

Mplify 139.1



Mplify Standard

Mplify 139.1

**Internet Access Product Schema and Developer
Guide**

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Mplify 139.1

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1 List of Contributing Members

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

- Amartus
- Colt
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2 Abstract

This Mplify Standard implements business requirements defined by Mplify 164 - Internet Access Product Attributes and Use Cases [18]. It consists of this schema guide and its associated software artifacts (JSON Schemas) that define and describe the product-specific information used in LSO Cantata and LSO Sonata APIs for a set of Business Functions - specifically, Product Offering Qualification, Quote, Product Ordering, and Product Inventory – for the Internet Access product.

The document starts with an overview of LSO Cantata, LSO Sonata, and Internet Access services. It then provides a basic information model for the Mplify Internet Access Attributes. The final sections describe the Data Model described by JSON Schemas associated with this specification.

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

[MEF-LSO-Sonata-SDK](#), commit id: [87e22ade253cccba93c4654adac35d8d78999a79](#)

[MEF-LSO-Cantata-SDK](#), commit id: [4ff8e66db5a5293fcaea705aa15c8bad1f320c7b](#)

Files:

- schema\productSchema\ip\internetAccess\internetAccess.yaml
- schema\common\common.yaml
- schema\common\ip\ipCommon.yaml
- schema\common\ip\ipRoutingProtocolsCommon.yaml

Also included in the GitHub repository is a Postman file that contains informative examples illustrating the use of the Internet Access. This file is not part of this standard but is referred to in Appendix A.

- documentation\productSchema\ip\internetAccess\MEF 139.1 resources\Mplify 139.1 Appendix A.postman_collection.json

3 Terminology and Abbreviations

This document does not define any new terms or definitions. All of the terms defined in the standards below are included in this document by reference:

- Mplify 164 - Internet Access Product Attributes and Use Cases [18]
- MEF 55.1 Lifecycle Service Orchestration (LSO): Reference Architecture and Framework [4]
- MEF 55.1.1 Amendment to MEF 55.1: Reference Architecture and Framework - Terminology [5]
- MEF 57.2 Product Order Management Requirements and Use Cases [6]
- MEF 61.1 IP Service Attributes [7]
- Mplify 79.1 - Product Offering Qualification Management Business Requirements and Use Cases [9]
- Mplify 150 Installation Place and Service Site Management - Business Requirements and Use Cases [17]

Term	Definition	Reference
Use Case	In context of this document an API operation that can be performed on a Product.	This document
Variant	A defined and named definition of specific Product appliance with a set of Product Attributes rules and requirements.	This document

Table 1 Terminology

4 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 [2], RFC 8174 [3]) when, and only when, they appear in all capitals, as shown here. All key words must be in bold text.

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

5 Numerical Prefix Conventions

This document uses the prefix notation to indicate multiplier values as shown in Table 2.

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

Table 2 Numerical Prefix Conventions

6 Introduction

This chapter starts with an overview of LSO Sonata and LSO Cantata. Then the document contains the following sections:

- An overview of the Internet Access Product (section 7)
- Data Model Design Principles (section 8)
- Product Order Milestones (section 9)
- The relationships between the Internet Access Product and other entities (section 10)
- Details of the Data Model (section 11)

6.1 Overview of LSO Cantata and LSO Sonata

MEF 55.1 [4] is the Reference Architecture for Lifecycle Service Orchestration (LSO) of Mplify-defined services. It defines seven LSO Interface Reference Points (see Figure 1) that are abstract interconnection points between different entities, either within the Service Provider domain (intra-domain) or between the Service Provider and other business entities (inter-domain). One of these LSO Reference Points is LSO Cantata, which defines the abstract interconnection point between a Subscriber (Buyer) and a Service Provider (Seller), and another is LSO Sonata, which defines the abstract interconnection point between a Service Provider (Buyer) and an Operator (Seller). It is at these Interface Reference Points - LSO Cantata and LSO Sonata - that the Buyer and the Seller interact to orchestrate business transactions for the different Business Functions. Inter-provider Business Functions include Address Qualification, Site Query, Product Offering Qualification, Quote, Product Ordering, Product Inventory, Trouble Ticketing, and Billing. In the context of this document, the following 4 business functions are relevant as ones exchanging product information:

- Product Offering Qualification, Mplify 79.1 [9]
- Quote, MEF 80 [10]
- Product Ordering, MEF 57.2 [6]
- Product Inventory, MEF 81 [11]

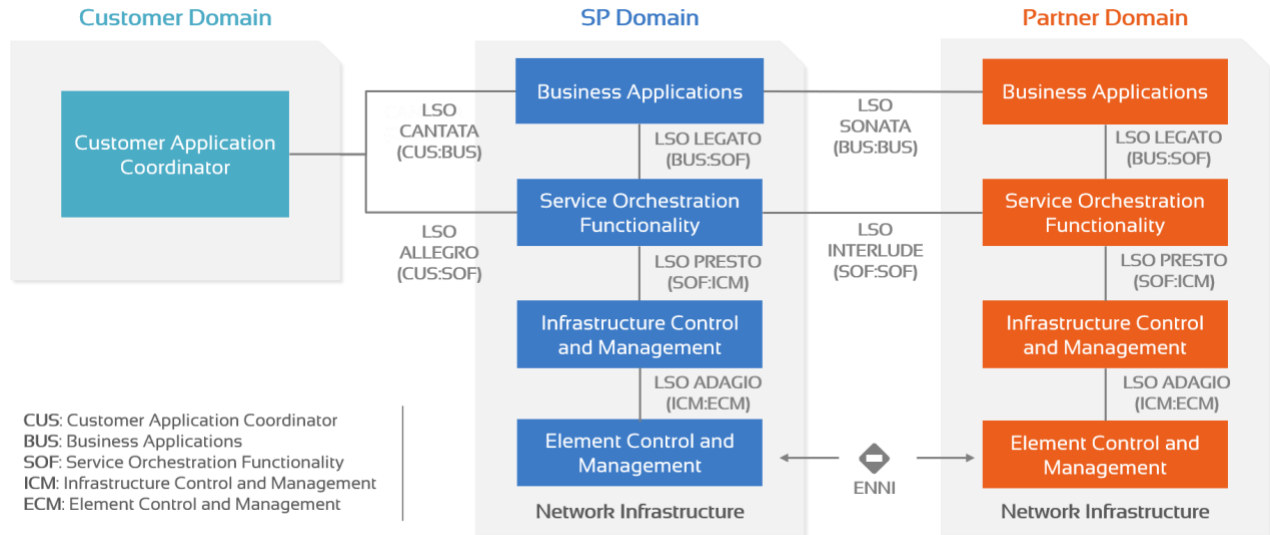


Figure 1 LSO Cantata and LSO Sonata Reference Diagram

The mutual access to Business Functionalities is automated via APIs at the LSO Cantata and LSO Sonata Interface Reference Points, which are standardized by Mplify as LSO Cantata and LSO Sonata APIs, and which are made available by Mplify in a series of releases of the LSO Cantata SDK and LSO Sonata SDK. The APIs are standardized by following the API and Developer Guide documents:

- Product Offering Qualification, Mplify 87.1 [12]
- Quote, Mplify 115.1 [13]
- Product Ordering, Mplify 123.1 [16]
- Product Inventory, Mplify 116.1 [14]

The LSO Cantata and LSO Sonata APIs comprise two parts: a product-agnostic API and a set of product-specific data models, as shown in Figure 2.

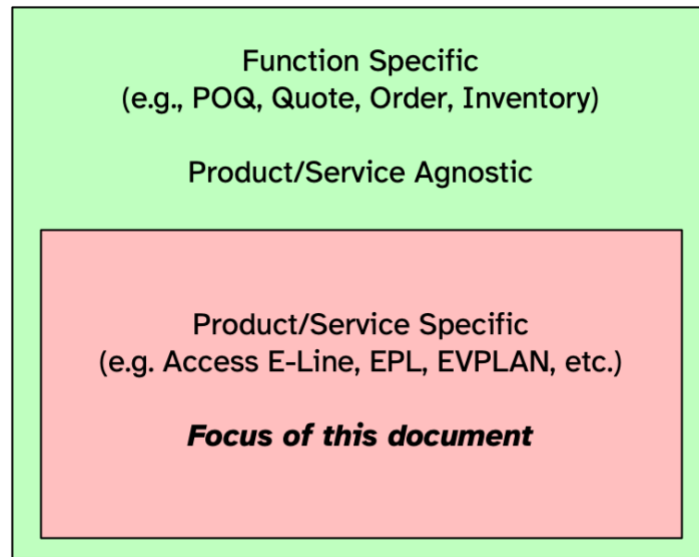


Figure 2 LSO Cantata and LSO Sonata API Structure

This document describes the product-specific Data Model for Mplify Internet Access.

7 Overview of Internet Access

Internet Access is a Subscriber IP service, which means it is provided to an end-user (the Subscriber) by a Service Provider. A Subscriber can be an enterprise, a mobile operator, an IT system integrator, a government department, etc. Internet Access provides the Subscriber with connectivity to the global Internet. In this case, the Service Provider is acting as an Internet Service Provider.

This section defines a set of typical Internet Access Product Offerings (Variant) that can be used by Sellers as the basis for their Product Offerings. Each of the Product Attributes described in Section 11 indicates which of these Variants the Product Attribute is applicable to.

7.1 Mplify Broadband Internet Access, Basic

This Product is the simplest type of Internet Access Product and is commonly used for Residential Internet Access. Internet Access is provided via a Broadband Network, which can be, for example, DOCSIS, PON, Satellite, or Cellular. The Product includes the Internet Access Device necessary for the type of Broadband Network. Most basic Internet Access Products provide options for bandwidth, but some also provide additional options such as fixed IP addresses, cellular backup, various security options, etc.

7.2 Mplify Broadband Internet Access, Advanced

This Product is similar to the Basic Internet Access Product. It is delivered over a Broadband Network and includes the Internet Access Device, but it is often more business-focused and designed for small businesses with a single location or a small number of locations with relatively modest technical requirements. It usually provides some options not available in Basic Internet Access, such as multiple Public IP Addresses, and better Service Level Agreements, better availability, etc.

7.3 Mplify Dedicated Internet Access, no Router

This Product is a Dedicated Internet Access Product usually delivered on a wavelength (or part of a wavelength) on a fiber optic interface although it could be delivered over other media such as microwave, satellite, etc. It is designed for larger organizations that have substantial technical requirements for their Internet Access including (for example) substantial flexibility in deployment of IP addresses, advertising routes, dual homing, redundancy, etc. For this product, the Buyer provides the router.

7.4 Mplify Dedicated Internet Access, with Router

This Product is the same as the “Dedicated Internet Access, no Router” but the Seller is providing the router. The router can be physical or virtual. Therefore, the required and optional Product Attributes are the same as the previous Variant with the addition of Product Attributes related to the router and features that can be enabled on the router.

8 Data Model Design Principles and Assumptions

An attribute for a Product can have a value that is a simple datatype, such as an integer or string (or list of simple datatypes), or a value that is an object with multiple properties, such as a Local Network Addresses or a composition of objects such as Bandwidth. Within this document, each simple value (integer, string, boolean, etc.) is referred to as a Product-Specific Attribute.

The data model for the Internet Access product configuration is expressed as a JSON schema based on JSON schema draft 7 [1] and encoded in YAML. This schema accompanies this document. It can also be found in the SDK release in the following path:

```
schema\productSchema\ip\internetAccess\internetAccess.yaml
```

In the schema, the following naming conventions are used:

- class and type names are UpperCamelCase,
- Product Attribute and property names are lowerCamelCase,
- enumeration values are defined using UPPER_SNAKE_CASE.

The data model is defined with variations, depending on:

- Business Function - a given Product-Specific Attribute may, for example, be classified as Optional for the Create POQ request, while it may be classified as Mandatory for the Create Product Order request.
- Applicable Variants: It indicates with which of the Variants described in section 7 the Product Attribute is appropriate for use.

To avoid multiplication of schemas resulting from possible combinations, there is only one schema provided that fulfills all the requirements possible, leaving the rest to be implemented and checked by business logic, and not by the API contract.

On top of the standard-defined model, the Buyer and the Seller may agree on which attributes are required, predefined, or used in a given context. This can be achieved, for example, with the use of the Product Catalog API.

Note: A CHANGE request cannot change a single Service Attribute. The Buyer must send a full product configuration, including all Mandatory Attributes and all Optional Attributes that were previously specified by the Buyer (in an INSTALL request or previous CHANGE request). Any Optional Service Attributes that are not specified in a CHANGE request are reset to their default value.

In the figures, some classes' attributes or further class structures are skipped for diagram readability. This is denoted by the <<skipped>> clause.

For readability of the diagrams, the default multiplicity of relations is 0..1.

Some requirements define Product Attributes as mutually exclusive. This means that either one or the other must be provided, but not two (or more) of them at the same time. This is defined in the schema using the *minProperties: 1, maxProperties: 1* statements.

For example, *ForwardingInformation* has 2 attributes: *nextHopIpAddress*, *uniAccessLink*, but only one of them must and can be set at the same time. This part of the schema that defines this requirement looks as follows:

```
properties:
  nextHopIpAddress:
    description: Next hop IP address.
    $ref: '../.../common/ip/ipCommon.yaml#/definitions/Ipv4OrIpv6Address'
  uniAccessLink:
    description: >-
      UNI Access Link identifier as set by the Buyer in
      IpUniAccessLink.identifier attribute.
    $ref: '../.../common/common.yaml#/definitions/IdentifierString'
  minProperties: 1
  maxProperties: 1
```

In the following sections, where applicable, this information is provided after the table with the attributes.

Tables listing the attributes have the following columns:

- Name - attribute name as present in the schema file,
- Type - the data type of the attribute. All additional constraints are also listed in this column if they are defined in the schema (ex. *minItems*, *maxItems*, *minimum*, etc.)
 - List attributes are designated by square bracket *[]* next to the type name. E.g. *Ipv4OrIpv6Prefix[]* means the attribute is a list of objects of type *Ipv4OrIpv6Prefix*
- M/O - specifies if the attribute is mandatory or optional to provide.
- Description - description of the attribute.

9 Product Order Milestones

The Service Provider (Seller) can optionally track milestones and provide Product-Specific Product Order Item Milestone notifications to the Buyer on the status of a Product Order as a sequence of Milestones for that Product Order as they are achieved. Milestones commonly used in ordering of Internet Access are presented in Table 3. Service Provider may support some or all of these milestones or introduce new ones.

The Milestone Name in the first column is included in *ProductOrderItem.milestone* and *ProductSpecificProductOrderItemMilestoneEventPayload.milestoneName* in the Product Order API (see Mplify 123.1 [16]).

Note: Milestones and their notifications are independent of the Product Order Item’s state.

Milestone Name	Description
SITE_SURVEY_SCHEDULED	Site Survey Scheduled
SITE_SURVEY_COMPLETE	Site Survey Complete
PLANNING_COMPLETE	Planning Complete
FIRM_DELIVERY_DATE_PROVIDED	Firm Delivery Date Provided
AWAITING_MUNICIPAL_APPROVAL	Awaiting Municipal Approval
MUNICIPAL_APPROVAL_GRANTED	Municipal Approval Granted
AWAITING_LANDLORD_APPROVAL	Awaiting Landlord Approval
LANDLORD_APPROVAL_GRANTED	Landlord Approval Granted
CONSTRUCTION_STARTED	Construction Started
CONSTRUCTION_COMPLETED	Construction Completed
AWAITING_ACCESS	Awaiting Site Access Permission (for the end-to-end test)
ACCESS_DENIED	Site Access Denied (for the end-to-end test).
AWAITING_WIRING	Awaiting Installation of Inside Wiring by Landlord
WIRING_COMPLETE	Installation of Inside Wiring by Landlord Complete
EQUIPMENT_DISPATCHED	Equipment Dispatched
EQUIPMENT_DELIVERED	Equipment Delivered
EQUIPMENT_INSTALLED	Equipment Installed
E2E_TESTING_SCHEDULED	End-to-End Testing Scheduled
E2E_TESTING_COMPLETED	End-to-End Testing Completed
E2E_TESTING_FAILED	End-to-End Testing Failed.

Table 3 Product Order Milestones for Internet Access

10 Relationships Between Entities

This section describes the relationships (and their constraints) between the products and between the products and places.

Internet Access is a location-specific product. The installation location can be provided, depending on the Variant, with:

- Place Relationship – for Broadband Variants, OR
- Product Relationship to Service Access Interface – for Dedicated Variants.

- [R1]** The Buyer **MUST** specify the Installation Place either with Place Relationship or Product Relationship for POQ, Quote, and Product Order. [Mplify164 R2]
- [R2]** For Broadband Internet Access Basic and Advanced, the Buyer **MUST** use the Place Relationship to specify the Installation Place. [Mplify164 R3]
- [R3]** For Dedicated Internet Access with and without Router, the Buyer **MUST** use the Product Relationship to refer to a Service Access Interface to specify the Installation Place. [Mplify164 R4]

Product	Place Relationship Role	Cardinality	Modifiable
Internet Access	INSTALL_LOCATION	0..1	Yes

Table 4 Place Relationship

- [R4]** The Role field (*role*) of the Related Place (*RelatedPlaceRefOrQueryWithSubUnit* or *RelatedPlaceRefOrQuery*) type **MUST** contain the INSTALL_LOCATION value shown in the Place Relationship Role column in Table 4.

Source Product	Target Product	Relationship Type	Cardinality	Modifiable	Multiple Allowed at POQ and Quote?
Internet Access	Service Access Interface	CONNECTS_TO_SAI	0..1	Yes	No
Internet Access	Internet Access	DIVERSE_FROM	0..1	Yes	No

Table 5 Product Relationship

The DIVERSE_FROM Product Relationship is used to reference an Internet Access product to diverse from, when the Facility Diversity Feature is enabled (see 11.11.6).

Editor Note 1: At the time of this Draft version being published, there is no Standard available for Service Access Interface Product Attributes. The Seller and Buyer are free to agree on what type of Product can be referenced.

11 Internet Access Attributes

This section provides a guide to the detailed model of the Internet Access product in all flavors. Mplify 164 defines sets of requirements on Internet Access Attributes. Some of them are fulfilled by already existing API functions and parameters (marked as “Envelope” in Table 6), and some of them are part of the Internet Access product schema (“Payload”), defined by this standard.

When an attribute is covered by API features’ respective requirements, defined by the API standard are applicable. These requirements are not mentioned in this document, as they are part of a broader business flow defined in these APIs and should not be taken out of context.

Product Attribute	ENV/Payload	Broadband				Dedicated			
		POQ	Quote	Order	Inv.	POQ	Quote	Order	Inv.
Installation Location	Envelope	M	M	M	M	M	M	M	M
Pricing	Envelope	N/A	M	N/A	N/A	N/A	M	N/A	N/A
Buyer Administrative Contact	Envelope	O	O	O	O	O	O	O	O
Requested Lead Time	Envelope	N/A	M	N/A	N/A	N/A	M	N/A	N/A
Requested Installation Date	Envelope	N/A	N/A	M	N/A	N/A	N/A	M	N/A
Contract Term	Envelope	N/A	M	M	N/A	N/A	M	M	N/A
Variant	Payload	M	M	M	M	M	M	M	M
Demarcation Point	Payload	N/A	N/A	O	M	N/A	N/A	N/A	N/A
Delivery Mechanism	Payload	M	M	M	M	M	M	M	M
Service Access Interface	Payload	O	O	M	M	N/A	N/A	N/A	N/A
VLAN	Payload	N/A	N/A	N/A	N/A	O	O	M	M
List of Features	Payload	M	M	M	M	M	M	M	M
Bandwidth	Payload	M	M	M	M	M	M	M	M
Guaranteed Bandwidth	Payload	O	O	O	O	M	M	M	M
Billing	Payload	O	M	M	M	O	M	M	M
Local Network Addresses	Payload	O	O	O	O	O	O	O	O
Provider Independent IP Addresses	Payload	O	O	O	O	O	O	O	O
Autonomous System Number	Payload	O	O	O	O	O	O	O	O
IP Address Type	Payload	O	M	M	M	O	M	M	M
Public Addresses Prefix Length	Payload	O	O	O	O	O	O	O	O
Public Address Block	Payload	O	O	O	O	O	O	O	O
Transit Addresses	Payload	N/A	N/A	N/A	N/A	O	O	O	O

Table 6 Internet Access All Attributes Summary

Table 6 lists all Internet Access Product attributes and summarizes realization by either Envelope or Payload and requirements or applicability per Variant and API, as defined by Mplify 164.

- [O1]** The Buyer **MAY** include a Product Attribute in a request unless an explicit requirement indicates otherwise.

11.1 Installation Location

This attribute is covered by the LSO API Envelope and is covered in section 10.

11.2 Variant

Applicable Variants: All

This attribute enumerates all defined Variants of Internet Access. This is a technical attribute that must be set by the Buyer to explicitly state the requested Variant, so that the Seller can apply proper validation and processing logic.

File: schema\productSchema\ip\internetAccess\internetAccess.yaml

Type: InternetAccessVariantName

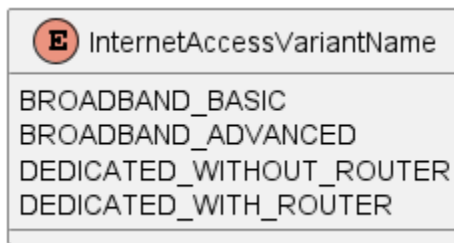


Figure 4 InternetAccessVariantName

[R1] The Variant Product Attribute **MUST** always be specified.

11.3 Demarcation Point

Applicable Variants: Broadband Internet Access Basic, and Advanced

This Product Attribute presents the demarcation point between the responsibility of the Buyer and the responsibility of the Seller upon delivery of the Internet Access Product.

Demarcation Point is modeled as a list of SubUnits.

File: schema\common\common.yaml

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

Table 8 SubUnit

[R2] For Dedicated Internet Access Products, the *demarcationPoint* **MUST NOT** be provided. [Mplify164 R6]

- [R3]** For Broadband Internet Access Products, the *demarcationPoint* **MUST** be provided in the Product Inventory. [Mplify164 R5]
- [O2]** For Broadband Internet Access Products, the *demarcationPoint* **MAY** be specified by the Buyer in the Product Order. [Mplify164 O1]

Example:

```
{
  "demarcationPoint": [
    {
      "subUnitType": "FLOOR",
      "subUnitNumber": "3"
    },
    {
      "subUnitType": "ROOM",
      "subUnitNumber": "305"
    },
    {
      "subUnitType": "RACK",
      "subUnitNumber": "7"
    },
    {
      "subUnitType": "CHASSIS",
      "subUnitNumber": "2"
    },
    {
      "subUnitType": "SLOT",
      "subUnitNumber": "5"
    },
    {
      "subUnitType": "PORT",
      "subUnitNumber": "12"
    }
  ]
}
```

11.4 Buyer Contact Information

Applicable Variants: All

This Product Attribute specifies a list of contacts where each element in the list indicates the contact role and the contact information for an individual or group responsible for a specified function, action, or role. A list of contact roles is found in Table 38 in MEF 57.2 [6].

A Buyer Administrative Contact is typically the representative of a single administrative entity (such as a university, a business enterprise or a business division) responsible for managing the

service contract and handling administrative tasks related to the service, such as service changes, billing, and payments, and, when necessary, management and registration of the Buyer's IP Addresses.

This attribute is covered by the use of:

- *ProductOfferingQualificationItem.relatedContactInformation* in POQ [12],
- *QuoteItem.relatedContactInformation* in Quote [13],
- *ProductOrderItem.relatedContactInformation* in Product Order [16],
- *Product.relatedContactInformation* in Product Inventory [14]

The *RelatedContactInformation* Type defines the *role* attribute that specifies the contact role in the given context. The additional *buyerAdministrativeContact* role must be supported.

[R4] The Buyer and the Seller **MUST** support the additional *buyerAdministrativeContact* role of *RelatedContactInformation*.

Example:

```
"relatedContactInformation": [
  {
    "number": "12-345-6789",
    "emailAddress": "john.example@buyer.example.com",
    "role": "buyerAdministrativeContact",
    "organization": "Buyer Co.",
    "name": "John Example",
    "numberExtension": "1234"
  }
],
```

11.5 Requested Lead Time

Applicable Variants: All

This Product Attribute is used by the Buyer to indicate the desired lead time for installation of the Internet Access Product.

This attribute is covered by the use of:

- *ProductOfferingQualificationItem.installationInterval* in POQ
- *MEFQuoteItem_Common.requestedQuoteItemInstallationInterval* in Quote
- *QuoteItem.quoteItemInstallationInterval* in Quote

The *installationInterval* is provided by the Seller in the POQ response. The Buyer requests a *requestedQuoteItemInstallationInterval* in the Quote, and the Seller responds with the *quoteItemInstallationInterval* that the Seller can meet, which may be shorter or longer than the *requestedQuoteItemInstallationInterval*.

Example:

```
"installationInterval": {  
  "amount": 10,  
  "units": "businessDays"  
},
```

11.6 Requested Installation Date

Applicable Variants: All

This Product Attribute specifies the installation date requested by the Buyer.

This attribute is covered by the use of:

- *MEFProductOrderItem_Common.requestedCompletionDate* in Product Order

Example:

```
"requestedCompletionDate": "2025-05-25T21:32:28.826Z",
```

11.7 Contract Term

Applicable Variants: All

This Product Attribute specifies the terms of the contract for the Internet Access Product.

This attribute is covered by the use of:

- *MEFQuoteItem_Common.requestedQuoteItemTerm* in Quote
- *MEFQuoteItem_Common.quoteItemTerm* in Quote
- *MEFProductOrderItem_Common.requestedItemTerm* in Product Order
- *MEFProductOrderItem_Common.itemTerm* in Product Order

The Buyer requests a *requestedQuoteItemTerm* in the Quote and the Seller responds with the closest *quoteItemTerm* that the Seller can meet, which may be different than the *requestedQuoteItemTerm*.

Example:

```
"requestedQuoteItemTerm": {  
  "duration": {  
    "amount": 12,  
    "units": "calendarMonths"  
  },  
  "endOfTermAction": "autoRenew",  
  "name": "Yearly Subscription"  
},
```

11.8 Delivery Mechanism

Applicable Variants: All

The value of this Product Attribute describes the type of equipment provided by the Seller as part of the Internet Access Product.

File: schema\productSchema\ip\internetAccess\internetAccess.yaml

Type: InternetAccessDeliveryMechanism

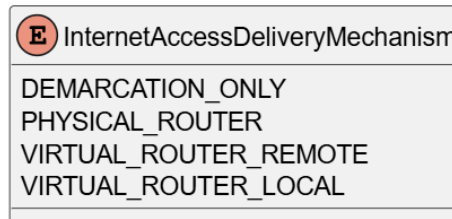


Figure 5 InternetAccessDeliveryMechanism

The Delivery Mechanism values are defined as follows:

- *DEMARCATION_ONLY* – The product is delivered to the customer without IP routing. It is the Buyer’s responsibility to provide the mandatory routing function.
- *PHYSICAL_ROUTER* – The product delivered to the Buyer includes a physical IP Router installed at the customer's premises.
- *VIRTUAL_ROUTER_REMOTE* – The product delivered to the Buyer includes an IP routing function, which is executed in a virtual environment, not at the customer premises. The network connectivity from the Buyer’s location to the virtual router provides transport only.
- *VIRTUAL_ROUTER_LOCAL* – The product delivered to the Buyer includes an IP routing function running in a virtual environment at the Buyer’s premises. The virtual environment (frequently referred to as a universal CPE, white-box CPE, or edge device) is provided by the Seller and can be pre-existing or can be delivered with the Internet Access Product.

[R5] The Internet Access Delivery Mechanism Product Attribute **MUST** be specified for POQ, Quote, and Product Order. [Mplify164 R13]

11.9 Service Access Interface

Applicable Variants: Broadband Internet Access, Basic and Advanced

For Broadband Internet Access (Basic and Advanced), the Service Access Interface is included as part of the Internet Access Product. (Note that this does not result in a separate Service Access Interface product instance). This Product Attribute is used to describe the important characteristics of the Service Access Interface.

File: schema\productSchema\ip\internetAccess\internetAccess.yaml

Type: InternetAccessServiceAccessType

E InternetAccessResiliency

NONE
ALL_ACTIVE
2_LINK_ACTIVE_STANDBY
OTHER

E ConnectorType

RJ45
SC
LC
OTHER

E SaiEthernetPhysicalLayer

10BASE-CX4
10BASE-ER/EW
10BASE-FL
10BASE-LR/LW
10BASE-LX4
10BASE-SR/SW
10BASE-T
10GBASE-CX4
10GBASE-ER/EW
10GBASE-LR/LW
10GBASE-LX4
10GBASE-SR/SW
10GBASE-T
1000BASE-BX10
1000BASE-LX
1000BASE-LX10
1000BASE-SX
1000BASE-T
100BASE-BX10
100BASE-FX
100BASE-LX10
100BASE-SR10
100BASE-SX
100BASE-TX
100GBASE-CR1
100GBASE-CR10
100GBASE-CR2
100GBASE-CR4
100GBASE-DR
100GBASE-ER4
100GBASE-FR1
100GBASE-LR1
100GBASE-LR4
100GBASE-SR2
100GBASE-SR4
100GBASE-ZR
200GBASE-CR2
200GBASE-CR4
200GBASE-DR4
200GBASE-ER4
200GBASE-FR4
200GBASE-LR4
200GBASE-SR4
25GBASE-CR
25GBASE-ER
25GBASE-LR
25GBASE-SR
25GBASE-T
2.5GBASE-T
40GBASE-CR4
40GBASE-ER4
40GBASE-FR
40GBASE-LR4
40GBASE-SR4
40GBASE-T
400GBASE-DR4
400GBASE-ER8
400GBASE-FR4
400GBASE-FR8
400GBASE-LR4-6
400GBASE-LR8
400GBASE-SR16
400GBASE-SR4
400GBASE-SR4.2
400GBASE-SR8
50GBASE-CR
50GBASE-ER
50GBASE-FR
50GBASE-LR
50GBASE-SR
5GBASE-T

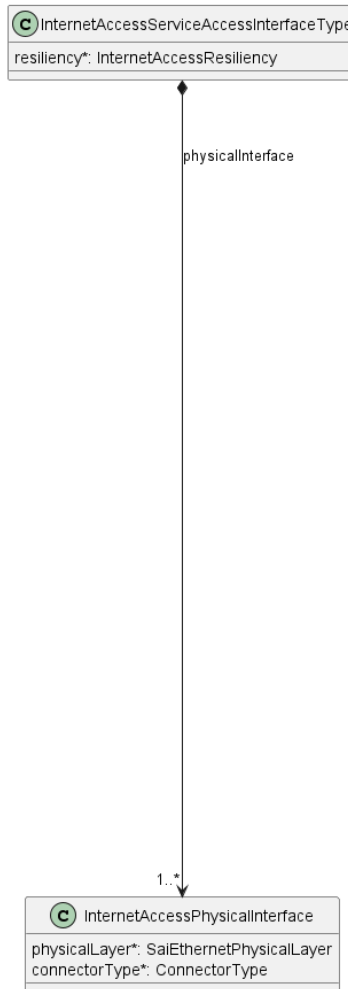


Figure 6 Service Access Interface Attribute

Name	Type	M/O	Description
physicalInterface	InternetAccessPhysicalInterface[] minItems = 1	M	Describes the physical aspects of the Service Access Interface delivered by the Seller
resiliency	InternetAccessResiliency	M	Describes the configuration for resiliency at the Service Access Interface

Table 9 InternetAccessServiceAccessInterfaceType

Name	Type	M/O	Description
physicalLayer	SaiEthernetPhysicalLayer	M	Specifies a physical layer
connectorType	ConnectorType	M	Indicates the connector type,

Table 10 InternetAccessPhysicalInterface

- [R6]** For Broadband Internet Access Basic and Advanced, the value of the *serviceAccessInterfaceType* **MUST** be provided in the Product Order. [Mplify164 R14]
- [O3]** For Broadband Internet Access Basic and Advanced, the value of the *serviceAccessInterfaceType* **MAY** be provided in the POQ or Quote. [Mplify164 O2]
- [R7]** For Dedicated Internet Access with and without a Router, the value of the *serviceAccessInterfaceType* **MUST NOT** be provided in any function. [Mplify164 R15]

The *resiliency* values are defined as follows:

- *NONE* - No resiliency
- *ALL_ACTIVE* - indicates that Link Aggregation is used, and all the specified physical interfaces can be active and carrying traffic simultaneously.
- *2_LINK_ACTIVE_STANDBY* - indicates that Link Aggregation is used and that there are two physical interfaces and only one of them can be carrying traffic.
- *OTHER* - indicates that the Buyer and Seller have agreed on a resiliency approach other than Link Aggregation.

- [R8]** The value *NONE* **MUST** be selected if and only if the list of physical interfaces (*physicalInterface*) contains exactly one entry. [Mplify164 R16]
- [R9]** If the value of *resiliency* is *2_LINK_ACTIVE_STANDBY*, then the list of physical interfaces (*physicalInterface*) **MUST** contain exactly 2 entries. [Mplify164 R17]
- [R10]** If the list of physical interfaces (*physicalInterface*) contains more than two entries, then the option for *resiliency* **MUST** be either *ALL_ACTIVE* or *OTHER*. [Mplify164 R18]

Example:

```
{
  "physicalInterface": [
    {
      "physicalLayer": "1000BASE-T",
      "connectorType": "RJ45"
    }
  ],
  "resiliency": "NONE"
}
```

11.10 VLAN

Applicable Variants: Dedicated Internet Access, with and without router

The value of this Product Attribute is the C-tag VLAN ID that is used for the Internet Access at the Service Access Interface. It is an integer with a value between 1 and 4094. The value 0 indicates that untagged Ethernet frames are used for Internet Access.

File: schema\common\ip\ipCommon.yaml

Type: *VlanIdOrUntagged*

- [D1] The *vlan* attribute **SHOULD** be omitted for POQ and Quote. [Mplify164 D1]
- [R11] The *vlan* attribute **MUST** be specified for Product Order. [Mplify164 R19]

Requirement [R11] indicates that the Buyer is required to tell the Seller in the Product Order whether it is using untagged frames (value 0) or VLAN-tagged frames (value greater than 0).

11.11 Features

Applicable Variants:

- Broadband Internet Access, Advanced
- Dedicated Internet Access, with and without router

The value of this Product Attribute indicates the major functional and protocol features provided for the Internet Access.

- [R12] For Basic Broadband Internet Access, the *features* attribute **MUST** be an empty list.



Figure 7 Internet Access Features

File: schema\productSchema\ip\internetAccess\internetAccess.yaml

Type: InternetAccessFeatures

Name	Type	M/O
assistance	InternetAccessFeatureAssistance	O
cloudPrioritization	InternetAccessFeatureCloudPrioritization	O
ddosMitigation	InternetAccessFeature	O
dedicatedFirewall	InternetAccessFeatureDedicatedFirewall	O
dns	InternetAccessFeatureDns	O
facilityDiversity	InternetAccessFeature	O
layer3Resiliency	InternetAccessFeatureLayer3Resiliency	O
mobileBackup	InternetAccessFeatureMobileBackup	O
monitoring	InternetAccessFeatureMonitoring	O
performanceReporting	InternetAccessFeature	O
routing	InternetAccessFeatureRouting	O
snmpRead	InternetAccessFeature	O

Table 11 InternetAccessFeatures

Each defined feature is modelled as a separate named attribute of *InternetAccessFeature* type or its extension, when feature-specific configuration is required. *InternetAccessFeature* allows for basic configuration of a feature:

Name	Type	M/O	Description
isSupported	boolean	M	Indicates whether support of the feature by the Seller is required.
isEnabled	boolean	M	Indicates whether the Buyer requests that the Feature is enabled.

Table 12 InternetAccessFeature

[R13] For each feature, if the value of *isEnabled* is *true*, then the value of *isSupported* **MUST** be *true*. [Mplify164 R21]

A Buyer can request that a particular feature be supported but not enabled (at the time of the request). If the Buyer requests that a particular feature be enabled, support for the feature is clearly required.

- [R14]** If a feature is not specified, it **MUST** be treated as the equivalent to specifying the feature with *isSupported* = *false* and *isEnabled* = *false*.

Example:

```
"features": {
  "assistance": {
    "isSupported": true,
    "isEnabled": true,
    "assistanceLevel": "CO_MANAGED",
    "simpleRequestsPerMonth": 5,
    "complexRequestsPerMonth": 1
  },
  "cloudPrioritization": {
    "isSupported": true,
    "isEnabled": false,
    "cloudServiceProvider": []
  },
  "ddosMitigation": {
    "isSupported": false,
    "isEnabled": false
  },
  "dedicatedFirewall": {
    "isSupported": true,
    "isEnabled": true,
    "firewallCapability": "BASIC"
  },
  "dns": {
    "isSupported": true,
    "isEnabled": true,
    "searchDomain": [
      "mplify.example.com",
      "example.com"
    ]
  },
  "facilityDiversity": {
    "isSupported": true,
    "isEnabled": true
  },
  "layer3Resiliency": {
    "isSupported": true,
    "isEnabled": true,
    "layer3Resiliency": "WIRELESS_BACKUP"
  },
  "mobileBackup": {
    "isSupported": true,
```

```

"isEnabled": true,
"minimumExpectedBandwidth": {
  "downstream": {
    "irValue": 100,
    "irUnits": "MBPS"
  },
  "upstream": {
    "irValue": 20,
    "irUnits": "MBPS"
  }
},
},
"monitoring": {
  "isSupported": true,
  "isEnabled": true,
  "monitoringType": "PROACTIVE"
},
"snmpRead": {
  "isSupported": false,
  "isEnabled": false
}
}

```

11.11.1 Assistance

Definition: The level of Installation, Operation, and Configuration Changes done by Seller

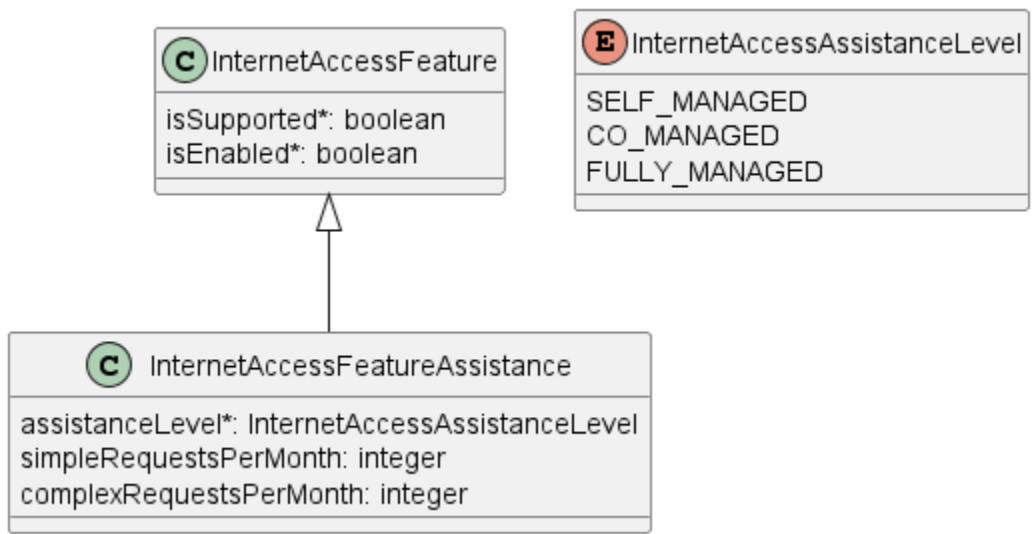


Figure 8 Assistance Feature

Feature Parameters for POQ:

- *assistanceLevel*

Feature Parameters for Quote:

- *assistanceLevel*
- If *assistanceLevel* is *CO_MANAGED* or *FULLY_MANAGED*
 - a. *simpleRequestsPerMonth*
 - b. *complexRequestsPerMonth*

Feature Parameters for Order: Same as Quote

11.11.2 Cloud Prioritization

Definition: The Seller enables prioritization, traffic congestion control, and SLAs for cloud traffic.

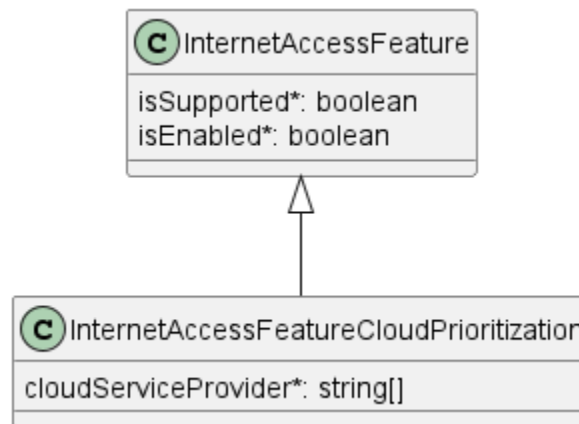


Figure 9 Cloud Prioritization

Feature Parameters for POQ:

- *cloudServiceProvider*

Feature Parameters for Quote: Same as POQ

Feature Parameters for Order: Same as POQ

11.11.3 DDOS-Mitigation

Definition: The Seller provides enhanced protection of the customer network from Distributed Denial of Service (DDoS) attacks.

Feature Parameters for POQ: No additional parameters

Feature Parameters for Quote: No additional parameters

Feature Parameters for Product Order: No additional parameters

11.11.4 Dedicated Firewall

Definition: The Seller provides a firewall service implemented on a dedicated device.

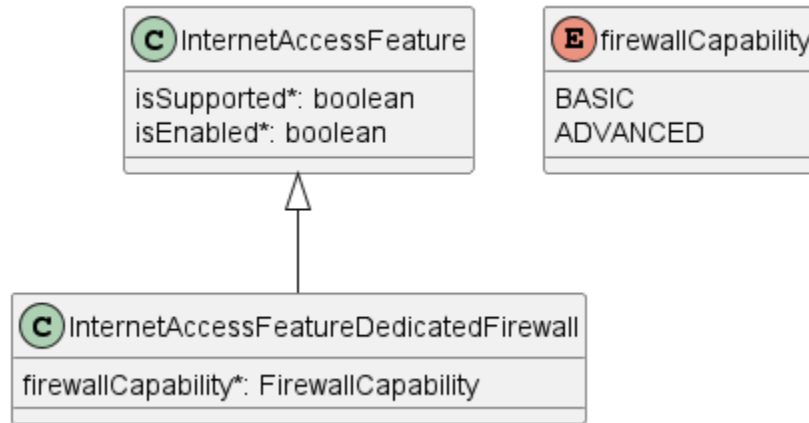


Figure 10 Dedicated Firewall Feature

Feature Parameters for POQ:

- *firewallCapability*

Feature Parameters for Quote: Same as POQ

Feature Parameters for Product Order: Same as POQ

The value *Basic* denotes a simple Firewall based on IP 5-tuples and/or Access Control Lists. The value *Advanced* denotes more sophisticated Firewall capabilities such as Deep Packet Inspection. The parameters for each of the two options are specified during product installation.

11.11.5 DNS

Definition: The Seller is providing a Domain Name Service to translate Domain Names to IP addresses.

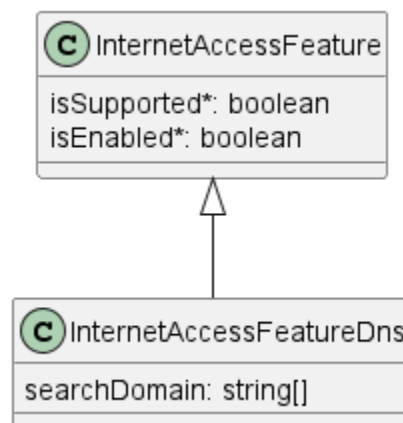


Figure 11 DNS Feature

Feature Parameters for POQ: No additional parameters

Feature Parameters for Quote: No additional parameters

Feature Parameters for Product Order:

- *searchDomain* – a possibly empty ordered list of domain names, specified as strings, that are sequentially appended to the specified domain name if the specified domain name does not include a dot (.), until the first successful DNS lookup.

11.11.6 Facility Diversity

Definition: The Seller ensures that this Internet Access Product has no common points of failure with another Internet Access Product.

Feature Parameters for POQ: No additional parameters

Feature Parameters for Quote: No additional parameters

Feature Parameters for Product Order:

- reference to the other Internet Access Product using Product Relationship
 - [R15] When Facility Diversity is enabled, in the Product Order Request, the Buyer **MUST** provide a reference to the other Internet Access Product using Product Relationship with *relationshipType= DIVERSE_FROM*.
 - [R16] The Buyer **MUST NOT** provide Product Relationship with *relationshipType= DIVERSE_FROM* if Facility Diversity feature is not enabled.

11.11.7 Layer 3 Resiliency

Definition: The Seller provides Layer 3 resiliency for the access connection to the Buyer.

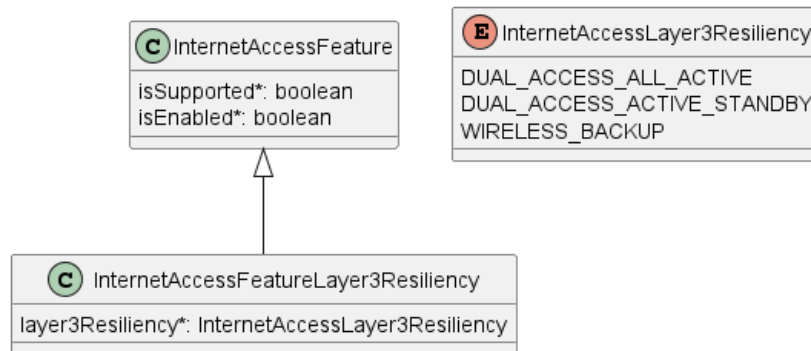


Figure 12 Layer 3 Resiliency Feature

Feature Parameters for POQ:

- *layer3Resiliency*

Feature Parameters for Quote: Same as POQ

Feature Parameters for Product Order: Same as POQ

- [R17] If *layer3Resiliency* feature is configured with *isSupported=true* and *layer3Resiliency=WIRELESS_BACKUP*, then the *mobileBackup* feature **MUST** also have the *isSupported=true*. [Mplify164 R23]
- [R18] If *layer3Resiliency* feature is configured with *isEnabled=true* and *layer3Resiliency=WIRELESS_BACKUP*, then the *mobileBackup* feature **MUST** also have the *isEnabled=true*. [Mplify164 R23]

11.11.8 Mobile Backup

Definition: The Seller provides a method for backing up the Internet Access via a 4G or 5G cellular service.

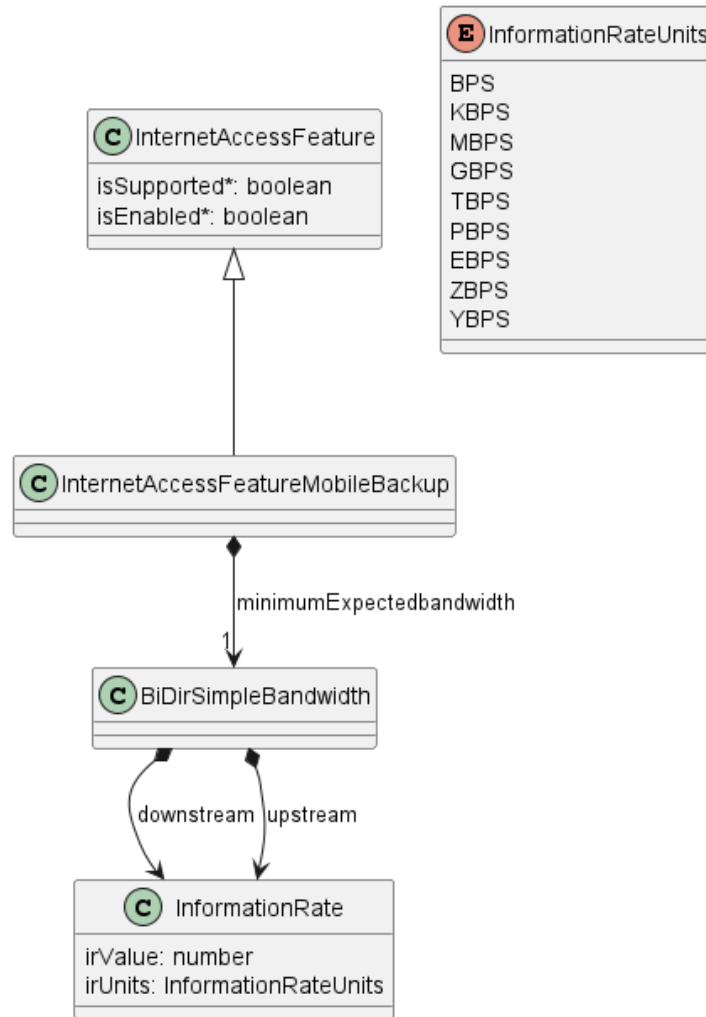


Figure 13 Mobile Backup Feature

Feature Parameters for POQ:

- *minimumExpectedBandwidth*

Feature Parameters for Quote: Same as POQ

Feature Parameters for Product Order: Same as POQ

11.11.9 Monitoring

Definition: The Seller is monitoring the Internet Access for the Buyer.

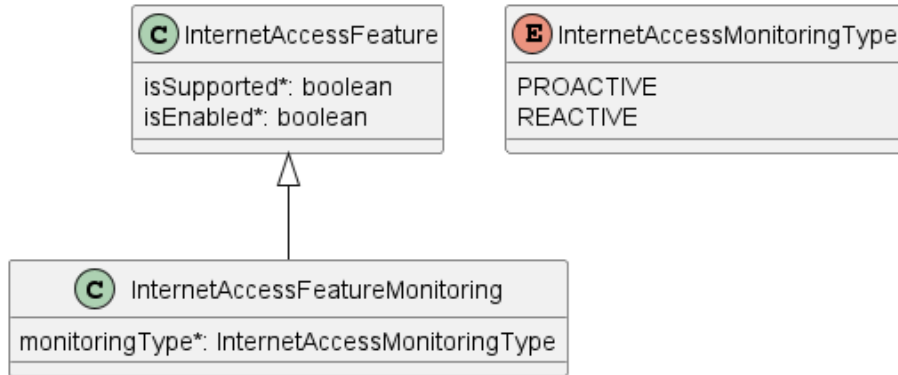


Figure 14 Monitoring Feature

Feature Parameters for POQ:

- *monitoringType*

Feature Parameters for Quote: Same as POQ

Feature Parameters for Product Order: Same as POQ

11.11.10 Performance Reporting

Definition: Performance Metrics are delivered to the Buyer for the Internet Access Product.

Feature Parameters for POQ: No additional parameters

Feature Parameters for Quote: No additional parameters

Feature Parameters for Product Order: No additional parameters

11.11.11 Routing

Definition: The method by which IP routes are exchanged between the Buyer and the Seller.

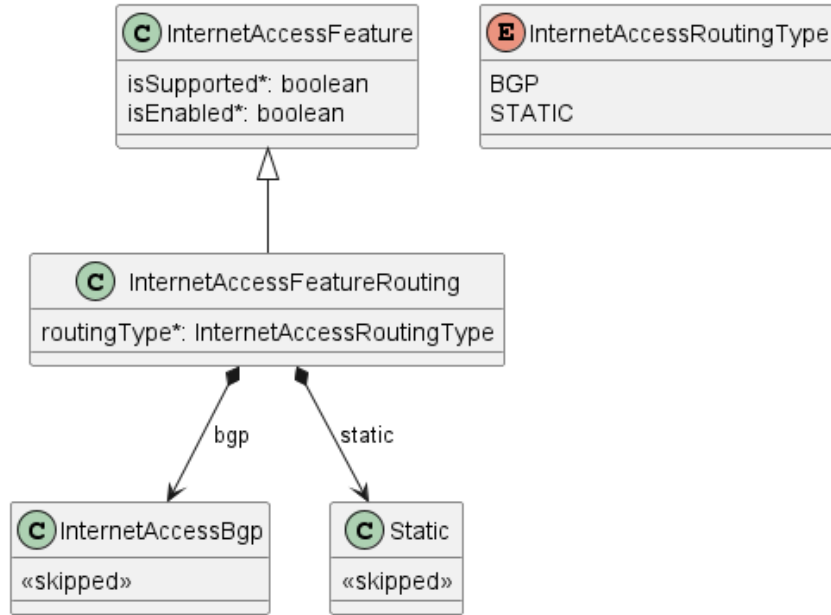


Figure 15 Routing Feature

Feature Parameters for POQ:

- *routingType*

Feature Parameters for Quote: Same as POQ

Feature Parameters for Product Order:

- *routingType*
- *static* – if *routingType=STATIC*, otherwise not provided
- *bgp* – if *routingType=BGP*, otherwise not provided

11.11.11.1 InternetAccessBgp

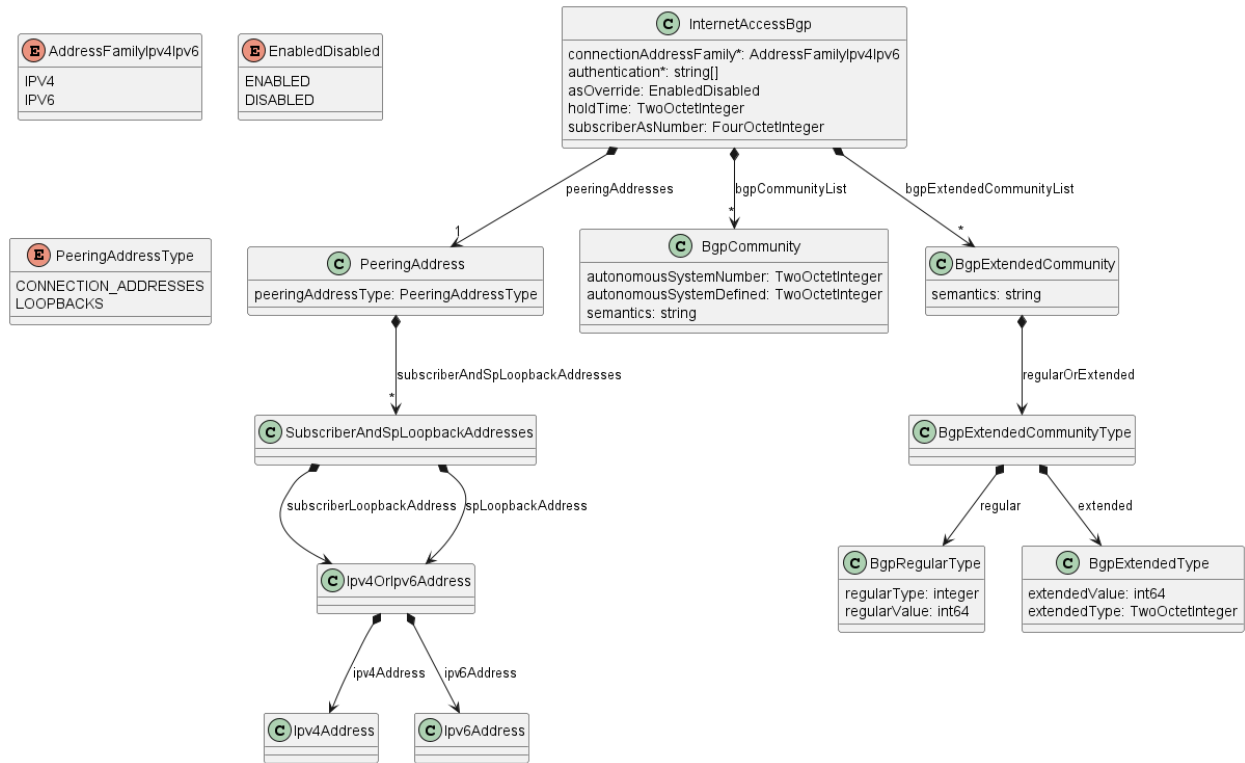


Figure 16 InternetAccessBgp

Figure 16 depicts the model of BGP routing protocol configuration model.

File: schema\common\ip\internetAccess\internetAccess.yaml

Name	Type	M/O	Description
subscriberAsNumber	FourOctetInteger	M	BGP Subscriber Autonomous System number.
connectionAddressFamily	AddressFamilyIpv4Ipv6	M	Connection Address Family (IPv4 or IPv6).
peeringAddresses	PeeringAddress	M	Peering Addresses.
authentication	string[] <i>maxItems=1</i>	M	BGP Authentication. It is either empty or if present is it a value of MD5 Password. It is assumed that an encrypted channel is used when this data is passed across the API so that the password is protected.
bgpCommunityList	BgpCommunity[]	O	Used to control which routers are accepted, preferred, distributed, or advertised.
bgpExtendedCommunityList	BgpExtendedCommunity[]	O	Mechanism for labeling information carried in BGP-4. Provide enhancement over existing BGP Community Attribute an extended range, the addition of type field.
holdTime	TwoOctetInteger	O	Hold time in seconds. Indicates the agreed Hold Time used for BGP sessions. The possible values are 0 or an integer in the range 3-65535.
asOverride	EnabledDisabled	O	Autonomous System Override. The SP (or Operator) can overwrite instances of the Subscriber's AS Number in the AS Path with their own AS Number, when advertising routes to the Subscriber. This needs to be explicitly agreed between the SP and the Subscriber, and/or between an SP/SO and an Operator.

Table 13 Bgp

Example:

```

"routing": {
  "isSupported": true,
  "isEnabled": true,
  "routingType": "BGP",
  "bgp": {
    "subscriberAsNumber": 64512,
    "connectionAddressFamily": "IPV4",
    "peeringAddresses": {
      "peeringAddressType": "CONNECTION_ADDRESSES"
    },
    "authentication": [],
    "bgpCommunityList": [],
    "bgpExtendedCommunityList": [],
    "holdTime": 180,
    "asOverride": "DISABLED"
  }
}

```

11.11.11.2 BgpCommunity

File: schema\common\ip\ipRoutingProtocolsCommon.yaml

A community is a group of destinations which share some common property. Each autonomous system administrator may define which communities a destination belongs to.

Name	Type	M/O	Description
autonomousSystemNumber	TwoOctetInteger	O	The first two octets encoding the Autonomous System value.
autonomousSystemDefined	TwoOctetInteger	O	The remaining octets.
semantics	string	O	Text describing how the Seller will handle routes tagged with this Community

Table 14 BgpCommunity

11.11.11.3 BgpExtendedCommunity

File: schema\common\ip\ipRoutingProtocolsCommon.yaml

This attribute provides a mechanism for labeling information carried in BGP-4. These labels can be used to control the distribution of this information, or for other applications.

Name	Type	M/O	Description
regularOrExtended	BgpExtendedCommunityType	O	Indicates whether the BGP Extended Community is of Regular Type or Extended Type.
semantics	string	O	Text describing how the Seller will handle routes tagged with this Community

Table 15 BgpExtendedCommunity

11.11.11.4 BgpExtendedCommunityType

File: schema\common\ip\ipRoutingProtocolsCommon.yaml

Options for BGP Extended Community Type. Either Regular Type or Extended Type.

Name	Type	M/O	Description
regular	BgpRegularType	O	BGP Regular Type Extended Community.
extended	BgpExtendedType	O	BGP Extended Type Extended Community.

Table 16 BgpExtendedCommunityType

11.11.11.5 BgpRegularType

File: schema\common\ip\ipRoutingProtocolsCommon.yaml

This attribute provides a mechanism for labeling information carried in BGP.

Name	Type	M/O	Description
regularType	integer <i>minimum</i> = 0 <i>maximum</i> = 255	O	Regular Type Field, 1 octet length
regularValue	int64 <i>minimum</i> = 0 <i>maximum</i> = 72057594037927940 <i>format</i> = int64	O	Octets 2 - 8 of the value part of the address. Used in case only Regular Type is provided.

Table 17 BgpRegularType

11.11.11.6 BgpExtendedType

File: schema\common\ip\ipRoutingProtocolsCommon.yaml

This attribute provides a mechanism for labeling information carried in BGP.

Name	Type	M/O	Description
extendedType	TwoOctetInteger	O	Extended Type Field, 2 octets length
extendedValue	int64 <i>minimum</i> = 0 <i>maximum</i> = 281474976710655 <i>format</i> = int64	O	Octets 3 - 8 of the value part of the address. Used in case only Extended Type is provided.

Table 18 BgpExtendedType

11.11.11.7 AddressFamilyIpv4Ipv6

File: schema\common\ip\ipRoutingProtocolsCommon.yaml

Specifies whether the session is established over IPv4 or IPv6.

Value
IPV4
IPV6

Table 19 AddressFamilyIpv4Ipv6

11.11.11.8 PeeringAddress

File: schema\common\ip\ipRoutingProtocolsCommon.yaml

Peering Addresses. Connection Addresses, or Loopbacks plus a list of pairs of IP addresses. Reference - MPLIFY 61.1 Section 12.7.3.

Name	Type	M/O	Description
peeringAddressType	PeeringAddressType	O	If the Peering Addresses parameter is CONNECTION_ADDRESSES, a separate BGP peering session is established over each UNI Access Link, using the primary IPv4 addresses in the UNI Access Link IPv4 Connection Addressing Service Attribute (section 13.4) or the first IPv6 addresses in the UNI Access Link IPv6 Connection Addressing Service Attribute (section 13.5), as indicated by the Connection Address Family parameter. If the Peering Addresses parameter is LOOPBACKS, a list of pairs of IP addresses is additionally specified, each pair containing the Subscriber's loopback address and the SP's or Operator's loopback address. A single BGP peering session is established for each pair of addresses.
subscriberAndSpLoopbackAddresses	SubscriberAndSpLoopbackAddresses[]	O	A list of pairs of IP addresses, each pair containing the Subscriber's loopback address and the SP's or Operator's loopback address. A single BGP peering session is established for each pair of addresses.

Table 20 PeeringAddress

11.11.11.9 PeeringAddressType

File: schema\common\ip\ipRoutingProtocolsCommon.yaml

If the Peering Addresses parameter is CONNECTION_ADDRESSES, a separate BGP peering session is established over each UNI Access Link, using the primary IPv4 addresses in the UNI Access Link IPv4 Connection Addressing Service Attribute (section 13.4) or the first IPv6 addresses in the UNI Access Link IPv6 Connection Addressing Service Attribute (section 13.5), as indicated by the Connection Address Family parameter. If the Peering Addresses parameter is LOOPBACKS, a list of pairs of IP addresses is additionally specified, each pair containing the Subscriber's loopback address and the SP's or Operator's loopback address. A single BGP peering session is established for each pair of addresses.

Value
CONNECTION_ADDRESSES
LOOPBACKS

Table 21 PeeringAddressType

11.11.11.10SubscriberAndSpLoopbackAddresses

File: schema\common\ip\ipRoutingProtocolsCommon.yaml

A list of pairs of IP addresses, each pair containing the Subscriber's loopback address and the SP's or Operator's loopback address. A single BGP peering session is established for each pair of addresses.

Name	Type	M/O	Description
subscriberLoopbackAddress	Ipv4OrIpv6Address	O	Subscriber's loopback Address for BGP establishing a session
spLoopbackAddress	Ipv4OrIpv6Address	O	Service Provider's loopback Address for BGP establishing a session

Table 22 SubscriberAndSpLoopbackAddresses

11.11.11.11Static

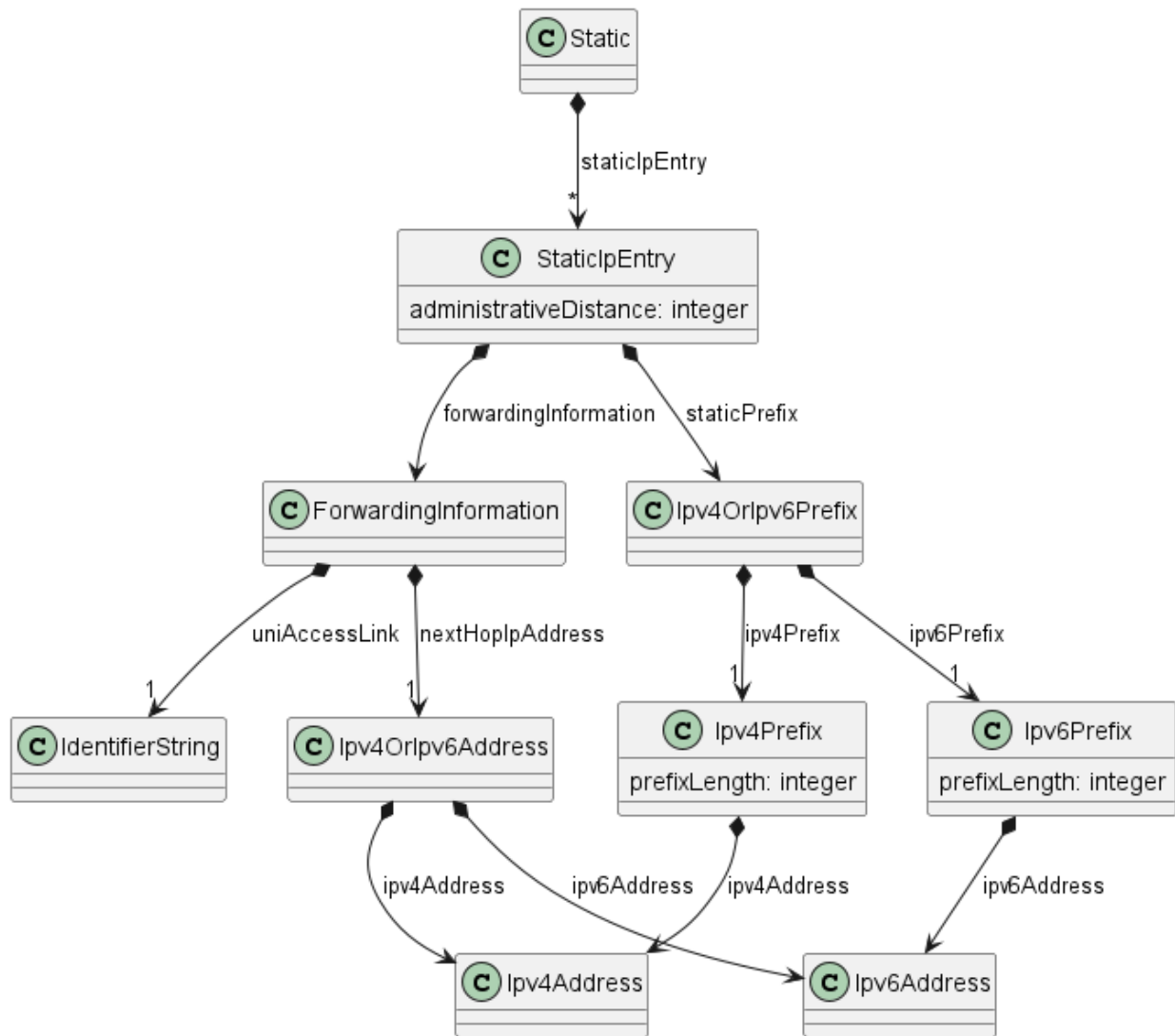


Figure 17 Static

Figure 17 shows the resource model for Static routing configuration.

File: schema\common\ip\ipRoutingProtocolsCommon.yaml

Name	Type	M/O	Description
staticIpEntry	StaticIpEntry[] minItems = 1	O	Static IP address entry.

Table 23 Static

Example:

```

"routing": {
  "isSupported": true,
  "isEnabled": true,
  "routingType": "STATIC",
  "static": {
    "staticIpEntry": [
      {
        "staticPrefix": {
          "ipv4Prefix": {
            "ipv4Address": "192.0.2.0",
            "prefixLength": 24
          }
        },
        "forwardingInformation": {
          "nextHopIpAddress": "198.51.100.1"
        },
        "administrativeDistance": 1
      },
      {
        "staticPrefix": {
          "ipv6Prefix": {
            "ipv6Address": "2001:db8::",
            "prefixLength": 48
          }
        },
        "forwardingInformation": {
          "nextHopIpAddress": "2001:db8::1"
        },
        "administrativeDistance": 1
      }
    ]
  }
}

```

11.11.11.12 StaticIpEntry

File: schema\common\ip\ipRoutingProtocolsCommon.yaml

StaticIpEntry data type including IPv4/IPv6 prefixes, forwarding information and administrative distance.

Name	Type	M/O	Description
administrativeDistance	integer minimum = 1	O	Administrative distance, an integer > 0.
forwardingInformation	ForwardingInformation	O	Forwarding information with either Next Hop IP address or UNI Access Link identifier.
staticPrefix	Ipv4OrIpv6Prefix	O	IPv4 or IPv6 Prefix that is advertised.

Table 24 Static IP Entry

11.11.11.13 Forwarding Information

File: schema\common\ip\ipRoutingProtocolsCommon.yaml

Forwarding information, consisting of either a next-hop IP address in the Subscriber Network (if the access medium is multipoint capable, e.g., Ethernet), or a specific UNI Access Link (if the access medium is strictly point-to-point, e.g., HDLC, PPP over DSL).

Name	Type	M/O	Description
nextHopIpAddress	Ipv4OrIpv6Address	O	Next hop IP address.
uniAccessLink	IdentifierString	O	UNI Access Link identifier as set by the Buyer in IpUniAccessLink.identifier attribute.

Table 25 Forwarding Information

11.11.12 SNMP Read

Definition: The Seller provides SNMP v2/v3 read access to the router including MIB-2.

Feature Parameters for POQ: No additional parameters

Feature Parameters for Quote: No additional parameters

Feature Parameters for Product Order: No additional parameters

11.12 Bandwidth

Applicable Variants: All

For Broadband Internet Access, this Product Attribute represents the “nominal” bandwidth. For Dedicated Internet Access, this Product Attribute represents the maximum bandwidth that can be sustained by the Buyer. The value of this Product Attribute is provided with the *BiDirSimpleBandwidth* type.

The term “nominal” is used to represent the name or description of the Internet Access Product. It is not necessarily a committed/guaranteed bandwidth or a maximum bandwidth although it is indicative of the expected or average bandwidth. For example, “a 400Mbps Internet Access”. 400Mbps is the nominal bandwidth and indicates that the Subscriber will be able to achieve approximately 400Mbps of bandwidth with some level of regularity.

File: schema\common\common.yaml

Type: BiDirSimpleBandwidth

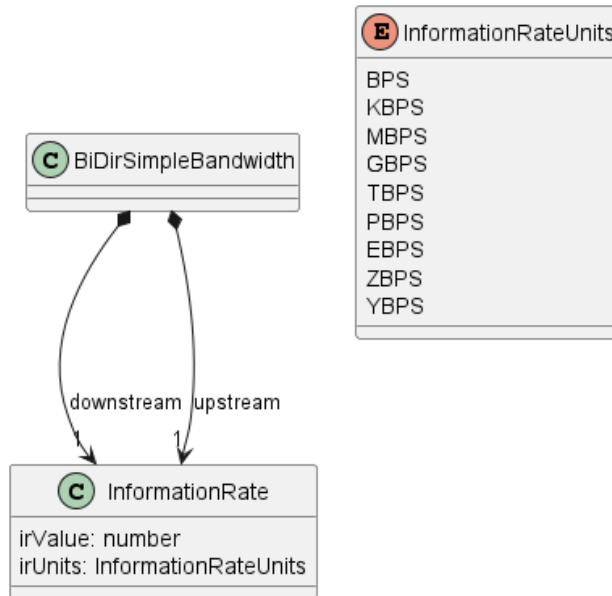


Figure 18 Bi Dir Simple Bandwidth

[R19] The value of *bandwidth*, including both *downstream* and *upstream* values, **MUST** be provided in POQ, Quote, and Product Order. [Mplify164 R25]

11.13 Guaranteed Bandwidth

Applicable Variants: All

The value of this Product Attribute is the bandwidth level that can be sustained by the Buyer on a continual basis with a very high probability of successful packet delivery. This parameter is required for Dedicated Internet Access and is less often used for Broadband Internet Access. The value of this Product Attribute is provided with the *BiDirSimpleBandwidth* type (see Figure 18)

[R20] The value of *guaranteedBandwidth* for each direction **MUST** be less than or equal to the value of *bandwidth* for the corresponding direction. [Mplify164 R26]

[R21] The value of *guaranteedBandwidth* **MUST** be provided for POQ, Quote, and Product Order for Dedicated Internet Access Products. [Mplify164 R27]

11.14 Billing Model

Applicable Variants: All

The value of this Product Attribute allows the Buyer to indicate how they would like the Product billed. Although the charge for the Product Attribute depends on the values of many Product Attributes, it is based primarily on the bandwidth-related Product Attributes described in sections 11.12 and 11.13. Three models are defined.

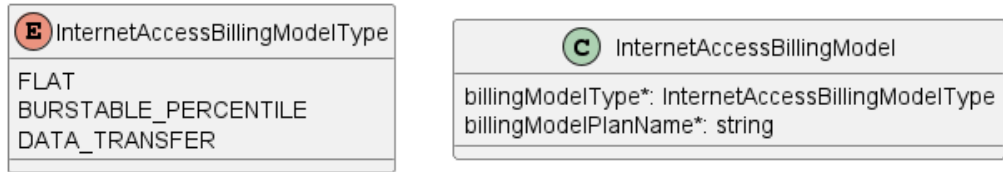


Figure 19 Internet Access Billing Model

The *billingModeType* values are defined as follows:

FLAT billing is a recurring amount for a fixed time for a nominal amount of bandwidth. For example, \$30.00 per month for broadband Internet Access at 400 Mbps is a flat billing amount. For Dedicated Internet Access, this would be the maximum bandwidth available to the Buyer.

BURSTABLE_PERCENTILE billing is a recurring amount for a committed amount of bandwidth, the Burstable Bandwidth. For example, €20.00 per month for 400 Mbps of committed bandwidth and an additional amount per month for burstable bandwidth above that amount. The Burstable Percentile specifies how this value is determined. A common value for this is 95 (95th Percentile).

DATA_TRANSFER is based on the amount of data rather than the rate. For example, during each data transfer period, this cost is \$10 per 10GB up to 100GB, and \$20.00 per 10GB for the next 500GB, and \$40 per 1GB for all additional data transfer. The value of the data transfer tiers parameter specifies a list of values that describe each of these tiers. In the example above, there would be three entries, (10GB, 100GB), the second would be (10GB, 500GB), and the third would be (1GB, 0GB).

[R22] The value of *billingModel* **MUST** be specified for Quote and Product Order. [Mplify164 R28]

Editor Note 2: Billing model overlaps and enhances the standard Pricing model covered by Quote API. This model does not incorporate the full list of attributes defined by Mplify 164, to avoid complicating the implementation by deriving from the standard pricing process. It is assumed that Quote API will be enhanced to support new requirements.

The examples below show a proposal for using the existing Quote Price data model to represent particular types of billing:

Flat Billing:

```

[
  {
    "name": "Monthly Flat Rate",
    "description": "Standard recurring charge for the service",
    "priceType": "recurring",
    "price": {
      "dutyFreeAmount": {
        "unit": "USD",
        "value": 100.0
      }
    }
  }
]

```

```

    },
    "taxIncludedAmount": {
      "unit": "USD",
      "value": 108.0
    },
    },
    "taxRate": 8.0
  },
  "recurringChargePeriod": {
    "amount": 1,
    "units": "months"
  }
}
},
{
  "name": "Installation Charge",
  "description": "A one time installation charge",
  "priceType": "nonRecurring",
  "price": {
    "dutyFreeAmount": {
      "unit": "USD",
      "value": 150.0
    },
    },
    "taxIncludedAmount": {
      "unit": "USD",
      "value": 162.0
    },
    },
    "taxRate": 8.0
  }
}
]

```

Burstable Billing:

```

[
  {
    "name": "Monthly Flat Rate",
    "description": "Standard recurring charge for the service",
    "priceType": "recurring",
    "price": {
      "dutyFreeAmount": {
        "unit": "USD",
        "value": 100.0
      },
      },
      "taxIncludedAmount": {
        "unit": "USD",
        "value": 108.0
      },
      },
    }
  ]

```

```

    "taxRate": 8.0
  },
  "recurringChargePeriod": {
    "amount": 1,
    "units": "months"
  }
},
{
  "name": "Burstable Bandwidth",
  "description": "A charge applied when burstable percentile of 95 is exceeded
above the committed bandwidth",
  "priceType": "usageBased",
  "unitOfMeasure": "95 percentile",
  "price": {
    "dutyFreeAmount": {
      "unit": "USD",
      "value": 50.0
    },
    "taxIncludedAmount": {
      "unit": "USD",
      "value": 54.0
    },
    "taxRate": 8.0
  }
}
]

```

Data Transfer Billing:

```

[
  {
    "name": "Data Transfer Tier 1",
    "description": "A charge of $10 per 10GB up to 100GB",
    "priceType": "usageBased",
    "unitOfMeasure": "10 GBYTES",
    "price": {
      "dutyFreeAmount": {
        "unit": "USD",
        "value": 10.0
      },
      "taxIncludedAmount": {
        "unit": "USD",
        "value": 10.8
      },
      "taxRate": 8.0
    }
  }
]

```

```

    },
    {
      "name": "Data Transfer Tier 2",
      "description": "A charge of $20.00 per 10GB for the next 500GB",
      "priceType": "usageBased",
      "unitOfMeasure": "10 GBYTES",
      "price": {
        "dutyFreeAmount": {
          "unit": "USD",
          "value": 20.0
        },
        "taxIncludedAmount": {
          "unit": "USD",
          "value": 21.6
        },
        "taxRate": 8.0
      }
    }
  ],
  {
    "name": "Data Transfer Tier 3",
    "description": "A charge of $40.00 per 1GB for any usage above 500GB",
    "priceType": "usageBased",
    "unitOfMeasure": "1 GBYTES",
    "price": {
      "dutyFreeAmount": {
        "unit": "USD",
        "value": 40.0
      },
      "taxIncludedAmount": {
        "unit": "USD",
        "value": 43.2
      },
      "taxRate": 8.0
    }
  }
]

```

11.15 Local Network Addresses

Applicable Variants:

- Broadband Internet Access, Advanced
- Dedicated Internet Access, with router

The Local Network Addresses attribute is used when the Seller is responsible for assigning Private Local Network Addresses for the Buyer's Network (see Mplify 164 [18] section 11.3). The value

of Product Attribute specifies the private address block to be assigned to the Buyer’s IP hosts, whether DHCP and NAT are used, and if so, parameters necessary to configure the DHCP and NAT servers.

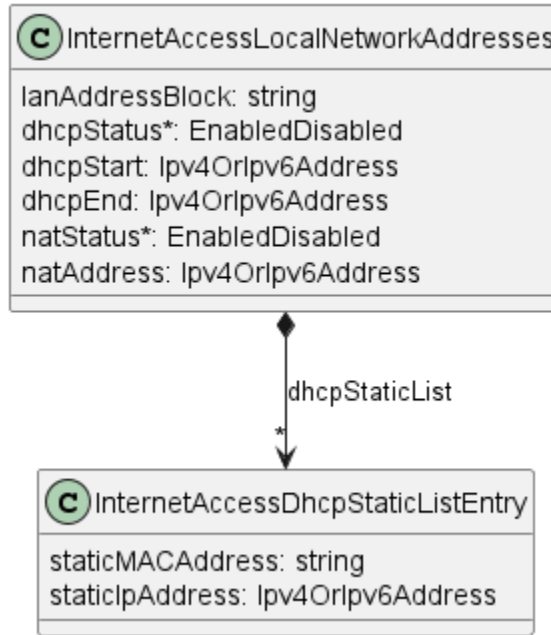


Figure 20 Local Network Addresses

Name	Type	M/O	Description
lanAddressBlock	string	O	IP address range, specified in CIDR notation.
dhcpStatus	EnabledDisabled	M	Indicates whether the Buyer wants the Seller to provide a DHCP Service.
dhcpStart	Ipv4OrIpv6Address	O	Start of the DHCP address range. This is the first address in the range that can be assigned to a device. IPv4 or IPv6 address.
dhcpEnd	Ipv4OrIpv6Address	O	End of the DHCP address range. This is the last address in the range that can be assigned to a device. IPv4 or IPv6 address.
dhcpStaticList	InternetAccess-DhcpStaticListEntry[]	O	A list of static IP addresses that are reserved for specific devices in the network. Each entry in the list is a string representing an IPv4 or IPv6 address.
natStatus	EnabledDisabled	M	Indicates whether the Seller is providing a NAT Service
natAddress	Ipv4OrIpv6Address	O	An IP address if `natStatus` is Enabled. This is the single IP Address

Table 26 LocalNetworkAddresses

[R23] The *localNetworkAddresses* **MUST** be provided in the Product Order if and only if the Seller is responsible for managing Local Network Addresses for the Buyer. [Mplify164 R33]

[R24] For POQ, Quote, and Product Order, the Buyer **MUST** include a value for the *dhcpStatus* and *natStatus* parameters. [Mplify164 R34]

- [R25] For Product Order, the Buyer **MUST** include the following: [Mplify164 R35]
- *lanAddressBlock*
 - *dhcpStart*, *dhcpEnd*, and *dhcpStaticList* if *dhcpStatus* is *Enabled*
- [R26] Values for *dhcpStart*, *dhcpEnd*, and *dhcpStaticList* **MUST NOT** be provided if the value of *dhcpStatus* is *Disabled*. [Mplify164 R36]

Requirement [R26] ensures that values for DHCP parameters are specified only if the Seller is providing DHCP.

- [R27] If the value of *dhcpStatus* is *ENABLED*, the IP addresses specified as values of *dhcpStart* and *dhcpEnd*, and any IP address specified in the *staticIpAddress* element of the *dhcpStaticList*, **MUST** be in the block of IP Addresses specified by *lanAddressBlock*. [Mplify164 R37]
- [R28] If the value of *dhcpStatus* is *ENABLED*, the IP address specified in the value of *dhcpEnd* **MUST** be numerically greater than the IP address specified in the value of *dhcpStart*. [Mplify164 R38]
- [R29] The value of *natAddress*, if specified, **MUST** be one of the Public Addresses used to access the Buyer's network. [Mplify164 R39]

Example:

```

"localNetworkAddresses": {
  "lanAddressBlock": "10.0.0.0/24",
  "dhcpStatus": "ENABLED",
  "dhcpStart": "10.0.0.10",
  "dhcpEnd": "10.0.0.200",
  "dhcpStaticList": [
    {
      "staticMACAddress": "00:11:22:33:44:55",
      "staticIpAddress": "10.0.0.50"
    },
    {
      "staticMACAddress": "00:11:22:33:44:66",
      "staticIpAddress": "10.0.0.51"
    }
  ],
  "natStatus": "ENABLED",
  "natAddress": "203.0.113.5"
}

```

11.16 Provider Independent IP Addresses

Applicable Variants:

- Broadband Internet Access, Advanced

- Dedicated Internet Access with and without router

This Product Attribute indicates whether the Buyer is using Public (WAN) IP addresses routable over the Internet purchased directly from a registration authority for Internet Access or Public IP addresses obtained from the Seller.

Type: *EnabledDisabled*

ENABLED, meaning that the Buyer is providing the addresses

DISABLED, meaning that the Seller is providing the addresses

11.17 Autonomous System Number

Applicable Variants:

- Broadband Internet Access, Advanced
- Dedicated Internet Access, with and without router

An autonomous system (AS) is a collection of connected Internet Protocol (IP) routing prefixes under the control of one or more network operators on behalf of a single administrative entity or domain, that presents a common and clearly defined routing policy to the Internet. If the Buyer is providing the Internet-routable IP Addresses (see 11.16) then this Product Attribute is required to be specified. The value of this Product Attribute has two parameters, the type of Autonomous System and the Autonomous System Number (ASN).

Name	Type	M/O	Description
asnType	AsnType	M	The type of the ASN.
asnId	FourOctetInteger	O	ASN Id. This MUST be provided if the value of asnType is `PUBLIC`

Table 27 Autonomous System Number

- [D2]** If the value of the *providerIndependentIpAddresses* is *ENABLED*, the *autonomousSystemNumber* **SHOULD** be specified. [Mplify164 D2]
- [R30]** When specifying the *autonomousSystemNumber*, the value of *asnType* **MUST** be provided. [Mplify164 R40]
- [R31]** If the value of the *asnType* is *PUBLIC*, then the *asnId* **MUST** be provided by the Buyer. [Mplify164 R41]

11.18 IP Address Type

Applicable Variants:

- Broadband Internet Access, Advanced
- Dedicated Internet Access, with and without router

The value of this Product Attribute indicates whether the publicly routable IP address block consists of fixed addresses or addresses that can change over time.

Value
STATIC
DYNAMIC

Table 28 InternetAccessIpAddressType

- [R32] The *ipAddressType* **MUST** be specified for Quote and Product Order. [Mplify164 R42]
- [R33] If the value of the *providerIndependentIpAddresses* is *ENABLED*, the value of the *ipAddressType* **MUST** be *STATIC*. [Mplify164 R43]

11.19 Public Addresses Prefix Length

Applicable Variants:

- Broadband Internet Access, Advanced
- Dedicated Internet Access, with and without router

If the Seller is providing the Public Addresses for the Internet Access Product (i.e., the value of the *providerIndependentIpAddresses* is *DISABLED*) then the value of this Product Attribute specifies the size of the IPv4 address block and the IPv6 address block requested by the Buyer and provided by the Seller. The value of this Product Attribute has two parameters: a string that indicates the length (in bits) of the network mask for the IPv4 address block and a string that indicates the length of the network mask for the IPv6 address block. By extension, these strings indicate the length of the host mask for each address block.



Figure 21 Public Addresses Prefix Length

The values */32* and */128*, respectively, indicate a host route, i.e., a single IP address. This is common for Basic Internet Access and Advanced Internet Access. The value *NONE* indicates that no addresses should be allocated for the specified IP version.

- [R34]** If the value of the *providerIndependentIpAddresses* is *ENABLED*, the *publicAddressesPrefixLength* **MUST NOT** be provided. [Mplify164 R44]
- [R35]** If the value of the *providerIndependentIpAddresses* is *DISABLED*, *publicAddressesPrefixLength* **MUST** be provided for Quote and Product Order. [Mplify164 R45]
- [R36]** If the *publicAddressesPrefixLength* is provided, values **MUST** be specified for both *ipv4* and *ipv6*. [Mplify164 R46]
- [R37]** If the value of the *providerIndependentIpAddresses* is *DISABLED*, at least one of the parameters of *providerIndependentIpAddresses* (*ipv4* or *ipv6*) **MUST NOT** have the value *NONE*. [Mplify164 R47]

11.20 Public Address Block

Applicable Variants:

- Broadband Internet Access, Advanced
- Dedicated Internet Access, with and without router

If the Buyer is providing the WAN (public) addresses for the Internet Service (i.e., the value of the *providerIndependentIpAddresses* is *ENABLED*), then this Product Attribute fully specifies the blocks (IPv4 or IPv6) of public addresses used by the Buyer, e.g., *72.23.28.248/29*.

Name	Type	M/O	Description
ipv4	string	M	IPv4 Address Block in CIDR notation or `NONE`
ipv6	string	M	IPv6 Address Block in CIDR notation or `NONE`

Table 29 InternetAccessPublicAddressBlock

- [R38]** If the value of the *providerIndependentIpAddresses* is *DISABLED*, the *publicAddressBlock* **MUST NOT** be provided. [Mplify164 R48]
- [R39]** If the value of the *providerIndependentIpAddresses* is *ENABLED*, the *publicAddressBlock* **MUST** be specified for Quote and Product Order. [Mplify164 R49]
- [R40]** If the *publicAddressBlock* attribute is provided, values **MUST** be specified for both *ipv4* and *ipv6*. [Mplify164 R50]
- [R41]** If the value of *providerIndependentIpAddresses* is *ENABLED*, at least one of the components of the *publicAddressesPrefixLength* (*ipv4* or *ipv6*) **MUST NOT** have the value *NONE*. [Mplify164 R51]

11.21 Transit Addresses

Applicable Variants:

- Dedicated Internet Access, with and without router

Internet Access Transit Addresses Prefix Length Product Attribute specifies the size of the IPv4 address block and the IPv6 address block used for Transit Addresses (see Mplify 164 [18] section 11.2) in the Seller’s network to access the Buyer’s Public Addresses. The value of this Product Attribute allows the Buyer to specify the number of Transit Addresses (IPv4 and IPv6) that it wants the Seller to allocate and the Seller to return the Transit Address blocks allocated by the Seller to the Buyer.

C InternetAccessTransitAddresses

requestedIpv4TransitAddressPrefixLength: InternetAccessIpv4TransitAddressPrefixLength
 requestedIpv6TransitAddressPrefixLength: InternetAccessIpv6TransitAddressPrefixLength
 serviceProviderIpv4TransitAddress: string
 serviceProviderIpv6TransitAddress: string

E InternetAccessIpv4TransitAddressPrefixLength

/24
/25
/26
/27
/28
/29
/30
/31
/32
NONE

E InternetAccessIpv6TransitAddressPrefixLength

/120
/124
/128
NONE

Figure 22 Internet Access Transit Addresses

Name	Type	M/O	Description
requestedIpv4TransitAddressPrefixLength	InternetAccessIpv4TransitAddress-PrefixLength	O	IPv4 Transit Address Prefix Length
requestedIpv6TransitAddressPrefixLength	InternetAccessIpv6TransitAddress-PrefixLength	O	IPv6 Transit Address Prefix Length
serviceProviderIpv4TransitAddress	string	O	IPv4 address block, specified in CIDR notation or NONE
serviceProviderIpv6TransitAddress	string	O	IPv6 address block, specified in CIDR notation or NONE

Table 30 InternetAccessTransitAddresses

A common case is that the Buyer requests a single IPv4 Transit Address (by specifying the value /32 for *ipv4TransitAddressPrefixLength*) and the Seller responds with a single IPv4 address (e.g., 71.71.32.32/32 for the *ipv4TransitAddressBlock*).

Example:

```
"transitAddresses": {
  "requestedIpv4TransitAddressPrefixLength": "/30",
  "requestedIpv6TransitAddressPrefixLength": "/124",
  "serviceProviderIpv4TransitAddress": "198.51.100.8/30",
  "serviceProviderIpv6TransitAddress": "2001:db8:0:1::/124"
}
```

12 References

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- [2] IETF RFC 2119, Key words for use in RFCs to Indicate Requirement Levels, March 1997
- [3] IETF RFC 8174, Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words, May 2017
- [4] MEF 55.1, Lifecycle Service Orchestration (LSO): Reference Architecture and Framework, January 2021
- [5] MEF 55.1.1 Amendment to MEF 55.1: Reference Architecture and Framework - Terminology, June 2023
- [6] MEF 57.2 Product Order Management Requirements and Use Cases, October 2022
- [7] MEF 61.1, IP Service Attributes, May 2019
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- [9] Mplify 79.1, Product Offering Qualification Management, Requirements and Use Cases, June 2025
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[18] Mplify 164, Internet Access Product Attributes and Use Cases, February 2026

Appendix A Acknowledgements

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

- Javier **LECANDA**
- Michał **ŁACZYŃSKI**
- Ettore **PULIERI**

Appendix B Usage examples (Informative)

This appendix aims to provide an extensive set of examples to cover:

- configurations for each Internet Access product
- basic all APIs steps walkthrough to order an Internet Access product
- modification Use Cases
- deletion of products

The full examples are delivered as a Postman collection file available at:

- [documentation/productSchema/ip/internetAccess/Mplify 139.1 – Appendix A.postman_collection.json](#)

B.1 High-Level flow

The Cantata and Sonata Interface Reference Points are composed of a set of APIs that serve distinct functions within the end-to-end flow. Figure 31 shows all of the tasks and their sequence.



Figure 23 Cantata and Sonata End-to-End Function Flow

- Address Validation - allows the Buyer to retrieve address information from the Seller, including exact formats, for addresses known to the Seller.
- Site Retrieval - allows the Buyer to retrieve Service Site information, including exact formats for Service 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 service 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 existing Product instances from the 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 that are not part of the normal operations of the Product provided by the Seller.

All the above-mentioned APIs are provided in the SDK together with accompanying Developer Guides. Please refer to those documents for more details and examples of functional APIs.

B.2 Integration of product specifications into the APIs.

The above-mentioned APIs are product-agnostic in the sense that they serve as a business interaction level between the Buyer and the Seller, and they do not contain any product-specific information in their specifications. In order to pass the product-specific information, an extension pattern must be used. This applies to four APIs that carry product-specific information: POQ, Quote, Product Order, and Product Inventory.

The extension hosting type in the API data model is *MEFProductConfiguration*. The *@type* attribute of that type must be set to a value that uniquely identifies the product specification (Figure 24). A unique identifier for the Mplify standard product specifications is in URN format and is assigned by Mplify. This identifier is provided as the root schema *sid* and in product specification documentation. In case of Internet Access, this will be one of:

- urn:mef:lso:spec:cantata-sonata:internet-access:v1.0.0:all

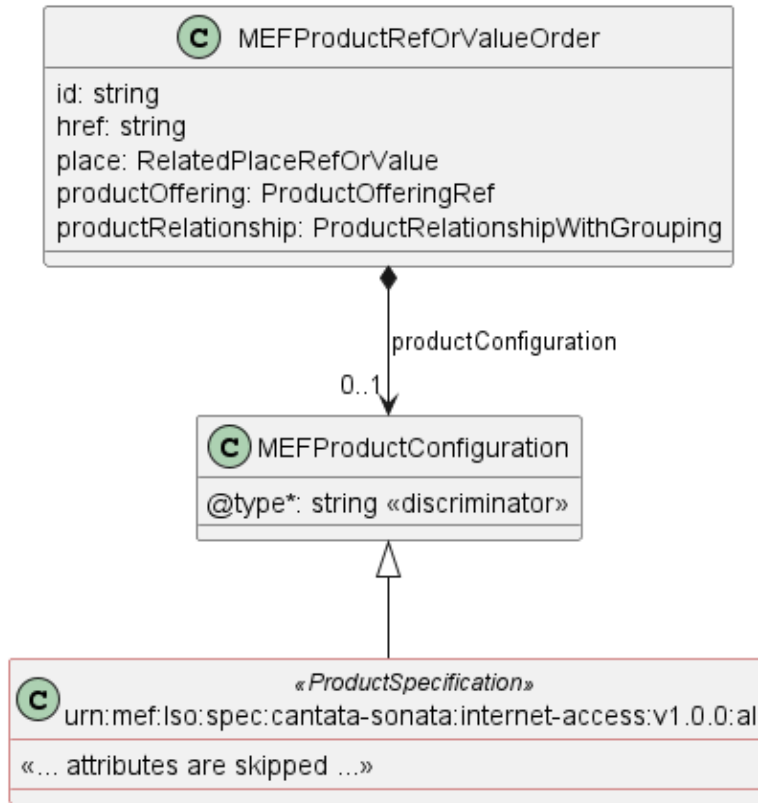
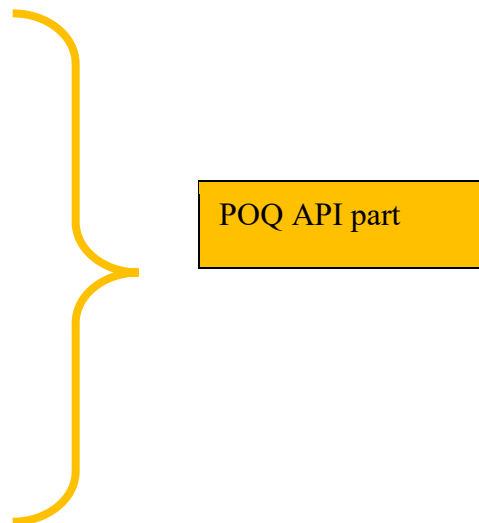


Figure 24 The Extension Pattern

Product specifications are provided by Mplify as JSON schemas without the *MEFProductConfiguration* context. Product-specific attributes are introduced via the *MEFProductRefOrValue*. This entity has the *productConfiguration* attribute of type *MEFProductConfiguration* which is used as an extension point for product-specific attributes. The example result of such binding in a request may look like this (for POQ):

```

{
  "externalId": "BuyerPoq-00001",
  "instantSyncQualification": false,
  "provideAlternative": true,
  "projectId": "BuyerProject1",
  "productOfferingQualificationItem": [
    {
      "action": "add",
      "id": "item-00001",
      "product": {
        "productOffering": {
          "id": "BroadbandBasicOffering-0001"
        }
      }
    }
  ],
}
  
```



```

"productConfiguration": {
  "@type": "urn:mef:iso:spec:cantata-sonata:internet-access:v1.0.0:all",
  "variant": "BROADBAND_BASIC",
  "deliveryMechanism": "DEMARCATIION_ONLY",
  "serviceAccessInterfaceType": {
    "physicalInterface": [
      {
        "physicalLayer": "1000BASE-T",
        "connectorType": "RJ45"
      }
    ],
    "resiliency": "NONE"
  },
  "features": {},
  "bandwidth": {
    "downstream": {
      "irValue": 100,
      "irUnits": "MBPS"
    },
    "upstream": {
      "irValue": 20,
      "irUnits": "MBPS"
    }
  },
  "billingModel": {
    "billingModelType": "FLAT",
    "billingModelPlanName": "Broadband Basic Monthly"
  }
}
}
}
]
}

```



B.3 action: add

This section guides through all the steps of Sonata and Cantata APIs that need to be performed in order to order an Internet Access product successfully.

Note: Sellers are free to mandate some of these steps.

As the examples of particular steps in many cases will replicate the product-specific information, in some of the snippets some parts of it will be omitted for better readability.

There are common rules for all request items for creation requests (POQ, Quote, Order):

- *item.action* must be set to *add*
- *item.product.id* must not be provided
- *product.productConfiguration* must contain full desired configurations.

B.3.1 Use Case 1: Address Validation

For detailed guidance on how to use the Address Validation API, please refer to Mplify 121.1 [15].

The first step of the process is Address Validation. This step aims to align the address representation between the Buyer and the Seller. This is to overcome the very common problem of different address representations in various countries and systems. The Buyer sends a representation of the address intended to be used in subsequent steps (most likely the installation place). The question is: “Dear Seller, do you recognize and understand this address?” The Seller provides a response where, in the *bestMatchGeographicAddress* (if found), a matching address is provided with an Identifier that can be used in further steps to avoid the need for Address resolution at each of them. The Seller’s response might come with some enhancements in the Address. Additionally, the Seller may provide alternatives if there is no clear match. It is up to the Seller’s discretion what makes the best match and an alternative.

It is not mandatory for the Seller to provide the Identifier of the returned Address, yet it is highly recommended.

In the request, the Buyer provides one or more of 4 possible representations of the Address: *FieldedAddressRepresentation*, *FormattedAddressRepresentation*, *LabelRepresentation*, or *GeographicPointRepresentation*. The following figure and snippet present an example request:

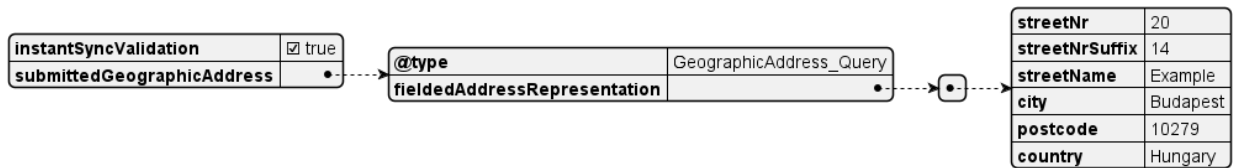


Figure 25 Address Validation Request

Example Address Validation Request:

```
{
  "instantSyncValidation": true,
  "submittedGeographicAddress": {
    "@type": "GeographicAddress_Query",
    "fieldedAddressRepresentation": [
      {
        "streetNr": "20",
        "streetNrSuffix": "14",
        "streetName": "Example",
        "city": "Budapest",
        "postcode": "10279",
        "country": "Hungary"
      }
    ]
  }
}
```

```
}
}
```

In the response, the Seller repeats the submitted address representations for reference and populates the *bestMatchGeographicAddress* and/or the *alternateGeographicAddress*. In the example, the Seller matches the best match address, which has a little more detail than the one in the request. The Seller also provides the address Identifier (*BudapestAddress-id-1*) that the Buyer will refer to in later steps.

The identifiers will most likely be some kind of technical identifier (like UUID) to provide uniqueness. In all examples, the identifiers are shortened and made human-readable to make it easier to read and match across the Use Cases.

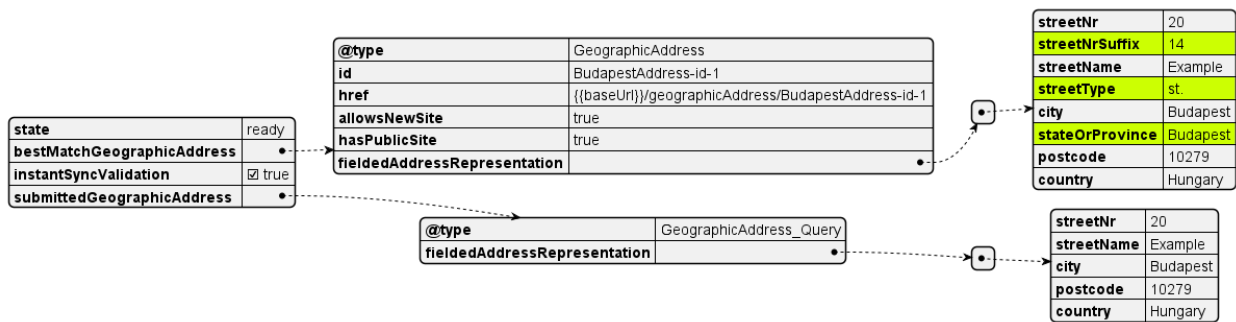


Figure 26 Address Validation response

Seller’s response:

```
{
  "state": "ready",
  "bestMatchGeographicAddress": {
    "@type": "GeographicAddress",
    "id": "BudapestAddress-id-1",
    "href": "{{baseUrl}}/geographicAddress/BudapestAddress-id-1",
    "allowsNewSite": "true",
    "hasPublicSite": "true",
    "fieldedAddressRepresentation": [
      {
        "streetNr": "20",
        "streetNrSuffix": "14",
        "streetName": "Example",
        "streetType": "st.",
        "city": "Budapest",
        "stateOrProvince": "Budapest",
        "postcode": "10279",
        "country": "Hungary"
      }
    ]
  }
},
```

```
"instantSyncValidation": true,
"submittedGeographicAddress": {
  "@type": "GeographicAddress_Query",
  "fieldedAddressRepresentation": [
    {
      "streetNr": "20",
      "streetName": "Example",
      "city": "Budapest",
      "postcode": "10279",
      "country": "Hungary"
    }
  ]
}
```

B.3.2 Use Case 2: POQ - Broadband Internet Access, Basic

For detailed guidance on how to use the Product Offering Qualification (POQ) API, please refer to Mplify 87.1 [12].

The Product Offering Qualification step is designed for the Buyer to ask the question “Dear Seller, are you able to provide a certain product (based on *productOffering*) with specific configuration (provided as *productConfiguration*) at a given location?” The Seller responds with one of the qualification confidences:

- *green* - the Seller has high confidence that this Product can be delivered,
- *yellow* - the Seller believes they can deliver the Product, but is not highly confident,
- *red* - the Seller cannot deliver the Product as specified.

In case of *yellow* or *red*, the Seller may additionally return (if requested) an *alternativeProductOfferingProposal*, that might alternatively fulfill the Buyer’s needs.

It is very important to understand the pattern of integrating the product-specific configuration with the functional product-agnostic API, like POQ. As explained in Chapter 11.1, the Internet Access comes in four Variants that differ in the use of place and product relationships.

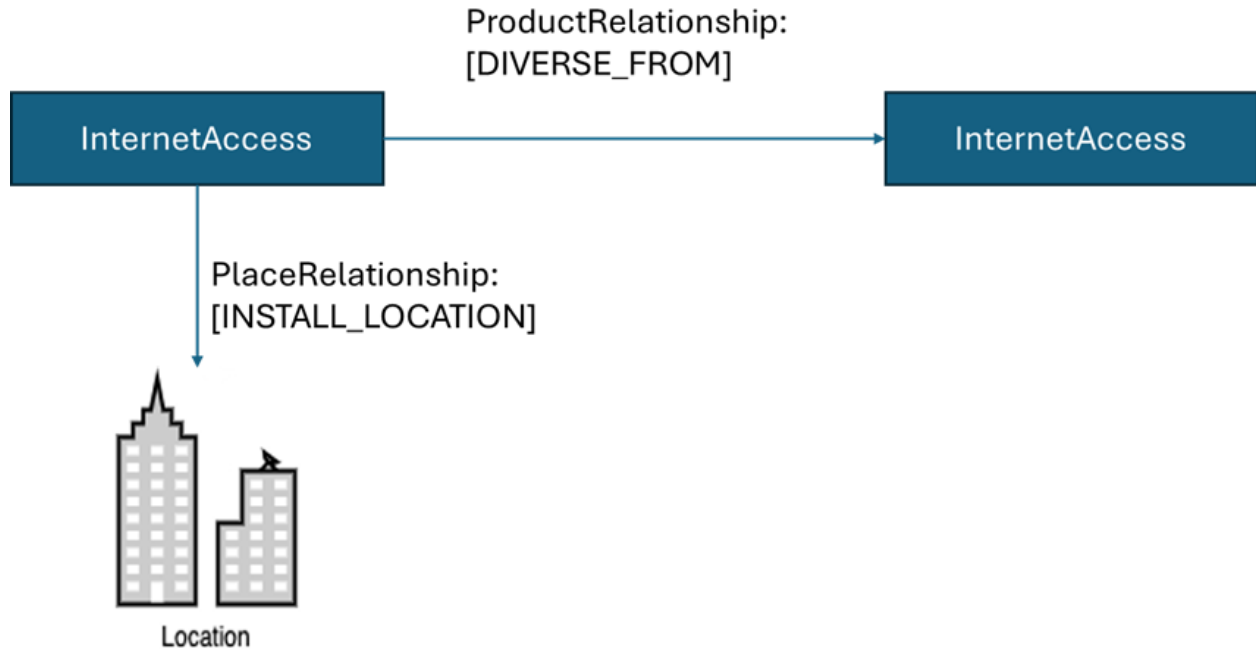


Figure 27 Broadband Internet Access Topology

The Broadband Variants use the *PlaceRelationship* to refer to an installation place. This reference points on instance of a Geographic Address, which was validated in the previous step. There is no Service Access Interface Product instance ordered and present in the Product Inventory.

All Variants, except for Broadband Basic, can use the Facility Diversity feature to point to other instances of Internet Access Product that demand not to have any joint point of failure with. This dependency is defined with the use of *ProductRelationship* with *relationshipType* of *DIVERSE_FROM*.

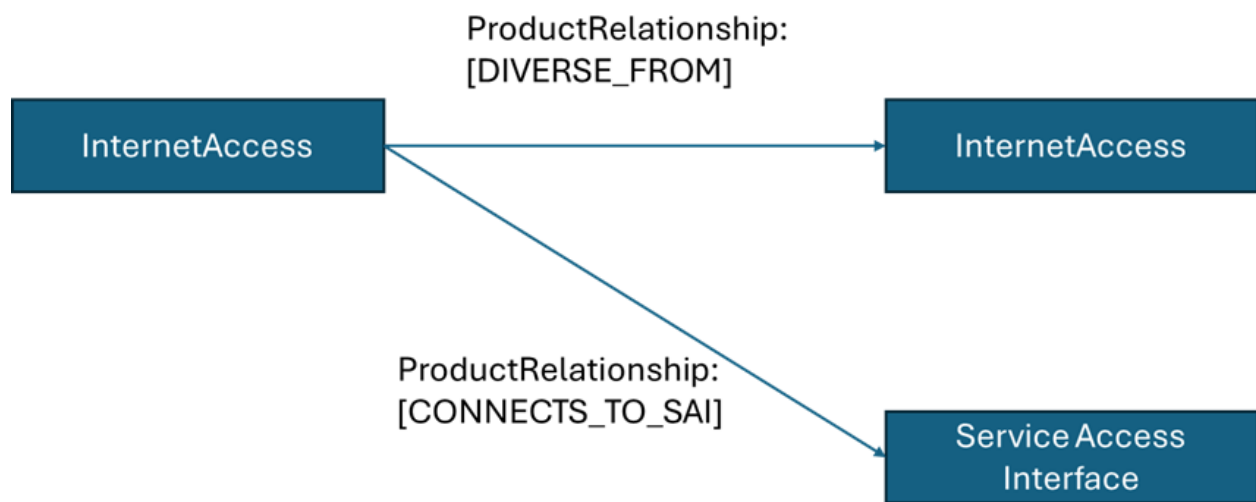


Figure 28 Dedicated Internet Access Topology

Dedicated Internet Access Variants depending on the Service Access Interface being present and refer to it with the use of *ProductRelationship* with *relationshipType* of *CONNECTS_TO_SAI*.

The information about one single product is carried within the POQ API by a single *productOfferingQualificationItem* being subject to qualification. One POQ Request can carry more than one POQ Items, that may or may not be related to each other.

There are 2 ways to reference products:

- existing Products - present in the Product Inventory at the moment of issuing the request, to which the Buyer has the *product.id*. These must be referenced by *productOfferingQualificationItem.product.productRelationship* with appropriate *product.id* and *relationshipType*. Product Specification defines what relationship types must be used during referencing other products.
- newly created or modified products - the ones being created or modified by other POQ Item in the same POQ request, so there is a relation between the Items within a POQ. These must be referenced using the *productOfferingQualificationItem.qualificationItemRelationship* by the target Item *id* and the *relationshipType*.

Whenever this document uses the term *ProductRelationship*, it assumes use of any of the two above, depending on the context.

An instance diagram in Figure 29 shows an extracted part from the POQ Request to present the most important attributes.

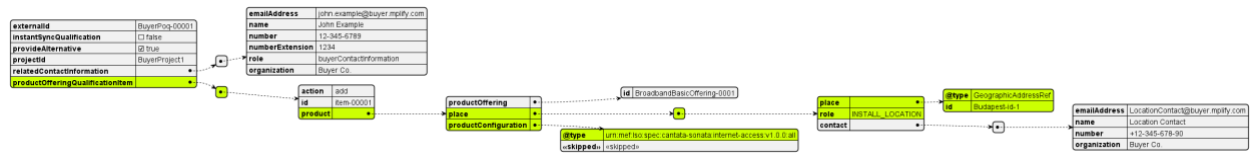


Figure 29 UC2: POQ Request, product-agnostic part

The green color highlights key aspects:

- there is only one *productOfferingQualificationItem*
- the type of the product is Internet Access:
- *urn:mef:iso:spec:cantata-sonata:internet-access:v1.0.0:all*
- the example is based on the Broadband Internet Access Basic, so it contains a *PlaceRelationship* to point to an Installation Place.
- the details of *productConfiguration* are for the sake of readability (*<<skipped>>*)

Figure 30 shows the configuration of Internet Access in the Broadband Basic Variant:

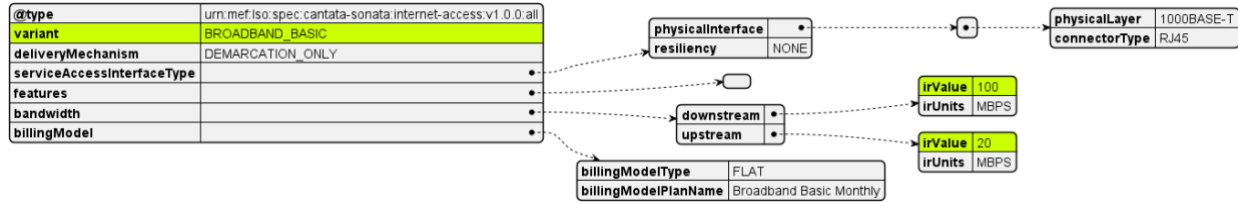


Figure 30 UC2: Broadband Internet Access, Basic - Configuration

This is a simple configuration with:

- A request for 1000BASE-T, RJ45 interface
- No features
- 100 MBPS downstream and 20 MBPS upstream
- FLAT billing model

B.3.3 Use Case 3: Quote - Broadband Internet Access, Basic

For detailed guidance on how to use the Quote Management API, please refer to Mplify 115.1 [13]. The aim of the Quote step is to allow the Buyer to submit a request to find out how much the installation of a new Product, an update to an existing Product, or a disconnect of an existing Product will cost, and what the term is.

This Use Case is the continuation of Use Case 2. It asks for a quotation for the installation of the Internet Access Broadband Basic Variant, with a configuration that was previously checked for availability.

The Quote API carries product information the same way as the POQ in terms of building the request from a list of items, referencing other products, referencing locations, and attaching the product information. The *product* part will be the same as in POQ and will not be discussed further in this chapter (<<skipped>>).

Figure 31 presents a diagram of a Quote request for the creation of Basic Internet Access, with product information skipped.

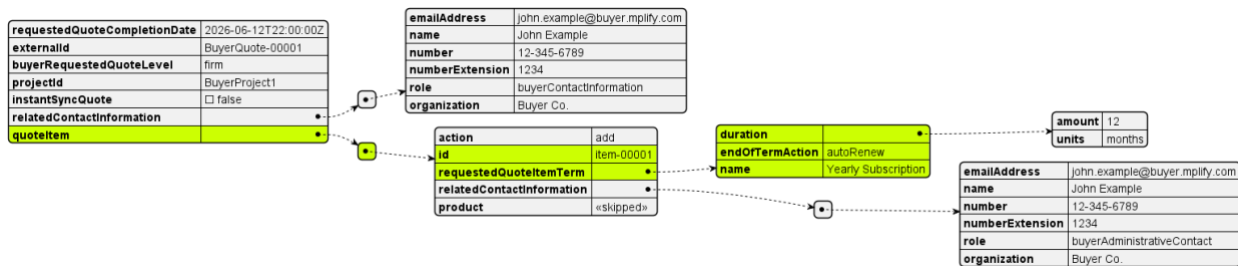


Figure 31 UC3: Quote Request, product-agnostic part

The most important attributes to set in the Quote request are:

- *instantSyncQuote* - to state the preference of receiving an instant (synchronous) response or a deferred (asynchronous) one. In the latter case, the Seller only sends back

an acknowledgment response and proceeds with the quotation. The Buyer may choose to register for notification or perform a periodical poll.

- *requestedQuoteCompletionDate* - If an instant response is not requested, this specifies the requested response time.
- *buyerRequestedQuoteLevel* - 3 different types of quotes are managed:
 - **Budgetary:** A Quote that is provided quickly and with very little analysis, such that the Buyer can get an idea of how much the requested Product Offering could cost. Any charges specified are subject to change.
 - **Firm - Subject to Feasibility Check:** A Quote that is provided to the Buyer based on some, but not a complete, pre-order analysis. At this stage, the Seller may not be willing to perform any further work on the Quote and requests that the Buyer use the Firm - Subject to Feasibility Check Quote to proceed to the Order process. Ordering is possible based on the Firm - Subject to Feasibility Check Quote with some stipulations as to how cost identified during delivery is addressed. The Monthly Recurring Charges specified in the Quote Response are final. Non-Recurring Charges specified in the Quote Response are subject to change and new Non-Recurring Charges may be identified during fulfillment.
 - **Firm:** A Quote provided to the Buyer based on complete pre-order analysis. All Monthly Recurring Charges and Non-Recurring Charges specified on a Firm Quote are committed. A Firm Quote may expire at some date specified by the Seller.
- *requestedQuoteItemTerm* - to specify the term (also known as commitment) – a yearly subscription with auto-renewal.

In the response, the Seller confirms (most likely) the *quoteLevel*, *quoteItemTerm*, and provides a price for each quote item. An example of price specification is shown below.

```
"quoteItemPrice": [
  {
    "name": "Monthly Plan 25",
    "priceType": "recurring",
    "recurringChargePeriod": "month",
    "price": {
      "taxRate": 16,
      "dutyFreeAmount": {
        "unit": "EUR",
        "value": 25,
      },
      "taxIncludedAmount": {
        "unit": "EUR",
        "value": 29,
      },
    },
  },
]
```

]

Note: The Seller may require the Buyer to perform a POQ prior to sending a Quote request.

B.3.4 Use Case 4: Product Order - Broadband Internet Access, Basic

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.

This Use Case is the continuation of Use Case 3. It places a Product Order for the installation of the Internet Access Broadband Basic product, which was qualified and quoted in Use Cases 2 and 3.

The Product Order API carries product information the same way as POQ and Quote in terms of building the request from a list of items, referencing other products, referencing locations, and attaching the product information. The *product* part will be the same as in the Quote and will not be discussed further in this chapter (<<skipped>>).

Figure 32 presents an example of a Product Order:

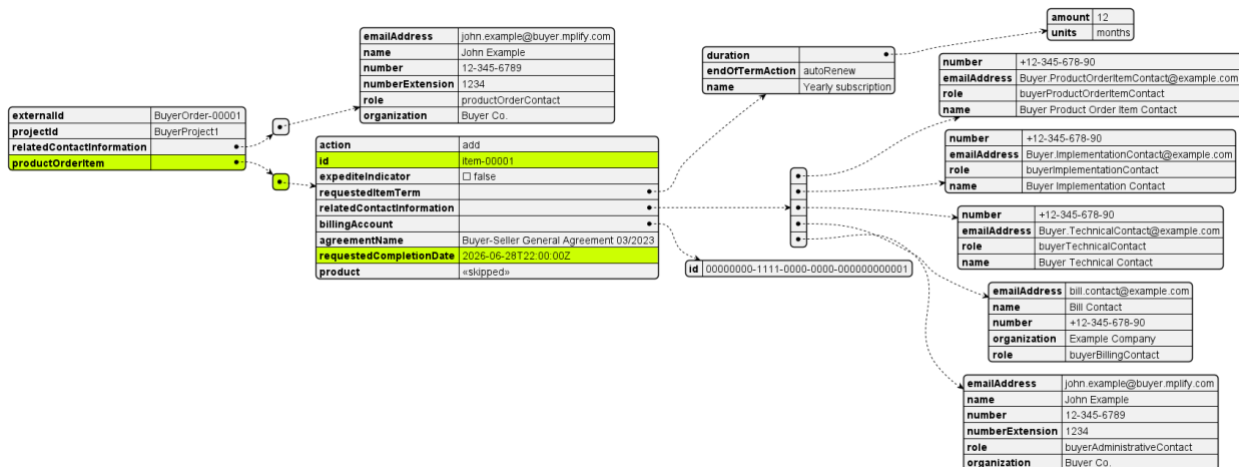


Figure 32 UC4: Product Order Request, product-agnostic part

The Seller responds with an acknowledgment confirmation and then starts processing the order. The order fulfillment process is longer than a simple request-response one of the previous steps (POQ, Quote), and the state machine is more complex. The process may also be more interactive due to charge negotiation, possible request updates, etc.

Product Order API offers many more Use Cases, such as updating, expediting, or canceling order requests, and additional charge negotiation. For detailed guidance on how to use the Product Order Management API, please refer to Mplify 123.1 [16].

B.3.5 Use Case 5: Product Order - Broadband Internet Access, Advanced

Product Order is the step where most of the attributes may or must be provided, so this is the step that is good to showcase all the discrepancies between all the Variants.

The Broadband Internet Access, Advanced provides a more detailed configuration compared to the Basic Variant. The product-agnostic part of the Request is (or may be) exactly the same, so the example below shows only the product-specific part, with the Advanced Variant added attributes highlighted.

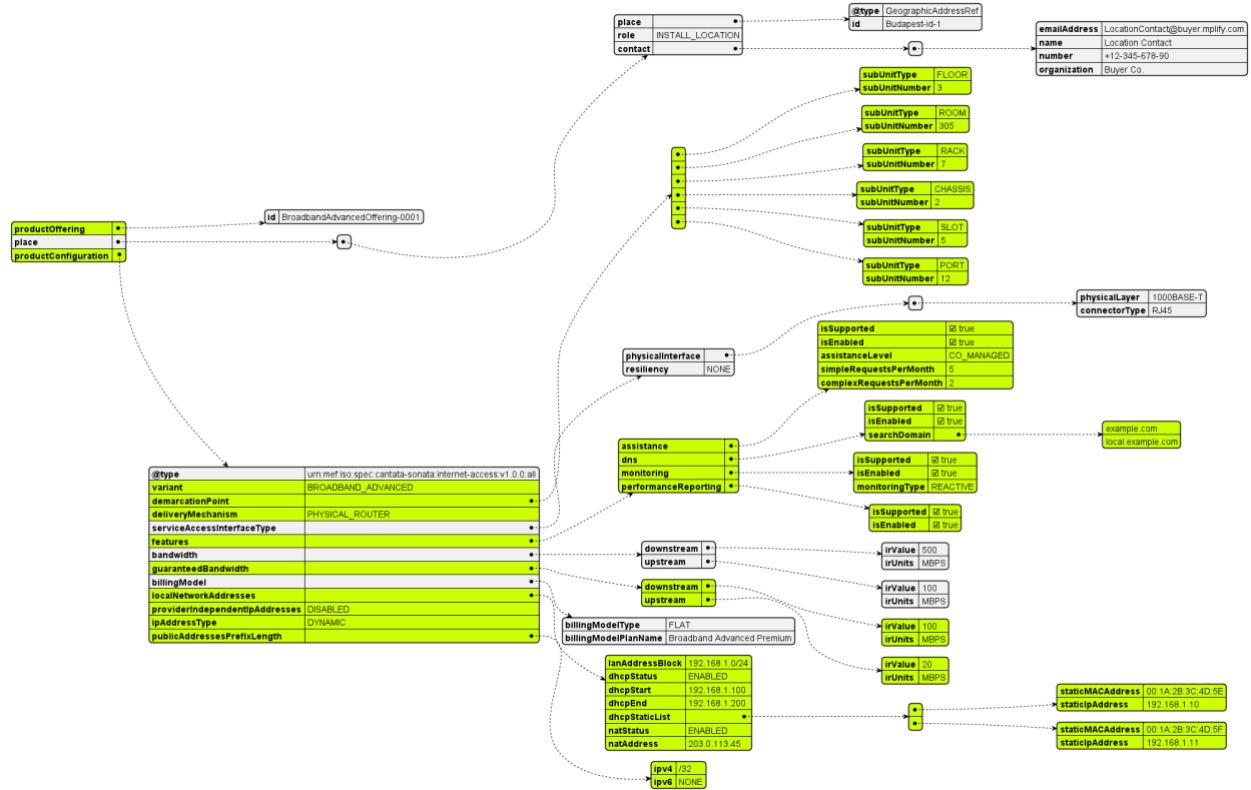


Figure 33 UC5: Broadband Internet Access, Advanced - Configuration

The main difference is the presence of values for attributes:

- *features*,
- *guaranteedBandwidth*
- *localNetworkAddresses*
- *providerIndependentIpAddresses*
- *ipAddressType*
- *publicAddressesPrefixLength*

B.3.6 Use Case 6: Product Order - Dedicated Internet Access, without Router

From the product topology point of view, the main difference between the Broadband and Dedicated Variants of Internet Access is that the Dedicated refers to an instance of the Service Access Interface product with a *productRelationship*. It must either already exist in the Product Inventory or be ordered prior to or together with Internet Access.

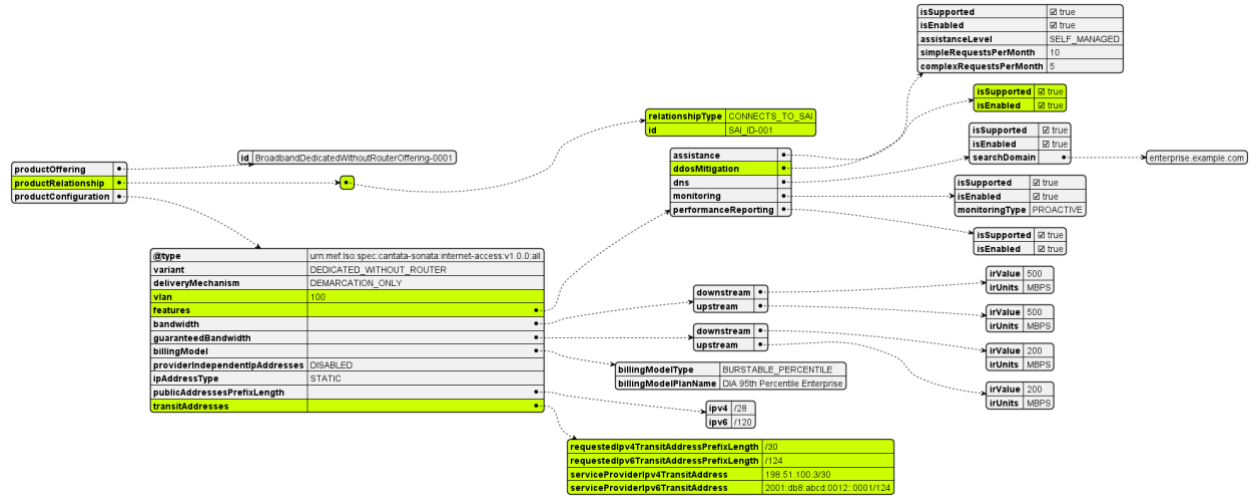


Figure 34 UC6: Dedicated Internet Access, without Router - Configuration

B.3.7 Use Case 7: Product Order - Dedicated Internet Access, with Router

In this example, a feature of *facilityDiversity* is enabled. It points to another instance of an Internet Access product, that it requires no common point of failure with. The relation is expressed with a *productRelationship*.

The difference with the “without Router” Variant configuration is highlighted in Figure 35 and Figure 36.

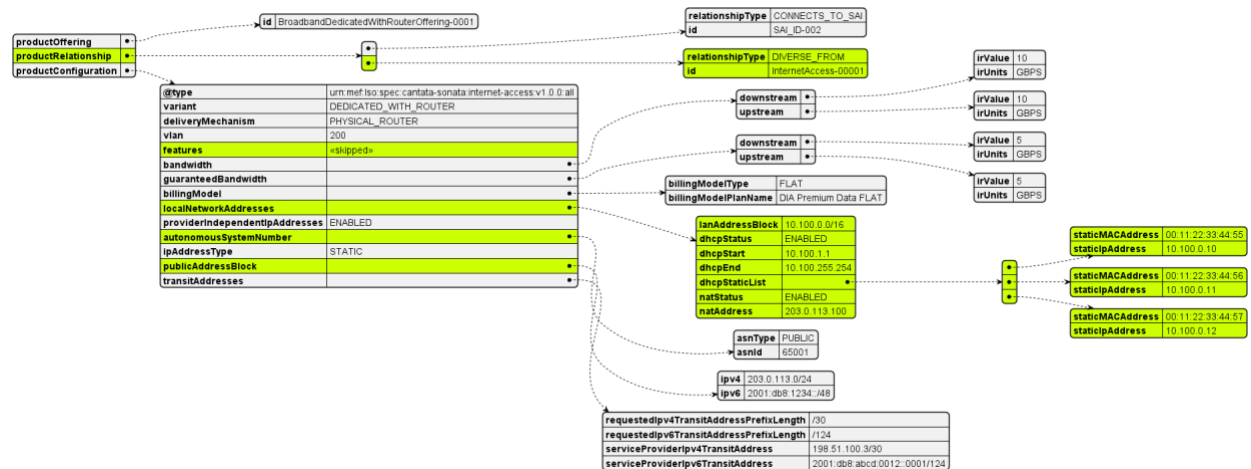


Figure 35 UC7: Dedicated Internet Access, with Router – Configuration

The details of *features* parameter are extracted to a separate figure. Notice that the *facilityDiversity* is enabled. This is the place that defines if the feature itself is enabled, and if it is, the avoided Internet Access product must be referred to with the use of *ProductRelationship* (per [R15]).

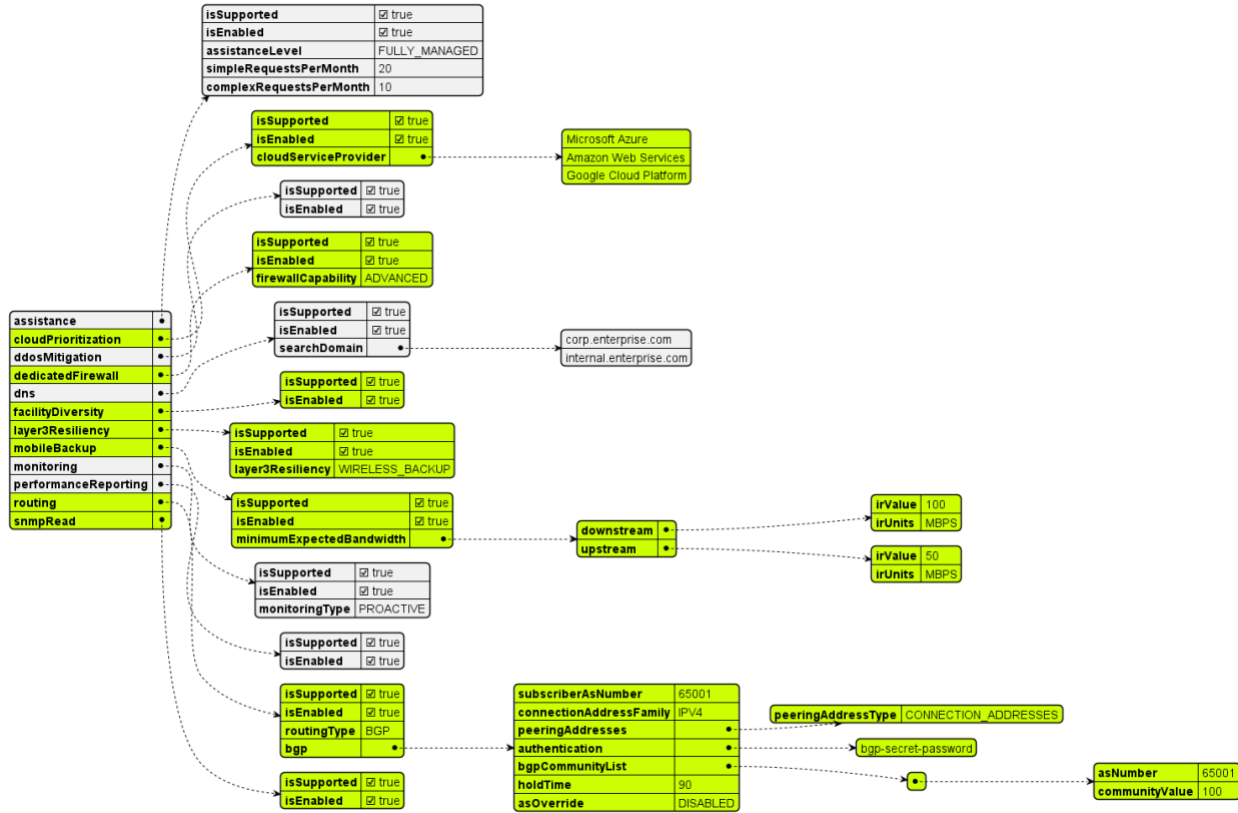


Figure 36 UC7: Dedicated Internet Access, with Router - Features

B.4 action: modify

The mechanism of building a modification request for both product-independent and product-specific parts for all steps are practically the same as for the create request.

The differences are in the following common rules (POQ, Quote, Order):

- *item.action* must be set to *modify*
- *item.product.id* of the product to be modified must be provided
- *product.productConfiguration* must contain all desired configuration (not only the modified values)
- The *place* and *productRelationship* lists must comply with the Product Specification requirements with regard to possibility of modification. It is allowed for Internet Access.

The Seller may decide which Product Attributes are modifiable by the Buyer.

B.4.1 Use Case 8: POQ - Dedicated Internet Access, without Router – bandwidth upgrade

This case presents POQ for a bandwidth change of Dedicated Internet Access without Router product instance. The assumption is that the change is not significant and can be provided only with an update of configuration without a need for any installation of new equipment.

This Use Case is applied to Internet Access created in Use Case 6 in section B.3.6 (we assume its *id=InternetAccess-BroadbandDedicatedWithoutRouter-00001*).

Figure 54 shows the structure of the POQ product-agnostic part.

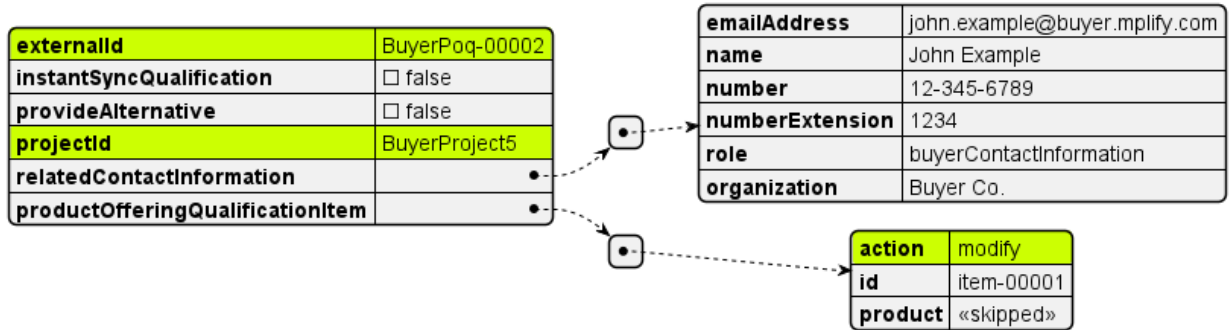


Figure 37 UC8: POQ Request, product-agnostic part

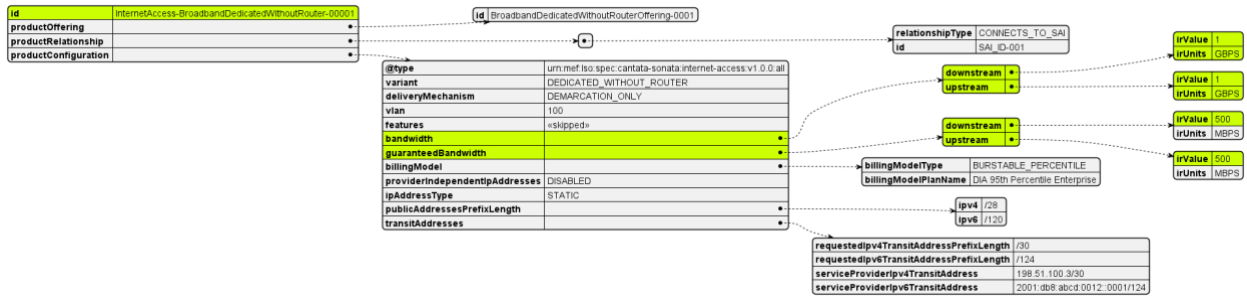


Figure 38 UC8: POQ Request - configuration

B.4.2 Use Case 9: Product Order – term enhancement

Use case 4 created Product Order for Broadband Internet Access Basic with the *term* of 12 months *duration* and *endOfTermAction=autoRenew*. That means that after 12 months it will renew itself for another 12 months. Presumably at the same price.

There is however a possibility (if offered by the Seller) for the Buyer to enhance the *duration* of current term and make it longer or shorter, to achieve a change in the price. In that case, only the product-agnostic part of the request will change.

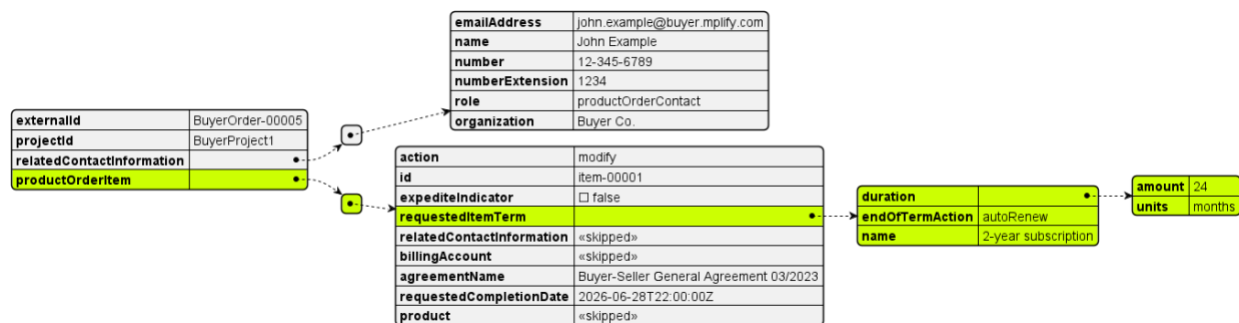


Figure 39 UC9: Product Order Request, product-agnostic part

B.4.3 Use Case 10: Product Order - Move Broadband Internet Access

To perform a move of Broadband Internet Access, a modify request changing the referred *place* must be performed.

This operation is allowed for Internet Access product specification. Still, it is up to the Seller’s decision to provide such functionality for the Buyer.

This Use Case is applied to Internet Access created in Use Case 4 in section B.3.4 (we assume its *id=InternetAccess-BroadbandBasic-00001*).



Figure 40 UC10: Product Order Request, product-agnostic part

B.4.4 Use Case 11: Product Order - Move Dedicated Internet Access

Dedicated Internet Access Variants point to Service Access Interface with the use of *ProductRelationship* thus it is this relation in this case that must be updated.

This operation is allowed for Internet Access product specification. Still, it is up to the Seller’s decision to provide such functionality for the Buyer.

This Use Case is applied to Internet Access created in Use Case 6 in section 69B.3.6 (we assume its *id=InternetAccess-BroadbandDedicatedWithoutRouter-00001*).

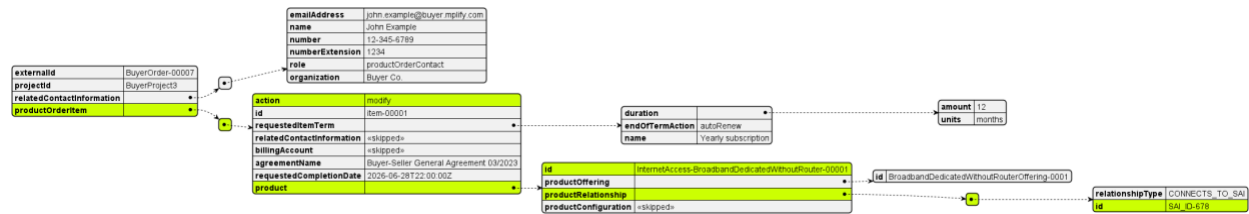


Figure 41 UC11: Product Order Request, product-agnostic part

B.5 action: delete

Delete requests are very straightforward, as they only carry the *product.id*.

Following common rules apply for delete operation:

- *item.action* must be set to *delete*
- *item.product.id* of the product to be deleted must be provided
- *product.productConfiguration* must not be provided

- no other item attribute may be provided (except for optional *billingAccount* in Order)

Delete action is not available for the POQ as it is assumed that decommissioning of a product is always possible.

B.5.1 Use Case 12: Quote - Dedicated Internet Access, with Router – delete without SAI

When the Buyer is willing to decommission a Product prior to its term completion, additional fees may apply. To check the potential costs, the Buyer can ask for a quotation for deletion of a product.

This example attempts to quote a deletion of a Dedicated Internet Access product instance that was ordered in Use Case 7 (section B.3.7). It only deletes Internet Access, which means the referred Service Access Interface will be available. presents a diagram of a full Quote request for deletion:

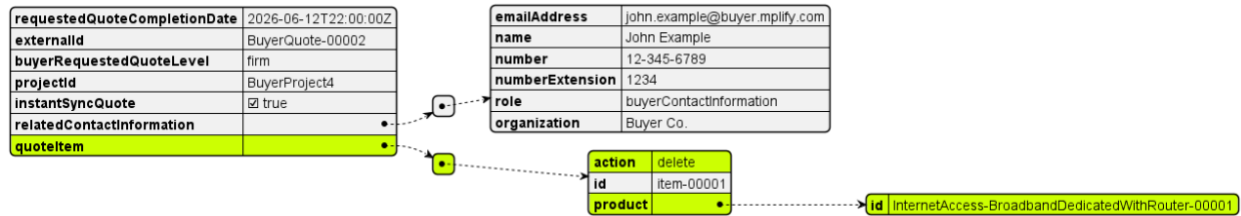


Figure 42 UC12: Product Order Request, product-agnostic part

B.5.2 Use Case 13: Product Order - Dedicated Internet Access, with Router – delete with SAI

In this scenario both the Dedicated Internet Access, with Router and its target Service Access Interface are requested to be deleted. The Product Order Request contains two Product Order Items.



Figure 43 UC13: Product Order Request, product-agnostic part