Frameworx Specification

REST API Design Guidelines Part 2

Advanced guidelines for RESTful APIs lifecycle management, polymorphism, common tasks

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Notice

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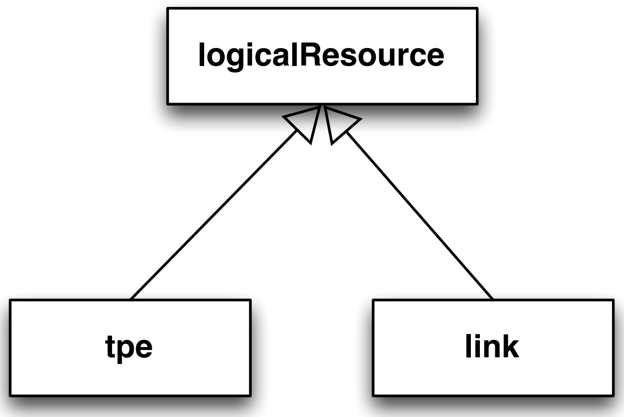
Executive Summary

This document, “REST API Design Guidelines Part 2” provides information for the development of TM Forum APIs using REST.

It provides recommendations and guidelines for the implementation of the Polymorphic Operations, Common Export and Import Tasks and finally the Entity Lifecycle Management related patterns.

1. Polymorphic Collections and Types

In the following section we will use a simple example based on a Logical Resource Inventory Management system to illustrate the concept of polymorphic collections and types.



Anonymous collections are used to group resource of the same type or resources related to the same base type.

For example the party collection in a party management system can be used to group all the individual and organization resources.

- The name of a type in the design guideline represents the collection linked to the type of resource.
    - For example “tpe” represents the collection of all tpe resources while “link” represents the collection of all the “link” resources.
- TYPE is a reserved resource attribute like ID is.
    - For example a link entity will have a “type”=”link” attribute.
- The name of the TYPE attribute is the same as the name of the resource.
- Type scoping is implict to the declaration of the collection type.
- The base type of an entity can be used to represent the collection

of all entitities with the same base type.
  - For example the “logicalResource” collection will scope both the “tpe” and “link” resources.
- The subtype can be used to represent the collection of all entities of a sub type.
  - For example “tpe” only represent the “tpe” resources.
- When querying on a base collection type only the most derived concrete resource representations are returned. The abstract resource is never returned.
  - GET /logicalResource will only return resource representation for “tpe or “link”. Never for “party”.
- A base collection can only be used as the base colelction type to target entities related by the same super type.
- Every entity must be adressable via their proper collections. Only the most derived resource is the representation of the entity there are no other representations.
  - For example it may possible to do a GET /logicalResource/?type=”link”&”id”=”42” or GET /link/42 will return the same resources.
- Only concrete resources support the CUD uniform operations
  - POST operations are not supported against BASE TYPES
  - PUT operations are not supported against BASE TYPES
  - PATCH operations are not supported against BASE TYPES
  - DELETE operations are not supported against BASE TYPES
- Abstract resources may support GET operations
- Notifications are always relative to the concrete type or most derived resource representation.

Query using base collection

The following example operation shows how to retrieve collections of any logical resource items.
For example we can retrieve both tpe and links using this operation.

REQUEST

```
GET /api/inventory/logicalResource

Accept: application/json
```

RESPONSE

```
200

Content-Type: application/json

Content-Range: 1-3/3

[
   {
      "id": "1",
      "type": "tpe",
      "isBundle": false,
      "alias": [
         {
            "name": "CLI name",
            "value": "tpe22938"
         }
      ],
      "href": "http://server/api/inventory/tpe/1"
   },
   {
      "id": "2",
      "type": "tpe",
      "isBundle": false,
      "alias": [
         {
            "name": "CLI name",
            "value": "tpe22938"
         }
      ],
      "href": "http://server/api/inventory/tpe/2"
   },
   {
      "id": "3",
      "type": "link",
      "isBundle": false,
      "href": "http://server/api/inventory/link/3",
            "tp": [
              {
                "href": "http://server/api/inventory/tpe/1",
                "role": "AEND"
              },
              {
                "href": "http://server/api/inventory/tpe/2",
                "role": "ZEND"
              }
            ]
          }
        ]
```

Or using ID based filtering to extract specific resources.

REQUEST

```
GET /api/inventory/logicalResource?id=1&id=3

Accept: application/json
```

RESPONSE

```
200

Content-Type: application/json



[
  {
    "id": "1",
    "type": "tpe",
    "isBundle": false,
    "alias": [
      {
        "name": "CLI name",
        "value": "tpe22938"
      }
    ],
    "href": "http://server/api/inventory/tpe/1"
```

```
        },
        {
            "id": "3",
            "type": "link",
            "isBundle": false,
            "href": "http://server/api/inventory/link/3",
            "tp": [
                {
                    "href": "http://server/api/inventory/tpe/1",
                    "role": "AEND"
                },
                {
                    "href": "http://server/api/inventory/tpe/2",
                    "role": "ZEND"
                }
            ]
        }
    ]
```

2. Export and Import Data Tasks

This section describes the common tasks used for exporting and importing resources representations to files.

Two common task resources are defined:

- ImportJob used to import resources from a File
- ExportJob used to export resources to a File

Export Job Resource

An ExportJob resource represents a TASK used to export resources to a File

The ExportJob resource supports the following properties:

Attribute name	Description
query	Used to scope the exported data (identical to GET filter construct using target ID as base) “query”: ”type=productOffering&version=2.0”
path	URL of the root resource acting as the source for for streaming content to the file specified by the ExportJob ../catalogManagement/catalog/42 i.e the relative path to the exportJob when it was created can also be used
content-type	The format of the exported data .By default “application/json”

status	notstarted, running, succeeded, failed
url	URL of the File containing the data to be exported a file URL, which is of the form file://host/path where host is the fully qualified domain name of the system on which the path is accessible, and path is a hierarchical directory path of the form directory/directory/.../name
completionDate	Date at which the Job was completed.
creationDate	Date at which the Job was created.
errorLog	Reason for Failure

Import Job Resource

An ImportJob resource represent a TASK used to import resources from a File

The ImportJob resource supports the following properties:

Attribute name	Description
content-type	The format of the imported data .By default "application/json"

path	URL of the root resource where the content of the file specified by the ImportJob must be applied ../catalogManagement/catalog/42 i.e the relative path to the importJob when it was created
status	notstarted, running, succeeded, failed
url	URL of the File containing the data to be imported a file URL, which is of the form file://host/path where host is the fully qualified domain name of the system on which the path is accessible, and path is a hierarchical directory path of the form directory/directory/.../name
completionDate	Date at which the Job was completed.
creationDate	Date at which the Job was created.
errorLog	Reason for Failure if status is failed

Creating Export Jobs

ExportJob Tasks are created as resources. The ExportJob is attached to a specific resource acting as the root for the collection of resources to be streamed to a File.

An ExportJob can be attached to a specific Catalog in a Catalog application or may be attached to the Product Offerings within a Catalog.

- ../catalogManagement/catalog/42/exportJob
  Export all the resources within the Catalog 42
- ../catalogManagement/catalog/42/productOffering/exportJob
  Export all the ProductOffering resources

For example:

REQUEST

```
POST catalogManagement/catalog/{10}/exportJob
Content-type: application/json

{
}
```

RESPONSE

```
201
Content-Type: application/json
Location: /api/catalogManagement/exportJob/54


{
    "id": "54",
    "href": "http:/api/catalogManagement/exportJob/54",
    "status": "running",
    “path”: “catalogManagement/catalog/10" ,
    “content-type”: “application/json”,
    "errorLog": "",
    “creationDate” : “2013-04-19T16:42:23-04:00",
    “completionDate” : “",
        "url": "ftp://ftp.myCatalog.com/productCatalog/54"
    }
```

Creating Import Jobs

ImportJob Tasks are created as resources. The ImportJob maybe attached to the URL of the root resource where the content of the file specified by the ImportJob will be applied.

For example to apply the content of the import file to the catalog 10 :

REQUEST

```
POST catalogManagement/catalog/{10}/importJob
Content-type: application/json

{
}
```

RESPONSE

```
201
Content-Type: application/json
Location: /api/catalogManagement/importJob/554


{
    "id": "554",
    "href": "http:/api/catalogManagement/importJob/554",
    "status": "running",
    "path": "catalogManagement/catalog/10" ,
    "content-type": "application/json",
    "errorLog": "",
    "creationDate" : "2013-04-19T16:42:23-04:00",
    "completionDate" : "",
     "url": "ftp://ftp.myCatalog.com/productCatalog/partner54"
}
```

Query Export Jobs

ExportJob resources can be found under the API/exportJob collection and may be retrieved using the normal GET constructs.

For example:

```
GET API/catalogManagement/exportJob/{10}
Accept: application/json
```

RESPONSE

```
{
    "id": "10",
    "status": "Succeeded"
}
```

Query Import Jobs

ImportJob resources can be found under the API/importJob collection and may be retrieved using the normal GET constructs.

```
GET /catalogManagement/importJob/{25}
Accept: application/json
```

RESPONSE

```
{
        "id": "25",
        "status": "Succeeded"

    }
```

Export Job Completion Notification

This event provides notification that an export task has been completed.

For example:

REQUEST

```
POST /client/listener
Accept: application/json

{
  "event": {
    "id": "54",
     "href": "http:/api/catalogManagement/exportJob/54",
    "status": "running",
     “path”: “catalogManagement/catalog/{10}" ,
     “content-type”: “application/json”,
    "errorLog": "",
     “creationDate” : “2013-04-19T16:42:23-04:00",
     “completionDate” : “",
      "url": "ftp://ftp.myCatalog.com/productCatalog/54"
  },
  "eventType": "exportJobCompleted"
}
```

Import Job Completion Notification

This event provides a notification that an import task has been completed.

REQUEST

```
POST /client/listener
Accept: application/json

{
   "event": {
    "id": "554",
     "href": "http:/api/catalogManagement/importJob/554",
    "status": "running",
     “path”: “catalogManagement/catalog/10" ,
     “content-type”: “application/json”,
    "errorLog": "",
     “creationDate” : “2013-04-19T16:42:23-04:00",
     “completionDate” : “2013-04-19T16:42:23-04:15",
      "url": "ftp://ftp.myCatalog.com/productCatalog/partner54"
   },
   "eventType": "importJobCompleted"
}
```

3. Depth Directive

A common use case is to query a resource and “dereference” or “embed” the hyperlinked resource representations. This is achieved by issuing a GET with the DEPTH directive.

The GET /api/<resource>/?DEPTH=n operation is used to expand inline the referenced data up to the level of the specified depth level.

In the following example the local represented the dereferenced data for href": "http://server/api/shelf/7788

```
GET /catalogManagement/productOffering/23/?depth=3
Accept: application/json
```

RESPONSE

```
Content-Range:items 23-24/50
[
    {
            "id": "23",
            "href":
"http://serverlocation:port/catalogManagement/productOffering/23",
            "version": "2.0",
            "lastUpdate": "2013-04-19T16:42:23-04:00",
            "name": "Sensor mini",
            "description": "A wireless sensor for small garden",
            "isBundle": "false",
            "lifecycleStatus": "Active",
            "validFor": {
                    "startDateTime": "2013-04-19T16:42:23-04:00",
                    "endDateTime": "2013-06-19T00:00:00-04:00"
            },
            "category": [
                    {
                            "id": "14",
                            "href":
"http://serverlocation:port/catalogManagement/category/14",
                            "version": "2.0",
                    "name": "Wireless sensors"
                }
            ],
            "channel": [
                {
                    "id": "13",
                    "href":
"http://serverlocation:port/marketSales/channel/13",
                    "name": "IOT Corner"
                }
            ],
            "place": [
                {
                    "id": "12",
                    "href":
"http://serverlocation:port/marketSales/place/12",
                    "name": "France"
                }
            ],
            "serviceLevelAgreement": {
                "id": "28",
                "href":
"http://serverlocation:port/slaManagement/serviceLevelAgreement/28",
                "name": "Standard SLA"
            },
            "productSpecification": [
                {
                    "id": "13",
                    "href":
"http://serverlocation:port/catalogManagement/productSpecification/13",
                    "version": "2.0",
                    "name": "wireless sensor mini",
                    "productSpecCharacteristic": [
                        {
                            "id": "34",
                            "name": "Colour",
                            "description": "Colour",
                            "valueType": "string",
                            "configurable": "true",
                            "validFor": {
                                "startDateTime": "2013-
04-19T16:42:23-04:00",
                                "endDateTime": ""
                            },
        "ProductSpecCharacteristicValue": [
                                            {
                                                "valueType":
    "string",
                                                "default": "false",
                                                "value": "Black",

        "unitOfMeasure": "",
                                                "valueFrom": "",
                                                "valueTo": "",
                                                "validFor": {

        "startDateTime": "2013-04-19T16:42:23-04:00",

        "endDateTime": ""
                                                }
                                            }, {
                                                "valueType":
    "string",
                                                "default": "false",
                                                "value": "White",

        "unitOfMeasure": "",
                                                "valueFrom": "",
                                                "valueTo": "",
                                                "validFor": {

        "startDateTime": "2013-04-19T16:42:23-04:00",

        "endDateTime": ""
                                                }
                                            }
                                        ]
                                    }
                                ]
                            }
                        ],
                        "productOfferingPrice": [
                            {
                                "id": "15",
                                "href":
    "http://serverlocation:port/catalogManagement/productOfferingPrice/15",
                                "name": "Sale Price",
                                "description": "Sale price",
                                "validFor": {
                                        "startDateTime": "2013-04-
19T16:42:23-04:00",
                                        "endDateTime": "2013-06-19T00:00:00-
04:00"
                                },
                                "priceType": "one time",
                                "unitOfMeasure": "",
                                "price": {
                                        "taxIncludedAmount": "12.00",
                                        "dutyFreeAmount": "10.00",
                                        "taxRate": "20.00",
                                        "currencyCode": "EUR"
                                },
                                "recurringChargePeriod": "",
                                "productOfferPriceAlteration": {
                                        "id": "15",
                                        "href": "
http://serverlocation:port/catalogManagement/productOfferPriceAlteration/1
5",
                                        "name": "Shipping Discount",
                                        "description": "One time shipping
discount",
                                        "validFor": {
                                                "startDateTime": "2013-04-
19T16:42:23-04:00",
                                                "endDateTime": ""
                                        },
                                        "priceType": "One Time discount",
                                        "unitOfMeasure": "",
                                        "price": {
                                                "percentage": "100%"
                                        },
                                        "recurringChargePeriod": "",
                                        "applicationDuration": "",
                                        "priceCondition": "apply if total amount
of the  order is greater than 300.00"
                                }
                        }
                ]
        }
```

4. Entity Versioning and Lifecycle Management

In Product Lifecycle Management there is a requirement to distinguish between entities existing with different PLM version numbers and accessible via different ACL mechanisms.

For example the same Product Offerings may exist in a Catalog but with different version numbers.

It may be possible for an administrator to see all the existing versions or for a partner to see only a subset of all the existing versions.

The entity version number is not dependent on the version number of the API. For example in PLM the same API (running at a specific version number) may be used to retrieve entities with different PLM version numbers.

In order to distinguish resources representing entities running with different version numbers and accessible though the same API version the following directive can be used /id:(version=x) and the version attribute is added to each entity.

```
{
    "id": "42",
    "href": "http://serverlocation:port/catalogManagement/productOffering/42",
    "version": "1.0",
    "lastUpdate": "2013-04-19T16:42:23-04:00",
    "name": "Virtual Storage Medium",
    "description": "Virtual Storage Medium",
    "isBundle": "true",
    "lifecycleStatus": "Active",
…..
}
```

Note that the resources in this case may have the same ID but may be distinguished by the inclusion of the version number in their ID i.e

/42:(version=1.0), /42:(version=2.0).

In the following examples we will assume that two versions of the VirtualStorage Product Offer exist in the Product Catalog an Inactive and Active version respectively version 1.0 and version 2.0.

Query all versioned resources

Admin user of Catalog have access to all the versions of the resources while non admin users have by default access to only the latest version of the entities in the Catalog.

Users with different roles may have access to different versions of the entities in the catalog. For example user A may have access to only the version 1.0 of the entities while user B may have access to version 1.0 and version 2.0.

For example the following request on the admin endpoint will return all the versioned resources matching a specific ID.

REQUEST

```
GET api/admin/catalogManagement/productOffering/?id=VirtualStorage
Accept: application/json
```

RESPONSE

```
200
Content-Type: application/json

[{
    "id": " VirtualStorage ",
    "href":
"http://serverlocation:port/catalogManagement/productOffering/VirtualStorage",
    "version": "1.0",
    "lastUpdate": "2013-04-19T16:42:23-04:00",
    "name": "Virtual Storage Medium",
    "description": "Virtual Storage Medium",
    "isBundle": "true",
    "lifecycleStatus": "InActive",
…..
},
{
    "id": " VirtualStorage ",
    "href": "http://serverlocation:port/catalogManagement/productOffering/
VirtualStorage ",
    "version": "2.0",
    "lastUpdate": "2013-04-19T16:42:23-04:00",
    "name": "Virtual Storage Medium",
    "description": "Virtual Storage Medium",
    "isBundle": "true",
    "lifecycleStatus": "Active",
…..
}
]
```

Query a specific versioned resource

In general a non admin API user only has visibility to the latest version number or visibility to a subset of versioned resources.

It may be possible for an admin API user to retrieve a resource with a specific version number by using an ID and versioning filtering criteria.

REQUEST

```
GET
api/admin/catalogManagement/productOffering/?id=VirtualStorage&version=1.0
Accept: application/json
```

RESPONSE

```
200
Content-Type: application/json

[{
    "id": "42",
    "href": "http://serverlocation:port/catalogManagement/productOffering/42",
    "version": "1.0",
    "lastUpdate": "2013-04-19T16:42:23-04:00",
    "name": "Virtual Storage Medium",
    "description": "Virtual Storage Medium",
    "isBundle": "true",
    "lifecycleStatus": "Active",
…..
]
```

Query current version of a resource

By default only the most current version is returned (for admin and non admin).

REQUEST

```
GET api/admin/catalogManagement/productOffering/VirtualStorage
Accept: application/json
```

RESPONSE

```
200
Content-Type: application/json

{
    "id": "42",
    "href": "http://serverlocation:port/catalogManagement/productOffering/42",
    "version": "2.0",
    "lastUpdate": "2013-04-19T16:42:23-04:00",
    "name": "Virtual Storage Medium",
    "description": "Virtual Storage Medium",
    "isBundle": "true",
    "lifecycleStatus": "Active",
…..
}
```

Create new version of a resource

POST is used to create a new version of a resource.

The constraint is that the version numbers for the resource having the same ID must differ.

REQUEST

POST catalogManagement/productOffering
Content-type: application/json
 	
{
    “id”: “VirtualStorage”,
    "version": "3.0",
    "name": "Virtual Storage Medium",
    "description": "Virtual Storage Medium",
    "isBundle": "true",
    "lifecycleStatus": "Active",
    "validFor": {
        "startDateTime": "2013-04-19T16:42:23-04:00",
        "endDateTime": "2013-06-19T00:00:00-04:00"
    },
…
    }

RESPONSE

201
Content-Type: application/json
 	
{
    "id": "VirtualStorage",
    "href": "http://serverlocation:port/catalogManagement/productOffering/42",
    "version": "3.0",
    "lastUpdate": "2013-04-19T16:42:23-04:00",
    "name": "Virtual Storage Medium",
    "description": "Virtual Storage Medium",
    "isBundle": "true",
    "lifecycleStatus": "Active",
    "validFor": {
        "startDateTime": "2013-04-19T16:42:23-04:00",
        "endDateTime": "2013-06-19T00:00:00-04:00"
    },
…
    }

Modify an existing version of a resource

By default PATCH or PUT will be acting only on the latest version of the Resource. For example PATCH /…/productOffering/VirtualStorage will only update the VirtualStoage ProductOffering at Version 2.0 (which is the most current).

To update a specific version of an entity the (Version=X) directive is added to the ID (i.e /id:(version=x) .

Note that this capability is only available to API users having the proper authorizations to change the catalog entities with specific version numbers.

For example to change the VirtualStorage versioned at 1.0 we could use /productOffering/VirtualStorage(Version=1.0)

REQUEST

```
PATCH /catalogManagement/productOffering/VirtualStorage(Version=1.0)
Content-type: application/json-patch+json

{

"lifecycleStatus": "Active"

    }
```

RESPONSE

```
201
Content-Type: application/json

{
    "id": "VirtualStorage",
    "href":
"http://serverlocation:port/catalogManagement/productOffering/VirtualStorage",
    "version": "1.0",

"lifecycleStatus": "Active",



…..
```

```
        }
```

Role based Access Control

The user presents their credentials for authentication

If the credentials are valid

1. The user is given access to the catalog
2. As defined by their role(s)
3. As defined by their access rights
4. As defined by the access type: CRUD, discover
5. As defined by the pre-defined filter

For example if they issue a get on a catalog that a party has no access they get an error response

Or if they try to modify an area of the catalog but do not have Write Access they get an error response

We anticipate that the OAUTH2 or Open ID Connect will be used as the authorization APIs and that ACL are established between authorized parties with regards to the content of the Catalog (i.e GET but also enable of update operations on specific entities).

5. Appendix A: Terms and Abbreviations Used within this Document

Terminology

Term	Definition	TMF or Outside Source
<<BA Specific Term 1>>	<<Definition 1>>	<<Source>>
<<BA Specific Term n>>	<<Definition n>>	<<Source>>

Abbreviations and Acronyms

Abbreviation/ Acronym	Abbreviation/ Acronym Spelled Out	Definition	TMF or External Source
<<Abbreviation/ Acronym 1>>	<<Expansion of abbreviation/acronym 1>>	<<Definition 1>>	<<Source>>
<<Abbreviation/ Acronym n>>	<<Expansion of abbreviation/acronym n>>	<<Definition n>>	<<Source>>

6. References

References

Reference	Description	Source	Brief Use Summary
Project Charter	<<PROJECT name>> Project Charter		<<summary>>
Link To Models	<< Hyperlinks to or location of associated models>>		<<summary>>
<<Reference 1>>	<<Type, Title, Number, Revision, Date>>		<<summary>>
<<Reference n>>	<< Type, Title, Number, Revision, Date>>		<<summary>>

IPR Releases and Patent Disclosures

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7. Administrative Appendix

This Appendix provides additional background material about the TM Forum and this document. In general, sections may be included or omitted as desired; however, a Document History must always be included.

Document History

7.0.1. Version History

<This section records the changes between this and the previous document version as it is edited by the team concerned. Note: this is an incremental number which does not have to match the release number and used for change control purposes only>

Version Number	Date Modified	Modified by:	Description of changes
1.0	23/11/2014	Pierre Gauthier TM Forum	Description e.g. first issue of document

7.0.2. Release History

< This section records the changes between this and the previous Official document release. The release number is the 'Marketing' number which this version of the document is first being assigned to >

Release Number	Date Modified	Modified by:	Description of changes
1.0	DD/MMM/YY	<<name>>	first release of document

Company Contact Details

Company	Team Member Representative
Include all involved companies adding lines as	*Name* *Title*

necessary.	*Email* *Phone* *Fax*
	Name *Title* *Email* *Phone* *Fax*

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This document was prepared by the members of the TM Forum <<team name>> team:

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