



Mplify Standard

Mplify 142

**LSO Cantata and LSO Sonata Product Catalog
API - Developer Guide**

November 2025

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Table of Contents

- List of Contributing Members
- 1. Abstract
- 2. Terminology and Abbreviations
- 3. Compliance Levels
- 4. Introduction
 - 4.1. Conventions in the Document
 - 4.2. Relation to Other Documents
 - 4.3. Approach
 - 4.4. General concepts
 - 4.4.1. General concepts introduction
 - 4.4.2. JSON Subschema
 - 4.4.3. Product Specification and Product Offering Schemas
 - 4.4.4. Bundles
 - 4.5. High-Level Flow
- 5. API Description
 - 5.1. High-level use cases
 - 5.2. API Endpoint and Operation Description
 - 5.2.1. Seller side API Endpoints
 - 5.2.2. Buyer side API Endpoints
 - 5.3. Specifying the Buyer ID and the Seller ID
 - 5.4. Model Structural Validation
 - 5.5. Security Considerations
- 6. API Interactions and Flows
 - 6.1. Product Category Use Cases
 - 6.1.1. Product Category - Model
 - 6.1.2. Use case 1: Retrieve Product Category List
 - 6.1.2.1. Interaction flow
 - 6.1.2.2. Retrieve Product Category List - Request
 - 6.1.2.3. Retrieve Product Category List - Response
 - 6.1.3. Use case 2: Retrieve Product Category by Identifier
 - 6.1.3.1. Interaction flow
 - 6.1.3.2. Retrieve Product Category by Identifier - Request
 - 6.1.3.3. Retrieve Product Category by Identifier - Response
 - 6.2. Product Offering Use Cases
 - 6.2.1. Product Offering - Model
 - 6.2.1.1. Product Offering
 - 6.2.1.2. Product Offering Bundle Relationship
 - 6.2.1.3. Product Relationship Constraint
 - 6.2.1.4. Place Relationship Constraint
 - 6.2.1.5. Product Offering Specification Schema
 - 6.2.1.6. Product Offering Contextual Info
 - 6.2.1.7. Product Offering Price
 - 6.2.2. Product Offering - Lifecycle
 - 6.2.3. Use case 3: Retrieve Product Offering List
 - 6.2.3.1. Interaction flow
 - 6.2.3.2. Retrieve Product Offering List - Request
 - 6.2.3.3. Retrieve Product Offering List - Response
 - 6.2.4. Use case 4: Retrieve Product Offering by Identifier
 - 6.2.4.1. Interaction flow
 - 6.2.4.2. Retrieve Product Offering by Identifier - Request
 - 6.2.4.3. Retrieve Product Offering by Identifier - Response
 - 6.3. Product Specification Use Cases

- 6.3.1. Product Specification - Model
 - 6.3.2. Product Specification - Lifecycle
 - 6.3.3. Use case 5: Retrieve Product Specification List
 - 6.3.3.1. Interaction flow
 - 6.3.3.2. Retrieve Product Specification List - Request
 - 6.3.3.3. Retrieve Product Specification List - Response
 - 6.3.4. Use case 6: Retrieve Product Specification by Identifier
 - 6.3.4.1. Interaction flow
 - 6.3.4.2. Retrieve Product Specification by Identifier - Request
 - 6.3.4.3. Retrieve Product Specification by Identifier - Response
 - 6.4. Use case 7: Register for Event Notifications
 - 6.4.1. Register for Event Notifications - Request
 - 6.4.2. Register for Event Notifications - Response
 - 6.4.3. Unregister from Event Notifications - Request
 - 6.4.4. Unregister for Event Notifications - Response
 - 6.5. Use case 8: Send Event Notification
- 7. API Details
 - 7.1. API patterns
 - 7.1.1. Indicating errors
 - 7.1.1.1. Type Error
 - 7.1.1.2. Type Error400
 - 7.1.1.3. `enum` Error400Code
 - 7.1.1.4. Type Error401
 - 7.1.1.5. `enum` Error401Code
 - 7.1.1.6. Type Error403
 - 7.1.1.7. `enum` Error403Code
 - 7.1.1.8. Type Error404
 - 7.1.1.9. Type Error422
 - 7.1.1.10. `enum` Error422Code
 - 7.1.1.11. Type Error500
 - 7.1.1.12. Type Error501
 - 7.2. API Data model
 - 7.2.1. Product Category
 - 7.2.1.1. Type ProductCategory
 - 7.2.1.2. Type ProductOfferingRef
 - 7.2.2 Product Offering
 - 7.2.2.1. Type ProductOffering_Common
 - 7.2.2.2. Type ProductOffering
 - 7.2.2.3. Type ProductOffering_Find
 - 7.2.2.4. `enum` ProductOfferingLifecycleStatusType
 - 7.2.2.5. Type ProductOfferingLifecycleStatusTransition
 - 7.2.2.6. Type ProductSpecificationRef
 - 7.2.2.7. Type MEFItemTerm
 - 7.2.2.7. Type ProductOfferingTerm
 - 7.2.2.8. `enum` MEFEndOfTermAction
 - 7.2.2.9. Type ProductOfferingContextualInfo
 - 7.2.2.10. Type Context
 - 7.2.2.11. `enum` ProductActionMask
 - 7.2.2.12. `enum` BusinessFunctionMask
 - 7.2.2.13. Type Region
 - 7.2.2.14. Type ProductOfferingBundleRelationship
 - 7.2.2.15. Type ProductOfferingPrice
 - 7.2.2.16. Type Price
 - 7.2.2.17. Type PriceModifier
 - 7.2.2.18. `enum` MEFPriceType

- 7.2.2.19. Type Money
 - 7.2.3 Product Specification
 - 7.2.3.1. Type ProductSpecification_Common
 - 7.2.3.2. Type ProductSpecification
 - 7.2.3.3. Type ProductSpecification_Find
 - 7.2.3.4. **enum** ProductSpecificationLifecycleStatusType
 - 7.2.4. Common types
 - 7.2.4.1. Type AttachmentValue
 - 7.2.4.2. **enum** DataSizeUnit
 - 7.2.4.3. Type Duration
 - 7.2.4.4. Type FieldedAddressRepresentation
 - 7.2.4.6. **enum** MEFBuyerSellerType
 - 7.2.4.7. Type MEFByteSize
 - 7.2.4.8. Type SubUnit
 - 7.2.4.9. Type Note
 - 7.2.3.10. Type PlaceRelationshipConstraint
 - 7.2.1.11. Type ProductCategoryRef
 - 7.2.1.12. Type ProductMilestoneDefinition
 - 7.2.3.13 Type ProductRelationshipConstraint
 - 7.2.4.14 Type RelatedContactInformation
 - 7.2.4.15 Type SchemaRefOrValue
 - 7.2.4.16. Type TimePeriod
 - 7.2.4.17. **enum** TimeUnit
 - 7.2.5. Notification Registration
 - 7.2.8.1. Type EventSubscriptionInput
 - 7.2.8.2. Type EventSubscription
- 7.3. Notification API Data model
 - 7.3.1. Type Event
 - 7.3.2. Type ProductCategoryCreateEvent
 - 7.3.3. Type ProductCategoryAttributeValueChangeEvent
 - 7.3.4. Type ProductCategoryEventPayload
 - 7.3.5. Type ProductOfferingAttributeValueChangeEvent
 - 7.3.6. Type ProductOfferingCreateEvent
 - 7.3.7. Type ProductOfferingEventPayload
 - 7.3.8. Type ProductOfferingStateChangeEvent
 - 7.3.9. Type ProductOfferingStateChangeEventPayload
 - 7.3.10. Type ProductSpecificationAttributeValueChangeEvent
 - 7.3.11. Type ProductSpecificationCreateEvent
 - 7.3.12. Type ProductSpecificationEventPayload
 - 7.3.13. Type ProductSpecificationStateChangeEvent
 - 7.3.14. Type ProductSpecificationStateChangeEventPayload
- 8. References
- Appendix A Examples (Informative)
 - A.1 Bundling Product Offering
 - A.2 Bundled Access E-Line Product Offering
 - A.3 Bundled UNI Product Offering
- Appendix B Acknowledgments

List of Contributing Members

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

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Table 1. Contributing Members

1. Abstract

This standard is intended to assist implementation of the Product Catalog functionality defined for the LSO Cantata and LSO Sonata Interface Reference Points (IRPs), for which requirements and use cases are defined in Mplify 127.1 *Product Catalog Requirements and Use Cases* [Mplify 127.1]. This standard consists of this document and complementary API definitions for Product Catalog Querying and Product Catalog Notifications.

This standard normatively incorporates the following files by reference as if they were part of this document, from the GitHub repository:

<https://github.com/MEF-GIT/MEF-LSO-Sonata-SDK>

commit id: [d3d0dc1a0281afd8a964311193438012a5e605b9](#)

- [productApi/catalog/productCatalog.api.yaml](#)
- [productApi/catalog/productCatalogNotification.api.yaml](#)

<https://github.com/MEF-GIT/MEF-LSO-Cantata-SDK>

commit id: [3a0956c2b46bd198d41808bdb97fd17957f844d5](#)

- [productApi/catalog/productCatalog.api.yaml](#)
- [productApi/catalog/productCatalogNotification.api.yaml](#)

The Product Catalog API is defined using OpenAPI 3.0 [OAS-V3]

2. Terminology and Abbreviations

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

In addition, terms defined in the standards referenced below are included in this document by reference and are not repeated in the table below:

- MEF 55.1.1 Lifecycle Service Orchestration (LSO): Reference Architecture and Framework [[MEF 55.1.1](#)]
- MEF 57.2 Product Order Management Requirements and Use Cases [[MEF 57.2](#)]
- Mplify 127.1 Product Catalog Requirements and Use Cases [[Mplify 127.1](#)]
- Mplify 150 Installation Place and Service Site Management Business Requirements and Use Cases [[Mplify 150](#)]

Term	Description	Reference
Bundle	In the context of this document, a Bundle is a Product Offering that groups multiple Product Offerings (for example, to provide a different price or simplified ordering process). A Bundle may not contain a Product Offering that is a Bundle.	[Mplify 127.1]
JSON subschema	JSON schema A is called the subschema of schema B when every JSON that is valid against schema A is valid against schema B.	This document
List Price	The standard published price, without any price reductions, deal references or discounts.	[Mplify 127.1]
Non-backwards Compatible Modification	Any modification to a Product Offering that results in a previously valid Product Offering Configuration to become invalid.	[Mplify 127.1]
Product	The realization of a Product Offering to create a single instance for a specific Buyer.	[MEF 55.1.1]
Product Catalog	Describes the Product Specifications and Product Offerings made available by a Seller to potential Buyers.	[MEF 55.1.1]
Product Category	A grouping of Product Offerings in logical containers defined by the Seller. A Product Category may contain other (sub)Product Categories and/or Product Offerings	[Mplify 127.1]
Product Catalog Element	In the context of this document, this is a generic term used to refer to any of the Product Catalog entities: Product Category, Product Offering and Product Specification.	[Mplify 127.1]
Product Offering Contextual Target Schema	In the context of this document, a subschema of the Product Offering Specification Schema that defines additional constraints on the Product-Specific Attributes for the purpose of generating and validating the request for a given Business Function and Product Action. Each combination of Business Function and Product Action may result in a different contextual schema.	[Mplify 127.1]
Product Offering Specification Schema	In the context of this document, a subschema of the Product Specification defined by the Seller that restricts the possible values of the Product-Specific Attributes, relationships, and milestones to define the Product Offering.	[Mplify 127.1]

Product Schema	In the context of this document, a schema (i.e., JSON) that defines all the attributes of a Product and their possible values. This may be the Product Specification Schema or a constraint subschema thereof.	[Mplify 127.1]
Product Specification	In the context of this document, a specification comprising the following, for use with MEF APIs: a set of schemas that define all of the attributes of a Product and their possible values, definition of relationships with other Products and/or locations	[Mplify 127.1]

Table 2. Terminology

3. Compliance Levels

The key words "**MUST**", "**MUST NOT**", "**REQUIRED**", "**SHALL**", "**SHALL NOT**", "**SHOULD**", "**SHOULD NOT**", "**RECOMMENDED**", "**NOT RECOMMENDED**", "**MAY**", and "**OPTIONAL**" in this document are to be interpreted as described in BCP 14 (RFC 2119 [[RFC2119](#)], RFC 8174 [[RFC8174](#)]) when, and only when, they appear in all capitals, as shown here. All key words must be in bold text.

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

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

4. Introduction

The Product Catalog API allows the Buyer to retrieve Product Specifications, Product Offerings, and Product Categories they are assigned to. The API defines notifications related to the lifecycle of these entities. This allows the establishment of commercial synchronization between the Seller and potential Buyers by the possibility of zero-touch introduction of the new Product Specifications and Product Offerings to the market.

This standard specifies the Application Programming Interface (API) for the Product Catalog functionality of the LSO Cantata IRP and LSO Sonata IRP as defined in the *MEF 55.1 Lifecycle Service Orchestration (LSO): Reference Architecture and Framework* [MEF 55.1]. The LSO Reference Architecture is shown in Figure 1 with both IRPs highlighted.

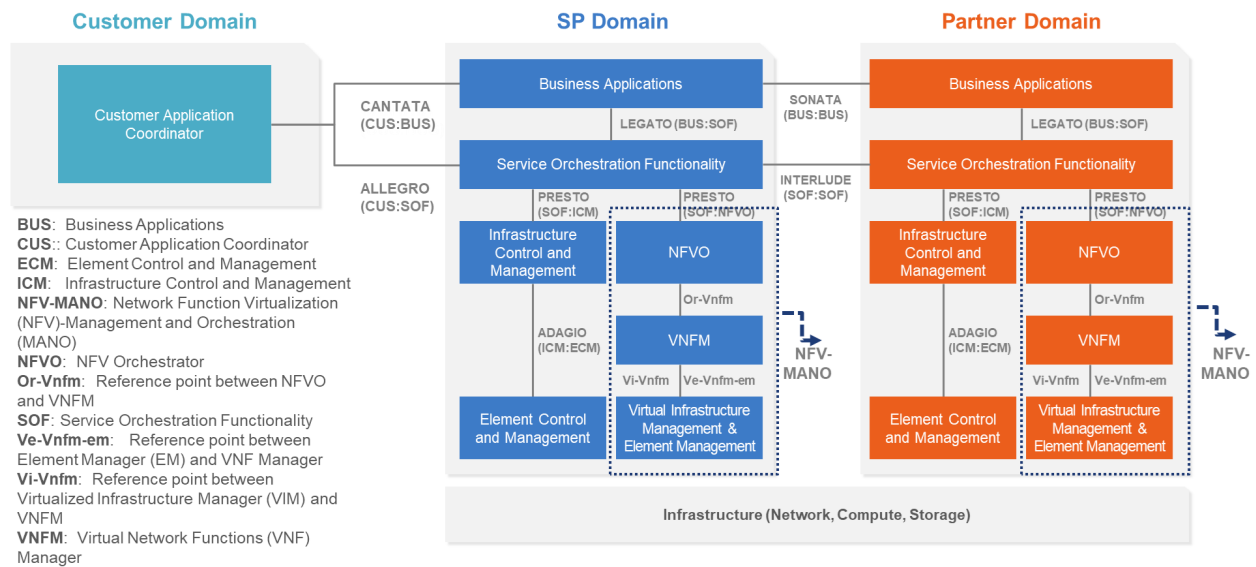


Figure 1. The LSO Reference Architecture

Cantata and Sonata IRPs define pre-ordering and ordering functionalities that allow an automated exchange of information between business applications of the Buyer (Customer or Service Provider) and Seller (Service Provider or Partner) Domains. Those are:

- Product Catalog
- Address Validation
- Site Retrieval
- Product Offering Qualification
- Product Quote
- Product Inventory
- Product Ordering
- Trouble Ticketing
- Billing

This document is structured as follows:

- [Chapter 4](#) provides an introduction to the Product Catalog and its description in a broader context of Cantata and Sonata and their corresponding SDKs.
- [Chapter 5](#) gives an overview of endpoints, resource model and design patterns.
- Use cases and flows are presented in [Chapter 6](#).
- And finally, [Chapter 7](#) complements previous sections with a detailed API description.

4.1. Conventions in the Document

- Code samples are formatted using code blocks. When notation `<< some text >>` is used in the payload sample it indicates that a comment is provided instead of an example value and it might not comply with the OpenAPI definition.
- Model definitions are formatted as in-line code (e.g. `ProductOffering`).
- In UML diagrams the default cardinality of associations is `0..1`. Other cardinality markers are compliant with the UML standard.
- In the API details tables and UML diagrams required attributes are marked with a `*` next to their names.
- In UML sequence diagrams ``` notation is used to indicate a variable to be substituted with a correct value.

4.2. Relation to Other Documents

The business requirements and use cases for this API are defined by Mplify 127.1 *Product Catalog Requirements and Use Cases* [Mplify 127.1]. Product specifications are defined using JSON Schema (draft 7) standard [JS], whereas the Product Catalog API is defined using OpenAPI 3.0 [OAS-V3].

This API definition builds on *TMF620 Product Catalog API REST Specification 4.1.0* [TMF620]. TMF620 covers use cases related to the Product Catalog management as well, whereas the goal of the API specified in this document is to allow the publishing of Product Offerings and Product Specifications and onboarding of them (between the Buyer and Seller) in a fast and efficient way (inter-carrier read-only API).

4.3. Approach

As presented in Figure 2, both Cantata and Sonata API frameworks consist of three structural components:

- Generic API framework
- Product-independent information (Function-specific information and Function-specific operations)
- Product-specific information (Mplify product specification data model)

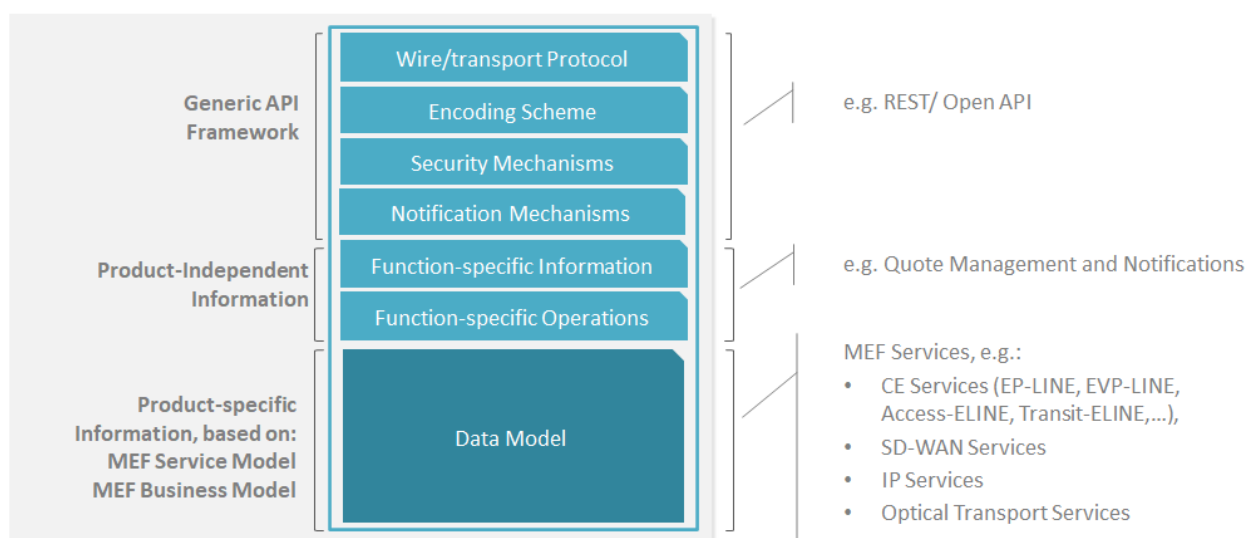


Figure 2. Cantata and Sonata API framework

The essential concept behind the framework is to decouple the common structure, information and operations from the specific product information content. Firstly, the Generic API Framework defines a set of design rules and patterns that are applied across all Cantata or Sonata APIs. Secondly, the product-independent information of the framework focuses on a model of a

particular Cantata or Sonata functionality and is agnostic to any of the product specifications. Finally, the product-specific information part of the framework focuses on Mplify product specifications that define business-relevant attributes and requirements for supporting Mplify subscriber and Mplify operator services.

In this framework, the Product Catalog is a Seller provided repository that hosts Product-specific definitions. Every product-related operation starts with the Product Catalog, firstly by specifying the product, then by publishing the Product Offerings and Product Specifications to chosen Buyers.

4.4. General concepts

4.4.1. General concepts introduction

Product Catalog introduces three key Product Catalog Element types: Product Specification, Product Offering, and Product Category. The Product Catalog modeling starts with the introduction of the Product Specification type which defines the Product's attributes (with their types, cardinalities, and allowable values) and relationships that define how the Product may be related to other Products. Once Product Specifications are defined in the Product Catalog, they may be made available by the Seller for marketing purposes. Because terms and conditions that define where and how a Product is available on the market are usually organized by different business processes, the Product Offering element type has been defined in the Product Catalog. Product Offering element type may further constrain attributes' values and cardinalities of the relations to define the desired offer.

In short, Product Specification is the definition of the Product, and Product Offering is the commercial realization of the Product Specification in the market by the Seller.

A given Product Specification may be exposed on the market by multiple different Product Offerings. To better structure and organize the Product Catalog, Product Categories have been introduced to allow the grouping of related Product Offerings. To make the categorization more flexible, it is allowed to group Product Categories within a parent Product Category as well.

4.4.2. JSON Subschema

JSON Subschema term has been introduced to allow defining specialization of a particular JSON Schema. Specialization should be understood as narrowing the set of JSONs that are valid against the given JSON Schema.

JSON Subschema definition is formalized as:

JSON schema A is called the subschema of schema B when every JSON that is valid against schema A is valid against schema B.

The rules that are used to constrain or restrict the JSON Schema are described in the chapter [[Product Offering Specification Schema](#)].

Let's consider an illustrative JSON Schema as an example (this is the reduced JSON Schema of AccessElineOvc for illustrative purposes):

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "https://seller.mef.com/product.schema.json",
  "title": "AccessElineOvc",
  "type": "object",
  "properties": {
    "maximumFrameSize": {
```

```

    "type": "integer",
    "minimum": 1526
  },
  "ceVlanIdPreservation": {
    "type": "string",
    "enum": ["PRESERVE", "STRIP", "RETAIN"]
  }
}
}
}

```

JSON Subschema of the schema above could be constructed as:

```

{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$id": "https://seller.mef.com/product.schema.json",
  "title": "AccessELineOvc",
  "type": "object",
  "properties": {
    "maximumFrameSize": {
      "type": "integer",
      "minimum": 1526
    },
    "ceVlanIdPreservation": {
      "type": "string",
      "enum": ["PRESERVE", "STRIP"]
    }
  },
  "required": ["maximumFrameSize"]
}

```

Considering the following two JSON payloads:

- Payload A:

```

{
  "maximumFrameSize": 1526,
  "ceVlanIdPreservation": "STRIP"
}

```

- Payload B:

```

{
  "maximumFrameSize": 1526,
  "ceVlanIdPreservation": "RETAIN"
}

```

We see that Payload A is compliant with both schemas, while Payload B is valid only against the first schema. Since the second schema is more restrictive, it is considered a subschema of the first schema.

4.4.3. Product Specification and Product Offering Schemas

The chapters above introduced the Product Specification as the Product Catalog Element type that defines the attributes of the Product. Those attributes are organized as [\[JSON Schema\]](#) that is called the **Source Schema**.

Product Offering is introduced as the second key Product Catalog Element type which exposes the Product Specification to the market and may constrain the Product Specification attributes defined in the **Source Schema** that produces another more restrictive JSON Schema specific to the

Product Offering called the **Intermediate Schema**. This Intermediate Schema is the JSON Subschema of the **Source Schema**.

Additionally, it may be required to constrain the **Intermediate Schema** in the context of a particular Business Function and Product Action (e.g. some attributes may not be relevant for the Product Offering Qualification business function or the **modify** Product Action). As such, it is possible to define such cases in the **Contextual Schema** for every combination of Business Function and Product Action context. This Contextual Schema is the JSON Subschema of the **Intermediate Schema**.

The JSON Subschema is still a JSON Schema.

Summarizing, three types of schemas may be defined in the Product Catalog:

- **Source Schema** that is the definition of the Product Specification (e.g. Mplify Standard),
- **Intermediate Schema** that is the constrained usage of the **Source Schema** for a given Product Offering [**Intermediate Schema**],
- **Contextual Schema** which defines the contextual usage of the **Intermediate Schema** in the given context of Business Function and Product Action [**Contextual Schema**].

The diagram below depicts the above summary in graphical form.

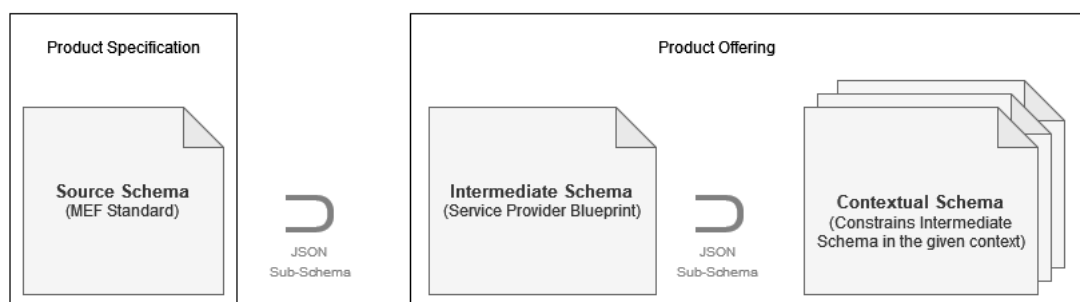


Figure 3. Relationship between Source Schema, Intermediate Schema, and Contextual Schema

4.4.4. Bundles

The LSO Cantata/Sonata APIs support Bundles that are comprised of multiple Product Offerings made available by the Seller. The benefits for a Buyer are, for example, a preferential price or a simplified ordering process for a Bundle, versus ordering all the individual Product Offerings separately. A Bundle may not contain a Product Offering that is a Bundle.

A Bundle definition also includes a list of Product Offering Bundle Relation, which specifies the set of Product Offerings that comprise the Bundle, along with the ability for the Seller to constrain the minimum and maximum number of instances of each Product Offering supported for a given Bundle. Figure 4 shows an example of this Bundle definition and Bundle Relations, with the "OVC UNI Bundle" comprised of exactly one "Access E-Line OVC Excellence" Product Offering and exactly one "UNI Excellence" Product Offering. Figures 5 and 6 show Product Offering of bundled Access E-Line and UNI, respectively.

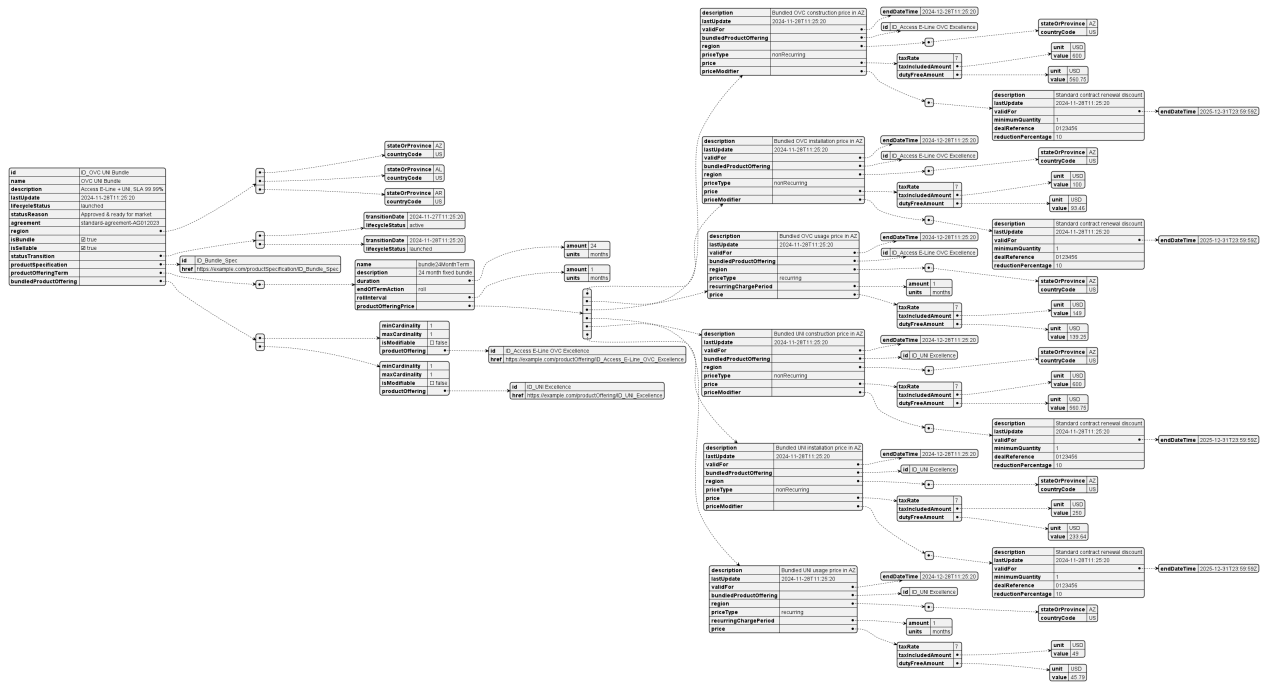


Figure 4. Bundling Product Offering Example

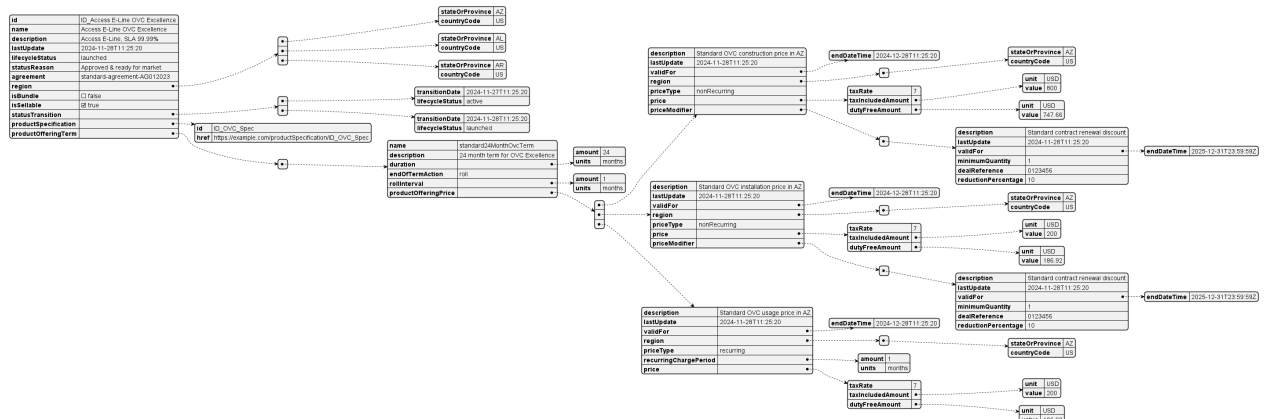


Figure 5. Bundling Product Offering Example

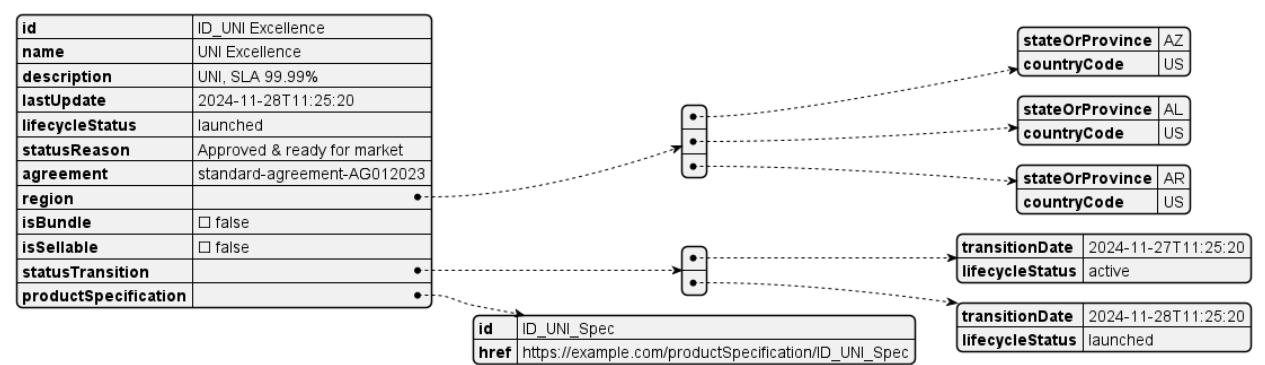


Figure 6. Bundling Product Offering Example

Note: Full JSON examples can be found in Appendix A.

A given Product Offering may be sellable independently and be part of a Bundle at the same time. When this occurs, the Product Offering and the Bundle must each include a separate set of Product Offering Terms and Product Offering Prices. A Bundle with an optional or variable number of Product Offerings must always include the Product Offering Terms and the Product Offering Prices that includes all the instances of Product Offerings included in the Bundle. An

example of this can be seen in Figure 5 above, where the “Access E-Line OVC Excellence” Product Offering is sellable independently and as part of the Bundle. As such, the Product Offering Terms with Prices (e.g. “24 month term for OVC Excellence”) must be defined for the independently sellable Product Offering, along with a separate Product Offering Terms with Prices (e.g. “24 month fixed bundle”) that must be defined for the “OVC UNI Bundle” Product Offering with the **bundledProductOffering** attribute pointing to the “Access E-Line OVC Excellence Product Offering”. Whereas the “UNI Excellence” Product Offering is not sellable independently and as such, it’s Product Offering Terms and Prices may only be defined within the Bundle. A Product Offering Term of a Product Offering that is a Bundle covers all Product Offerings that are contained within the Bundle.

In addition, every independently sellable Product Offering and Bundle may include a separate Price Modifiers (e.g. as a Reduction Percentage or Discounted Price). In the example above, the Bundle includes a 10% Reduction Percentage for all the non-recurring prices as part of the standard contract renewal discount (e.g. as a Deal Reference promo code), while the “Access E-Line OVC Excellence” Product Offering does not currently offer any pricing discounts.

When ordered, both the bundling and bundled Product Offerings result in Product instances. That means that for example above there will be 3 items in POQ, Quote, Product Order requests, and 3 Products in the Product Inventory. Those will be items/Products created based on the following Product Offerings (an their respective Product Specifications):

- "OVC UNI Bundle"
- "Access E-Line OVC Excellence"
- "UNI Excellence".

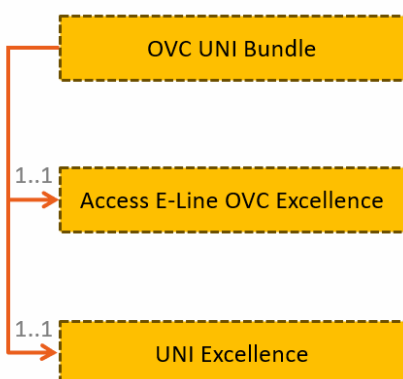
All technical requirements (e.g. place and product relationships) to Access E-Line and UNI still apply. That is shown in Figure 7 as a relation between the OVC and UNI Product instances. The bundling Product uses standard **ProductRelationship** with the restricted **relationshipType=bundles** to point to the elements of the bundle.

Each Product Offering must have a Product Specification ([R76]) so that the Seller's system knows the attributes of the Product to be created. While Mplify does not define a standard specification (schema) for a bundling Product Offering, it is recommended that it does not aggregate or simplify any technical attributes of bundled Product Offerings. It may define no attributes as well.

Product Offering:

POQ/Quote/Order items / Products in Inventory

ProductOfferingBundleRelationship



ProductRelationship
relationshipType=bundles

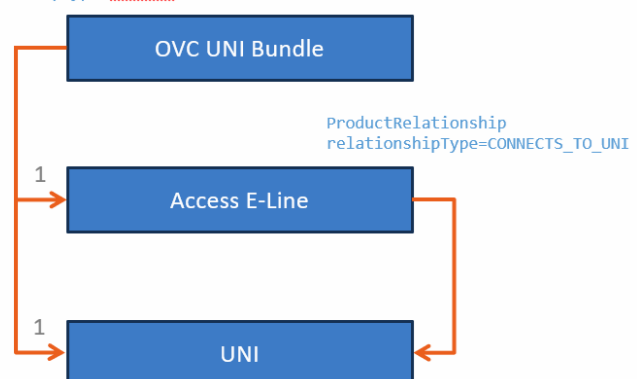


Figure 7. Bundle instantiation

4.5. High-Level Flow

The Product Catalog is part of a broader Cantata and Sonata End-to-End flow. Figure 8 shows a high-level diagram to get a good understanding of the whole process and the Product Catalog's position within it.



Figure 8. Cantata and Sonata End-to-End Function Flow

- **Product Catalog:**
 - Allows the Buyer to retrieve Product Offerings and Product Specifications describing the Products available for ordering from the Seller's Product Catalog.
- **Address Validation:**
 - Allows the Buyer to retrieve address information from the Seller, including exact formats, for Geographic Addresses known to the Seller.
- **Site Retrieval:**
 - Allows the Buyer to retrieve Geographic Site information including exact formats for Geographic Sites known to the Seller.
- **Product Offering Qualification (POQ):**
 - Allows the Buyer to check whether the Seller can deliver a product or set of products from among their product offerings at the geographic address or a Geographic Site specified by the Buyer; or modify a previously purchased product.
- **Quote:**
 - Allows the Buyer to submit a request to find out how much the installation of an instance of a Product Offering, an update to an existing Product, or a disconnect of an existing Product will cost.
- **Product Order:**
 - Allows the Buyer to request the Seller to initiate and complete the fulfillment process of an installation of a Product Offering, an update to an existing Product, or a disconnect of an existing Product at the address defined by the Buyer.
- **Product Inventory:**
 - Allows the Buyer to retrieve the information about the existing Product instances from Seller's Product Inventory.
- **Trouble Ticketing:**
 - Allows the Buyer to create, retrieve, and update Trouble Tickets as well as receive notifications about Incidents' and Trouble Tickets' updates. This allows managing issues and situations for a Product provided by the Seller.
- **Billing:**
 - Allows the Buyer to retrieve the Billing (Invoice) information, download it as a document, and receive notifications of document creation.

5. API Description

This section presents the API structure and design patterns. It starts with the high-level use cases diagram. Then it describes the REST endpoints with use case mapping. Next, it gives an overview of the API resource model.

5.1. High-level use cases

Figure 9 presents a high-level use case diagram as specified in [Mplify 127.1] in section 8. This picture aims to help understand the endpoint mapping for the supported use cases. Use cases are described extensively in [chapter 6](#).

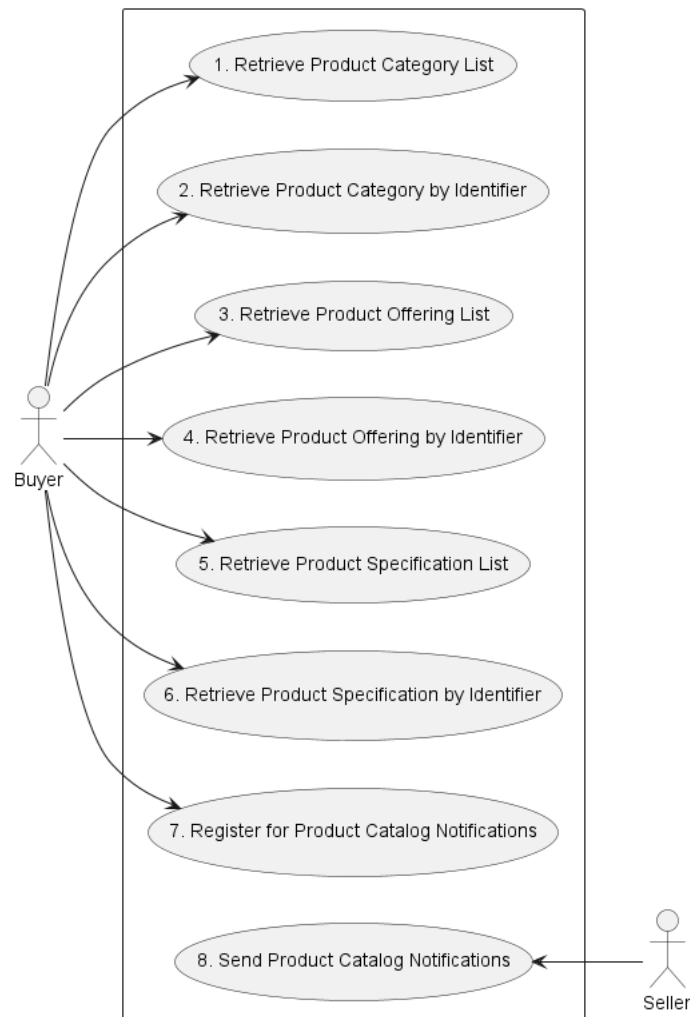


Figure 9. Use cases

5.2. API Endpoint and Operation Description

5.2.1. Seller side API Endpoints

Base URL for Cantata:

`https://{serverBase}:{port}{?/seller_prefix}/mefApi/cantata/productCatalog/v4/`

Base URL for Sonata:

`https://{serverBase}:{port}{?/seller_prefix}/mefApi/sonata/productCatalog/v4/`

The following API endpoints are implemented by the Seller and allow the Buyer to retrieve Product Categories, Product Offerings, and Product Specifications as well as register for Notifications. The endpoints and corresponding data model are defined in

[productApi/productCatalog/productCatalog.api.yaml](#).

API endpoint	Description	Mplify 127.1 Use Case mapping
GET /category	The Buyer requests a list of Product Categories from the Seller based on a set of specified filter criteria. The Seller returns a summarized list of Product Categories.	UC 1: Retrieve Product Category List
GET /category/{{id}}	The Buyer requests detailed information about a single Product Category based on a Product Category Identifier.	UC 2: Retrieve Product Category by Identifier
GET /productOffering	The Buyer requests a list of Product Offerings from the Seller based on a set of specified filter criteria. The Seller returns a summarized list of Product Offerings.	UC 3: Retrieve Product Offering List
GET /productOffering/{{id}}	The Buyer requests detailed information about a single Product Offering based on a Product Offering Identifier.	UC 4: Retrieve Product Offering by Identifier
GET /productSpecification	The Buyer requests a list of Product Specifications from the Seller based on a set of specified filter criteria. The Seller returns a summarized list of Product Specifications.	UC 5: Retrieve Product Specification List
GET /productSpecification/{{id}}	The Buyer requests detailed information about a single Product Specification based on a Product Specification Identifier.	UC 6: Retrieve Product Specification by Identifier

Table 3. Seller side mandatory API endpoints

[R1] The Seller **MUST** implement all API endpoints listed in Table 3. [Mplify127.1 R16]

API endpoint	Description	Mplify 127.1 Use Case mapping
POST /hub	The Buyer requests to subscribe to Product Catalog notifications.	UC 7: Register for Product Catalog Notifications

API endpoint	Description	Mplify 127.1 Use Case mapping
GET /hub/{{id}}	A request initiated by the Buyer to retrieve the details of the notification subscription with the given Identifier.	UC 7: Register for Product Catalog Notifications
DELETE /hub/	A request initiated by the Buyer to instruct the Seller to stop sending notifications.	UC 7: Register for Product Catalog Notifications

Table 4. Seller side optional API endpoints

[O1] The Seller **MAY** implement API endpoints listed in Table 4. [Mplify127.1 O3]

[CR1]<[O1] If any of the endpoints defined in Table 4 is implemented, then all of the endpoints listed in Table 4 **MUST** be implemented.

5.2.2. Buyer side API Endpoints

Base URL for Cantata:

https://{{serverBase}}:{{port}}
{{?/buyer_prefix}}:/mefApi/sonata/productCatalogNotification/v4/

Base URL for Sonata:

https://{{serverBase}}:{{port}}
{{?/buyer_prefix}}:/mefApi/cantata/productCatalogNotification/v4/

The following API Endpoints are used by the Seller to post notifications to registered listeners. The endpoints and corresponding data model are defined in

productApi/catalog/productCatalogNotification.api.yaml

API Endpoint	Mplify 127.1 Use Case Mapping
POST /listener/categoryCreateEvent	UC 08: Send Product Catalog Notification
POST /listener/categoryAttributeValueChangeEvent	UC 08: Send Product Catalog Notification
POST /listener/productOfferingCreateEvent	UC 08: Send Product Catalog Notification
POST /listener/productOfferingAttributeValueChangeEvent	UC 08: Send Product Catalog Notification
POST /listener/productOfferingStateChangeEvent	UC 08: Send Product Catalog Notification
POST /listener/productSpecificationCreateEvent	UC 08: Send Product Catalog Notification
POST /listener/productSpecificationAttributeValueChangeEvent	UC 08: Send Product Catalog Notification
POST /listener/productSpecificationStatusChangeEvent	UC 08: Send Product Catalog Notification

Table 5. Buyer side optional API endpoints

[O2] The Buyer **MAY** support API endpoints listed in Table 5. [Mplify127.1 O3]

5.3. Specifying the Buyer ID and the Seller ID

A business entity willing to represent multiple Buyers or multiple Sellers must follow requirements of [Mplify 150] chapter 8.8, which states:

For requests of all types, there is a business entity that is initiating an Operation (called a Requesting Entity) and a business entity that is responding to this request (called the Responding Entity). In the simplest case, the Requesting Entity is the Buyer, and the Responding Entity is the Seller. However, in some cases, the Requesting Entity may represent more than one Buyer and similarly, the Responding Entity may represent more than one Seller.

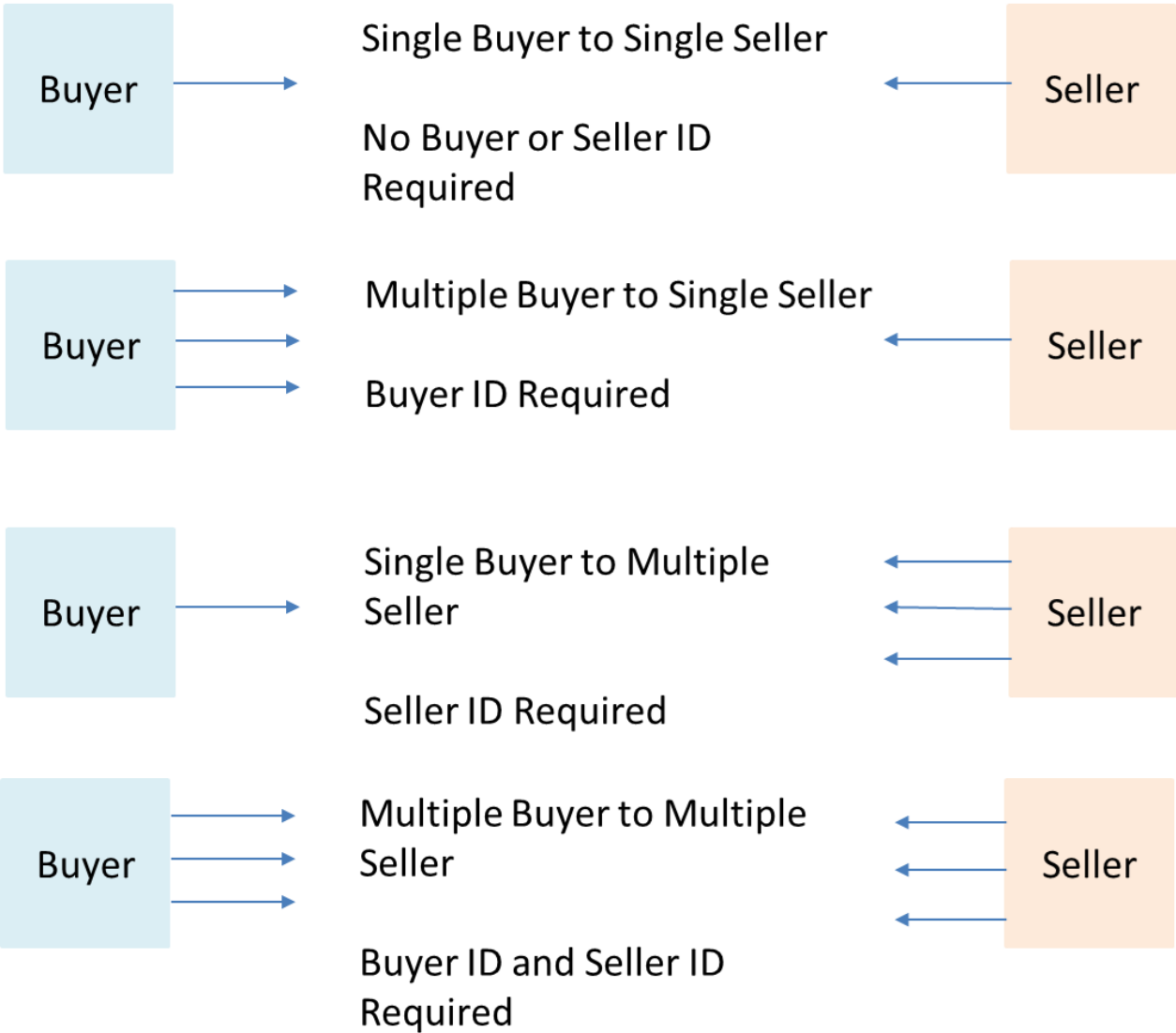


Figure 10. Buyer ID and Seller ID Examples

As shown in Figure 10, if a Requesting Entity representing a single Buyer is doing business with a Responding Entity representing a single Seller, Buyer and Seller IDs are not required to be passed between the two entities. If a Requesting Entity representing more than one Buyer is doing business with a Responding Entity representing a single Seller, the Buyer ID is required to be passed between the two entities. If a Requesting Entity representing a single Buyer is doing business with a Responding entity representing

multiple Sellers, the Seller ID is required to be passed between the two entities. If a Requesting Entity representing multiple Buyers is doing business with a Responding Entity representing multiple Sellers, both the Buyer ID and the Seller ID are required to be passed between the entities.

While it is outside the scope of this specification, it is assumed that the Requesting Entity and the Responding Entity are aware of each other and can authenticate requests initiated by the other party. It is further assumed that the Requesting Entity knows:

- the list of Buyers the Requesting Entity represents when interacting with this Responding Entity; and
- the list of Sellers that this Responding Entity represents to this Requesting Entity.

It is also assumed that the Responding Entity knows:

- the list of Sellers that this Responding Entity represents to this Requesting Entity and
- the list of Buyers the Requesting Entity represents when interacting with this Responding Entity.

In the API the **buyerId** and **sellerId** are represented as optional query parameters in each operation defined.

[R2] If the Requesting Entity has the authority to represent more than one Buyer the request **MUST** include **buyerId** that identifies the Buyer being represented. [Mplify150 R62]

[R3] If the Responding Entity represents more than one Seller to this Buyer the request **MUST** include **sellerId** that identifies the Seller with whom this request is associated. [Mplify150 R63]

[R4] If **buyerId** or **sellerId** attributes were specified in the request same attributes **MUST** be used in the notification payload.

5.4. Model Structural Validation

The structure of the HTTP payloads exchanged via Quote API endpoints is defined using:

- OpenAPI version 3.0 for the product-agnostic part of the payload
- JsonSchema (draft 7) for the product-specific part of the payload

[R5] Implementations **MUST** use payloads that conform to these definitions.

[R6] The Buyer and the Seller **MUST NOT** use any operation, entity or attribute that is not explicitly defined or allowed by this standard.

[R7] A product specification may define additional consistency rules and requirements that **MUST** be respected by implementations.

These are defined for:

- required relation type, multiplicity to other items in the same quote request
- required relation type, multiplicity to entities in the Seller's product inventory
- related contact information roles that are to be defined at the item level
- relations to places (locations) and their roles that are to be defined at the item level

5.5. Security Considerations

There must be an authentication mechanism whereby a Seller can be assured who a Buyer is and vice-versa. There must also be authorization mechanisms in place to control what a particular

Buyer or Seller is allowed to do and what information may be obtained. However, the definition of the exact security mechanism and configuration is outside the scope of this document. Security considerations are standardized by *LSO API Security Profile* [[MEF 128.1](#)].

6. API Interactions and Flows

This section provides a detailed insight into the API functionality, use cases, and flows. It starts with Table 6 presenting a list and short description of all business use cases then presents the variants of end-to-end interaction flows, and in the following subchapters describes the API usage flow and examples for each of the use cases.

Table 6 lists the use cases supported by Product Catalog API (use case numbers as in Mplify 127.1 for mapping):

Use Case #	Use Case Name		Use Case Description
1	Retrieve Product Category List	Product	The Buyer requests a list of Product Categories from the Seller based on a set of specified filter criteria. The Seller returns a summarized list of Product Categories.
2	Retrieve Product Category by Product Category Identifier	Product	The Buyer requests detailed information about a single Product Category based on a Product Category Identifier.
3	Retrieve Product Offering List	Product	The Buyer requests a list of Product Offerings from the Seller based on a set of specified filter criteria. The Seller returns a summarized list of Product Offering.
4	Retrieve Product Category by Product Offering Identifier	Product	The Buyer requests detailed information about a single Product Offering based on a Product Offering Identifier.
5	Retrieve Product Specification List	Product	The Buyer requests a list of Product Specifications from the Seller based on a set of specified filter criteria. The Seller returns a summarized list of Product Specifications.
6	Retrieve Product Specification by Product Specification Identifier	Product	The Buyer requests detailed information about a single Product Specification based on a Product Specification Identifier.
7	Register for Event Notifications	Event	The Buyer requests to subscribe to Product Categories, Product Offerings and Product Specifications Notifications.
8	Send Event Notification	Event	Send Event Notification The Seller sends a notification regarding a Product Category, Product Offering, or Product Specification to the Buyer.

Table 6. Use cases description

Figure 11 presents an example of the flow of **ProductOffering** lifecycle and possible related requests.

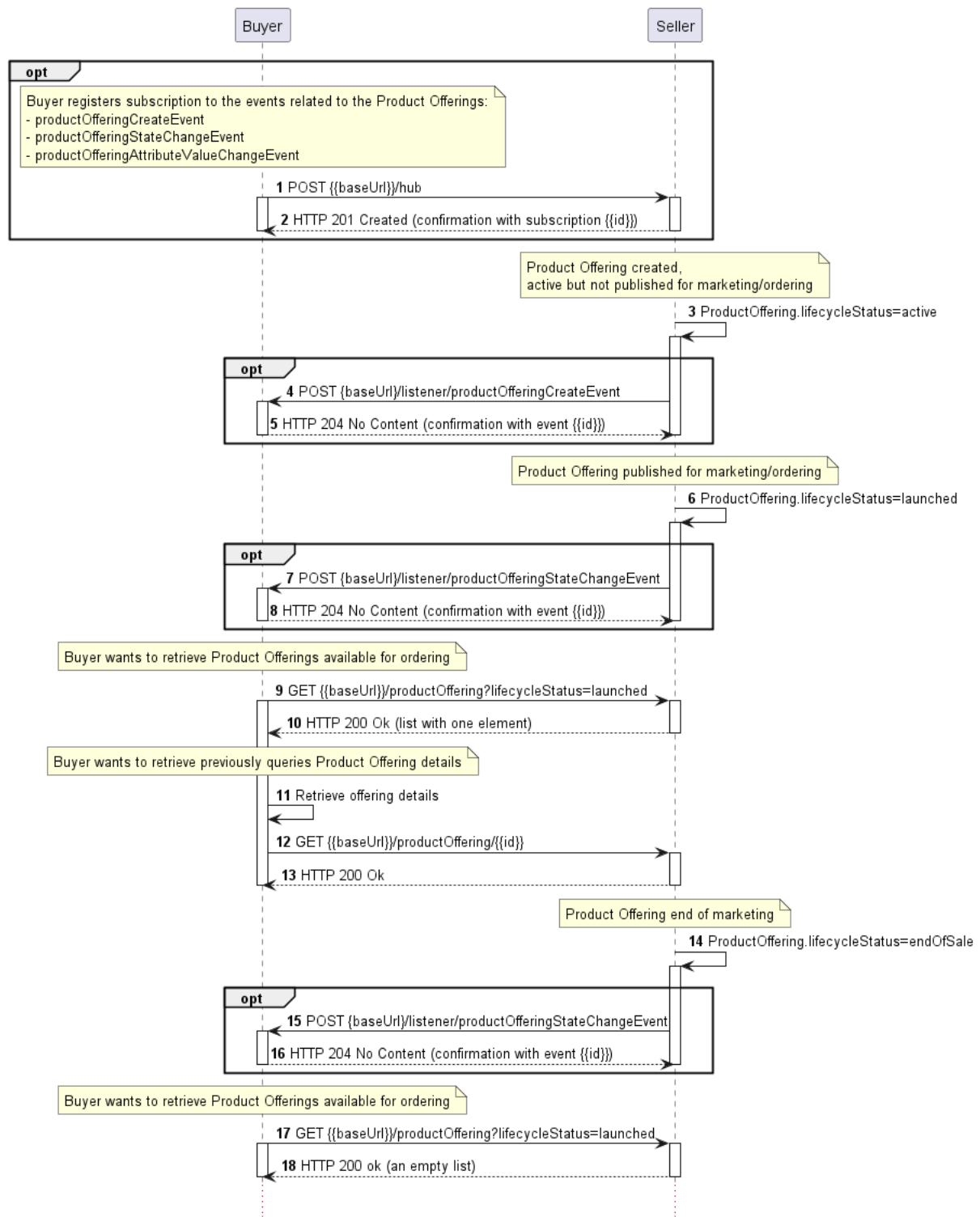


Figure 11. Exemplary API flow for Product Offering

Registration for events is optional, so all sequences on the diagram related to notification exchange were framed as optional, so as the below description of the sequence diagram.

- (optional) The Buyer registers the listener by sending the request (1) with specified **eventType** as **productOfferingCreateEvent**, **productOfferingStateChangeEvent**, and **productOfferingAttributeValueChangeEvent**.
- (optional) (2) The Seller responds with success.
- The Seller publishes a new **ProductOffering** with **lifecycleStatus=active** (3).
- (optional) What causes sending notification to the Buyer (4-5) with the type **productOfferingCreateEvent**.

- The Seller decides to make the previously created offering available for ordering by changing **lifecycleStatus** to **launched** (6).
- (optional) What causes sending notification to the Buyer (7-8) with type the **productOfferingStateChangeEvent**.
- The Buyer decides to ask for offerings available for ordering by sending a request (9) providing in query parameters required **lifecycleStatus** as **launched**.
- (10) The Seller responds with the list of **launched** offerings.
- (11) The Buyer asks for details of the retrieved offering by sending a request (12) with the specified **identifier** of the offering.
- (13) The Seller responds with detailed offering information.
- The Seller decides to end selling previously published offering by changing **lifecycleStatus** to **endOfSale** (14).
- (optional) What causes sending notification to the Buyer (15-16) with the type **productOfferingStateChangeEvent**.
- The Buyer asks again for offerings available for ordering by sending a request (17) providing in query parameters required **lifecycleStatus** as **launched**.
- Because there is no offering that is available for sale, the Seller responds with an empty list (18).

The detailed business requirements of each of the use cases are described in section 8 of [Mplify127.1].

6.1. Product Category Use Cases

6.1.1. Product Category - Model

Product Categories are designed to be used for grouping related Product Offerings into logical containers (e.g. grouping Product Offerings delivered via Fiber medium).

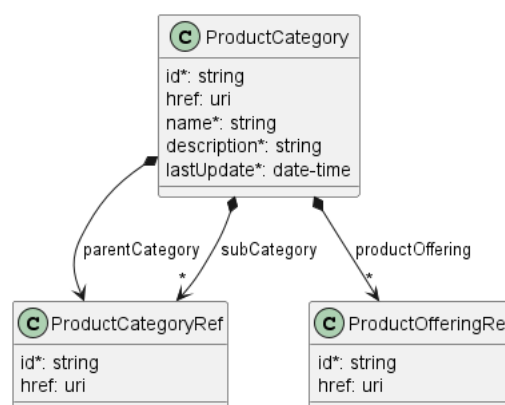


Figure 12. Product Category Model

[R8] After a Product Category has been created, the **id** **MUST NOT** be modified. [Mplify127.1 R22]

[R9] In the case of a change of any attribute, the Seller **MUST** set the **lastUpdate** attribute with the date of the most recent modification. [Mplify127.1 R21]

[R10] If a **ProductCategory** has a parent category, then its **id** **MUST** be in the **subCategory** list of the referenced Product Category. [Mplify127.1 R17]

[R11] If a Product Category A is specified in the **subCategory** list of Product Category B, then the **id** of Product Category B **MUST** be included in the **parentCategory** attribute of Product Category A. [Mplify127.1 R19]

[R12] If a Product Category has no parent Category, then its **id** **MUST NOT** be in the **subCategory** list for any Product Category. [Mplify127.1 R18]

[R13] The **productOffering** attribute **MUST** include a list of references to all Product Offerings that are grouped in this Product Category. [Mplify127.1 R20]

6.1.2. Use case 1: Retrieve Product Category List

6.1.2.1. Interaction flow

The flow of this use case is very simple and is described in Figure 13.

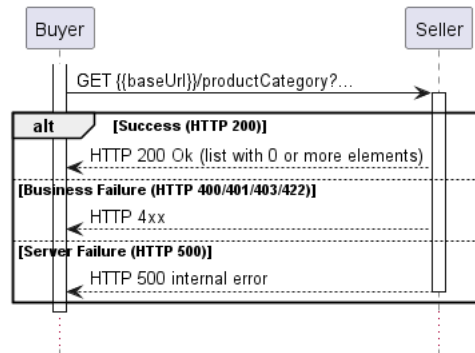


Figure 13. Use Case 1 - Retrieve Product Category List

The Buyer wants to retrieve the list of Product Categories that match the given filtering criteria. Later on, the result may be used to query Product Offerings by category.

6.1.2.2. Retrieve Product Category List - Request

[O3] The Buyer **MAY** retrieve the list of Product Categories by using a **GET /category** operation with desired filtering criteria. The attributes that are available to be used are [Mplify127.1 O4]:

- **lastUpdate.gt**
- **lastUpdate.lt**
- **parentCategory.id**

The Buyer may also ask for pagination with the use of the **offset** and **limit** parameters. The Buyer can specify the following query attributes related to pagination:

- **limit** - number of expected list items
- **offset** - offset of the first element in the result list

The Seller returns a list of elements that comply with the requested **limit**. If the requested **limit** is higher than the supported list size the smaller list result is returned. In that case, the size of the result is returned in the header attribute **X-Result-Count**. The Seller can indicate that there are additional results available using:

- **X-Total-Count** header attribute with the total number of available results
- **X-Pagination-Throttled** header set to **true**

```
https://serverRoot/mefApi/sonata/productCatalog/v4/category?lastUpdate.gt=2023-01-01T00:00:00.000Z&limit=10&offset=0
```

[D] The Seller **SHOULD** support the pagination mechanism.

6.1.2.3. Retrieve Product Category List - Response

The snippet below presents an example of the Retrieve Product Category List response:

Retrieve **ProductCategory** List Response

Headers:

```
X-Result-Count=1
X-Total-Count=1
X-Pagination-Throttled=false
```

Body:

```
[
  {
    "id": "productCategory-2",
    "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/category/productCategory-2",
    "name": "Access E-Lines Product Offerings",
    "description": "This category groups are available Access E-Line Product Offerings",
    "lastUpdate": "2023-01-19T16:33:20.324Z",
    "parentCategory": {
      "id": "productCategory-1",
      "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/category/productCategory-1"
    },
    "productOffering": [
      {
        "id": "productOffering-1",
        "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productOffering/productOffering-1"
      },
      {
        "id": "productOffering-2",
        "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productOffering/productOffering-2"
      }
    ]
  }
]
```

[R14] The Seller **MUST** provide all attributes of **ProductCategory** (if they are set in the system) [Mplify127.1 R23], [Mplify127.1 R24]:

[R15] In case no items matching the criteria are found, the Seller **MUST** return a valid response with an empty list. [Mplify127.1 R26]

The full list of attributes is available in [Section 7](#) and in the API specification which is an integral part of this standard.

6.1.3. Use case 2: Retrieve Product Category by Identifier

6.1.3.1. Interaction flow

The flow of this use case is very simple and is described in Figure 14.

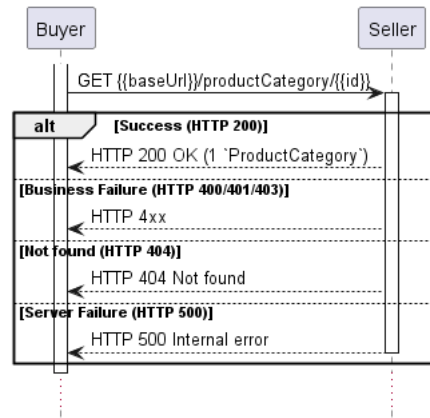


Figure 14. Use Case 2 - Retrieve Product Category by Identifier

The Buyer wants to retrieve detailed information about a single Product Category with a given **id**.

6.1.3.2. Retrieve Product Category by Identifier - Request

[R16] The Buyer must provide the **id** of the Product Category in the query. [Mplify127.1 R27]

```
https://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/category/productCategory-2
```

The example above shows a Buyer's request to get the Product Category with **id** equal to **productCategory-2**. The correct response (HTTP code **200**) in the response body contains a single **ProductCategory** object matching the given **id**.

6.1.3.3. Retrieve Product Category by Identifier - Response

The snippet below presents an example of the Retrieve Product Category Response:

Retrieve **ProductCategory** by Identifier Response

```
{
  "id": "productCategory-2",
  "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/category/productCategory-2",
  "name": "Access E-Lines Product Offerings",
  "description": "This category groups are available Access E-Line Product Offerings",
  "lastUpdate": "2023-01-19T16:33:20.324Z",
  "parentCategory": {
    "id": "productCategory-1",
    "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/category/productCategory-1"
  },
  "productOffering": [
    {
      "id": "productOffering-1",
      "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productOffering/productOffering-1"
    },
    {
      "id": "productOffering-2",
      "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productOffering/productOffering-2"
    }
  ]
}
```

[R17] The Seller **MUST** put the all **ProductCategory** attributes that are set in the Seller's system: [Mplify127.1 R28], [Mplify127.1 R29]

- id
- name
- description
- lastUpdate

The full list of attributes is available in [Section 7](#) and in the API specification which is an integral part of this standard.

6.2. Product Offering Use Cases

6.2.1. Product Offering - Model

6.2.1.1. Product Offering

Figure 15 presents the data model of the Product Offering. The model of the retrieve list response (`ProductOffering_Find`) is a subset of the `ProductOffering` model and contains only those attributes that can (or must) be returned by the Seller. For visibility of these differences, the `ProductOffering_Common` has been introduced. However, it is not to be used directly in the response to any endpoint.

The full list of attributes is available in [Section 7](#) and in the API specification which is an integral part of this standard.

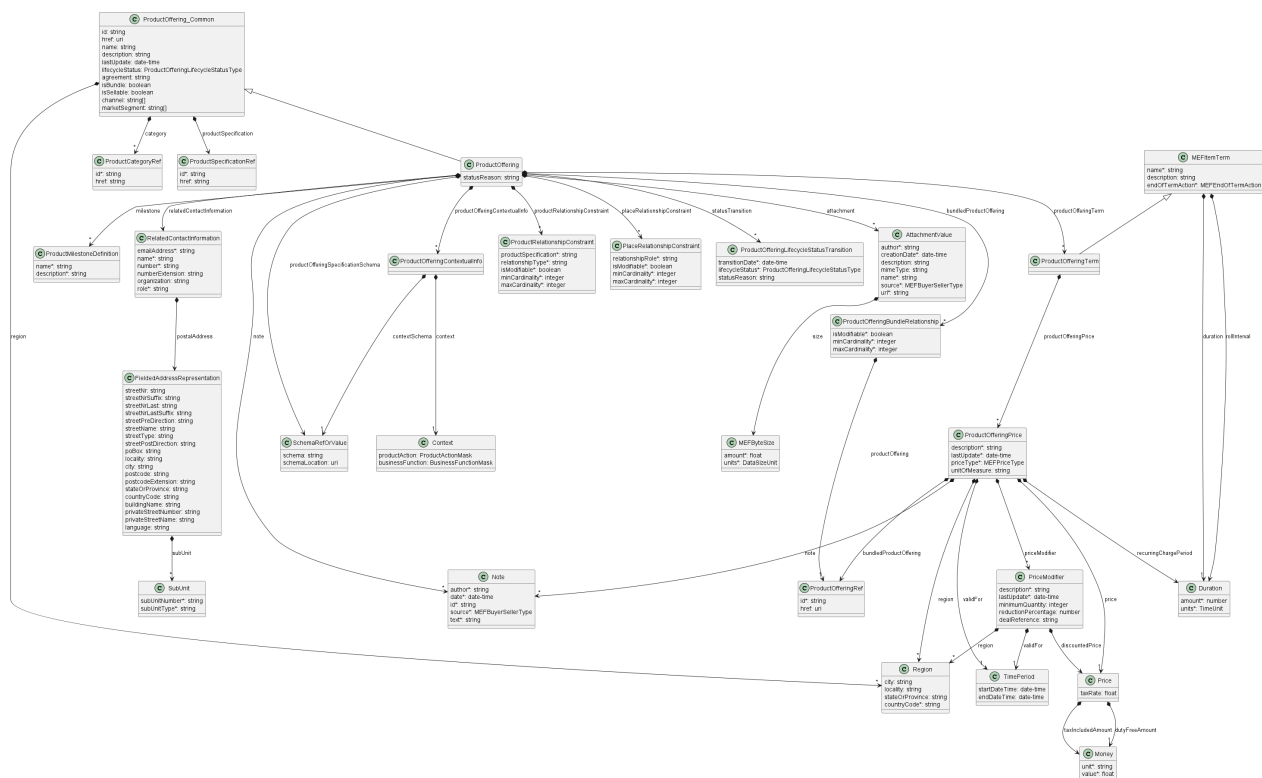


Figure 15. Product Offering Model

[R18] Once the Product Offering is created, the Seller **MUST NOT** update the following attributes: [Mplify127.1 R37]

- id
- productSpecification

Product Offerings are designed to be used for exposing the particular Product Specification to the market, therefore Product Specification related attributes must not change.

[R19] If any of the **ProductOffering** attributes are changed in a non-backward compatible way, the Seller **MUST** create a new Product Offering with a different Identifier. [Mplify127.1 R36]

"Non-backwards compatibility" refers to any modification to a Product Offering that results in any previously valid Product Offering Configuration to become invalid.

It's at the Seller's discretion to transition the older version of Product Offering to a **lifecycleStatus** that prevents using that offering for ordering.

[R20] The **productOfferingTerm** attribute **MUST NOT** be defined if **isSellable=false**. [Mplify127.1 R33]

[R21] The **productOfferingTerm** attribute **MUST** be defined if **isSellable=true**.

[R22] A **productOfferingTerm** of Product Offering that is a Bundle **MUST** cover all bundled Product Offerings, including their prices.

The point of the requirement above is to decouple the definition and lifecycle of a standalone Product Offering from possible definitions of Bundles that would include it.

The prices defined within a Bundle may or may not be dependant on the number of bundled Product Offerings ordered.

[R23] If the **isBundle** attribute is **true**, then the **isSellable** attribute **MUST** be also be set to **true**. [Mplify127.1 R34]

[R24] The **bundledProductOffering** attribute **MUST** only be defined if the **isBundle** attribute is **true**. [Mplify127.1 R35]

[R25] In the case of any of the **ProductOffering** attributes has changed, the Seller **MUST** update the **lastUpdate** attribute with the date the modification occurred. [Mplify127.1 R31]

[R26] The Seller **MUST** update the **statusTransition** attribute whenever the **lifecycleStatus** attribute is changed.

[R27] The following attributes of **statusTransition** entities **MUST** be set [Mplify127.1 R38]:

- **transitionDate**
- **lifecycleStatus**

[D1] Whenever the **transitionDate** has passed but the transition has not taken place, then the Seller **SHOULD** update the **transitionDate** with the new anticipated date of transition.

[R28] When the planned transition took place, then the Seller **MUST NOT** remove the corresponding record from the **statusTransition** list.

The **statusTransition** records are used for historical log purposes.

[R29] The **countryCode** attribute **MUST** be set when specifying a **region**, using the ISO 3166 two-letter codes. [Mplify127.1 R39]

[R30] The following attributes of **productOfferingTerm** **MUST** be set [Mplify127.1 R41]:

- **name**
- **duration**
- **endOfTermAction**

[R31] If the `productOfferingTerm.endOfTermAction` is set to `roll` then attribute `productOfferingTerm.rollInternal` **MUST** be set. [Mplify127.1 R42]

6.2.1.2. Product Offering Bundle Relationship

[R32] A `ProductOfferingBundleRelationship` **MUST** contain the following attributes: [Mplify127.1 R43]

- `isModifiable`
- `productOffering`
- `maxCardinality`
- `minCardinality`

[R33] If `maxCardinality` is not unlimited (`-1`) then it **MUST** be greater than or equal to the `minCardinality`. [Mplify127.1 R44]

[R34] The `ProductOfferingBundleRelationship` **MUST NOT** reference a Product Offering with the attribute `isBundle` set to `true`. [Mplify127.1 R45]

6.2.1.3. Product Relationship Constraint

[R35] A `ProductRelationshipConstraint` **MUST** contain the following attributes: [Mplify127.1 R46], [Mplify127.1 R72]

- `productSpecification`
- `relationshipType`
- `isModifiable`
- `minCardinality`
- `maxCardinality`

[R36] If used for the purpose of putting a restriction, the `minCardinality` **MUST** be greater than or equal to the `minCardinality` of the respective `productRelationship` it attempts to restrict (the Product Offering's Specification for the specified `id` and `relationshipType`). [Mplify127.1 R47]

[R37] If used for the purpose of putting a restriction, the `maxCardinality` **MUST** be less than or equal to the `maxCardinality` of the respective `productRelationship` it attempts to restrict (the Product Offering's Specification for the specified `id` and `relationshipType`). [Mplify127.1 R49]

[R38] If `maxCardinality` is not unlimited (`-1`) then it **MUST** be greater than or equal to the `minCardinality`. [Mplify127.1 R48], [Mplify127.1 R73]

6.2.1.4. Place Relationship Constraint

[R39] A `PlaceRelationshipConstraint` **MUST** contain the following attributes: [Mplify127.1 R50], [Mplify127.1 R74]

- `isModifiable`
- `maxCardinality`
- `minCardinality`
- `relationshipRole`

[R40] If used for the purpose of putting a restriction, the `minCardinality` **MUST** be greater than or equal to the `minCardinality` of the respective `placeRelationship` it attempts to restrict (the Product Offering's Specification for the specified `relationshipRole`). [Mplify127.1 R51]

[R41] If used for the purpose of putting a restriction, the **maxCardinality** **MUST** be less than or equal to the **maxCardinality** of the respective **placeRelationship** it attempts to restrict (the Product Offering's Specification for the specified **relationshipRole**). [Mplify127.1 R53]

[R42] If **maxCardinality** is not unlimited (-1) then it **MUST** be greater than or equal to the **minCardinality**. [Mplify127.1 R52], [Mplify127.1 R75]

6.2.1.5. Product Offering Specification Schema

The concept of subschema was introduced to allow defining the Product Specification schema in the context of a particular Product Offering which is expressed as the **productOfferingSpecificationSchema** attribute. The **JSON subschema** term is introduced in [Chapter 2] of this document.

Per the Product Schemas Specification (e.g. MEF 106, MEF 125), all Product-Specific Attributes are defined as optional. Some of them are defined as enumerations, some of them should satisfy the given regular expression, etc. For Product Offering purposes the Seller and Buyer may agree to restrict some of the Product-Specific Attributes as mandatory, optional or fixed (especially for particular business functions and product actions), the set of enumerated values may be constrained, etc. Subschema was introduced in the Product Catalog to express such constraints in an unambiguous form.

The table 7 defines the list of changes that can be applied to the schema and the rules for expressing them:

The change on attribute	How to express in schema	Reference requirement
Make required	Add attribute name to required array.	[Mplify127.1 R5], [Mplify127.1 R6]
Make not applicable	Remove from the schema.	[Mplify127.1 R10], [Mplify127.1 R11], [Mplify127.1 R13]
Fix the value	Set fixed value as const .	[Mplify127.1 R10], [Mplify127.1 R14]
Fix the already enumerated value	Remove enum array, set fixed value as const	[Mplify127.1 R10], [Mplify127.1 R14]
Apply enumeration	Set enumerated values as enum array.	--not covered--
Narrow existing enumeration	Set narrowed enumerations as enum array.	--not covered--
Set default value	Set default value as default . If it's not set already.	[Mplify127.1 R3], [Mplify127.1 R8]

Table 7. Schema modification rules

[R43] The Seller **MUST** respect the rules defined in Table 7 for the **productOfferingSpecificationSchema** schema. [Mplify127.1 R1], [Mplify127.1 R2], [Mplify127.1 R3]

[R44] The Seller **MUST** apply the agreed default value for an Optional Product-Specific Attribute if a value is not included by the Buyer in the corresponding API request. [Mplify127.1 R8]

Let's consider the following JSON Schema of Product Specification **AccessElineOvc** as the schema that will be used to construct **productOfferingSpecificationSchema** JSON Subschema (the below schema is a subset of the **AccessElineOvc** schema for readability purposes):

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "allOf": [
    {
      "$ref": "#/definitions/AccessElineOvcCommon"
    },
    {
      "type": "object",
      "properties": {
        "uniEp": {
          "$ref": "#/definitions/AccessElineOvcEndPoint",
          "description": "MEF 26.2 sec. 16 - The OVC EP object for the OVC EP at the UNI. The UNI OVC End Point must be included in the Access E-Line Product."
        },
        "enniEp": {
          "$ref": "#/definitions/AccessElineOvcEndPoint",
          "description": "MEF 26.2 sec. 16 - The OVC EP object for the OVC EP at the ENNI. The ENNI OVC End Point must be included in the Access E-Line Product."
        }
      },
      "required": [
        "enniEp",
        "uniEp"
      ]
    }
  ],
  "definitions": {
    "AccessElineOvcCommon": {
      "type": "object",
      "description": "..",
      "properties": {
        "maximumFrameSize": {
          "type": "integer",
          "minimum": 1526,
          "description": "..."
        },
        "ceVlanIdPreservation": {
          "type": "string",
          "enum": [
            "PRESERVE",
            "STRIP",
            "RETAIN"
          ],
          "description": "..."
        },
        "cTagPcpPreservation": {
          "$ref": "#/definitions/EnabledDisabled",
          "description": "..."
        },
        "cTagDeiPreservation": {
          "$ref": "#/definitions/EnabledDisabled",
          "description": "..."
        },
        "listOfClassOfServiceNames": {
          "type": "array",
          "items": {
            "type": "string"
          },
          "minItems": 1,
          "uniqueItems": true,
          "description": "..."
        },
        "carrierEthernetSls": {
          "type": "array",
          "items": {
            "$ref": "#/definitions/CarrierEthernetSls"
          },
          "maxItems": 1,
          "minItems": 0,
          "uniqueItems": true,
          "description": "..."
        },
        "frameDisposition": {
          "$ref": "#/definitions/FrameDisposition",

```

```

        "description": "...",
    },
    "availableMegLevel": {
        "$ref": "#/definitions/AvailableMegList",
        "description": "...",
    },
    "ovcl2cpAddressSet": {
        "$ref": "#/definitions/L2cpAddressSet",
        "description": "...",
    }
}
},
... // the rest of the schema
}
}

```

For example, a Seller wants to define a Product Offering of the **AccessElineOvc** with the following constraints:

- class of service is constrained to **Excellence**,
- attribute **maximumFrameSize** is fixed to **9100**,
- attribute **ceVlanIdPreservation** is forbidden to be used,
- attributes **cTagPcpPreservation**, **frameDisposition** are mandatory

The constraints above may be expressed as the JSON Subschema of the Product Specification **AccessElineOvc** i.e. **productOfferingSpecificationSchema** JSON Schema:

```

{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "allOf": [
    {
      "$ref": "#/definitions/AccessElineOvcCommon"
    },
    {
      "type": "object",
      "properties": {
        "uniEp": {
          "$ref": "#/definitions/AccessElineOvcEndPoint",
          "description": "MEF 26.2 sec. 16 - The OVC EP object for the OVC EP at the UNI. The UNI OVC End Point must be included in the Access E-Line Product."
        },
        "enniEp": {
          "$ref": "#/definitions/AccessElineOvcEndPoint",
          "description": "MEF 26.2 sec. 16 - The OVC EP object for the OVC EP at the ENNI. The ENNI OVC End Point must be included in the Access E-Line Product."
        }
      },
      "required": [
        "enniEp",
        "uniEp"
      ]
    }
  ],
  "definitions": {
    "AccessElineOvcCommon": {
      "type": "object",
      "description": "...",
      "properties": {
        "maximumFrameSize": {
          "type": "integer",
          "minimum": 1526,
          "const": 9100,
          "description": "..."
        },
        "cTagPcpPreservation": {
          "$ref": "#/definitions/EnabledDisabled",
          "description": "..."
        },
        "cTagDeiPreservation": {
          "$ref": "#/definitions/EnabledDisabled",
          "description": "..."
        }
      },
      "listOfClassOfServiceNames": {

```

```

        "type": "array",
        "items": {
            "type": "string"
        },
        "minItems": 1,
        "uniqueItems": true,
        "description": "...",
        "const": "Excellence"
    },
    "carrierEthernetSls": {
        "type": "array",
        "items": {
            "$ref": "#/definitions/CarrierEthernetSls"
        },
        "maxItems": 1,
        "minItems": 0,
        "uniqueItems": true,
        "description": "..."
    },
    "frameDisposition": {
        "$ref": "#/definitions/FrameDisposition",
        "description": "..."
    },
    "availableMegLevel": {
        "$ref": "#/definitions/AvailableMegList",
        "description": "..."
    },
    "ovcl2cpAddressSet": {
        "$ref": "#/definitions/L2cpAddressSet",
        "description": "..."
    }
},
"required": ["cTagPcpPreservation", "frameDisposition"]
... // the rest of the schema
}

```

[R45] Attribute `productOfferingSpecificationSchema` **MUST** be the subschema of the `sourceSchema` of `ProductSpecification`.

6.2.1.6. Product Offering Contextual Info

The Product Offering Contextual Info was introduced to express how the `productOfferingSpecificationSchema` JSON Schema should be constrained for the Product-Specific Attributes for every combination of Business Functions and Product Actions.

It's driven by the business need to simplify the API and not require providing attributes that are fixed or not required for particular Business Functions and Product Actions.

For better understanding, the below examples show potential use cases:

- an attribute is not required during the Product Order Qualification, because it does not impact the result. However, this attribute is required by the Product Ordering function,
- an attribute must not be changed during the modification of the existing product.

The Product Offering Contextual Info is expressed as a pair:

- `contextSchema` which is a JSON Schema,
- `context` which is a `businessFunction` and `productAction` pair.

Notice that `contextSchema` is JSON Subschema of `sourceSchema` as well as a JSON Subschema of `productOfferingSpecificationSchema` schema.

[R46] The following attributes of `ProductOfferingContextualInfo` **MUST** be set [Mplify127.1 R54]:

- `contextSchema`
- `context.businessFunction`

[R47] `productOfferingContextualInfo` **MUST** provide the `context.productAction` attribute when `context.businessFunction` is not `productInventory`. [Mplify127.1 R55]:

[R48] For each `productOfferingContextualInfo`, attribute `contextSchema` **MUST** be the subschema of the `sourceSchema` of the corresponding Product Specification.

[R49] For each `productOfferingContextualInfo`, attribute `contextSchema` **MUST** be the subschema of the `productOfferingSpecificationSchema` of the corresponding Product Offering (if present).

[R50] The Seller **MUST** respect the rules defined in Table 7 for each `contextSchema` schema.

Continuing the example from [Chapter 6.2.1.5], the Product Offering Qualification would be constrained as follows::

- attribute `cTagDeiPreservation` becomes required,
- attributes `availableMegLevel`, `ovcl2cpAddressSet`, `carrierEthernetSls`, `cTagDeiPreservation`, `cTagPcpPreservation` are not applicable and
- for all other cases `productOfferingSpecificationSchema` JSON Schema should be applied.

The snippet below presents the above use case for the Product Offering Qualification Contextual Info.

For the clarity of the example the embedded schemas (i.e. `contextSchema` attributes) were replaced with references that are placed below this example. Additionally, the embedded schemas are presented in easy-to-read form (unescaped).

```
{
  ...
  "productOfferingContextualInfo":
  [
    {
      "contextSchema": {
        // "#context-schema-1"
      },
      "context":
      {
        "productAction": "all",
        "businessFunction": "all"
      }
    },
    {
      "contextSchema": {
        // "#context-schema-2"
      },
      "context":
      {
        "productAction": "all",
        "businessFunction": "poq"
      }
    }
  ]
  ...
}
```

The above example presents the list of the `productOfferingContextualInfo` that specifies that `#context-schema-1` should be used for any combination of `businessFunction` and `productAction` except the case when `businessFunction=poq`, in which case `#context-schema-2` should be used instead.

Embedded schemas:

- **#context-schema-1**

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "allOf": [
    {
      "$ref": "#/definitions/AccessElineOvcCommon"
    },
    {
      "type": "object",
      "properties": {
        "uniEp": {
          "$ref": "#/definitions/AccessElineOvcEndPoint",
          "description": "MEF 26.2 sec. 16 - The OVC EP object for the OVC EP at the UNI. The UNI OVC End Point must be included in the Access E-Line Product."
        },
        "enniEp": {
          "$ref": "#/definitions/AccessElineOvcEndPoint",
          "description": "MEF 26.2 sec. 16 - The OVC EP object for the OVC EP at the ENNI. The ENNI OVC End Point must be included in the Access E-Line Product."
        }
      },
      "required": [
        "enniEp",
        "uniEp"
      ]
    }
  ],
  "definitions": {
    "AccessElineOvcCommon": {
      "type": "object",
      "description": "...",
      "properties": {
        "maximumFrameSize": {
          "type": "integer",
          "minimum": 1526,
          "const": 9100,
          "description": "..."
        },
        "cTagPcpPreservation": {
          "$ref": "#/definitions/EnabledDisabled",
          "description": "..."
        },
        "cTagDeiPreservation": {
          "$ref": "#/definitions/EnabledDisabled",
          "description": "..."
        },
        "listOfClassOfServiceNames": {
          "type": "array",
          "items": {
            "type": "string"
          },
          "minItems": 1,
          "uniqueItems": true,
          "description": "...",
          "const": "Excellence"
        },
        "carrierEthernetSls": {
          "type": "array",
          "items": {
            "$ref": "#/definitions/CarrierEthernetSls"
          },
          "maxItems": 1,
          "minItems": 0,
          "uniqueItems": true,
          "description": "..."
        },
        "frameDisposition": {
          "$ref": "#/definitions/FrameDisposition",
          "description": "..."
        },
        "availableMegLevel": {
          "$ref": "#/definitions/AvailableMegList",
          "description": "..."
        },
        "ovcl2cpAddressSet": {
```

```

        "$ref": "#/definitions/L2cpAddressSet",
        "description": "...",
    },
    },
    "required": ["cTagPcpPreservation", "frameDisposition"]
},
... // the rest of the schema
}
}

```

Schema **#context-schema-1** is equal to the **productOfferingSpecificationSchema** schema. That means that for every use case (except **businessFunction=poq**) the schema is unchanged.

- **#context-schema-2**

```

{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "allOf": [
    {
      "$ref": "#/definitions/AccessElineOvcCommon"
    },
    {
      "type": "object",
      "properties": {
        "uniEp": {
          "$ref": "#/definitions/AccessElineOvcEndPoint",
          "description": "MEF 26.2 sec. 16 - The OVC EP object for the OVC EP at the UNI. The UNI OVC End Point must be included in the Access E-Line Product."
        },
        "enniEp": {
          "$ref": "#/definitions/AccessElineOvcEndPoint",
          "description": "MEF 26.2 sec. 16 - The OVC EP object for the OVC EP at the ENNI. The ENNI OVC End Point must be included in the Access E-Line Product."
        }
      },
      "required": [
        "enniEp",
        "uniEp"
      ]
    }
  ],
  "definitions": {
    "AccessElineOvcCommon": {
      "type": "object",
      "description": "..",
      "properties": {
        "maximumFrameSize": {
          "type": "integer",
          "minimum": 1526,
          "const": 9100,
          "description": "..."
        },
        "listOfClassOfServiceNames": {
          "type": "array",
          "items": {
            "type": "string"
          },
          "minItems": 1,
          "uniqueItems": true,
          "description": "...",
          "const": "Excellence"
        },
        "frameDisposition": {
          "$ref": "#/definitions/FrameDisposition",
          "description": "..."
        },
        "cTagDeiPreservation": {
          "$ref": "#/definitions/EnabledDisabled",
          "description": "..."
        },
        "cTagPcpPreservation": {
          "$ref": "#/definitions/EnabledDisabled",
          "description": "..."
        }
      }
    },
    "required": ["cTagPcpPreservation", "frameDisposition", "cTagDeiPreservation"]
  }
}

```



```

    },
    ... // the rest of the schema
  }
}

```

The above example is the realization of [D2].

Schema `#context-schema-2` is modified according to the example described above. The below list summarizes the modifications applied to the `productOfferingSpecificationSchema` schema that results with `#context-schema-2`:

- attribute `cTagDeiPreservation` is required and, therefore is added to the `required` array,
- attributes `availableMegLevel`, `ovcl2cpAddressSet`, `carrierEthernetSls`, `cTagPcpPreservation` are not applicable, therefore were removed from the schema

[R51] If the `productOfferingContextualInfo` includes an entry for one Business Function or Product Action, then the Seller **MUST** provide a `productOfferingContextualInfo` entry in this list for every combination of Business Function and Product Action. [Mplify127.1 R32]

It doesn't mean that all possible combinations must be listed explicitly. Wildcards are recommended to be used, when feasible, to cover the whole group of possibilities, as is shown in the example above.

[D2] The Seller **SHOULD** use the `productAction=all`, `businessAction=all` wildcards to cover as many use cases as feasible and extend the `productOfferingContextualInfo` by adding specific use cases as required.

[R52] When the Buyer sends the request for any combination of `businessFunction` and `productAction`, the request's Product Payload **MUST** be valid against the schema defined in the corresponding `productOfferingContextualInfo` attribute of referred `ProductOffering`.

[R53] The Buyer and the Seller **MUST** agree on whether the Buyer can include in an API request Product-Specific Attributes that have been classified as Fixed. [Mplify127.1 R10]

[R54] If the Buyer and Seller agree that Product-Specific Attributes classified as Fixed cannot be included in the API request, the Buyer and Seller **MUST** agree on whether the Seller includes Product-Specific Attributes classified as Fixed in the corresponding API responses. [Mplify127.1 R11]

[R55] If the Buyer and Seller agree that Product-Specific Attributes classified as Fixed cannot be included in an API request, the Seller **MUST** reject an API request from the Buyer if it includes a Product-Specific Attribute that has been classified as Fixed for the Business Function (POQ, Quote, Order), Product Action (add, modify), and Product Offering. [Mplify127.1 R12]

[R56] If the Buyer and Seller agree that Product-Specific Attributes classified as Fixed cannot be included in an API request, and if a Product-Specific Attribute is classified to be Fixed for Inventory for a Product Offering, then the Seller **MUST NOT** include a value for the attribute in the corresponding API response. [Mplify127.1 R13]

[R57] If the Buyer and Seller agree that Product-Specific Attributes classified as Fixed can be included in an API request, the Seller **MUST** reject an API request from the Buyer if it includes a Product-Specific Attribute that has been classified as Fixed for the Business Function (POQ, Quote, Order), Product Action (add, modify), and Product Offering and includes a value that is different than the agreed-on fixed value. [Mplify127.1 R14]

[R58] If the Buyer and Seller agree that Product-Specific Attributes classified as Fixed can be included in API request, and if a Product-Specific Attribute is agreed to be Fixed for Inventory

for a Product Offering, then the Seller **MUST** include a value for the Product-Specific attribute in the Inventory API response. [Mplify127.1 R15]

6.2.1.7. Product Offering Price

[R59] A **ProductOfferingPrice** **MUST** contain the following attributes: [Mplify127.1 R84]

- **description**
- **lastUpdate**
- **validFor**
- **priceType**
- **price**

[R60] When specifying the **ProductOfferingPrice** the Seller **MUST** follow the combination of attributes presented in Table 8. [Mplify127.1 R85], [Mplify127.1 R86]

priceType	recurring-ChargePeriod	unitOfMeasure	price.dutyFreeAmount	Comments
recurring	X		X	
nonRecurring			X	
usageBased		X	X	price.dutyFreeAmount is the charge per unitOfMeasure

Table 8. Price Type Required Information

[R61] The **bundledProductOffering** **MUST NOT** be set for a Product Offering that is not a Bundle. [Mplify127.1 R87]

[R62] The **bundledProductOffering** **MUST** refer only Product Offerings that are part of the Bundle. [Mplify127.1 R88]

[R63] The **bundledProductOffering** **MUST** be set for every Product Offering, for which the price of the Bundle is dependent on the number of ordered instances of the Product Offering. [Mplify127.1 R89]

[R64] A **PriceModifier** **MUST** contain the following attributes: [Mplify127.1 R90]

- **description**
- **lastUpdate**
- **validFor**

[R65] A **PriceModifier** **MUST** contain either the **reductionPercentage** or the **discountedPrice**, but not both. [Mplify127.1 R91]

6.2.2. Product Offering - Lifecycle

Figure 16 presents the Product Offering state machine:

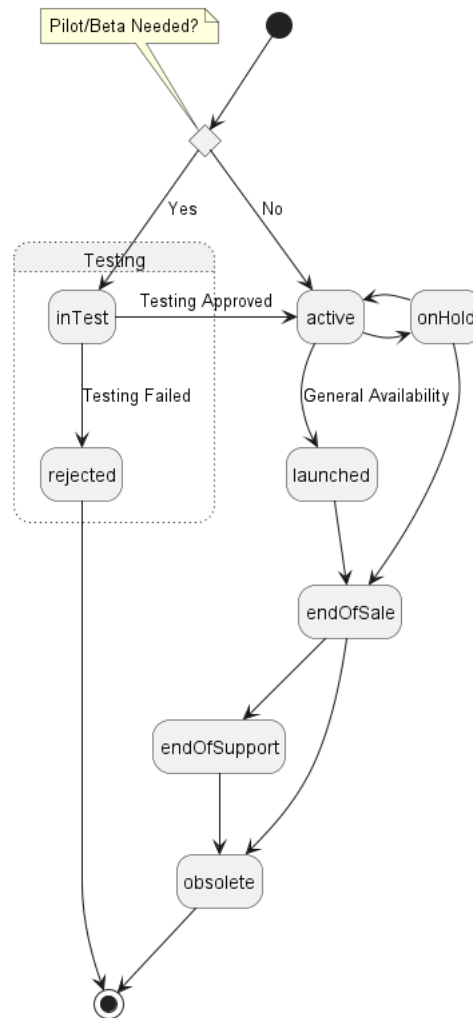


Figure 16. Product Offering State Machine

The Product Offering State Machine is simpler than the one proposed by TMF [TMF620] because it focuses on exposing Product Offerings and the states that are relevant to the Buyers, not the whole Product Offering Management lifecycle, some of which is only relevant and internal to the Seller. The specific states are managed by the Seller.

[O4] The Seller **MAY** decide for agreed upon Buyers being part of beta test process to expose the Product Offerings in **inTest** or **rejected** state.

Table 9 presents the mapping between API **lifecycleStatus** values (aligned with TMF) and Mplify 127.1 naming together with states' descriptions.

lifecycleStatus	Mplify 127.1 name	Description
active	active	A Product Offering has been defined in the Product Catalog for marketing purposes but is not yet available for ordering.
endOfSale	END_OF_SALE	A new Product based on the Product Offering cannot be ordered by any Buyers, but Products may still be in use and may be changed or disconnected, and receive support.
endOfSupport	END_OF_SUPPORT	A Product Offering is no longer possible to Install new or Change any existing Products based on the Product Offering. The Buyer can still use Products based on the Product Offering as is without any support from the Seller (the only allowed action is remove).

lifecycleStatus	Mplify 127.1 name	Description
obsolete	OBSOLETE	The Product Offering is only available in the Product Catalog for historical documentation reasons. No actions are allowed on Products based on these Product Offerings. A Product Offering that is obsolete may be removed at the Seller's discretion from the Product Catalog. This is a final state.
onHold	ON_HOLD	The Seller decides to stop Buyers from ordering new Products based on the Product Offering (for example, due to supply constraints, product recall, legal reasons, etc.). The Product Offering can transition to either launched when the constraints are lifted and the Buyer can order new Products again, or to endOfSale , if the Seller decides to stop offering Products based on the Product Offering. This is an intermediate temporary state.
launched	launched	The Buyer can order new Products, and change or disconnect any active Products based on the Product Offering.
inTest	PILOT_BETA	A Product Offering can only be used by a Buyer during a limited period for beta testing or during the pilot of a Product. Normally, only a limited set of Buyers will be given access to a Product Offering in this state.
rejected	REJECTED	When the pilot testing period is ended by the Seller, they may decide whether the Product Offering becomes available for ordering; otherwise, the Product Offering transitions to the rejected state. This is a final state.

Table 9. Product Offering lifecycle statuses

[R66] The Seller **MUST** support all statuses for Product Offering and the associated state transitions as shown in Table 9 and Figure 16. [Mplify127.1 R99].

It is at the Seller's discretion whether the **inTest** and **rejected** states will be used.

[D3] The Seller **SHOULD** add a **statusReason** describing the reasons for the condition when a Product Offering transitions to the **onHold** state. [Mplify127.1 D1]

[R67] The Seller **MUST NOT** remove a Product Offering from the Product Catalog unless the state is **rejected** or **obsolete**. [Mplify127.1 R100]

Removing obsoleted Product Offerings is at the Seller's discretion. There may be a value in keeping them in the Product Catalog for an extended period so the Buyer may reference them for historical reasons.

6.2.3. Use case 3: Retrieve Product Offering List

6.2.3.1. Interaction flow

The flow of this use case is very simple and is described in Figure 17.

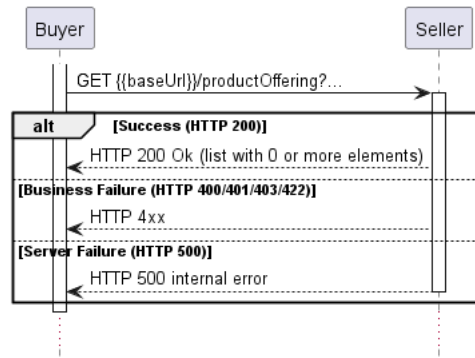


Figure 17. Use Case 3 - Retrieve Product Offering List

6.2.3.2. Retrieve Product Offering List - Request

[O5] The Buyer **MAY** retrieve the list of Product Offerings by using a **GET** `/productOffering` operation with desired filtering criteria. The attributes that are available to be used are: [Mplify127.1 O5]

- `name`
- `lastUpdate.gt`
- `lastUpdate.lt`
- `lifecycleStatus`
- `agreement`
- `channel`
- `marketSegment`
- `region.countryCode`
- `isBundle`
- `isSellable`
- `category.id`
- `productSpecification.id`

The Buyer may also ask for pagination with the use of the `offset` and `limit` parameters. The filtering and pagination attributes must be specified in URI query format [RFC3986](#). Section [7.1.2](#). provides details about the implementation of pagination mechanism.

Attributes `marketSegment` and `channel` are collections of primitive types (in this particular case `List<String>`). For implementation purposes, the strategy of querying interpretation is settled as:

- Requesting Entity may provide any number of desired values in filtering criteria provided as query parameters ([RFC3986](#) with the standard limitation of URIs length) respecting the following notation:

```
?marketSegment=Wholesale&marketSegment=Federal&...
```

- Provided values are interpreted as the alternatives,
- Resource is matched if any of the provided values match any value from the collection.

[R68] If the Buyer provides more than one value in filtering criteria for the array type attributes, then the Seller **MUST** return all Product Offerings whose corresponding attributes contain any of the provided values.

Regarding [R68], if the Buyer provides e.g. `marketSegment=Federal&marketSegment=Financial` then the Seller uses that values as alternatives i.e. result matches if at least one of the provided

values is contained by the Product Offering's **marketSegment** list.

```
http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productOffering?
lifecycleStatus=launched&marketSegment=Federal&marketSegment=Financial&limit=10&offset=0
```

The example above shows a Buyer's request to get the first ten Product Offerings that are in **launched** status and are available for the **Federal** or **Financial** markets. The correct response (HTTP code **200**) in the response body contains a list of **ProductOffering_Find** objects matching the criteria. To get more details (e.g. the list of 'Product Offering Terms'), the Buyer has to query a specific **ProductOffering** by **id**.

6.2.3.3. Retrieve Product Offering List - Response

The snippet below presents an example of the Retrieve Product Offering Lis response:

Retrieve **ProductOffering** List Response

Headers:

```
X-Result-Count=1
X-Total-Count=1
X-Pagination-Throttled=false
```

Body:

```
[
  {
    "id": "productOffering-1",
    "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productOffering/productOffering-1",
    "name": "Access E-line OVC Basic",
    "lastUpdate": "2023-01-19T16:33:20.324Z",
    "lifecycleStatus": "launched",
    "agreement": "Official agreement no 4",
    "channel": ["DirectSales", "Distribution"],
    "marketSegment": ["Federal", "Financial"],
    "isBundle": "false",
    "isSellable": "true",
    "region": [
      {
        "stateOrProvince": "Malopolskie",
        "countryCode": "PL"
      }
    ],
    "category": [
      {
        "id": "productCategory-2",
        "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/category/productCategory-2"
      }
    ],
    "productSpecification": {
      "id": "productSpecification-1",
      "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productSpecification/productSpecification-1"
    }
  },
  {
    "id": "productOffering-2",
    "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productOffering/productOffering-2",
    "name": "Access E-line OVC Excellence",
    "lastUpdate": "2023-01-19T16:33:20.324Z",
    "lifecycleStatus": "launched",
    "agreement": "string",
    "channel": ["DirectSales"],
    "marketSegment": ["Federal"],
    "isBundle": "false",
```

```

    "isSellable": "true",
    "region": [
      {
        "stateOrProvince": "Malopolskie",
        "countryCode": "PL"
      }
    ],
    "category": [
      {
        "id": "productCategory-2",
        "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/category/productCategory-2"
      }
    ],
    "productSpecification": {
      "id": "productSpecification-1",
      "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productSpecification/productSpecification-1"
    }
  }
]

```

[R69] When the Buyer queries by **category.id** attribute, then the Seller **MUST** include every Product Offering that is a direct or indirect member of this category. [Mplify127.1 R63]

An indirect member of a given category is any member that is present in the **subcategory** list of that category. This rule applies recursively.

For example, Assume that Category C is the subcategory of Category B and Category B is the subcategory of Category A. Then a Product Offering that is categorized by Category C is:

- a direct member of Category C,
- an indirect member of Category B (because Category C is a subcategory of Category B),
- an indirect member of Category A (because Category C is a subcategory of Category A by recursiveness).

[R70] The Seller **MUST** put the following attributes into the **ProductOffering_Find** object in the response if they are set: [Mplify127.1 R56]

- **id**
- **name**
- **lastUpdate**
- **lifecycleStatus**
- **agreement**
- **channel**
- **marketSegment**
- **region**
- **isBundle**
- **isSellable**
- **category**
- **productSpecification**

[R71] The Seller response **MUST** include every Product Offering where the **channel** filter criteria match one of the Product Offering's **channel** or the Product Offering's **channel** is an empty list [Mplify127.1 R57], [Mplify127.1 R58]

[R72] The Seller response **MUST** include every Product Offering where the **marketSegment** filter criteria match one of the Product Offering's **marketSegment** or the Product Offering's **marketSegment** is an empty list. [Mplify127.1 R59], [Mplify127.1 R60]

[R73] The Seller response **MUST** include every Product Offering where the **region.countryCode** filter criteria match one of the Product Offering's **region.countryCode** or the Product Offering's

region is an empty list. [Mplify127.1 R61], [Mplify127.1 R62]

[R74] If case no items matching the criteria are found, the Seller **MUST** return a valid (HTTP code **200**) response with an empty list. [Mplify127.1 R65]

The full list of attributes is available in [Section 7](#) and in the API specification which is an integral part of this standard.

Note: The Product Offering model for this use case is the subset of the model from the chapter [\[6.2.1\]](#).

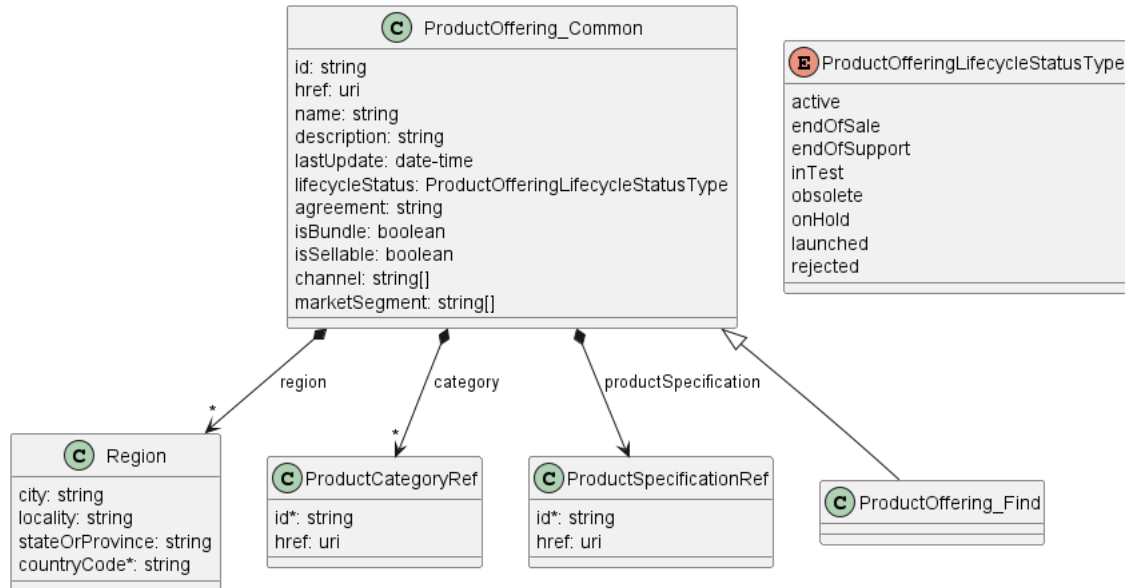


Figure 18. Use Case 3 - Product Offering Find Model

6.2.4. Use case 4: Retrieve Product Offering by Identifier

6.2.4.1. Interaction flow

The flow of this use case is very simple and is described in Figure 19.

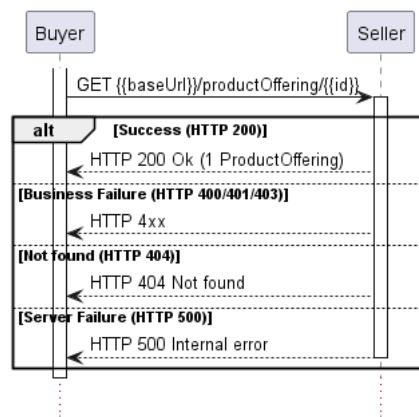


Figure 19. Use Case 4 - Retrieve Product Offering by Identifier

The Buyer wants to retrieve detailed information about a single Product Offering with the given **id**.

6.2.4.2. Retrieve Product Offering by Identifier - Request

[R75] The Buyer must provide the **id** of the Product Offering that originates from the Seller.
[Mplify127.1 R66]

```
http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productOffering/productOffering-1
```

The example above shows a Buyer's request to get the Product Category with **id** equal to **productOffering-1**. The correct response (HTTP code **200**) in the response body contains a single **ProductOffering** object matching the given **id**.

6.2.4.3. Retrieve Product Offering by Identifier - Response

The snippet below presents an example of the Retrieve Product Offering Request (the schemas were not provided intentionally due to the example's clarity):

Retrieve **ProductOffering** by Identifier Response

```
{
  "id": "productOffering-1",
  "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productOffering/productOffering-1",
  "name": "Access E-line OVC Basic",
  "lastUpdate": "2023-01-19T16:33:20.324Z",
  "lifecycleStatus": "launched",
  "agreement": "Official agreement no 4",
  "channel": [
    "DirectSales",
    "Distribution"
  ],
  "marketSegment": [
    "Federal",
    "Financial"
  ],
  "isBundle": "false",
  "isSellable": "true",
  "region": [
    {
      "stateOrProvince": "Malopolskie",
      "countryCode": "PL"
    }
  ],
  "category": [
    {
      "id": "productCategory-2",
      "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/category/productCategory-2"
    }
  ],
  "statusTransition": [
    {
      "transitionDate": "2023-01-01T00:00:00.004Z",
      "lifecycleStatus": "active"
    },
    {
      "transitionDate": "2023-01-19T16:33:20.324Z",
      "lifecycleStatus": "launched"
    },
    {
      "transitionDate": "2024-01-19T16:33:20.324Z",
      "lifecycleStatus": "obsolete"
    }
  ],
  "statusReason": "Ready to be used for ordering.",
  "attachment": [
    {
      "author": "John Doe",
      "creationDate": "2023-01-19T16:33:20.324Z",
      "description": "Signed contract",
      "mimeType": "application/pdf",
      "name": "Customers contract",
      "size": {
        "amount": 105.0,

```

```

        "units": "KBYES"
      },
      "source": "buyer",
      "url": "http://some-domain.com/attachment/file/4e5b3701-47f8-47a7-bcf8-d3d740b4cd60"
    }
  ],
  "productOfferingTerm": [
    {
      "description": "Basic Term",
      "duration": {
        "amount": 12,
        "units": "months"
      },
      "endOfTermAction": "roll",
      "name": "Basic",
      "rollInterval": {
        "amount": 6,
        "units": "months"
      }
    }
  ],
  "note": [
    {
      "author": "John Doe",
      "date": "2023-01-19T16:33:20.324Z",
      "id": "43072c06-34ac-4713-b0b1-371cb7479400",
      "source": "buyer",
      "text": "Lorem ipsum"
    }
  ],
  "productSpecification": {
    "id": "productSpecification-1",
    "href":
    "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productSpecification/productSpecification-1"
  },
  "productOfferingContextualInfo":
  [
    {
      "contextSchema": {
        // here should be the schema
      },
      "context":
      {
        "productAction": "all",
        "businessFunction": "all"
      }
    }
  ]
}

```

[R76] The Seller **MUST** put the following attributes into the **ProductOffering** object in the response: [Mplify127.1 R67]

- **id**
- **name**
- **description**
- **lastUpdate**
- **lifecycleStatus**
- **statusTransition**
- **isBundle**
- **isSellable**
- **productSpecification**

[R77] The Seller response **MUST** include every other of the remaining attributes of the **ProductOffering** if they are set. [Mplify127.1 R68]

[R78] The Seller response **MUST** include exactly one of the **productOfferingSpecificationSchema** attributes:

- **schema**

- `schemaLocation`

[R79] The Seller response **MUST** include exactly one of the `contextSchema` attributes:

- `schema`
- `schemaLocation`

Attributes `schema` and `schemaLocation` are modeled as mutually exclusive to avoid the dualistic representation of `contextSchema`.

[R82] For Product Offerings, the Seller **MUST** set the respective `source=seller` attribute when adding any item to one of the following lists: `note`, `attachment`.

The source of the notes is always the Seller (`note[?].source=seller`) because API doesn't allow for any modifications that could be initiated by the Buyer.

Note: The Product Offering model for this use case is the full set of the model from the chapter [6.2.1]. To see the model go to the mentioned chapter.

The full list of attributes is available in [Section 7](#) and in the API specification which is an integral part of this standard.

6.3. Product Specification Use Cases

6.3.1. Product Specification - Model

Figure 20 presents the data model of the Product Specification. The model of the retrieve list response (`ProductSpecification_Find`) is a subset of the `ProductSpecification` model and contains only those attributes that can (or must) be returned by the Seller. For visibility of these differences the `ProductSpecification_Common` has been introduced. However, it is not to be used directly in the response of any endpoint.

The full list of attributes is available in [Section 7](#) and in the API specification which is an integral part of this standard.

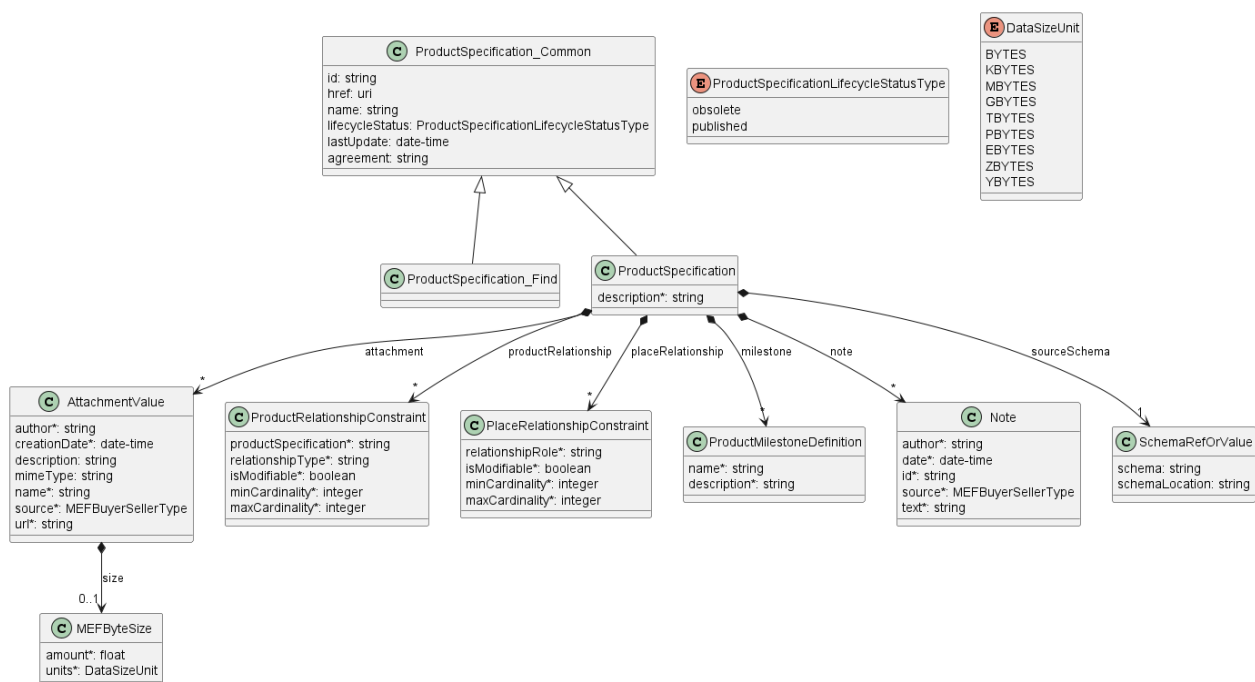


Figure 20. Product Specification Model

[R83] After a **ProductSpecification** has been created, the following attributes **MUST NOT** be modified: [Mplify127.1 R71]

- **id**
- **productRelationship**
- **placeRelationship**
- **sourceSchema**

[R84] In the case of a change of any attribute of **ProductSpecification**, the Seller **MUST** set the **lastUpdate** to reflect the most recent date the modification occurred. [Mplify127.1 R70]

[R85] A **ProductMilestoneDefinition** **MUST** contain the following attributes: [Mplify127.1 R76]

- **name**
- **description**

Product Specifications are designed to be used for the decoration of the Product Schema (represented by **sourceSchema**) by the business attributes to publish them for commercial usage. Related **sourceSchema** defines the JSON schema (**JSONSchema**) of a prospective Product instance. At the very beginning, by definition all attributes in the **sourceSchema** are optional and during integration between the Buyer and Seller must be negotiated and defined in **ProductOffering** as **productOfferingSpecificationSchema** and **productOfferingContextualInfo** attributes.

6.3.2. Product Specification - Lifecycle

Figure 21 presents the Product Specification state machine:

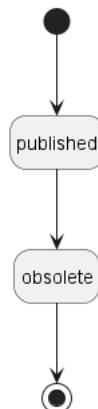


Figure 21. Product Specification State Machine

The Product Specification State Machine is consistent with the State Machine of Product Offering and it is a simplification of the one proposed by TMF [**TMF620**] because it focuses on exposing Product Specification to the Buyers, not the whole Product Specifications Management. The specific states and notifications are managed by the Seller.

Table 10 presents the mapping between API **lifecycleStatus** values and Mplify 127.1 naming together with the state's description.

Name	Mplify 127.1 Name	Description
------	-------------------	-------------

Name	Mplify 127.1 Name	Description
obsolete	OBSOLETE	After a Product Offering orThe Product Specification is only available in the Product Catalog for historical documentation reasons. There are no active Products on the Seller's Network based on the Product Specification. A Product Specification that is no longer available it transitions to obsolete and may be removed at the Seller's discretion from the Product Catalog. This is a final state.
published	PUBLISHED	A Product Specification has been defined in the Product Catalog. Product Offerings based on the Product Specification may be available for ordering.

Table 10. Product Specification lifecycle statuses

[R86] The Seller **MUST** support all lifecycle statuses for Product Specification and the associated state transitions [Mplify127.1 R101].

[O6] The Seller **MAY** update the Product Specification (see chapter [6.3.1] to find updatable attributes) when the Product Specification **lifecycleStatus** is not final i.e. **rejected**

[R87] A Product Specification **MUST NOT** be set to the **obsolete** state unless all associated Product Offerings are in the **obsolete** or **rejected** state. [Mplify127.1 R102]

[R88] The Seller **MUST NOT** remove a Product Specification from the Product Catalog unless the state is **obsolete**. [Mplify127.1 R103]

[R89] When the Seller is removing the **obsolete** Product Specifications, then the Seller **MUST** remove all related Product Offerings referencing the **obsolete** Product Specification. [Mplify127.1 R104]

Removing obsoleted Product Specifications is at the Seller's discretion. Nevertheless, it must be consulted with the Buyer for the reasons why the Buyer still uses their definitions for historical purposes.

6.3.3. Use case 5: Retrieve Product Specification List

6.3.3.1. Interaction flow

The flow of this use case is very simple and is described in Figure 22.

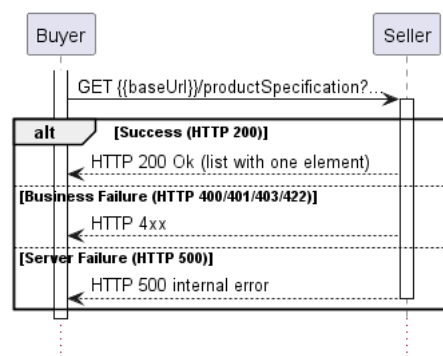


Figure 22. Use Case 5 - Retrieve Product Specification List

6.3.3.2. Retrieve Product Specification List - Request

[O7] The Buyer **MAY** retrieve the list of Product Specifications by using a **GET** **/productSpecification** operation with desired filtering criteria. The attributes that are available to be used are: [Mplify127.1 O6]:

- **name**
- **lastUpdate.gt**
- **lastUpdate.lt**
- **lifecycleStatus**
- **agreement**

The Buyer may also ask for pagination with the use of the **offset** and **limit** parameters. The filtering and pagination attributes must be specified in URI query format [RFC3986](#).

```
http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productSpecification?
lifecycleStatus=published&limit=3&offset=8
```

The example above shows a Buyer's request to omit the first seven and get the next two Product Specifications that are in **published** status. The correct response (HTTP code **200**) in the response body contains a list of **ProductSpecification_Find** objects matching the criteria. To get more details (e.g. **sourceSchema**), the Buyer has to query a specific **ProductSpecification** by **id**.

6.3.3.3. Retrieve Product Specification List - Response

The snippet below presents an example of the Retrieve Product Specification List response:

Retrieve **ProductSpecification** List Response

Headers:

```
X-Result-Count=2
X-Total-Count=10
X-Pagination-Throttled=true
```

Body:

```
[
  {
    "id": "productSpecification-11",
    "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productSpecification/productSpecification-11",
    "name": "Ethernet Virtual Private Tree EVC",
    "lifecycleStatus": "published",
    "lastUpdate": "2023-01-19T16:30:51.626Z"
  },
  {
    "id": "productSpecification-9",
    "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productSpecification/productSpecification-9",
    "name": "Ethernet Private Tree EVC EP",
    "lifecycleStatus": "published",
    "lastUpdate": "2023-01-19T16:30:51.626Z"
  }
]
```

[R90] The Seller **MUST** put the following attributes into the `ProductSpecification_Find` object in the response if they are set: [Mplify127.1 R77]

- `id`
- `name`
- `lastUpdate`
- `lifecycleStatus`
- `agreement`

[R91] In case no items matching the criteria are found, the Seller **MUST** return a valid response with an empty list. [Mplify127.1 R79]

The full list of attributes is available in [Section 7](#) and in the API specification which is an integral part of this standard.

Note: The Product Specification model for this use case is the subset of the model from the chapter [\[6.3.1\]](#).

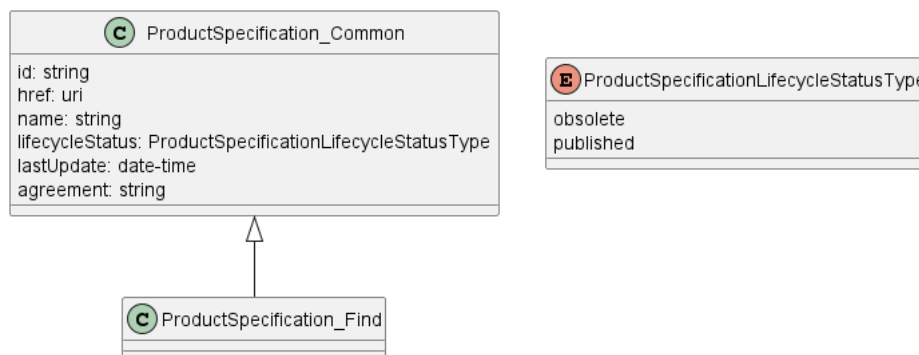


Figure 23. Use Case 5 - Product Specification Find Model

6.3.4. Use case 6: Retrieve Product Specification by Identifier

6.3.4.1. Interaction flow

The flow of this use case is very simple and is described in Figure 24.

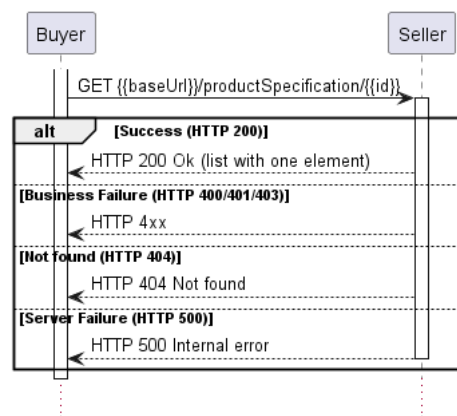


Figure 24. Use Case 6 - Retrieve Product Specification by Identifier

The Buyer wants to retrieve detailed information about a single Product Specification with a given `id`.

6.3.4.2. Retrieve Product Specification by Identifier - Request

[R92] The Buyer must provide the **id** of the Product Specification that originates from the Seller.
[Mplify127.1 R80]

```
http://127.1.0.0.1:8080/mefApi/sonata/productCatalog/v4/productSpecification/productSpecification-9
```

The example above shows a Buyer's request to get the Product Specification with **id** equal to **productSpecification-9**. The correct response (HTTP code **200**) in the response body contains a single **ProductSpecification** object matching the given **id**.

6.3.4.3. Retrieve Product Specification by Identifier - Response

The snippet below presents an example of the Retrieve Product Specification Request (the schemas were not provided intentionally due to the example's clarity):

Retrieve **ProductSpecification** by Identifier Response

```
{
  "id": "productSpecification-9",
  "href": "http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/productSpecification/productSpecification-9",
  "name": "Ethernet Private Tree EVC EP",
  "lifecycleStatus": "published",
  "lastUpdate": "2023-01-19T16:30:51.626Z",
  "description": "EP TREE EVC EP",
  "attachment": [
    {
      "author": "John Doe",
      "creationDate": "2023-01-19T16:33:20.324Z",
      "description": "EP TREE EVC doc",
      "mimeType": "application/pdf",
      "name": "Technical documentation",
      "size": {
        "amount": 1050.0,
        "units": "KBYTES"
      },
      "source": "buyer",
      "url": "https://lso.mef.net/lso-payload-catalog/ep-tree-ep-product-payload"
    }
  ],
  "note": [
    {
      "author": "John Doe",
      "date": "2023-01-19T16:33:20.324Z",
      "id": "43072c06-34ac-4713-b0b1-371cb7479400",
      "source": "buyer",
      "text": "Lorem ipsum"
    }
  ],
  "sourceSchema": {
    "schemaLocation": "http://seller.mef.com:8081/publisher/v4/schema/6346d966-0a9c-4dfe-88f2-86b0e995a8a9"
  },
  "placeRelationship": [],
  "productRelationship": [
    {
      "id": "productSpecification-10",
      "relationshipType": "ROOT_ENDPOINT_OF_EVC",
      "minCardinality": 0,
      "maxCardinality": 1
    },
    {
      "id": "productSpecification-10",
      "relationshipType": "LEAF_ENDPOINT_OF_EVC",
      "minCardinality": 0,
      "maxCardinality": 1
    },
    {
      "id": "productSpecification-6",
      "relationshipType": "CONNECTS_TO_UNI",
      "minCardinality": 1,
      "maxCardinality": 1
    }
  ]
}
```



```
}  
  ]  
}
```

[R93] The Seller **MUST** put the following attributes into the **ProductSpecification** object in the response: [Mplify127.1 R81]

- **id**
- **name**
- **description**
- **lastUpdate**
- **lifecycleStatus**
- **sourceSchema**

[R94] The Seller response **MUST** include the remaining optional attributes in the **ProductSpecification** if they are set. [Mplify127.1 R82]

The full list of attributes is available in [Section 7](#) and in the API specification which is an integral part of this standard.

[R96] For Product Specifications, the Seller **MUST** set the respective **source=seller** attribute when adding any item to one of the following lists: **note**, **attachment**.

The source of the notes is always the Seller (**note[?].source=seller**) because API doesn't allow for any modifications that could be initiated by the Buyer.

Note: The Product Specification model for this use case is the full set of the model from the chapter [\[6.3.1\]](#). To see the model go to the mentioned chapter.

[R97] The Seller response **MUST** include exactly one of the **sourceSchema** attributes:

- **schema**
- **schemaLocation**

Attributes **schema** and **schemaLocation** are modeled as mutually exclusive to avoid the dual nature of **sourceSchema** representation.

6.4. Use case 7: Register for Event Notifications

It's in the Seller's and Buyer's discretion to decide if registration for Event Notifications is supported.

[CR2]<[O1] If the Seller supports the Register for Product Catalog Notification Use Case, the Seller **MUST** support all of the Notification Types. [Mplify127.1 CR1]

6.4.1. Register for Event Notifications - Request

To register for notifications the Buyer uses the **registerListener** operation from the API: **POST /hub**. The request model contains only 2 attributes:

- **callback** - mandatory, to provide the callback address the events will be notified to,
- **query** - optional, to provide the required types of event.

[R98] The Buyer request **MUST** contain the following attributes [Mplify127.1 R92]:

- **callback**

By using a simple request:

```
{
  "callback": "https://buyer.mef.com/listenerEndpoint"
}
```

The Buyer subscribes for notification of all types of events.

If the Buyer wishes to receive only notification of a certain type, a **query** must be added:

```
{
  "callback": "https://buyer.mef.com/listenerEndpoint",
  "query": "eventType=productOfferingCreateEvent,productOfferingStateChangeEvent"
}
```

If the Buyer wishes to subscribe to 2 different types of events, there are 2 possible syntax variants [TMF630]:

```
eventType=productOfferingCreateEvent,productOfferingStateChangeEvent
```

or

```
eventType=productOfferingCreateEvent&eventType=productOfferingStateChangeEvent
```

The **query** formatting complies with RCF3986 RFC3986. According to it, every attribute defined in the Event model (from notification API) can be used in the **query**. However, this standard requires only **eventType** attribute to be supported.

[R99] **eventType** is the only attribute that the Seller **MUST** support in the query.

[R100] If the Seller does not support notifications, they **MUST** return an error message to the Buyer indicating that notifications are not supported (**Error501**). [Mplify127.1 R94]

6.4.2. Register for Event Notifications - Response

The Seller responds to the subscription request by adding the **id** of the subscription to the message that must be further used for unsubscribing.

```
{
  "callback": "https://buyer.mef.com/listenerEndpoint",
  "id": "1659bc83-d334-4de4-aa60-0818e4060ae1",
  "query": "eventType=productOfferingCreateEvent&eventType=productOfferingStateChangeEvent"
}
```

Example of a final address that the Notifications will be sent to (for Sonata, **productOfferingCreateEvent**):

- <https://buyer.mef.com/listenerEndpoint/mefApi/sonata/productCatalogNotifications/v4/listener/productOfferingCreateEvent>

6.4.3. Unregister from Event Notifications - Request

To stop receiving events, the Buyer has to use the **unregisterListener** operation from the **DELETE /hub/{id}** endpoint. The **id** is the identifier received from the Seller during the listener registration.

[R101] The Buyer must provide the **id** of the registered **EventSubscription** that originates from the Seller. [Mplify127.1 R92]

The example below shows an exemplary unregister call sent by the Buyer to the Seller:

```
http://seller.mef.com:8080/mefApi/sonata/productCatalog/v4/hub/1659bc83-d334-4de4-aa60-0818e4060ae1
```

6.4.4. Unregister for Event Notifications - Response

[R102] In the successful scenario the Seller **MUST** respond with an empty body and HTTP code **204**. [Mplify127.1 R93]

The Buyer can unregister only the whole **EventSubscription**, regardless of the provided **query**. In the case when the Buyer e.g. resigns from specific types of events (or changes the callback address), the previous **EventSubscription** that includes undesired notification types that need to be removed and replaced by the new **EventSubscription** with adjusted **query** attribute.

Note: The above note concludes that the Buyer cannot update the existing **EventSubscription**. Every kind of update is done by subscription replacement.

6.5. Use case 8: Send Event Notification

Notifications are used to asynchronously inform the Buyer about the respective objects and attributes changes.

[R103] The Seller **MUST** send Notifications for **eventTypes** to Buyers who have registered for them. [Mplify127.1 R95]

[R104] The Seller **MUST NOT** send Notifications for **eventTypes** to Buyers who have not registered for them.

[R105] The Seller **MUST** send a **...CreateEvent** Notification whenever a new corresponding Product Catalog Element has been created. [Mplify127.1 CR2]

[R106] The Seller **MUST** send a **...AttributeValueChangeEvent** Notification whenever a corresponding Product Catalog Element has been updated. [Mplify127.1 CR3]

[R107] The Seller **MUST** send a **...StateChangeEvent** Notification whenever a state change has occurred for a corresponding Product Catalog Element. [Mplify127.1 CR4]

[O8] If the Seller fails to receive an acknowledgment from the Buyer repeatedly then Seller **MAY** mark related **EventSubscription** as corrupted and stop sending notifications. [Mplify127.1 O7]

[CR3]<[O8] If the Seller marked related **EventSubscription** as corrupted then unsent notifications **MUST** be stored as dead letters for resending purposes.

It's at the Buyer and Seller's discretion how to inform the Buyer that the listener is out of service and how to uncheck corrupted **EventSubscription** when the listener is claimed.

Figure 25 shows all entities involved in the Notification use cases.

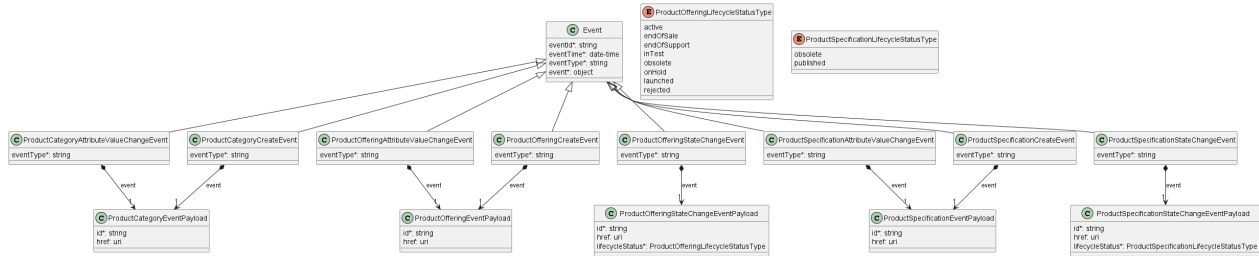


Figure 25. Use Case 8. Notification Data Model

The following snippet presents an example of **productOfferingCreateEvent**

```
{
  "eventId": "f97ec7b4-050d-44b6-91d1-771ad4151695",
  "eventTime": "2023-03-06T15:58:51.968Z",
  "eventType": "productOfferingCreateEvent",
  "event": {
    "id": "b1e4ce38-2328-4d10-8801-f277fbed891d"
  }
}
```

The body of the event carries only the source object's **id**. The Buyer needs to query it later by **id** to get details.

The Seller is always the author of any change in the Product Catalog. This implies that each kind of event that is sent by the Seller is triggered by the Seller activities. This is because all the endpoints of the Product Catalog API published to the Buyer are used only for query purposes.

Table 11 presents the mapping between the API Notification types' names and the ones in Mplify 127.1 together with event descriptions. The inconsistencies are caused by the API naming convention and using the TMF's [TMF620] event types as the base for this API.

API name	Mplify 127.1 name
categoryCreateEvent	PRODUCT_CATEGORY_CREATE
categoryAttributeValueChangeEvent	PRODUCT_CATEGORY_UPDATE
productOfferingCreateEvent	PRODUCT_OFFERING_CREATE

API name	Mplify 127.1 name
productOfferingAttributeValueChangeEvent	PRODUCT_OFFERING_UPDATE
productOfferingStateChangeEvent	PRODUCT_OFFERING_STATE_CHANGE
productSpecificationCreateEvent	PRODUCT_SPECIFICATION_CREATE
productSpecificationAttributeValueChangeEvent	PRODUCT_SPECIFICATION_UPDATE
productSpecificationStatusChangeEvent	PRODUCT_SPECIFICATION_STATE_CHANGE

Table 11. Notification types mapping

[R105] The Seller **MUST** send Product Catalog Notifications for **inTest** or **rejected** states only to Buyers that have been included in beta testing or during the pilot of a Product Offering based on prior agreement between the Buyer and Seller. [Mplify127.1 R98]

7. API Details

7.1. API patterns

7.1.1. Indicating errors

Erroneous situations are indicated by appropriate HTTP responses. An error response is indicated by HTTP status 4xx (for client errors) or 5xx (for server errors) and appropriate response payload. The POQ API uses the error responses depicted and described below.

Implementations can use http error codes not specified in this standard in compliance with rules defined in RFC 7231 [RFC7231]. In such case the error message body structure might be aligned with the **Error**.

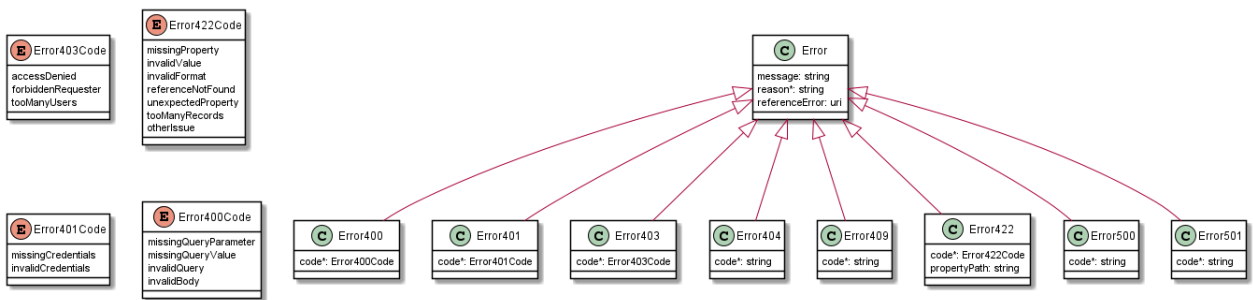


Figure 26. Data model types to represent an erroneous response

7.1.1.1. Type Error

Description: Standard Class used to describe API response error Not intended to be used directly. The **code** in the HTTP header is used as a discriminator for the type of error returned in runtime.

Name	Type	Description
reason*	string <small>maxLength = 255</small>	Text that explains the reason for the error. This can be shown to a client user.
message	string	Text that provides mode details and corrective actions related to the error. This can be shown to a client user.
referenceError	uri <small>format = uri</small>	URL pointing to documentation describing the error

7.1.1.2. Type Error400

Description: Bad Request. (<https://tools.ietf.org/html/rfc7231#section-6.5.1>)

Inherits from:

- [Error](#)

Name	Type	Description
------	------	-------------

Name	Type	Description
code*	Error400Code	One of the following error codes: - missingQueryParameter: The URI is missing a required query-string parameter - missingQueryValue: The URI is missing a required query-string parameter value - invalidQuery: The query section of the URI is invalid. - invalidBody: The request has an invalid body

7.1.1.3. **enum** Error400Code

Description: One of the following error codes:

- missingQueryParameter: The URI is missing a required query-string parameter
- missingQueryValue: The URI is missing a required query-string parameter value
- invalidQuery: The query section of the URI is invalid.
- invalidBody: The request has an invalid body

7.1.1.4. **Type** Error401

Description: Unauthorized. (<https://tools.ietf.org/html/rfc7235#section-3.1>)

Inherits from:

- [Error](#)

Name	Type	Description
code*	Error401Code	One of the following error codes: - missingCredentials: No credentials provided. - invalidCredentials: Provided credentials are invalid or expired

7.1.1.5. **enum** Error401Code

Description: One of the following error codes:

- missingCredentials: No credentials provided.
- invalidCredentials: Provided credentials are invalid or expired

7.1.1.6. **Type** Error403

Description: Forbidden. This code indicates that the server understood the request but refuses to authorize it. (<https://tools.ietf.org/html/rfc7231#section-6.5.3>)

Inherits from:

- [Error](#)

Name	Type	Description
code*	Error403Code	This code indicates that the server understood the request but refuses to authorize it because of one of the following error codes: - accessDenied: Access denied - forbiddenRequester: Forbidden requester - tooManyUsers: Too many users

7.1.1.7. **enum** Error403Code

Description: This code indicates that the server understood the request but refuses to authorize it because of one of the following error codes:

- accessDenied: Access denied
- forbiddenRequester: Forbidden requester
- tooManyUsers: Too many users

7.1.1.8. Type Error404

Description: Resource for the requested path not found.
(<https://tools.ietf.org/html/rfc7231#section-6.5.4>)

Inherits from:

- [Error](#)

Name	Type	Description
------	------	-------------

code*	string	The following error code: - notFound: A current representation for the target resource not found
-------	--------	--

7.1.1.9. Type Error422

The response for HTTP status **422** is a list of elements that are structured using the **Error422** data type. Each list item describes a business validation problem. This type introduces the **propertyPath** attribute which points to the erroneous property of the request, so that the Buyer may fix it easier. It is highly recommended that this property should be used, yet remains optional because it might be hard to implement.

Description: Unprocessable entity due to a business validation problem.
(<https://tools.ietf.org/html/rfc4918#section-11.2>)

Inherits from:

- [Error](#)

Name	Type	Description
------	------	-------------

code*	Error422Code	One of the following error codes: - missingProperty: The property the Seller has expected is not present in the payload - invalidValue: The property has an incorrect value - invalidFormat: The property value does not comply with the expected value format - referenceNotFound: The object referenced by the property cannot be identified in the Seller system - unexpectedProperty: Additional property, not expected by the Seller has been provided - tooManyRecords: the number of records to be provided in the response exceeds the Seller's threshold. - otherIssue: Other problem was identified (detailed information provided in a reason)
-------	------------------------------	---

Name	Type	Description
propertyPath	string	A pointer to a particular property of the payload that caused the validation issue. It is highly recommended that this property should be used. Defined using JavaScript Object Notation (JSON) Pointer (https://tools.ietf.org/html/rfc6901).

7.1.1.10. **enum** Error422Code

Description: One of the following error codes:

- missingProperty: The property the Seller has expected is not present in the payload
- invalidValue: The property has an incorrect value
- invalidFormat: The property value does not comply with the expected value format
- referenceNotFound: The object referenced by the property cannot be identified in the Seller system
- unexpectedProperty: Additional property, not expected by the Seller has been provided
- tooManyRecords: the number of records to be provided in the response exceeds the Seller's threshold.
- otherIssue: Other problem was identified (detailed information provided in a reason)

7.1.1.11. **Type** Error500

Description: Internal Server Error. (<https://tools.ietf.org/html/rfc7231#section-6.6.1>)

Inherits from:

- [Error](#)

Name	Type	Description
------	------	-------------

code*	string	The following error code: - internalError: Internal server error - the server encountered an unexpected condition that prevented it from fulfilling the request.
-------	--------	--

7.1.1.12. **Type** Error501

Description: Not Implemented. Used in case Seller is not supporting an optional operation (<https://tools.ietf.org/html/rfc7231#section-6.6.2>)

Inherits from:

- [Error](#)

Name	Type	Description
------	------	-------------

code*	string	The following error code: - notImplemented: Method not supported by the server
-------	--------	--

7.2. API Data model

Figure 27 presents the whole Product Catalog data model. The data types, requirements related to them and mapping to MEF 127.1 specification are discussed later in this section.

Name	Type	M/O	Description	Mplify 127.1
subCategory	ProductCategoryRef[]	O	A list of references to the Product Category, to which this Product Category is a parent of.	Sub Categories
productOffering	ProductOfferingRef[]	O	A list of references to Product Offering grouped within this Category	Product Offerings

7.2.1.2. Type ProductOfferingRef

Description: ProductOffering reference. A product offering represents entities that are launched from the provider of the catalog.

Name	Type	M/O	Description	Mplify 127.1
id	string	M	Unique (within the Seller domain) identifier for the Product Offering.	Not represented in MEF 127
href	string	O	Hyperlink to access the Product Offering	Not represented in MEF 127

7.2.2 Product Offering

7.2.2.1. Type ProductOffering_Common

Description: The Product Offering represents the Products launched from a Seller's Product Catalog.

Name	Type	M/O	Description	Mplify 127.1
id	string	O	Unique identifier (within the Seller domain) for the Product Offering. Note - The Seller must create a new Product Offering Identifier for every new version of a Product Offering. The Seller may choose to incorporate the version information as part of the Offering Identifier.	Product Offering Identifier
href	uri <i>format = uri</i>	O	Hyperlink reference to the Product Offering	Not represented in MEF 127
name	string	O	The commercial name of the Product Offering	Product Offering Name

Name	Type	M/O	Description	Mplify 127.1
description	string	O	Description of the Product Offering	Product Offering Description
lastUpdate	date-time <i>format = date-time</i>	O	The date and time the Product Offering was created or most recently updated.	Product Offering Last Update
lifecycleStatus	ProductOffering-LifecycleStatusType	O	The current lifecycle status of the Product Offering.	Product Offering State
agreement	string	O	The name of the Seller's standard offer arrangement (such as a framework agreement). The name is unique within the Seller domain. This should be the name of the Seller's standard offer arrangement or framework agreement for this category of Product Offering (e.g., Commercial, Federal or Regulated) as used by the Seller in their official communication of the Product.	Standard Framework Agreement
isBundle	boolean	O	Determines whether a productOffering represents a single productOffering (false), or a bundle of productOfferings (true).	Is Product Offering Bundle
isSellable	boolean	O	A flag indicating if this product offer can be ordered or not. If this flag is false it indicates that the offer can only be sold within a bundle.	Is Sellable

Name	Type	M/O	Description	Mplify 127.1
channel	string[]	O	A list of names defined by the Seller which identify the different methods by which the Product Offering is made available to the Buyer for ordering. The different Sales Channels should be specified in the Standard Framework Agreement or provided during the onboarding process. For example: Reseller, Distribution, Direct Sales. Note: If Sales Channels is an empty list, it implies that the Product Offering is available in all Seller-supported Sales Channels.	Sales Channels
marketSegment	string[]	O	The names of the market segments targeted for the Product Offering. The set of market segment names should be specified in the Agreement or provided during the onboarding process. For example: wholesale, federal, financial. Note: If marketSegment is an empty list, it implies that the Product Offering is available in all Seller supported market segments	Market Segments
region	Region []	O	Areas where the products are offered by the Seller to potential Buyers. Note: If region is an empty list, it implies that the Product Offering is available in all Seller-supported Regions.	Regions

Name	Type	M/O	Description	Mplify 127.1
category	ProductCategoryRef[]	O	A list of 0 or more Product Category Identifiers, with each referring to a Product Category in which this Product Offering is grouped together with other Product Offerings.	Product Offering Product Categories
productSpecification	ProductSpecificationRef	O	A Product Specification Reference to the detailed description of the specifications and attributes defining all of the Product Offering characteristics.	Product Specification

7.2.2.2. Type ProductOffering

Description: Represents entities that are launched from the provider of the catalog, this resource included all available information of Product Offering

Inherits from:

- [ProductOffering_Common](#)

Name	Type	M/O	Description	Mplify 127.1
statusTransition	ProductOffering-LifecycleStatusTransition[]	M	The list of Product Offering Status transitions, including the date they are expected to occur or have occurred	Product Offering State Transition
statusReason	string	O	Provides complementary information on the reason why the 'lifecycleStatus' is set to a particular value.	Product Offering State Rea

Name	Type	M/O	Description	Mplify 127.1
attachment	AttachmentValue[]	O	Complements the Product Offering description with presentation, video, pictures, etc.	Attachme
related-ContactInformation	Related-ContactInformation	O	Defines the contact info and role for the related contact of a Product Offering.	Related Contacts
productOfferingTerm	ProductOfferingTerm[]	O	Commitment durations under which a Product Offering is available to Buyers. For instance, a Product Offering can be made available with multiple commitment periods of 1, 2 or 3 year terms.	Product Offering Terms
milestone	Product-MilestoneDefinition[]	O	Allows constraining the Product Specification Milestones for the Product Offering. This list must be a subset of the Product Specification Milestones and if defined, it will override the entire set of Product Specification Milestones	Product Offering Milestone

Name	Type	M/O	Description	Mplify 127.1
bundledProductOffering	ProductOffering-BundleRelationship[]	O	Defines the set of Product Offerings that comprise the Product Offering Bundle, along with how they are related. This list may only be defined if 'isBundle' attribute is TRUE.	Product Offering Bundle Relations
note	Note[]	O	A set of comments for additional information.	Product Offering Notes
productOfferingSpecificationSchema	SchemaRefOrValue	O	A reference to or value of a subschema of the Source Product Specification Schema that restricts the possible values of the Product-Specific Attributes, relationships, and milestones to define the Product Offering.	Product Offering Specificat Schema
productOffering-ContextualInfo	ProductOffering-ContextualInfo[]	O	Defines additional constraints on the Product Offering Specification for the Product-Specific Attributes of a Product Offering for each Business Function and Product Action.	Product Offering Contextual Informati

Name	Type	M/O	Description	Mplify 127.1
productRelationship-Constraint	ProductRelationship-Constraint[]	O	Allows constraining the relationships between related Product Specifications. As an example, an Access E-Line OVC references Operator UNI and ENNI Product Offerings. Note: this constrains the relationship between related Product Offerings (since the relationship is inherited from the Product Specification).	Product Offering Product Relations Constrain
placeRelationship-Constraint	PlaceRelationship-Constraint[]	O	Allows constraining the Place relationships for the Product Offering. Only the Place relationships that need to be constraint should be included.	Product Offering Place Relations Constrain

7.2.2.3. Type ProductOffering_Find

Description: Represents entities that are launched from the provider of the catalog, this resource includes pricing information.

Inherits from:

- [ProductOffering_Common](#)

7.2.2.4. **enum** ProductOfferingLifecycleStatusType

Description:	Name	Mplify 127.1 Name
--------------	------	-------------------

Description:	Name	Mplify 127.1 Name
active	ANNOUNCED	A Product Offering has been defined in the Product Catalog for marketing purposes, but is not yet available for ordering.
endOfSale	END_OF_SALE	A new Product based on the Product Offering cannot be ordered by any Buyers, but Products may still be in use and may be changed or disconnected, and receive support
endOfSupport	END_OF_SUPPORT	When a Product Offering is in the endOfSupport state, it is no longer possible to add new, nor modify any existing Products based on the Product Offering. The Buyer can still use Products based on the Product Offering as is without any support from the Seller (the only allowed action is delete).
inTest	PILOT_BETA	When a Product Offering or Product Specification starts Pilot/Beta testing, it starts in the inTest state .
obsolete	OBSOLETE	The Product Offering is only available in the Product Catalog for historical documentation reasons. No actions are allowed on Products based on these Product Offering. A Product Offering that is obsolete may be removed at the Seller's discretion from the Product Catalog. This is a final state.
onHold	ON_HOLD	A Product Offering is onHold when the Seller decides to stop Buyers from ordering new Products based on the Product Offering (for example, due to supply constraints, product recall, legal reasons, etc.). The Product Offering can transition to either launched when the constraints are lifted and the Buyer can order new Products again, or to endOfSale , if the Seller decides to stop offering Products based on the Product Offering.
launched	ORDERABLE	When a Product Offering is in the launched state, a Buyer can add new Products, and modify or delete any active Products based on the Product Offering
rejected	REJECTED	When the pilot testing period is ended by the Seller, they may decide whether the Product Offering becomes available for ordering; otherwise, the Product Offering transitions to the rejected state. This is a final state.

7.2.2.5. Type ProductOfferingLifecycleStatusTransition

Description: The Date and Time that the next Product Offering Status transition is planned to occur, or have occurred.

Name	Type	M/O	Description	Mplify 127.1
------	------	-----	-------------	--------------

Name	Type	M/O	Description	Mplify 127.1
transitionDate	date-time <i>format = date-time</i>	M	The Date and Time that the Transition Product Offering State is planned to occur or has occurred.	Transition Date
lifecycleStatus	ProductOfferingLifecycleStatusType	M	The status of the Product Offering on the Transition Date.	Transition Product Offering State
statusReason	string	O	Provides complementary information on the reason why the Product Offering State is planned to occur or was set to a particular value. For example, a description of "Supply Constraint" as why a Product Offering is on ON_HOLD.	Transition State Reason

7.2.2.6. Type ProductSpecificationRef

Description: Product Specification reference.

Name	Type	M/O	Description	Mplify 127.1
id	string	M	Unique (within the Seller domain) identifier for the Product Specification.	Not represented in MEF 127
href	string	O	Hyperlink to access the Product Specification	Not represented in MEF 127

7.2.2.7. Type MEItemTerm

Description: The definition of the Term.

Name	Type	M/O	Description	Mplify 127.1
name	string	M	Name of the term	Name
description	string	O	Description of the term	Description
duration	Duration	M	Duration of the term	Duration

Name	Type	M/O	Description	Mplify 127.1	
endOfTermAction	MEFEndOfTermAction	M	The action that needs to be taken by the Seller once the term expires	End Term Action	Of
rollInterval	Duration	O	The recurring period that the Buyer is willing to pay for the Product after the original term has expired.	Roll Interval	

7.2.2.7. Type ProductOfferingTerm

Description: The commitment duration under which a Product Offering is available to Buyers. A Product Offering can have multiple Product Offering Terms, each with a different commitment period, for instance with a 1, 2 or 3 year duration.

Inherits from:

- [MEFItemTerm](#)

Name	Type	M/O	Description	Mplify 127.1	
productOfferingPrice	ProductOfferingPrice[]	O	A list of prices for which a Product Offering is available for the Term Duration.	Product Offering Prices	

7.2.2.8. **enum** MEFEndOfTermAction

Description: The action the Seller will take once the term expires. Roll indicates that the Product's contract will continue on a rolling basis for the duration of the Roll Interval at the end of the Term.

Auto-disconnect indicates that the Product will be disconnected at the end of the Term. Auto-renew indicates that the Product's contract will be automatically renewed for the Term Duration at the end of the Term.

Value

roll

autoDisconnect

autoRenew

7.2.2.9. Type ProductOfferingContextualInfo

Description: Used for the cases when the schema must be differentiated per the defined Context, where Context is built as a pair - a Business Function (e.g. Quote) and Product Action (e.g. add). Those product schemas are created by applying the constraints to Product Schemas defined in the Product Specification. If provided, Contextual info MUST cover every possible combination of Product Actions and Business Functions (if there are no differences per function or per action then use wildcard - 'all' - and reuse the value of Product Offering Specification attribute).

Name	Type	M/O	Description	Mplify 127.1
contextSchema	SchemaRefOrValue	M	Product Schema that is defined for the given Context. Schema MUST be compliant with JSON scheme standard.	Product Offering Contextual Target Schema
context	Context	M	Context that is defined as a two-dimensional vector of Business Function and Product Action.	Not represented in MEF 127

7.2.2.10. Type Context

Description: Context that is defined as a two-dimensional vector of Business Function and Product Action.

Name	Type	M/O	Description	Mplify 127.1
productAction	ProductActionMask	O	Defines Product Action to which the given context applies. 'all' Applies for all supported Product Action for a given Product Offering. This attribute does not apply for 'businessFunction=productInventory'. 'remove' does not apply here, since this Product Action only includes a Product Identifier.	Product Action
businessFunction	BusinessFunctionMask	M	Defines Business Function to which the given context applies. 'all' Applies for all supported Business Functions for a given Product Offering.	Business Function

7.2.2.11. enum ProductActionMask

Description: Action that could be applied to the Product (or future product) during the execution of the Business Function. Value 'all' is the wildcard - stands for any action.

Value

add

modify

all

7.2.2.12. enum BusinessFunctionMask

Description: Business Function that could be executed for the given Product accordingly to LSO Cantata/Sonata IRPs. Value 'all' is the wildcard - stands for any action.

Value

Mplify 127.1

Value	Mplify 127.1
poq	POQ
quote	QUOTE
productOrder	PRODUCT_ORDER
productInventory	PRODUCT_INVENTORY
all	ALL

7.2.2.13. Type Region

Description: Specifies a region

Name	Type	M/O	Description	Mplify 127.1
city	string	O	City in which the Product can be provided	City
locality	string	O	An area of defined or undefined present boundaries within a local authority or other legislatively defined area, usually rural or semi-rural in nature. Should only be specified by a Seller for a Product Offering that is not available Country wide	Locality
stateOrProvince	string	O	The State or Province in the region is located. Should only be specified by a Seller for a Product Offering that is not available Country wide.	State Or Province
countryCode	string <small>minLength = 2 maxLength = 2</small>	M	Country in which the Address is located, defined using two characters as defined in ISO 3166	Country Code

7.2.2.14. Type ProductOfferingBundleRelationship

Description: The Product Offering Bundle Relationship defines the set of Product Offerings that comprise a Product Offering Bundle, along with the ability to specify the minimum and maximum number of instances of a Product Offering (e.g. fixed, optional or variable component) that are supported for the Bundle. The Product Offering Bundle Relationship may only be specified within a Product Offering Bundle.

Name	Type	M/O	Description	Mplify 127.1
productOffering	ProductOfferingRef	M	Identifier of the Product Offering being grouped in this Product Offering Bundle Relation.	Bundled Product Offering Identifier
isModifiable	boolean	M	Indicates if the ProductOfferingBundleRelationship for given ProductOffering can be added, modified or deleted after the Product Bundle has been activated.	Bundle Relation Is Modifiable

Name	Type	M/O	Description	Mplify 127.1
minCardinality	integer <i>minimum = 0</i>	M	The minimum required number of instances of the Bundled Product Offerings	Min Cardinality
maxCardinality	integer <i>minimum = -1</i>	M	The maximum required number of instances of the Bundled Product Offerings. -1 defines no restriction (unlimited)	Max Cardinality

7.2.2.15. Type ProductOfferingPrice

Description: Is based on both the basic cost to develop and produce products and the enterprises policy on revenue targets. This price may be further revised through discounting (a Product Offering Price that reflects an alteration). The price, applied for a productOffering may also be influenced by the productOfferingTerm, the customer selected, eg: a productOffering can be offered with multiple terms, like commitment periods for the contract. The price may be influenced by this productOfferingTerm. A productOffering may be cheaper with a 24 month commitment than with a 12 month commitment.

Name	Type	M/O	Description	Mplify 127.1
description	string	M	Description of the productOfferingPrice	Product Offering Price Description
lastUpdate	date-time <i>format = date-time</i>	M	the last update time of this ProductOfferingPrice	Product Offering Price Last Update
validFor	TimePeriod	M	The date range that the ProductOfferingPrice is applicable	Valid For
bundledProductOffering	ProductOfferingRef	O	The identifier of a Product Offering within the Bundle to which this Product Offering Price applies. This indicates that this is the unit price per one instance of the Bundled Product Offering.	Bundled Product Offering Identifier
region	Region[]	O	The areas where the Price is applicable. If region is an empty list, it implies that the Price is not region-restricted	Product Offering Price Regions
note	Note[]	O	A set of comments for additional information.	Product Offering Price Notes

Name	Type	M/O	Description	Mplify 127.1
priceType	MEFPriceType	M	Indicates if the price is for recurring, non-recurring, or usage based charges	Product Offering Price Type
recurringChargePeriod	Duration	O	Used for a recurring charge to indicate a period	Product Offering Price Recurring Charge Period
unitOfMeasure	string	O	Unit of Measure if price depending on it (Gb, SMS volume, etc..) MEF: if Quote Item Price Type equals usageBased	Product Offering Price Unit of Measure
price	Price	M	The value the List Price for the Product Offering.	Product Offering Price Amount
priceModifier	PriceModifier[]	O	Related price discounts.	Product Offering Price Modifiers

7.2.2.16. Type Price

Description: Provides all amounts (tax included, duty-free, tax rate) and used currency of a Price

Name	Type	M/O	Description	Mplify 127.1
taxRate	float <small>format = float</small>	O	Price Tax Rate. Unit: [%]. E.g. value 16 stand for 16% tax.	Price Tax Rate.
taxIncludedAmount	Money	O	All taxes included amount (expressed in the given currency)	Price Tax Included Amount
dutyFreeAmount	Money	M	All taxes excluded amount (expressed in the given currency)	Price Duty Free Amount

7.2.2.17. Type PriceModifier

Description: The Price Modifier allows specifying promotional (via Price Modifier Deal Reference) and/or volume based pricing discounts. For example, if only Minimum Quantity is specified, then the Price Modifier is a volume based discount, and if only Price Modifier Deal Reference is set then the Price Modifier is a form of promo code, and if both are set then the Price Modifier is a form of promo code with a minimum purchase requirement.

Name	Type	M/O	Description	Mplify 127.1
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Name	Type	M/O	Description	Mplify 127.1
description	string	M	Description of the Price Modifier	Price Modifier Description
lastUpdate	date-time <i>format = date-time</i>	M	The last update time of this Price Modifier	Price Modifier Last Update
validFor	TimePeriod	M	The date range that the Price Modifier is applicable	Valid For
region	Region[]	O	Allows constraining the Regions where the Price Modifier is applicable. Only the Regions that need to be constraint should be included (since this is inherited from the Product Offering Price).	Price Modifier Region Constraints
minimumQuantity	integer <i>minimum = 1</i>	O	The minimum quantity of the associated Product Offering required to receive the price reduction.	Minimum Quantity
reductionPercentage	number <i>minimum = 0</i> <i>maximum = 100</i>	O	The amount of price discount, expressed as a percentage. A value of 5 represents a 5% price reduction. This attribute may only be set if the discountedPrice is not set.	Reduction Percentage
discountedPrice	Price	O	The associated discounted price. This attribute may only be set if the reductionPercentage is not set.	Discounted Price
dealReference	string	O	A pre-agreed pricing modifier reference that the Seller is offering which may impact the pricing (for example, a Promo Code). This Price Modifier is applicable when the fulfillment of the associated Product Offering satisfies this pre-agreed Deal Reference.	Price Modifier Deal Reference

7.2.2.18. enum MEFPPriceType

Description: Indicates if the price is for recurring or non-recurring charges.

Value

recurring

nonRecurring

usageBased

7.2.2.19. Type Money

Description: A base/value business entity used to represent money

Name	Type	M/O	Description	Mplify 127.1
unit	string	M	Currency (ISO4217 norm uses 3 letters to define the currency)	Currency
value	float <i>format = float</i>	M	A positive floating point number	Value

7.2.3 Product Specification

7.2.3.1. Type ProductSpecification_Common

Description: Is the basis for all Production Specification representations.

Name	Type	M/O	Description	Mplify 127.1
id	string	O	Unique identifier for the Product Specification. For Mplify standardized products, this should be the Mplify assigned URN.	Product Specification Identifier
href	uri <i>format = uri</i>	O	Reference of the Product Specification	Not represented in MEF 127
name	string	O	Name of the Product Specification	Product Specification Name
lifecycleStatus	ProductSpecification-LifecycleStatusType	O	The current lifecycle status of the Product Specification.	Product Specification State
lastUpdate	date-time <i>format = date-time</i>	O	The date and time of an attribute within this Product Specification was created or most recently updated.	Product Specification Last Update
agreement	string	O	The name of the Seller's standard offer arrangement (such as a framework agreement). The name is unique within the Seller domain. This should be the name of the Seller's standard offer arrangement or framework agreement for the Product Specification.	Standard Framework Agreement

7.2.3.2. Type ProductSpecification

Description: Is a detailed description of a tangible or intangible object made available externally in the form of a ProductOffering to customers or other parties playing a party role.

Inherits from:

- [ProductSpecification_Common](#)

Name	Type	M/O	Description	Mplify 127.1
description	string	M	Description of the Product Specification.	Product Specification Description
attachment	AttachmentValue[]	O	Complements the Product Offering description with presentation, video, pictures, etc. Note: The Seller should include all documents describing the Standard Framework Agreement as an Attachment.	Product Specification Attachments
productRelationship	ProductRelationship-Constraint[]	O	Specifies the relationships with their names between Products described by related Product Specifications. As an example, an Access E-Line OVC references an Operator UNI and an ENNI Product Specification.	Product Specification Product Relationships
placeRelationship	PlaceRelationship-Constraint[]	O	Specifies the relationships with their names between Product described by this Product Specifications and Place(s).	Product Specification Place Relationships
milestone	ProductMilestone-Definition[]	O	Specifies the different milestones during the fulfillment process	Product Specification Milestones
note	Note[]	O	A set of comments for additional information.	Product Specification Notes
sourceSchema	SchemaRefOrValue	M	A reference to or value of the schemaProduct Schema as included in the Product Specification.	Source Product Specification Schema

7.2.3.3. Type ProductSpecification_Find

Description: Is a lightweight version of the Product Specification object used in Get List use case.

Inherits from:

- [ProductSpecification_Common](#)

7.2.3.4. **enum** ProductSpecificationLifecycleStatusType

Description: Name		Mplify 127.1 Name
obsolete	OBSOLETE	The Product Specification is only available in the Product Catalog for historical documentation reasons. There are no active Products on the Seller's Network based on the Product Specification. A Product Specification that is no longer available transitions to obsolete and may be removed at the Seller's discretion from the Product Catalog. This is a final state.
published	PUBLISHED	A Product Specification has been defined in the Product Catalog. Product Offerings based on the Product Specification may be available for ordering.

7.2.4. Common types

This chapter includes common types that are shared between Product Category, Product Offering, or Product Specification types.

7.2.4.1. Type AttachmentValue

Description: Complements the description of an element (for instance a product) through video, pictures...

Name	Type	M/O	Description	Mplify 127.1
author	string	M	The name of the person or organization who added the Attachment.	Attachment Author
creationDate	date-time <small>format = date-time</small>	M	The date the Attachment was added.	Attachment Date
description	string	O	A narrative text describing the content of the attachment	Description
contentType	string	O	Attachment mime type such as extension file for video, picture and document	Mime Type
name	string	M	The name of the attachment	Attachment Name
size	MEFByteSize	O	The size of the attachment.	Size
source	MEFBuyerSellerType	M	Indicates if the attachment was added by the Buyer or the Seller.	Attachment Source
url	string	M	URL where the attachment is located.	URL

7.2.4.2. **enum** DataSizeUnit

Description: The unit of measure in the data size.

Value
BYTES
KBYTES

Value

MBYTES

GBYTES

TBYTES

PBYTES

EBYTES

ZBYTES

YBYTES

7.2.4.3. Type Duration**Description:** A Duration in a given unit of time e.g. 3 hours, or 5 days.

Name	Type	M/O	Description	Mplify 127.1
amount	integer <small>minimum = 0</small>	M	Duration (number of seconds, minutes, hours, etc.)	Value
units	TimeUnit	M	Time unit enumerated	Unit

7.2.4.4. Type FieldedAddressRepresentation**Description:** A type of Address that has a discrete field and value for each type of boundary or identifier down to the lowest level of detail. For example "street number" is one field, "street name" is another field, etc.

Name	Type	M/O	Description	Mplify 127.1
streetNr	string	O	Number identifying a specific property on a public street. It may be combined with streetNrLast for ranged addresses.	Street Number
streetNrSuffix	string	O	The first street number suffix (in a street number range) or the suffix for the street number if there is no range	Street Number Suffix
streetNrLast	string	O	Last number in a range of street numbers allocated to an Address	Street Number Last
streetNrLastSuffix	string	O	Last street number suffix for a ranged Address	Street Number Last Suffix
streetPreDirection	string	O	The direction of the street that appears before the Street Name	Street Pre- Direction
streetName	string	O	Name of the street or other street type	Street Name

Name	Type	M/O	Description	Mplify 127.1
streetType	string	O	The type of street (e.g., alley, avenue, boulevard, brae, crescent, drive, highway, lane, terrace, parade, place, tarn, way, wharf)	Street Type
streetPostDirection	string	O	A modifier denoting a relative direction that appears after the Street Name.	Street Post-Direction
poBox	string	O	Number identifying a specific location in a post office.	PO Box Number
locality	string	O	An area of defined or undefined boundaries within a local authority or other legislatively defined area.	Locality
city	string	O	City in which the Address is located.	City
postcode	string	O	A descriptor for a postal delivery area used to speed and simplify the delivery of mail (also known as zip code)	Postal Code
postcodeExtension	string	O	The extension used on a postal code. Note: there are different use codes for this attribute depending upon the country.	Postal Code Extension
stateOrProvince	string	O	The State or Province in which the Address is located.	State or Province
countryCode	string <small>minLength = 2 maxLength = 2</small>	O	Country in which the Address is located, defined using two characters as defined in ISO 3166	Country
subUnit	SubUnit[]	O	The Sub Unit represented as a list. This is a list to allow complex sub-unit information such as SUITE 42 ROOM A	Sub Units
buildingName	string	O	The well-known name of a building that is located at this Address (e.g., where there is one Address for a campus).	Building Name
privateStreetNumber	string	O	Street number on a private street within the Address.	Private Street Number
privateStreetName	string	O	Private streets internal to a property (e.g., a university) may have internal names that are not recorded by the land title office.	Private Street Name
language	string <small>minLength = 2 maxLength = 2</small>	O	The language in which the address is expressed. It MUST use the ISO 639:2023 two letter code 639:2023	Language

7.2.4.6. enum MEFBuyerSellerType

Description: An enumeration with buyer and seller values.

Value

buyer

seller

7.2.4.7. Type MEFByteSize

Description: A size represented by value and Byte units

Name	Type	M/O	Description	Mplify 127.1
amount	float <small>format = float</small>	M	Numeric value in a given unit	Value
units	DataSizeUnit	M	Byte Unit	Unit

7.2.4.8. Type SubUnit

Description: Allows for sub unit identification

Name	Type	M/O	Description	Mplify 127.1
subUnitNumber	string	M	The discriminator used for the subunit, often just a simple number but may also be a range.	Sub Unit Name
subUnitType	string	M	The type of subunit e.g. BERTH, FLAT, PIER, SUITE, SHOP, TOWER, UNIT, WHARF.	Sub Unit Type

7.2.4.9. Type Note

Description: Extra information about a given entity. Only useful in processes involving human interaction. Not applicable for the automated process.

Name	Type	M/O	Description	Mplify 127.1
author	string	M	Author of the note	Note Author
date	date-time <small>format = date-time</small>	M	Date the Note was created	Note Date
id	string	M	Identifier of the note within its containing entity (may or may not be globally unique, depending on provider implementation)	Not represented in MEF 127
source	MEFBuyerSellerType	M	Indicates if the note is from Buyer or Seller	Note Source
text	string	M	Text of the note	Note Text

7.2.3.10. Type PlaceRelationshipConstraint

Description: Allows definition and constraining of PlaceRelationship that can be specified for the ordered Product.

Name	Type	M/O	Description	Mplify 127.1
relationshipRole	string	M	Specifies the nature of the relationship between the Product Offering and Place. This must be one of the roles as defined in the related Product Specification. For example, 'INSTALL_LOCATION'.	Place Relationship Role
isModifiable	boolean	M	Specifies if the Place Relationship can be modified on an active Product.	Bundle Relation Is Modifiable
minCardinality	integer <small>minimum = 0</small>	M	The minimum required number of PlaceRelationships of given relationshipRole that must configured for ordered Product. For example, as specified in the 'Relationship Between Entities' Section of MEF 106. '0' means the relation is optional.	Min Cardinality
maxCardinality	integer <small>minimum = -1</small>	M	The maximum required number of PlaceRelationships of given relationshipRole that must configured for ordered Product. For example, as specified in the 'Relationship Between Entities' Section of MEF 106. '-1' stands for infinity i.e. any number of instances of the given type could be related to the considered instance.	Max Cardinality

7.2.1.11. Type ProductCategoryRef

Description: Represents the reference to Category

Name	Type	M/O	Description	Mplify 127.1
id	string	M	Unique (within the Seller domain) identifier for the Category	Product Category Identifier
href	uri <small>format = uri</small>	O	Hyperlink to access the Category	Not represented in MEF 127

7.2.1.12. Type ProductMilestoneDefinition

Description: Allows specifying the different stages of the Product provisioning process.

Name	Type	M/O	Description	Mplify 127.1
------	------	-----	-------------	--------------

Name	Type	M/O	Description	Mplify 127.1
name	string	M	The unique identifier of the milestone (as specified e.g. in the corresponding MEF Product Specification).	Milestone Name
description	string	M	The explanation of what the milestone represents and when it occurs.	Milestone Description

7.2.3.13 Type ProductRelationshipConstraint

Description: Allows definition and constraining of Product Relationship that can be specified for the ordered Product.

Name	Type	M/O	Description	Mplify 127.1
productSpecification	string	M	The identifier of the associated Product Specification to define the allowable target Product types	Related Product Specification Identifier
relationshipType	string	M	Specifies the nature of productRelationship between Products. This must be one of the relationshipTypes as defined by the main product specification.	Relationship Type
isModifiable	boolean	M	Specifies if the Product Relationship can be modified on an active Product.	Product Relationship Is Modifiable
minCardinality	integer <small>minimum = 0</small>	M	The minimum required number of ProductRelationships (of given relationshipType and target productSpecification) that must be configured for ordered Product. For example, as specified in the 'Relationship Between Entities' Section of MEF 106. '0' means the relation is optional.	Min Cardinality
maxCardinality	integer <small>minimum = -1</small>	M	The maximum required number of ProductRelationships (of given relationshipType and target productSpecification) that must be configured for ordered Product. '-1' stands for infinity i.e. any number of instances of the given type could be related to the considered instance.	Max Cardinality

7.2.4.14 Type RelatedContactInformation

Description: Contact data for a person or organization that is involved in a given context. It is specified by the Seller (e.g. Seller Contact Information) or by the Buyer.

Name	Type	M/O	Description	Mplify 127.1
emailAddress	string	M	Email address	Email address
name	string	M	Name of the contact	Name of the contact
number	string	M	Phone number	Contact Phone Number
numberExtension	string	O	Phone number extension	Contact Phone Number Extension
organization	string	O	The organization or company that the contact belongs to	Contact Organization
postalAddress	FieldedAddressRepresentation	O	Identifies the postal address of the person or office to be contacted.	Contact Postal Address
role	string	M	A role the party plays in a given context.	Not represented in MEF 127

7.2.4.15 Type SchemaRefOrValue

Description: Reference to the JSON schema location or the exact value of the JSON schema.

Note: One of the properties must be provided i.e. schemaLocation or schema.

Name	Type	M/O	Description	Mplify 127.1
schema	string	O	Raw JSON schema value.	Not represented in MEF 127
schemaLocation	uri <small>format = uri</small>	O	This field provides a link to the schema describing the target product	Not represented in MEF 127

7.2.4.16. Type TimePeriod

Description: A period of time, either as a deadline (endDateTime only) a startDateTime only, or both.

Name	Type	M/O	Description	Mplify 127.1
------	------	-----	-------------	--------------

Name	Type	M/O	Description	Mplify 127.1
startDateTime	date-time <i>format = date-time</i>	O	Start of the time period, using IETC-RFC-3339 format. If you define a start, you must also define an end	Start Date Time
endDateTime	date-time <i>format = date-time</i>	O	End of the time period, using IETC-RFC-3339 format	End Date Time

7.2.4.17. **enum** TimeUnit

Description: Represents a unit of time.

Value

seconds

minutes

businessHours

calendarHours

businessDays

calendarDays

months

years

7.2.5. Notification Registration

Notification registration and management are done through **/hub** API endpoint. The below sections describe data models related to this endpoint.

7.2.8.1. Type EventSubscriptionInput

The **query** attribute is used to constrain the notification types that the Buyer is willing to receive to the callback endpoint. The **query** formatting complies to RCF3986 [rfc3986](#) and [TMF620](#). Every attribute defined in the Event model (from notification API) can be used in the **query**. Example:

```
"query": "eventType=productOfferingCreateEvent"
```

If the Buyer wishes to subscribe to 2 different types of events, there are 2 possible syntax variants:

- **eventType=productOfferingCreateEvent,productOfferingStateChangeEvent** or
- **eventType=productOfferingCreateEvent&eventType=productOfferingStateChangeEvent**

Description: This class is used to register for Notifications.

Name	Type	M/O	Description	Mplify 127.1
------	------	-----	-------------	-----------------

Name	Type	M/O	Description	Mplify 127.1
callback	string	M	This callback value must be set to <code>*host*</code> property from the Buyer Product Catalog Notification API (productCatalogNotification.api.yaml). This property is appended with the base path and notification resource path specified in that API to construct a URL to which notification is sent. E.g. for "callback": "https://buyer.mef.com/listenerEndpoint", the Product Specification state change event notification will be sent to: <code>'https://buyer.mef.com/listenerEndpoint/-mefApi/sonata/productCatalogNotifications/-v4/listener/productCatalogStateChange'</code>	Recipient Information
query	string	O	This attribute is used to define which type of events to register to. See the <code>'ProductCategoryEventType'</code> , <code>'ProductSpecificationEventType'</code> , <code>'ProductOfferingEventType'</code> in (productCatalogNotification.api.yaml to check what kind of events are supported. To subscribe for more than one event type, put the values separated by a comma: <code>'eventType=productOfferingCreateEvent,-productOfferingAttributeValueChangeEvent'</code> or repeat the same attribute: <code>'eventType=-productOfferingCreateEvent&eventType=-productOfferingAttributeValueChangeEvent'</code> An empty query is treated as specifying no filters - ending in subscription for all event types.	Notification Type

7.2.8.2. Type EventSubscription

Description: This resource is used to respond to notification subscriptions.

Name	Type	M/O	Description	Mplify 127.1
callback	string	M	The value provided by the Buyer in <code>'EventSubscriptionInput'</code> during notification registration	Recipient Information
id	string	M	An identifier of this Event Subscription assigned by the Seller when a resource is created.	Not represented in MEF 127
query	string	O	The value provided by the Buyer in <code>'EventSubscriptionInput'</code> during notification registration	Notification Type

7.3. Notification API Data model

Figure 28 presents the Product Catalog Notification data model. section.

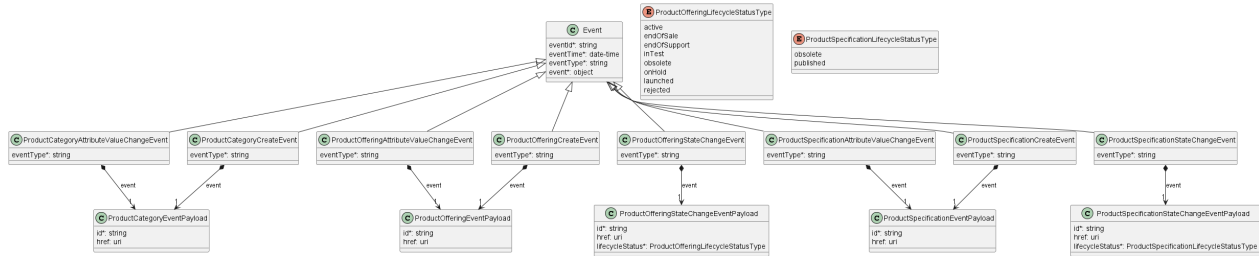


Figure 28. Product Catalog Notification Notification Data Model

This data model is used to construct requests and responses of the API endpoints described in [Section 5.2.2](#).

7.3.1. Type Event

Description: Event class is used to describe information structure used for notification.

Name	Type	M/O	Description	Mplify 127.1
eventId	string	M	Id of the event	Product Identifier Catalog Element
eventTime	date-time <i>format = date-time</i>	M	Date-time when the event occurred	Not represented in Mplify 127.1
eventType	string	M	The type of the notification.	Notification Type
event	object	M	The event linked to the involved resource object	Product Identifier, Catalog Element State Product Catalog Element

7.3.2. Type ProductCategoryCreateEvent

Description:

Inherits from:

- [Event](#)

Name	Type	M/O	Description	Mplify 127.1
eventType	string	M	Indicates the type of the event.	Notification Type
event	ProductCategory-EventPayload	M	A reference to the object that is the source of the notification.	Product Identifier, Catalog Element State Product Catalog Element

7.3.3. Type ProductCategoryAttributeValueChangeEvent

Description:

Inherits from:

- [Event](#)

Name	Type	M/O	Description	Mplify 127.1
------	------	-----	-------------	--------------

Name	Type	M/O	Description	Mplify 127.1
eventType	string	M	Indicates the type of the event.	Notification Type
event	ProductCategory-EventPayload	M	A reference to the object that is the source of the notification.	Product Catalog Element Identifier, Product Catalog Element State

7.3.4. Type ProductCategoryEventPayload

Description: The identifier of the Product Category being subject of this event.

Name	Type	M/O	Description	Mplify 127.1
id	string	M	ID of the Product Category attributed by the Seller	Product Catalog Element Identifier
href	uri <small>format = uri</small>	O	Hyperlink to access the Product Category	Not represented in Mplify 127.1

7.3.5. Type ProductOfferingAttributeValueChangeEvent

Description:

Inherits from:

- [Event](#)

Name	Type	M/O	Description	Mplify 127.1
eventType	string	M	Indicates the type of the event.	Notification Type
event	ProductOffering-EventPayload	M	A reference to the object that is the source of the notification.	Product Catalog Element Identifier

7.3.6. Type ProductOfferingCreateEvent

Description:

Inherits from:

- [Event](#)

Name	Type	M/O	Description	Mplify 127.1
eventType	string	M	Indicates the type of the event.	Notification Type
event	ProductOffering-EventPayload	M	A reference to the object that is the source of the notification.	Product Catalog Element Identifier

7.3.7. Type ProductOfferingEventPayload

Description: The identifier of the Product Offering being subject of this event.

Name	Type	M/O	Description	Mplify 127.1
id	string	M	ID of the Product Offering attributed by the Seller	Product Catalog Element Identifier

Name	Type	M/O	Description	Mplify 127.1
href	uri <small>format = uri</small>	O	Hyperlink to access the Product Offering	Not represented in Mplify 127.1

7.3.8. Type ProductOfferingStateChangeEvent

Description:

Inherits from:

- [Event](#)

Name	Type	M/O	Description	Mplify 127.1
eventType	string	M	Indicates the type of the event.	Notification Type
event	ProductOffering-StateChangeEventPayload	M	A reference to the object that is the source of the notification.	Product Catalog Element Identifier, Product Catalog Element State

7.3.9. Type ProductOfferingStateChangeEventPayload

Description: The identifier of the Product Offering being subject of this event.

Name	Type	M/O	Description	Mplify 127.1
id	string	M	ID of the Product Offering attributed by the Seller	Product Catalog Element Identifier
href	uri <small>format = uri</small>	O	Hyperlink to access the Product Offering	Not represented in Mplify 127.1
lifecycleStatus	ProductOffering-LifecycleStatusType	M	The current lifecycle status of the Product Offering.	Product Catalog Element State

7.3.10. Type ProductSpecificationAttributeValueChangeEvent

Description:

Inherits from:

- [Event](#)

Name	Type	M/O	Description	Mplify 127.1
eventType	string	M	Indicates the type of the event.	Notification Type
event	ProductSpecification-EventPayload	M	A reference to the object that is the source of the notification.	Product Catalog Element Identifier

7.3.11. Type ProductSpecificationCreateEvent

Description:

Inherits from:

- [Event](#)

Name	Type	M/O	Description	Mplify 127.1
eventType	string	M	Indicates the type of the event.	Notification Type
event	ProductSpecification-EventPayload	M	A reference to the object that is the source of the notification.	Product Element Identifier

7.3.12. Type ProductSpecificationEventPayload

Description: The identifier of the Product Specification being subject of this event.

Name	Type	M/O	Description	Mplify 127.1
id	string	M	ID of the Product Specification attributed by the Seller	Product Element Identifier
href	uri <small>format = uri</small>	O	Hyperlink to access the Product Specification	Not represented in Mplify 127.1

7.3.13. Type ProductSpecificationStateChangeEvent

Description:

Inherits from:

- [Event](#)

Name	Type	M/O	Description	Mplify 127.1
eventType	string	M	Indicates the type of the event.	Notification Type
event	ProductSpecification-StateChangeEventPayload	M	A reference to the object that is the source of the notification.	Product Element Identifier, Product Catalog Element State

7.3.14. Type ProductSpecificationStateChangeEventPayload

Description: The identifier of the Product Specification being subject of this event.

Name	Type	M/O	Description	Mplify 127.1
id	string	M	ID of the Product Specification attributed by the Seller	Product Element Identifier
href	uri <small>format = uri</small>	O	Hyperlink to access the Product Specification	Not represented in Mplify 127.1
lifecycleStatus	ProductSpecification-LifecycleStatusType	M	The current lifecycle status of the Product Specification.	Product Element State

8. References

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Appendix A Examples (Informative)

This appendix contains examples for which diagram where presented in [section 4.4.4](#).

A.1 Bundling Product Offering

The following snippet contains a raw JSON payload presented on Figure 4.

```
{
  "id": "ID_OVC UNI Bundle",
  "name": "OVC UNI Bundle",
  "description": "Access E-Line + UNI, SLA 99.99%",
  "lastUpdate": "2024-11-28T11:25:20",
  "lifecycleStatus": "launched",
  "statusReason": "Approved & ready for market",
  "agreement": "standard-agreement-AG012023",
  "region": [
    {
      "stateOrProvince": "AZ",
      "countryCode": "US"
    },
    {
      "stateOrProvince": "AL",
      "countryCode": "US"
    },
    {
      "stateOrProvince": "AR",
      "countryCode": "US"
    }
  ],
  "isBundle": true,
  "isSellable": true,
  "statusTransition": [
    {
      "transitionDate": "2024-11-27T11:25:20",
      "lifecycleStatus": "active"
    },
    {
      "transitionDate": "2024-11-28T11:25:20",
      "lifecycleStatus": "launched"
    }
  ],
  "productSpecification": {
    "id": "ID_Bundle_Spec",
    "href": "https://example.com/productSpecification/ID_Bundle_Spec"
  },
  "productOfferingTerm": [
    {
      "name": "bundle24MonthTerm",
      "description": "24 month fixed bundle",
      "duration": {
        "amount": 24,
        "units": "months"
      },
      "endOfTermAction": "roll",
      "rollInterval": {
        "amount": 1,
        "units": "months"
      }
    },
    {
      "productOfferingPrice": [
        {
          "description": "Bundled OVC construction price in AZ",
          "lastUpdate": "2024-11-28T11:25:20",
          "validFor": {
            "endDateTime": "2024-12-28T11:25:20"
          },
          "bundledProductOffering": {
            "id": "ID_Access E-Line OVC Excellence"
          },
          "region": [
            {
              "stateOrProvince": "AZ",
              "countryCode": "US"
            }
          ]
        }
      ]
    }
  ]
}
```

```

    ],
    "priceType": "nonRecurring",
    "price": {
      "taxRate": 7,
      "taxIncludedAmount": {
        "unit": "USD",
        "value": 600
      },
      "dutyFreeAmount": {
        "unit": "USD",
        "value": 560.75
      }
    },
    "priceModifier": [
      {
        "description": "Standard contract renewal discount",
        "lastUpdate": "2024-11-28T11:25:20",
        "validFor": {
          "endDateTime": "2025-12-31T23:59:59Z"
        },
        "minimumQuantity": 1,
        "dealReference": "0123456",
        "reductionPercentage": 10
      }
    ]
  },
  {
    "description": "Bundled OVC installation price in AZ",
    "lastUpdate": "2024-11-28T11:25:20",
    "validFor": {
      "endDateTime": "2024-12-28T11:25:20"
    },
    "bundledProductOffering": {
      "id": "ID_Access E-Line OVC Excellence"
    },
    "region": [
      {
        "stateOrProvince": "AZ",
        "countryCode": "US"
      }
    ],
    "priceType": "nonRecurring",
    "price": {
      "taxRate": 7,
      "taxIncludedAmount": {
        "unit": "USD",
        "value": 100
      },
      "dutyFreeAmount": {
        "unit": "USD",
        "value": 93.46
      }
    },
    "priceModifier": [
      {
        "description": "Standard contract renewal discount",
        "lastUpdate": "2024-11-28T11:25:20",
        "validFor": {
          "endDateTime": "2025-12-31T23:59:59Z"
        },
        "minimumQuantity": 1,
        "dealReference": "0123456",
        "reductionPercentage": 10
      }
    ]
  },
  {
    "description": "Bundled OVC usage price in AZ",
    "lastUpdate": "2024-11-28T11:25:20",
    "validFor": {
      "endDateTime": "2024-12-28T11:25:20"
    },
    "bundledProductOffering": {
      "id": "ID_Access E-Line OVC Excellence"
    },
    "region": [
      {
        "stateOrProvince": "AZ",
        "countryCode": "US"
      }
    ]
  },

```

```

    "priceType": "recurring",
    "recurringChargePeriod": {
      "amount": 1,
      "units": "months"
    },
    "price": {
      "taxRate": 7,
      "taxIncludedAmount": {
        "unit": "USD",
        "value": 149
      },
      "dutyFreeAmount": {
        "unit": "USD",
        "value": 139.25
      }
    }
  },
  {
    "description": "Bundled UNI construction price in AZ",
    "lastUpdate": "2024-11-28T11:25:20",
    "validFor": {
      "endDateTime": "2024-12-28T11:25:20"
    },
    "bundledProductOffering": {
      "id": "ID_UNI Excellence"
    },
    "region": [
      {
        "stateOrProvince": "AZ",
        "countryCode": "US"
      }
    ],
    "priceType": "nonRecurring",
    "price": {
      "taxRate": 7,
      "taxIncludedAmount": {
        "unit": "USD",
        "value": 600
      },
      "dutyFreeAmount": {
        "unit": "USD",
        "value": 560.75
      }
    },
    "priceModifier": [
      {
        "description": "Standard contract renewal discount",
        "lastUpdate": "2024-11-28T11:25:20",
        "validFor": {
          "endDateTime": "2025-12-31T23:59:59Z"
        },
        "minimumQuantity": 1,
        "dealReference": "0123456",
        "reductionPercentage": 10
      }
    ]
  },
  {
    "description": "Bundled UNI installation price in AZ",
    "lastUpdate": "2024-11-28T11:25:20",
    "validFor": {
      "endDateTime": "2024-12-28T11:25:20"
    },
    "bundledProductOffering": {
      "id": "ID_UNI Excellence"
    },
    "region": [
      {
        "stateOrProvince": "AZ",
        "countryCode": "US"
      }
    ],
    "priceType": "nonRecurring",
    "price": {
      "taxRate": 7,
      "taxIncludedAmount": {
        "unit": "USD",
        "value": 250
      },
      "dutyFreeAmount": {
        "unit": "USD",

```

```

        "value": 233.64
      }
    },
    "priceModifier": [
      {
        "description": "Standard contract renewal discount",
        "lastUpdate": "2024-11-28T11:25:20",
        "validFor": {
          "endDateTime": "2025-12-31T23:59:59Z"
        },
        "minimumQuantity": 1,
        "dealReference": "0123456",
        "reductionPercentage": 10
      }
    ]
  },
  {
    "description": "Bundled UNI usage price in AZ",
    "lastUpdate": "2024-11-28T11:25:20",
    "validFor": {
      "endDateTime": "2024-12-28T11:25:20"
    },
    "bundledProductOffering": {
      "id": "ID_UNI Excellence"
    },
    "region": [
      {
        "stateOrProvince": "AZ",
        "countryCode": "US"
      }
    ],
    "priceType": "recurring",
    "recurringChargePeriod": {
      "amount": 1,
      "units": "months"
    },
    "price": {
      "taxRate": 7,
      "taxIncludedAmount": {
        "unit": "USD",
        "value": 49
      },
      "dutyFreeAmount": {
        "unit": "USD",
        "value": 45.79
      }
    }
  }
]
},
"bundledProductOffering": [
  {
    "minCardinality": 1,
    "maxCardinality": 1,
    "isModifiable": false,
    "productOffering": {
      "id": "ID_Access E-Line OVC Excellence",
      "href": "https://example.com/productOffering/ID_Access_E-Line_OVC_Excellence"
    }
  },
  {
    "minCardinality": 1,
    "maxCardinality": 1,
    "isModifiable": false,
    "productOffering": {
      "id": "ID_UNI Excellence",
      "href": "https://example.com/productOffering/ID_UNI_Excellence"
    }
  }
]
}

```

A.2 Bundled Access E-Line Product Offering

The following snippet contains a raw JSON payload presented on Figure 5.

```

{
  "id": "ID_Access E-Line OVC Excellence",
  "name": "Access E-Line OVC Excellence",
  "description": "Access E-Line, SLA 99.99%",
  "lastUpdate": "2024-11-28T11:25:20",
  "lifecycleStatus": "launched",
  "statusReason": "Approved & ready for market",
  "agreement": "standard-agreement-AG012023",
  "region": [
    {
      "stateOrProvince": "AZ",
      "countryCode": "US"
    },
    {
      "stateOrProvince": "AL",
      "countryCode": "US"
    },
    {
      "stateOrProvince": "AR",
      "countryCode": "US"
    }
  ],
  "isBundle": false,
  "isSellable": true,
  "statusTransition": [
    {
      "transitionDate": "2024-11-27T11:25:20",
      "lifecycleStatus": "active"
    },
    {
      "transitionDate": "2024-11-28T11:25:20",
      "lifecycleStatus": "launched"
    }
  ],
  "productSpecification": {
    "id": "ID_OVC_Spec",
    "href": "https://example.com/productSpecification/ID_OVC_Spec"
  },
  "productOfferingTerm": [
    {
      "name": "standard24MonthOvcTerm",
      "description": "24 month term for OVC Excellence",
      "duration": {
        "amount": 24,
        "units": "months"
      },
      "endOfTermAction": "roll",
      "rollInterval": {
        "amount": 1,
        "units": "months"
      }
    },
    {
      "name": "standard12MonthOvcTerm",
      "description": "12 month term for OVC Excellence",
      "duration": {
        "amount": 12,
        "units": "months"
      },
      "endOfTermAction": "roll",
      "rollInterval": {
        "amount": 1,
        "units": "months"
      }
    }
  ],
  "productOfferingPrice": [
    {
      "description": "Standard OVC construction price in AZ",
      "lastUpdate": "2024-11-28T11:25:20",
      "validFor": {
        "endDateTime": "2024-12-28T11:25:20"
      },
      "region": [
        {
          "stateOrProvince": "AZ",
          "countryCode": "US"
        }
      ],
      "priceType": "nonRecurring",
      "price": {
        "taxRate": 7,
        "taxIncludedAmount": {
          "unit": "USD",
          "value": 800
        },
        "dutyFreeAmount": {
          "unit": "USD",
          "value": 747.66
        }
      },
      "priceModifier": [
        {
          "description": "Standard contract renewal discount",
          "lastUpdate": "2024-11-28T11:25:20",
          "discount": {
            "amount": 52.34,
            "units": "USD"
          }
        }
      ]
    }
  ]
}

```


A.3 Bundled UNI Product Offering

The following snippet contains a raw JSON payload presented on Figure 4.

```
{
  "id": "ID_UNI Excellence",
  "name": "UNI Excellence",
  "description": "UNI, SLA 99.99%",
  "lastUpdate": "2024-11-28T11:25:20",
  "lifecycleStatus": "launched",
  "statusReason": "Approved & ready for market",
  "agreement": "standard-agreement-AG012023",
  "region": [
    {
      "stateOrProvince": "AZ",
      "countryCode": "US"
    },
    {
      "stateOrProvince": "AL",
      "countryCode": "US"
    },
    {
      "stateOrProvince": "AR",
      "countryCode": "US"
    }
  ],
  "isBundle": false,
  "isSellable": false,
  "statusTransition": [
    {
      "transitionDate": "2024-11-27T11:25:20",
      "lifecycleStatus": "active"
    },
    {
      "transitionDate": "2024-11-28T11:25:20",
      "lifecycleStatus": "launched"
    }
  ],
  "productSpecification": {
    "id": "ID_UNI_Spec",
    "href": "https://example.com/productSpecification/ID_UNI_Spec"
  }
}
```


Appendix B Acknowledgments

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