute Modification Request Identifier. |
| 7 | Cancel Scheduled Modification of Elastic Service Attributes | The Buyer cancels Elastic Service Attribute Modification Request scheduled in the future. |
| 8 | Retrieve Cancel Attribute Modification Request List | The Buyer requests the list of Cancel Attribute Modification Requests. |
| 9 | Retrieve Cancel Attribute Modification by Cancel Attribute Modification Request Identifier | The Buyer requests detailed information related to a Cancel Attribute Modification Request based on a Cancel Modification Request Identifier. |
| 10 | Register for Notifications | A request initiated by the Buyer to instruct the Seller to send Notifications of Elastic Service Attribute Modifications. |
| 11 | Notifications | The Seller sends Notifications to the Buyer related to Elastic Service Attribute modifications. |

**Table 2: Use Cases**

In the following sections, Use Cases in **Table 2** and associated requirements are described.

## 8.1 Use Case 1 – Retrieve Service Attribute Values

| Field | Description |
|---|---|
| Use Case Number | 1 |
| Use Case Name | Retrieve Service Attribute Values |
| Description | The Buyer requests retrieving Service Attribute Values. |
| Actors | Buyer and Seller |
| Pre-Conditions | 1. The Buyer already has a Service with the Seller.<br>2. Service ID of the Service belongs to the Product identified with Product ID is known by the Buyer. |
| Process Steps | 1. The Buyer initiates retrieval of current values of Service Attributes:<br>a. $Attribute_k$ Name (k=1, 2,..,N)<br>b. $Attribute_k$ Current Value (k=1, 2,.., M)<br>as described in **Table 16** by providing Service ID.<br>2. In response to Buyer's request, the Seller returns<br>a. Buyer ID<br>b. Seller ID<br>c. Service ID<br>d. $Attribute_k$ Name (k=1, 2,..,N)<br>e. $Attribute_k$ Current Value (k=1, 2,.., M) |
| Post-Conditions | The Buyer obtains attribute values. |
| Alternative Paths | 1. The Seller rejects the request and returns an error message if Service ID is incorrect.<br>2. The Seller returns an error message if the Service ID does not contain requested Elastic Service Attributes.<br>3. The Seller returns an error message if an error is encountered while processing that prevents the Seller from completing the request. |
| Orchestration Process | Section 8.2.3 of MEF 55.1 |

**Table 3: Use Case 1 – Retrieving Service Attribute Values**

**[R_SERVICE-CONTROL_001]** The Buyer and Seller **MUST** support Use Case 1 in **Table 3**.

Note that Service Attribute values for all three categories of Service Attributes described in Section 7 are retrieved. In other words, the information returned includes the current value of the "standard" Service Attributes that directly affect the behavior of the service, as well as information about which of those Service Attributes can be modified and the possible values (or value ranges) that they can be set to using an Attribute Modification Request.

## 8.2 Use Case 2 – Retrieve Service Attribute Value Ranges

| Field | Description |
|---|---|
| Use Case Number | 2 |
| Use Case Name | Retrieve Service Attribute Value Ranges |
| Description | The Buyer requests retrieving Service Attribute Value Ranges. |
| Actors | Buyer and Seller |
| Pre-Conditions | 1. The Buyer already has a Service with the Seller.<br>2. Service ID of the Service belongs to the Product identified with Product ID is known by the Buyer. |
| Process Steps | 1. The Buyer initiates retrieval of the Service Attribute value ranges of a Service by providing the Service ID.<br>2. In response to Buyer's request, the Seller returns<br>a. Buyer ID<br>b. Seller ID<br>c. Service ID<br>d. Attribute Value Ranges such as those described in **Table 16** |
| Post-Conditions | The Buyer obtains attribute values. |
| Alternative Paths | 1. The Seller rejects the request and returns an error message if Service ID is incorrect.<br>2. The Seller returns an error message if the Service ID does not contain requested Elastic Service Attributes.<br>3. The Seller returns an error message if an error is encountered while processing that prevents the Seller from completing the request. |
| Orchestration Process | Section 8.2.3 of MEF 55.1 |

**Table 4: Use Case 2 – Retrieving Service Attribute Value Ranges**

**[R_SERVICE-CONTROL_002]** The Buyer and Seller **MUST** support Use Case 2 in **Table 5**.

Note that this Use Case is a subset of Use Case 1 in which only Service Attributes in the third of the three categories described in Section 7 are returned. A Buyer or Seller who supports use case 1 and complies with **[R_SERVICE-CONTROL_001]** therefore automatically supports use case 2 and complies with **[R_SERVICE-CONTROL_002]**.

## 8.3 Use Case 3 – Immediate Modification of Elastic Service Attributes of an Elastic Service

| Field | Description |
|---|---|
| Use Case Number | 3 |
| Use Case Name | Immediate Modification of Elastic Service Attributes of an Elastic Service |
| Description | The Buyer submits a request to the Seller for Immediate modification of values of Elastic Service Attributes belong to an Elastic Service |
| Actors | Buyer and Seller |
| Pre-Conditions | 1. The Buyer has the Service ID of the Service that they wish to modify.<br>2. Requested Elastic Service Attribute values are supported by the Seller.<br>3. The Seller supports Immediate Service Attribute Modification of the Service. |
| Process Steps | 1.The Buyer submits an Immediate Service Attribute Modification Request, consisting of<br>• Modification Request Contact information as specified in Section 8.11 of MEF 79 [12]<br>• Buyer ID per requirements in Section 8.8 of MEF 79 [12]<br>• Seller ID per requirements in Section 8.8 of MEF 79 [12]<br>• Service ID<br>• Request Type: Immediate<br>• Payload specific Attribute Names and Requested Attribute Values, as described in **Table 16**<br>2. The Seller returns an Acknowledged response<br>3. The Seller validates the Buyer Service Attribute Modification Request based on business/service validation rules and pre-conditions.<br>4. The Seller returns a response to the Buyer's request. If successful, the response includes the Attribute Modification Request ID.<br>5. The Seller determines if there are enough resources to support the request and sends the State Change Notification to the Buyer.<br>6. If configuration is successful, the Seller completes the requested modification and sends the State Change Notification to the Buyer. Optionally, the Seller may test the new configuration for example as described in MEF 48.1[4] and MEF 67 [9] before placing the request into COMPLETE state and sending the State Change Notification. |
| Post-Conditions | The modification is completed within the maximum time interval for the Seller's delivery of the attribute (s) modification, per the agreement between the Buyer and Seller (i.e., Modification Maintenance Interval Limit). |

| | |
|---|---|
| Alternative Paths | 1. The Seller rejects the request if request does not meet business/service validation rules and pre-conditions.<br>2. The Seller rejects the request if sufficient resources are not available.<br>3. If the configuration of any one of Service Attributes to the requested value fails, the request moves into FAILED state. Optionally, if testing any one of newly configured Service Attributes fails, the request moves into FAILED state. The attribute values are rolled back to the values prior to the modification request by the Seller.<br>4. The Seller returns an error message if an error is encountered while processing that prevents the Seller from completing the request. |
| Orchestration Process | Section 8.2.3 of MEF 55.1 |

**Table 5: Use Case 3 – Immediate Modification of Elastic Service Attributes**

Note that descriptions of Buyer ID and Seller ID and their usage in all types of requests are given in Sections 8.1 and 8.8 in MEF79 [12].

Note that attribute modifications can be initiated automatically based on service events instead of a request from the Buyer if there is such an agreement between Buyer and Seller. This approach is out of scope for this specification.

**[R_SERVICE-CONTROL_003]** The Buyer and Seller **MUST** support Use Case 3 in **Table 5**, and associated states and interactions among states in **Figure 5**.

**[R_SERVICE-CONTROL_004]** The Buyer and Seller **MUST** support the following attributes listed in **Table 5** and described in **Table 14** for the Service Attribute Modification Request of *Immediate Modification of Service Attributes of an Elastic Service*:

- Modification Request Contact information as specified in Section 8.11 of MEF 79 [12]
- Buyer ID per requirements in Section 8.8 of MEF 79 [12]
- Seller ID per requirements in Section 8.8 of MEF 79 [12]
- Service ID
- Request Type: Immediate

**[R_SERVICE-CONTROL_005]** The Buyer and Seller **MUST** support the following payload specific attributes for *Immediate Modification of Elastic Service Attributes of an Elastic Service*:

- Attribute Names
- Requested Attribute Values

**[R_SERVICE-CONTROL_006]** The Seller **MUST** record the date and time of the request in **Table 5** when the request is received by the Seller.

## 8.4 Use Case 4 – Scheduled Modification of Elastic Service Attributes of an Elastic Service

| Field | Description |
|---|---|
| Use Case Number | 4 |
| Use Case Name | Scheduled Modification of Elastic Service Attributes of an Elastic Service |
| Description | The Buyer submits a request to the Seller for Scheduled modification of Service Attributes' values belonging to an Elastic Service. |
| Actors | Buyer and Seller |
| Pre-Conditions | 1. The Buyer has the Service ID of the Service that they wish to modify.<br>2. Requested Elastic Service Attribute values are supported by the Seller.<br>3. The Seller supports Scheduled Service Attribute Modification of the Elastic Service. |

| | |
|---|---|
| Process Steps | 1.The Buyer submits a Scheduled Service Attribute Modification Request, consisting of<br>• Modification Request Contact information as specified in Section 8.11 of MEF79 [12]<br>• Buyer ID per requirements in Section 8.8 of MEF79 [12]<br>• Seller ID per requirements in Section 8.8 of MEF79 [12]<br>• Service ID<br>• Request Type: Scheduled<br>• Start Date and Time<br>• Payload specific Attribute Names and Requested Attribute Values, as described in **Table 16**<br>2. The Seller returns an Acknowledged response.<br>3. The Seller validates the Buyer Service Attribute Modification Request based on business/service validation rules and pre-conditions.<br>4. The Seller returns a response to the Buyer's request. If successful, the response includes the Attribute Modification Request ID.<br>5. The Seller verifies if there are enough resources to support the request, places the request into SCHEDULED state, and sends the State Change Notification to the Buyer.<br>6. When the Scheduled time arrives, the request is moved into IN-PROGRESS state. The Seller sends the State Change Notification.<br>7. If configuration is successful, the Seller completes the requested modification and sends the State Change Notification to the Buyer. Optionally, the Seller may test the new configuration for example as described in MEF 48.1[4] and MEF 67 [9] before placing the request into COMPLETE state and sending the State Change Notification.<br>8. In the SCHEDULED state, if a Cancel request is received by the Seller, the request is moved to CANCELLED state and the State Change Notification is sent to the Buyer. |
| Post-Conditions | The modification is completed.<br>Note that the attribute modification may have to be completed within the maximum time interval per the agreement between the Buyer and Seller (i.e., Modification Maintenance Interval Limit**)**. |

| | |
|---|---|
| Alternative Paths | 1. The Seller rejects the request if request does not meet business/service validation rules and pre-conditions.<br>2. If sufficient resources are unavailable, the Seller moves the request into INSUFFICENT RESOURCES state.<br>3. If the configuration of any one of Service Attributes to the requested value fails, the request moves into FAILED state. Optionally, the Seller may test the new configuration, for example as described in MEF 48.1[4] and MEF 67 [9]. If testing any one of newly configured Elastic Service Attributes fails, the request moves into FAILED state. The attribute values are rolled back to the values prior to the modification request.<br>4. If a Cancel request is received in a state other than Scheduled state, the Seller rejects the request.<br>5. The Seller returns an error message if an error is encountered while processing that prevents the Seller from completing the request. |
| Orchestration Process | Section 8.2.3 of MEF 55.1 |

**Table 6: Use Case 4 – Scheduled Modification of Elastic Service Attributes**

**[R_SERVICE-CONTROL_007]** The Buyer and Seller **MUST** support Use Case 4 in **Table 6**, and associated states and interactions among states in Figure 5.

**[R_SERVICE-CONTROL_008]** The Buyer and Seller **MUST** support the following attributes listed in **Table 6** and described in **Table 14** for *Scheduled Modification of Elastic Service Attributes of an Elastic Service*:

- Modification Request Contact information as specified in Section 8.11 of MEF79 [12]
- Buyer ID per requirements in Section 8.8 of MEF79 [12]
- Seller ID per requirements in Section 8.8 of MEF79 [12]
- Service ID
- Request Type: Scheduled
- Start Date and Time

**[R_SERVICE-CONTROL_009]** The Buyer and Seller **MUST** support the following payload specific attributes for *Scheduled Modification of Elastic Service Attributes of an Elastic Service* as described in **Table 16:**

- Attribute Names
- Requested Attribute Values

**[R_SERVICE-CONTROL_0010]** The Buyer **MUST** be able to cancel the *Scheduled Modification of Elastic Service Attributes of an Elastic Service* request while the request is in the SCHEDULED state.

**[R_SERVICE-CONTROL_0011]** The time interval between the start times of any two Service Attribute modification requests for the same Service Attribute in the same Service **MUST** be $\geq$ Modification Maintenance Interval Limit, per the agreement between Buyer and Seller.

**[R_SERVICE-CONTROL_0012]** The Seller **MUST** reject when the time interval between the start times in two Service Attribute modification requests for the same Service Attributes in the same Service is smaller than the *Modification Maintenance Interval Limit*.

**[R_SERVICE-CONTROL_0013]** The Seller **MUST** reject consecutive Service Attribute modification requests exceeding *Maximum Request Density* if, during the preceding time period of the duration specified in the *Maximum Request Density*, the number of Service Attribute modification requests received was greater than or equal to the number specified in the *Maximum Request Density*.

## 8.5 Use Case 5 – Retrieve Attribute Modification Request List

| Field | Description |
|---|---|
| Use Case Number | 5 |
| Use Case Name | Retrieve Elastic Service Attribute Modification Request List |
| Description | A request initiated by the Buyer to retrieve the list of Attribute Modification Requests. |
| Actors | Buyer/Seller |
| Pre-Conditions | The Buyer initiated one or more Attribute Modification Requests. |
| Process Steps | 1.Buyer initiates a request with the following attributes forming a filter criteria to retrieve the list of Attribute Modification Requests that have been submitted successfully:<br>• Buyer ID per requirements in Section 8.8 of MEF79 [12]<br>• Seller ID per requirements in Section 8.8 of MEF79 [12]<br>• Request Type (optional)<br>• Min and Max Request Received Date and Time (optional)<br>• Attribute Modification Request State (optional)<br>2.Seller returns a response with the following attributes for each Attribute Modification Request:<br>• Buyer ID<br>• Seller ID<br>• Request Type<br>• Attribute Modification Request Identifier<br>• Request Received Date and Time<br>• Attribute Modification Request State |
| Post-Conditions | Buyer has the list of Attribute Modification Requests. |
| Alternative Paths | 1. The Seller rejects the request if Seller ID and/or Buyer ID are incorrect.<br>2. The Seller returns an error message if an error is encountered while processing that prevents the Seller from completing the request. |
| Orchestration Process | Section 8.2.3 of MEF 55.1 |

**Table 7: Use Case 5 – Retrieve Attribute Modification Request List**

Note that the Seller may keep request records for a certain time interval after they have been completed based on the agreement between the Seller and the Buyer.

**[R_SERVICE-CONTROL_0014]** The Buyer and Seller **MUST** support Use Case 5 in **Table 7**.

## 8.6 Use Case 6 – Retrieve Attribute Modification by Attribute Modification Request ID

| Field | Description |
|---|---|
| Use Case Number | 6 |
| Use Case Name | Retrieve Elastic Service Attribute Modification by Attribute Modification Request ID |
| Description | The Buyer requests detailed information related to an Elastic Service Attribute Modification by Attribute Modification Request ID. |
| Actors | Buyer/Seller |
| Pre-Conditions | The Buyer has a valid Attribute Modification Request ID. |
| Process Steps | 1. Buyer initiates a request to retrieve the details of a request with Attribute Modification Request ID that has been submitted successfully.<br>2.Seller returns a response with the following attributes:<br>• Modification Request Contact information as specified in Section 8.11 of MEF79 [12]<br>• Seller ID per requirements in Section 8.8 of MEF79 [12]<br>• Buyer ID per requirements in Section 8.8 of MEF79 [12]<br>• Service ID<br>• Attribute Modification Request ID<br>• Request Type which is either Immediate or Scheduled<br>• Start Date and Time[1]<br>• Request received Date and Time<br>• Attribute Names<br>• Requested Attribute Values<br>• State of the Attribute Modification Request<br>• Date and Time of State Change |
| Post-Conditions | Buyer has detailed information about the Attribute Modification identified by the Attribute Modification Request ID. |
| Alternative Paths | 1. The Seller rejects the request if Attribute Modification Request ID is incorrect.<br>2. The Seller returns an error message if an error is encountered while processing that prevents the Seller from completing the request. |
| Business Process | Section 8.2.3 of MEF 55.1 |

**Table 8: Use Case 6 – Retrieve Attribute Modification Request ID**

[1] Start Date and Time are an attribute of Scheduled Service Attribute Modification Request as described in Use Case 3. On the other hand, Start Date and Time are not an attribute of Immediate Service Attribute Modification Request, but is recorded by the Seller at the time of request. Therefore, for both request types, the status retrieval provides Start Date and Time.

**[R_SERVICE-CONTROL_0014]** The Buyer and Seller **MUST** support Use Case 6 in **Table 8**.

## 8.7 Use Case 7 – Cancelling Scheduled Modification of Elastic Service Attributes

| Field | Description |
|---|---|
| Use Case Number | 7 |
| Use Case Name | Cancel Scheduled Modification of Elastic Service Attributes |
| Description | The Buyer requests cancelling Scheduled request for modifying Elastic Service Attributes. |
| Actors | Buyer/Seller |
| Pre-Conditions | The Buyer already has a request with Attribute Modification Request ID to modify Service Attributes of an Elastic Service scheduled in the future. |
| Process Steps | 1. The Buyer submits a Cancel Attribute Modification request with attributes in **Table 17** including Attribute Modification Request ID in the request.<br>2. Seller validates the request.<br>3. Seller cancels the request identified with Attribute Modification Request ID. |
| Post-Conditions | Scheduled Service Attribute modification request is cancelled. |
| Alternative Paths | 1. The Buyer receives an error message if there is an error in the process.<br>2. The Sellers rejects the request if the request fails the business validation.<br>3. The Seller rejects the request if the attribute modification request is not in SCHEDULED state. |
| Orchestration Process | Section 8.2.3 of MEF 55.1 |

**Table 9: Use Case 7 – Cancelling Scheduled Modification Request of Elastic Service Attributes**

**[R_SERVICE-CONTROL_0015]** The Seller **MUST** support Use Case 7 in **Table 9** and associated states and interactions among states in Figure 5 and Figure 6.

**[R_SERVICE-CONTROL_0016]** The Buyer **MUST** be able to cancel the *Scheduled Modification of Elastic Service Attributes of an Elastic Service* request after it is initiated and while the request is in SCHEDULED state.

**[R_SERVICE-CONTROL_0017]** The Seller **MUST** reject the request for cancelling the *Scheduled Modification of Elastic Service Attributes of an Elastic Service* request after it is initiated if the request is not in SCHEDULED state.

## 8.8 Use Case 8 – Retrieve Cancel Attribute Modification Request List

| Field | Description |
|---|---|
| Use Case Number | 8 |
| Use Case Name | Retrieve Cancel Attribute Modification Request List |
| Description | A request initiated by the Buyer to retrieve the list of Cancel Attribute Modification Requests. |
| Actors | Buyer/Seller |
| Pre-Conditions | The Buyer initiated one or more Cancel Attribute Modification Requests |
| Process Steps | 1.Buyer initiates a request to retrieve the list of Cancel Attribute Modification Requests that have been submitted successfully.<br>• Min and Max Request Received Date and Time (optional)<br>• Attribute Modification Request ID (optional)<br>2.Seller returns a response with Cancel Request ID, and none or more of the following attributes for each Cancel Request:<br>• Buyer ID per requirements in Section 8.8 of MEF79 [12]<br>• Seller ID per requirements in Section 8.8 of MEF79 [12]<br>• Attribute Modification Request Identifier<br>• Cancel Attribute Modification Request State<br>• Request Received Date and Time<br>Cancellation Reason Type |
| Post-Conditions | Buyer has the list of Cancel Attribute Modification Requests |
| Alternative Paths | 1. The Seller rejects the request if Buyer ID and/or Seller ID are incorrect.<br>2. The Seller returns an error message if an error is encountered while processing that prevents the Seller from completing the request. |
| Orchestration Process | Section 8.2.3 of MEF 55.1 |

**Table 10: Use Case 8 – Retrieve Cancel Attribute Modification Request List**

**[R_SERVICE-CONTROL_0015]** The Buyer and Seller **MUST** support Use Case 8 in **Table 10**.

## 8.9 Use Case 9 – Retrieve Cancel Attribute Modification Request

| Field | Description |
|---|---|
| Use Case Number | 9 |
| Use Case Name | Retrieve Cancel Attribute Modification Request by Cancel Attribute Modification Request Identifier |
| Description | The Buyer requests detailed information related to a cancelled Attribute Modification Request by Cancel Attribute Modification Request Identifier. |
| Actors | Buyer/Seller |
| Pre-Conditions | The Buyer has a valid Cancel Attribute Modification Request Identifier. |
| Process Steps | 1. Buyer initiates a request to retrieve the details of a request with Cancel Attribute Modification Request Identifier that has been submitted successfully.<br>2.Seller returns a response with the following attributes:<br>• Modification Request Contact information as specified in Section 8.11 of MEF79 [12]<br>• Buyer ID per requirements in Section 8.8 of MEF79 [12]<br>• Seller ID per requirements in Section 8.8 of MEF79 [12]<br>• Cancel Request ID<br>• Attribute Modification Request Identifier<br>• Cancel Attribute Modification Request State<br>• Cancellation Reason Type<br>• Request Received Date and Time |
| Post-Conditions | Buyer has the list of Cancel Attribute Modification Requests |
| Alternative Paths | 1. The Seller rejects the request if Buyer ID and/or Seller ID are incorrect.<br>2. The Seller returns an error message if an error is encountered while processing that prevents the Seller from completing the request. |
| Orchestration Process | Section 8.2.3 of MEF 55.1 |

**Table 11: Use Case 9 – Retrieve Cancel Attribute Modification Request List**

**[R_SERVICE-CONTROL_0016]** The Buyer and Seller **MUST** support Use Case 9 in **Table 11**.

## 8.10 Use Case 10 – Register for Notifications

| Field | Description |
|---|---|
| Use Case Number | 10 |
| Use Case Name | Register for Notifications in **Table 20** |
| Description | A request initiated by the Buyer to instruct the Seller to send Notifications when an Attribute Modification Request is received and/or an Attribute Modification Request state change occurs |
| Actors | Buyer/Seller |
| Pre-Conditions | The Seller supports Notifications. |
| Process Steps | 1.The Buyer sends the Register for Notifications Request to the Seller specifying attributes in **Table 19**.<br>2. The Seller receives the Register for Notifications Request.<br>3. The Seller records where to send such Notifications for this Buyer.<br>4. The Seller acknowledges the Buyer request.<br>5. The Seller begins sending Notifications to the Buyer. |
| Post-Conditions | Seller knows where to send Notifications to. |
| Alternative Paths | The Buyer receives an error message if there is an error in the process. |
| Orchestration Process | Section 8.2.3 of MEF 55.1 |
| | |

**Table 12: Use Case 10 – Registering for Notifications**

**[R_SERVICE-CONTROL_0017]** The Seller **MUST** support Use Case 10 in **Table 12**.

**[R_SERVICE-CONTROL_0018]** The Buyer **MUST** be able to register for Notifications associated with modifications of Service Attributes as described in **Table 20**.

**[R_SERVICE-CONTROL_0019]** The Buyer **MUST** be able to unregister for Notifications that were registered before by the Buyer.

## 8.11 Use Case 11 – Notifications

| Field | Description |
|---|---|
| Use Case Number | 11 |
| Use Case Name | Notifications |
| Description | The Seller sends Notifications to the Buyer. |
| Actors | Buyer/Seller |
| Pre-Conditions | The Buyer subscribes for Notifications with appropriate credentials. |
| Process Steps | The Seller sends Notifications subscribed by the Buyer consisting of attributes in **Table 20**. |
| Post-Conditions | The Buyer receives Notifications. |
| Alternative Paths | 1. The Seller receives an error message if there is an error in the process.<br>2. If the Buyer endpoint (i.e., address specified by the Buyer to receive Notifications) is unreachable, error is returned to the Seller. The Seller may, at the Seller's discretion, continue to try to send Notifications to the endpoint or may mark that endpoint as failed and stop sending Notifications to that end-point. |
| Orchestration Process | Section 8.2.3 of MEF 55.1 |

**Table 13: Use Case 11 – Notifications**

**[R_SERVICE-CONTROL_0020]** The Seller and Buyer **MUST** support Use Case 11 in **Table 13**.

**[R_SERVICE-CONTROL_0021]** The Seller **MUST** only send Notifications if the Buyer has subscribed to Notifications.

# 9 Service Control Attributes

Service Control Attributes for retrieving and modifying are listed in tables below.

**Table 14** describes payload independent attributes.

| Common Attributes | Description | Type |
|---|---|---|
| **Buyer ID** | The unique identifier of the organization that is acting as the Customer in this transaction (MEF79 [12] Section 8.8). It is assigned by the Seller. | String |
| **Seller ID** | The unique identifier of the organization that is acting as the supplier in this transaction (MEF79 [12] Section 8.8). It is assigned by the Seller. | String |
| **Product ID** | The product identifier | String |
| **Service ID** | The identifier of a Service | String |
| **Request Type** | Type of Service Attribute Modification Request that takes values of Immediate or Scheduled | String |
| **Modification Request ID** | The identifier of Service Attribute Modification Request | String |
| **Modification Request Contact information** | Modification Request Contact information as specified in Section 8.11 of MEF79 [12] | String |
| **Start Date and Time** | Start Date and Time for Elastic Service Attribute Modification | Date and Time |
| **Request Received Date and Time** | Date and Time for the Modification of Service Attributes request received by the Seller | Date and Time |
| **Payload Specific Attributes** | Attributes that come from Product Schema such as those in MEF 106 [14]. See **Table 15** and **Table 16** for examples. | |

**Table 14: Example Service Control Payload Independent Attributes**

Start Date and Time in **Table 14** are to be retrieved for both Immediate and Scheduled Modifications.

**Table 15** and **Table 16** show payload specific attributes.

| Service Control Payload Dependent Attributes | Description | Type |
|---|---|---|
| **Attribute$_K$ Name (k=1,…, M)** | Name of Attribute$_K$ | String |
| **Requested Attribute$_k$ Value (k=1,...,N)** | Requested Value of Attribute$_K$ | Payload Specific |
| **Attribute$_k$ Current Value (k=1,2,…, S)** | Attribute$_k$ value before the modification request | Payload Specific |

**Table 15: Service Control Payload Dependent Attributes in an Attribute Modification Request**

| Service Control Payload Dependent Attributes | | Description | Type |
|---|---|---|---|
| **Attribute Value Ranges** | **Attribute$_k$ Minimum Value (k=1,2,…, M)** | Minimum value of Attribute$_k$ that a Buyer can request from the Seller | Integer |
| | **Attribute$_k$ Maximum Value(k=1,2,…, N)** | Maximum value of Attribute$_k$ that a Buyer can request from the Seller | Integer |
| | **Attribute$_k$ Incremental Value (k=1,2,…, S)** | Incremental value of Attribute$_k$ that a Buyer can request from the Seller.<br>The Buyer can request an Attribute$_k$ value which is Minimum value of Attribute$_k$ + Incremental values of Attribute$_k$ that is less than or equal to the Maximum value of Attribute$_k$. | Integer |
| | **List of Attribute$_k$ Values (k=1,2,…, S)** | List of Attribute$_k$ values that a Buyer can request from the Seller.<br>The Seller may choose to list allowable Attribute$_k$ values instead of listing Maximum, Minimum and Incremental values for Attribute$_k$ that Buyer can request. | Integer |

**Table 16: Example Service Control Payload Dependent Service Attributes for Specifying Allowed Value Ranges of Elastic Service Attributes**

Note that the Buyer might track whether the Seller enacts each request within the agreed *Modification Maintenance Interval Limit*, and that this might form part of the SLO between the Buyer and the Seller.

# 10 Cancel Attribute Modification Request Attributes

The Cancel Attribute Modification Request attributes are detailed in **Table 17**.

| Attribute | Description | Type | Comments |
|---|---|---|---|
| Cancel Attribute Modification Request ID | Unique identifier for the Cancel Attribute Modification Request that is generated by the Seller when the Cancel Attribute Modification Request is acknowledged via an API | Identifier | Provided by the Seller |
| Attribute Modification Request ID | Unique identifier for the Attribute Modification Request that is generated by the Seller when the Attribute Modification Request is initially accepted via an API. | Identifier | Value is set by the Buyer using Seller specified Attribute Modification Request Identifier that is to be cancelled. |
| Cancel Attribute Modification Request State | The state is used to convey the Cancel Attribute Modification Request status during the lifecycle of the Attribute Modification Request. | SCHEDULED | Set by the Seller |
| Cancel Attribute Modification Request Contact | Identifies the name of the person or office that is responsible for the Cancel Request within the Buyer's organization. | Cancel Attribute Modification Request Contact information as specified in Section 8.11 of MEF79 [12] | Set by Buyer |
| Seller Contact | Identifies the name of the person or office that is responsible from Elastic Services. | Attribute Modification Request Contact information as specified in Section 8.11 of MEF79 [12] | Set by Seller |
| Request Received Date and Time | Date and Time for the Cancel Modification | Date and Time | Set by Seller |

| Attribute | Description | Type | Comments |
|---|---|---|---|
| | Request received by the Seller | | |
| Cancellation Reason Type | Identifies the type of reason, Technical or Commercial, for the Cancellation Request | One of:<br>• TECHNICAL<br>• COMMERCIAL | Set by the Buyer |
| Cancellation Reason | An optional attribute that allows the Buyer to provide additional detail to the Seller on their reason for cancelling the Attribute Modification Request | String | Set by the Buyer. |
| Cancellation Denied Reason | If the Cancel Attribute Modification Request is denied by the Seller, the Seller provides a reason to the Buyer using this attribute. | String | Set by the Seller |

**Table 17: Cancel Attribute Modification Request Attributes**

# 11 State Machines of Service Attribute Modification Request

This section describes state machines and states of the Elastic Service Attribute Modification Request.

State machines for the Elastic Service Attribute Modification Request are depicted in **Figure 5** and **Figure 6**.

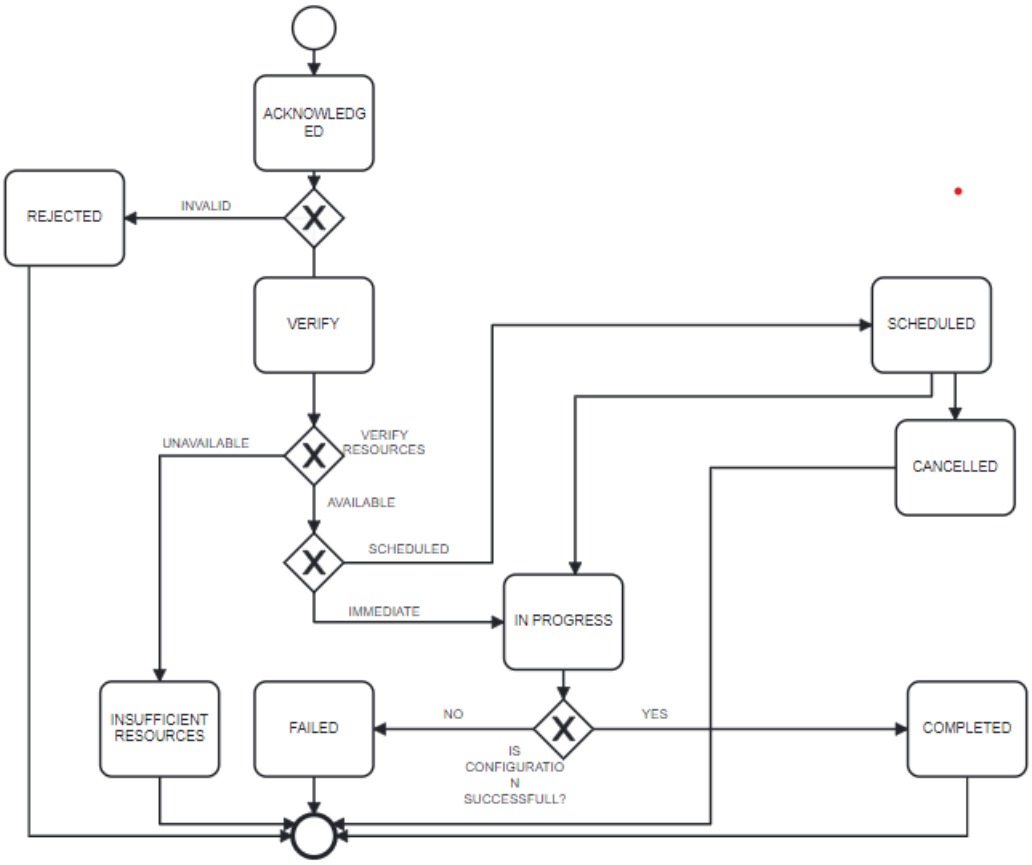


**Figure 5: State Diagram for Elastic Service Attribute Modification Request**

**Figure 6** depicts the state machine for cancelling a Scheduled request.

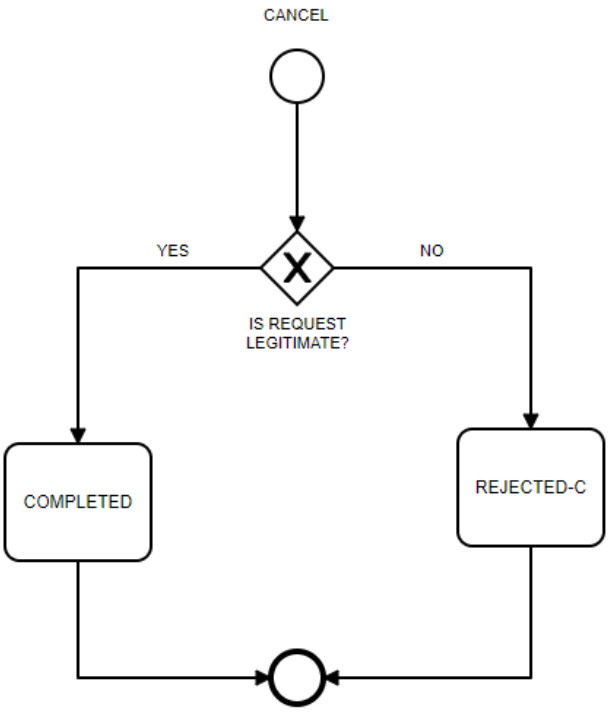


**Figure 6: State Diagram for Cancel Request received in Scheduled State of Service Attribute Request**

The process steps for Immediate Modification of Service Attributes based on the state diagram in **Figure 5** are as follows:

1. Buyer initiates a request for Immediate Modification of Service Attributes.
2. Seller authenticates the Buyer and acknowledges the request by sending the Acknowledgement Notification.
3. Seller validates the request by verifying parameters in the request (e.g., if requested attributes are within the range supported). If the request is not valid, the request moves into REJECTED state and the Seller sends the State Change Notification to the Buyer. If it is valid, an Attribute Modification Request ID is assigned to the request. The request moves into VERIFY state. The Seller sends the State Change Notification to the Buyer and verifies availability of its resources.
4. If resources are not available, the request moves into INSUFFICIENT RESOURCES state and the Seller sends the State Change Notification to the Buyer. If resources are available, the request moves into IN-PROGRESS state for configuring attributes to the requested values, and the Seller sends the State Change Notification to the Buyer.
5. If the configuration of attributes is unsuccessful, the request moves into FAILED state and the State Change Notification is sent to the Buyer.

   At this step, we assume that the attribute values prior to this attribute modification request are restored by the Seller after the request is failed.

6. If the configuration of attributes is successful, the request moves into COMPLETED state. The State Change Notification is sent to the Buyer. Optionally, the Seller may test the configured attributes, for example as described in MEF 48.1[4] and MEF 67 [9] before moving the request into COMPLETED state if the configured attributes pass testing. If the configured attributes fail testing, the request moves into FAILED state.

The process steps for Scheduled Modification Request of Elastic Service Attributes of an Elastic Service based on the state diagram in **Figure 5** are as follows:

1. Buyer initiates a request for Scheduled Modification of Service Attributes.
2. Seller authenticates the Buyer and acknowledges the request by sending an Acknowledgement Notification.
3. Seller validates the request by verifying parameters in the request (e.g., if requested attributes are within the range supported). If the request is not valid, the request moves into REJECTED state and the Seller sends the State Change Notification to the Buyer. If it is valid, an Attribute Modification Request ID is assigned to the request. The request moves into VERIFY state. The Seller sends the State Change Notification to the Buyer and verifies availability of its resources.
4. If resources are not available, the request moves into INSUFFICIENT RESOURCES state and Seller sends the State Change Notification to the Buyer. If resources are available, the request moves into SCHEDULED state, and the Seller sends the State Change Notification to the Buyer.
5. In the SCHEDULED state, if Cancel Request is received, the request moves into CANCELLED state. If there is no Cancel Request received, the request moves into IN-PROGRESS state when the scheduled time arrives. The Seller re-verifies if resources are available.
    a. If resources are unavailable, the request moves into FAILED state. The Seller sends the State Change Notification to the Buyer. The attribute values prior to this attribute modification request are restored by the Seller after the request is failed.
    b. If resources are available, the Seller configures attributes to the requested values.
6. If the configuration of attributes is successful, the request moves into COMPLETED state and the State Change Notification is sent to the Buyer. Optionally, the Seller may test the configured attributes, for example as described in MEF 48.1[4] and MEF 67 [9] before moving the request into COMPLETED state if the configured attributes pass testing. If the configured attributes fail testing, the request moves into FAILED state.

The process steps for the cancellation of Scheduled Modification Request based on **Figure 6** are as follows:

1. In the SCHEDULED state, the Buyer can request cancelling the request. If the Cancel request is initiated by the Buyer as depicted in **Figure 6**, a Cancel Request ID is assigned to the request by the Seller and the request moves into CANCELLED state.
2. In the CANCELLED state, if the Cancel request is valid, the Cancel request is executed and the request moves into COMPLETED state. At the same time, the Scheduled Modification of Service Attributes request is moved into CANCELLED state. The state Change Notification is sent to the Buyer.

3. If the Cancel request is not valid, the Cancel request moves into REJECTED state. The Seller sends the State Change Notification for the Cancel request and moves the Scheduled Modification of Service Attributes request back into the SCHEDULED state.

States in **Figure 5** and **Figure 6** are described in **Table 18**[2].

| State | Description |
|---|---|
| ACKNOWLEDGED | Buyer's request has been received by the Seller and has passed basic validation. The request is assigned to the ACKNOWLEDGED state. The request remains in the ACKNOWLEDGED state while business validation is completed. If the request parameters are validated, the request moves into the VERIFY state. If not validated, the request moves to the REJECTED state. |
| VERIFY | After the request is acknowledged, the request is assigned to VERIFY state. In this state, the Seller verifies its resources to see if the requested modification can be supported. If there are not enough resources to support the request, the request moves into INSUFFICIENT RESOURCES state. |
| IN-PROGRESS | If the Buyer's attribute modification request is immediate, the request is moved into IN-PROGRESS state after verifying resource availability in VERIFY state. In IN-PROGRESS state, the Seller processes the request. Requested attribute values are configured and maybe tested in this state. |
| SCHEDULED | If the Buyer's attribute modification request is scheduled for a date and time in the future, the request is moved into SCHEDULED state after verifying resource availability in VERIFY state. At the request scheduled date and time, if there is no cancellation, the request moves into IN-PROGRESS state. |
| COMPLETED | If new attribute values are configured successfully in IN-PROGRESS state or the cancel request is successful, the request is moved into COMPLETED state. The service with new attribute values is ready for the Buyer to use if the request is successfully implemented. If the request is cancelled, the service with attribute values prior to the request is ready for the Buyer. This is a terminal state. |
| REJECTED | If the request fails business validation or request validation. The request is moved into REJECTED state. This is a terminal state. |
| INSUFFICIENT RESOURCES | While the request is in VERIFY state, the Seller identifies that there are not enough resources to support the request, the request is moved into INSUFFICIENT RESOURCES state. This is a terminal state. |

[2] A mapping of these states to those in MEF 47.1 [3] is given in Appendix B.

| | |
|---|---|
| FAILED | The Seller fails configuring attributes to requested values. This is a terminal state. |
| CANCELLED | The Buyer cancels an attribute modification request scheduled for a future date and time while the request is in SCHEDULED state. The request moves into CANCELLED state if it is cancelled. This is a terminal state. |

**Table 18: States of Service Attribute Modification Request**

**[R_SERVICE-CONTROL_0016]** For the elastic modifications of Service Attributes, the Seller **MUST** support the states described in **Table 18**.

# 12 Notifications

This section describes requirements and attributes of the Notifications associated with states in **Table 18.**

The Seller returns State Change Notifications to indicate changes in Attribute Modification Request states.

**Table 19** describes Buyer attributes to subscribe and unsubscribe these Notifications.

| Attribute | Description | Type | Comments |
|---|---|---|---|
| Return Address Information | The detailed information on the mechanism and address specifying where the Seller is to send Notifications. There can be multiple addresses for one Buyer. | | The address could be addresses of Buyer Contacts provided by the Buyer or URL for the Customer. |
| List of Notification Types | Types of Notifications that the Buyer wishes to receive. | State Change Notification | |
| Action | Specification to Start Notifications or Stop Notifications. | • START<br>• STOP | For START, return address and Notification type are required.<br>For STOP, Notification type is required. |

**Table 19: Register and Unregister for Notifications Buyer Attributes**

**[R_SERVICE-CONTROL_0017]** State Change Notification **MUST** be generated by the Seller whenever a state change as described in Section 11 occurs.

**[O_SERVICE-CONTROL_001]** The Buyer **MAY** register for the State Change Notification.

**[R_SERVICE-CONTROL_0018]** The Seller **MUST** support Notification registration attributes in **Table 19**.

**Table 20** describes attributes for Notifications created by the Seller.

| Attribute | Description | Type | Comments |
|---|---|---|---|
| Request Identifier | Unique identifier that is generated by the Seller when the Seller receives a Request from the Buyer | Identifier | Provided by the Seller |

| | | | |
|---|---|---|---|
| Notification Identifier | Unique identifier that is generated by the Seller for this notification | Identifier | Provided by the Seller |
| Notification Type | Types of Notifications | State Change Notification | |

**Table 20: Seller Notification Attributes**

**[R_SERVICE-CONTROL_0019]** The Seller **MUST** support Notification attributes in **Table 20**.

**[R_SERVICE-CONTROL_0020]** After the Buyer receives State Change Notifications, the Buyer **MUST** be able to retrieve the status of the request as defined in Use Case 6 in **Table 8.**

# 13 Responses

Requirements for Seller responses associated with Use Case 2 in **Table 4** are described below.

**[R_SERVICE-CONTROL_0021]** The Seller response for retrieving all Elastic Service Attributes in Use Case 2 **MUST** contain one of the following set of attributes:

Set A:

- Service ID
- Attribute Names
- List of Attribute Values per Attribute Name

Set B:

- Service ID
- Attribute Names
- Maximum Value per Attribute Name
- Minimum Value per Attribute Name
- Incremental Value per Attribute Name

Note that Set A attributes are for Sellers with a list of attribute values for a given attribute that the Buyer can request from while Set B attributes are for Sellers with maximum, minimum and incremental values for a given attribute that the Buyer can use in determining the attribute value to request.

# 14 References


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

[2] MEF 26.2, *External Network Network Interfaces (ENNI) and Operator Service Attributes*, August 2016

[3] MEF 47.1, *Elastic Ethernet Services & Cloud Connectivity*, October 2020

[4] MEF 48.1, *Ethernet Service Activation Testing*, February 2020

[5] MEF 55.1, *Lifecycle Service Orchestration (LSO): Reference Architecture and Framework*, January 2020

[6] MEF 57.2, *Product Order Management Requirements and Use Cases*, October 2022

[7] MEF 61.1, *IP Service Attributes*, May 2019

[8] MEF 63, *Subscriber Layer 1 Service Attributes*, August 2018

[9] MEF 67, *Service Activation Testing for IP Services*, December 2020

[10] MEF 68, *Cloud Services Architecture*, September 2021

[11] MEF 70.1, *SD-WAN Service Attributes and Service Framework*, November 2021

[12] MEF 79, *Address, Service Site, and Product Offering Qualification Management Requirements and Use Cases*, November 2019

[13] MEF 80, *Quote Management Requirements and Use Cases*, July 2021

[14] MEF 106, *LSO Sonata Access E-Line Product Schemas and Developer Guide*, September 2022

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

[16] IETF RFC 3339, *Date and Time on the Internet: Timestamps*, July 2002. Copyright © 2002 IETF Trust and the persons identified as the document authors. All rights reserved.

[17] IETF RFC 8174, *Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words*, May 2017. Copyright © 2017 IETF Trust and the persons identified as the document authors. All rights reserved.

# Appendix A Appendix A – Service Level Objectives for Service Control

Service Level Objectives (SLOs) for service modification transactions are expected to be identified in the agreement between Buyer and Seller. For example, the percentage of the number of Buyer valid modification requests that are successfully delivered by the Seller can be subject to a SLO.

Charges for each Service attribute values can be identified in the agreement between Buyer and Seller. Determining charges at the time of modification request is outside the scope of this document.

Operational policies between the Buyer and the Seller for the modification of service attributes can be identified in the agreement. Examples of operational policies are whether an attribute modification is to be performed in-service or out-of-service and time interval for readiness of the service with new attribute values (i.e., time from the customer request for service modification to the modified service available for usage).

# Appendix B Appendix B – Mapping of Service Control States

MEF 47.1 [3] specifies the required behavior of the Ethernet SP or Operator when handling Service Modification Requests in terms of a state machine. A mapping of the states in MEF 47.1 [3] and the states defined in this document is given in Table 21.

The following states defined in MEF 47.1 [3] do not have a corresponding state in this specification:

- Initial Change Process
- Periodic Change Process
- Wait Revert
- Wait Reverting Periodic Revert
- Reverting Periodic Revert Process

| Service Control State in this Document | MEF 47.1 States |
|---|---|
| ACKNOWLEDGED | Check Valid |
| VERIFY | Is Valid |
| IN-PROGRESS | One-Time Change Process |
| SCHEDULED | Accepted |
| COMPLETED | Active Timeout |
| INSUFFICIENT RESOURCES | No Equivalent State |
| REJECTED | No Equivalent State |
| FAILED | Active Timeout |
| CANCELLED | Active Timeout |

**Table 21: Service Control States Mapping**