Technical Specification

MEF W99 v0.5

LSO Legato Interface Implementation Specification for Service Catalog, Service Ordering, Service Inventory and Service Notification

April 2020

This draft represents MEF work in progress and is subject to change.

Copyright

Table of Contents

List of Figures

List of Tables

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.

Member

Table 1: Contributing Member Companies

2. Abstract

This standard specification describes the Application Programming Interfaces (APIs) for Service Catalog, Service Order, Service Inventory and Service Notification functions of the Service Orchestration Functionality at the LSO Legato Interface Reference Point.

The Legato Interface Reference Point is defined in the MEF 55 at the interface between the Business Application Systems layer and Service Orchestration Functionality layer.

This Standard normatively incorporates the following OpenAPI 3.0 definitions by reference as if they were part of this document, from MEF-GIT github repository https://github.com/MEF-GIT/MEF-LSO-Legato-SDK CfC1_MEF_W99 branch:

- `api/serviceCommon/v0/apiSchema.openapi.yaml`
- `api/serviceCommon/v0/errorSchema.openapi.yaml`
- `api/serviceCommon/v0/hubSchema.openapi.yaml`
- `api/serviceCatalog/v0/serviceCatalogApi.openapi.yaml`
- `api/serviceCatalog/v0/serviceCatalogSchema.openapi.yaml`
- `api/serviceCatalog/v0/serviceNotificationApi.openapi.yaml`
- `api/serviceInventory/v0/serviceInventoryApi.openapi.yaml`
- `api/serviceInventory/v0/serviceInventorySchema.openapi.yaml`
- `api/serviceInventory/v0/serviceNotificationApi.openapi.yaml`
- `api/serviceOrdering/v0/serviceOrderingApi.openapi.yaml`
- `api/serviceOrdering/v0/serviceOrderingSchema.openapi.yaml`
- `api/serviceOrdering/v0/serviceNotificationApi.openapi.yaml`

3. Terminology and Acronyms

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

In addition, terms defined in the following documents are included in this document by reference, and are not repeated in the table below.

- MEF 55, *MEF LSO Reference Architecture and Framework*, March 2016
- MEF 55.0.1, *Amendment to MEF 55 - Operational Threads*, October, 2017

Term	**Definition**	**Source**
API	Application Programming Interface. In this document, API is used synomously with REST API.	This document
API Endpoint	The endpoint of an communication channel (the complete URL of an API Resource) to which the HTTP-REST requests are addressed in order to operate on the *API Resource*	rapidapi.com This document
API Resource	A REST Resource. In REST, the primary data representation is called Resource. In this document, *API Resource* is defined as a OAS *SchemaObject* with specified *API Endpoints*	restfulapi.net This document
Business Applications	The Service Provider functionality supporting Business Management Layer functionality	MEF 55.0.1
BUS	Business Applications	MEF 55.0.1
Deferred Response	A SOF's response to a BUS's request whereby the SOF immediately acknowledges that the request was received, and, over time, sends notifications to update the BUS on the status and results of the request (assuming the BUS has subscribed to receive the notifications). The BUS sends additional fetch requests to synchronize its state with the SOF.	This document
Immediate Response	A SOF's response to the BUS whereby the SOF responds immediately with the results of the request or indicates that the request cannot be processed.	This document
IRP	Interface Reference Point	This document
OAS	OpenAPI Specification	openapis.org
OAS Document	An API description document in the OpenAPI specification format.	openapis.org
OpenAPI	The OpenAPI 3.0 Specification, formerly known as the Swagger specification is an API description format for REST APIs.	spec.openapis.org
Operation	An interaction between the BUS and SOF, potentially involving multiple back and forth transactions.	This document

Term	Definition	Source
SchemaObject	The construct that allows the definition of input and output data types. These types can represent object classes, as well as primitives and arrays. specification	spec.openapis.org
Service Orchestration Functionality	The set of service management layer functionality supporting an agile framework to streamline and automate the service lifecycle in a sustainable fashion for coordinated management supporting design, fulfillment, control, testing, problem management, quality management, usage measurements, security management, analytics, and policy-based management capabilities providing coordinated end-to-end management and control of Layer 2 and Layer 3 Connectivity Services.	MEF 55.0.1
SOF	Service Orchestration Functionality	MEF 55.0.1

Table 2: Terminology and Acronyms

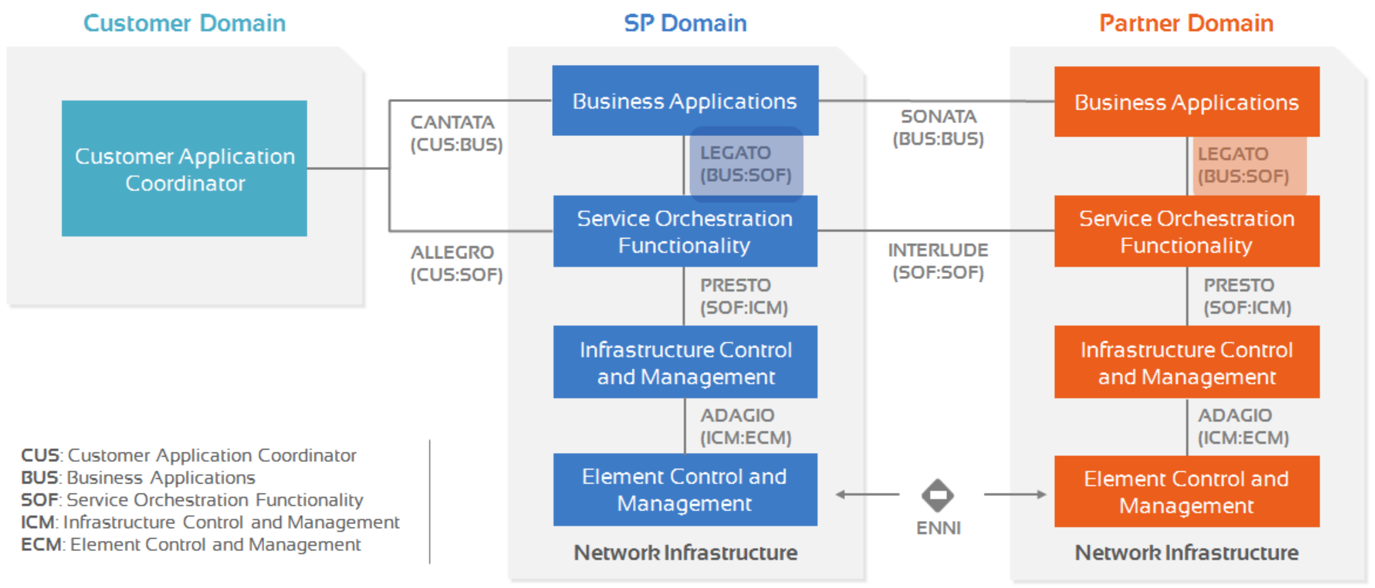
4. Compliance Levels

The key words "**MUST**", "**MUST NOT**", "**REQUIRED**", "**SHALL**", "**SHALL NOT**", "**SHOULD**", "**SHOULD NOT**", "**RECOMMENDED**", "**MAY**", and "**OPTIONAL**" in this document are to be interpreted as described in RFC 2119 (guide-2). All key words must be in upper case, 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

This standard specification describes the Application Programming Interfaces (APIs) for Service Catalog, Service Order, Service Inventory and Service Notification functions of the Service Orchestration Functionality (SOF) at the LSO Legato Interface Reference Point (IRP) as defined in the MEF LSO Reference Architecture.


Customer Domain
SP Domain
Partner Domain
Customer Application Coordinator
CANTATA (CUS:BUS)
ALLEGRO (CUS:SOF)
Business Applications
LEGATO (BUS:SOF)
Service Orchestration Functionality
PRESTO (SOF:ICM)
Infrastructure Control and Management
ADAGIO (ICM:ECM)
Element Control and Management
Network Infrastructure
SONATA (BUS:BUS)
INTERLUDE (SOF:SOF)
ENNI
Business Applications
LEGATO (BUS:SOF)
Service Orchestration Functionality
PRESTO (SOF:ICM)
Infrastructure Control and Management
ADAGIO (ICM:ECM)
Element Control and Management
Network Infrastructure
CUS: Customer Application Coordinator
BUS: Business Applications
SOF: Service Orchestration Functionality
ICM: Infrastructure Control and Management
ECM: Element Control and Management

5.1. Scope

This standard is scoped to cover APIs for following Service Orchestration Functionalities:

- Service Catalog and Design
  - Includes Service Specification Query and Retrieval functions
- Service Ordering and Fulfillment
  - Includes Service Configuration & Activation functions
- Service Inventory and Topology
  - Includes Service Query and Retrieval functions
- Service Notification
  - Includes Event Subscription/Hub and Listener notification functions

Other Service Orchestration Functionalities not addressed in this standard include (but not limited to):

- Service Qualification
- Service Activation Testing
- Service Problem Management
- Service Quality Management
- Service Usage measurements and Reporting (in support of billing)
- License Management

This document primarily supports the requirements defined in section 8.2 (Order Fulfillment and Service Control) of MEF-55, LSO Reference Architecture [1] for interactions over the Legato interface within a single operator. Both the Business Applications (BUS) and Service Orchestration Functionality (SOF) systems use the information contained within this document.

This standard is intended to support the design of API implementations that enable inter-operable SOF operations (in scope of this standard) across the Legato IRP.

This standard is based on ONAP External API (el-alto release) and TMF Open API (v3.0.0) for Service Catalog (TMF 633), Service Inventory (TMF 638) and Service Ordering (TMF 641).

5.2. Legato SDK description

The Legato Service Catalog, Service Order, Service Inventory and Service Notification API specifications are part of this standard and are located at https://github.com/MEF-GIT/MEF-LSO-Legato-SDK-extended/ CfC1_MEF_W99 branch.

The following OpenAPI definitions and schema files are relevant for the functionalities in scope of this standard:

- `api/serviceCommon/v0/apiSchema.openapi.yaml`
- `api/serviceCommon/v0/errorSchema.openapi.yaml`
- `api/serviceCommon/v0/hubSchema.openapi.yaml`
- `api/serviceCatalog/v0/serviceCatalogApi.openapi.yaml`
- `api/serviceCatalog/v0/serviceCatalogSchema.openapi.yaml`
- `api/serviceCatalog/v0/serviceNotificationApi.openapi.yaml`
- `api/serviceInventory/v0/serviceInventoryApi.openapi.yaml`
- `api/serviceInventory/v0/serviceInventorySchema.openapi.yaml`
- `api/serviceInventory/v0/serviceNotificationApi.openapi.yaml`
- `api/serviceOrdering/v0/serviceOrderingApi.openapi.yaml`
- `api/serviceOrdering/v0/serviceOrderingSchema.openapi.yaml`
- `api/serviceOrdering/v0/serviceNotificationApi.openapi.yaml`

In addition, there is a Postman collection available with representative sample of API usage examples.

MEF members can obtain a copy of the above either by downloading or by cloning the repository from https://github.com/MEF-GIT/MEF-LSO-Legato-SDK/ CfC1_MEF_W99 branch

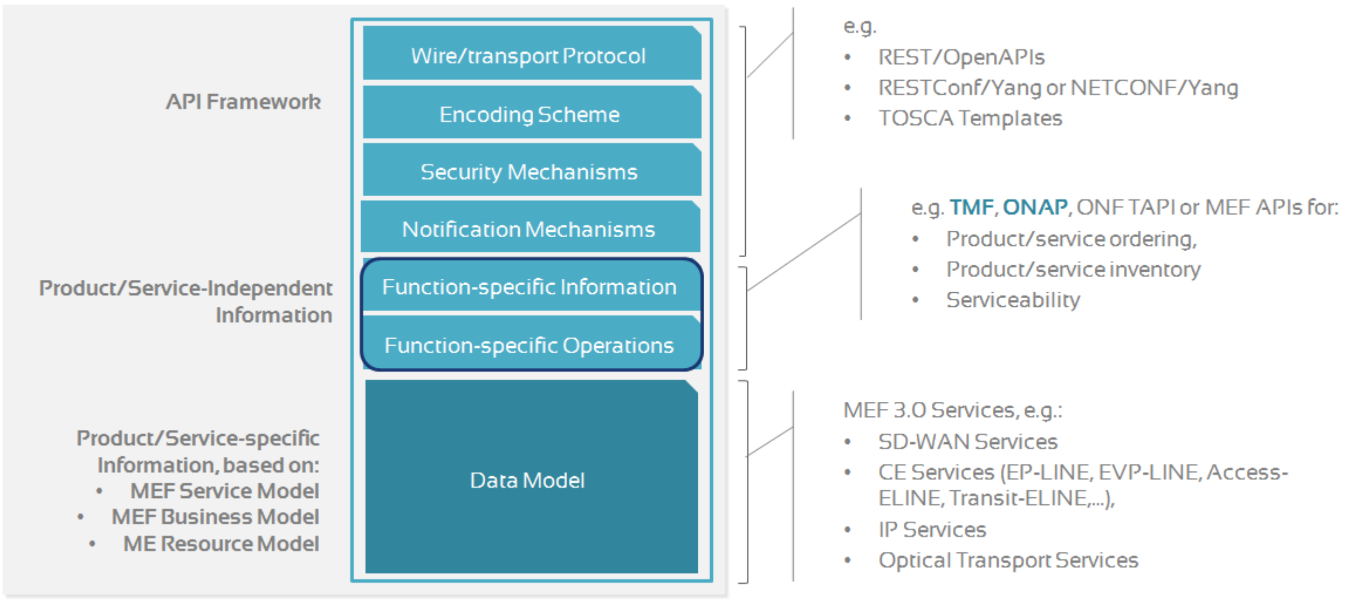
Git command usage

```
git clone https://github.com/MEF-GIT/MEF-LSO-Legato-SDK/
git checkout CfC1_MEF_W99
```

5.3. Approach

The Legato API framework consists of three structural components:

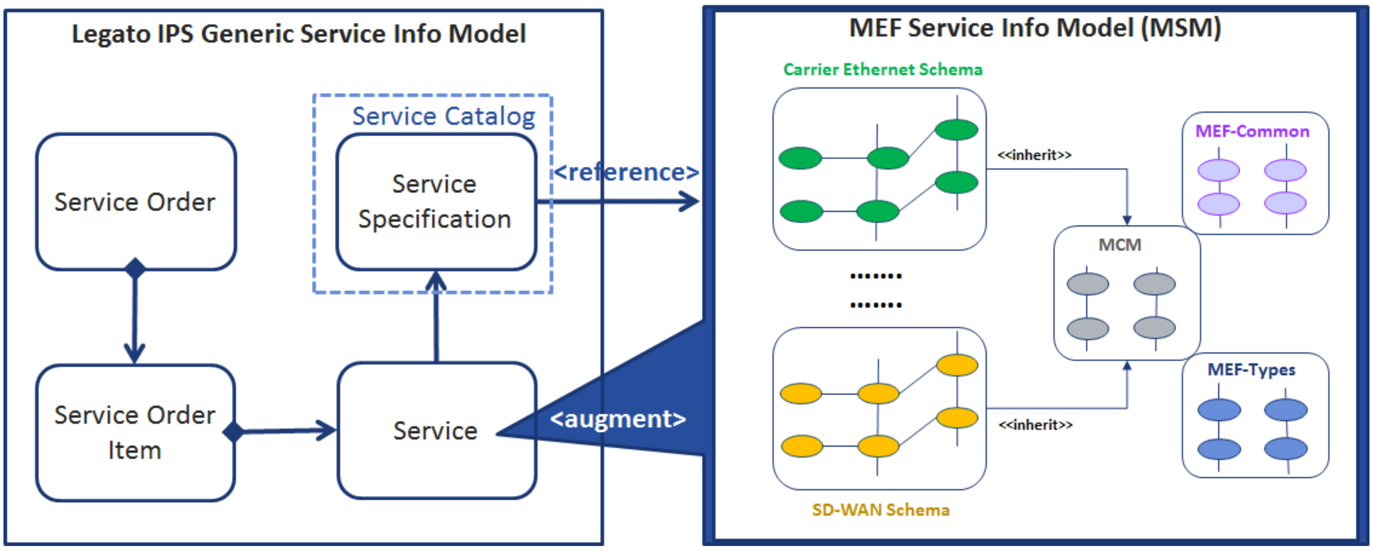
- Generic API framework
- Service-agnostic function-specific envelope (operations and data models)
- Service-specific payload data model schema


API Framework
Wire/transport Protocol
Encoding Scheme
Security Mechanisms
Notification Mechanisms
e.g.
• REST/OpenAPIs
• RESTConf/Yang or NETCONF/Yang
• TOSCA Templates
Product/Service-Independent Information
Function-specific Information
Function-specific Operations
e.g. TMF, ONAP, ONF TAPI or MEF APIs for:
• Product/service ordering,
• Product/service inventory
• Serviceability
Product/Service-specific Information, based on:
• MEF Service Model
• MEF Business Model
• ME Resource Model
Data Model
MEF 3.0 Services, e.g.:
• SD-WAN Services
• CE Services (EP-LINE, EVP-LINE, Access-ELINE, Transit-ELINE,...),
• IP Services
• Optical Transport Services

The generic operations and data-models described in this standard are designed to be agnostic of any specific MEF product, service or technology specification. These generic service data-model characteristics are then extended through the "*specification*" approach. The essential concept is to decouple the common structure, information and operations from the specific product, service or technology information content (payload). Thus, the operations signatures always remain the same even for different types of information content. This approach is further described in the section on Polymorphic Schema-based Extensions

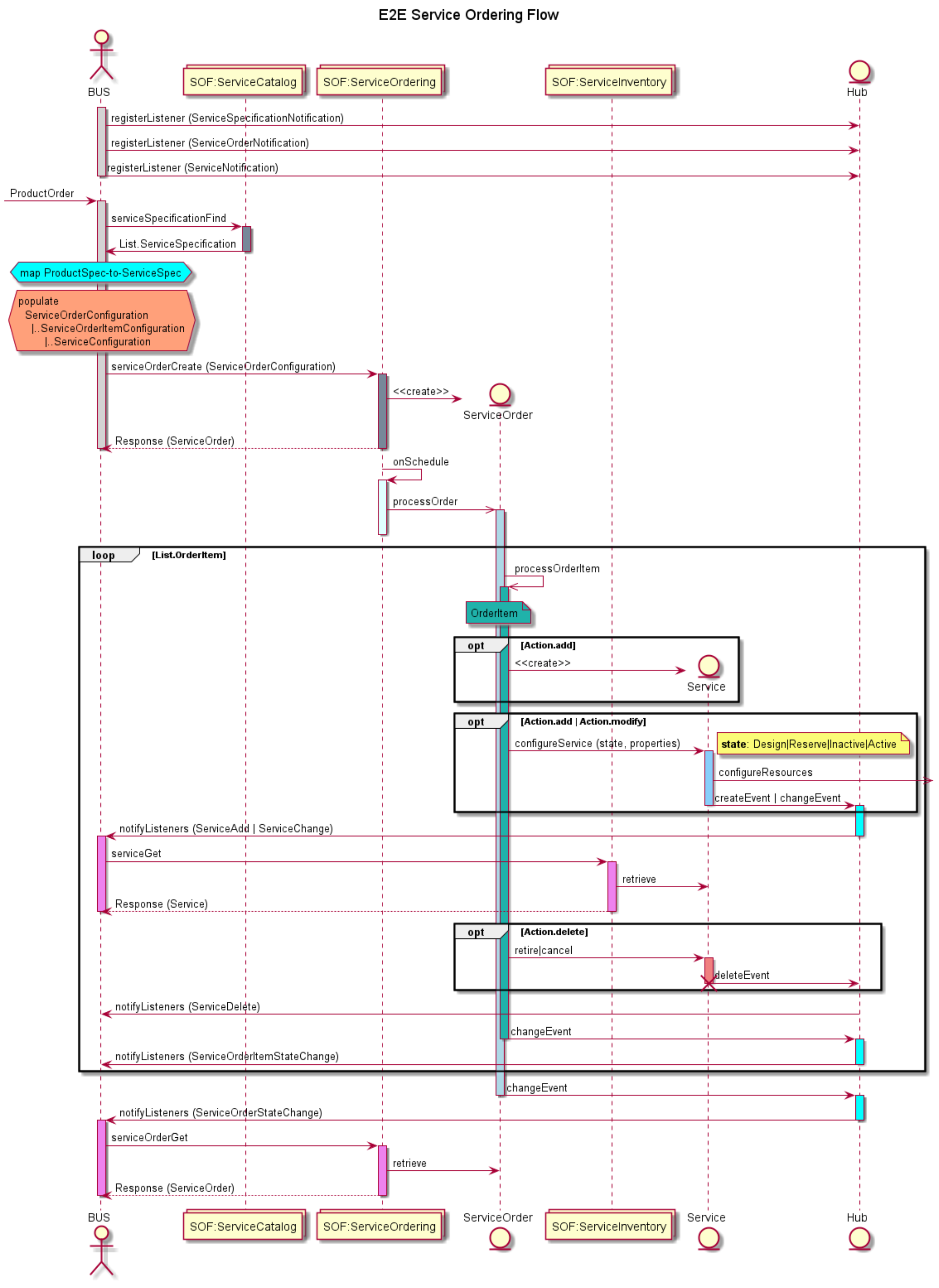
The service-agnostic generic framework in this standard is based on ONAP External API (el-alto) release . The payload schema for the different types of MEF *Services* are not specified in this document and are instead adopted from the related *MEF Services Model* (MSM) specifications. These various MSM *Service* schema are linked to the generic service schema as *Service Specifications* instances retrievable via the *Service Catalog* API. Examples of MSM *Service* schema include:

- Carrier Ethernet services based on MEF 10.4 and MEF 26.2
- Optical Transport services based on MEF 63 and MEF W64
- IP Services based on MEF 61.1
- SD-WAN Services based on MEF 70



5.4. High Level Flow

The Legato Service Catalog, Service Order, Service Inventory and Service Notification APIs in essence allow the BUS to request SOF to configure and activate one or more services as part of an order fulfillment process.


E2E Service Ordering Flow
BUS
SOF:ServiceCatalog
SOF:ServiceOrdering
SOF:ServiceInventory
Hub
registerListener (ServiceSpecificationNotification)
registerListener (ServiceOrderNotification)
registerListener (ServiceNotification)
ProductOrder
serviceSpecificationFind
List.ServiceSpecification
map ProductSpec-to-ServiceSpec
populate ServiceOrderConfiguration |..ServiceOrderItemConfiguration |..ServiceConfiguration
serviceOrderCreate (ServiceOrderConfiguration)
<<create>>
ServiceOrder
Response (ServiceOrder)
onSchedule
processOrder
loop [List.OrderItem]
processOrderItem
OrderItem
opt [Action.add]
<<create>>
Service
opt [Action.add | Action.modify]
configureService (state, properties)
state: Design|Reserve|Inactive|Active
configureResources
createEvent | changeEvent
notifyListeners (ServiceAdd | ServiceChange)
serviceGet
retrieve
Response (Service)
opt [Action.delete]
retire|cancel
deleteEvent
notifyListeners (ServiceDelete)
changeEvent
notifyListeners (ServiceOrderItemStateChange)
changeEvent
notifyListeners (ServiceOrderStateChange)
serviceOrderGet
retrieve
Response (ServiceOrder)

The following steps describe the high level flow:

- As part of the ordering flow, the BUS system receives the product order (through Cantata or Sonata) which triggers the fulfillment processes in the BUS system.
- The BUS system first queries the *Service Catalog* to retrieve the `ServiceSpecifications` supported by the SOF
  Note1: *The process of maping and decomposing a product order to identify appropriate `ServiceSpecifications` is out of scope for this standard.*
  Note2: *The mechanisms to design, construct and populate the `ServiceSpecifications` into SOF Service Catalog is out of scope for this standard.*
  - Each specific instance of a `ServiceSpecification` (retrieved from the *Service Catalog*) minimally contains a reference to target `Service` schema. A `Service` schema describes the set of properties that characterize that service and are exchanged over Legato IRP.
  - The BUS may register for notifications on specific `ServiceSpecifications`
    - In such cases, the SOF also reports the `ServiceSpecification` life-cycle state change event as per the ServiceSpecification State Transitions
- During the service configuration and activation phase, the BUS system uses the *Service Order API* to instantiate the `Service` utilizing the `ServiceSpecifications` (retrieved from the *Service Catalog*).
  - The BUS achieves this by creating a `ServiceOrder` which contains a one or more `ServiceOrderItems`.
  - Each `ServiceOrderItem` carries some `ServiceConfiguration` data and the type of operation (*`add`*/*`delete`*/*`modify`*) to be performed (instructions to SOF).
  - The SOF utilizes `Service` schema referenced in the `ServiceSpecification` to validate the `ServiceConfiguration` data passed in by the BUS.
  - The `ServiceOrder` / `ServiceOrderItem` is processed by the SOF as per the state transition rules described in Service Order State Transitions
  - The BUS may register for notifications on specific `ServiceOrders` \ `ServiceOrderItems`
    - In such cases, the SOF also reports the `ServiceOrder` \ `ServiceOrderItem` state changes as per the Service Order State Transitions
  - The SOF performs the actions (*`add`*/*`delete`*/*`modify`*) specified in a `ServiceOrderItem` on the specified target `Service` instance in the *Service Inventory* as per the state transition rules described in Service State Transitions
  - The BUS may register for notifications on `Service` instances
    - In such cases, the SOF also reports the `Service` instance state changes as per the Service State Transitions
- The BUS system uses the same *Service Order API* to create **new** `Service` instances as well as update **existing** `Service` instance's properties, trigger state transitions and delete **existing** `Service` instance.

6. API Summary

6.1. API Endpoint and Operation summary

6.1.1. SOF Service Catalog API Endpoints

BasePath: `https://<server>:<port>/api/serviceCatalog/v0`

The following API Endpoints are used by BUS to query for `ServiceSpecification` instances and to subscribe/unsubscribe to `ServiceSpecification` notifications.

API Endpoint (Operation ID)	Description	User Story mapping
`GET /serviceSpecification` (serviceSpecificationFind)	A request initiated by the BUS to retrieve list of `ServiceSpecifications` from service catalog system in SOF, that match the provided filter criteria as *`query`* parameters	- Query Service Catalog
`GET /serviceSpecification/{ID}` (serviceSpecificationGet)	A request initiated by the BUS to retrieve a specific `ServiceSpecification` from service catalog system in SOF, that match the provided *`ID`* as *`path`* parameter	- Query Service Catalog
`POST /hub` (hubCreate)	A request initiated by the BUS to instruct the SOF to send notifications on `ServiceSpecification` change events	- Register for ServiceSpecification Event Notifications
`DELETE /hub/{ID}` (hubDelete)	A request initiated by the BUS to instruct the SOF to stop sending notifications on `ServiceSpecification` change events	- Deregister for ServiceSpecification Event Notifications

6.1.2. BUS Service Catalog API Endpoints

BasePath: `https://<server>:<port>/api/serviceCatalog/v0/listener`

The following API Endpoints are used by SOF to post `ServiceSpecification` notifications to registered BUS listeners.

API Endpoint (Operation ID)	Description	User Story mapping
`POST /serviceSpecificationCreateNotification` (serviceSpecificationCreateNotify)	A request initiated by the SOF to notify BUS on *`ServiceSpecification`* instance creation	- Notify Listeners of ServiceSpecification Events
`POST /serviceSpecificationDeleteNotification` (serviceSpecificationDeleteNotify)	A request initiated by the SOF to notify BUS on *`ServiceSpecification`* instance deletion	- Notify Listeners of ServiceSpecification Events
`POST /serviceSpecificationChangeNotification` (serviceSpecificationChangeNotify)	A request initiated by the SOF to notify BUS on *`ServiceSpecification`* instance change	- Notify Listeners of ServiceSpecification Events

6.1.3. SOF Service Inventory API Endpoints

BasePath: `https://<server>:<port>/api/serviceInventory/v0`

The following API Endpoints are used by BUS to query for `Service` instances and to subscribe/unsubscribe to `Service` notifications.

API Endpoint (Operation ID)	Description	User Story mapping
`GET /service/` (serviceFind)	A request initiated by the BUS to retrieve list of `Service` instances from service inventory management system in SOF, that match the provided filter criteria as *`query`* parameters	- Query Service Inventory
`GET /service/{ID}` (serviceGet)	A request initiated by the BUS to retrieve a specific `Service` Instance from service inventory management system in SOF, that match the provided *`ID`* as *`path`* parameter	- Query Service Inventory
`POST /hub` (hubCreate)	A request initiated by the BUS to instruct the SOF to send notifications on `Service` Instance change events	- Register for Service Event Notifications
`DELETE /hub/{ID}` (hubDelete)	A request initiated by the BUS to instruct the SOF to stop sending notifications on `Service` Instance change events	- Deregister for Service Event Notifications

6.1.4. BUS Service Inventory API Endpoints

BasePath: `https://<server>:<port>/api/serviceInventory/v0/listener`

The following API Endpoints are used by SOF to post `Service` notifications to registered BUS listeners.

API Endpoint (Operation ID)	Description	User Story mapping
`POST /serviceCreateNotification` (serviceCreateNotify)	A request initiated by the SOF to notify BUS on *`Service`* instance creation	- Notify Listeners of Service Events
`POST /serviceDeleteNotification` (serviceDeleteNotify)	A request initiated by the SOF to notify BUS on *`Service`* instance deletion	- Notify Listeners of Service Events
`POST /serviceStateChangeNotification` (serviceStateChangeNotify)	A request initiated by the SOF to notify BUS on *`Service`* instance state change	- Notify Listeners of Service Events
`POST /serviceAttributeValueChangeNotification` (serviceAttributeValueChangeNotify)	A request initiated by the SOF to notify BUS on *`Service`* instance attribute value change	- Notify Listeners of Service Events

6.1.5. SOF Service Ordering API Endpoints

BasePath: `https://<server>:<port>/api/serviceOrdering/v0`

The following API Endpoints are used by BUS to create and query for `ServiceOrder` instances and to subscribe/unsubscribe to `ServiceOrder` notifications.

API Endpoint (Operation ID)	Description	User Story mapping

API Endpoint (Operation ID)	Description	User Story mapping
`POST /serviceOrder` (serviceOrderCreate)	A request initiated by the BUS to *create* new `Service` instances as well as *update* `Service` instance's properties, trigger state transitions and/or *delete* existing `Service` instance.	- Design Service - Reserve Service - Provision Service - Activate Service - Deactivate Service - Amend Service - Terminate Service - Retire Service - Cancel Service
`GET /serviceOrder` (serviceOrderFind)	A request initiated by the BUS to retrieve list of `ServiceOrders` from service order management system in SOF, that match the provided filter criteria as *`query`* parameters	- Query Service Order
`GET /serviceOrder/{ID}` (serviceOrderGet)	A request initiated by the BUS to retrieve a specific `ServiceOrder` from service order management system in SOF, that match the provided *`ID`* as *`path`* parameter	- Query Service Order
`POST /hub` (hubCreate)	A request initiated by the BUS to instruct the SOF to send notifications on `ServiceOrder` Instance change events	- Register for ServiceOrder Event Notifications
`DELETE /hub/{ID}` (hubDelete)	A request initiated by the BUS to instruct the SOF to stop sending notifications on `ServiceOrder` Instance change events	- Deregister for ServiceOrder Event Notifications

6.1.6. BUS Service Ordering API Endpoints

BasePath: `https://<server>:<port>/api/serviceOrdering/v0/listener`

The following API Endpoints are used by SOF to post `ServiceOrder` notifications to registered BUS listeners.

API Endpoint (Operation ID)	Description	User Story mapping
`POST /serviceOrderCreateNotification` (serviceOrderCreateNotify)	A request initiated by the SOF to notify BUS on *`ServiceOrder`* instance creation	- Notify Listeners of ServiceOrder Events
`POST /serviceOrderAttributeValueChangeNotification` (serviceOrderAttributeValueChangeNotify)	A request initiated by the SOF to notify BUS on *`ServiceOrder`* instance attribute value change	- Notify Listeners of ServiceOrder Events

API Endpoint (Operation ID)	Description	User Story mapping
`POST /serviceOrderStateChangeNotification` (serviceOrderStateChangeNotify)	A request initiated by the SOF to notify BUS on `ServiceOrder` instance state change	- Notify Listeners of ServiceOrder Events
`POST /serviceOrderItemStateChangeNotification` (serviceOrderItemStateChangeNotify)	A request initiated by the SOF to notify BUS on `ServiceOrderItem` instance state change	- Notify Listeners of ServiceOrder Events

6.2. API Error Responses and Codes

In case of error responses for the above operations, the SOF returns an Error structure that contains additional information reated to the exception including an application error code. The following is the list of supported application error codes:

Http Status Code	Application Error Code
400: Bad Request	- 20: Invalid URL parameter value - 21: Missing body - 22: Invalid body - 23: Missing body field - 24: Invalid body field - 25: Missing header - 26: Invalid header value - 27: Missing query-string parameter - 28: Invalid query-string parameter value
401: Unauthorized	- 40: Missing credentials - 41: Invalid credentials - 42: Expired credentials
403: Forbidden	- 50: Access denied - 51: Forbidden requestor - 52: Forbidden user - 53: Too many requests
404: Not Found	- 60: Resource not found
405: Method Not Allowed	- 61: Method not allowed
408: Request Timeout	- 63: Request time-out
409: Conflict	- 64: Resource Conflict

Http Status Code	Application Error Code
422: Unprocessable Entity	Functional Error codes specific to following operation: **Operation: `serviceOrderCreate`** - 100: `RelatedParty` (customer) for `Service`(s) is provided but the record does not exist - 101: `ServiceOrderItem` with *add* action but `serviceSpecification` id missing - 102: `ServiceOrderItem` with *add* action - `ServiceSpecification` id provided but instance does not exist - 103: `ServiceOrderItem` with *add* action but `Service` id already exists in the inventory - 104: `ServiceOrderItem` with *`modify`*/*`noChange`*/*`delete`* action but `Service` id missing - 105: `ServiceOrderItem` with *`modify`*/*`noChange`*/*`delete`* action - `Service` id provided but it does not exist in the inventory - 106: `ServiceOrderItem` with *`modify`*/*`noChange`*/*`delete`* action - `Service` instance exists, but illegal state as per Service State Transistions rules
500: Internal Server Error	- 1: Internal Error
501: Not Implemented	- 2: Functionality not Implemented
503: Service Unavailable	- 5: The service is temporarily unavailable - 6: API is over capacity, retry later

6.3. API Resource Schema summary

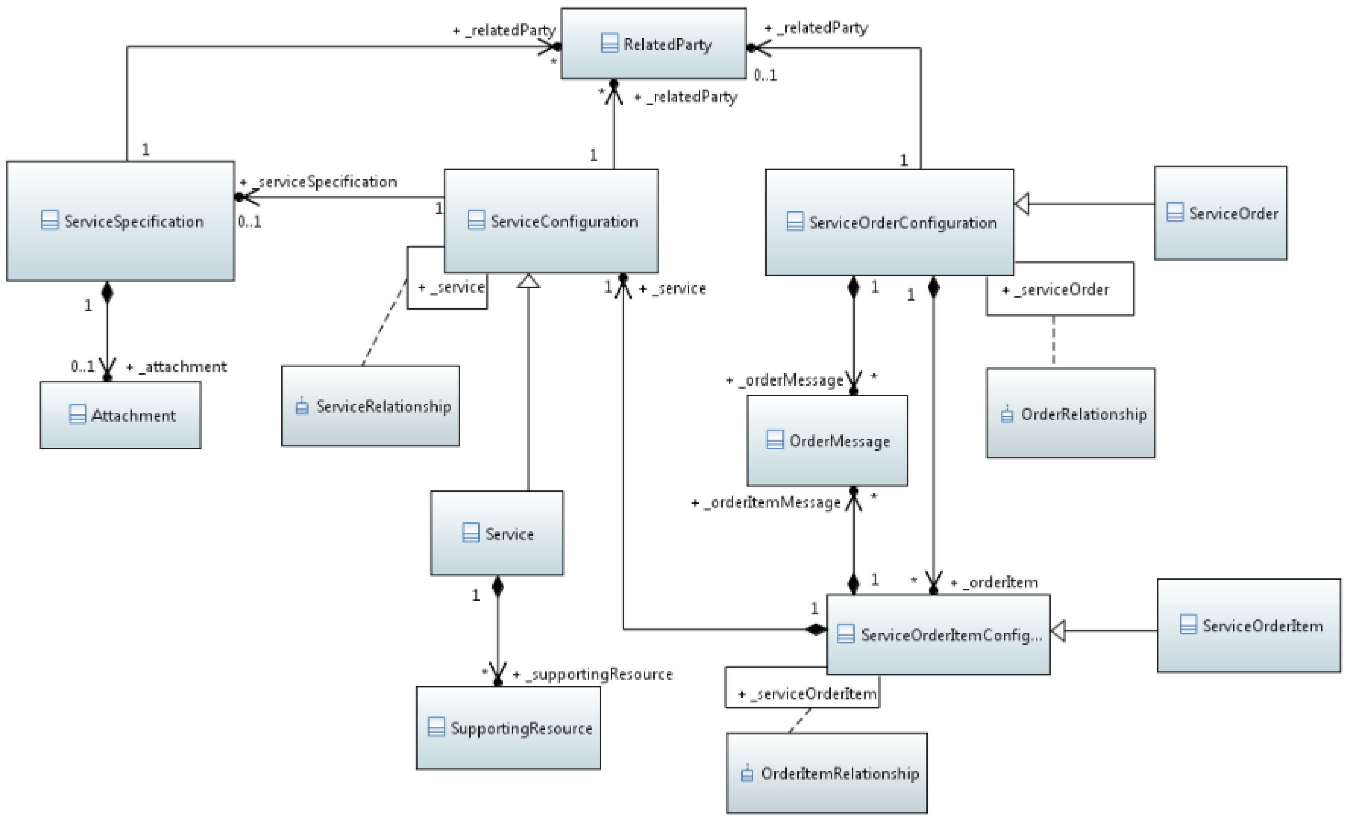


Diagram above depicts most important entities from data model which can be found in API specification.

For detailed description and complete definition of data model please refer to API Details.

6.4. Model structure and validation

Structure of the payloads exchanged via Legato Service API endpoints is defined using:

- OpenAPI 3.0 schema for service-agnostic part of the payload
- OpenAPI 3.0 schema for service-specific part of the payload

Implementations MUST use payload that conforms with these definitions.

In addition, specific service may define additional consistency rules that MUST be respected by implementations. These rules may be defined with respect to:

- relations to other service order items in the same service order request (e.g. required relation type, multiplicity)
- requirements for the relations from an service order item to entities in the service inventory
- requirements for the party roles that are to be defined at service order item level

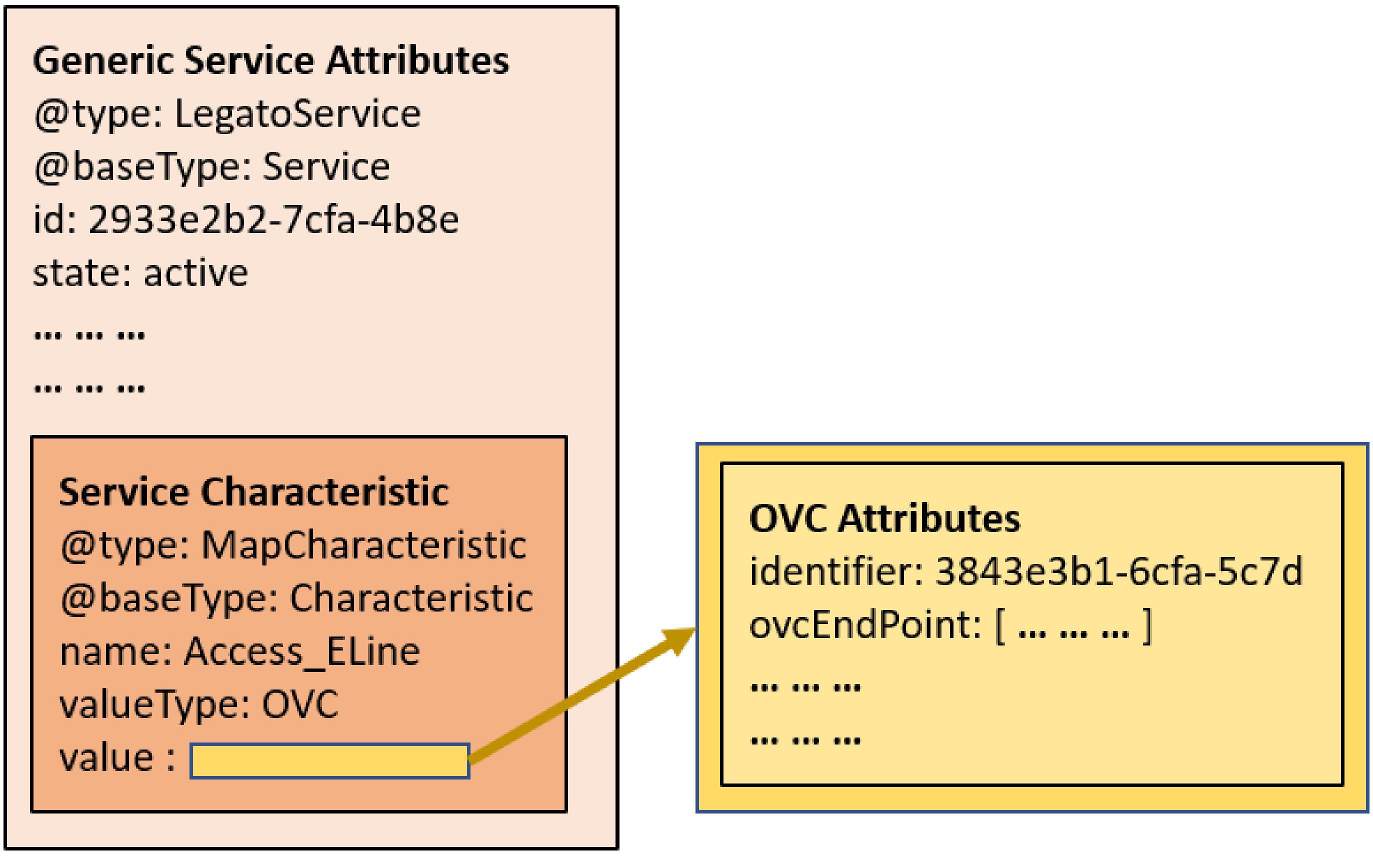
6.4.1 Polymorphism and Schema Extensions Support

Support for polymorphic *schema-based* extension is provided through a set of generic meta-properties as described below. Polymorphism as described in this document allows for a generalized base `SchemaObject` to be extended with additional properties defined in a specialized `SchemaObject` much like inheritance hierarchy relationship between *base-class* and *sub-classes* in *Object Oriented* modeling.

- ***`@type`***: This attribute provides a way to represent the actual class type of an entity. For example, within a list of `ServiceOrder` instances some may be instances of `TypeAServiceOrder` while others could be instances of `TypeBServiceOrder`. The *`@type`* property is valued with concrete *class-type* of the `SchemaObject` instances and is specified as the `discriminator` for the base `SchemaObject`.
- ***`@baseType`***: This attribute provides a way to explicitly name the base *class-type* of a given `SchemaObject` from which the current instance has been extended.
- ***`@referredType`***: This attribute provides a way for reference entities (entities that contain pointers such as *ID/name/URI* to another *API Resource* instance) to explicitly denote the *class-type* of the instance being referenced. Notice that in reference entities the *`@type`*, when used, denotes the *class-type* of the reference entity itself, and not the *class-type* of the referenced instance. However since reference entity classes are rarely sub-classed, *`@type`* is generally not useful in reference entities.
- ***`@schemaLocation`***: This property provides a way for `SchemaObject` instances to specify the location of its corresponding schema which allows for specifying user-defined properties or expected characteristics for it.

6.4.2 Characteristics Pattern for Specifications Integration

In support of the envelope/payload approach described earlier, the *characteristics* pattern is used to integrate the MEF-defined `Service` characteristics with the generic `Service` structure. The figure below illustrates an example `Service` instance with a specific *MEF Service* payload using this pattern.



`MapCharacteristic` is the only type of `Characteristics` supported in this standard (additional types are supported in TMF OpenAPI). The `Service` specific payload is provided as value of *`value`* property whereas the *`valueType`* property indicates the type of the payload (a *MEF Service type* such as EVC, OVC, SD-WAN, etc).

The schema for all supported payload types are maintained in the form of `ServiceSpecifications` within the SOF *Service Catalog*. Every `ServiceSpecification` includes a reference to the target `Service` schema which corresponds to one of supported `MapCharacteristic` *`valueTypes`*.

The following JSON representation provides an example usage of the `MapCharacteristic` pattern:

```
TBD
```

6.5. Security Considerations

Although the Legato IRP is internal to an Service Provider/Operator business boundary, it is expected that some minimal security mechanisms are in place for any communication over this IRP. For example, the following considerations may apply:

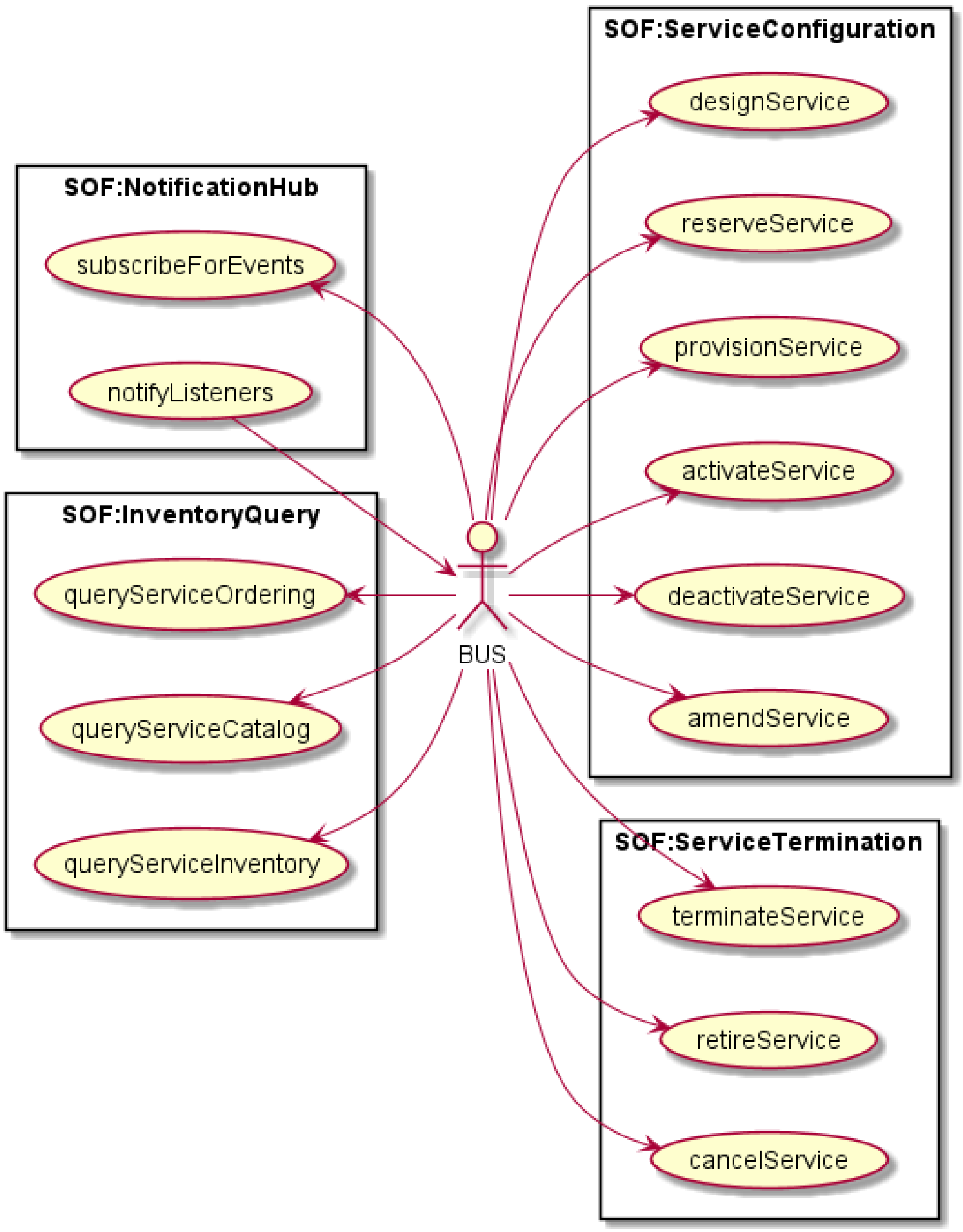
- All BUS-SOF interaction happen over an established secure communication protocol such as TLS (Transport Layer Security)
- An authentication mechanism is in place whereby a SOF can be assured of the identity of BUS and vice-versa
- An authorization mechanisms is in place to control what a particular BUS or SOF installation is allowed to do and what information may be obtained.
- Others considerations..

However, definition of exact security mechanism are out of the scope of this document.

7. API Interactions and Flows

The user stories in this section are described in the context of four API interaction patterns:

- Service Configuration and Activation
- Service Termination and Cancellation
- Event Subscription and Notification
- Inventory Query and Retrieval



Each of the following sections describe the expected BUS and SOF behaviors and sample message structure and flows at a high level.

7.1. Service Configuration and Activation Flow

The Service Configuration and Activation Flow supports the execution of following user stories:

- Design Service

- Reserve Service
- Provision Service
- Activate (Resume) Service
- Deactivate (Suspend) Service
- Amend Service

7.1.1. User Stories

7.1.1.1. Design Service

Field	Description
User Story Name	Design Service
Description	The BUS wishes to *design* a `Service` in SOF, but does not yet want to *reserve/block* any network resources nor *provision* them into the network. This scenario could be aplied towards *desiging* a new `Service` or *re-designing* an existing `Service`. In either case, SOF identifies and configures the `Service` with the network resources information necessary to fulfill the `Service`.
Actors/Subject	BUS / SOF
Pre-conditions	1. Corresponding `ServiceSpecification`(s) for the `Service` to be *designed* exists in SOF *Service Catalog* and has been retrieved by BUS. 2. BUS has registered listeners to receive notifications on changes to `ServiceOrder` `ServiceOrderItem` and `Service` 3. The corresponding `Service` instance either does not exist in SOF *Service Inventory* or exists in one of these valid states: - `ServiceStateType.feasibilityChecked` - `ServiceStateType.reserved`
Process Steps	1. The BUS populates the `ServiceOrderConfiguration` with the restriction that `ServiceConfiguration` state property is set to - `ServiceStateType.designed` `ServiceOrderItemConfiguration` action property is set to either - `ActionType.add` - `ActionType.modify` 2. BUS posts `ServiceOrderConfiguration` data: `POST {basePath}/serviceOrder` 3. SOF acknowledges BUS request with either *Success* or *Error* response using *Deferred Response* pattern 4. SOF sends notifications to registered BUS listeners on changes to `ServiceOrder`, `ServiceOrderItem` and `Service` instance 5. BUS may query SOF inventory to fetch updated snapshots of `ServiceOrder` or `Service` instances The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `Service` instance is available in the *Service Inventory* and the value of the state attribute: `state=ServiceStateType.designed` state. 2. The *`supportingResource`* attribute contains list of references to the supporting *Resources*
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.1.1.2. Reserve Service

Field	Description
User Story Name	Reserve Service
Description	The BUS wishes to *reserve* a `Service` in SOF by blocking the network resources assigned to it. In case of a new `Service` SOF first identifies, verifies and confirms the availability of the network resources necessary to fulfill the `Service` and then *reserves* these for exclusive use of this `Service`. This scenario does not include provisioning of resources into the network and could be applied in context of multi-step iterating design processes (*design*->*reserve*->*redesign*) or as a preparation step for provisioning/activation of complex multi-domain `Services` thus avoiding potential rollbacks or partial network provisioning failures.
Actors/Subject	BUS / SOF
Pre-conditions	1. Corresponding `ServiceSpecification`(s) for the `Service` to be *reserved* exists in SOF *Service Catalog* and has been retrieved by BUS. 2. BUS has registered listeners to receive notifications on changes to `ServiceOrder` `ServiceOrderItem` and `Service` 2. The corresponding `Service` instance either does not exist in SOF *Service Inventory* or exists in one of these valid states: - `ServiceStateType.feasibilityChecked` - `ServiceStateType.designed`
Process Steps	1. The BUS populates the `ServiceOrderConfiguration` with the restriction that `ServiceConfiguration` state property is set to - `ServiceStateType.reserved` `ServiceOrderItemConfiguration` action property is set to either - `ActionType.add` - `ActionType.modify` 2. BUS posts `ServiceOrderConfiguration` data: `POST {basePath}/serviceOrder` 3. SOF acknowledges BUS request with either *Success* or *Error* response using *Deferred Response* pattern 4. SOF sends notifications to registered BUS listeners on changes to `ServiceOrder`, `ServiceOrderItem` and `Service` instance 5. BUS may query SOF inventory to fetch updated snapshots of `ServiceOrder` or `Service` instances The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `Service` instance is available in the *Service Inventory* and the value of the state attribute: `state=ServiceStateType.reserved` state. 2. The *`supportingResource`* attribute contains list of references to the supporting *Resources*
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.1.1.3. Provision Service

Field	Description

Field	Description
User Story Name	Provision Service
Description	The BUS wishes to request SOF to *provision* a new or previously (*designed / reserved*) `Service`. In case of a new `Service`, SOF first has to identify, verify and confirm the availability of the network resources necessary to fulfill the `Service` and then *provision* these into the network. This scenario does not include activation of the network resources and could be applied in context of multi-step configuration-activation process involving service turn-up testing procedures.
Actors/Subject	BUS / SOF
Pre-conditions	1. Corresponding `ServiceSpecification`(s) for the `Service` to be *provisioned* exists in SOF *Service Catalog* and has been retrieved by BUS. 2. BUS has registered listeners to receive notifications on changes to `ServiceOrder` `ServiceOrderItem` and `Service` 2. The corresponding `Service` instance either does not exist in SOF *Service Inventory* or exists in one of these valid states: - `ServiceStateType.feasibilityChecked` - `ServiceStateType.designed` - `ServiceStateType.reserved`
Process Steps	1. The BUS populates the `ServiceOrderConfiguration` with the restriction that `ServiceConfiguration` state property is set to - `ServiceStateType.inactive` `ServiceOrderItemConfiguration` action property is set to either - `ActionType.add` - `ActionType.modify` 2. BUS posts `ServiceOrderConfiguration` data: `POST {basePath}/serviceOrder` 3. SOF acknowledges BUS request with either *Success* or *Error* response using *Deferred Response* pattern 4. SOF sends notifications to registered BUS listeners on changes to `ServiceOrder`, `ServiceOrderItem` and `Service` instance 5. BUS may query SOF inventory to fetch updated snapshots of `ServiceOrder` or `Service` instances The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `Service` instance is available in the *Service Inventory* and the value of the state attribute: `state`=`ServiceStateType.inactive` state. 2. The *`supportingResource`* attribute contains list of references to the supporting *Resources*
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.1.1.4. Activate (Resume) Service

Field	Description
User Story Name	Activate Service (*Resume Service*)

Field	Description
Description	The BUS wishes to request SOF to *activate* a new or previously (*designed / reserved/ provisioned / suspended*) `Service`. In case of new `Service` SOF first has to identify, verify and confirm the availability of the network resources necessary to fulfill the `Service` and then provision these in a *active* state into the network. In case of an existing `Service`, this could either be the first time the `Service` is being *activated* or it could be *resuming* a previously *suspended* `Service`. On successful completion of this scenario, the `Service` is ready for customer usage.
Actors/Subject	BUS / SOF
Pre-conditions	1. Corresponding `ServiceSpecification`(s) for the `Service` to be *activated* exists in SOF *Service Catalog* and has been retrieved by BUS. 2. BUS has registered listeners to receive notifications on changes to `ServiceOrder` `ServiceOrderItem` and `Service` 2. The corresponding `Service` instance either does not exist in SOF *Service Inventory* or exists in one of these valid states: - `ServiceStateType.feasibilityChecked` - `ServiceStateType.designed` - `ServiceStateType.reserved` - `ServiceStateType.inactive`
Process Steps	1. The BUS populates the `ServiceOrderConfiguration` with the restriction that `ServiceConfiguration` state property is set to - `ServiceStateType.active` `ServiceOrderItemConfiguration` action property is set to either - `ActionType.add` - `ActionType.modify` 2. BUS posts `ServiceOrderConfiguration` data: `POST {basePath}/serviceOrder` 3. SOF acknowledges BUS request with either *Success* or *Error* response using *Deferred Response* pattern 4. SOF sends notifications to registered BUS listeners on changes to `ServiceOrder`, `ServiceOrderItem` and `Service` instance 5. BUS may query SOF inventory to fetch updated snapshots of `ServiceOrder` or `Service` instances The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `Service` instance is available in the *Service Inventory* and the value of the state attribute: `state`=`ServiceStateType.active` state. 2. The *`supportingResource`* attribute contains list of references to the supporting *Resources*
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.1.1.5. Deactivate (Suspend) Service

Field	Description
User Story Name	Dectivate Service (*Suspend Service*)

Field	Description
Description	The BUS wishes to request SOF to *deactivate/suspend* a previously *activated* `Service`. This scenario does not entail de-provisioning or release of the network resources assigned to the `Service` and is applied in the context of temporarily suspending active customer usage and/or to perform maintenance or certain in-flight updates.
Actors/Subject	BUS / SOF
Pre-conditions	1. Corresponding `ServiceSpecification`(s) for the `Service` to be *activated* exists in SOF *Service Catalog* and has been retrieved by BUS. 2. BUS has registered listeners to receive notifications on changes to `ServiceOrder` `ServiceOrderItem` and `Service` 2. The corresponding `Service` instance exists in SOF *Service Inventory* in the following state: - `ServiceStateType.active`
Process Steps	1. The BUS populates the `ServiceOrderConfiguration` with the restriction that `ServiceConfiguration` state property is set to - `ServiceStateType.inactive` `ServiceOrderItemConfiguration` action property is set to - `ActionType.modify` 2. BUS posts `ServiceOrderConfiguration` data: `POST {basePath}/serviceOrder` 3. SOF acknowledges BUS request with either *Success* or *Error* response using *Deferred Response* pattern 4. SOF sends notifications to registered BUS listeners on changes to `ServiceOrder`, `ServiceOrderItem` and `Service` instance 5. BUS may query SOF inventory to fetch updated snapshots of `ServiceOrder` or `Service` instances The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `Service` instance is available in the *Service Inventory* and the value of the state attribute: `state=ServiceStateType.inactive` state. 2. The *`supportingResource`* attribute contains list of references to the supporting *Resources*
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

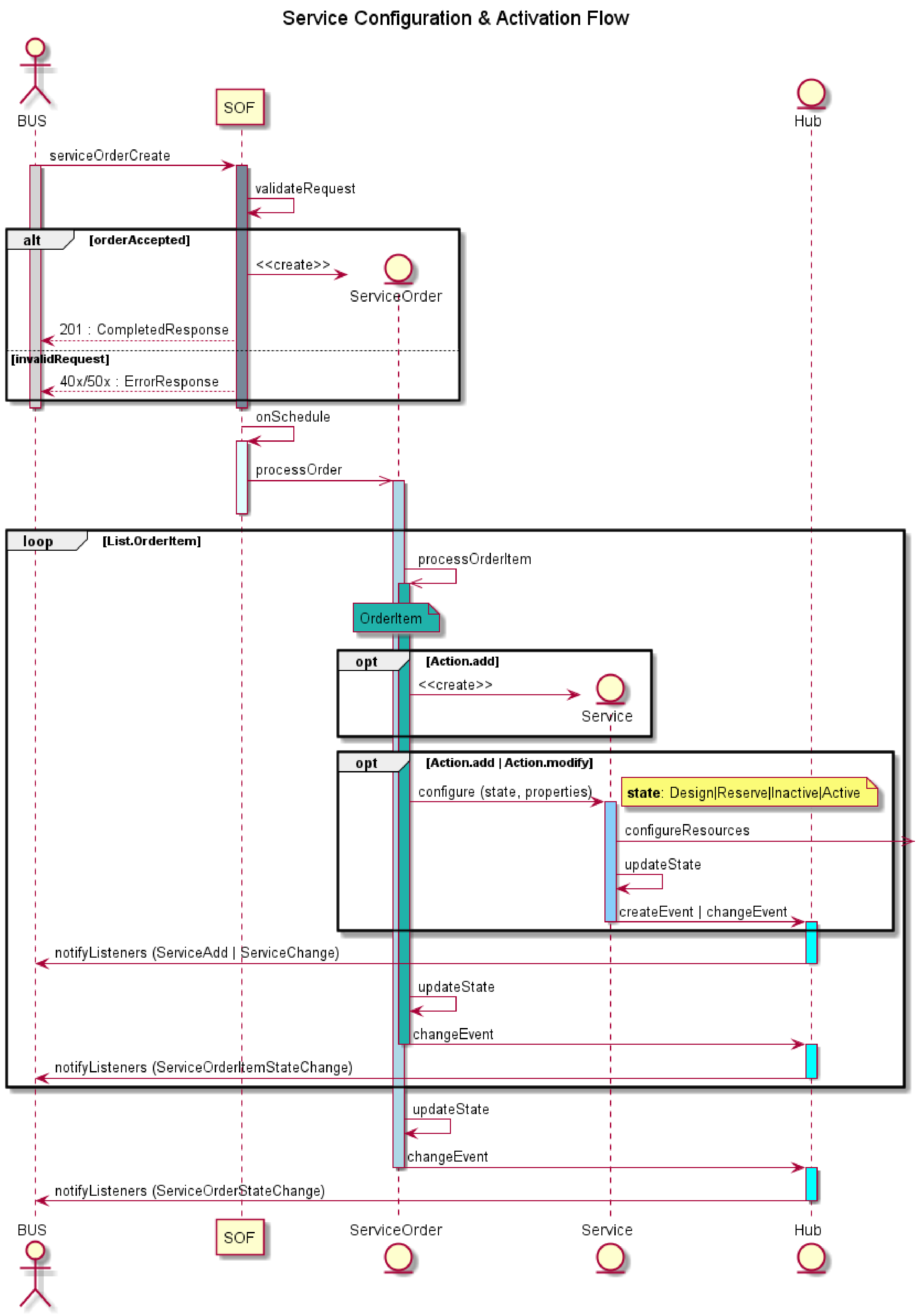
7.1.1.6. Amend Service

Field	Description
User Story Name	Amend Service (*Modify Service*)
Description	The BUS wishes to request SOF to *amend/modify* a previously configured (*designed / reserved / provisioned / activated / suspended*) `Service`. In case `Service` is - *designed/reserved*: `Service` can be modified with comparatively minimal impact - *provisioned/suspended*: this scenario may require de-provisioning/release of network resources in certain cases - *actived*: when applied in the context of an *active* operational `Service`, certain modifications may require that the `Service` is first *suspended* to avoid SLA violations and/or genaration of Alarm/TCA notifications.

Field	Description
Actors/Subject	BUS / SOF
Pre-conditions	1. Corresponding `ServiceSpecification`(s) for the `Service` to be *activated* exists in SOF *Service Catalog* and has been retrieved by BUS. 2. BUS has registered listeners to receive notifications on changes to `ServiceOrder` `ServiceOrderItem` and `Service` 2. The corresponding `Service` instance exists in SOF *Service Inventory* in one of these valid states: - `ServiceStateType.feasibilityChecked` - `ServiceStateType.designed` - `ServiceStateType.reserved` - `ServiceStateType.inactive` - `ServiceStateType.active`
Process Steps	1. The BUS populates the `ServiceOrderConfiguration` with the restriction that `ServiceConfiguration` state property is *not* set `ServiceOrderItemConfiguration` action property is set to - `ActionType.modify` 2. BUS posts `ServiceOrderConfiguration` data: `POST {basePath}/serviceOrder` 3. SOF acknowledges BUS request with either *Success* or *Error* response using *Deferred Response* pattern 4. SOF sends notifications to registered BUS listeners on changes to `ServiceOrder`, `ServiceOrderItem` and `Service` instance 5. BUS may query SOF inventory to fetch updated snapshots of `ServiceOrder` or `Service` instances The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `Service` instance is available in the *Service Inventory* in the same state as before the scenario and the value of the state attribute remains unchanged. 2. The *`supportingResource`* attribute contains list of references to the supporting *Resources*
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.1.2 Process Steps and Sequence

The following sequence diagram illustrates the service configuration and activation flow.



At a high level, the process involves following steps:

1. BUS instantiates `ServiceOrderCofiguration` with one or more
    - `ServiceOrderItemConfiguration` instances, each of which includes an
        - `ActionType`- the operation to be performed on the `Service` instance
            - `ActionType.add` creates a new `Service` instance
            - `ActionType.modify` operates on an existing `Service` instance
        - `ServiceConfiguration` - the configuration properties to be applied to the `Service` instance. This includes
            - revelant state attribute value `ServiceStateType` to be applied as per the specific user story requirement
            - reference to the `ServiceSpecification` used by BUS to construct the `ServiceConfiguration` (*`serviceSpecificationRef`* property).
            - references to an existing `Service` instance in the SOF *Service Inventory* for `ActionType.modify` operation using the *`id`* and *`href`* properties. These are left blank for `ActionType.add`.
    - If BUS is aware of any dependencies or cross-relationships with existing `ServiceOrder`(s) in the SOF *Service Ordering* system, the `ServiceOrderConfiguration` is populated with references to those preceeding related `ServiceOrders` using the `OrderRelationship` property. This is likely in cases of `ActionType.modify` operations on existing `Service` instances.

2. BUS posts the `ServiceOrderConfiguration` to the SOF using the serviceOrderCreate operation URI path

3. SOF performs following steps and returns an *acknowledgement* response using the *Deferred Response* pattern.
    - Creates a `ServiceOrder` instance in the *Service Order Management* system
        - Dispatches `ServiceOrder` *AddEvent* to the `Hub` for notifying registered listeners
    - Sends an *Error Response* with appropriate error codes as per API Error Response Codes, if the basic validation checks fail. These validation checks include
        - Schema validation
        - Presence and consistency of required/mandatory parameters
        - Presence of existing `Service` instance for `ActionType.modify`
        - Presence of supporting/related *API Resources* such as `RelatedParty` or `ServiceSpecification`
        - Non-conflicts with existing `Service` instances for `ActionType.add`
        - Target `ServiceStateType` state transition validation as per Service State Transition rules
        - Validations against the lifecyle state of any dependent or related existing `ServiceOrders` in the SOF *Service Ordering* system.
            - This is likely in case of `ActionType.modify` on exisitng `Service` instances in the SOF *Service Inventory*
        - Other basic validations
    - In case of successful validation, sends a *Success Response* after performing the following operations
        - Schedules the `ServiceOrder` for processing as per *`requestedStartDate`* with an internal *Task Scheduler*

4. At the scheduled execution time, the *Task Scheduler* triggers the processing of the `ServiceOrder` to perform the following tasks in accordance with the Service Order State Transition rules:
    - Processes each `ServiceOrderItem` contained in `ServiceOrder` in sequence considering the *`priority`* attribute as per the Service Order Item State Transition rules.
        - In case of `ActionType.add` operation,
            - Creates the `Service` instance in the *Service Inventory* system assigning it the *initial* `ServiceState.feasibilityChecked` state
            - Dispatches `Service` *AddEvent* to the `Hub` for notifying registered listeners

        - In case of `ActionType.modify` operation, configures the `Service` with values from `ServiceConfiguration` as per Service State Transistion rules.
            - As part of this step, SOF may query its subordinate ICM(s) for more information or may request ICM(s) to reserve/provision/activate/ deactivate resources.
                - **Note**: *SOF-ICM interaction mechanisms are out of scope for this document*
            - Updates `Service` state and dispatches `Service` *ChangeEvents* to the `Hub` for notifying registered listeners
        - Updates `ServiceOrderItem` state and dispatches `ServiceOrderItem` *ChangeEvents* to the `Hub` for notifying registered listeners
    - Updates `ServiceOrderItem` state and dispatches `ServiceOrder` *ChangeEvents* to the `Hub` for notifying registered listeners

7.1.3. JSON Representation Sample

The following is a sample JSON data for `ServiceOrderConfiguration` to * (reserve, provision and activate Service)* posted to SOF
`POST https://<server>:<port>/api/serviceOrdering/v0/serviceOrder`

```
TBD
```

7.2. Service Termination and Cancellation Flow

The Service Termination and Cancellation Flow supports the execution of following user stories:

- Terminate Service
- Retire Service
- Cancel Service

7.2.1. User Stories

7.2.1.1. Terminate Service

Field	Description
User Story Name	Terminate Service
Description	The BUS wishes to request SOF to *terminate* a previously (*activated / provisioned / suspended*) `Service`. This scenario logically deletes the `Service` and entails de-provisioning and releasing of the network resources assigned to the `Service`. It is applied in the context of permanentely de-commissioning an active provisioned `Service` offered to the customer.
Actors/Subject	BUS / SOF

Field	Description
Pre-conditions	1. Corresponding `ServiceSpecification`(s) for the `Service` to be *terminated* exists in SOF *Service Catalog* and has been retrieved by BUS. 2. BUS has registered listeners to receive notifications on changes to `ServiceOrder` `ServiceOrderItem` and `Service` 2. The corresponding `Service` instance exists in SOF *Service Inventory* in one of these valid states: - `ServiceStateType.active` - `ServiceStateType.inactive`
Process Steps	1. The BUS populates the `ServiceOrderConfiguration` with the restriction that `ServiceConfiguration` state property is set to - `ServiceStateType.terminated` `ServiceOrderItemConfiguration` action property is set to - `ActionType.modify` 2. BUS posts `ServiceOrderConfiguration` data: `POST {basePath}/serviceOrder` 3. SOF acknowledges BUS request with either *Success* or *Error* response using *Deferred Response* pattern 4. SOF sends notifications to registered BUS listeners on changes to `ServiceOrder`, `ServiceOrderItem` and `Service` instance 5. BUS may query SOF inventory to fetch updated snapshots of `ServiceOrder` or `Service` instances The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `Service` instance is available in the *Service Inventory* and the value of the state attribute: `state`=`ServiceStateType.terminated` state. 2. The *`supportingResource`* attribute is empty
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.2.1.2. Retire Service

Field	Description
User Story Name	Retire Service
Description	The BUS wishes to request SOF to *retire* a previously (*terminated*) `Service`. This scenario permanently deletes the `Service` from the SOF *Service Inventory*. It is applied in the context of permanentely de-commissioning an active provisioned `Service` offered to the customer.
Actors/Subject	BUS / SOF
Pre-conditions	1. BUS has registered listeners to receive notifications on changes to `ServiceOrder` `ServiceOrderItem` and `Service` 2. The corresponding `Service` instance exists in SOF *Service Inventory* in following valid state: - `ServiceStateType.terminated`

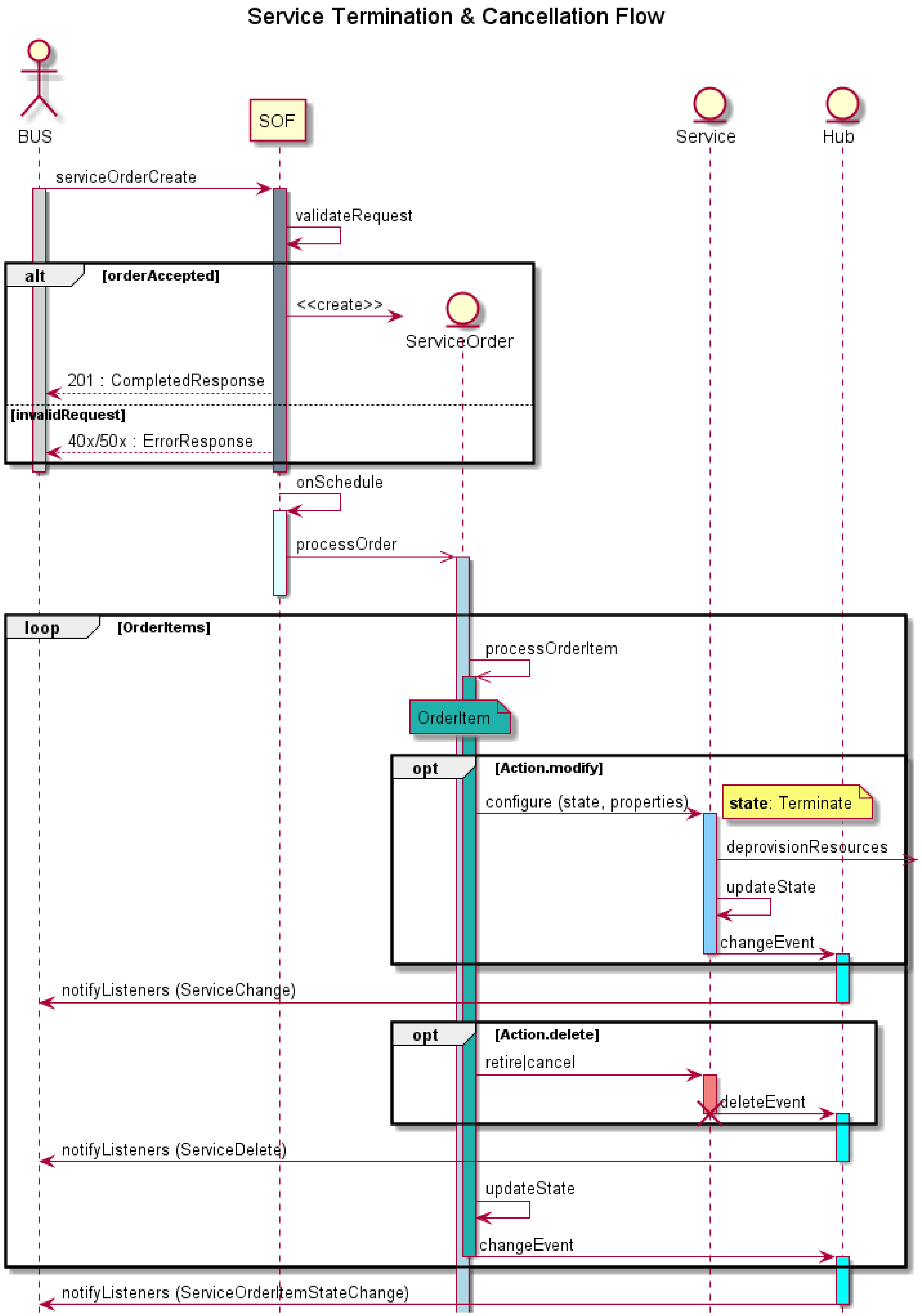
Field	Description
Process Steps	1. The BUS populates the `ServiceOrderConfiguration` with the restriction that `ServiceOrderItemConfiguration` action property is set to - `ActionType.delete` 2. BUS posts `ServiceOrderConfiguration` data: `POST {basePath}/serviceOrder` 3. SOF acknowledges BUS request with either *Success* or *Error* response using *Deferred Response* pattern 4. SOF sends notifications to registered BUS listeners on changes to `ServiceOrder`, `ServiceOrderItem` and on deletion of `Service` instance The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `Service` instance is *not* available in the *Service Inventory*
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

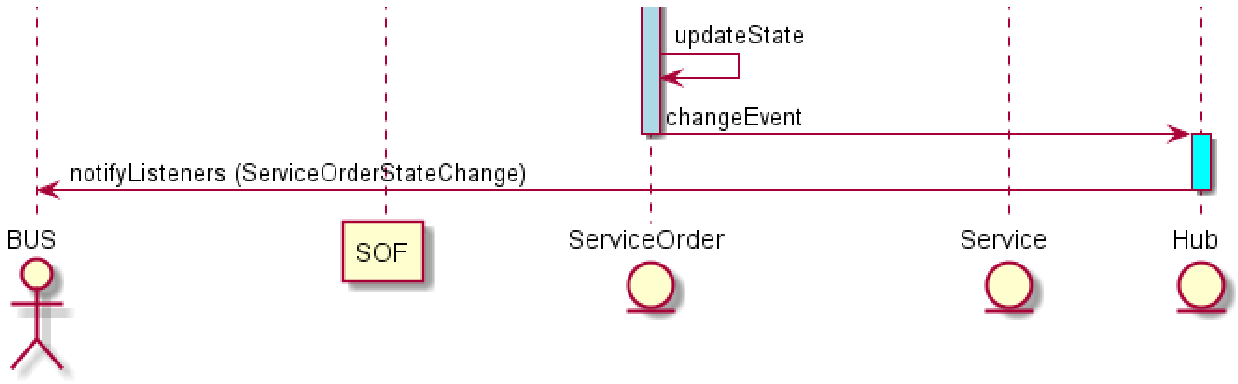
7.2.1.3. Cancel Service

Field	Description
User Story Name	Cancel Service
Description	The BUS wishes to request SOF to *cancel* a previously (*designed / reserved*) `Service`. This scenario permanently deletes the `Service` from the SOF *Service Inventory*. It is applied in the context of permanentely abandoning an unprovisioned `Service` and releasing any logically-blocked network resources.
Actors/Subject	BUS / SOF
Pre-conditions	1. BUS has registered listeners to receive notifications on changes to `ServiceOrder` `ServiceOrderItem` and `Service` 2. The corresponding `Service` instance exists in SOF *Service Inventory* in one of these valid states: - `ServiceStateType.designed` - `ServiceStateType.reserved`
Process Steps	1. The BUS populates the `ServiceOrderConfiguration` with the restriction that `ServiceOrderItemConfiguration` action property is set to - `ActionType.delete` 2. BUS posts `ServiceOrderConfiguration` data: `POST {basePath}/serviceOrder` 3. SOF acknowledges BUS request with either *Success* or *Error* response using *Deferred Response* pattern 4. SOF sends notifications to registered BUS listeners on changes to `ServiceOrder`, `ServiceOrderItem` and on deletion of `Service` instance The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `Service` instance is *not* available in the *Service Inventory*
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.2.2 Process Steps and Sequence

The following sequence diagram illustrates the service termination and cancellation flow.





At a high level, the process involves following steps:

1. BUS instantiates `ServiceOrderCofiguration` with one or more
    - `ServiceOrderItemConfiguration` instances, each of which includes an
        - `ActionType`- the operation to be performed on the `Service` instance
            - `ActionType.modify` operates on an existing `Service` instance
            - `ActionType.delete` deletes an existing `Service` instance
        - `ServiceConfiguration` - the configuration properties to be applied to the `Service` instance. This includes
            - revelant state attribute value `ServiceStateType` to be applied as per the specific user story requirement
            - reference to the `ServiceSpecification` used by BUS to construct the `ServiceConfiguration` (*`serviceSpecificationRef`* property).
            - references to an existing `Service` instance in the SOF *Service Inventory* for `ActionType.modify` and `ActionType.delete` operations using the *`id`* and *`href`* properties.
    - If BUS is aware of any dependencies or cross-relationships with existing `ServiceOrder`(s) in the SOF *Service Ordering* system, the `ServiceOrderConfiguration` is populated with references to those preceeding related `ServiceOrders` using the `OrderRelationship` property. This is likely in cases of `ActionType.modify` and `ActionType.delete`operations on existing `Service` instances.

2. BUS posts the `ServiceOrderConfiguration` to the SOF using the serviceOrderCreate operation URI path

3. SOF performs following steps and returns an *acknowledgement* response using the *Deferred Response* pattern.

    - Creates a `ServiceOrder` instance in the *Service Order Management* system
        - Dispatches `ServiceOrder` *AddEvent* to the `Hub` for notifying registered listeners
    - Sends an *Error Response* with appropriate error codes as per API Error Response Codes, if the basic validation checks fail. These validation checks include
        - Schema validation
        - Presence and consistency of required/mandatory parameters
        - Presence of existing `Service` instance for `ActionType.modify` and `ActionType.delete`
        - Presence of supporting/related *API Resources* such as `RelatedParty` or `ServiceSpecification`
        - Target `ServiceStateType` state transition validation as per Service State Transition rules
        - Validations against the lifecyle state of any dependent or related existing `ServiceOrders` in the SOF *Service Ordering* system.
            - This is likely in case of `ActionType.modify` and `ActionType.delete` on exisiting `Service` instances in the SOF *Service Inventory*
        - Other basic validations
    - In case of successful validation, sends a *Success Response* after performing the following operations

        - Schedules the `ServiceOrder` for processing as per *`requestedStartDate`* with an internal *Task Scheduler*

4. At the scheduled execution time, the *Task Scheduler* triggers the processing of the `ServiceOrder` to perform the following tasks in accordance with the Service Order State Transition rules:

    - Processes each `ServiceOrderItem` contained in `ServiceOrder` in sequence considering the *`priority`* attribute as per the Service Order Item State Transition rules.
        - In case of `ActionType.modify` operation, configures the `Service` with values from `ServiceConfiguration` as per Service State Transition rules.
            - As part of this step, SOF may query its subordinate ICM(s) for more information or may request ICM(s) to de-provision/release resources.
                - **Note**: *SOF-ICM interaction mechanisms are out of scope for this document*
            - Updates `Service` state and dispatches `Service` *ChangeEvents* to the `Hub` for notifying registered listeners
        - In case of `ActionType.delete` operation,
            - Deletes the `Service` instance from the *Service Inventory* system
            - Dispatches `Service` *DeleteEvent* to the `Hub` for notifying registered listeners
        - Updates `ServiceOrderItem` state and dispatches `ServiceOrderItem` *ChangeEvents* to the `Hub` for notifying registered listeners
    - Updates `ServiceOrderItem` state and dispatches `ServiceOrder` *ChangeEvents* to the `Hub` for notifying registered listeners

7.2.3. JSON Representation Sample

The following is a sample JSON data for `ServiceOrderConfiguration` to *(terminate and retire Service)* posted to SOF
`POST https://<server>:<port>/api/serviceOrdering/v0/serviceOrder`

```
TBD
```

7.3 Event Subscription and Notification Flow

The Event Subscription and Notification Flow supports the execution of following user stories:

- Register for ServiceSpecification Event Notifications
- Deregister for ServiceSpecification Event Notifications
- Notify Listeners of ServiceSpecification Events
- Register for Service Event Notifications
- Deregister for Service Event Notifications
- Notify Listeners of Service Events
- Register for ServiceOrder Event Notifications
- Deregister for ServiceOrder Event Notifications
- Notify Listeners of ServiceOrder Events

7.3.1. User Stories

7.3.1.1. Register for ServiceSpecification Event Notifications

Field	Description

Field	Description
User Story Name	Register for ServiceSpecification Event Notifications
Description	The BUS registers a listener to be notified of changes to `ServiceSpecification` instances in the SOF *Service Catalog*. This scenario logically creates a notification `Hub` in the SOF *Service Catalog* to distribute relevant events and is applied in the context of *autonomous* synchronization of information with SOF.
Actors/Subject	BUS / SOF
Pre-conditions	1. A corresponding *Event Listener Service* is configured and running in the BUS at an *API Endpoint (URL)* accesible to SOF 2. SOF *Service Catalog* notification `Hub` is either able to support multiple listeners or is not configured with any listener.
Process Steps	1. The BUS populates the `EventSubscriptionInput` with - The *API Endpoint (URL)* information of its *Event Listener Service* - Optionally a query to filter on one or more of following `EventType`: --- `ServiceSpecificationCreateEvent` --- `ServiceSpecificationDeleteEvent` --- `ServiceSpecificationChangeEvent` 2. BUS posts `EventSubscriptionInput` data: `POST {basePath}/hub` 3. SOF responds to BUS request with either *Success* or *Error* response using *Immediate Response* pattern. The *Success* response contains the created `EventSubscription` instance *`id`*. The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `EventSubscription` instance is available in the SOF *Service Catalog* notification `Hub` 2. Registered BUS listeners for the `EventSubscription` are being notified of the `ServiceSpecification` events matching the `EventType` filter.
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.3.1.2. Deregister for ServiceSpecification Event Notifications

Field	Description
User Story Name	Deregister for ServiceSpecification Event Notifications
Description	The BUS deregisters a previously registered listener to stop being notified of changes to `ServiceSpecification` instances in the SOF *Service Catalog*. This scenario logically deletes a notification `Hub` in SOF *Service Catalog* created to distribute relevant events and is applied in the context of *autonomous* synchronization of information with SOF.
Actors/Subject	BUS / SOF
Pre-conditions	1. The previously registered `EventSubscription` instance is avaialble in SOF *Service Catalog* notification `Hub`.

Field	Description
Process Steps	1. BUS posts a delete `EventSubscription` request with appropriate *`id`* from the original *hubCreate* response: `DELETE {basePath}/hub/{id}` 2. SOF responds to BUS request with either *Success* or *Error* response using *Immediate Response* pattern. The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `EventSubscription` instance is *not* available in the SOF *Service Catalog* notification `Hub` 2. `ServiceSpecification` events are not sent to the deregistered BUS listener anymore.
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.3.1.3. Notify Listeners of ServiceSpecification Events

Field	Description
User Story Name	Notify Listeners of ServiceSpecification Events
Description	The SOF notifies a previously registered BUS *Event Listener* of changes to `ServiceSpecification` instances in the SOF *Service Catalog*. This scenario utilizes the `EventSubscription` information that was registered in logical notification `Hub` in SOF *Service Catalog* to distribute relevant events and is applied in the context of *autonomous* synchronization of information with SOF.
Actors/Subject	BUS / SOF
Pre-conditions	1. The previously registered `EventSubscription` instance is avaialble in SOF *Service Catalog* notification `Hub`. 2. The corresponding *Event Listener Service* is configured and running in the BUS at the *API Endpoint (URL)* specified in the `EventSubscription`
Process Steps	1. The SOF *Service Catalog* notifies its notification `hub` of following change events related to `ServiceSpecification` instances managed by it: --- `ServiceSpecificationCreateEvent` --- `ServiceSpecificationDeleteEvent` --- `ServiceSpecificationChangeEvent` 2. For every registered `EventSubscription`, the SOF *Service Catalog* notification `Hub` applies the specified `EventType` filter 3. In case of matching filter query, posts the corresponding notification to the BUS *Event Listener Service* at the specified *API Endpoint (URL)*: --- `POST {listenerBasePath}/ServiceSpecificationCreateNotification` --- `POST {listenerBasePath}/ServiceSpecificationDeleteNotification` --- `POST {listenerBasePath}/ServiceSpecificationChangeNotification` 4. BUS *Event Listener Service* responds to SOF request with either *Success* or *Error* response using *Immediate Response* pattern. In case of *Success*, the response contains the `EventSubscription` information that received the notification. The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The SOF *Service Catalog* notification `Hub` receives acknowledgement that `ServiceSpecification` change event was sucessfully delivered. .

Field	Description
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.3.1.4. Register for Service Event Notifications

Field	Description
User Story Name	Register for Service Event Notifications
Description	The BUS registers a listener to be notified of changes to `Service` instances in the SOF *Service Inventory*. This scenario logically creates a notification `Hub` in the SOF *Service Inventory* to distribute relevant events and is applied in the context of *autonomous* synchronization of information with SOF.
Actors/Subject	BUS / SOF
Pre-conditions	1. A corresponding *Event Listener Service* is configured and running in the BUS at an *API Endpoint (URL)* accesible to SOF 2. SOF *Service Inventory* notification `Hub` is either able to support multiple listeners or is not configured with any listener.
Process Steps	1. The BUS populates the `EventSubscriptionInput` with - The *API Endpoint (URL)* information of its *Event Listener Service* - Optionally a query to filter on one or more of following `EventType`: --- `ServiceCreateEvent` --- `ServiceDeleteEvent` --- `ServiceAttributeValueChangeEvent` --- `ServiceStateChangeEvent` 2. BUS posts `EventSubscriptionInput` data: `POST {basePath}/hub` 3. SOF responds to BUS request with either *Success* or *Error* response using *Immediate Response* pattern. The *Success* response contains the created `EventSubscription` instance *`id`*. The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `EventSubscription` instance is available in the SOF *Service Inventory* notification `Hub` 2. Registered BUS listeners for the `EventSubscription` are being notified of the `Service` events matching the `EventType` filter.
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.3.1.5. Deregister for Service Event Notifications

Field	Description
User Story Name	Deregister for Service Event Notifications
Description	The BUS deregisters a previously registered listener to stop being notified of changes to `Service` instances in the SOF *Service Inventory*. This scenario logically deletes a notification `Hub` in SOF *Service Inventory* created to distribute relevant events and is applied in the context of *autonomous* synchronization of information with SOF.

Field	Description
Actors/Subject	BUS / SOF
Pre-conditions	1. The previously registered `EventSubscription` instance is available in SOF *Service Inventory* notification `Hub`.
Process Steps	1. BUS posts a delete `EventSubscription` request with appropriate *`id`* from the original *hubCreate* response: `DELETE {basePath}/hub/{id}` 2. SOF responds to BUS request with either *Success* or *Error* response using *Immediate Response* pattern. The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `EventSubscription` instance is *not* available in the SOF *Service Inventory* notification `Hub` 2. `Service` events are not sent to the deregistered BUS listener anymore.
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.3.1.6. Notify Listeners of Service Events

Field	Description
User Story Name	Notify Listeners of Service Events
Description	The SOF notifies a previously registered BUS *Event Listener* of changes to `Service` instances in the SOF *Service Inventory*. This scenario utilizes the `EventSubscription` information that was registered in logical notification `Hub` in SOF *Service Inventory* to distribute relevant events and is applied in the context of *autonomous* synchronization of information with SOF.
Actors/Subject	BUS / SOF
Pre-conditions	1. The previously registered `EventSubscription` instance is avaialble in SOF *Service Inventory* notification `Hub`. 2. The corresponding *Event Listener Service* is configured and running in the BUS at the *API Endpoint (URL)* specified in the `EventSubscription`

Field	Description
Process Steps	1. The SOF *Service Inventory* notifies its notification `hub` of following change events related to `Service` instances managed by it: --- `ServiceCreateEvent` --- `ServicenDeleteEvent` --- `ServiceAttributeValueChangeEvent` --- `ServiceStateChangeEvent` 2. For every registered `EventSubscription`, the SOF *Service Inventory* notification `Hub` applies the specified `EventType` filter 3. In case of matching filter query, posts the corresponding notification to the BUS *Event Listener Service* at the specified *API Endpoint (URL)*: --- `POST {listenerBasePath}/ServiceCreateNotification` --- `POST {listenerBasePath}/ServiceDeleteNotification` --- `POST {listenerBasePath}/ServiceAttributeValueChangeNotification` --- `POST {listenerBasePath}/ServiceStateChangeNotification` 4. BUS *Event Listener Service* responds to SOF request with either *Success* or *Error* response using *Immediate Response* pattern. In case of *Success*, the response contains the `EventSubscription` information that received the notification. The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The SOF *Service Inventory* notification `Hub` receives acknowledgement that `Service` change event was sucessfully delivered. .
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.3.1.7. Register for ServiceOrder Event Notifications

Field	Description
User Story Name	Register for ServiceOrder Event Notifications
Description	The BUS registers a listener to be notified of changes to `ServiceOrder` instances in the SOF *Service Ordering*. This scenario logically creates a notification `Hub` in the SOF *Service Ordering* to distribute relevant events and is applied in the context of *autonomous* synchronization of information with SOF.
Actors/Subject	BUS / SOF
Pre-conditions	1. A corresponding *Event Listener Service* is configured and running in the BUS at an *API Endpoint (URL)* accesible to SOF 2. SOF *Service Ordering* notification `Hub` is either able to support multiple listeners or is not configured with any listener.

Field	Description
Process Steps	1. The BUS populates the `EventSubscriptionInput` with - The *API Endpoint (URL)* information of its *Event Listener Service* - Optionally a query to filter on one or more of following `EventType`: --- `ServiceOrderCreateEvent` --- `ServiceOrderAttributeValueChangeEvent` --- `ServiceOrderStateChangeEvent` --- `ServiceOrderItemStateChangeEvent` 2. BUS posts `EventSubscriptionInput` data: `POST {basePath}/hub` 3. SOF responds to BUS request with either *Success* or *Error* response using *Immediate Response* pattern. The *Success* response contains the created `EventSubscription` instance *`id`*. The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `EventSubscription` instance is available in the SOF *Service Ordering* notification `Hub` 2. Registered BUS listeners for the `EventSubscription` are being notified of the `ServiceOrder` events matching the `EventType` filter.
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.3.1.8. Deregister for ServiceOrder Event Notifications

Field	Description
User Story Name	Deregister for ServiceOrder Event Notifications
Description	The BUS deregisters a previously registered listener to stop being notified of changes to `ServiceOrder` instances in the SOF *Service Ordering*. This scenario logically deletes a notification `Hub` in SOF *Service Ordering* created to distribute relevant events and is applied in the context of *autonomous* synchronization of information with SOF.
Actors/Subject	BUS / SOF
Pre-conditions	1. The previously registered `EventSubscription` instance is avaialble in SOF *Service Ordering* notification `Hub`.
Process Steps	1. BUS posts a delete `EventSubscription` request with appropriate *`id`* from the original *hubCreate* response: `DELETE {basePath}/hub/{id}` 2. SOF responds to BUS request with either *Success* or *Error* response using *Immediate Response* pattern. The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The `EventSubscription` instance is *not* available in the SOF *Service Ordering* notification `Hub` 2. `ServiceOrder` events are not sent to the deregistered BUS listener anymore.
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

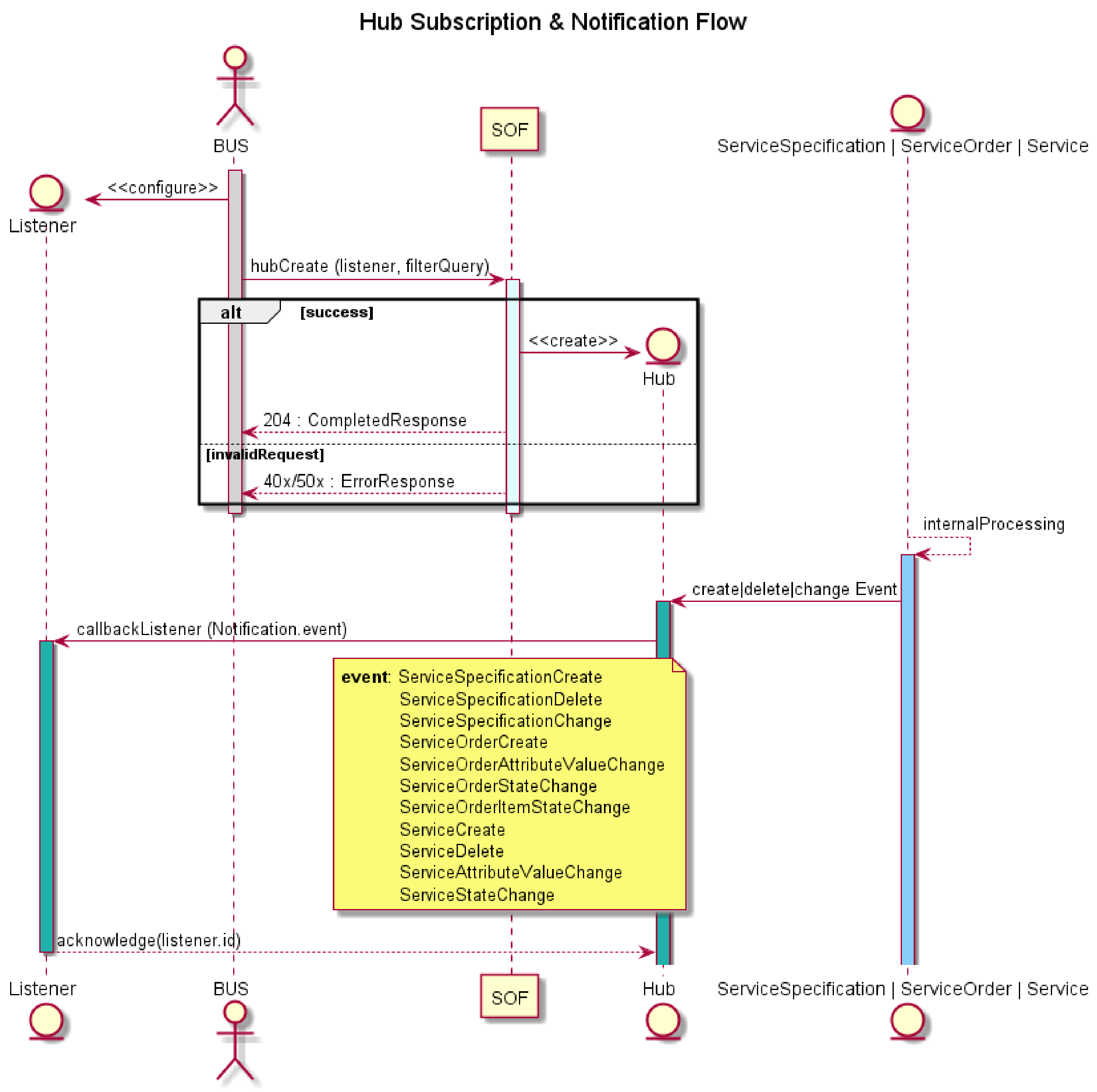
7.3.1.9. Notify Listeners of ServiceOrder Events

Field	Description

Field	**Description**
User Story Name	Notify Listeners of ServiceOrder Events
Description	The SOF notifies a previously registered BUS *Event Listener* of changes to `ServiceOrder` instances in the SOF *Service Ordering*. This scenario utilizes the `EventSubscription` information that was registered in logical notification `Hub` in SOF *Service Ordering* to distribute relevant events and is applied in the context of *autonomous* synchronization of information with SOF.
Actors/Subject	BUS / SOF
Pre-conditions	1. The previously registered `EventSubscription` instance is avaialble in SOF *Service Ordering* notification `Hub`. 2. The corresponding *Event Listener Service* is configured and running in the BUS at the *API Endpoint (URL)* specified in the `EventSubscription`
Process Steps	1. The SOF *Service Ordering* notifies its notification `hub` of following change events related to `ServiceOrder` instances managed by it: --- `ServiceOrderCreateEvent` --- `ServiceOrderAttributeValueEvent` --- `ServiceOrderStateChangeEvent` --- `ServiceOrderItemStateChangeEvent` 2. For every registered `EventSubscription`, the SOF *Service Ordering* notification `Hub` applies the specified `EventType` filter 3. In case of matching filter query, posts the corresponding notification to the BUS *Event Listener Service* at the specified *API Endpoint (URL)*: --- `POST {listenerBasePath}/ServiceOrderCreateNotification` --- `POST {listenerBasePath}/ServiceOrderAttributeValueChangeNotification` --- `POST {listenerBasePath}/ServiceOrderStateChangeNotification` --- `POST {listenerBasePath}/ServiceOrderItemStateChangeNotification` 4. BUS *Event Listener Service* responds to SOF request with either *Success* or *Error* response using *Immediate Response* pattern. In case of *Success*, the response contains the `EventSubscription` information that received the notification. The above steps are detailed in Process Steps and Sequence
Post-conditions	1. The SOF *Service Ordering* notification `Hub` receives acknowledgement that `ServiceOrder` change event was sucessfully delivered. .
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.3.2 Process Steps and Sequence

The following sequence diagram illustrates the event subscription and notification flow.


Hub Subscription & Notification Flow
BUS
SOF
ServiceSpecification | ServiceOrder | Service
Listener
<<configure>>
hubCreate (listener, filterQuery)
alt
[success]
<<create>>
Hub
204 : CompletedResponse
[invalidRequest]
40x/50x : ErrorResponse
internalProcessing
create|delete|change Event
callbackListener (Notification.event)
event: ServiceSpecificationCreate
ServiceSpecificationDelete
ServiceSpecificationChange
ServiceOrderCreate
ServiceOrderAttributeValueChange
ServiceOrderStateChange
ServiceOrderItemStateChange
ServiceCreate
ServiceDelete
ServiceAttributeValueChange
ServiceStateChange
acknowledge(listener.id)

7.3.3. JSON Representation Sample

The following is a sample JSON data for creating `hub` in SOF to register for `ServiceSpecification` event notifications

`POST https://<server>:<port>/api/serviceCatalog/v0/hub`

```
TBD
```

The following is a sample JSON data for posting `ServiceSpecificationChangeNotification` to BUS registered event listeners

`POST https://<server>:<port>/api/serviceCatalog/v0/listener/serviceSpecificationChangeNotification`

```
TBD
```

The following is a sample JSON data for creating `hub` in SOF to register for `Service` event notifications
`POST https://<server>:<port>/api/serviceInventory/v0/hub`

```
TBD
```

The following is a sample JSON data for posting `ServiceStateChangeNotification` to BUS registered event listeners
`POST https://<server>:<port>/api/serviceInventory/v0/listener/serviceStateChangeNotification`

```
TBD
```

The following is a sample JSON data for creating `hub` in SOF to register for `ServiceOrder` event notifications
`POST https://<server>:<port>/api/serviceOrdering/v0/hub`

```
TBD
```

The following is a sample JSON data for posting `ServiceOrderStateChangeNotification` to BUS registered event listeners
`POST https://<server>:<port>/api/serviceOrdering/v0/listener/serviceOrderStateChangeNotification`

```
TBD
```

7.4. Inventory Query and Retrieval Flow

The Inventory Query and Retrieval Flow supports the execution of following user stories:

- Query Service Catalog
- Query Service Inventory
- Query Service Ordering

7.4.1. User Stories

7.4.1.1. Query Service Catalog

Field	Description
User Story Name	Query Service Catalog

Field	Description
Description	The BUS wishes to query *Service Catalog* in SOF for a *set of* `ServiceSpecification` instances that match one or more of following optional filter query parameters: - *`category`* - *`subCategory`* - *`status`* This scenario could be applied in BUS in context of decomposing/mapping a *Product Order Specification* to appropriate `ServiceSpecification`(s) and/or in construction of `ServiceConfiguration` instance to be dispatched as input in a *serviceOrderCreate* request.
Actors/Subject	BUS / SOF
Pre-conditions	1. SOF *Service Catalog* has been populated with necessary `ServiceSpecification`(s) instances. The mechanisms to design, construct and populate the `ServiceSpecifications` in SOF *Service Catalog* is out of scope for this standard.
Process Steps	1. The BUS first determines - the filter query parameters such as: --- *`state`* --- *`category`* --- *`subCategory`* - the subset of `ServiceSpecification` properties to be retrieved (*`fields`* query parameter) - the *pagination* strategy (*`offset`* and *`limit`* query parameters) 2. BUS posts *serviceSpecificationFind* query request to: `GET {basePath}/serviceSpecification` 3. SOF responds to the BUS request with either *Success* or *Error* response using *Immediate Response* pattern. In case of *Success*, the response contains the set of `ServiceSpecification` instances that match all of the specified criteria 4. Based on the response header fields (*`X-Total-Count`* and *`X-Result-Count`*) and its *pagination* strategy, the BUS may send subsequent additional *serviceSpecificationFind* query requests with *pagination* query parameters (*`offset`* and *`limit`*) set to appropriate values. The above steps are detailed in Process Steps and Sequence
Post-conditions	1. A set of `ServiceSpecification` instances that match all of the specified criteria is available in the BUS.
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.4.1.2. Query Service Inventory

Field	Description
User Story Name	Query Service Inventory

Field	Description
Description	The BUS wishes to query *Service Inventory* in SOF for a *set of* `Service` instances that match one or more of following optional filter query parameters: - `relatedParty.id` - `serviceSpecifiation.id` - `serviceSpecifiation.name` - `state` This scenarios could be applied in BUS in context of synchronizing with SOF *Service Inventory* prior to executing modification operations (*redesign/reserve/provision/activate/deactivate/amend/terminate/retire/cancel*) on existing `Service` instances.
Actors/Subject	BUS / SOF
Pre-conditions	1. SOF *Service Inventory* has been populated with necessary `Service`(s) instances using the *serviceOrderCreate* operations.
Process Steps	1. The BUS first determines - the filter query parameters such as: --- `relatedParty.id` --- `serviceSpecification.id` --- `serviceSpecification.name` --- `state` - the subset of `Service` properties to be retrieved (`fields` query parameter) - the *pagination* strategy (`offset` and `limit` query parameters) 2. BUS posts *serviceFind* query request to: `GET {basePath}/service` 3. SOF responds to the BUS request with either *Success* or *Error* response using *Immediate Response* pattern. In case of *Success*, the response contains the set of `Service` instances that match all of the specified criteria 4. Based on the response header fields (`X-Total-Count` and `X-Result-Count`) and its *pagination* strategy, the BUS may send subsequent additional *serviceFind* query requests with *pagination* query parameters (`offset` and `limit`) set to appropriate values. The above steps are detailed in Process Steps and Sequence
Post-conditions	1. A set of `Service` instances that match all of the specified criteria is availble in the BUS
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.4.1.3. Query Service Ordering

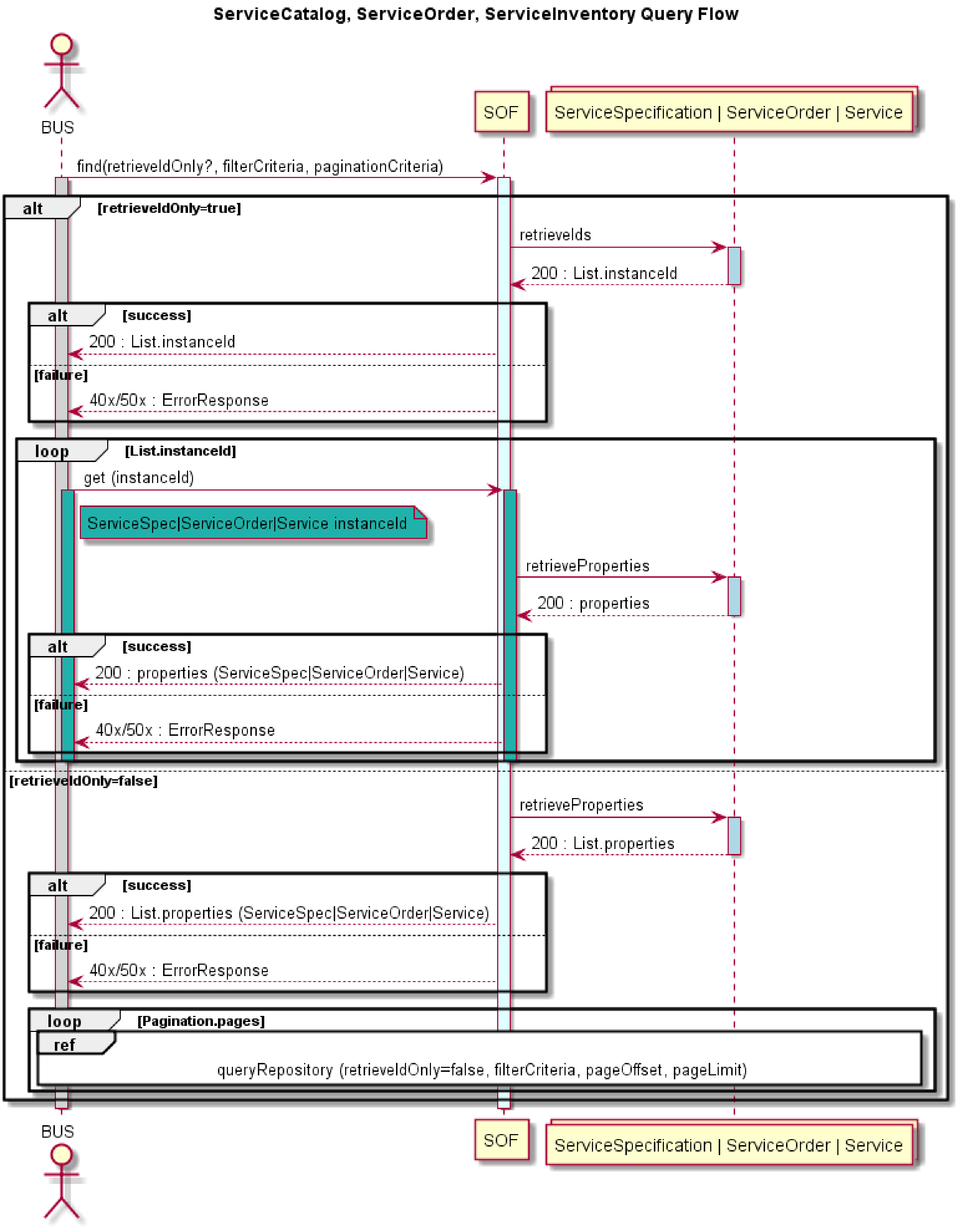
Field	Description
User Story Name	Query Service Ordering System

Field	Description
Description	The BUS wishes to query *Service Ordering* system in SOF for a *set of* `ServiceOrder` instances that match one or more of following optional filter query parameters: - *`externalId`* - *`category`* - *`orderDate.gt`* - *`orderDate.lt`* - *`state`* This scenarios could be applied in BUS in context of synchronizing with SOF *Service Ordering* system prior to executing modification operations (*redesign/reserve/provision/activate/deactivate/amend/terminate/retire/cancel*) on existing `Service` instances that were operated on by preceeding `ServiceOrder`(s).
Actors/Subject	BUS / SOF
Pre-conditions	1. SOF *Service Ordering* system has been populated with necessary `ServiceOrder`(s) instances using the *serviceOrderCreate* operations.
Process Steps	1. The BUS first determines - the filter query parameters such as: --- *`externalId`* --- *`category`* --- *`orderDate.gt`* --- *`orderDate.lt`* --- *`state`* - the subset of `ServiceOrder` properties to be retrieved (*`fields`* query parameter) - the *pagination* strategy (*`offset`* and *`limit`* query parameters) 2. BUS posts *serviceOrderFind* query request: `GET {basePath}/serviceOrder` 3. SOF responds to the BUS request with either *Success* or *Error* response using *Immediate Response* pattern. In case of *Success*, the response contains the set of `ServiceOrder` instances that match all of the specified criteria 4. Based on the response header fields (*`X-Total-Count`* and *`X-Result-Count`*) and its *pagination* strategy, the BUS may send subsequent additional *serviceOrderFind* query requests with *pagination* query parameters (*`offset`* and *`limit`*) set to appropriate values. The above steps are detailed in Process Steps and Sequence
Post-conditions	1. A set of `ServiceOrder` instances that match all of the specified criteria is availble in the BUS
Error-Conditions	Processes error conditions to reflect (422) functional errors described in Error Responses and Codes table

7.4.2 Process Steps and Sequence

The following sequence diagram illustrates the inventory query and retrieval flow. This flow depicts the sequence for two scenarios:

- BUS first retrieves a list of IDs from the inventory and then makes subsequent *getById* request for every ID returned in the first operation
- BUS retrieves the entire set of properties of the *API Resource*, but uses a simple *limit/offset* pagination strategy to retrieve batches of data.


ServiceCatalog, ServiceOrder, ServiceInventory Query Flow
BUS
SOF
ServiceSpecification | ServiceOrder | Service
find(retrieveIdOnly?, filterCriteria, paginationCriteria)
alt [retrieveIdOnly=true]
retrieveIds
200 : List.instanceId
alt [success]
200 : List.instanceId
[failure]
40x/50x : ErrorResponse
loop [List.instanceId]
get (instanceId)
ServiceSpec|ServiceOrder|Service instanceId
retrieveProperties
200 : properties
alt [success]
200 : properties (ServiceSpec|ServiceOrder|Service)
[failure]
40x/50x : ErrorResponse
[retrieveIdOnly=false]
retrieveProperties
200 : List.properties
alt [success]
200 : List.properties (ServiceSpec|ServiceOrder|Service)
[failure]
40x/50x : ErrorResponse
loop [Pagination.pages]
ref
queryRepository (retrieveIdOnly=false, filterCriteria, pageOffset, pageLimit)
BUS
SOF
ServiceSpecification | ServiceOrder | Service

7.4.3. JSON Representation Sample

The following is a sample JSON data for `ServiceSpecification` find query posted to SOF
`GET https://<server>:<port>/api/serviceCatalog/v0/serviceSpecification`

```
TBD
```

```
```

The following is a sample JSON data for `ServiceSpecification` get query posted to SOF
`GET https://<server>:<port>/api/serviceCatalog/v0/serviceSpecification/{id}`

```
TBD
```

The following is a sample JSON data for `ServiceOrder` find query posted to SOF
`GET https://<server>:<port>/api/serviceOrdering/v0/serviceOrder`

```
TBD
```

The following is a sample JSON data for `ServiceOrder` get query posted to SOF
`GET https://<server>:<port>/api/serviceOrdering/v0/serviceOrder/{id}`

```
TBD
```

The following is a sample JSON data for `Service` find query posted to SOF
`GET https://<server>:<port>/api/serviceInventory/v0/service`

```
TBD
```

The following is a sample JSON data for `Service` get query posted to SOF
`GET https://<server>:<port>/api/serviceInventory/v0/service/{id}`

```
TBD
```

8 State Transitions

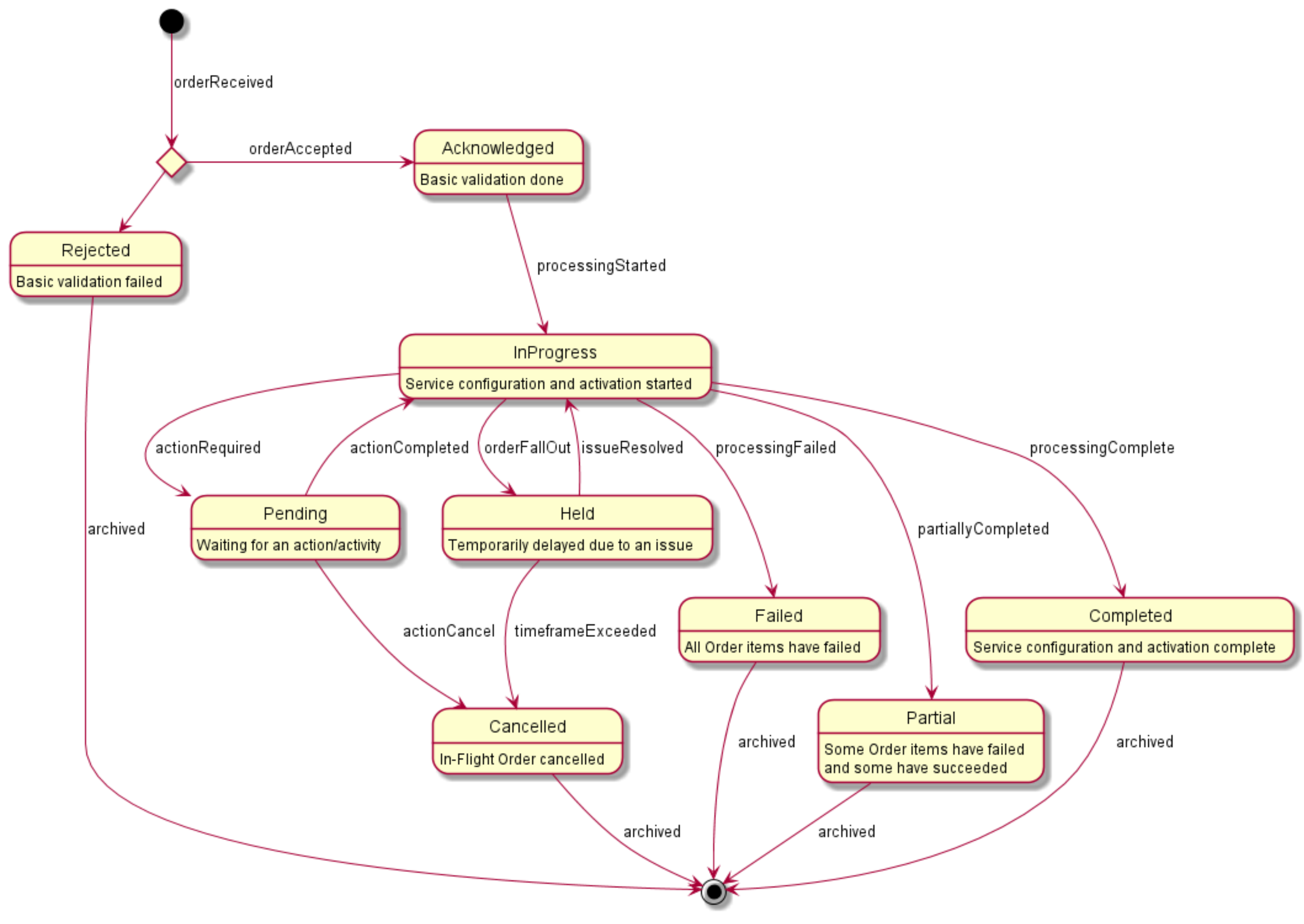
The API Interactions and Flows described above rely on the following key state machines types and transition rules:

- Service Order State
- Service State

8.1 Service Order State Transitions

The figure below depicts valid states and transitions for the `ServiceOrderStateType`. The following *SchemaObjects (classes)* have a *`state`* property of type `ServiceOrderStateType`

- `ServiceOrder`: The property value represents the actual/current state of a `ServiceOrder` instance in the SOF *Service Order Management* system
- `ServiceOrderItem`: The property value represents the actual/current state of a `ServiceOrderItem` instance contained within the `ServiceOrder` in the SOF *Service Order Management* system



The following table provides the description of the states in the `ServiceOrderStateType`

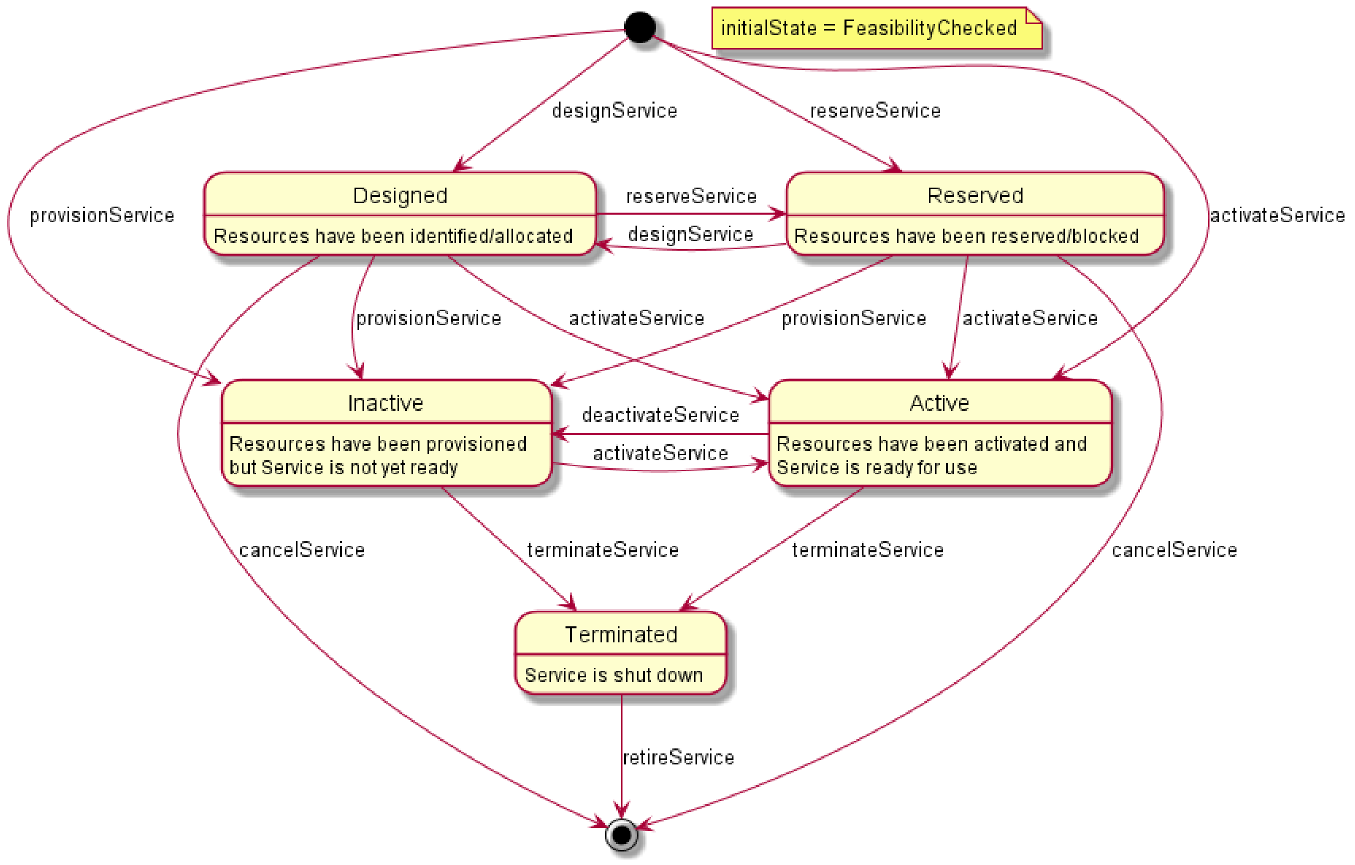
State	Description
acknowledged	The Acknowledged state indicates that `ServiceOrder` request has been received and has passed message and basic validations and a *Success Response* has been sent.
rejected	This state indicates that: - Invalid information is provided through the `ServiceOrder` / `ServiceOrderItem` request - The request fails to meet validation rules for `Service` delivery (processing) If one `ServiceOrderItem` is rejected, then the entire `ServiceOrder` request is rejected and a *Error Response* is sent.
inProgress	This state indicates that all `ServiceOrderItems` have successfully passed the validations checks and the scheduled `Service` delivery/processing has started. The `ServiceOrder` will be in *`inProgress`* state if *at least one* `ServiceOrderItem` is in *`inProgress`* state
pending	This state indicates that a `ServiceOrderItem` is currently in a waiting stage for an action/activity to be completed before the order-processing can progress further, pending order amend or cancel assessment. A *`pending`* state can lead into auto cancellation of an `ServiceOrderItem`, if no action is taken within the agreed timeframe. The `ServiceOrder` will be in *`pending`* state if *at least one* `ServiceOrderItem` is in *`pending`* state

State	Description
held	This state indicates that a `ServiceOrderItem` cannot be progressed due to an issue. The `Service` delivery (processing) has been temporarily delayed to resolve an infrastructure shortfall to facilitate supply of order. Upon resolution of the issue, the `ServiceOrderItem` will continue to progress. A *`held`* state can lead into auto cancellation of an `ServiceOrderItem`, if no action is taken within the agreed timeframe. The `ServiceOrder` will be in *`held`* state if at least one `ServiceOrderItem` is in *`held`* state
cancelled	This state indicates that a `ServiceOrderItem` has been cancelled. The `ServiceOrder` will be in *`cancelled`* state if at *ALL* `ServiceOrderItems` are in *`cancelled`* state
failed	This state indicates that `Service` delivery (processing) associated with a `ServiceOrderItem` has failed. This indicates an irrecoverable error as opposed to *`held`* or *`pending`* issues. The `ServiceOrder` will be in *`failed`* state if at *ALL* `ServiceOrderItems` are in *`failed`* state
completed	This state indicates that `Service` delivery (processing) associated with a `ServiceOrderItem` has completed. The `ServiceOrder` will be in *`completed`* state if at *ALL* `ServiceOrderItems` are in *`completed`* state
partial	This state indicates that some `ServiceOrderItem` are in *`completed`* state while others are in *`cancelled`* and/or *`failed`* states, so the entire `ServiceOrder` is in a *`partial`* state.

8.2 Service State Transitions

The figure below depicts valid states and transitions for the `ServiceStateType`. The following *SchemaObjects (classes)* have a *`state`* property of type `ServiceStateType`

- `Service`: The property value represents the actual/current state of a `Service` instance in the SOF *Service Inventory* system
- `ServiceConfiguration`: The property value represents the intended state of the targeted `Service` instance in the SOF *Service Inventory* system. This property in conjunction with requested action (`ActionType.add` / `ActionType.modify`) conveys an additonal semantic of `Service` configuration operations such as *designService*, *reserveService*, *provisionService* *activateService*, *deactivateService*, *amendService* and *terminateService* as described in the user stories.



The following table provides the description of the states in the `ServiceStateType`

State	Description
feasibilityChecked	This is the transient initial state of a new `Service` instance added to the *Service Inventory* at the start of the corresponding `ServiceOrderItem`'s `ActionType.add` processing. This indicates that pre-ordering feasibility checks have been performed.
designed	This is the intended/target state specified in `ServiceConfiguration` for initiating a *designService* activity. When applied to the `Service` instance in the *Service Inventory*, this indicates that the network resources necessary to fulfill the `Service` have been identified and allocated to the `Service`, but not yet blocked/reserved and hence can be re-allocated to other `Services`.
reserved	This is the intended/target state specified in `ServiceConfiguration` for initiating a *reserveService* activity. When applied to the `Service` instance in the *Service Inventory*, this indicates that the network resources necessary to fulfill the `Service` have been identified, are available and have reserved/blocked for the `Service`'s exclusive use.
inactive	This is the intended/target state specified in `ServiceConfiguration` for initiating a *provisionService* or *suspendService* activity. When applied to the `Service` instance in the *Service Inventory*, this indicates that the network resources necessary to fulfill the `Service` have been provisioned into the network, but not yet activated for customer use.
active	This is the intended/target state specified in `ServiceConfiguration` for initiating a *activateService* or *resumeService* activity. When applied to the `Service` instance in the *Service Inventory*, this indicates that the network resources necessary to fulfill the `Service` have been provisioned into the network and activated for customer use.

State	Description
terminated	This is the intended/target state specified in `ServiceConfiguration` for initiating a *terminateService* activity. When applied to the `Service` instance in the *Service Inventory*, this indicates that the `Service` is logically deleted and the network resources supporting the `Service` have been de-provisioned from the network and released/disassociated from the `Service`. (available for use by other `Services`).

9. API Details

9.1. API Operation and Parameter Definitions

9.1.1 ServiceCatalog

This Service Catalog APIs provide a consistent/standardized mechanism for BUS to query the Service Catalog maintained by the SOF.

9.1.1.1. Operation: serviceSpecificationFind

This operation retrieves list of `ServiceSpecification` instances matching the *`query`* parameters from the *Service Catalog* system maintained by the SOF. Attribute selection is possible using the *`fields`* parameter to filter returned attribute(s) for the retrieved `ServiceSpecification` instances. *Offset Pagination* is supported using the *`limit/offset`* parameters in *`query`* with a implied ordered-list based on `ServiceSpecification.id`. If an exception is encountered, then appropriate *StatusCode* and `Error` information is returned as specified.

Parameter Name	Type	Location	Multi.	Description
state	`ServiceSpecificationState`	in: query	0..1	Filter by `ServiceSpecification` status
category	string	in: query	0..1	Filter by `ServiceSpecification` category
subCategory	string	in: query	0..1	Filter by `ServiceSpecification` category
offset	integer	in: query	0..1	Requested start index for `ServiceSpecification` instances to be retrieved.
limit	integer	in: query	0..1	Requested number of `ServiceSpecification` instances to be provided in response
fields	string	in: query	0..1	Used to filter returned attribute(s) of the retrieved `ServiceSpecification` instance. Specified as string value containing a list of attribute names separated by space

Parameter Name	Type	Location	Multi.	Description
X-Total-Count	integer	out: header	0..1	**Success Response** (Status Code: `200`): Total number of `ServiceSpecification` instances matching criteria
X-Result-Count	integer	out: header	0..1	**Success Response** (Status Code: `200`): Actual number of `ServiceSpecification` instances returned in the response body
serviceSpecification	`ServiceSpecification`	out: content	0..*	**Success Response** (Status Code: `200`): The list of `ServiceSpecification` instances matching the input query parameters. If the *`fields`* input parameter is specified, the returned `ServiceSpecification` instance will only contain the requested properties.
error	`Error`	out: content	0..1	**Error Response** (Status Codes: `400 401 403 404 405 409 500 503`) : The `Error` instance containing additional information about the error

9.1.1.2. Operation: serviceSpecificationGet

This operation retrieves a `ServiceSpecification` instance identified by the *`id`* parameter from the *Service Catalog* system maintained by the SOF. Attribute selection is possible using the *`fields`* parameter to filter returned attribute(s) for the retrieved `ServiceSpecification` instance. If an exception is encountered, then appropriate *StatusCode* and `Error` information is returned as specified.

Parameter Name	Type	Location	Multi.	Description
id	string	in: path	1	Id of the specific `ServiceSpecification` instance to be retrieved
fields	string	in: query	0..1	Used to filter returned attribute(s) of the retrieved `ServiceSpecification` instance. Specified as string value containing a list of attribute names separated by space

Parameter Name	Type	Location	Multi.	Description
serviceSpecification	`ServiceSpecification`	out: content	0..1	**Success Response** (Status Code: `200`): The `ServiceSpecification` instance matching the input Id parameters. If the *`fields`* input parameter is specified, the returned `ServiceSpecification` instance will only contain the request properties.
error	`Error`	out: content	0..1	**Error Response** (Status Codes: `400 401 403 404 405 409 500 503`) : The `Error` instance containing additional information about the error

9.1.2. ServiceInventory

The Service Inventory APIs provide a consistent/standardized mechanism for the BUS to query the Service inventory management system maintained by the SOF.

9.1.2.1. Operation: serviceFind

This operation retrieves list of `Service` instances matching the *`query`* parameters from the *Service Inventory* system maintained by the SOF. Attribute selection is possible using the *`fields`* parameter to filter returned attribute(s) for the retrieved `Service` instances. *Offset Pagination* is supported using the *`limit/offset`* parameters in *`query`* with a implied ordered-list based on `Service.id`. If an exception is encountered, then appropriate *StatusCode* and `Error` information is returned as specified.

Parameter Name	Type	Location	Multi.	Description
state	`ServiceState`	in: query	0..1	Filter by `Service` instance status
relatedParty.id	string	in: query	0..1	Filter by Id of the `RelatedParty` associated with the Service instance.
serviceSpecification.id	string	in: query	0..1	Filter by Id of the associated `ServiceSpecification` used to instatiate the Service. It is possible for multiple Services to be associated with a single Service Specification.
serviceSpecification.name	string	in: query	0..1	Filter by Name of the associated `ServiceSpecification` used to instatiate the Service. It is possible for multiple Services to be associated with a single Service Specification.
offset	integer	in: query	0..1	Requested start index for `Service` instances to be retrieved.
limit	integer	in: query	0..1	Requested number of `Service` instances to be provided in response

Parameter Name	Type	Location	Multi.	Description
fields	string	in: query	0..1	Used to filter returned attribute(s) of the retrieved `Service` instance. Specified as string value containing a list of attribute names separated by space
X-Total-Count	integer	out: header	0..1	**Success Response** (Status Code: `200`): Total number of `Service` instances matching criteria
X-Result-Count	integer	out: header	0..1	**Success Response** (Status Code: `200`): Actual number of `Service` instances returned in the response body
service	`Service`	out: content	0..*	**Success Response** (Status Code: `200`): The list of `Service` instances matching the input query parameters. If the *`fields`* input parameter is specified, the returned `Service` instance will only contain the requested properties.
error	`Error`	out: content	0..1	**Error Response** (Status Codes: `400` `401` `403` `404` `405` `409` `500` `503`) : The `Error` instance containing additional information about the error

9.1.2.2. Operation: serviceGet

This operation retrieves a `Service` instance identified by the *`id`* parameter from the *Service Inventory* system maintained by the SOF. Attribute selection is possible using the *`fields`* parameter to filter returned attribute(s) for the retrieved `Service` instance. If an exception is encountered, then appropriate *StatusCode* and `Error` information is returned as specified.

Parameter Name	Type	Location	Multi.	Description
id	string	in: path	1	Id of the specific `Service` instance to be retrieved
fields	string	in: query	0..1	Used to filter returned attribute(s) of the retrieved `Service` instance. Specified as string value containing a list of attribute names separated by space
service	`Service`	out: content	0..1	**Success Response** (Status Code: `200`): The `Service` instance matching the input Id parameters. If the *`fields`* input parameter is specified, the returned `Service` instance will only contain the request properties.
error	`Error`	out: content	0..1	**Error Response** (Status Codes: `400` `401` `403` `404` `405` `409` `500` `503`) : The `Error` instance containing additional information about the error

9.1.3. ServiceOrder

The Service Order APIs provide a consistent/standardized mechanism for BUS to manipulate the Service instances (and in turn the Service Configuration and Activation processes) through Service Orders.

9.1.3.1. Operation: serviceOrderFind

This operation retrieves list of `ServiceOrder` instances matching the *`query`* parameters from the *Service Order* system maintained by the SOF. Attribute selection is possible using the *`fields`* parameter to filter returned attribute(s) for the retrieved `ServiceOrder` instances. *Offset Pagination* is supported using the *`limit/offset`* parameters in *`query`* with a implied ordered-list based on `ServiceOrder.id`. If an exception is encountered, then appropriate *StatusCode* and `Error` information is returned as specified.

Parameter Name	Type	Location	Multi.	Description
state	`ServiceOrderState`	in: query	0..1	Filter by `ServiceOrder` instance status
externalId	String	in: query	0..1	Filter by `ServiceOrder` externalId
category	String	in: query	0..1	Filter by `ServiceOrder` category
orderDate.gt	String	in: query	0..1	Filter `ServiceOrder` with orderDate greater than or equal to the specified date
orderDate.lt	String	in: query	0..1	Filter `ServiceOrder` with orderDate less than equal to the specified date
offset	integer	in: query	0..1	Requested start index for `ServiceOrder` instances to be retrieved.
limit	integer	in: query	0..1	Requested number of `ServiceOrder` instances to be provided in response
fields	string	in: query	0..1	Used to filter returned attribute(s) of the retrieved `ServiceOrder` instance. Specified as string value containing a list of attribute names separated by space
X-Total-Count	integer	out: header	0..1	**Success Response** (Status Code: `200`): Total number of `ServiceOrder` instances matching criteria
X-Result-Count	integer	out: header	0..1	**Success Response** (Status Code: `200`): Actual number of `ServiceOrder` instances returned in the response body
serviceOrder	`ServiceOrder`	out: content	0..*	**Success Response** (Status Code: `200`): The list of `ServiceOrder` instances matching the input query parameters. If the *`fields`* input parameter is specified, the returned `Service` instance will only contain the requested properties.
error	`Error`	out: content	0..1	**Error Response** (Status Codes: `400` `401` `403` `404` `405` `409` `500` `503`) : The `Error` instance containing additional information about the error

9.1.3.2. Operation: serviceOrderGet

This operation retrieves a `ServiceOrder` instance identified by the *`id`* parameter from the *Service Order* system maintained by the SOF. Attribute selection is possible using the *`fields`* parameter to filter returned attribute(s) for the retrieved `ServiceSpecification` instance. If an exception is encountered, then appropriate *StatusCode* and `Error` information is returned as specified.

Parameter Name	Type	Location	Multi.	Description
id	string	in: path	1	Id of the specific `ServiceOrder` instance to be retrieved
fields	string	in: query	0..1	Used to filter returned attribute(s) of the retrieved `ServiceOrder` instance. Specified as string value containing a list of attribute names separated by space
serviceOrder	`ServiceOrder`	out: content	0..1	**Success Response** (Status Code: `200`): The `ServiceOrder` instance matching the input Id parameters. If the *`fields`* input parameter is specified, the returned `Service` instance will only contain the requested properties.
error	`Error`	out: content	0..1	**Error Response** (Status Codes: `400 401 403 404 405 409 500 503`) : The `Error` instance containing additional information about the error

9.1.3.3. Operation: serviceOrderCreate

This operation creates a `ServiceOrder` instance in the SOF. A `ServiceOrder` is used to request operations on a `Service` instance. A `ServiceOrder` groups one or more `ServiceOrderItems` each of which specifices a operation to be performed (*`add`*/*`delete`*/*`modify`*/*`noChange`*) and `ServiceConfiguration` data for that operation. The `ServiceConfiguration` can be applied to *`add`* a new `Service` instance in SOF or (*`modify`*) an existing `Service` instance. If an exception is encountered, then appropriate *StatusCode* and `Error` information is returned as specified.

Parameter Name	Type	Location	Multi.	Description
serviceOrder	`ServiceOrderConfiguration`	in: content	1	The `ServiceOrderConfiguration` contains one or more *`ServiceOrderItem`* each of which contains `ServiceConfiguration` information and an action (*`add`*/*`delete`*/*`modify`*) to be performed.
serviceOrder	`ServiceOrder`	out: content	0..1	**Success Response** (Status Code: `201`): Success The created Service Order instance with Id and Href fields assigned by SOF.
error	`Error`	out: content	0..1	**Error Response** (Status Codes: `400 401 403 404 405 409 422 500 503`) : The `Error` instance containing additional information about the error

9.2. API Schema and Attribute Definitions

TBD

10. References

TBD

A.1 Appendix: TMF and ONAP API Mapping

A.1.1. BasePath Mapping

The following are the Legato API *basePaths* and the corresponding TMF/ONAP API *basePaths*:

Legato API v0 BasePath	**TMF OpenAPI 3.0.0 BasePath**	**ONAP ExtAPI elalto BasePath**
`/api/serviceCatalog/v0`	`/tmf-api/serviceCatalog/v3`	`/nbi/api/v4`
`/api/serviceCatalog/v0/listener`	`/tmf-api/serviceCatalog/v3/listener`	`/nbi/api/v4/notification`
`/api/serviceInventory/v0`	`/tmf-api/serviceInventory/v3`	`/nbi/api/v4`
`/api/serviceInventory/v0/listener`	`/tmf-api/serviceInventory/v3/listener`	`/nbi/api/v4/notification`
`/api/serviceOrdering/v0`	`/tmf-api/serviceOrdering/v3`	`/nbi/api/v4`
`/api/serviceOrdering/v0/listener`	`/tmf-api/serviceOrdering/v3/listener`	`/nbi/api/v4/notification`

A.1.2. Endpoint Mapping

The following are the supported Legato API *endpoints* and the corresponding TMF/ONAP API *endpoints*:

Legato API v0 Endpoint	**TMF OpenAPI 3.0.0 Endpoint**	**ONAP ExtAPI v.elalto Endpoint**
`GET /serviceSpecification`	`GET/POST /serviceSpecification`	`GET /serviceSpecification`
`GET /serviceSpecification/{ID}`	`GET/PATCH/DELETE /serviceSpecification/{ID}`	`GET /serviceSpecification/{ID}`
`GET /service`	`GET/POST /service`	`GET /service`
`GET /service/{ID}`	`GET/PATCH/DELETE /service/{ID}`	`GET /service/{ID}`
`GET/POST /serviceOrder`	`GET/POST /serviceOrder`	`GET/POST /serviceOrder`
`GET /serviceOrder/{ID}`	`GET/PATCH/DELETE /serviceOrder/{ID}`	`GET /serviceOrder/{ID}`
`POST /hub`	`POST /hub`	`GET/POST /hub`
`DELETE /hub/{ID}`	`DELETE /hub/{ID}`	`GET/DELETE /hub/{ID}`

A.1.3. SchemaObject Mapping

Legato API v0 Construct	TMF OpenAPI 3.0.0 Construct	ONAP ExtAPI elalto Construct
`ActionType`	`ServiceOrderActionType`	`ActionType`
`AttachmentRef`	`AttachmentRef`	`Attachment`
`DistributionStatus`	*None*	`DistributionStatus`
`Error`	`Error`	`ErrorRepresentation`
`EventSubscription`	`EventSubscription`	`Hub`
`EventSubscriptionInput`	`EventSubscriptionInput`	`HubIn`
`MapCharacteristic`	`Characteristic`	`Characteristic`
`ResourceRef`	`ResourceRef`	`SupportingResource`
`RelatedPartyRef`	`RelatedParty`	`RelatedPartyRef`
`Service`	`Service`	`Service`
`ServiceConfiguration`	`ServiceRestriction`	`Service`
`ServiceEventType`	*string*	`EventType`
`ServiceOrder`	`ServiceOrder`	`ServiceOrder`
`ServiceOrderConfiguration`	`ServiceOrder_Create`	`CreateServiceOrder`
`ServiceOrderEventType`	*string*	`EventType`
`ServiceOrderItem`	`ServiceOrderItem`	`ServiceOrderItem`
`ServiceOrderItemConfiguration`	`ServiceOrderItem`	`CreateServiceOrderItem`
`ServiceOrderItemRelationship`	`ServiceOrderItemRelationship`	`OrderItemRelationship`
`ServiceOrderItemRelationshipType`	*string*	`RelationshipType`
`ServiceOrderRelationship`	`ServiceOrderRelationship`	`OrderRelationship`
`ServiceOrderRelationshipType`	*string*	*string*
`ServiceOrderRef`	`ServiceOrderRef`	*None*
`ServiceOrderStateType`	`ServiceOrderStateType`	`StateType`
`ServiceRef`	`ServiceRef`	`ServiceRef`
`ServiceRelationship`	`ServiceRelationship`	`ServiceRelationship`
`ServiceRelationshipType`	*string*	`RelationshipType`
`ServiceSpecification`	`ServiceSpecification`	`ServiceSpecification`
`ServiceSpecificationEventType`	*string*	*None*
`ServiceSpecificationRef`	`ServiceSpecificationRef`	`ServiceSpecificationRef`
`ServiceSpecificationRelationship`	`ServiceSpecRelationship`	*None*
`ServiceSpecificationState`	*string*	`LifecycleStatusValues`
`ServiceStateType`	`ServiceStateType`	*string*

Legato API v0 Construct	TMF OpenAPI 3.0.0 Construct	ONAP ExtAPI elalto Construct
`TargetServiceSchema`	`TargetServiceSchema`	`TargetServiceSchemaRef`