

# TM Forum Specification

## TMF908 IoT Device Management API REST Specification

**TMF908**

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N/A

# Introduction

The following document is the specification of the REST API for Any management. It includes the model definition as well as all available operations.



## SAMPLE USE CASES

Reader will find an example of use cases using Usage API in “Open Digital Business Scenarios and Use Cases” document.

## Support of polymorphism and extension patterns

Support of polymorphic collections and types and schema-based extension is provided by means of a list of generic meta-attributes that we describe below. Polymorphism in collections occurs when entities inherit from base entities, for instance a `BillingAccount` and `SettlementAccount` inheriting properties from the abstract `Account` entity.

Generic support of polymorphism and pattern extensions is described in the TMF API Guidelines v3.0 Part 2 document.

The `@type` attribute provides a way to represent the actual class type of an entity. For example, within a list of `Account` instances some may be instances of `BillingAccount` where other could be instances of `SettlementAccount`. The `@type` gives this information. All resources and sub-resources of this API have a `@type` attributes that can be provided when this is useful.

The `@referredType` can be used within reference entities (like for instance an `AccountRef` object) to explicitly denote the actual entity type of the referred class. Notice that in reference entities the `@type`, when used, denotes the class type of the reference itself, such as `BillingAccountRef` or `SettlementAccountRef`, and not the class type of the referred object. However, since reference classes are rarely sub-classed, `@type` is generally not useful in reference objects.

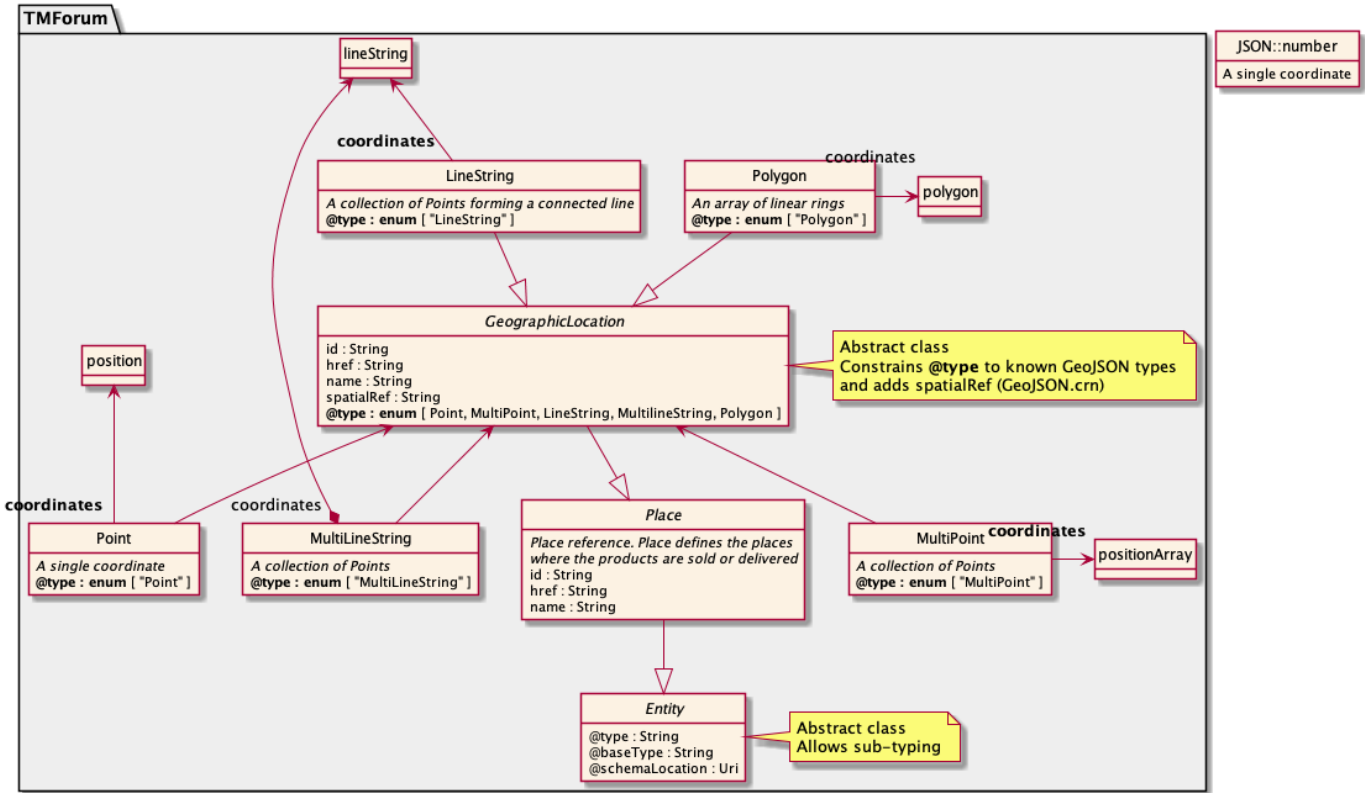
The `@schemaLocation` property can be used in resources to allow specifying user-defined properties of an Entity or to specify the expected *characteristics* of an entity.

The `@baseType` attribute gives a way to provide explicitly the base of class of a given resource that has been extended.

# RESOURCE MODEL

This API uses the GeoLocation Datamodel defined as follows:

TMForum Open-API for GeographicLocation

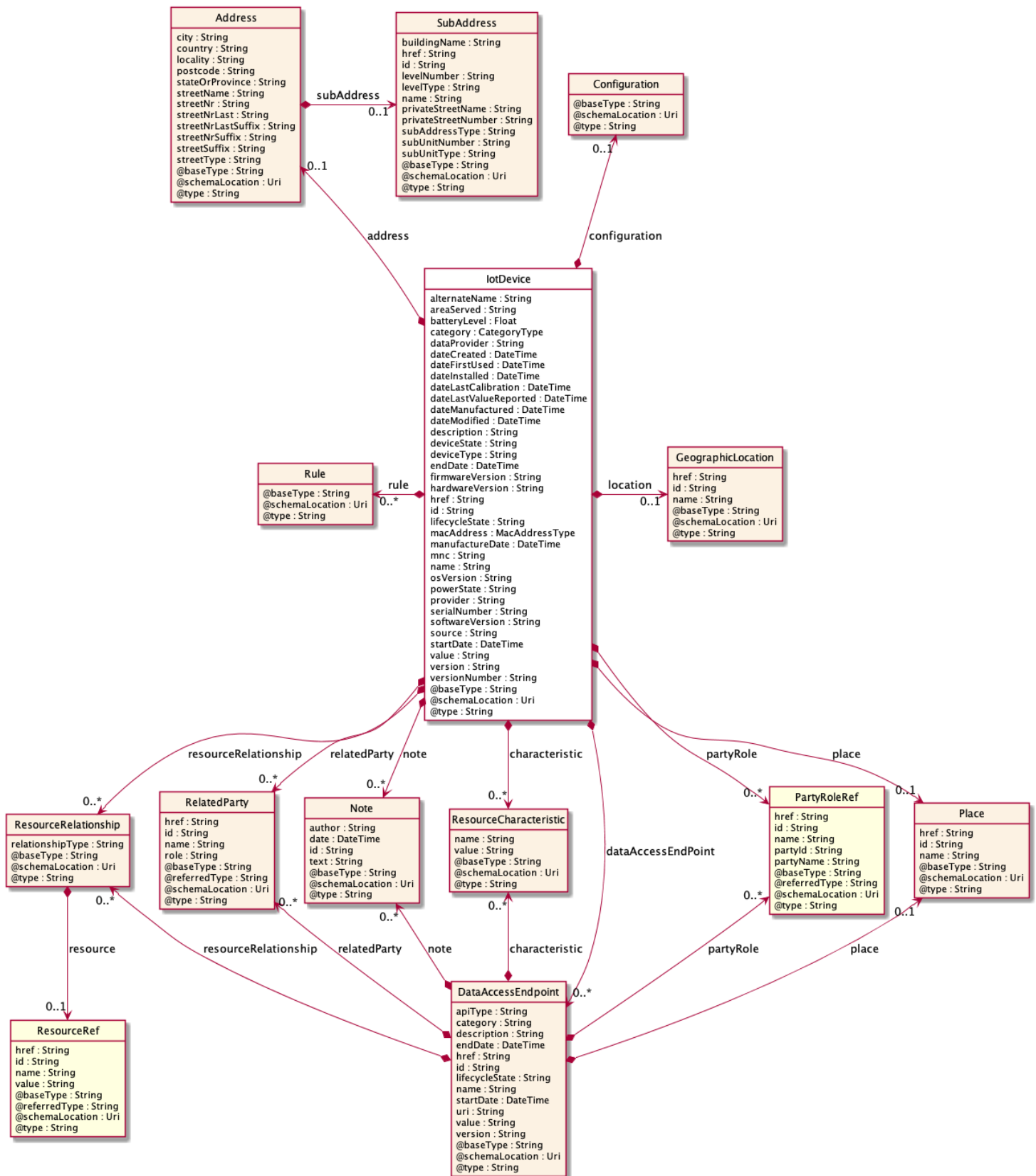


## Managed Entity and Task Resource Models

### IoT Device resource

#TODO.

### Resource model



**Field descriptions***lotDevice* fields

batteryLevel	A float.
dateFirstUsed	A date time (DateTime).
dateInstalled	A date time (DateTime).
dateLastCalibration	A date time (DateTime).
dateLastValueReported	A date time (DateTime).
dateManufactured	A date time (DateTime).
deviceState	A string.
deviceType	A string. NGSI Entity type.
firmwareVersion	A string.
hardwareVersion	A string.
mnc	A string.
osVersion	A string.
provider	A string.
serialNumber	A string. This is a string that represents a manufacturer-allocated number used to identify different instances of the same hardware item. The ModelNumber and PartNumber attributes are used to identify different types of hardware items. This is a REQUIRED attribute.
softwareVersion	A string.
value	A string.
alternateName	A string.
dataProvider	A string.
dateCreated	A date time (DateTime).
dateModified	A date time (DateTime).
description	A string. free-text description of the resource.
name	A string. A string used to give a name to the resource.

source	A string.
areaServed	A string.
category	A list of category types (CategoryType [1..*]).
description	A string. free-text description of the resource.
endDate	A date time (DateTime). A date time( DateTime). The date till the resource is effective.
href	A string. The URI for the object itself.
id	A string. Identifier of an instance of the resource. Required to be unique within the resource type. Used in URIs as the identifier for specific instances of a type.
lifecycleState	A string. The life cycle state of the resource.
manufactureDate	A date time (DateTime). This is a string attribute that defines the date of manufacture of this item in the fixed format "dd/mm/yyyy". This is an optional attribute.
name	A string. A string used to give a name to the resource.
powerState	A string. This defines the current power status of the hardware item. Values include:  0: Unknown 1: Not Applicable 2: No Power Applied 3: Full Power Applied 4: Power Save - Normal 5: Power Save - Degraded 6: Power Save - Standby 7: Power Save - Critical 8: Power Save - Low Power Mode 9: Power Save - Unknown 10: Power Cycle 11: Power Warning 12: Power Off.
serialNumber	A string. This is a string that represents a manufacturer-allocated number used to identify different instances of the same hardware item. The ModelNumber and PartNumber attributes are used to identify different types of hardware items. This is a REQUIRED attribute.
startDate	A date time (DateTime). A date time ( DateTime). The date from which the resource is effective.
version	A string. A field that identifies the specific version of an instance of a resource.

versionNumber	A string. This is a string that identifies the version of this object. This is an optional attribute.
category	A list of category types (CategoryType [1..*]).
dataAccessEndPoint	A list of data access endpoints (DataAccessEndpoint [*]). This is the endpoint exposed by the IoT Device to authorized users.
location	A geographic location (GeographicLocation). A GeographicLocation is a pure-virtual super-class to the GeoJSON-aligned geometries of Point (addresses and locations), MultiPoint, LineString (streets, highways and boundaries), MultiLineString and Polygon (countries, provinces, tracts of land). Use the @type attribute to specify which of these is being specified by the geometry attribute.
configuration	A configuration (Configuration). #TODO.
macAddress	A list of mac address types (MacAddressType [*]). #TODO.
rule	A list of rules (Rule [*]).
address	An address (Address). Structured textual way of describing how to find a Property in an urban area (country properties are often defined differently). Note: Address corresponds to SID UrbanPropertyAddress.
location	A geographic location (GeographicLocation). A GeographicLocation is a pure-virtual super-class to the GeoJSON-aligned geometries of Point (addresses and locations), MultiPoint, LineString (streets, highways and boundaries), MultiLineString and Polygon (countries, provinces, tracts of land). Use the @type attribute to specify which of these is being specified by the geometry attribute.
characteristic	A list of resource characteristics (ResourceCharacteristic [*]).
note	A list of notes (Note [*]). Extra information about a given entity.
partyRole	A list of party role references (PartyRoleRef [*]). A party role represents the part played by a party in a given context.
place	A place (Place). Place reference. Place defines the places where the products are sold or delivered.
relatedParty	A list of related parties (RelatedParty [*]). Related Entity reference. A related party defines party or party role linked to a specific entity.
resourceRelationship	A list of resource relationships (ResourceRelationship [*]). Describes links between resources.

Address sub-resource

Structured textual way of describing how to find a Property in an urban area (country properties are often defined differently).

Note: Address corresponds to SID UrbanPropertyAddress.

city	A string. City that the address is in.
country	A string. Country that the address is in.
locality	A string. "An area of defined or undefined boundaries within a local authority or other legislatively defined area, usually rural or semi-rural in nature." [ANZLIC-STREET], or a suburb "a bounded locality within a city, town or shire principally of urban character " [ANZLICSTREET].
postcode	A string. descriptor for a postal delivery area, used to speed and simplify the delivery of mail (also known as zipcode).
stateOrProvince	A string. the State or Province that the address is in.
streetName	A string. Name of the street or other street type.
streetNr	A string. Number identifying a specific property on a public street. It may be combined with streetNrLast for ranged addresses.
streetNrLast	A string. Last number in a range of street numbers allocated to a property.
streetNrLastSuffix	A string. Last street number suffix for a ranged address.
streetNrSuffix	A string. the first street number suffix.
streetSuffix	A string. A modifier denoting a relative direction.
streetType	A string. alley, avenue, boulevard, brae, crescent, drive, highway, lane, terrace, parade, place, tarn, way, wharf.
subAddress	A sub address (SubAddress). Within a property in an urban area, may refer to a building, building cluster, or a floor of a multistory building.

DataAccessEndpoint sub-resource

This is the endpoint exposed by the IoT Device to authorized users.

category	A string. Category of the concrete resource, such as: Gold, Silver for MSISDN concrete resource.
description	A string. Free-text description of the resource.
endDate	A date time (DateTime). The date till the resource is effective.



href	A string. The URI for the object itself.
id	A string. Identifier of an instance of the resource. Required to be unique within the resource type. Used in URIs as the identifier for specific instances of a type.
lifecycleState	A string. The life cycle state of the resource.
name	A string. A string used to give a name to the resource.
startDate	A date time (DateTime). A date time (DateTime). The date from which the resource is effective.
value	A string. The value of the logical resource, such as: 0044746712345 for an MSISDN.
version	A string. A field that identifies the specific version of an instance of a resource.
apiType	A string.
uri	A string. URI for using the data access API.
characteristic	A list of resource characteristics (ResourceCharacteristic [*]).
note	A list of notes (Note [*]). Extra information about a given entity.
partyRole	A list of party role references (PartyRoleRef [*]). A party role represents the part played by a party in a given context.
place	A place (Place). Place reference. Place defines the places where the products are sold or delivered.
relatedParty	A list of related parties (RelatedParty [*]). Related Entity reference. A related party defines party or party role linked to a specific entity.
resourceRelationship	A list of resource relationships (ResourceRelationship [*]). Describes links between resources.

### GeographicLocation sub-resource

A GeographicLocation is a pure-virtual super-class to the GeoJSON-aligned geometries of Point (addresses and locations), MultiPoint, LineString (streets, highways and boundaries), MultiLineString and Polygon (countries, provinces, tracts of land). Use the @type attribute to specify which of these is being specified by the geometry attribute.

href	A string. An URI used to access to the geographic location resource.
id	A string. Unique identifier of the geographic location.
name	A string. A user-friendly name for the place, such as [Paris Store], [London Store], [Main Home].

MacAddressType sub-resource

#TODO.

MacAddressType      A string.

Note sub-resource

Extra information about a given entity.

author                A string. Author of the note.

date                  A date time (DateTime). Date of the note.

id                    A string. Identifier of the note within its containing entity (may or may not be globally unique, depending on provider implementation).

text                  A string. Text of the note.

Place sub-resource

Place reference. Place defines the places where the products are sold or delivered.

href                 A string. Unique reference of the place.

id                    A string. Unique identifier of the place.

name                 A string. A user-friendly name for the place, such as [Paris Store], [London Store], [Main Home].

RelatedParty sub-resource

Related Entity reference. A related party defines party or party role linked to a specific entity.

@referredType      A string. The actual type of the target instance when needed for disambiguation.

href                 A string. Reference of the related entity.

id                    A string. Unique identifier of a related entity.

name                 A string. Name of the related entity.

role                 A string. Role played by the related party.

ResourceCharacteristic sub-resource

name                 A string. name of the characteristic.

value                A string. value of the characteristic.

ResourceRelationship sub-resource

Describes links between resources.

relationshipType	A string. Semantic of the relationship.
resource	A resource reference (ResourceRef). A reference to the resource.

SubAddress sub-resource

Representation of a SubAddress

It is used for addressing within a property in an urban area (country properties are often defined differently). It may refer to a building, a building cluster, or a floor of a multistory building.

buildingName	A string. Allows for buildings that have well-known names.
href	A string.
id	A string. Unique ID for this SubAddress.
levelNumber	A string. Used where a level type may be repeated e.g. BASEMENT 1, BASEMENT 2.
levelType	A string. Describes level types within a building.
name	A string. Name of the subAddress to identify it with a meaningful identification.
privateStreetName	A string. Private streets internal to a property (e.g. a university) may have internal names that are not recorded by the land title office.
privateStreetNumber	A string. Private streets numbers internal to a private street.
subAddressType	A string. The type of subaddress: it can be a subunit or a private street.
subUnitNumber	A string. The discriminator of the subunit, often just a simple number e.g. FLAT 5, may also be a range.
subUnitType	A string. The type of subunit, such as BERTH, FLAT, PIER, SUITE, SHOP, TOWER, UNIT, WHARF.

PartyRoleRef relationship

Party role reference. A party role represents the part played by a party in a given context.

@referredType	A string. The actual type of the target instance when needed for disambiguation.
href	A string. Reference of the product.
id	A string. Unique identifier of the product.
name	A string. The name of the referred party role.

partyId	A string. The identifier of the engaged party that is linked to the PartyRole object.
partyName	A string. The name of the engaged party that is linked to the PartyRole object.

ResourceRef relationship

@referredType	A string. The actual type of the target instance when needed for disambiguation.
href	A string. Reference of the related entity.
id	A string. Unique identifier of a related entity.
name	A string. Name of the resource.
value	A string. The resource value that can be used to identify a resource with a public key (e.g.: a tel nr, an msisdn).

**Json representation sample**

We provide below the json representation of an example of an 'IoTDevice' resource object

```
{
  "dateFirstUsed": "2019-05-13T00:00",
  "dateInstalled": "2019-05-13T00:00",
  "dateLastCalibration": "2019-05-13T00:00",
  "dateLastValueReported": "2019-05-13T00:00",
  "dateManufactured": "2019-05-13T00:00",
  "deviceState": "ok",
  "deviceType": "Temperature",
  "firmwareVersion": "1.0.0",
  "hardwareVersion": "1.0.0",
  "mnc": "01",
  "osVersion": "1.0.0",
  "provider": "Mandat International",
  "serialNumber": "12345",
  "softwareVersion": "1.0.0",
  "value": "0041227744222",
  "alternateName": "CoAP temperature sensor 3",
  "dataProvider": "https://www.mandint.org",
  "dateCreated": "2019-05-13T00:00",
  "dateModified": "2019-05-13T00:00",
  "description": "This is a temperature sensor using CoAP and 6LoWPAN.",
  "name": "temp_3",
  "source": "coap://[2001:41e0:6002:1800:0:0:3]:61616/temp ",
  "areaServed": "Switzerland ",
  "category": "Gold ",
  "endDate": "2019-05-13T00:00",
  "href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",
  "lifecycleState": "InService",
  "manufactureDate": "2019-05-13T00:00",
  "powerState": "3",
}
```

```
"startDate": "2019-05-13T00:00",
"version": "1.0",
"versionNumber": "1.0.0",
"dataAccessEndPoint": {
  "category": "Gold",
  "description": "This is a temperature sensor using CoAP and 6LoWPAN.",
  "endDate": "2019-05-13T00:00",
  "href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",
  "id": "3",
  "lifecycleState": "InService",
  "name": "temp_3",
  "startDate": "2019-05-03T00:00",
  "value": "0041227744222",
  "version": "1.0",
  "apiType": "NGSI",
  "uri": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3/dataAccessEndpoint/3"
},
"batteryLevel": 1.0,
"configuration": {
  "timeout": 5,
  "reportingPeriod": 300
},
"macAddress": [
  "02:00:00:00:00:03"
],
"$id": "Device.schema.json",
"address": {
  "addressLocality": "Geneva",
  "postalCode": "1209",
  "streetAddress": "Chemin du Champ-Baron 3"
},
"location": {
  "attrName": "position",
  "coords": {
    "type": "Point",
    "coordinates": [
      46.223064,
      6.1305982
    ]
  }
},
"characteristic": [
  {
    "name": "accuracy",
    "value": "1.0"
  }
],
"note": [
  {
    "author": "Cedric Crettaz",
    "date": "2019-05-13T00:00",
    "id": "txt001",
    "text": "This is a CoAP temperature sensor."
  }
],
```

```
"partyRole": [
  {
    "@referredType": "temperatureSensor",
    "href": "https://www.mandint.org/temperatureSensor",
    "id": "CoapTempSensor",
    "name": "Mandat International",
    "partyId": "MI",
    "partyName": "Mandat International"
  }
],
"place": {
  "href": "Chemin du Champ-Baron 3",
  "id": "1209",
  "name": "Geneva Office"
},
"relatedParty": [
  {
    "@referredType": "temperatureSensor",
    "href": "https://www.mandint.org/temperatureSensor",
    "id": "CoapTempSensor",
    "name": "Mandat International",
    "role": "vendor"
  }
],
"resourceRelationship": [
  {
    "@Type": "IotAgent",
    "href": "https://www.mandint.org/iotAgent",
    "id": "MI",
    "name": "UDG",
    "value": "0041227744222"
  }
],
"iotAgent": [
  {
    "name": "UDG",
    "objectId": "udgmi",
    "href": "https://www.mandint.org/iotAgent",
    "@referredType": "IotAgent",
    "dataAccessEndPoint": {
      "category": "Gold",
      "description": "This is a temperature sensor using CoAP and 6LoWPAN.",
      "endDate": "2019-05-13T00:00",
      "href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",
      "id": "3",
      "lifecycleState": "InService",
      "name": "temp_3",
      "startDate": "2019-05-03T00:00",
      "value": "0041227744222",
      "version": "1.0",
      "apiType": "NGSI",
      "uri": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3/dataAccessEndpoint/3"
    }
  }
]
```

```

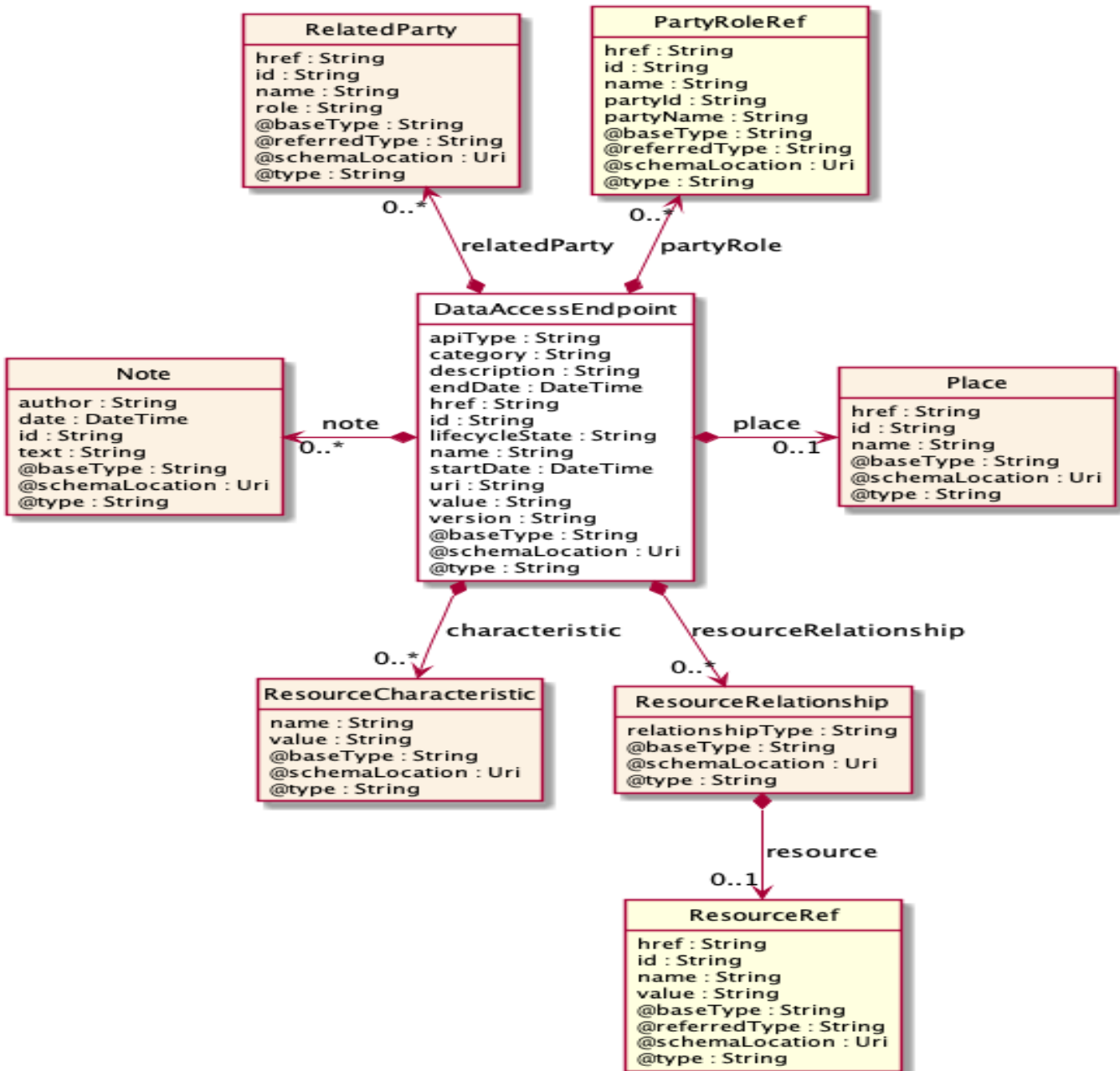
    ]
  }

```

### Data Access Endpoint resource

This is the endpoint exposed by the IoT Device to authorized users.

#### Resource model



**Field descriptions**DataAccessEndpoint fields

category	A string. Category of the concrete resource, such as: Gold, Silver for MSISDN concrete resource.
description	A string. Free-text description of the resource.
endDate	A date time (DateTime). The date till the resource is effective.
href	A string. The URI for the object itself.
id	A string. Identifier of an instance of the resource. Required to be unique within the resource type. Used in URIs as the identifier for specific instances of a type.
lifecycleState	A string. The life cycle state of the resource.
name	A string. A string used to give a name to the resource.
startDate	A date time (DateTime). A date time (DateTime). The date from which the resource is effective.
value	A string. The value of the logical resource, such as: 0044746712345 for an MSISDN.
version	A string. A field that identifies the specific version of an instance of a resource.
apiType	A string.
uri	A string. URI for using the data access API.
characteristic	A list of resource characteristics (ResourceCharacteristic [*]).
note	A list of notes (Note [*]). Extra information about a given entity.
partyRole	A list of party role references (PartyRoleRef [*]). A party role represents the part played by a party in a given context.
place	A place (Place). Place reference. Place defines the places where the products are sold or delivered.
relatedParty	A list of related parties (RelatedParty [*]). Related Entity reference. A related party defines party or party role linked to a specific entity.
resourceRelationship	A list of resource relationships (ResourceRelationship [*]). Describes links between resources.

Note sub-resource

Extra information about a given entity.



author	A string. Author of the note.
date	A date time (DateTime). Date of the note.
id	A string. Identifier of the note within its containing entity (may or may not be globally unique, depending on provider implementation).
text	A string. Text of the note.

Place sub-resource

Place reference. Place defines the places where the products are sold or delivered.

href	A string. Unique reference of the place.
id	A string. Unique identifier of the place.
name	A string. A user-friendly name for the place, such as [Paris Store], [London Store], [Main Home].

RelatedParty sub-resource

Related Entity reference. A related party defines party or party role linked to a specific entity.

@referredType	A string. The actual type of the target instance when needed for disambiguation.
href	A string. Reference of the related entity.
id	A string. Unique identifier of a related entity.
name	A string. Name of the related entity.
role	A string. Role played by the related party.

ResourceCharacteristic sub-resource

name	A string. name of the characteristic.
value	A string. value of the characteristic.

ResourceRelationship sub-resource

Describes links between resources.

relationshipType	A string. Semantic of the relationship.
resource	A resource reference (ResourceRef). A reference to the resource.

PartyRoleRef relationship

Party role reference. A party role represents the part played by a party in a given context.

@referredType	A string. The actual type of the target instance when needed for disambiguation.
href	A string. Reference of the product.
id	A string. Unique identifier of the product.
name	A string. The name of the referred party role.
partyId	A string. The identifier of the engaged party that is linked to the PartyRole object.
partyName	A string. The name of the engaged party that is linked to the PartyRole object.

#### ResourceRef relationship

@referredType	A string. The actual type of the target instance when needed for disambiguation.
href	A string. Reference of the related entity.
id	A string. Unique identifier of a related entity.
name	A string. Name of the resource.
value	A string. The resource value that can be used to identify a resource with a public key (e.g.: a tel nr, an msisdn).

#### Json representation sample

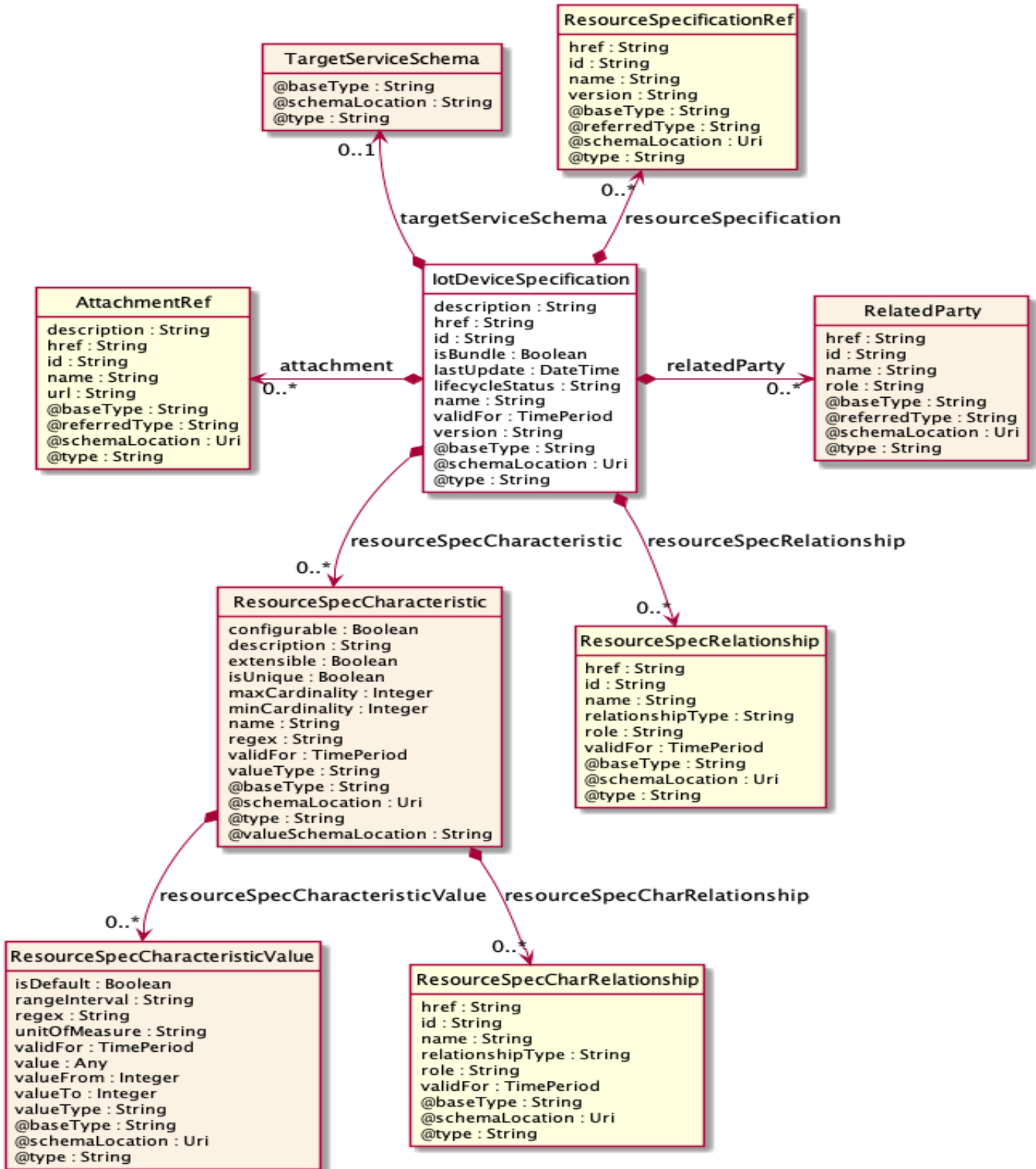
We provide below the json representation of an example of a 'DataAccessEndpoint' resource object

```
{
  "category": "Gold",
  "description": "This is a temperature sensor using CoAP and 6LoWPAN.",
  "endDate": "2019-05-13T00:00",
  "href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",
  "id": "3",
  "lifecycleState": "InService",
  "name": "temp_3",
  "startDate": "2019-05-03T00:00",
  "value": "0041227744222",
  "version": "1.0",
  "apiType": "NGSI",
  "uri": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3/dataAccessEndpoint/3"
}
```

#### IoT Device Specification resource

#TODO.

Resource model



**Field descriptions***lotDeviceSpecification* fields

description	A string. A narrative that explains in detail what the service specification is.
href	A string. Reference of the service specification.
id	A string. Unique identifier of the service specification.
isBundle	A boolean. isBundle determines whether a ServiceSpecification represents a single ServiceSpecification (false), or a bundle of ServiceSpecification (true).
lastUpdate	A date time (DateTime). Date and time of the last update of the service specification.
lifecycleStatus	A string. Used to indicate the current lifecycle status of the service specification.
name	A string. Name of the service specification.
version	A string. Service specification version.
attachment	A list of attachment references (AttachmentRef [*]). A list of attachments (Attachment [*]). Complements the description of the specification through video, pictures...
relatedParty	A list of related parties (RelatedParty [*]). A list of related party references (RelatedParty [*]). A related party defines party or party role linked to a specific entity.
resourceSpecCharacteristic	A list of resource spec characteristics (ResourceSpecCharacteristic [*]). A list of service spec characteristics (ServiceSpecCharacteristic [*]). This class represents the key features of this service specification.
resourceSpecRelationship	A list of resource spec relationships (ResourceSpecRelationship [*]). A list of resource specifications related to this specification, e.g. migration, substitution, dependency or exclusivity relationship.
resourceSpecification	A list of resource specification references (ResourceSpecificationRef [*]). A list of resource specification references (ResourceSpecificationRef [*]). The ResourceSpecification is required for a service specification with type ResourceFacingServiceSpecification (RFSS).
targetServiceSchema	A target service schema (TargetServiceSchema). A target service schema reference (TargetServiceSchemaRef). The reference object to the schema and type of target service which is described by service specification.
validFor	A time period. The period for which the service specification is valid.

RelatedParty sub-resource

Related Entity reference. A related party defines party or party role linked to a specific entity.

@referredType	A string. The actual type of the target instance when needed for disambiguation.
href	A string. Reference of the related entity.
id	A string. Unique identifier of a related entity.
name	A string. Name of the related entity.
role	A string. Role played by the related party.

ResourceSpecCharRelationship sub-resource

An aggregation, migration, substitution, dependency or exclusivity relationship between/among resourceSpecCharacteristics.

href	A string. Hyperlink reference to the target specification.
id	A string. Unique identifier of the target specification.
name	A string. Name of the target characteristic.
relationshipType	A string. Type of relationship such as aggregation, migration, substitution, dependency, exclusivity.
role	A string. The association role for this service specification.
validFor	A time period. The period for which the serviceSpecCharRelationship is valid.

ResourceSpecCharacteristic sub-resource

This class represents the key features of this service specification. For example, bandwidth is a characteristic of many different types of services; if bandwidth is a relevant characteristic (e.g., from the point-of-view of a Customer obtaining this Service via a Product) then bandwidth would be a ServiceSpecCharacteristic for that particular Service.

@valueSchemaLocation	A string. This (optional) field provides a link to the schema describing the value type.
configurable	A boolean. If true, the Boolean indicates that the serviceSpecCharacteristic is configurable.
description	A string. A narrative that explains in detail what the serviceSpecCharacteristic is.

extensible	A boolean. An indicator that specifies that the values for the characteristic can be extended by adding new values when instantiating a characteristic for an Entity.
isUnique	A boolean. An indicator that specifies if a value is unique for the specification. Possible values are; "unique while value is in effect" and "unique whether value is in effect or not".
maxCardinality	An integer. The maximum number of instances a CharacteristicValue can take on. For example, zero to five phone numbers in a group calling plan, where five is the value for the maxCardinality.
minCardinality	An integer. The minimum number of instances a CharacteristicValue can take on. For example, zero to five phone numbers in a group calling plan, where zero is the value for the minCardinality.
name	A string. A word, term, or phrase by which this characteristic specification is known and distinguished from other characteristic specifications.
regex	A string. A rule or principle represented in regular expression used to derive the value of a characteristic value.
resourceSpecCharRelationship	A list of resource spec char relationships (ResourceSpecCharRelationship [*]). A list of resource spec char relationships (ResourceSpecCharRelationship [*]). An aggregation, migration, substitution, dependency or exclusivity relationship between/among Specification Characteristics.
resourceSpecCharacteristicValue	A list of resource spec characteristic values (ResourceSpecCharacteristicValue [*]). A list of resource spec characteristic values (ResourceSpecCharacteristicValue [*]). A ResourceSpecCharacteristicValue object is used to define a set of attributes, each of which can be assigned to a corresponding set of attributes in a ResourceSpecCharacteristic object. The values of the attributes in the ResourceSpecCharacteristicValue object describe the values of the attributes that a corresponding ResourceSpecCharacteristic object can take on.
validFor	A time period. The period for which the serviceSpecCharacteristic is valid.
valueType	A string. A kind of value that the characteristic can take on, such as numeric, text and so forth.

#### ResourceSpecCharacteristicValue sub-resource

A ResourceSpecCharacteristicValue object is used to define a set of attributes, each of which can be assigned to a corresponding set of attributes in a ResourceSpecCharacteristic object. The values of the attributes in the ResourceSpecCharacteristicValue object describe the values of the attributes that a corresponding ResourceSpecCharacteristic object can take on.

isDefault	A boolean. Indicates if the value is the default value for a characteristic.
rangeInterval	A string. An indicator that specifies the inclusion or exclusion of the valueFrom and valueTo attributes. If applicable, possible values are "open", "closed", "closedBottom" and "closedTop".
regex	A string. A regular expression constraint for given value.
unitOfMeasure	A string. A length, surface, volume, dry measure, liquid measure, money, weight, time, and the like. In general, a determinate quantity or magnitude of the kind designated, taken as a standard of comparison for others of the same kind, in assigning to them numerical values, as 1 foot, 1 yard, 1 mile, 1 square foot.
validFor	A time period. The period of time for which a value is applicable.
value	An any (Any). A discrete value that the characteristic can take on, or the actual value of the characteristic.
valueFrom	An integer. The low range value that a characteristic can take on.
valueTo	An integer. The upper range value that a characteristic can take on.
valueType	A string. A kind of value that the characteristic can take on, such as numeric, text, and so forth.

#### ResourceSpecRelationship sub-resource

A migration, substitution, dependency or exclusivity relationship between/among Resource specifications.

href	A string. Reference of the target ResourceSpecification.
id	A string. Unique identifier of the target ResourceSpecification.
name	A string. The name given to the target Resource specification instance.
relationshipType	A string. Type of relationship such as migration, substitution, dependency, exclusivity.
role	A string. The association role for this Resource specification.
validFor	A time period. The period for which the ResourceSpecRelationship is valid.

#### TargetServiceSchema sub-resource

The reference object to the schema and type of target service which is described by service specification.

@schemaLocation	A string. This field provides a link to the schema describing the target service.
@type	A string. Class type of the target service.

#### AttachmentRef relationship

Attachment reference. An attachment complements the description of an element (for instance a product) through video, pictures.

@referredType	A string. The actual type of the target instance when needed for disambiguation.
href	A string. URL serving as reference for the attachment resource.
id	A string. Unique-Identifier for this attachment.
name	A string. Name of the related entity.
description	A string. A narrative text describing the content of the attachment.
url	A string. Link to the attachment media/content.

#### ResourceSpecificationRef relationship

Resource Specification reference: The ResourceSpecification is required to realize a ProductSpecification.

@referredType	A string. The actual type of the target instance when needed for disambiguation.
href	A string. Reference of the resource specification.
id	A string. Unique identifier of the resource specification.
name	A string. Name of the requiredResourceSpecification.
version	A string. Resource specification version.

#### Json representation sample

We provide below the json representation of an example of an 'IotDeviceSpecification' resource object

```
{
  "description": "This iot device specification ...",
  "href": "https://host:port/tmf-api/iotDeviceSpecification/v1/iotDeviceSpecification/4976",
  "id": "4976",
  "isBundle": true,
  "lastUpdate": "2019-10-03T00:00",
  "lifecycleStatus": "a string ...",
  "name": "a string ...",
  "version": "a string ...",
  "attachment": [
    {}
  ],
  "relatedParty": [
    {}
  ],
  "resourceSpecRelationship": [
    {}
  ],
  "resourceSpecCharacteristic": [
    {}
  ]
}
```



```

    },
    "resourceSpecification": [
      {}
    ],
    "targetServiceSchema": {},
    "validFor": {}
  }

```

## lot Data Event resource

#TODO.

### Resource model

lotDataEvent
correlationId : String description : String domain : String event : Any eventId : String eventTime : DateTime eventType : String priority : String timeOccurred : DateTime title : String @baseType : String @schemaLocation : Uri @type : String

### Field descriptions

#### lotDataEvent fields

correlationId	A string. The correlation id for this event.
description	A string. An explanatory of the event.
domain	A string. The domain of the event.
eventId	A string. The identifier of the notification.
eventTime	A date time (DateTime). Time of the event occurrence.
eventType	A string. The type of the notification.
priority	A string. A priority.

timeOccurred	A date time (DateTime). The time the event occurred.
title	A string. The title of the event.
event	An any (Any).

### Json representation sample

We provide below the json representation of an example of an 'lotDataEvent' resource object

```
{
  "correlationId": "413",
  "description": "This iot data event ...",
  "domain": "a string ...",
  "eventId": "374",
  "eventTime": "2019-10-03T00:00",
  "eventType": "a string ...",
  "priority": "a string ...",
  "timeOccurred": "2019-10-03T00:00",
  "title": "a string ...",
  "event": {}
}
```

### lot Management Event resource

Generic lotManagementEvent structure used to define commonalities between sub concepts of PartylotManagementEvent and Financial lotManagementEvent.

#### Resource model

lotManagementEvent
correlationId : String
description : String
domain : String
event : Any
eventId : String
eventTime : DateTime
eventType : String
priority : String
timeOccurred : DateTime
title : String
@baseType : String
@schemaLocation : Uri
@type : String

## Field descriptions

### lotManagementEvent fields

correlationId	A string. The correlation id for this event.
description	A string.
domain	A string. The domain of the event.
eventId	A string. The identifier of the notification.
eventTime	A date time (DateTime). Time of the event occurrence.
eventType	A string. The type of the notification.
priority	A string. A priority.
timeOccurred	A date time (DateTime). The time the event occurred.
title	A string. The title of the event.
description	A string.
event	An any (Any).

## Json representation sample

We provide below the json representation of an example of an 'lotManagementEvent' resource object

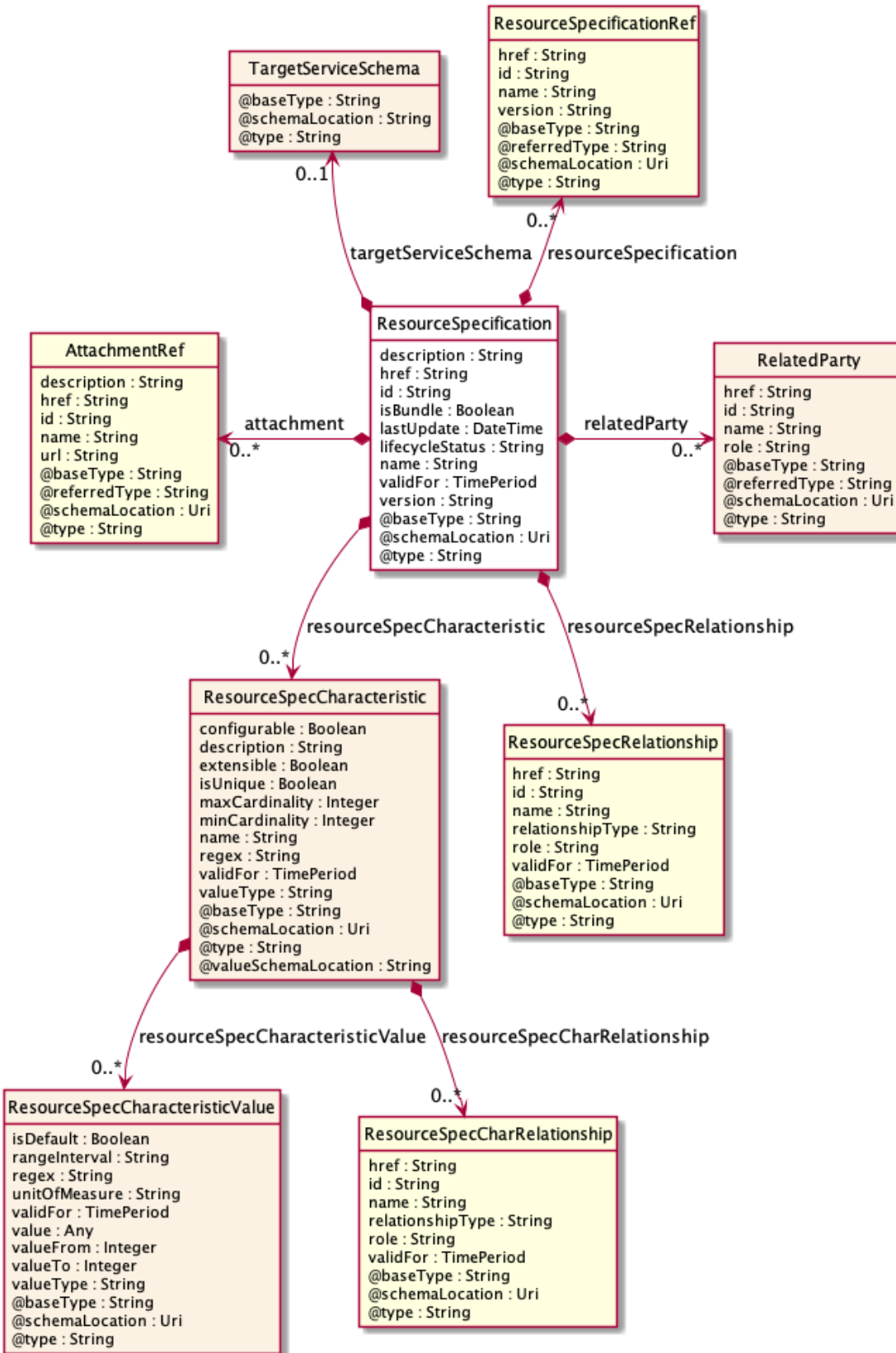
```
{
  "correlationId": "423",
  "description": "This iot management event ...",
  "domain": "a string ...",
  "eventId": "536",
  "eventTime": "2019-10-03T00:00",
  "eventType": "a string ...",
  "priority": "a string ...",
  "timeOccurred": "2019-10-03T00:00",
  "title": "a string ...",
  "event": {}
}
```

## Resource Specification resource

ResourceSpecification is a class that offers characteristics to describe a type of service.

Functionally, it acts as a template by which Services may be instantiated. By sharing the same specification, these services would therefore share the same set of characteristics.

Resource model



**Field descriptions**ResourceSpecification fields

attachment	A list of attachment references (AttachmentRef [*]). A list of attachments (Attachment [*]). Complements the description of the specification through video, pictures...
description	A string. A narrative that explains in detail what the service specification is.
href	A string. Reference of the service specification.
id	A string. Unique identifier of the service specification.
isBundle	A boolean. isBundle determines whether a ServiceSpecification represents a single ServiceSpecification (false), or a bundle of ServiceSpecification (true).
lastUpdate	A date time (DateTime). Date and time of the last update of the service specification.
lifecycleStatus	A string. Used to indicate the current lifecycle status of the service specification.
name	A string. Name of the service specification.
relatedParty	A list of related parties (RelatedParty [*]). A list of related party references (RelatedParty [*]). A related party defines party or party role linked to a specific entity.
resourceSpecCharacteristic	A list of resource spec characteristics (ResourceSpecCharacteristic [*]). A list of service spec characteristics (ServiceSpecCharacteristic [*]). This class represents the key features of this service specification.
resourceSpecRelationship	A list of resource spec relationships (ResourceSpecRelationship [*]). A list of resource specifications related to this specification, e.g. migration, substitution, dependency or exclusivity relationship.
resourceSpecification	A list of resource specification references (ResourceSpecificationRef [*]). A list of resource specification references (ResourceSpecificationRef [*]). The ResourceSpecification is required for a service specification with type ResourceFacingServiceSpecification (RFSS).
targetServiceSchema	A target service schema (TargetServiceSchema). A target service schema reference (TargetServiceSchemaRef). The reference object to the schema and type of target service which is described by service specification.
validFor	A time period. The period for which the service specification is valid.
version	A string. Service specification version.

RelatedParty sub-resource

Related Entity reference. A related party defines party or party role linked to a specific entity.

@referredType	A string. The actual type of the target instance when needed for disambiguation.
href	A string. Reference of the related entity.
id	A string. Unique identifier of a related entity.
name	A string. Name of the related entity.
role	A string. Role played by the related party.

ResourceSpecCharRelationship sub-resource

An aggregation, migration, substitution, dependency or exclusivity relationship between/among resourceSpecCharacteristics.

href	A string. Hyperlink reference to the target specification.
id	A string. Unique identifier of the target specification.
name	A string. Name of the target characteristic.
relationshipType	A string. Type of relationship such as aggregation, migration, substitution, dependency, exclusivity.
role	A string. The association role for this service specification.
validFor	A time period. The period for which the serviceSpecCharRelationship is valid.

ResourceSpecCharacteristic sub-resource

This class represents the key features of this service specification. For example, bandwidth is a characteristic of many different types of services; if bandwidth is a relevant characteristic (e.g., from the point-of-view of a Customer obtaining this Service via a Product) then bandwidth would be a ServiceSpecCharacteristic for that particular Service.

@valueSchemaLocation	A string. This (optional) field provides a link to the schema describing the value type.
configurable	A boolean. If true, the Boolean indicates that the serviceSpecCharacteristic is configurable.
description	A string. A narrative that explains in detail what the serviceSpecCharacteristic is.

extensible	A boolean. An indicator that specifies that the values for the characteristic can be extended by adding new values when instantiating a characteristic for an Entity.
isUnique	A boolean. An indicator that specifies if a value is unique for the specification. Possible values are; "unique while value is in effect" and "unique whether value is in effect or not".
maxCardinality	An integer. The maximum number of instances a CharacteristicValue can take on. For example, zero to five phone numbers in a group calling plan, where five is the value for the maxCardinality.
minCardinality	An integer. The minimum number of instances a CharacteristicValue can take on. For example, zero to five phone numbers in a group calling plan, where zero is the value for the minCardinality.
name	A string. A word, term, or phrase by which this characteristic specification is known and distinguished from other characteristic specifications.
regex	A string. A rule or principle represented in regular expression used to derive the value of a characteristic value.
resourceSpecCharRelationship	A list of resource spec char relationships (ResourceSpecCharRelationship [*]). A list of resource spec char relationships (ResourceSpecCharRelationship [*]). An aggregation, migration, substitution, dependency or exclusivity relationship between/among Specification Characteristics.
resourceSpecCharacteristicValue	A list of resource spec characteristic values (ResourceSpecCharacteristicValue [*]). A list of resource spec characteristic values (ResourceSpecCharacteristicValue [*]). A ResourceSpecCharacteristicValue object is used to define a set of attributes, each of which can be assigned to a corresponding set of attributes in a ResourceSpecCharacteristic object. The values of the attributes in the ResourceSpecCharacteristicValue object describe the values of the attributes that a corresponding ResourceSpecCharacteristic object can take on.
validFor	A time period. The period for which the serviceSpecCharacteristic is valid.
valueType	A string. A kind of value that the characteristic can take on, such as numeric, text and so forth.

#### ResourceSpecCharacteristicValue sub-resource

A ResourceSpecCharacteristicValue object is used to define a set of attributes, each of which can be assigned to a corresponding set of attributes in a ResourceSpecCharacteristic object. The values of the attributes in the ResourceSpecCharacteristicValue object describe the values of the attributes that a corresponding ResourceSpecCharacteristic object can take on.

isDefault	A boolean. Indicates if the value is the default value for a characteristic.
rangeInterval	A string. An indicator that specifies the inclusion or exclusion of the valueFrom and valueTo attributes. If applicable, possible values are "open", "closed", "closedBottom" and "closedTop".
regex	A string. A regular expression constraint for given value.
unitOfMeasure	A string. A length, surface, volume, dry measure, liquid measure, money, weight, time, and the like. In general, a determinate quantity or magnitude of the kind designated, taken as a standard of comparison for others of the same kind, in assigning to them numerical values, as 1 foot, 1 yard, 1 mile, 1 square foot.
validFor	A time period. The period of time for which a value is applicable.
value	An any (Any). A discrete value that the characteristic can take on, or the actual value of the characteristic.
valueFrom	An integer. The low range value that a characteristic can take on.
valueTo	An integer. The upper range value that a characteristic can take on.
valueType	A string. A kind of value that the characteristic can take on, such as numeric, text, and so forth.

#### ResourceSpecRelationship sub-resource

A migration, substitution, dependency or exclusivity relationship between/among Resource specifications.

href	A string. Reference of the target ResourceSpecification.
id	A string. Unique identifier of the target ResourceSpecification.
name	A string. The name given to the target Resource specification instance.
relationshipType	A string. Type of relationship such as migration, substitution, dependency, exclusivity.
role	A string. The association role for this Resource specification.
validFor	A time period. The period for which the ResourceSpecRelationship is valid.

#### TargetServiceSchema sub-resource

The reference object to the schema and type of target service which is described by service specification.

@schemaLocation	A string. This field provides a link to the schema describing the target service.
@type	A string. Class type of the target service.



AttachmentRef relationship

Attachment reference. An attachment complements the description of an element (for instance a product) through video, pictures.

@referredType	A string. The actual type of the target instance when needed for disambiguation.
href	A string. URL serving as reference for the attachment resource.
id	A string. Unique-Identifier for this attachment.
name	A string. Name of the related entity.
description	A string. A narrative text describing the content of the attachment.
url	A string. Link to the attachment media/content.

ResourceSpecificationRef relationship

Resource Specification reference: The ResourceSpecification is required to realize a ProductSpecification.

@referredType	A string. The actual type of the target instance when needed for disambiguation.
href	A string. Reference of the resource specification.
id	A string. Unique identifier of the resource specification.
name	A string. Name of the requiredResourceSpecification.
version	A string. Resource specification version.

**Json representation sample**

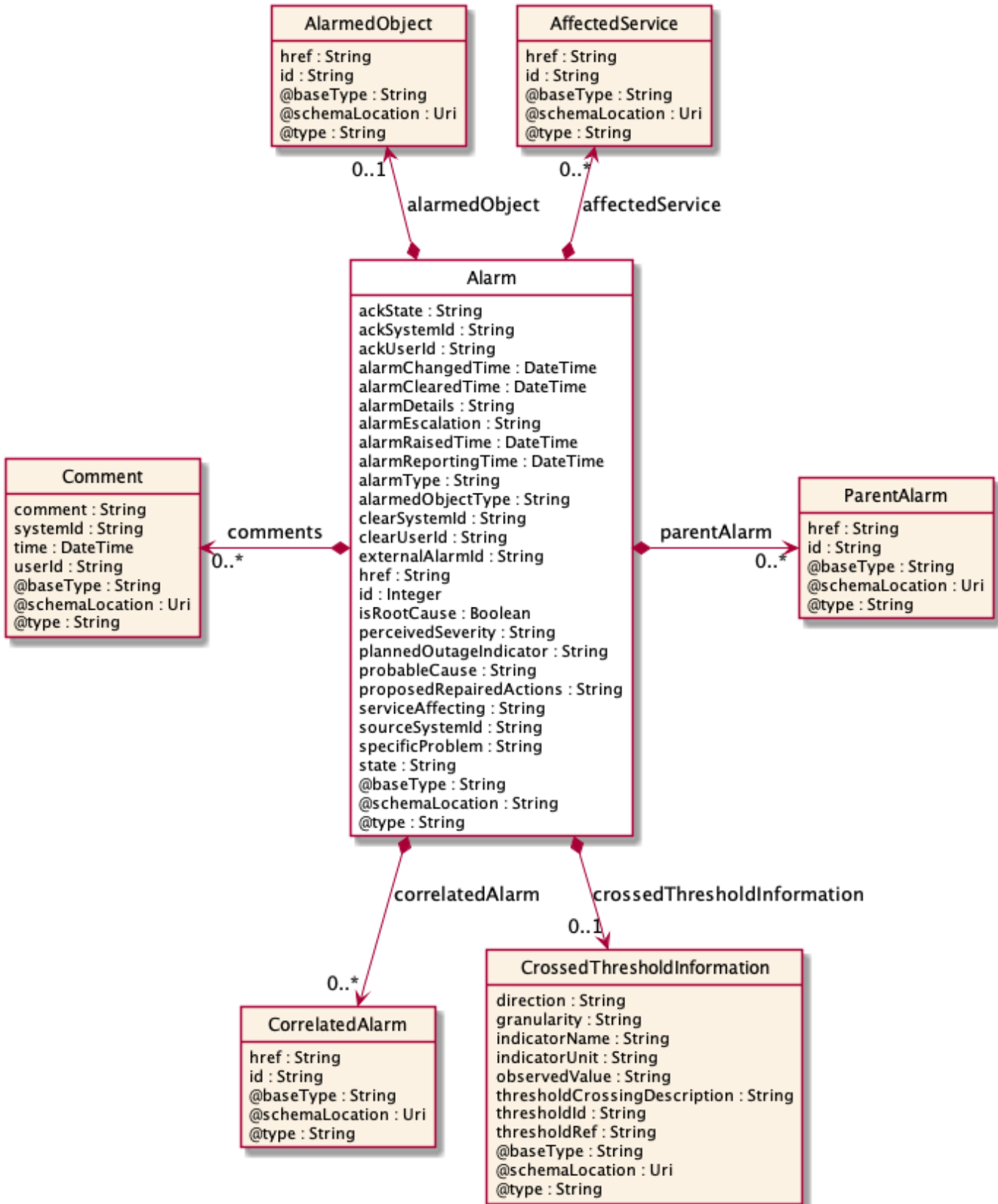
We provide below the json representation of an example of a 'ResourceSpecification' resource object

```
{
  "href": "https://mycsp.com:8080/tmf-api/resourceCatalogManagement/v3/resourceSpecification/42",
  "id": "42",
  "name": "Firewall",
  "version": "1.0",
  "@referredType": "ResourceFunctionSpec"
}
```

**Alarm resource**

This resource represents an alarm supporting the information model defined in ITU-T X.733.

Resource model



**Field descriptions**Alarm fields

@baseType	A string. The base type of this alarm.
@schemaLocation	A string. A reference to the schema describing this alarm.
@type	A string. The type for this alarm.
ackState	A string. Provides the Acknowledgement State of the alarm ACKNOWLEDGED, UNACKNOWLEDGED.
ackSystemId	A string. Provides the name of the system that last changed the ackState of an alarm, i.e. acknowledged or unacknowledged the alarm.
ackUserId	A string. Provides the id of the user who has last changed the ack state of the alarm, i.e. acknowledged or unacknowledged the alarm.
affectedService	A list of affected services (AffectedService [*]).
alarmChangedTime	A date time (DateTime). Indicates the last date and time when the alarm is changed on the alarm-owning system. Any change to the alarm whether coming from the alarmed resource or triggered by a change from the client is changing this time.
alarmClearedTime	A date time (DateTime). Indicates the time (as a date + time) at which the alarm is cleared at the source.
alarmDetails	A string. Contains further information on the alarm.
alarmEscalation	A string. Indicates if this alarm has been escalated or not.
alarmRaisedTime	A date time (DateTime). Indicates the time (as a date + time) at which the alarm occurred at its source.
alarmReportingTime	A date time (DateTime). Indicates the time (as a date + time) at which the alarm was reported by the owning OSS. It might be different from the alarmRaisedTime. For instance, if the alarm list is maintained by an EMS, the alarmRaisedTime would be the time the alarm was detected by the NE, while the alarmReportingTime would be the time this alarm was stored in the alarm list of the EMS.
alarmType	A string. Categorize the alarm. Should be one of the values defined in X.733 8.1.1 or 3GPP TS 32.111-2 Annex A: Communications Alarm Processing Error Alarm Environmental Alarm

	<p>Quality of Service Alarm</p> <p>Equipment Alarm</p> <p>Integrity Violation</p> <p>Operational Violation</p> <p>Physical Violation</p> <p>Security Service or Mechanism Violation</p> <p>Time Domain Violation.</p>
alarmedObject	An alarmed object (AlarmedObject). Identifies the managed object instance associated with the alarm.
alarmedObjectType	A string. The type (class) of the managed object associated with the event.
clearSystemId	A string. Provides the id of the system where the user who invoked the alarmCleared operation is located.
clearUserId	A string. Provides the id of the user who invoked the alarmCleared operation.
comments	A list of comments (Comment [*]). Indicates the comments entered on the alarm.
correlatedAlarm	A list of correlated alarms (CorrelatedAlarm [*]). Indicates the alarms attached to this alarm as correlated alarms from a correlation point of view. An alarm can be correlated to one or more underlying alarms. There might be multiple levels of alarm correlation and an underlying alarm in one relation can be itself a parent alarm for other underlying alarms.
crossedThresholdInformation	A crossed threshold information (CrossedThresholdInformation). Identifies the details of the threshold that has been crossed.
externalAlarmId	A string. An identifier of the alarm in the source system.
href	A string. A reference to the alarm.
id	An integer. Identifier of the alarm, determined by the alarm owning system.
isRootCause	A boolean. Indicates whether the alarm is a root cause alarm.
parentAlarm	A list of parent alarms (ParentAlarm [*]). Indicates the alarms attached to this alarm as parent alarms from a correlation point of view.
perceivedSeverity	<p>A string. Lists the possible severities that can be allocated to an Alarm. The values are consistent with ITU-T Recommendation X.733:</p> <p>CRITICAL</p> <p>MAJOR</p> <p>MINOR</p> <p>WARNING</p> <p>INDETERMINATE</p>

## CLEARED

Once an alarm has been cleared, its perceived severity is set to CLEARED and can no longer be set.

plannedOutageIndicator	A string. Indicates that the Managed Object (related to this alarm) is in planned outage (in planned maintenance, or out-of-service).
probableCause	A string. Provides the probable cause of the alarm. The values are consistent with ITU-T Recommendation X.733 or 3GPP TS 32.111-2 Annex B.
proposedRepairedActions	A string. Indicates proposed repair actions, if known to the system emitting the alarm.
serviceAffecting	A string. Indicates whether the alarm affects service or not.
sourceSystemId	A string.
specificProblem	A string. Provides more specific information about the alarm.
state	A string. Defines the alarm state during its life cycle RAISED, UPDATED or CLEARED.

AffectedService sub-resource

href	A string. Provides the identifier of the service affected by the alarm.
id	A string.

AlarmedObject sub-resource

Identifies the managed object instance associated with the alarm.

href	A string. A reference to the managed object associated with the event.
id	A string. The identifier of the managed object associated with the event.

Comment sub-resource

Indicates the comments entered on the alarm.

comment	A string. Indicates the text of the comment.
systemId	A string. Indicates the system identifier on which the client set the comment.
time	A date time (DateTime). Indicates the time commenting the alarm.
userId	A string. Indicates the user commenting the alarm.

CorrelatedAlarm sub-resource

Indicates the alarms attached to this alarm as correlated alarms from a correlation point of view. An alarm can be correlated to one or more underlying alarms. There might be multiple levels of alarm correlation and an underlying alarm in one relation can be itself a parent alarm for other underlying alarms.

href	A string.
id	A string.

CrossedThresholdInformation sub-resource

Identifies the details of the threshold that has been crossed.

direction	A string. Indicates the threshold crossing direction: up or down.
granularity	A string. Indicates the granularity at which the indicator is evaluated for threshold crossing.
indicatorName	A string. Indicates the name of indicator which crossed the threshold.
indicatorUnit	A string. Indicates the unit of the measurement of the indicator corresponding to the threshold that has been crossed.
observedValue	A string. Indicates the value of the indicator which crossed the threshold.
thresholdCrossingDescription	A string. Indicates further information on the threshold crossing alarm.
thresholdId	A string. Indicates the threshold id that caused the alarm.
thresholdRef	A string.

ParentAlarm sub-resource

Indicates the alarms attached to this alarm as parent alarms from a correlation point of view.

href	A string.
id	A string.

**Json representation sample**

We provide below the json representation of an example of an 'Alarm' resource object

```
{
  "id": "8675309",
  "href": "https://host:port/alarmManagement/v4/alarm/8675309",
  "@baseType": "Alarm",
  "@type": "Alarm",
  "@schemaLocation": "https://host:port/Alarm.schema.json",
  "externalAlarmId": "5551212",
  "state": "UPDATED",
}
```

```
"alarmType": "Environmental Alarm",
"perceivedSeverity": "MAJOR",
"probableCause": "Rectifier Low voltage",
"specificProblem": "ps=3,sl=1,in=8",
"alarmedObjectType": "Rectifier",
"alarmedObject": {
  "id": "93051825",
  "href": "https://host:port/resourceInventoryManagement/v4/resource/93051825"
},
"sourceSystemId": "ems-1",
"alarmDetails": "voltage=95",
"alarmRaisedTime": "2019-07-03T03:32:17.235Z",
"alarmReportingTime": "2019-07-03T03:32:17.552Z",
"alarmChangedTime": "2019-07-03T03:32:52.744Z",
"ackSystemId": "ems-1",
"ackUserId": "bob@example.net",
"ackTime": "2019-07-03T03:33:12.623Z",
"ackState": "ACKNOWLEDGED",
"isRoot": false,
"parentAlarm": {
  "id": "8675300"
},
"correlatedAlarm": [
  {
    "id": "8675399",
    "href": "https://host:port/alarmManagement/v4/alarm/868675399"
  }
],
"comments": [
  {
    "userId": "bob@example.net",
    "systemId": "ems-1",
    "time": "2019-07-03T03:37:33.827Z",
    "comment": "Dispatched"
  }
]
}
```

## Notification Resource Models

13 notifications are defined for this API

Notifications related to lotDevice:

- lotDeviceCreateEvent
- lotDeviceChangeEvent
- lotDeviceBatchEvent
- lotDeviceDeleteEvent
- lotDeviceHeartBeatEvent
- lotDeviceStateChangeEvent

Notifications related to lotDeviceSpecification:

- lotDeviceSpecificationCreateEvent
- lotDeviceSpecificationChangeEvent
- lotDeviceSpecificationBatchEvent
- lotDeviceSpecificationDeleteEvent

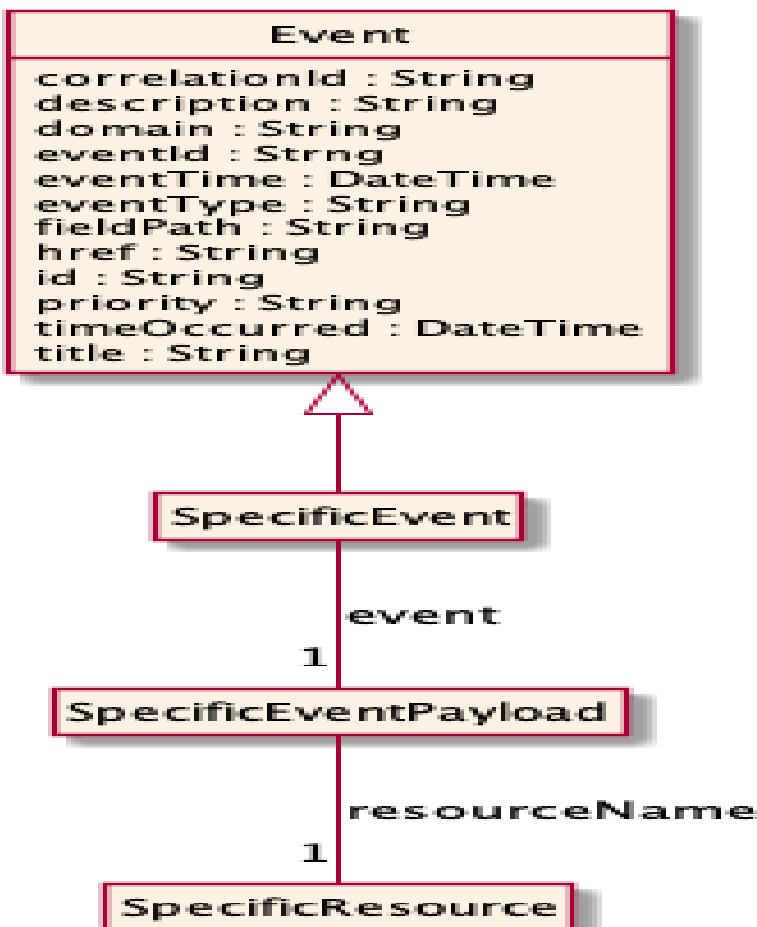
Notifications related to Alarm:

- AlarmCreateEvent
- AlarmChangeEvent
- AlarmDeleteEvent

The notification structure for all notifications in this API follow the pattern depicted by the figure below.

A notification event resource (depicted by "SpecificEvent" placeholder) is a sub class of a generic Event structure containing at least an id of the event occurrence (eventId), an event timestamp (eventTime), and the name of the resource (eventType).

This notification structure owns an event payload structure ("SpecificEventPayload" placeholder) linked to the resource concerned by the notification using the resource name as access field ("resourceName" placeholder).





## lot Device Create Event

Notification lotDeviceCreateEvent case for resource lotDevice

### Json representation sample

We provide below the json representation of an example of an 'lotDeviceCreateEvent' notification event object

```
{
  "eventId":"00001",
  "eventTime":"2015-11-16T16:42:25-04:00",
  "eventType":"lotDeviceCreateEvent",
  "event": {
    "iotDevice" :
      {-- SEE lotDevice RESOURCE SAMPLE --}
  }
}
```

## lot Device Change Event

Notification lotDeviceChangeEvent case for resource lotDevice

### Json representation sample

We provide below the json representation of an example of an 'lotDeviceChangeEvent' notification event object

```
{
  "eventId":"00001",
  "eventTime":"2015-11-16T16:42:25-04:00",
  "eventType":"lotDeviceChangeEvent",
  "event": {
    "iotDevice" :
      {-- SEE lotDevice RESOURCE SAMPLE --}
  }
}
```

## lot Device Batch Event

Notification lotDeviceBatchEvent case for resource lotDevice

### Json representation sample

We provide below the json representation of an example of an 'lotDeviceBatchEvent' notification event object

```
{
  "eventId":"00001",
  "eventTime":"2015-11-16T16:42:25-04:00",
  "eventType":"lotDeviceBatchEvent",
  "event": {
    "iotDevice" :
      {-- SEE lotDevice RESOURCE SAMPLE --}
  }
}
```

```
}  
}
```

### lot Device Delete Event

Notification lotDeviceDeleteEvent case for resource lotDevice

#### Json representation sample

We provide below the json representation of an example of an 'lotDeviceDeleteEvent' notification event object

```
{  
  "eventId":"00001",  
  "eventTime":"2015-11-16T16:42:25-04:00",  
  "eventType":"lotDeviceDeleteEvent",  
  "event": {  
    "iotDevice" :  
      {-- SEE lotDevice RESOURCE SAMPLE --}  
  }  
}
```

### lot Device Heart Beat Event

Notification lotDeviceHeartBeatEvent case for resource lotDevice

#### Json representation sample

We provide below the json representation of an example of an 'lotDeviceHeartBeatEvent' notification event object

```
{  
  "eventId":"00001",  
  "eventTime":"2015-11-16T16:42:25-04:00",  
  "eventType":"lotDeviceHeartBeatEvent",  
  "event": {  
    "iotDevice" :  
      {-- SEE lotDevice RESOURCE SAMPLE --}  
  }  
}
```

### lot Device State Change Event

Notification lotDeviceStateChangeEvent case for resource lotDevice

#### Json representation sample

We provide below the json representation of an example of an 'lotDeviceStateChangeEvent' notification event object

```
{
  "eventId":"00001",
  "eventTime":"2015-11-16T16:42:25-04:00",
  "eventType":"lotDeviceStateChangeEvent",
  "event": {
    "iotDevice" :
      {-- SEE lotDevice RESOURCE SAMPLE --}
  }
}
```

## lot Device Specification Create Event

Notification lotDeviceSpecificationCreateEvent case for resource lotDeviceSpecification

### Json representation sample

We provide below the json representation of an example of an 'lotDeviceSpecificationCreateEvent' notification event object

```
{
  "eventId":"00001",
  "eventTime":"2015-11-16T16:42:25-04:00",
  "eventType":"lotDeviceSpecificationCreateEvent",
  "event": {
    "lotDeviceSpecification" :
      {-- SEE lotDeviceSpecification RESOURCE SAMPLE --}
  }
}
```

## lot Device Specification Change Event

Notification lotDeviceSpecificationChangeEvent case for resource lotDeviceSpecification

### Json representation sample

We provide below the json representation of an example of an 'lotDeviceSpecificationChangeEvent' notification event object

```
{
  "eventId":"00001",
  "eventTime":"2015-11-16T16:42:25-04:00",
  "eventType":"lotDeviceSpecificationChangeEvent",
  "event": {
    "lotDeviceSpecification" :
      {-- SEE lotDeviceSpecification RESOURCE SAMPLE --}
  }
}
```

## IoT Device Specification Batch Event

Notification `lotDeviceSpecificationBatchEvent` case for resource `lotDeviceSpecification`

### Json representation sample

We provide below the json representation of an example of an '`lotDeviceSpecificationBatchEvent`' notification event object

```
{
  "eventId": "00001",
  "eventTime": "2015-11-16T16:42:25-04:00",
  "eventType": "lotDeviceSpecificationBatchEvent",
  "event": {
    "lotDeviceSpecification" :
      {-- SEE lotDeviceSpecification RESOURCE SAMPLE --}
  }
}
```

## IoT Device Specification Delete Event

Notification `lotDeviceSpecificationDeleteEvent` case for resource `lotDeviceSpecification`

### Json representation sample

We provide below the json representation of an example of an '`lotDeviceSpecificationDeleteEvent`' notification event object

```
{
  "eventId": "00001",
  "eventTime": "2015-11-16T16:42:25-04:00",
  "eventType": "lotDeviceSpecificationDeleteEvent",
  "event": {
    "lotDeviceSpecification" :
      {-- SEE lotDeviceSpecification RESOURCE SAMPLE --}
  }
}
```

## Alarm Create Event

Notification `AlarmCreateEvent` case for resource `Alarm`

### Json representation sample

We provide below the json representation of an example of an '`AlarmCreateEvent`' notification event object

```
{
  "eventId": "00001",
  "eventTime": "2015-11-16T16:42:25-04:00",
  "eventType": "AlarmCreateEvent",
  "event": {
```

```
"alarm" :
  {-- SEE Alarm RESOURCE SAMPLE --}
}
```

## Alarm Change Event

Notification AlarmChangeEvent case for resource Alarm

### Json representation sample

We provide below the json representation of an example of an 'AlarmChangeEvent' notification event object

```
{
  "eventId":"00001",
  "eventTime":"2015-11-16T16:42:25-04:00",
  "eventType":"AlarmChangeEvent",
  "event": {
    "alarm" :
      {-- SEE Alarm RESOURCE SAMPLE --}
  }
}
```

## Alarm Delete Event

Notification AlarmDeleteEvent case for resource Alarm

### Json representation sample

We provide below the json representation of an example of an 'AlarmDeleteEvent' notification event object

```
{
  "eventId":"00001",
  "eventTime":"2015-11-16T16:42:25-04:00",
  "eventType":"AlarmDeleteEvent",
  "event": {
    "alarm" :
      {-- SEE Alarm RESOURCE SAMPLE --}
  }
}
```

## API OPERATIONS

Remember the following Uniform Contract:

Operation on Entities	Uniform API Operation	Description
Query Entities	GET Resource	GET must be used to retrieve a representation of a resource.
Create Entity	POST Resource	POST must be used to create a new resource
Partial Update of an Entity	PATCH Resource	PATCH must be used to partially update a resource
Complete Update of an Entity	PUT Resource	PUT must be used to completely update a resource identified by its resource URI
Remove an Entity	DELETE Resource	DELETE must be used to remove a resource
Execute an Action on an Entity	POST on TASK Resource	POST must be used to execute Task Resources
Other Request Methods	POST on TASK Resource	GET and POST must not be used to tunnel other request methods.

Filtering and attribute selection rules are described in the TMF REST Design Guidelines.

Notifications are also described in a subsequent section.

## Operations on IoT Device

### List IoT devices

**GET** /iotDevice?fields=...&{filtering}

#### Description

This operation list IoT device entities.

Attribute selection is enabled for all first level attributes.

Filtering may be available depending on the compliance level supported by an implementation.

#### Usage Samples

Here's an example of a request for retrieving IoTDevice resources.

<b>Request</b>
GET /tmf-api/iotdevicemanagement/v4/iotDevice Accept: application/json
<b>Response</b>
200  [ { "dateFirstUsed": "2019-05-13T00:00", "dateInstalled": "2019-05-13T00:00", "dateLastCalibration": "2019-05-13T00:00", "dateLastValueReported": "2019-05-13T00:00", "dateManufactured": "2019-05-13T00:00", "deviceState": "ok", "deviceType": "Temperature", "firmwareVersion": "1.0.0", "hardwareVersion": "1.0.0", "mnc": "01", "osVersion": "1.0.0", "provider": "Mandat International", "serialNumber": "12345", "softwareVersion": "1.0.0", "value": "0041227744222", "alternateName": "CoAP temperature sensor 3", "dataProvider": "https://www.mandint.org", "dateCreated": "2019-05-13T00:00", "dateModified": "2019-05-13T00:00", "description": "This is a temperature sensor using CoAP and 6LoWPAN.",

```

"name": "temp_3",
"source": "coap://[2001:41e0:6002:1800:0:0:3]:61616/temp ",
"areaServed": "Switzerland ",
"category": "Gold ",
"endDate ": "2019-05-13T00:00",
"href ": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",
"lifecycleState": "InService",
"manufactureDate": "2019-05-13T00:00",
"powerState": "3",
"startDate": "2019-05-13T00:00",
"version": "1.0",
"versionNumber": "1.0.0",
"dataAccessEndPoint": {
  "category": "Gold",
  "description": "This is a temperature sensor using CoAP and 6LoWPAN.",
  "endDate": "2019-05-13T00:00",
  "href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",
  "id": "3",
  "lifecycleState": "InService",
  "name": "temp_3",
  "startDate": "2019-05-03T00:00",
  "value": "0041227744222",
  "version": "1.0",
  "apiType": "NGSI",
  "uri": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3/dataAccessEndpoint/3"
},
"batteryLevel": 1.0,
"configuration": {
  "timeout": 5,
  "reportingPeriod ": 300
},
"macAddress": [
  "02:00:00:00:00:03"
],
"$id": "Device.schema.json",
"address": {
  "addressLocality": "Geneva",
  "postalCode": "1209",
  "streetAddress": "Chemin du Champ-Baron 3"
},
"location": {
  "attrName": "position",
  "coords": {
    "type": "Point",
    "coordinates": [
      46.223064,
      6.1305982
    ]
  }
},
"characteristic": [
  {
    "name": "accuracy",
    "value": "1.0"
  }
]

```



```
    }
  ],
  "note": [
    {
      "author": "Cedric Crettaz",
      "date": "2019-05-13T00:00",
      "id": "txt001",
      "text": "This is a CoAP temperature sensor."
    }
  ],
  "partyRole": [
    {
      "@referredType": "temperatureSensor",
      "href": "https://www.mandint.org/temperatureSensor",
      "id": "CoapTempSensor",
      "name": "Mandat International",
      "partyId": "MI",
      "partyName": "Mandat International"
    }
  ],
  "place": {
    "href": "Chemin du Champ-Baron 3",
    "id": "1209",
    "name": "Geneva Office"
  },
  "relatedParty": [
    {
      "@referredType": "temperatureSensor",
      "href": "https://www.mandint.org/temperatureSensor",
      "id": "CoapTempSensor",
      "name": "Mandat International",
      "role": "vendor"
    }
  ],
  "resourceRelationship": [
    {
      "@Type": "IotAgent",
      "href": "https://www.mandint.org/iotAgent",
      "id": "MI",
      "name": "UDG",
      "value": "0041227744222"
    }
  ],
  "iotAgent": [
    {
      "name": "UDG",
      "objectId": "udgmi",
      "href": "https://www.mandint.org/iotAgent",
      "@referredType": "IotAgent",
      "dataAccessEndPoint": {
        "category": "Gold",
        "description": "This is a temperature sensor using CoAP and 6LoWPAN.",
        "endDate": "2019-05-13T00:00",
        "href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",
```

```

    "id": "3",
    "lifecycleState": "InService",
    "name": "temp_3",
    "startDate": "2019-05-03T00:00",
    "value": "0041227744222",
    "version": "1.0",
    "apiType": "NGSI",
    "uri": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3/dataAccessEndpoint/3"
  }
}
]
}
]

```

## Retrieve iot device

**GET /iotDevice/{id}?fields=...&{filtering}**

### Description

This operation retrieves an iot device entity.

Attribute selection is enabled for all first level attributes.

Filtering on sub-resources may be available depending on the compliance level supported by an implementation.

### Usage Samples

Here's an example of a request for retrieving an iotDevice resource.

Request
GET /tmf-api/iotdevicemanagement/v4/iotDevice/42 Accept: application/json
Response
200  { "dateFirstUsed": "2019-05-13T00:00", "dateInstalled": "2019-05-13T00:00", "dateLastCalibration": "2019-05-13T00:00", "dateLastValueReported": "2019-05-13T00:00", "dateManufactured": "2019-05-13T00:00", "deviceState": "ok", "deviceType": "Temperature", "firmwareVersion": "1.0.0", "hardwareVersion": "1.0.0", "mnc": "01", }

```
"osVersion": "1.0.0",
"provider": "Mandat International",
"serialNumber": "12345",
"softwareVersion": "1.0.0",
"value": "0041227744222",
"alternateName": "CoAP temperature sensor 3",
"dataProvider": "https://www.mandint.org",
"dateCreated": "2019-05-13T00:00",
"dateModified": "2019-05-13T00:00",
"description": "This is a temperature sensor using CoAP and 6LoWPAN.",
"name": "temp_3",
"source": "coap://[2001:41e0:6002:1800:0:0:0:3]:61616/temp ",
"areaServed": "Switzerland ",
"category": "Gold ",
"endDate ": "2019-05-13T00:00",
"href ": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",
"lifecycleState": "InService",
"manufactureDate": "2019-05-13T00:00",
"powerState": "3",
"startDate": "2019-05-13T00:00",
"version": "1.0",
"versionNumber": "1.0.0",
"dataAccessEndPoint": {
  "category": "Gold",
  "description": "This is a temperature sensor using CoAP and 6LoWPAN.",
  "endDate": "2019-05-13T00:00",
  "href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",
  "id": "3",
  "lifecycleState": "InService",
  "name": "temp_3",
  "startDate": "2019-05-03T00:00",
  "value": "0041227744222",
  "version": "1.0",
  "apiType": "NGSI",
  "uri": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3/dataAccessEndpoint/3"
},
"batteryLevel": 1.0,
"configuration": {
  "timeout": 5,
  "reportingPeriod ": 300
},
"macAddress": [
  "02:00:00:00:00:03"
],
"$id": "Device.schema.json",
"address": {
  "addressLocality": "Geneva",
  "postalCode": "1209",
  "streetAddress": "Chemin du Champ-Baron 3"
},
"location": {
  "attrName": "position",
  "coords": {
    "type": "Point",
```

```
"coordinates": [
  46.223064,
  6.1305982
]
},
"characteristic": [
  {
    "name": "accuracy",
    "value": "1.0"
  }
],
"note": [
  {
    "author": "Cedric Crettaz",
    "date": "2019-05-13T00:00",
    "id": "txt001",
    "text": "This is a CoAP temperature sensor."
  }
],
"partyRole": [
  {
    "@referredType": "temperatureSensor",
    "href": "https://www.mandint.org/temperatureSensor",
    "id": "CoapTempSensor",
    "name": "Mandat International",
    "partyId": "MI",
    "partyName": "Mandat International"
  }
],
"place": {
  "href": "Chemin du Champ-Baron 3",
  "id": "1209",
  "name": "Geneva Office"
},
"relatedParty": [
  {
    "@referredType": "temperatureSensor",
    "href": "https://www.mandint.org/temperatureSensor",
    "id": "CoapTempSensor",
    "name": "Mandat International",
    "role": "vendor"
  }
],
"resourceRelationship": [
  {
    "@Type": "IotAgent",
    "href": "https://www.mandint.org/iotAgent",
    "id": "MI",
    "name": "UDG",
    "value": "0041227744222"
  }
],
"iotAgent": [
```

```

{
  "name": "UDG",
  "objectId": "udgmi",
  "href": "https://www.mandint.org/iotAgent",
  "@referredType": "IotAgent",
  "dataAccessEndPoint": {
    "category": "Gold",
    "description": "This is a temperature sensor using CoAP and 6LoWPAN.",
    "endDate": "2019-05-13T00:00",
    "href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",
    "id": "3",
    "lifecycleState": "InService",
    "name": "temp_3",
    "startDate": "2019-05-03T00:00",
    "value": "0041227744222",
    "version": "1.0",
    "apiType": "NGSI",
    "uri": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3/dataAccessEndpoint/3"
  }
}
]
}

```

**Create iot device**

**POST /iotDevice**

**Description**

This operation creates an iot device entity.

**Mandatory and Non Mandatory Attributes**

The following tables provide the list of mandatory and non mandatory attributes when creating an IotDevice, including any possible rule conditions and applicable default values. Notice that it is up to an implementer to add additional mandatory attributes.

Mandatory Attributes	Rule
category	

Non Mandatory Attributes	Rule
batteryLevel	
dateFirstUsed	
dateInstalled	
dateLastCalibration	
dateLastValueReported	
dateManufactured	
deviceState	
deviceType	

Non Mandatory Attributes	Rule
firmwareVersion	
hardwareVersion	
mnc	
osVersion	
provider	
serialNumber	
softwareVersion	
value	
alternateName	
dataProvider	
dateCreated	
dateModified	
description	
name	
source	
areaServed	
description	
endDate	
lifecycleState	
manufactureDate	
name	
powerState	
serialNumber	
startDate	
version	
versionNumber	
dataAccessEndPoint	
location	
configuration	
macAddress	
rule	
address	
location	
characteristic	
note	
partyRole	
place	
relatedParty	
resourceRelationship	

### Usage Samples

Here's an example of a request for creating an lotDevice resource. In this example the request only passes mandatory attributes.

Request
POST /tmf-api/iotdevicemanagement/v4/iotDevice Content-Type: application/json  <pre>{   "category": "Gold " }</pre>
Response
201  <pre>{   "category": "Gold " }</pre>

## Patch iot device

### PATCH /iotDevice/{id}

#### Description

This operation allows partial updates of an iot device entity. Support of json/merge (<https://tools.ietf.org/html/rfc7386>) is mandatory, support of json/patch (<http://tools.ietf.org/html/rfc5789>) is optional.

Note: If the update operation yields to the creation of sub-resources or relationships, the same rules concerning mandatory sub-resource attributes and default value settings in the POST operation applies to the PATCH operation. Hence these tables are not repeated here.

#### Patchable and Non Patchable Attributes

The tables below provide the list of patchable and non patchable attributes, including constraint rules on their usage.

Patchable Attributes	Rule
batteryLevel	
dateFirstUsed	
dateInstalled	
dateLastCalibration	
dateLastValueReported	
dateManufactured	
deviceState	
deviceType	

Patchable Attributes	Rule
firmwareVersion	
hardwareVersion	
mnc	
osVersion	
provider	
serialNumber	
softwareVersion	
value	
alternateName	
dataProvider	
dateCreated	
dateModified	
description	
name	
source	
areaServed	
category	
description	
endDate	
lifecycleState	
manufactureDate	
name	
powerState	
serialNumber	
startDate	
version	
versionNumber	
category	
dataAccessEndPoint	
location	
configuration	
macAddress	
rule	
address	
location	
characteristic	
note	
partyRole	
place	
relatedParty	
resourceRelationship	

Non Patchable Attributes	Rule
id	
href	



## Usage Samples

Here's an example of a request for patching an `iotDevice` resource.

Request
PATCH /tmf-api/iotdevicemanagement/v4/iotDevice/42 Content-Type: application/merge-patch+json  <pre>{   "name": "new name" }</pre>
Response
200  <pre>{   "dateFirstUsed": "2019-05-13T00:00",   "dateInstalled": "2019-05-13T00:00",   "dateLastCalibration": "2019-05-13T00:00",   "dateLastValueReported": "2019-05-13T00:00",   "dateManufactured": "2019-05-13T00:00",   "deviceState": "ok",   "deviceType": "Temperature",   "firmwareVersion": "1.0.0",   "hardwareVersion": "1.0.0",   "mnc": "01",   "osVersion": "1.0.0",   "provider": "Mandat International",   "serialNumber": "12345",   "softwareVersion": "1.0.0",   "value": "0041227744222",   "alternateName": "CoAP temperature sensor 3",   "dataProvider": "https://www.mandint.org",   "dateCreated": "2019-05-13T00:00",   "dateModified": "2019-05-13T00:00",   "description": "This is a temperature sensor using CoAP and 6LoWPAN.",   "name": "new name",   "source": "coap://[2001:41e0:6002:1800:0:0:3]:61616/temp ",   "areaServed": "Switzerland ",   "category": "Gold ",   "endDate": "2019-05-13T00:00",   "href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",   "lifecycleState": "InService",   "manufactureDate": "2019-05-13T00:00",   "powerState": "3",   "startDate": "2019-05-13T00:00",   "version": "1.0",   "versionNumber": "1.0.0",   "dataAccessEndPoint": {</pre>

```
"category": "Gold",
"description": "This is a temperature sensor using CoAP and 6LoWPAN.",
"endDate": "2019-05-13T00:00",
"href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",
"id": "3",
"lifecycleState": "InService",
"name": "temp_3",
"startDate": "2019-05-03T00:00",
"value": "0041227744222",
"version": "1.0",
"apiType": "NGSI",
"uri": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3/dataAccessEndpoint/3"
},
"batteryLevel": 1.0,
"configuration": {
  "timeout": 5,
  "reportingPeriod": 300
},
"macAddress": [
  "02:00:00:00:00:03"
],
"$id": "Device.schema.json",
"address": {
  "addressLocality": "Geneva",
  "postalCode": "1209",
  "streetAddress": "Chemin du Champ-Baron 3"
},
"location": {
  "attrName": "position",
  "coords": {
    "type": "Point",
    "coordinates": [
      46.223064,
      6.1305982
    ]
  }
},
"characteristic": [
  {
    "name": "accuracy",
    "value": "1.0"
  }
],
"note": [
  {
    "author": "Cedric Crettaz",
    "date": "2019-05-13T00:00",
    "id": "txt001",
    "text": "This is a CoAP temperature sensor."
  }
],
"partyRole": [
  {
    "@referredType": "temperatureSensor",
```

```
"href": "https://www.mandint.org/temperatureSensor",
"id": "CoapTempSensor",
"name": "Mandat International",
"partyId": "MI",
"partyName": "Mandat International"
}
],
"place": {
"href": "Chemin du Champ-Baron 3",
"id": "1209",
"name": "Geneva Office"
},
"relatedParty": [
{
"@referredType": "temperatureSensor",
"href": "https://www.mandint.org/temperatureSensor",
"id": "CoapTempSensor",
"name": "Mandat International",
"role": "vendor"
}
],
"resourceRelationship": [
{
"@Type": "IotAgent",
"href": "https://www.mandint.org/iotAgent",
"id": "MI",
"name": "UDG",
"value": "0041227744222"
}
],
"iotAgent": [
{
"name": "UDG",
"objectId": "udgmi",
"href": "https://www.mandint.org/iotAgent",
"@referredType": "IotAgent",
"dataAccessEndPoint": {
"category": "Gold",
"description": "This is a temperature sensor using CoAP and 6LoWPAN.",
"endDate": "2019-05-13T00:00",
"href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",
"id": "3",
"lifecycleState": "InService",
"name": "temp_3",
"startDate": "2019-05-03T00:00",
"value": "0041227744222",
"version": "1.0",
"apiType": "NGSI",
"uri": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3/dataAccessEndpoint/3"
}
}
],
"id": "42"
```

```
}
```

### Delete iot device

```
DELETE /iotDevice/{id}
```

#### Description

This operation deletes an iot device entity.

#### Usage Samples

Here's an example of a request for deleting an iotDevice resource.

<b>Request</b>
DELETE /tmf-api/iotdevicemanagement/v4/iotDevice/42
<b>Response</b>
204

## Operations on Data Access Endpoint

### List data access endpoints

```
GET /dataAccessEndpoint?fields=...&{filtering}
```

#### Description

This operation list data access endpoint entities.

Attribute selection is enabled for all first level attributes.

Filtering may be available depending on the compliance level supported by an implementation.

#### Usage Samples

Here's an example of a request for retrieving DataAccessEndpoint resources.

<b>Request</b>
GET /tmf-api/iotdevicemanagement/v4/dataAccessEndpoint Accept: application/json
<b>Response</b>
200  [ { "category": "Gold", "description": "This is a temperature sensor using CoAP and 6LoWPAN.", "endDate": "2019-05-13T00:00", "href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3", "id": "3", "lifecycleState": "InService", "name": "temp_3", "startDate": "2019-05-03T00:00", "value": "0041227744222", "version": "1.0", "apiType": "NGSI", "uri": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3/dataAccessEndpoint/3" } ]

## Retrieve data access endpoint

**GET /dataAccessEndpoint/{id}?fields=...&{filtering}**

### Description

This operation retrieves a data access endpoint entity.

Attribute selection is enabled for all first level attributes.

Filtering on sub-resources may be available depending on the compliance level supported by an implementation.

### Usage Samples

Here's an example of a request for retrieving a DataAccessEndpoint resource.

<b>Request</b>
GET /tmf-api/iotdevicemanagement/v4/dataAccessEndpoint/3 Accept: application/json

Response
<pre> 200  {   "category": "Gold",   "description": "This is a temperature sensor using CoAP and 6LoWPAN.",   "endDate": "2019-05-13T00:00",   "href": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3",   "id": "3",   "lifecycleState": "InService",   "name": "temp_3",   "startDate": "2019-05-03T00:00",   "value": "0041227744222",   "version": "1.0",   "apiType": "NGSI",   "uri": "https://host:port/tmf-api/iotDevice/v1/iotDevice/temp_3/dataAccessEndpoint/3" } </pre>

## Operations on Iot Device Specification

### List Iot Device Specifications

**GET** /iotDeviceSpecification?fields=...&{filtering}

#### Description

This operation lists IoT device specification entities.

Attribute selection is enabled for all first level attributes.

Filtering may be available depending on the compliance level supported by an implementation.

#### Usage Samples

Here's an example of a request for retrieving IoTDeviceSpecification resources.

Request
<pre> GET /tmf-api/iotdevicemanagement/v4/iotDeviceSpecification Accept: application/json </pre>
Response
<pre> 200  [ { </pre>

```

"description": "This iot device specification ...",
"href": "https://host:port/tmf-api/iotDeviceSpecification/v1/iotDeviceSpecification/4976",
"id": "4976",
"isBundle": true,
"lastUpdate": "2019-10-03T00:00",
"lifecycleStatus": "a string ...",
"name": "a string ...",
"version": "a string ...",
"attachment": [
  {}
],
"relatedParty": [
  {}
],
"resourceSpecRelationship": [
  {}
],
"resourceSpecCharacteristic": [
  {}
],
"resourceSpecification": [
  {}
],
"targetServiceSchema": {},
"validFor": {}
}
]

```

## Retrieve iot device specification

**GET** /iotDeviceSpecification/{id}?fields=...&{filtering}

### Description

This operation retrieves an iot device specification entity.

Attribute selection is enabled for all first level attributes.

Filtering on sub-resources may be available depending on the compliance level supported by an implementation.

### Usage Samples

Here's an example of a request for retrieving an iotDeviceSpecification resource.

#### Request

```

GET /tmf-api/iotdevicemanagement/v4/iotDeviceSpecification/4976
Accept: application/json

```

Response
<pre> 200  {   "description": "This iot device specification ...",   "href": "https://host:port/tmf-api/iotDeviceSpecification/v1/iotDeviceSpecification/4976",   "id": "4976",   "isBundle": true,   "lastUpdate": "2019-10-03T00:00",   "lifecycleStatus": "a string ...",   "name": "a string ...",   "version": "a string ...",   "attachment": [     {}   ],   "relatedParty": [     {}   ],   "resourceSpecRelationship": [     {}   ],   "resourceSpecCharacteristic": [     {}   ],   "resourceSpecification": [     {}   ],   "targetServiceSchema": {},   "validFor": {} }                 </pre>

### Create iot device specification

#### POST /iotDeviceSpecification

##### Description

This operation creates an iot device specification entity.

##### Mandatory and Non Mandatory Attributes

The following tables provide the list of mandatory and non mandatory attributes when creating an iotDeviceSpecification, including any possible rule conditions and applicable default values. Notice that it is up to an implementer to add additional mandatory attributes.

Mandatory Attributes	Rule
name	



Non Mandatory Attributes	Rule
description	
isBundle	
lastUpdate	
lifecycleStatus	
version	
attachment	
relatedParty	
resourceSpecCharacteristic	
resourceSpecRelationship	
resourceSpecification	
targetServiceSchema	
validFor	

### Usage Samples

Here's an example of a request for creating an `iotDeviceSpecification` resource. In this example the request only passes mandatory attributes.

Request
POST /tmf-api/iotdevicemanagement/v4/iotDeviceSpecification Content-Type: application/json  <pre>{   "name": "a string ..." }</pre>
Response
201  <pre>{   "href": "https://host:port/tmf-api/iotDeviceSpecification/v1/iotDeviceSpecification/4976",   "id": "4976",   "name": "a string ..." }</pre>

### Patch iot device specification

**PATCH** /iotDeviceSpecification/{id}

## Description

This operation allows partial updates of an iot device specification entity. Support of json/merge (<https://tools.ietf.org/html/rfc7386>) is mandatory, support of json/patch (<http://tools.ietf.org/html/rfc5789>) is optional.

Note: If the update operation yields to the creation of sub-resources or relationships, the same rules concerning mandatory sub-resource attributes and default value settings in the POST operation applies to the PATCH operation. Hence these tables are not repeated here.

## Patchable and Non Patchable Attributes

The tables below provide the list of patchable and non patchable attributes, including constraint rules on their usage.

Patchable Attributes	Rule
description	
isBundle	
lifecycleStatus	
name	
version	
attachment	
relatedParty	
resourceSpecCharacteristic	
resourceSpecRelationship	
resourceSpecification	
targetServiceSchema	
validFor	

Non Patchable Attributes	Rule
id	
href	
lastUpdate	

## Usage Samples

Here's an example of a request for patching an `iotDeviceSpecification` resource.

Request
<pre>PATCH /tmf-api/iotdevicemanagement/v4/iotDeviceSpecification/4976 Content-Type: application/merge-patch+json  {   "name": "new name" }</pre>

Response
200
<pre>{   "description": "This iot device specification ...",   "href": "https://host:port/tmf-api/iotDeviceSpecification/v1/iotDeviceSpecification/4976",   "id": "4976",   "isBundle": true,   "lastUpdate": "2019-10-03T00:00",   "lifecycleStatus": "a string ...",   "name": "new name",   "version": "a string ...",   "attachment": [     {}   ],   "relatedParty": [     {}   ],   "resourceSpecRelationship": [     {}   ],   "resourceSpecCharacteristic": [     {}   ],   "resourceSpecification": [     {}   ],   "targetServiceSchema": {},   "validFor": {} }</pre>

## Delete iot device specification

**DELETE** /iotDeviceSpecification/{id}

### Description

This operation deletes an iot device specification entity.

### Usage Samples

Here's an example of a request for deleting an iotDeviceSpecification resource.

### Request

DELETE /tmf-api/iotdevicemanagement/v4/iotDeviceSpecification/42
<b>Response</b>
204

## Operations on Iot Data Event

### List Iot Data Events

**GET /iotDataEvent?fields=...&{filtering}**

#### Description

This operation lists IoT data event entities.

Attribute selection is enabled for all first level attributes.

Filtering may be available depending on the compliance level supported by an implementation.

#### Usage Samples

Here's an example of a request for retrieving IoTDataEvent resources.

<b>Request</b>
GET /tmf-api/iotdevicemanagement/v4/iotDataEvent Accept: application/json
<b>Response</b>
200  [ { "correlationId": "413", "description": "This IoT data event ...", "domain": "a string ...", "eventId": "374", "eventTime": "2019-10-03T00:00", "eventType": "a string ...", "priority": "a string ...", "timeOccurred": "2019-10-03T00:00", "title": "a string ...", }

```

"event": {}
}
]

```

## Retrieve iot data event

**GET** /iotDataEvent/{id}?fields=...&{filtering}

### Description

This operation retrieves an iot data event entity.

Attribute selection is enabled for all first level attributes.

Filtering on sub-resources may be available depending on the compliance level supported by an implementation.

### Usage Samples

Here's an example of a request for retrieving an iotDataEvent resource.

Request
GET /tmf-api/iotdevicemanagement/v4/iotDataEvent/42 Accept: application/json
Response
200  <pre> {   "correlationId": "413",   "description": "This iot data event ...",   "domain": "a string ...",   "eventId": "374",   "eventTime": "2019-10-03T00:00",   "eventType": "a string ...",   "priority": "a string ...",   "timeOcurrred": "2019-10-03T00:00",   "title": "a string ...",   "event": {} } </pre>

## Operations on Iot Management Event

### List Iot Management Events

**GET** /iotManagementEvent?fields=...&{filtering}

#### Description

This operation lists Iot Management Event entities.

Attribute selection is enabled for all first level attributes.

Filtering may be available depending on the compliance level supported by an implementation.

#### Usage Samples

Here's an example of a request for retrieving IotManagementEvent resources.

Request
GET /tmf-api/iotdevicemanagement/v4/iotManagementEvent Accept: application/json
Response
200  [ { "correlationId": "423", "description": "This Iot Management Event ...", "domain": "a string ...", "eventId": "536", "eventTime": "2019-10-03T00:00", "eventType": "a string ...", "priority": "a string ...", "timeOccurred": "2019-10-03T00:00", "title": "a string ...", "event": {} } ]

**Retrieve iot management event****GET /iotManagementEvent/{id}?fields=...&{filtering}****Description**

This operation retrieves an iot management event entity.

Attribute selection is enabled for all first level attributes.

Filtering on sub-resources may be available depending on the compliance level supported by an implementation.

**Usage Samples**

Here's an example of a request for retrieving an iotManagementEvent resource.

<b>Request</b>
GET /tmf-api/iotdevicemanagement/v4/iotManagementEvent/42 Accept: application/json
<b>Response</b>
200  { "correlationId": "423", "description": "This iot management event ...", "domain": "a string ...", "eventId": "536", "eventTime": "2019-10-03T00:00", "eventType": "a string ...", "priority": "a string ...", "timeOccurred": "2019-10-03T00:00", "title": "a string ...", "event": {} }

**Operations on Resource Specification****Operations on Alarm****List alarms****GET /alarm?fields=...&{filtering}**

## Description

This operation list alarm entities.

Attribute selection is enabled for all first level attributes.

Filtering may be available depending on the compliance level supported by an implementation.

## Usage Samples

Here's an example of a request for retrieving Alarm resources.

Request
GET /tmf-api/iotdevicemanagement/v4/alarm Accept: application/json
Response
200  [ { "id": "8675309", "href": "https://host:port/alarmManagement/v4/alarm/8675309", "@baseType": "Alarm", "@type": "Alarm", "@schemaLocation": "https://host:port/Alarm.schema.json", "externalAlarmId": "5551212", "state": "UPDATED", "alarmType": "Environmental Alarm", "perceivedSeverity": "MAJOR", "probableCause": "Rectifier Low voltage", "specificProblem": "ps=3,sl=1,in=8", "alarmedObjectType": "Rectifier", "alarmedObject": { "id": "93051825", "href": "https://host:port/resourceInventoryManagement/v4/resource/93051825" }, "sourceSystemId": "ems-1", "alarmDetails": "voltage=95", "alarmRaisedTime": "2019-07-03T03:32:17.235Z", "alarmReportingTime": "2019-07-03T03:32:17.552Z", "alarmChangedTime": "2019-07-03T03:32:52.744Z", "ackSystemId": "ems-1", "ackUserId": "bob@example.net", "ackTime": "2019-07-03T03:33:12.623Z", "ackState": "ACKNOWLEDGED", "isRoot": false, "parentAlarm": { "id": "8675300" }, }



```

"correlatedAlarm": [
  {
    "id": "8675399",
    "href": "https://host:port/alarmManagement/v4/alarm/868675399"
  }
],
"comments": [
  {
    "userId": "bob@example.net",
    "systemId": "ems-1",
    "time": "2019-07-03T03:37:33.827Z",
    "comment": "Dispatched"
  }
]
}
]

```

## Retrieve alarm

**GET /alarm/{id}?fields=...&{filtering}**

### Description

This operation retrieves an alarm entity.

Attribute selection is enabled for all first level attributes.

Filtering on sub-resources may be available depending on the compliance level supported by an implementation.

### Usage Samples

Here's an example of a request for retrieving an Alarm resource.

Request
GET /tmf-api/iotdevicemanagement/v4/alarm/8675309 Accept: application/json
Response
200  <pre> {   "id": "8675309",   "href": "https://host:port/alarmManagement/v4/alarm/8675309",   "@baseType": "Alarm",   "@type": "Alarm",   "@schemaLocation": "https://host:port/Alarm.schema.json", </pre>

```
"externalAlarmId": "5551212",
"state": "UPDATED",
"alarmType": "Environmental Alarm",
"perceivedSeverity": "MAJOR",
"probableCause": "Rectifier Low voltage",
"specificProblem": "ps=3,sl=1,in=8",
"alarmedObjectType": "Rectifier",
"alarmedObject": {
  "id": "93051825",
  "href": "https://host:port/resourceInventoryManagement/v4/resource/93051825"
},
"sourceSystemId": "ems-1",
"alarmDetails": "voltage=95",
"alarmRaisedTime": "2019-07-03T03:32:17.235Z",
"alarmReportingTime": "2019-07-03T03:32:17.552Z",
"alarmChangedTime": "2019-07-03T03:32:52.744Z",
"ackSystemId": "ems-1",
"ackUserId": "bob@example.net",
"ackTime": "2019-07-03T03:33:12.623Z",
"ackState": "ACKNOWLEDGED",
"isRoot": false,
"parentAlarm": {
  "id": "8675300"
},
"correlatedAlarm": [
  {
    "id": "8675399",
    "href": "https://host:port/alarmManagement/v4/alarm/868675399"
  }
],
"comments": [
  {
    "userId": "bob@example.net",
    "systemId": "ems-1",
    "time": "2019-07-03T03:37:33.827Z",
    "comment": "Dispatched"
  }
]
}
```

## Create alarm

### POST /alarm

#### Description

This operation creates an alarm entity.

#### Mandatory and Non Mandatory Attributes

The following tables provide the list of mandatory and non mandatory attributes when creating an Alarm, including any possible rule conditions and applicable default values. Notice that it is up to an implementer to add additional mandatory attributes.

Mandatory Attributes	Rule
----------------------	------

Non Mandatory Attributes	Rule
@baseType	
@schemaLocation	
@type	
ackState	
ackSystemId	
ackUserId	
affectedService	
alarmChangedTime	
alarmClearedTime	
alarmDetails	
alarmEscalation	
alarmRaisedTime	
alarmReportingTime	
alarmType	
alarmedObject	
alarmedObjectType	
clearSystemId	
clearUserId	
comments	
correlatedAlarm	
crossedThresholdInformation	
externalAlarmId	
isRootCause	
parentAlarm	
perceivedSeverity	
plannedOutageIndicator	
probableCause	
proposedRepairedActions	
serviceAffecting	
sourceSystemId	
specificProblem	
state	

## Usage Samples

Here's an example of a request for creating an Alarm resource. In this example the request only passes mandatory attributes.

<b>Request</b>
<pre>POST /tmf-api/iotdevicemanagement/v4/alarm Content-Type: application/json  {</pre>
<b>Response</b>
<pre>201  {   "id": "8675309",   "href": "https://host:port/alarmManagement/v4/alarm/8675309" }</pre>

## Patch alarm

### PATCH /alarm/{id}

#### Description

This operation allows partial updates of an alarm entity. Support of json/merge (<https://tools.ietf.org/html/rfc7386>) is mandatory, support of json/patch (<http://tools.ietf.org/html/rfc5789>) is optional.

Note: If the update operation yields to the creation of sub-resources or relationships, the same rules concerning mandatory sub-resource attributes and default value settings in the POST operation applies to the PATCH operation. Hence these tables are not repeated here.

#### Patchable and Non Patchable Attributes

The tables below provide the list of patchable and non patchable attributes, including constraint rules on their usage.

Patchable Attributes	Rule
@baseType	
@schemaLocation	
@type	
ackState	
ackSystemId	
ackUserId	
affectedService	
alarmChangedTime	
alarmClearedTime	

Patchable Attributes	Rule
alarmDetails	
alarmEscalation	
alarmRaisedTime	
alarmReportingTime	
alarmType	
alarmedObject	
alarmedObjectType	
clearSystemId	
clearUserId	
comments	
correlatedAlarm	
crossedThresholdInformation	
externalAlarmId	
isRootCause	
parentAlarm	
perceivedSeverity	
plannedOutageIndicator	
probableCause	
proposedRepairedActions	
serviceAffecting	
sourceSystemId	
specificProblem	
state	

Non Patchable Attributes	Rule
id	
href	

## Usage Samples

Here's an example of a request for patching an Alarm resource.

Request
PATCH /tmf-api/iotdevicemanagement/v4/alarm/8675309 Content-Type: application/merge-patch+json  <pre>{   "name": "new name" }</pre>
Response

200

```
{
  "id": "8675309",
  "href": "https://host:port/alarmManagement/v4/alarm/8675309",
  "@baseType": "Alarm",
  "@type": "Alarm",
  "@schemaLocation": "https://host:port/Alarm.schema.json",
  "externalAlarmId": "5551212",
  "state": "UPDATED",
  "alarmType": "Environmental Alarm",
  "perceivedSeverity": "MAJOR",
  "probableCause": "Rectifier Low voltage",
  "specificProblem": "ps=3,sl=1,in=8",
  "alarmedObjectType": "Rectifier",
  "alarmedObject": {
    "id": "93051825",
    "href": "https://host:port/resourceInventoryManagement/v4/resource/93051825"
  },
  "sourceSystemId": "ems-1",
  "alarmDetails": "voltage=95",
  "alarmRaisedTime": "2019-07-03T03:32:17.235Z",
  "alarmReportingTime": "2019-07-03T03:32:17.552Z",
  "alarmChangedTime": "2019-07-03T03:32:52.744Z",
  "ackSystemId": "ems-1",
  "ackUserId": "bob@example.net",
  "ackTime": "2019-07-03T03:33:12.623Z",
  "ackState": "ACKNOWLEDGED",
  "isRoot": false,
  "parentAlarm": {
    "id": "8675300"
  },
  "correlatedAlarm": [
    {
      "id": "8675399",
      "href": "https://host:port/alarmManagement/v4/alarm/868675399"
    }
  ],
  "comments": [
    {
      "userId": "bob@example.net",
      "systemId": "ems-1",
      "time": "2019-07-03T03:37:33.827Z",
      "comment": "Dispatched"
    }
  ],
  "name": "new name"
}
```

## API NOTIFICATIONS

For every single of operation on the entities use the following templates and provide sample REST notification POST calls.

It is assumed that the Pub/Sub uses the Register and UnRegister mechanisms described in the REST Guidelines reproduced below.

### Register listener

#### POST /hub

##### Description

Sets the communication endpoint address the service instance must use to deliver information about its health state, execution state, failures and metrics. Subsequent POST calls will be rejected by the service if it does not support multiple listeners. In this case DELETE /api/hub/{id} must be called before an endpoint can be created again.

##### Behavior

Returns HTTP/1.1 status code 204 if the request was successful.

Returns HTTP/1.1 status code 409 if the request is not successful.

##### Usage Samples

Here's an example of a request for registering a listener.

<b>Request</b>
<pre>POST /api/hub Accept: application/json  {"callback": "http://in.listener.com"}</pre>
<b>Response</b>
<pre>201 Content-Type: application/json Location: /api/hub/42  {"id": "42", "callback": "http://in.listener.com", "query": null}</pre>

## Unregister listener

**DELETE** /hub/{id}

### Description

Clears the communication endpoint address that was set by creating the Hub.

### Behavior

Returns HTTP/1.1 status code 204 if the request was successful.

Returns HTTP/1.1 status code 404 if the resource is not found.

### Usage Samples

Here's an example of a request for un-registering a listener.

<b>Request</b>
DELETE /api/hub/42 Accept: application/json
<b>Response</b>
204

## Publish Event to listener

**POST** /client/listener

### Description

Clears the communication endpoint address that was set by creating the Hub.

Provides to a registered listener the description of the event that was raised. The /client/listener url is the callback url passed when registering the listener.

### Behavior

Returns HTTP/1.1 status code 201 if the service is able to set the configuration.

### Usage Samples

Here's an example of a notification received by the listener. In this example "EVENT TYPE" should be replaced by one of the notification types supported by this API (see Notification resources Models section) and EVENT BODY refers to the data structure of the given notification type.



<b>Request</b>
POST /client/listener Accept: application/json  { "event": { EVENT BODY }, "eventType": "EVENT_TYPE" }
<b>Response</b>
201

For detailed examples on the general TM Forum notification mechanism, see the TMF REST Design Guidelines.

# Acknowledgements

## Document History

### Version History

Version Number	Date	Release led by:	Description
1.0	17-Oct-2019	Pierre Gauthier	Team Approved. This is the initial release of this document
1.0.1	25-May-2020	Adrienne Walcott	Updated to reflect TM Forum Approved Status

### Release History

Release Number	Date	Release led by:	Description
Pre-production	17-Oct-2019	Pierre Gauthier	This is the initial release of this document.
Production	25-May-2020	Adrienne Walcott	Updated to reflect TM Forum Approved Status

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