



## Service Layer API for oneM2M

Draft

110 Pages

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### Abstract

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oneM2M is standard organization and specifies middleware for IoT, called Common Services Entities (CSE). Application can access functionality in CSE with RESTful operations, which are Create, Retrieve, Update, Delete and Notify. oneM2M allows variety of communication methods, 4 protocol bindings (HTTP, MQTT, CoAP, Websocket) and 3 serializations (XML, JSON, CBOR). This RFC describes the way to provide high level API for oneM2M RESTful operations hiding the difference of variety of communication methods.

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# 0 Document Information

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## 0.3 Feedback

This document can be downloaded from the OSGi Alliance design repository at <https://github.com/osgi/design>. The public can provide feedback about this document by opening a bug at <https://www.osgi.org/bugzilla/>.

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## 0.5 Terminology and Document Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY" and "OPTIONAL" in this document are to be interpreted as described in 10.1.

Source code is shown in this typeface.

## 0.6 Revision History

The last named individual in this history is currently responsible for this document.

Revision	Date	Comments
Initial	SEP 15 2017	Initial Contribution. Hiroyuki Maeomichi, NTT, <a href="mailto:maeomichi.hiroyuki@lab.ntt.co.jp">maeomichi.hiroyuki@lab.ntt.co.jp</a>
0.0.1	SEP 21 2017	Updated alternatives, some figures, added description on validator. Hiroyuki Maeomichi, NTT, <a href="mailto:maeomichi.hiroyuki@lab.ntt.co.jp">maeomichi.hiroyuki@lab.ntt.co.jp</a>

Revision	Date	Comments
0.0.2	April 17 2018	Update based on discussion in Washington meeting. Hiroyuki Maeomichi, NTT, <a href="mailto:maeomichi.hiroyuki@lab.ntt.co.jp">maeomichi.hiroyuki@lab.ntt.co.jp</a>
0.0.3	June 22 2018	Add new fields and class reflecting R3 draft of oneM2M: Added fields in RequestPrimitiveDTO, ResponsePrimitiveDTO, and FilterCriteriaDTO, and ReleaseVersion enum.  Organize DTOs: Added AttributeDTO, LocalIdTokenIdAssignmentDTO, and DasInfoDTO and remove DynAuthLocalIdAssignmentsDTO and DynAuthReqInfoDTO  Introduce OperationIF interface as a super interface of ProtocolBinding interface and CSE interface for enabling concise application code. This replaces former simple.Client.  Organize Introspection interfaces with less methods. They are moved to dedicated package.
0.0.4	June 25 2018	Add section 'Mapping Rules for Generic DTO'  Update Javadoc with more explanations. (moved old classes to org.osgi.service.onem2m.old package for preparing deletion.)  Add description to Security Consideration section.  Add oneM2M R3 specs and XSD to references.

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# 1 Introduction

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*Introduce the RFC. Discuss the origins and status of the RFC and list any open items to do.*

oneM2M is standard organization and specifies middleware for Internet of Things (IoT), called Common Services Entities (CSE). Applications can access CSE's functionality with RESTful operations, which are Create, Retrieve, Update, Delete and Notify. TS-0001 [2] defines more than 40 resource types to expose CSE's functionalities. oneM2M allows variety of communication methods, combination of 4 protocol bindings (HTTP, MQTT, CoAP, WebSocket) and 3 serializations (XML, JSON, CBOR).

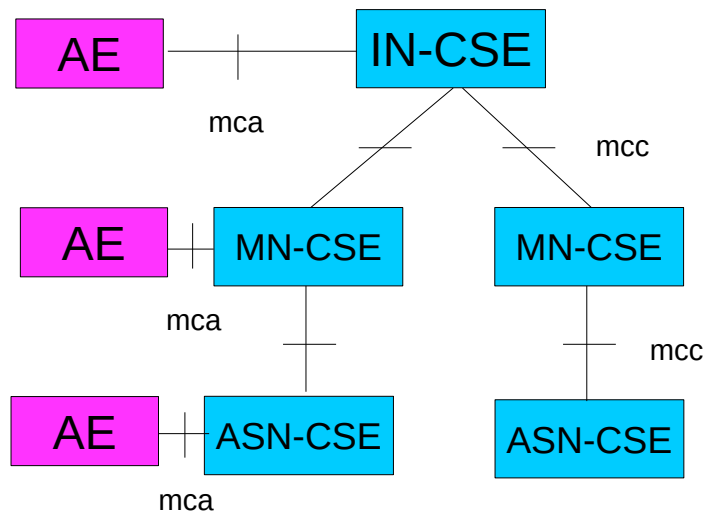
This RFP discuss the way to provide high level API (namely service layer API) for oneM2M RESTful operations hiding the difference of variety of communication methods.

## 2 Application Domain

*This section should be copied from the appropriate RFP(s). It is repeated here so it can be extended while the RFC authors learn more subtle details.*

### 2.1 IoT Application configuration using oneM2M

oneM2M's middleware, called CSE can be deployed in different locations and they are connected each other forming tree topology. Depending on deployed location, CSEs are categorized to 3 types, IN-CSE, MN-CSE and ASN-CSE. IN-CSE is located top of tree, ASN-CSE is located at leaf and MN-CSE is located and MN-CSE is located on middle.



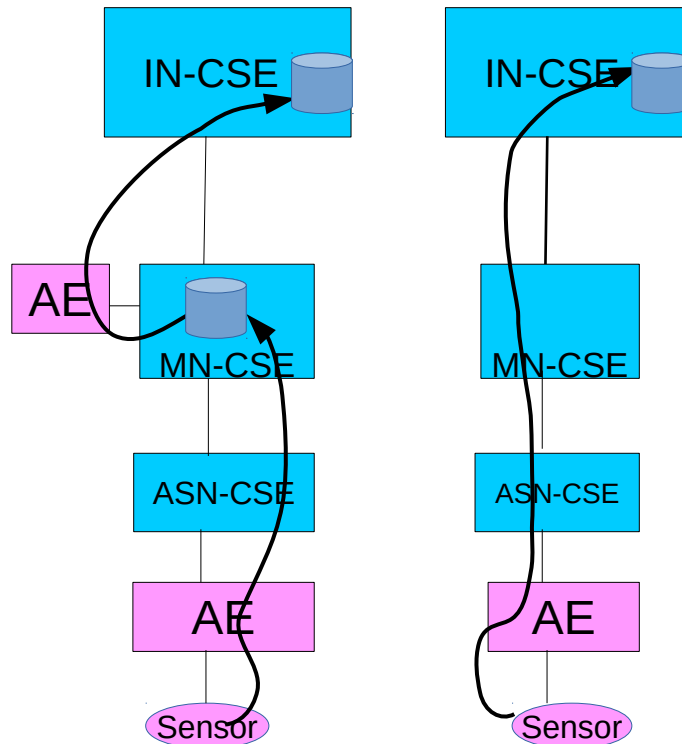
oneM2M's application, called Application Entity (AE) connects to one of CSEs. After AE connecting to the CSE, AE can access to all of CSEs, by retargeting function (similar to routing) of CSEs.

AE accesses to CSE's functionality through RESTful API, which consists of Create, Retrieve, Update, Delete and Notify in targeting more than 40 types of resources. For examples, typical resources are `<contentInstance>` that expresses IoT data and `<container>` that holds set of `<contentInstance>`s. AE can create or retrieve the `<contentInstance>` on any CSE by the retargeting functionality, as far as permission is allowed. Interface between CSEs is called `mcc` and interface between CSE and AE is called `mca`, both interfaces have almost same interface.

It is possible to develop variety types of distributed applications using the architecture. For example for IoT data aggregation applications, it is possible to develop gradual aggregation type or direct aggregation type. In gradual aggregation type, AE connected to ASN-CSE creates `<contentInstance>`s in ASN-CSE, and intermediate

applications calculate statistics and put the result on IN-CSE as a *<contentInstance>*, while, in direct aggregation type, AE connected to ASN-CSE creates *<contentInstance>*s in IN-CSE directly.

Under CSE layer, oneM2M specifies NSE(Network Services Entity), but this RFC doesn't cover the NSE layer.



## 2.2 Communication methods used in oneM2M

oneM2M allows variety of communication methods, combination of 4 protocol bindings (HTTP, MQTT, CoAP, Websocket) and 3 serializations (XML, JSON, CBOR). It might be added in future. oneM2M specifies specification in different level.

Firstly TS-0001[2] specifies high level resource definitions, it defines more than 40 resource types, such as *<contentInstance>* for storing IoT data, *<timeSeriesInstance>* for periodic sensor measurement with leap detection mechanism.

Secondly TS-0004[3] specifies procedures and serializations in independent manner from protocol bindings.

Resource type and protocol data unit are defined using XSD for XML serialization. Mapping between XML and other serializations are also specified.

Thirdly TS-0008, TS-0009, TS-0010, TS-0020 specify protocol specific details for CoAP, HTTP, MQTT and Web Socket respectively.

## 2.3 Long name and short name

oneM2M introduced two types of notation, called long name and short name for resource types, attribute and so on. Long name is human friendly string and specifications mainly use this notation, while short name is short string consist of typically 2 or 3 characters (but not limited and sometimes longer) and communication protocol use this notation. In most cases, the initial characters of long name are assigned as short name, for examples, ct for CreationTime and at for AnnounceTo.

## 3 Problem Description

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*This section should be copied from the appropriate RFP(s). It is repeated here so it can be extended while the RFC authors learn more subtle details.*

oneM2M specifies protocol based interface, but doesn't specify programming level API. As previously mentioned oneM2M allows variety of communication methods which are the combinations of 4 protocol bindings (HTTP, MQTT, CoAP, Websocket) and 3 serializations (XML, JSON, CBOR).

First problem is application portability. Without standardized API, application program tends to depend on the communication method initially intend to use and it will became hard to run another environment in which uses another communication method. (For example, an application designed for XML/HTTP, tend to run on environment use JSON/Websocket)

Second problem is the latency of the communication between CSE and application. Even if CSE and application is located in the same box, current oneM2M specifications define methods through protocols which requires serialization/deserialization of data, context-switch of applications, validation of incoming data and resulted in large latency compared to the situation both CSE and Application resides in the same Java VM and communicate with Java interfaces. Large latency reduces applicable area of oneM2M based solution.

Third problem is the complexity of handling of long name and short name. Even if short name is defined by trying to use initial characters, it is not straight forward to translate them in head.

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## 4 Requirements

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*This section should be copied from the appropriate RFP(s)*

- R0010 – The solution MUST provide means to access outer CSE from application.
- R0011 – The solution MUST provide means to access outer CSE from client CSE.
- R0012 – The solution MUST provide means to select a communication method for application.
- R0013 – The solution MUST provide means to select a communication method for client CSE.
- R0020 – The solution MUST provide means for CSE to accept requests form outer CSE.
- R0020 – The solution MUST provide means for CSE to accept requests form outer application.



- R0030 – The solution **MUST** provide means to communicate through Java interface between CSE and application that are located in the same OSGi framework.
- R0040 – The solution **SHOULD** hide differences of communication methods, which are combinations of 4 protocol bindings and 3 serializations (XML, JSON, CBOR).
- R0050 – The solution **SHOULD** provide developer friendly way for handling short names.
- R0060 – The solution **MUST** provide asynchronous interface using ‘call by value’, such as DTO.

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## 5 Technical Solution

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*First give an architectural overview of the solution so the reader is gently introduced in the solution (Javadoc is not considered gently). What are the different modules? How do the modules relate? How do they interact? Where do they come from? This section should contain a class diagram. Then describe the different modules in detail. This should contain descriptions, Java code, UML class diagrams, state diagrams and interaction diagrams. This section should be sufficient to implement the solution assuming a skilled person.*

*Strictly use the terminology a defined in the Problem Context.*

*On each level, list the limitations of the solutions and any rationales for design decisions. Almost every decision is a trade off so explain what those trade offs are and why a specific trade off is made.*

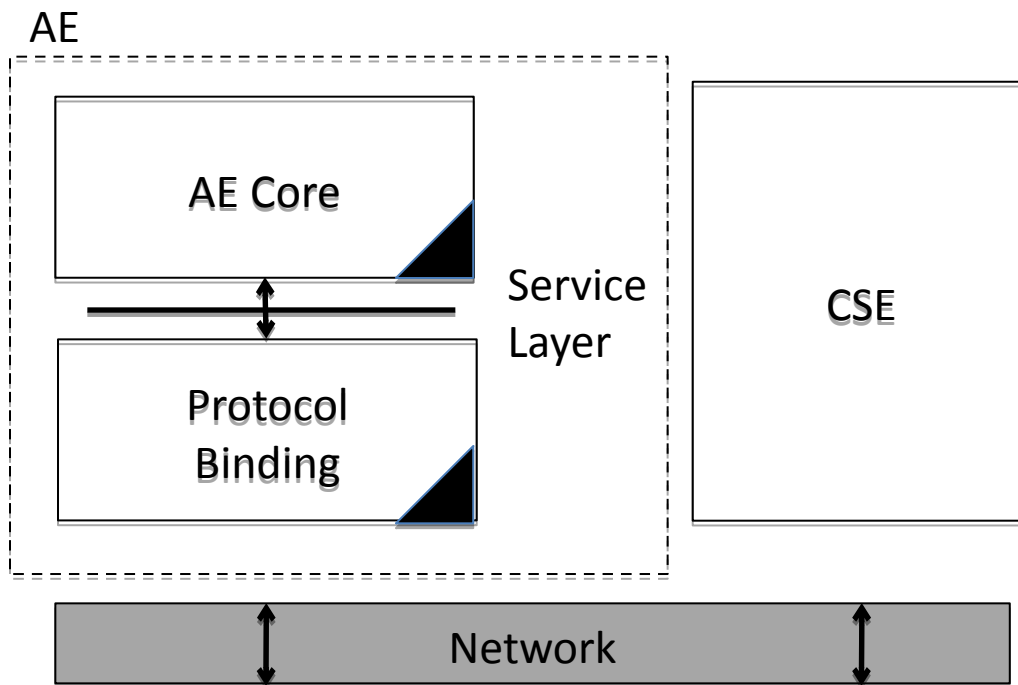
*Address what security mechanisms are implemented and how they should be used.*

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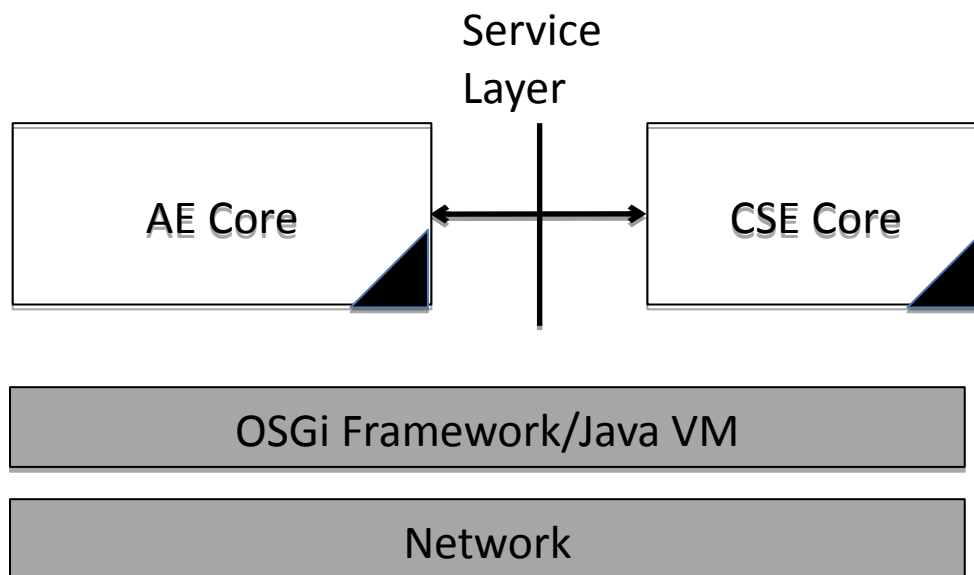
### 5.1 Overview for the solution

Protocol binding service is introduced to handle different protocols and serializations. oneM2M application uses the protocol binding service through Service Layer Interface to communicate CSE. The interface is protocol and serialization agnostic interface; it has no protocol and serialization specific methods, parameters, so that application can communicate to CSE without knowing which protocol is actually used.

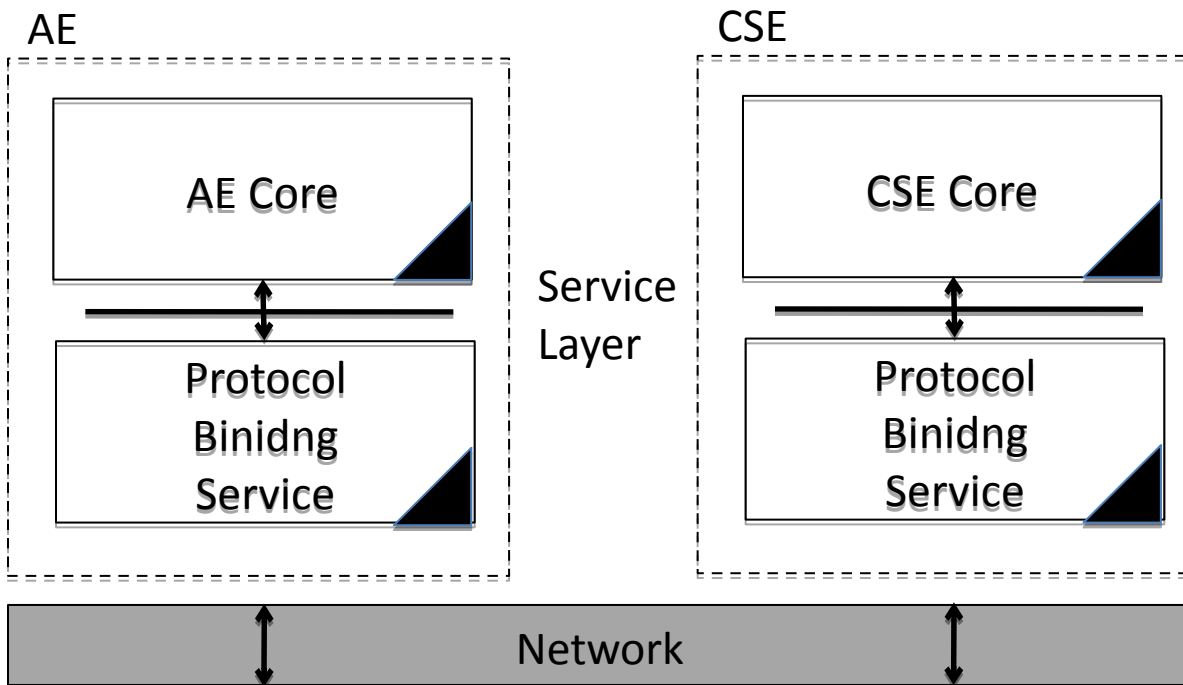
In figure, the term of Core is introduced for AE Core and CSE Core. This is for specifying parts which does not contain ProtocolBinding of AE and CSE.



Another use case is that the AE Core and the CSE core are located on the same OSGi Framework. In this use case, the AE Core and the CSE core communicate directly with API, without inter-mediating ProtocolBinding Services. Following figure depicts overall configuration. Though this type of communication is not clearly defined in oneM2M specification, communicating directly without serializing data between AE and CSE allows shorter latency and less computational resources.



Following figure (right hand side) shows potential implementation of CSE, which are consisted of CSE core and Protocol Binding Service, as symmetric to AE side. APIs defined in this RFC is consistent with the usage, but this RFC does not mandate that usage and it is left to implementor's choice.



## 5.2 Service Layer Interfaces

Service Layer Interface is defined as follows. Only method request sends request message and return Promise for the response. Here, Promise enables asynchronous messaging.

```
package org.osgi.service.onem2m.servicelayer;

import org.osgi.onem2m.dto.RequestDTO;
import org.osgi.onem2m.dto.ResponseDTO;
import org.osgi.util.promise.Promise;

/**
 * Service Layer Interface, which locates between AE and Protocol Binding Service.
 */
public interface ServiceLayer {
    /**
     * send a request.
     */
}
```

```
*  
* @param request request  
* @return promise for ResponseDTO.  
*/  
Promise<ResponseDTO> request(RequestDTO request);  
}
```

On the Service Layer interface, there are bidirectional invocations, that is, Both AE can be caller and callee of the interface. Typical and only case of AE acting as callee, is to receive notifications.

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### 5.3 OperationIF interfaces

Though Service Layer Interface enables all possible message exchange among oneM2M entities, it can be redundant to application developers, because they are required to write composition of requestPrimitive and decomposition of responsePrimitive. This interface is provided for application developer allowing to make less application codes. It provides higher level of abstraction; operation level of resource such as create, retrieve, update, delete and so on. They don't cover all of possible message exchange but do typical ones.

Note: If this RFC doesn't provide these methods, developers likely to create similar ones in their own (various) way.

```
public interface OperationIF {  
    /**  
     * create resource  
     *  
     * @param uri URI for parent resource  
     * @param resource resource data  
     * @return Promise of created resource  
     */  
    public Promise<ResourceDTO> create(String uri, ResourceDTO resource);  
  
    /**  
     * retrieve resource  
     *  
     * @param uri URI for retrieving resource  
     * @return retrieved resource data  
     */  
    public Promise<ResourceDTO> retrieve(String uri, ResourceDTO resource);  
  
    /**  
     * retrieve subset of attributes.  
     *  
     * @param uri URI for retrieving resource  
     * @param targetNames attribute names for retrival  
     * @return retrieved resource data  
     */  
}
```

```

    public Promise<ResourceDTO> retrieve(String uri, List<String>
targetAttributes);

    /**
     * update resource
     *
     * @param uri URI for updating resource
     * @param resource data resource
     * @return updated resource
     */
    public Promise<ResourceDTO> update(String uri, ResourceDTO resource);

    /**
     * delete resource
     *
     * @param uri target URI for deleting resource
     */
    public Promise<Boolean> delete(String uri);

    /**
     * find resources
     *
     * @param uri URI for top of search
     * @param fc filter criteria
     * @return list of URIs matching the condition specified in fc
     */
    public Promise<List<String>> discovery(String uri, FilterCriteriaDTO fc);

    /**
     * send notification
     *
     * @param notification
     */
    public Promise<Boolean> notify(String uri, NotificationDTO notification );
}

```

## 5.4 Concrete Interfaces

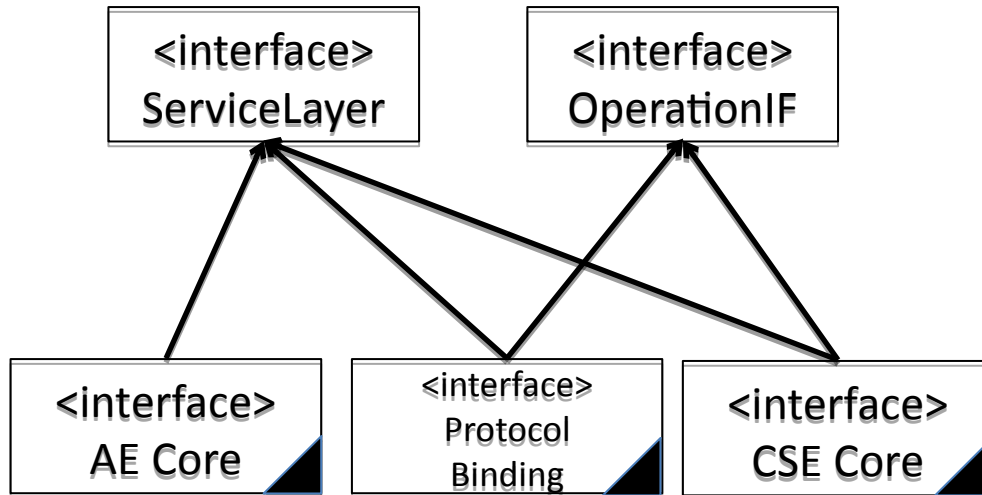
The concrete servicers that implements Service Layer interfaces are AE Core, CSE Core and Protocol Bindings. For clarification purpose, These interfaces are separately defined as a sub interface of Service Layer Interface. OperationIF is also provided by CSE Core and Protocol Bindings, which are used by AE Core.

```

public interface ProtocolBinding extends ServiceLayer, OperationIF {}
public interface Cse extends ServiceLayer, OperationIF {}

```

```
public interface Ae extends ServiceLayer {}
```



## 5.5 Service Property for sub-interfaces of Service Layer Interface

Services implementing Service Layer Interface shall be registered with following properties.

Interface	property Name	type	explanation
ProtocolBinidng	protocol	org.osgi.service.onem2m.ProtocolBindingType	Supporting protocol.
	serialization	org.osgi.service.onem2m.SerializationType	Serialization Type
	secure	boolean	True, if secure protocol is supported, otherwise false.
	version	org.osgi.service.onem2m.dto.ReleaseVersion	Supported version
CSECore	APP-ID	String	Indicates which Application can use this service.
	POA	String[]	URLs for point of access
	CSE-ID	String	CSE-ID: ID of CSE
	SP-ID	String	ID of Service Provider
	CSE-type	org.osgi.service.onem2m.CSEType	Type of CSE. Possible values are IN, MN, or ASN
	version	org.osgi.service.onem2m.dto.ReleaseVersion	Supported version
AECore	AE-ID	String	ID of Application Entity

	APP-ID	String	Application ID
	version	org.osgi.service.onem2m.dto.ReleaseVersion	Supported version

Here, AE-ID is assigned by CSE. After receiving assigned value, AE Core should update the property.

## 5.6 Introspection Interface

### 5.6.1 General Introspection Interface

This interface provides information for data structures and checks validity of data. For oneM2M resources, there are 3 types of attributes, which are mandatory, optional and NP(Not present) and they are different between create operation and update operation. So that there are `getAttributes()`'s variations for getting these types as following.

```
public String[] get{OPTIONALITY}AttributesFor{OPERATION}(int resourceType);
```

here, {OPTIONALITY} is one of Mandatory, Optional or NotPresent and {OPERATION} is Create or Update.

```
package org.osgi.service.onem2m;
```

```
import org.osgi.service.onem2m.dto.*;
```

```
public interface Introspector {
```

```
    /**
     * execute Validation of Data Structure
     *
     * @param resp
     * @return array of problems
     */
    public String[] findValidationProblems(ResponsePrimitiveDTO resp);

    /**
     * execute Validation of Data Structure
     *
     * @param resp
     * @return array of problems
     */
    public String[] findValidationProblems(RequestPrimitiveDTO req);

    /**
     * execute Validation of Data Structure
     *
     * @param resp
```

```
* @return array of problems
*/
public String[] findValidationProblems(ResourceDTO resource);

/**
 * get Possible Attribute Names for the given resourceType.
 *
 * @param resp
 * @return array of Possible Attributes
 */
public String[] getAttributeNames(int resourceType);

/**
 * get Mandatory Attributes for the given resourceType when Create.
 *
 * @param resp
 * @return array of Possible Attributes
 */
public String[] getMandatoryAttributesForCreate(int resourceType);

/**
 * get Optional Attributes for the given resourceType when Create.
 *
 * @param resp
 * @return array of Possible Attributes
 */
public String[] getOptionalAttributesForCreate(int resourceType);

/**
 * get Not Present Attributes for the given resourceType when Create.
 *
 * @param resp
 * @return array of Possible Attributes
 */
public String[] getNotPresentAttributesForCreate(int resourceType);

/**
 * get Mandatory Attributes for the given resourceType when Update.
 *
 * @param resp
 * @return array of Possible Attributes
 */
public String[] getMandatoryAttributesForUpdate(int resourceType);

/**
 * get Optional Attributes for the given resourceType when Update.
```



```

*
* @param resp
* @return array of Possible Attributes
*/
public String[] getOptionalAttributesForUpdate(int resourceType);

/**
* get Not Present Attributes for the given resourceType when Update.
*
* @param resp
* @return array of Possible Attributes
*/
public String[] getNotPresentAttributesForUpdate(int resourceType);

/**
* return Java Type for given attribute of resource type
* @param resourceType
* @param attribute
* @return expected class for the specified attribute
*/
public Class getType(int resourceType, String Attribute);

/**
* return Typical Data Structure for Type for given attribute of resource type
* @param resourceType
* @param attribute
* @return Template Object
*/
public Object getTemplateObject(int resourceType, String Attribute);
}

```

## 5.6.2 Introspection interface for FlexContainer

FlexContainer is a oneM2M Resource type that can be defined with adding custom attributes. Initially it was intended to be like JSON structure in oneM2M world. The definition of custom flex container is expressed in 'contentDefinition' attribute of the FlexContainer. It may be one of standardized URI or URI for location of XSD definitions; The XSD is stored as contentInstance resource in some CSE.

This interface checks validity of data structure representing <FlexContainer> resource. Following table shows service properties on the service. Being different from regular oneM2M resource, it has no

Property Name	Type	explanation
contentDefinitions	String[]	Supporting contentDefinition of <FlexContainer>. .

**package** org.osgi.service.onem2m;

```
import org.osgi.service.onem2m.dto.*;

/**
 * FlexContainerInspector
 *
 *
 */
public interface FlexContainerIntrospector {

    /**
     * Execute Validation of Data Structure
     *
     * @param resp
     * @return array of problems
     */
    public String[] findValidationProblems(ResourceDTO resource);

    /**
     * get Possible Attributes for the given resourceType.
     *
     * @param resp
     * @return array of Possible Attributes
     */
    public String[] getCustomAttributeNames(String containerDefinition);

    /**
     * return Java Type for given attribute of resource type
     *
     * @param resourceType
     * @param attribute
     * @return expected class for the specified attribute
     */
    public Class getType(String containerDefinition, String customAttributeName);

    /**
     * return Typical Data Structure for Type for given attribute of resource type
     *
     * @param resourceType
     * @param attribute
     * @return Template Object
     */
    public Object getTemplateObject(String containerDefinition, String
customAttributeName);
}
```

## 6 Data Transfer Objects

---

*RFC 185 defines Data Transfer Objects as a generic means for management solutions to interact with runtime entities in an OSGi Framework. DTOs provides a common, easily serializable representation of the technology.*

*For all new functionality added to the OSGi Framework the question should be asked: would this feature benefit from a DTO? The expectation is that in most cases it would.*

*The DTOs for the design in this RFC should be described here and if there are no DTOs being defined an explanation should be given explaining why this is not applicable in this case.*

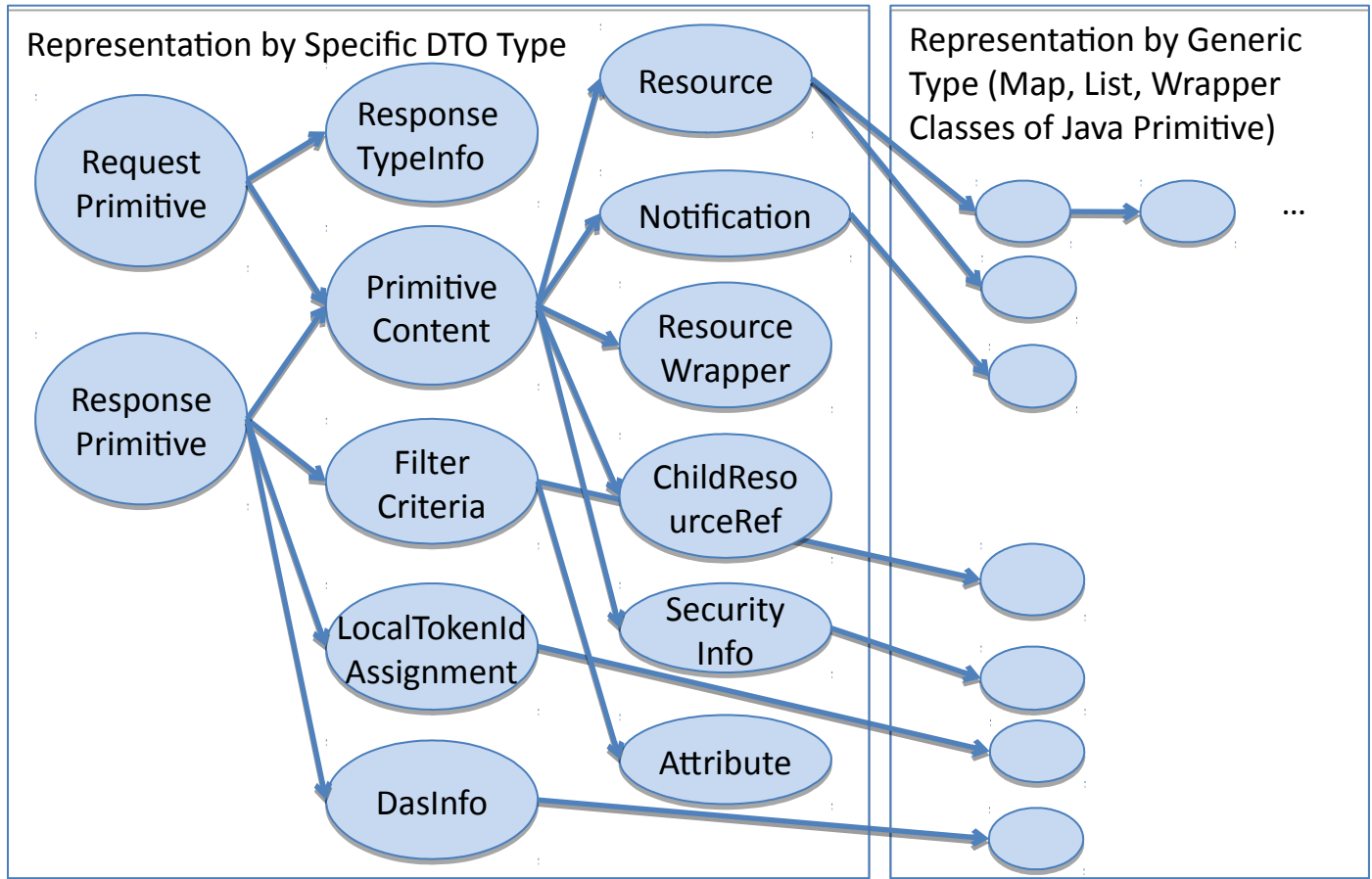
*This section is optional and could also be provided in a separate RFC.*

---

### 6.1 Design Policy of DTOs

Data transfer Object was chosen as data object passing by the interfaces, following OSGi's design convention. Though data structure near root structures are designed specific DTO, deeper data types are to be stored as generic types, such as Map, List and Wrapper classes of Java Primitives. (See also the considered Alternatives)

In the object definition, some data types are shown as Object, but the assigned value shall be a type that is allowed for OSGi DTO.



## 6.2 RequestPrimitiveDTO

RequestPrimitiveDTO holds a Request Information used for oneM2M communication.

```
package org.osgi.service.onem2m.dto;
```

```
import java.util.*;
```

```
public class RequestPrimitiveDTO extends org.osgi.dto.DTO {
    @javax.xml.bind.annotation.XmlElement(required = true)
    public Operation operation;
    @javax.xml.bind.annotation.XmlElement(required = true)
    public String to;
    public String from;
    @javax.xml.bind.annotation.XmlElement(required = true)
    public String requestIdIdentifier;
    @javax.xml.bind.annotation.XmlElement(required = false)
    public Integer resourceType;
    public PrimitiveContentDTO content;
    public List<String> roleIDs;
```

```
public String originatingTimestamp;
public String requestExpirationTimestamp;
public String resultExpirationTimestamp;
public String operationExecutionTime;

public ResponseTypeInfoDTO responseType;
public String resultPersistence;
@javax.xml.bind.annotation.XmlElement(required = false)
public ResultContent resultContent;
public String eventCategory;
@javax.xml.bind.annotation.XmlElement(required = false)
public Boolean deliveryAggregation;
public String groupRequestIdentifier;
public FilterCriteriaDTO filterCriteria;
@javax.xml.bind.annotation.XmlElement(required = false)
public DiscoveryResultType discoveryResultType;
public String tokens;
public List<String> tokenIDs;
public List<String> localTokenIDs;
@javax.xml.bind.annotation.XmlElement(required = false)
public Boolean tokenReqIndicator;

// Added at R3.0
public List<String> groupRequestTargetMembers;
public Boolean authSignatureIndicator;
public List<String> authSignature;
public Boolean authRelationshipIndicator;
public Boolean semanticQueryIndicator;
public ReleaseVersion releaseVersion;
public String verndorInformation;

public static enum DiscoveryResultType {
    structured(1), unstructured(2);
    // omitted
}

public static enum ResultContent {
    nothing(1), attributes(2), hierarchicalAddress(3),
    hierarchicalAddressAndAttributes(4),
attributesAndChildResources(5),
attributesAndChildResourceReferences(6),
childResourceReferences(7), originalResource(8), childResources(9);

    // omitted
}
```

```
    public static enum Operation {  
        Create(1), Retrieve(2), Update(3), Delete(4), Notify(5);  
        // omitted  
    }  
  
}
```

---

## 6.3 ResponsePrimitiveDTO

ResponsePrimitiveDTO holds a Response Information used for oneM2M communication.

```
package org.osgi.service.onem2m.dto;  
import java.util.*;  
  
public class ResponsePrimitiveDTO extends org.osgi.dto.DTO{  
    @javax.xml.bind.annotation.XmlElement( required = true)  
    public Integer responseStatusCode;  
    @javax.xml.bind.annotation.XmlElement( required = true)  
    public String requestIdIdentifier;  
    public PrimitiveContentDTO content;  
    public String to;  
    public String from;  
    public String originatingTimestamp;  
    public String resultExpirationTimestamp;  
    public String eventCategory;  
    @javax.xml.bind.annotation.XmlElement( required = false)  
    public ContentStatus contentStatus;  
    @javax.xml.bind.annotation.XmlElement( required = false)  
    public Integer contentOffset;  
    public List<LocalTokenIdAssignmentDTO>  
assignedTokenIdentifiers; //Map<String, Object>  
    public List<DasInfoDTO> tokenReqInfo; //DynAuthTokenReqInfoDTO  
  
    // Added R3.0  
    public Boolean AuthSignatureReqInfo;  
    public ReleaseVersion releaseVersionIndicator;  
    public String vendorInformation;  
  
    public static enum ContentStatus{  
        PARTIAL_CONTENT, // 1  
        FULL_CONTENT; //2  
    }  
  
}
```

## 6.4 ResponseTypeInfoDTO

```
package org.osgi.service.onem2m.dto;

import java.util.*;

public class ResponseTypeInfoDTO extends org.osgi.dto.DTO {
    @javax.xml.bind.annotation.XmlElement(required = true)
    public java.lang.Integer responseTypeValue;
    @javax.xml.bind.annotation.XmlElement(required = true)
    public List<java.lang.String> notificationURI;

    public static enum ResponseType {
        nonBlockingRequestSynch(1), nonBlockingRequestAsynch(2),
        blockingRequest(3), flexBlocking(4);
        // omitted.
    }
}
```

## 6.5 FilterCriteriaDTO

```
package org.osgi.service.onem2m.dto;
import java.util.*;

public class FilterCriteriaDTO extends org.osgi.dto.DTO{
    public String createdBefore;
    public String createdAfter;
    public String modifiedSince;
    public String unmodifiedSince;
    @javax.xml.bind.annotation.XmlElement( required = false)
    public Integer stateTagSmaller;
    @javax.xml.bind.annotation.XmlElement( required = false)
    public Integer stateTagBigger;
    public String expireBefore;
    public String expireAfter;
    public List<String> labels;
    public List<Integer> resourceType;
    @javax.xml.bind.annotation.XmlElement( required = false)
    public Integer sizeAbove;
    @javax.xml.bind.annotation.XmlElement( required = false)
    public Integer sizeBelow;
    public List<String> contentType;
    public AttributeDTO attribute;
```

```

    @javax.xml.bind.annotation.XmlElement( required = false)
    public FilterUsage filterUsage;
    @javax.xml.bind.annotation.XmlElement( required = false)
    public Integer limit;
    public String semanticsFilter;
    @javax.xml.bind.annotation.XmlElement( required = false)
    public FilterOperation filterOperation;
    @javax.xml.bind.annotation.XmlElement( required = false)
    public Integer contentFilterSyntax;
    public String contentFilterQuery;
    @javax.xml.bind.annotation.XmlElement( required = false)
    public Integer level;
    @javax.xml.bind.annotation.XmlElement( required = false)
    public Integer offset;

    // added in R3
    public List<String> childLabels;
    public List<String> parentLabels;
    public String labelsQuery;
    public Integer childResourceType;
    public Integer parentResourceType;
    public AttributeDTO childAttribute;
    public AttributeDTO parentAttribute;
    public String applyRelativePath;

    public static enum FilterOperation {
        AND(1), OR(2);
        // omitted...
    }

    public static enum FilterUsage {
        DiscoveryCriteria(1), ConditionalRetrival(2), IPEOnDemandDiscovery(3);
        // omitted...
    }
}

```

## 6.6 ResourceDTO

```

package org.osgi.service.onem2m.dto;
import java.util.*;

public class ResourceDTO extends org.osgi.dto.DTO{

```



```
// Universal Attribute, which can be held by all resources.
@javax.xml.bind.annotation.XmlElement( required = true)
public Integer resourceType;
@javax.xml.bind.annotation.XmlElement( required = true)
public String resourceID;
@javax.xml.bind.annotation.XmlElement( required = true)
public String parentID;
@javax.xml.bind.annotation.XmlElement( required = true)
public String creationTime;
@javax.xml.bind.annotation.XmlElement( required = true)
public String lastModifiedTime;

public String resourceName;

// optional, Universal Attributes
public List<String> labels;

/**
 * Non Universal Attribute.
 * Value Part must be the types that are allowed for OSGi DTO.
 */
public Map<String, Object> attribute;
}
```

---

## 6.7 NotificationDTO

NotificationDTO has information of notification.

```
package org.osgi.service.onem2m.dto;
import java.util.*;

public class NotificationDTO extends org.osgi.dto.DTO{
    public Map<String,Object> notificationEvent;//NotificationEventDTO
    @javax.xml.bind.annotation.XmlElement( required = false)
    public Boolean verificationRequest;
    @javax.xml.bind.annotation.XmlElement( required = false)
    public Boolean subscriptionDeletion;
    public String subscriptionReference;
    public String creator;
    public String notificationForwardingURI;
    @javax.xml.bind.annotation.XmlElement( required = false)
    public Map<String,Object> ipeDiscoveryRequest;//IPEDiscoveryRequestDTO
}
```

## 6.8 Other DTOs

There are some other DTOs, please refer Javadoc section for them.

## 6.9 Mapping Rules for Generic DTO

Following table summarizes mapping rule between oneM2M data types and Generic types used in DTOs.

oneM2M Types (XML Schema)	Type of OSGi DTO	
Basic Types of XML Schema	Wrapper Object of Java primitive	For example: xs:integer, xs:float
xs:anyURI, m2m:ID,	String	
m2m:timestamp	String	YYYYMMDDThhmmss,sssss
m2m:absRelTimestamp	String	Union of m2m:timestamp and xs:long. This is exception of union rule above. Distinction is done by existence of 'T'
xs:sequence (as complexType)	Map	Name of element is used for key of map.
xs:list, xs:sequence (as list)	List	
xs:union	Map	Base attribute of restriction tag is used for key of map. Only one key is allowed.  See Example of missingDataList:

Following XML is a example of missingData.

```

<xs:simpleType name="missingDataList">
  <xs:union>
    <simpleType>
      <restriction base='m2m:listOfTimeStamp' />
    </simpleType>
    <simpleType>
      <restriction base='m2m:listOfRelTimeStamp' />
    </simpleType>
  </xs:union>
</xs:simpleType>

```

---

## 7 Javadoc

---

*Please include Javadoc of any new APIs here, once the design has matured. Instructions on how to export Javadoc for inclusion in the RFC can be found here: <https://www.osgi.org/members/RFC/Javadoc>*

## Demo Documentation

18/06/25 7:01

Package Summary		Page
<a href="#">org.osgi.service.onem2m</a>	This package includes interfaces and Enums for service layer API for oneM2M	28
<a href="#">org.osgi.service.onem2m.dto</a>	This package contains OSGi DTOs used in oneM2M Service Layer API.	43
<a href="#">org.osgi.service.onem2m.introspection</a>	This package include interfaces for providing information of data structures and checking validity.	89
<a href="#">org.osgi.service.onem2m.old</a>	This package is used for temporal palace holder.	97

## Package org.osgi.service.onem2m

This package includes interfaces and Enums for service layer API for oneM2M

See:

[Description](#)

Interface Summary		Page
<a href="#">AECore</a>	Sub interface of Service Layer.	30
<a href="#">CSECore</a>	CSE Core implements this interface.	30
<a href="#">OperationIF</a>	OperationIF provides higher level of interface of CRUD+N operations to Application.	34
<a href="#">ProtocolBinding</a>	Protocol Binding Service implements this interface.	37
<a href="#">ServiceLayer</a>	Primary Interface for an oneM2M entity to send request and get response to/from other oneM2M entity.	42

Enum Summary		Page
<a href="#">CSEType</a>	Enum for type of CSE.	31
<a href="#">ProtocolBindingType</a>	Type of Protocol Binding. oneM2M currently defines 4 types.	37
<a href="#">SerializationType</a>	Type of Serialization. oneM2M currently defines 3 types.	40

## Package org.osgi.service.onem2m Description

This package includes interfaces and Enums for service layer API for oneM2M

## Interface AECore

[org.osgi.service.onem2m](#)

All Superinterfaces:

[ServiceLayer](#)

---

```
public interface AECore  
extends ServiceLayer
```

Sub interface of Service Layer. AE core implements this interface. Typical and only use case is receiveing notification from other oneM2M entity.

---

Methods inherited from interface <a href="#">org.osgi.service.onem2m.ServiceLayer</a>
<a href="#">request</a>

## Interface CSECore

[org.osgi.service.onem2m](#)

All Superinterfaces:

[OperationIF](#), [ServiceLayer](#)

---

```
public interface CSECore
extends ServiceLayer, OperationIF
```

CSE Core implements this interface.

---

<b>Methods inherited from interface <a href="#">org.osgi.service.onem2m.ServiceLayer</a></b>
<a href="#">request</a>

<b>Methods inherited from interface <a href="#">org.osgi.service.onem2m.OperationIF</a></b>
<a href="#">create</a> , <a href="#">delete</a> , <a href="#">discovery</a> , <a href="#">notify</a> , <a href="#">retrieve</a> , <a href="#">retrieve</a> , <a href="#">update</a>

# Enum CSEType

[org.osgi.service.onem2m](#)

```
java.lang.Object
└─ java.lang.Enum<CSEType>
    └─ org.osgi.service.onem2m.CSEType
```

All Implemented Interfaces:  
Comparable<[CSEType](#)>, Serializable

```
public enum CSEType
extends Enum<CSEType>
```

Enum for type of CSE. IN\_CSE is located at the top of configuration tree. ASN\_CSE is located at leaf of configuration tree. MN\_CSE is located at middle of them.

Enum Constant Summary	Page
<a href="#">ASN_CSE</a>	32
<a href="#">IN_CSE</a>	32
<a href="#">MN_CSE</a>	32

Method Summary	Page
<div>static <a href="#">CSEType</a> <a href="#">valueOf</a>(String name)</div>	33
<div>static <a href="#">CSEType</a>[] <a href="#">values</a>()</div>	32

## Enum Constant Detail

### IN\_CSE

```
public static final CSEType IN_CSE
```

### MN\_CSE

```
public static final CSEType MN_CSE
```

### ASN\_CSE

```
public static final CSEType ASN_CSE
```

## Method Detail

### values

```
public static CSEType[] values()
```



---

## valueOf

```
public static CSEType valueOf(String name)
```

## Interface OperationIF

[org.osgi.service.onem2m](#)

All Known Subinterfaces:

[CSECore](#), [ProtocolBinding](#)

```
public interface OperationIF
```

OperationIF provides higher level of interface of CRUD+N operations to Application.

Method Summary		Page
org.osgi.util.promise.Promise< <a href="#">ResourceDTO</a> >	<a href="#">create</a> (String uri, <a href="#">ResourceDTO</a> resource) create resource	34
org.osgi.util.promise.Promise<Boolean>	<a href="#">delete</a> (String uri) delete resource	35
org.osgi.util.promise.Promise<List<String>>	<a href="#">discovery</a> (String uri, <a href="#">FilterCriteriaDTO</a> fc) find resources	35
org.osgi.util.promise.Promise<Boolean>	<a href="#">notify</a> (String uri, <a href="#">NotificationDTO</a> notification) send notification	36
org.osgi.util.promise.Promise< <a href="#">ResourceDTO</a> >	<a href="#">retrieve</a> (String uri, List<String> targetAttributes) retrieve subset of attributes.	35
org.osgi.util.promise.Promise< <a href="#">ResourceDTO</a> >	<a href="#">retrieve</a> (String uri, <a href="#">ResourceDTO</a> resource) retrieve resource	35
org.osgi.util.promise.Promise< <a href="#">ResourceDTO</a> >	<a href="#">update</a> (String uri, <a href="#">ResourceDTO</a> resource) update resource	35

## Method Detail

### create

```
org.osgi.util.promise.Promise<ResourceDTO> create(String uri,
ResourceDTO resource)
```

create resource

#### Parameters:

uri - URI for parent resource  
resource - resource data

#### Returns:

Promise of created resource

**retrieve**[illegible]

retrieve resource

### Parameters:

`uri` - URI for retrieving resource

**Returns:**

retrieved resource data

**retrieve**

```
org.osgi.util.promise.Promise<ResourceDTO> retrieve(String uri,  
List<String> targetAttributes)
```

retrieve subset of attributes.

### Parameters:

`uri` - URI for retrieving resource

`targetAttributes` - names of the target attribute

**Returns:**

retrieved resource data

## update

[illegible]

update resource

### Parameters:

`uri` - URI for updating resource

resource - data resource

**Returns:**

updated resource

**delete**

```
org.osgi.util.promise.Promise<Boolean> delete(String uri)
```

delete resource

### Parameters:

`uri` - target URI for deleting resource

## discovery

[illegible]

find resources

**Parameters:**

uri - URI for top of search

fc - filter criteria

**Returns:**

list of URIs matching the condition specified in fc

---

## notify

```
org.osgi.util.promise.Promise<Boolean> notify(String uri,  
                                              NotificationDTO notification)
```

send notification

# Interface ProtocolBinding

[org.osgi.service.onem2m](#)

All Superinterfaces:  
[OperationIF](#), [ServiceLayer](#)

```
public interface ProtocolBinding
extends ServiceLayer, OperationIF
```

Protocol Binding Service implements this interface.

Methods inherited from interface org.osgi.service.onem2m. <a href="#">ServiceLayer</a>
<a href="#">request</a>

Methods inherited from interface org.osgi.service.onem2m. <a href="#">OperationIF</a>
<a href="#">create</a> , <a href="#">delete</a> , <a href="#">discovery</a> , <a href="#">notify</a> , <a href="#">retrieve</a> , <a href="#">retrieve</a> , <a href="#">update</a>

# Enum ProtocolBindingType

[org.osgi.service.onem2m](#)

```
java.lang.Object
└─ java.lang.Enum<ProtocolBindingType>
    └─ org.osgi.service.onem2m.ProtocolBindingType
```

All Implemented Interfaces:  
Comparable<[ProtocolBindingType](#)>, Serializable

```
public enum ProtocolBindingType
extends Enum<ProtocolBindingType>
```

Type of Protocol Binding. oneM2M currently defines 4 types.

Enum Constant Summary	Pag e
<a href="#">COAP</a>	38
<a href="#">HTTP</a>	38
<a href="#">MQTT</a>	38
<a href="#">WebService</a>	38

Method Summary	Pag e
static <a href="#">ProtocolBi ndingType</a> <a href="#">valueOf</a> (String name)	39
static <a href="#">ProtocolBi ndingType</a> [] <a href="#">values</a> ()	39

## Enum Constant Detail

### HTTP

```
public static final ProtocolBindingType HTTP
```

### MQTT

```
public static final ProtocolBindingType MQTT
```

### COAP

```
public static final ProtocolBindingType COAP
```

### WebService

```
public static final ProtocolBindingType WebService
```

## Method Detail

### values

public static [ProtocolBindingType](#)[] **values**()

---

### valueOf

public static [ProtocolBindingType](#) **valueOf**(String name)

## Enum SerializationType

[org.osgi.service.onem2m](#)

```
java.lang.Object
└─ java.lang.Enum<SerializationType>
    └─ org.osgi.service.onem2m.SerializationType
```

### All Implemented Interfaces:

Comparable<[SerializationType](#)>, Serializable

```
public enum SerializationType
extends Enum<SerializationType>
```

Type of Serialization. oneM2M currently defines 3 types.

Enum Constant Summary	Page
<a href="#">CBOR</a>	40
<a href="#">JSON</a>	40
<a href="#">XML</a>	40

Method Summary	Page
<small>static <a href="#">SerializationType</a></small> <a href="#">valueOf</a> (String name)	41
<small>static <a href="#">SerializationType</a>[]</small> <a href="#">values</a> ()	40

## Enum Constant Detail

### XML

```
public static final SerializationType XML
```

### JSON

```
public static final SerializationType JSON
```

### CBOR

```
public static final SerializationType CBOR
```

## Method Detail

### values

```
public static SerializationType[] values()
```



## valueOf

```
public static SerializationType valueOf(String name)
```

# Interface ServiceLayer

[org.osgi.service.onem2m](#)

All Known Subinterfaces:  
[AECore](#), [CSECore](#), [ProtocolBinding](#)

public interface **ServiceLayer**

Primary Interface for an oneM2M entity to send request and get response to/from other oneM2M entity.

Method Summary		Page
org.osgi.util.promise.Promise< <a href="#">ResponsePrimitiveDTO</a> >	<a href="#">request</a> ( <a href="#">RequestPrimitiveDTO</a> request) send a request.	42

## Method Detail

### request

org.osgi.util.promise.Promise<[ResponsePrimitiveDTO](#)> **request** ([RequestPrimitiveDTO](#) request)

send a request.

**Parameters:**  
request - request primitive

**Returns:**  
promise of ResponseDTO.

## Package org.osgi.service.onem2m.dto

This package contains OSGi DTOs used in oneM2M Service Layer API.

See:

[Description](#)

Class Summary		Page
<a href="#">AttributeDTO</a>	DTO expresses Attribute.	45
<a href="#">ChildResourceRefDTO</a>	DTO expressing ChildResourceRef.	46
<a href="#">DasInfoDTO</a>	DTO expressing DasInfo	48
<a href="#">FilterCriteriaDTO</a>	DTO expressing FilterCriteria.	49
<a href="#">LocalTokenIdAssignmentDTO</a>	DTO expressing LocalTokenIdAssignment.	58
<a href="#">NotificationDTO</a>	DTO expressing Notification.	59
<a href="#">PrimitiveContentDTO</a>	DTO expressing Primitive Content.	62
<a href="#">RequestPrimitiveDTO</a>	DTO expresses Request Primitive.	65
<a href="#">ResourceDTO</a>	DTO expressing Resource.	76
<a href="#">ResourceWrapperDTO</a>	DTO expressing ResourceWrapper.	78
<a href="#">ResponsePrimitiveDTO</a>	DTO expressing Response Primitive.	79
<a href="#">ResponseTypeInfoDTO</a>	Expressing ResponseTypeInfo	84
<a href="#">SecurityInfoDTO</a>	DTO expressing Security Info.	87

Enum Summary		Page
<a href="#">FilterCriteriaDTO.FilterOperation</a>		54
<a href="#">FilterCriteriaDTO.FilterUsage</a>		56
<a href="#">ReleaseVersion</a>	Enum expressing oneM2M specification version.	63
<a href="#">RequestPrimitiveDTO.DiscoveryResultType</a>		70
<a href="#">RequestPrimitiveDTO.Operation</a>		72

<a href="#">RequestPrimitiveDTO.ResultContent</a>		74
<a href="#">ResponsePrimitiveDTO.ContentStatus</a>		82
<a href="#">ResponseTypeInfoDTO.ResponseType</a>		85

Exception Summary		Page
<a href="#">OneM2MException</a>	General Exception for oneM2M.	61

## Package org.osgi.service.onem2m.dto Description

This package contains OSGi DTOs used in oneM2M Service Layer API.

## Class AttributeDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
├─ org.osgi.dto.DTO
│   └─ org.osgi.service.onem2m.dto.AttributeDTO
```

---

```
public class AttributeDTO
extends org.osgi.dto.DTO
```

DTO expresses Attribute. This is typically used in FilterCriteriaDTO

---

Field Summary		Page
String	<a href="#">name</a>	45
Object	<a href="#">value</a>	45

Constructor Summary	Page
<a href="#">AttributeDTO</a> ()	45

Methods inherited from class org.osgi.dto.DTO
toString

### Field Detail

#### name

```
public String name
```

#### value

```
public Object value
```

### Constructor Detail

#### AttributeDTO

```
public AttributeDTO ()
```

## Class ChildResourceRefDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ org.osgi.dto.DTO
    └─ org.osgi.service.onem2m.dto.ChildResourceRefDTO
```

---

```
public class ChildResourceRefDTO
extends org.osgi.dto.DTO
```

DTO expressing ChildResourceRef.

---

Field Summary		Page
String	<a href="#">name</a>	46
String	<a href="#">specializationID</a>	46
Integer	<a href="#">type</a>	46
String	<a href="#">uri</a>	46

Constructor Summary	Page
<a href="#">ChildResourceRefDTO()</a>	47

Methods inherited from class org.osgi.dto.DTO
<a href="#">toString</a>

### Field Detail

#### uri

```
public String uri
```

---

#### name

```
public String name
```

---

#### type

```
public Integer type
```

---

#### specializationID

```
public String specializationID
```

## Constructor Detail

### ChildResourceRefDTO

```
public ChildResourceRefDTO()
```

# Class DasInfoDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ org.osgi.dto.DTO
    └─ org.osgi.service.onem2m.dto.DasInfoDTO
```

```
public class DasInfoDTO
extends org.osgi.dto.DTO
```

DTO expressing DasInfo

Field Summary		Page
Map<String, Object>	<a href="#">dasRequest</a>	48
String	<a href="#">securedDasRequest</a>	48
String	<a href="#">uri</a>	48

Constructor Summary	Page
<a href="#">DasInfoDTO()</a>	48

Methods inherited from class org.osgi.dto.DTO
toString

## Field Detail

**uri**  
public String **uri**

## dasRequest

public Map<String, Object> **dasRequest**

## securedDasRequest

public String **securedDasRequest**

## Constructor Detail

**DasInfoDTO**  
public **DasInfoDTO()**



# Class FilterCriteriaDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
├─ org.osgi.dto.DTO
│   └─ org.osgi.service.onem2m.dto.FilterCriteriaDTO
```

```
public class FilterCriteriaDTO
    extends org.osgi.dto.DTO
```

DTO expressing FilterCriteria. This data structure is used for searching resources.

Nested Class Summary		Page
static enum	<a href="#">FilterCriteriaDTO.FilterOperation</a>	54
static enum	<a href="#">FilterCriteriaDTO.FilterUsage</a>	56

Field Summary		Page
String	<a href="#">applyRelativePath</a>	53
<a href="#">AttributeDTO</a>	<a href="#">attribute</a>	51
<a href="#">AttributeDTO</a>	<a href="#">childAttribute</a>	53
List<String>	<a href="#">childLabels</a>	52
Integer	<a href="#">childResourceType</a>	52
String	<a href="#">contentFilterQuery</a>	52
Integer	<a href="#">contentFilterSyntax</a>	52
List<String>	<a href="#">contentType</a>	51
String	<a href="#">createdAfter</a>	50
String	<a href="#">createdBefore</a>	50
String	<a href="#">expireAfter</a>	51
String	<a href="#">expireBefore</a>	51
<a href="#">FilterCriteriaDTO.FilterOperation</a>	<a href="#">filterOperation</a>	52
<a href="#">FilterCriteriaDTO.FilterUsage</a>	<a href="#">filterUsage</a>	51
List<String>	<a href="#">labels</a>	51
String	<a href="#">labelsQuery</a>	52
Integer	<a href="#">level</a>	52
Integer	<a href="#">limit</a>	51
String	<a href="#">modifiedSince</a>	50
Integer	<a href="#">offset</a>	52
<a href="#">AttributeDTO</a>	<a href="#">parentAttribute</a>	53

List<String>	<a href="#">parentLabels</a>	52
Integer	<a href="#">parentResourceType</a>	53
List<Integer>	<a href="#">resourceType</a>	51
String	<a href="#">semanticsFilter</a>	52
Integer	<a href="#">sizeAbove</a>	51
Integer	<a href="#">sizeBelow</a>	51
Integer	<a href="#">stateTagBigger</a>	50
Integer	<a href="#">stateTagSmaller</a>	50
String	<a href="#">unmodifiedSince</a>	50

<b>Constructor Summary</b>	<b>Page</b>
<a href="#">FilterCriteriaDTO</a> ()	53

<b>Methods inherited from class org.osgi.dto.DTO</b>
toString

## Field Detail

### createdBefore

public String **createdBefore**

### createdAfter

public String **createdAfter**

### modifiedSince

public String **modifiedSince**

### unmodifiedSince

public String **unmodifiedSince**

### stateTagSmaller

public Integer **stateTagSmaller**

### stateTagBigger

public Integer **stateTagBigger**

---

## expireBefore

```
public String expireBefore
```

---

## expireAfter

```
public String expireAfter
```

---

## labels

```
public List<String> labels
```

---

## resourceType

```
public List<Integer> resourceType
```

---

## sizeAbove

```
public Integer sizeAbove
```

---

## sizeBelow

```
public Integer sizeBelow
```

---

## contentType

```
public List<String> contentType
```

---

## attribute

```
public AttributeDTO attribute
```

---

## filterUsage

```
public FilterCriteriaDTO.FilterUsage filterUsage
```

---

## limit

```
public Integer limit
```

---

---

## **semanticsFilter**

```
public String semanticsFilter
```

---

## **filterOperation**

```
public FilterCriteriaDTO.FilterOperation filterOperation
```

---

## **contentFilterSyntax**

```
public Integer contentFilterSyntax
```

---

## **contentFilterQuery**

```
public String contentFilterQuery
```

---

## **level**

```
public Integer level
```

---

## **offset**

```
public Integer offset
```

---

## **childLabels**

```
public List<String> childLabels
```

---

## **parentLabels**

```
public List<String> parentLabels
```

---

## **labelsQuery**

```
public String labelsQuery
```

---

## **childResourceType**

```
public Integer childResourceType
```

---

---

## parentResourceType

```
public Integer parentResourceType
```

---

## childAttribute

```
public AttributeDTO childAttribute
```

---

## parentAttribute

```
public AttributeDTO parentAttribute
```

---

## applyRelativePath

```
public String applyRelativePath
```

## Constructor Detail

### FilterCriteriaDTO

```
public FilterCriteriaDTO()
```

# Enum `FilterCriteriaDTO.FilterOperation`

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ java.lang.Enum<FilterCriteriaDTO.FilterOperation>
    └─ org.osgi.service.onem2m.dto.FilterCriteriaDTO.FilterOperation
```

All Implemented Interfaces:  
Comparable<[FilterCriteriaDTO.FilterOperation](#)>, Serializable

Enclosing class:  
[FilterCriteriaDTO](#)

```
public static enum FilterCriteriaDTO.FilterOperation
extends Enum<FilterCriteriaDTO.FilterOperation>
```

Enum Constant Summary		Page
<a href="#">AND</a>		54
<a href="#">OR</a>		54

Method Summary		Page
int	<a href="#">getValue</a> ()	55
static <a href="#">FilterCriteriaDTO.FilterOperation</a>	<a href="#">valueOf</a> (String name)	55
static <a href="#">FilterCriteriaDTO.FilterOperation</a> []	<a href="#">values</a> ()	54

## Enum Constant Detail

**AND**  
public static final [FilterCriteriaDTO.FilterOperation](#) AND

**OR**  
public static final [FilterCriteriaDTO.FilterOperation](#) OR

## Method Detail

**values**  
public static [FilterCriteriaDTO.FilterOperation](#)[] **values**()

---

## **valueOf**

```
public static FilterCriteriaDTO.FilterOperation valueOf(String name)
```

---

## **getValue**

```
public int getValue()
```

# Enum FilterCriteriaDTO.FilterUsage

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ java.lang.Enum<FilterCriteriaDTO.FilterUsage>
    └─ org.osgi.service.onem2m.dto.FilterCriteriaDTO.FilterUsage
```

All Implemented Interfaces:  
Comparable<[FilterCriteriaDTO.FilterUsage](#)>, Serializable

Enclosing class:  
[FilterCriteriaDTO](#)

```
public static enum FilterCriteriaDTO.FilterUsage
extends Enum<FilterCriteriaDTO.FilterUsage>
```

Enum Constant Summary	Pag e
<a href="#">ConditionalRetrival</a>	56
<a href="#">DiscoveryCriteria</a>	56
<a href="#">IPEondemandDiscovery</a>	56

Method Summary	Pag e
int <a href="#">getValue</a> ()	57
static <a href="#">FilterCrit</a> <a href="#">eriaDTO.Fi</a> <a href="#">lterUsage</a> <a href="#">valueOf</a> (String name)	57
static <a href="#">FilterCrit</a> <a href="#">eriaDTO.Fi</a> <a href="#">lterUsage</a> <a href="#">values</a> ()	57

## Enum Constant Detail

**DiscoveryCriteria**  
public static final [FilterCriteriaDTO.FilterUsage](#) DiscoveryCriteria

## ConditionalRetrival

public static final [FilterCriteriaDTO.FilterUsage](#) ConditionalRetrival

## IPEondemandDiscovery

public static final [FilterCriteriaDTO.FilterUsage](#) IPEondemandDiscovery



## Method Detail

### values

```
public static FilterCriteriaDTO.FilterUsage[] values()
```

---

### valueOf

```
public static FilterCriteriaDTO.FilterUsage valueOf(String name)
```

---

### getValue

```
public int getValue()
```

## Class LocalTokenIdAssignmentDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ org.osgi.dto.DTO
    └─ org.osgi.service.onem2m.dto.LocalTokenIdAssignmentDTO
```

---

```
public class LocalTokenIdAssignmentDTO
extends org.osgi.dto.DTO
```

DTO expressing LocalTokenIdAssignment.

---

Field Summary		Page
String	<a href="#">localTokenID</a>	58
String	<a href="#">tokenID</a>	58

Constructor Summary	Page
<a href="#">LocalTokenIdAssignmentDTO()</a>	58

Methods inherited from class org.osgi.dto.DTO
<a href="#">toString</a>

### Field Detail

#### localTokenID

```
public String localTokenID
```

#### tokenID

```
public String tokenID
```

### Constructor Detail

#### LocalTokenIdAssignmentDTO

```
public LocalTokenIdAssignmentDTO()
```

## Class NotificationDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ org.osgi.dto.DTO
    └─ org.osgi.service.onem2m.dto.NotificationDTO
```

---

```
public class NotificationDTO
extends org.osgi.dto.DTO
```

DTO expressing Notification.

---

Field Summary		Page
String	<a href="#">creator</a>	60
Map<String, Object>	<a href="#">ipeDiscoveryRequest</a>	60
Map<String, Object>	<a href="#">notificationEvent</a>	59
String	<a href="#">notificationForwardingURI</a>	60
Boolean	<a href="#">subscriptionDeletion</a>	59
String	<a href="#">subscriptionReference</a>	60
Boolean	<a href="#">verificationRequest</a>	59

Constructor Summary	Page
<a href="#">NotificationDTO</a> ()	60

Methods inherited from class org.osgi.dto.DTO
<a href="#">toString</a>

### Field Detail

#### notificationEvent

```
public Map<String, Object> notificationEvent
```

---

#### verificationRequest

```
public Boolean verificationRequest
```

---

#### subscriptionDeletion

```
public Boolean subscriptionDeletion
```

---

---

## subscriptionReference

```
public String subscriptionReference
```

---

## creator

```
public String creator
```

---

## notificationForwardingURI

```
public String notificationForwardingURI
```

---

## ipeDiscoveryRequest

```
public Map<String,Object> ipeDiscoveryRequest
```

## Constructor Detail

### NotificationDTO

```
public NotificationDTO()
```

# Class OneM2MException

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ java.lang.Throwable
    └─ java.lang.Exception
        └─ java.io.IOException
            └─ org.osgi.service.onem2m.dto.OneM2MException
```

All Implemented Interfaces:  
Serializable

```
public class OneM2MException
extends IOException
```

General Exception for oneM2M.

Field Summary		Page
String	<a href="#">cause</a>	61
int	<a href="#">errorCode</a>	61

Constructor Summary	Page
<a href="#">OneM2MException</a> ()	61

Field Detail

errorCode

public int **errorCode**

cause

public String **cause**

Constructor Detail

OneM2MException

public **OneM2MException**()

# Class PrimitiveContentDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ org.osgi.dto.DTO
    └─ org.osgi.service.onem2m.dto.PrimitiveContentDTO
```

---

```
public class PrimitiveContentDTO
extends org.osgi.dto.DTO
```

DTO expressing Primitive Content. This Data structure is like union. Only one field MUST have a value, other field MUST be null.

---

Constructor Summary	Page
<a href="#">PrimitiveContentDTO()</a>	62

Methods inherited from class org.osgi.dto.DTO
toString

## Constructor Detail

### PrimitiveContentDTO

```
public PrimitiveContentDTO()
```

## Enum ReleaseVersion

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ java.lang.Enum<ReleaseVersion>
    └─ org.osgi.service.onem2m.dto.ReleaseVersion
```

### All Implemented Interfaces:

Comparable<[ReleaseVersion](#)>, Serializable

---

```
public enum ReleaseVersion
extends Enum<ReleaseVersion>
```

Enum expressing oneM2M specification version. This information is introduced after Release 2.0 and oneM2M uses only R2A,R3\_0 (as 2a and 3).

---

Enum Constant Summary	Page
<a href="#">R1_0</a>	63
<a href="#">R1_1</a>	63
<a href="#">R2_0</a>	63
<a href="#">R2A</a>	64
<a href="#">R3_0</a>	64

Method Summary	Page
static <a href="#">ReleaseVersion</a> <a href="#">valueOf</a> (String name)	64
static <a href="#">ReleaseVersion</a> [] <a href="#">values</a> ()	64

## Enum Constant Detail

### R1\_0

```
public static final ReleaseVersion R1_0
```

---

### R1\_1

```
public static final ReleaseVersion R1_1
```

---

### R2\_0

```
public static final ReleaseVersion R2_0
```

---

---

## R2A

```
public static final ReleaseVersion R2A
```

---

## R3\_0

```
public static final ReleaseVersion R3_0
```

## Method Detail

### values

```
public static ReleaseVersion[] values()
```

---

### valueOf

```
public static ReleaseVersion valueOf(String name)
```



# Class RequestPrimitiveDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
├─ org.osgi.dto.DTO
│   └─ org.osgi.service.onem2m.dto.RequestPrimitiveDTO
```

```
public class RequestPrimitiveDTO
extends org.osgi.dto.DTO
```

DTO expresses Request Primitive.

Nested Class Summary		Page
static enum	<a href="#">RequestPrimitiveDTO.DiscoveryResultType</a>	70
static enum	<a href="#">RequestPrimitiveDTO.Operation</a>	72
static enum	<a href="#">RequestPrimitiveDTO.ResultContent</a>	74

Field Summary		Page
Boolean	<a href="#">authRelationshipIndicator</a>	69
List<String>	<a href="#">authSignature</a>	69
Boolean	<a href="#">authSignatureIndicator</a>	68
<a href="#">PrimitiveContentDTO</a>	<a href="#">content</a>	67
Boolean	<a href="#">deliveryAggregation</a>	68
<a href="#">RequestPrimitiveDTO.DiscoveryResultType</a>	<a href="#">discoveryResultType</a>	68
String	<a href="#">eventCategory</a>	67
<a href="#">FilterCriteriaDTO</a>	<a href="#">filterCriteria</a>	68
String	<a href="#">from</a>	66
String	<a href="#">groupRequestIdentifier</a>	68
List<String>	<a href="#">groupRequestTargetMembers</a>	68
List<String>	<a href="#">localTokenIDs</a>	68
<a href="#">RequestPrimitiveDTO.Operation</a>	<a href="#">operation</a>	66
String	<a href="#">operationExecutionTime</a>	67
String	<a href="#">originatingTimestamp</a>	67
<a href="#">ReleaseVersion</a>	<a href="#">releaseVersion</a>	69
String	<a href="#">requestExpirationTimestamp</a>	67
String	<a href="#">requestIdentifier</a>	66
Integer	<a href="#">resourceType</a>	66
<a href="#">ResponseTypeInfoDTO</a>	<a href="#">responseType</a>	67

<a href="#">RequestPrimitiveDTO.ResultContent</a>	<a href="#">resultContent</a>	67
String	<a href="#">resultExpirationTimestamp</a>	67
String	<a href="#">resultPersistence</a>	67
List<String>	<a href="#">roleIDs</a>	67
Boolean	<a href="#">semanticQueryIndicator</a>	69
String	<a href="#">to</a>	66
List<String>	<a href="#">tokenIDs</a>	68
Boolean	<a href="#">tokenReqIndicator</a>	68
String	<a href="#">tokens</a>	68
String	<a href="#">verndorInformation</a>	69

Constructor Summary	Page
<a href="#">RequestPrimitiveDTO</a> ()	69

Methods inherited from class org.osgi.dto.DTO
toString

Field Detail

operation

public [RequestPrimitiveDTO.Operation](#) operation

to

public String to

from

public String from

requestIdentifier

public String requestIdentifier

resourceType

public Integer resourceType

---

## content

```
public PrimitiveContentDTO content
```

---

## roleIDs

```
public List<String> roleIDs
```

---

## originatingTimestamp

```
public String originatingTimestamp
```

---

## requestExpirationTimestamp

```
public String requestExpirationTimestamp
```

---

## resultExpirationTimestamp

```
public String resultExpirationTimestamp
```

---

## operationExecutionTime

```
public String operationExecutionTime
```

---

## responseType

```
public ResponseTypeInfoDTO responseType
```

---

## resultPersistence

```
public String resultPersistence
```

---

## resultContent

```
public RequestPrimitiveDTO.ResultContent resultContent
```

---

## eventCategory

```
public String eventCategory
```

---

---

## deliveryAggregation

```
public Boolean deliveryAggregation
```

---

## groupRequestIdentifier

```
public String groupRequestIdentifier
```

---

## filterCriteria

```
public FilterCriteriaDTO filterCriteria
```

---

## discoveryResultType

```
public RequestPrimitiveDTO.DiscoveryResultType discoveryResultType
```

---

## tokens

```
public String tokens
```

---

## tokenIDs

```
public List<String> tokenIDs
```

---

## localTokenIDs

```
public List<String> localTokenIDs
```

---

## tokenReqIndicator

```
public Boolean tokenReqIndicator
```

---

## groupRequestTargetMembers

```
public List<String> groupRequestTargetMembers
```

---

## authSignatureIndicator

```
public Boolean authSignatureIndicator
```

---

---

## authSignature

```
public List<String> authSignature
```

---

## authRelationshipIndicator

```
public Boolean authRelationshipIndicator
```

---

## semanticQueryIndicator

```
public Boolean semanticQueryIndicator
```

---

## releaseVersion

```
public ReleaseVersion releaseVersion
```

---

## verndorInformation

```
public String verndorInformation
```

## Constructor Detail

### RequestPrimitiveDTO

```
public RequestPrimitiveDTO()
```

## Enum RequestPrimitiveDTO.DiscoveryResultType

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ java.lang.Enum<RequestPrimitiveDTO.DiscoveryResultType>
    └─ org.osgi.service.onem2m.dto.RequestPrimitiveDTO.DiscoveryResultType
```

### All Implemented Interfaces:

Comparable<[RequestPrimitiveDTO.DiscoveryResultType](#)>, Serializable

### Enclosing class:

[RequestPrimitiveDTO](#)

```
public static enum RequestPrimitiveDTO.DiscoveryResultType
extends Enum<RequestPrimitiveDTO.DiscoveryResultType>
```

Enum Constant Summary		Page
<a href="#">structured</a>		70
<a href="#">unstructured</a>		70

Method Summary		Page
int	<a href="#">getValue</a> ()	71
static <a href="#">RequestPrimitiveDTO.DiscoveryResultType</a>	<a href="#">valueOf</a> (String name)	71
static <a href="#">RequestPrimitiveDTO.DiscoveryResultType</a> []	<a href="#">values</a> ()	70

## Enum Constant Detail

### structured

```
public static final RequestPrimitiveDTO.DiscoveryResultType structured
```

### unstructured

```
public static final RequestPrimitiveDTO.DiscoveryResultType unstructured
```

## Method Detail

### values

```
public static RequestPrimitiveDTO.DiscoveryResultType[] values()
```

---

## valueOf

```
public static RequestPrimitiveDTO.DiscoveryResultType valueOf(String name)
```

---

## getValue

```
public int getValue()
```

## Enum RequestPrimitiveDTO.Operation

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ java.lang.Enum<RequestPrimitiveDTO.Operation>
    └─ org.osgi.service.onem2m.dto.RequestPrimitiveDTO.Operation
```

### All Implemented Interfaces:

Comparable<[RequestPrimitiveDTO.Operation](#)>, Serializable

### Enclosing class:

[RequestPrimitiveDTO](#)

```
public static enum RequestPrimitiveDTO.Operation
extends Enum<RequestPrimitiveDTO.Operation>
```

Enum Constant Summary	Page
<a href="#">Create</a>	72
<a href="#">Delete</a>	73
<a href="#">Notify</a>	73
<a href="#">Retrieve</a>	72
<a href="#">Update</a>	72

Method Summary	Page
int <a href="#">getValue</a> ()	73
static <a href="#">RequestPrimitiveDTO.Operation</a> <a href="#">valueOf</a> (String name)	73
static <a href="#">RequestPrimitiveDTO.Operation</a> [] <a href="#">values</a> ()	73

## Enum Constant Detail

### Create

public static final [RequestPrimitiveDTO.Operation](#) Create

### Retrieve

public static final [RequestPrimitiveDTO.Operation](#) Retrieve

### Update

public static final [RequestPrimitiveDTO.Operation](#) Update



---

## Delete

```
public static final RequestPrimitiveDTO.Operation Delete
```

---

## Notify

```
public static final RequestPrimitiveDTO.Operation Notify
```

## Method Detail

### values

```
public static RequestPrimitiveDTO.Operation[] values()
```

---

### valueOf

```
public static RequestPrimitiveDTO.Operation valueOf(String name)
```

---

### getValue

```
public int getValue()
```

## Enum RequestPrimitiveDTO.ResultContent

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ java.lang.Enum<RequestPrimitiveDTO.ResultContent>
    └─ org.osgi.service.onem2m.dto.RequestPrimitiveDTO.ResultContent
```

### All Implemented Interfaces:

Comparable<[RequestPrimitiveDTO.ResultContent](#)>, Serializable

### Enclosing class:

[RequestPrimitiveDTO](#)

```
public static enum RequestPrimitiveDTO.ResultContent
extends Enum<RequestPrimitiveDTO.ResultContent>
```

Enum Constant Summary	Page
<a href="#">attributes</a>	74
<a href="#">attributesAndChildResourceReferences</a>	75
<a href="#">attributesAndChildResources</a>	75
<a href="#">childResourceReferences</a>	75
<a href="#">childResources</a>	75
<a href="#">hierarchicalAddress</a>	75
<a href="#">hierarchicalAddressAndAttributes</a>	75
<a href="#">nothing</a>	74
<a href="#">originalResource</a>	75

Method Summary	Page
int <a href="#">getValue</a> ()	75
static <a href="#">RequestPrimitiveDTO.ResultContent</a> <a href="#">valueOf</a> (String name)	75
static <a href="#">RequestPrimitiveDTO.ResultContent</a> [] <a href="#">values</a> ()	75

## Enum Constant Detail

### nothing

```
public static final RequestPrimitiveDTO.ResultContent nothing
```

### attributes

```
public static final RequestPrimitiveDTO.ResultContent attributes
```

## hierarchicalAddress

```
public static final RequestPrimitiveDTO.ResultContent hierarchicalAddress
```

---

## hierarchicalAddressAndAttributes

```
public static final RequestPrimitiveDTO.ResultContent hierarchicalAddressAndAttributes
```

---

## attributesAndChildResources

```
public static final RequestPrimitiveDTO.ResultContent attributesAndChildResources
```

---

## attributesAndChildResourceReferences

```
public static final RequestPrimitiveDTO.ResultContent attributesAndChildResourceReferences
```

---

## childResourceReferences

```
public static final RequestPrimitiveDTO.ResultContent childResourceReferences
```

---

## originalResource

```
public static final RequestPrimitiveDTO.ResultContent originalResource
```

---

## childResources

```
public static final RequestPrimitiveDTO.ResultContent childResources
```

## Method Detail

### values

```
public static RequestPrimitiveDTO.ResultContent[] values()
```

---

### valueOf

```
public static RequestPrimitiveDTO.ResultContent valueOf(String name)
```

---

### getValue

```
public int getValue()
```

# Class ResourceDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ org.osgi.dto.DTO
    └─ org.osgi.service.onem2m.dto.ResourceDTO
```

```
public class ResourceDTO
extends org.osgi.dto.DTO
```

DTO expressing Resource.

Field Summary		Page
Map<String, Object>	<a href="#">attribute</a> Non Universal Attribute.	77
String	<a href="#">creationTime</a>	77
List<String>	<a href="#">labels</a>	77
String	<a href="#">lastModifiedTime</a>	77
String	<a href="#">parentID</a>	76
String	<a href="#">resourceID</a>	76
String	<a href="#">resourceName</a>	77
Integer	<a href="#">resourceType</a>	76

Constructor Summary	Page
<a href="#">ResourceDTO</a> ()	77

Methods inherited from class org.osgi.dto.DTO
toString

## Field Detail

**resourceType**  
public Integer resourceType

**resourceID**  
public String resourceID

**parentID**  
public String parentID

---

## creationTime

```
public String creationTime
```

---

## lastModifiedTime

```
public String lastModifiedTime
```

---

## resourceName

```
public String resourceName
```

---

## labels

```
public List<String> labels
```

---

## attribute

```
public Map<String,Object> attribute
```

Non Universal Attribute. Value Part must be the types that are allowed for OSGi DTO.

## Constructor Detail

### ResourceDTO

```
public ResourceDTO()
```

# Class ResourceWrapperDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ org.osgi.dto.DTO
    └─ org.osgi.service.onem2m.dto.ResourceWrapperDTO
```

```
public class ResourceWrapperDTO
extends org.osgi.dto.DTO
```

DTO expressing ResourceWrapper.

Field Summary		Page
String	<a href="#">uri</a>	78

Constructor Summary		Page
<a href="#">ResourceWrapperDTO</a> ()		78

Methods inherited from class org.osgi.dto.DTO	
toString	

Field Detail

uri

public String uri

Constructor Detail

ResourceWrapperDTO

public ResourceWrapperDTO ()

## Class ResponsePrimitiveDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ org.osgi.dto.DTO
    └─ org.osgi.service.onem2m.dto.ResponsePrimitiveDTO
```

```
public class ResponsePrimitiveDTO
extends org.osgi.dto.DTO
```

DTO expressing Response Primitive.

Nested Class Summary		Page
static enum	<a href="#">ResponsePrimitiveDTO.ContentStatus</a>	82

Field Summary		Page
List< <a href="#">LocalTokenIdAssignmentDTO</a> >	<a href="#">assignedTokenIdentifiers</a>	81
Boolean	<a href="#">AuthSignatureReqInfo</a>	81
<a href="#">PrimitiveContentDTO</a>	<a href="#">content</a>	80
Integer	<a href="#">contentOffset</a>	80
<a href="#">ResponsePrimitiveDTO.ContentStatus</a>	<a href="#">contentStatus</a>	80
String	<a href="#">eventCategory</a>	80
String	<a href="#">from</a>	80
String	<a href="#">originatingTimestamp</a>	80
<a href="#">ReleaseVersion</a>	<a href="#">releaseVersionIndicator</a>	81
String	<a href="#">requestIdentifier</a>	80
Integer	<a href="#">responseStatusCode</a>	80
String	<a href="#">resultExpirationTimestamp</a>	80
String	<a href="#">to</a>	80
List< <a href="#">DasInfoDTO</a> >	<a href="#">tokenReqInfo</a>	81
String	<a href="#">vendorInformation</a>	81

Constructor Summary		Page
	<a href="#">ResponsePrimitiveDTO()</a>	81

Methods inherited from class org.osgi.dto.DTO	
<a href="#">toString</a>	

Field Detail

responseStatusCode

public Integer responseStatusCode

---

requestIdentifier

public String requestIdentifier

---

content

public [PrimitiveContentDTO](#) content

---

to

public String to

---

from

public String from

---

originatingTimestamp

public String originatingTimestamp

---

resultExpirationTimestamp

public String resultExpirationTimestamp

---

eventCategory

public String eventCategory

---

contentStatus

public [ResponsePrimitiveDTO.ContentStatus](#) contentStatus

---

contentOffset

public Integer contentOffset



---

## assignedTokenIdentifiers

```
public List<LocalTokenIdAssignmentDTO> assignedTokenIdentifiers
```

---

## tokenReqInfo

```
public List<DasInfoDTO> tokenReqInfo
```

---

## AuthSignatureReqInfo

```
public Boolean AuthSignatureReqInfo
```

---

## releaseVersionIndicator

```
public ReleaseVersion releaseVersionIndicator
```

---

## vendorInformation

```
public String vendorInformation
```

## Constructor Detail

### ResponsePrimitiveDTO

```
public ResponsePrimitiveDTO()
```

# Enum ResponsePrimitiveDTO.ContentStatus

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ java.lang.Enum<ResponsePrimitiveDTO.ContentStatus>
    └─ org.osgi.service.onem2m.dto.ResponsePrimitiveDTO.ContentStatus
```

All Implemented Interfaces:  
Comparable<[ResponsePrimitiveDTO.ContentStatus](#)>, Serializable

Enclosing class:  
[ResponsePrimitiveDTO](#)

```
public static enum ResponsePrimitiveDTO.ContentStatus
extends Enum<ResponsePrimitiveDTO.ContentStatus>
```

Enum Constant Summary		Page
<a href="#">FULL_CONTENT</a>		82
<a href="#">PARTIAL_CONTENT</a>		82

Method Summary		Page
static <a href="#">ResponsePrimitiveDTO.ContentStatus</a> <a href="#">valueOf</a> (String name)		83
static <a href="#">ResponsePrimitiveDTO.ContentStatus</a> [] <a href="#">values</a> ()		82

## Enum Constant Detail

**PARTIAL\_CONTENT**  
public static final [ResponsePrimitiveDTO.ContentStatus](#) PARTIAL\_CONTENT

## FULL\_CONTENT

public static final [ResponsePrimitiveDTO.ContentStatus](#) FULL\_CONTENT

## Method Detail

**values**  
public static [ResponsePrimitiveDTO.ContentStatus](#)[] values()

---

## valueOf

```
public static ResponsePrimitiveDTO.ContentStatus valueOf(String name)
```

# Class ResponseTypeInfoDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ org.osgi.dto.DTO
    └─ org.osgi.service.onem2m.dto.ResponseTypeInfoDTO
```

```
public class ResponseTypeInfoDTO
extends org.osgi.dto.DTO
```

Expressing ResponseTypeInfo

Nested Class Summary		Page
static enum	<a href="#">ResponseTypeInfoDTO.ResponseType</a>	85

Field Summary		Page
List<String>	<a href="#">notificationURI</a>	84
<a href="#">ResponseTypeInfoDTO.ResponseType</a>	<a href="#">responseTypeValue</a>	84

Constructor Summary		Page
<a href="#">ResponseTypeInfoDTO</a> ()		84

Methods inherited from class org.osgi.dto.DTO	
toString	

## Field Detail

### responseTypeValue

```
public ResponseTypeInfoDTO.ResponseType responseTypeValue
```

### notificationURI

```
public List<String> notificationURI
```

## Constructor Detail

### ResponseTypeInfoDTO

```
public ResponseTypeInfoDTO ()
```

# Enum ResponseTypeInfoDTO.ResponseType

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ java.lang.Enum<ResponseTypeInfoDTO.ResponseType>
    └─ org.osgi.service.onem2m.dto.ResponseTypeInfoDTO.ResponseType
```

All Implemented Interfaces:  
Comparable<[ResponseTypeInfoDTO.ResponseType](#)>, Serializable

Enclosing class:  
[ResponseTypeInfoDTO](#)

```
public static enum ResponseTypeInfoDTO.ResponseType
extends Enum<ResponseTypeInfoDTO.ResponseType>
```

Enum Constant Summary		Pag e
<a href="#">blockingRequest</a>		85
<a href="#">flexBlocking</a>		86
<a href="#">nonBlockingRequestAsynch</a>		85
<a href="#">nonBlockingRequestSynch</a>		85

Method Summary		Pag e
int	<a href="#">getValue</a> ()	86
static <a href="#">ResponseTy peInfoDTO. ResponseType pe</a>	<a href="#">valueOf</a> (String name)	86
static <a href="#">ResponseTy peInfoDTO. ResponseType pe[]</a>	<a href="#">values</a> ()	86

## Enum Constant Detail

### nonBlockingRequestSynch

public static final [ResponseTypeInfoDTO.ResponseType](#) nonBlockingRequestSynch

### nonBlockingRequestAsynch

public static final [ResponseTypeInfoDTO.ResponseType](#) nonBlockingRequestAsynch

### blockingRequest

public static final [ResponseTypeInfoDTO.ResponseType](#) blockingRequest

---

## flexBlocking

```
public static final ResponseTypeInfoDTO.ResponseType flexBlocking
```

## Method Detail

### values

```
public static ResponseTypeInfoDTO.ResponseType[] values()
```

---

### valueOf

```
public static ResponseTypeInfoDTO.ResponseType valueOf(String name)
```

---

### getValue

```
public int getValue()
```

# Class SecurityInfoDTO

[org.osgi.service.onem2m.dto](#)

```
java.lang.Object
└─ org.osgi.dto.DTO
    └─ org.osgi.service.onem2m.dto.SecurityInfoDTO
```

```
public class SecurityInfoDTO
extends org.osgi.dto.DTO
```

DTO expressing Security Info.

Field Summary		Page
Map<String, Object>	<a href="#">dasRequest</a>	87
Map<String, Object>	<a href="#">dasResponse</a>	87
byte[]	<a href="#">escertkeMessage</a>	88
String	<a href="#">esprimObject</a>	88
Map<String, Object>	<a href="#">esprimRandObject</a>	88
Integer	<a href="#">securityInfoType</a>	87

Constructor Summary	Page
<a href="#">SecurityInfoDTO()</a>	88

Methods inherited from class org.osgi.dto.DTO
toString

## Field Detail

**securityInfoType**  
public Integer securityInfoType

### dasRequest

public Map<String, Object> dasRequest

### dasResponse

public Map<String, Object> dasResponse

---

## **esprimRandObject**

```
public Map<String, Object> esprimRandObject
```

---

## **esprimObject**

```
public String esprimObject
```

---

## **escertkeMessage**

```
public byte[] escertkeMessage
```

## **Constructor Detail**

### **SecurityInfoDTO**

```
public SecurityInfoDTO()
```



## Package org.osgi.service.onem2m.introspection

This package include interfaces for providing information of data structures and checking validity.

See:

[Description](#)

Interface Summary		Page
<a href="#">FlexContainerInspector</a>	FlexContainerInspector provides information of sub data structures and validity of data structure for FlexContainer Resource.	90
<a href="#">Inspector</a>	Inspector provides information of sub data structures and validity of data structure of oneM2M, except FlexContainer.	92

Enum Summary		Page
<a href="#">Optionality</a>	Enum expressing optionality of fields.	95

## Package org.osgi.service.onem2m.introspection Description

This package include interfaces for providing information of data structures and checking validity.

## Interface FlexContainerIntrospector

[org.osgi.service.onem2m.introspection](http://org.osgi.service.onem2m.introspection)

```
public interface FlexContainerIntrospector
```

FlexContainerInspector provides information of sub data structures and validity of data structure for FlexContainer Resource.

Method Summary		Page
String[]	<a href="#">findValidationProblems</a> ( <a href="#">ResourceDTO</a> resource) Execute Validation of Data Structure	90
String[]	<a href="#">getCustomeAttributeNames</a> (String containerDefinition) get Possible Attributes for the given resouceType.	90
<a href="#">Optionalitv</a>	<a href="#">getOptionalitv</a> (String containerDefinition, String attributeName) get optionality of specified attribute	90
Object	<a href="#">getTemplateObject</a> (String containerDefinition, String customAttributeName) return Typical Data Structure for Type for given attribute of resource type	91
Class	<a href="#">getType</a> (String containerDefinition, String attributeName) return Java Type for given attribute of resource type	91

### Method Detail

#### findValidationProblems

```
String[] findValidationProblems(ResourceDTO resource)
```

Execute Validation of Data Structure

**Returns:**

array of problems

#### getCustomeAttributeNames

```
String[] getCustomeAttributeNames(String containerDefinition)
```

get Possible Attributes for the given resouceType.

**Returns:**

array of Possible Attributes

#### getOptionality

```
Optionalitv getOptionality(String containerDefinition,  
                           String attributeName)
```

get optionality of specified attribute

**Parameters:**

containerDefinition - container definition  
attributeName - attribute name

---

## getType

Class **getType**(String containerDefinition,  
String attributeName)

return Java Type for given attribute of resource type

**Parameters:**

containerDefinition - container definition of flexContainer  
attributeName - attribute name

**Returns:**

expected class for the specified attribute

---

## getTemplateObject

Object **getTemplateObject**(String containerDefinition,  
String customAttributeName)

return Typical Data Structure for Type for given attribute of resource type

**Parameters:**

containerDefinition - container definition of flexContainer

**Returns:**

Template Object

# Interface Introspector

[org.osgi.service.onem2m.introspection](#)

```
public interface Introspector
```

Inspector provides information of sub data structures and validity of data structure of oneM2M, except FlexContainer.

Method Summary		Page
String[]	<a href="#">findValidationProblems</a> ( <a href="#">RequestPrimitiveDTO</a> req) execute Validation of Data Structure	92
String[]	<a href="#">findValidationProblems</a> ( <a href="#">ResponsePrimitiveDTO</a> resp) execute Validation of Data Structure	92
String[]	<a href="#">findValidationProblemsForCreate</a> ( <a href="#">ResourceDTO</a> resource) execute Validation of Data Structure	93
String[]	<a href="#">findValidationProblemsForUpdate</a> ( <a href="#">ResourceDTO</a> resource) execute Validation of Data Structure	93
String[]	<a href="#">getAttributeNames</a> (int resourceType) get Possible Attributes for specified resourceType.	93
<a href="#">Optionalit y</a>	<a href="#">getOptionalitForCreate</a> (int resourceType, String attributeName) get Optionality of specified attribute in create operation.	93
<a href="#">Optionalit y</a>	<a href="#">getOptionalitForUpdate</a> (int resourceType, String attributeName) get Optionality of specified attribute in update operation.	93
Object	<a href="#">getTemplateObject</a> (int resourceType, String Attribute) return Typical Data Structure for Type of specified attribute of resource type	94
Class	<a href="#">getType</a> (int resourceType, String attributeName) return Java Type for given attribute of resource type	94

## Method Detail

### findValidationProblems

```
String[] findValidationProblems(ResponsePrimitiveDTO resp)
```

execute Validation of Data Structure

**Returns:**

array of problems

### findValidationProblems

```
String[] findValidationProblems(RequestPrimitiveDTO req)
```

execute Validation of Data Structure

**Returns:**

array of problems

## findValidationProblemsForCreate

`String[] findValidationProblemsForCreate (ResourceDTO resource)`

execute Validation of Data Structure

**Returns:**

array of problems

---

## findValidationProblemsForUpdate

`String[] findValidationProblemsForUpdate (ResourceDTO resource)`

execute Validation of Data Structure

**Returns:**

array of problems

---

## getAttributeNames

`String[] getAttributeNames (int resourceType)`

get Possible Attributes for specified resourceType.

**Returns:**

array of Possible Attribute Names

---

## getOptionaltyForCreate

`Optionalty getOptionaltyForCreate (int resourceType,  
String attributeName)`

get Optionalty of specified attribute in create operation.

**Parameters:**

resourceType - resource type  
attributeName - attribute Name

**Returns:**

Optionalty

---

## getOptionaltyForUpdate

`Optionalty getOptionaltyForUpdate (int resourceType,  
String attributeName)`

get Optionalty of specified attribute in update operation.

**Parameters:**

resourceType - resource type

attributeName - attribute Name

**Returns:**

Optionality

---

## getType

Class **getType**(int resouceType,  
String attributeName)

return Java Type for given attribute of resource type

**Parameters:**

resouceType - resource type

attributeName - attribute Name

**Returns:**

expected class for the specified attribute

---

## getTemplateObject

Object **getTemplateObject**(int resouceType,  
String Attribute)

return Typical Data Structure for Type of specified attribute of resource type

**Returns:**

Template Object

## Enum Optionality

[org.osgi.service.onem2m.introspection](#)

```
java.lang.Object
└─ java.lang.Enum<Optionality>
    └─ org.osgi.service.onem2m.introspection.Optionality
```

### All Implemented Interfaces:

Comparable<[Optionality](#)>, Serializable

---

```
public enum Optionality
extends Enum<Optionality>
```

Enum expressing optionality of fields.

---

Enum Constant Summary	Page
<a href="#">Mandatory</a>	95
<a href="#">NotPresent</a>	95
<a href="#">Optional</a>	95

Method Summary	Page
<pre>static <a href="#">Optionality</a> y</pre> <a href="#">valueOf</a> (String name)	96
<pre>static <a href="#">Optionality</a> y[]</pre> <a href="#">values</a> ()	95

## Enum Constant Detail

### Mandatory

```
public static final Optionality Mandatory
```

---

### Optional

```
public static final Optionality Optional
```

---

### NotPresent

```
public static final Optionality NotPresent
```

## Method Detail

### values

```
public static Optionality[] values()
```

## valueOf

```
public static Optionality valueOf(String name)
```



## Package org.osgi.service.onem2m.old

This package is used for temporal palace holder.

See:

[Description](#)

Class Summary		Page
<a href="#">AbsRelTimestampDTO</a>	AbsRelTimestamp	98
<a href="#">DynAuthTokenReqInfoDTO</a>		99

Enum Summary		Page
<a href="#">ResourceType</a>		100

## Package org.osgi.service.onem2m.old Description

This package is used for temporal palace holder. All interfaces and classes will be removed after confirmation.

# Class AbsRelTimestampDTO

[org.osgi.service.onem2m.old](#)

```
java.lang.Object
└─ org.osgi.dto.DTO
    └─ org.osgi.service.onem2m.old.AbsRelTimestampDTO
```

```
public class AbsRelTimestampDTO
extends org.osgi.dto.DTO
```

AbsRelTimestamp

Constructor Summary		Pag e
<a href="#">AbsRelTimestampDTO</a> ()		98

Methods inherited from class org.osgi.dto.DTO
toString

## Constructor Detail

### AbsRelTimestampDTO

```
public AbsRelTimestampDTO()
```

# Class DynAuthTokenReqInfoDTO

[org.osgi.service.onem2m.old](#)

```
java.lang.Object
└─ org.osgi.dto.DTO
    └─ org.osgi.service.onem2m.old.DynAuthTokenReqInfoDTO
```

```
public class DynAuthTokenReqInfoDTO
extends org.osgi.dto.DTO
```

Field Summary		Page
List<Map<String, Object>>	<a href="#">dasInfo</a>	99

Constructor Summary		Page
<a href="#">DynAuthTokenReqInfoDTO</a> ()		99

Methods inherited from class org.osgi.dto.DTO	
toString	

## Field Detail

**dasInfo**

```
public List<Map<String, Object>> dasInfo
```

## Constructor Detail

**DynAuthTokenReqInfoDTO**

```
public DynAuthTokenReqInfoDTO ()
```

## Enum ResourceType

[org.osgi.service.onem2m.old](#)

```
java.lang.Object
├─ java.lang.Enum<ResourceType>
│   └─ org.osgi.service.onem2m.old.ResourceType
```

### All Implemented Interfaces:

Comparable<[ResourceType](#)>, Serializable

---

```
public enum ResourceType
extends Enum<ResourceType>
```

---

Enum Constant Summary	Page
<a href="#">accessControlPolicy</a>	101
<a href="#">accessControlPolicyAnnc</a>	105
<a href="#">AE</a>	101
<a href="#">AEAnnc</a>	105
<a href="#">container</a>	102
<a href="#">containerAnnc</a>	105
<a href="#">contentInstance</a>	102
<a href="#">contentInstanceAnnc</a>	105
<a href="#">CSEBase</a>	102
<a href="#">delivery</a>	102
<a href="#">dynamicAuthorizationConsultation</a>	105
<a href="#">dynamicAuthorizationConsultationAnnc</a>	106
<a href="#">eventConfig</a>	102
<a href="#">execInstance</a>	102
<a href="#">fanOutPoint</a>	107
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<a href="#">flexContainerAnnc</a>	106
<a href="#">group</a>	102
<a href="#">groupAnnc</a>	105
<a href="#">latest</a>	106
<a href="#">locationPolicy</a>	102
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<a href="#">notificationTargetMgmtPolicyRef</a>	104

<a href="#">notificationTargetPolicy</a>	104
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<a href="#">pollingChannelURI</a>	107
<a href="#">remoteCSE</a>	103
<a href="#">remoteCSEAnnc</a>	106
<a href="#">request</a>	103
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<a href="#">schedule</a>	103
<a href="#">scheduleAnnc</a>	106
<a href="#">semanticDescriptor</a>	104
<a href="#">semanticDescriptorAnnc</a>	106
<a href="#">serviceSubscribedAppRule</a>	103
<a href="#">serviceSubscribedNode</a>	103
<a href="#">statsCollect</a>	103
<a href="#">statsConfig</a>	103
<a href="#">subscription</a>	104
<a href="#">timeSeries</a>	104
<a href="#">timeSeriesAnnc</a>	106
<a href="#">timeSeriesInstance</a>	104
<a href="#">timeSeriesInstanceAnnc</a>	106
<a href="#">token</a>	104
<a href="#">trafficPattern</a>	105
<a href="#">trafficPatternAnnc</a>	106

Method Summary		Page
int	<a href="#">getValue</a> ()	107
static <a href="#">ResourceType</a> <a href="#">pe</a>	<a href="#">valueOf</a> (String name)	107
static <a href="#">ResourceType</a> <a href="#">pe</a> []	<a href="#">values</a> ()	107

## Enum Constant Detail

### accessControlPolicy

public static final [ResourceType](#) accessControlPolicy

## AE

public static final [ResourceType](#) AE

---

## container

```
public static final ResourceType container
```

---

## contentInstance

```
public static final ResourceType contentInstance
```

---

## CSEBase

```
public static final ResourceType CSEBase
```

---

## delivery

```
public static final ResourceType delivery
```

---

## eventConfig

```
public static final ResourceType eventConfig
```

---

## execInstance

```
public static final ResourceType execInstance
```

---

## group

```
public static final ResourceType group
```

---

## locationPolicy

```
public static final ResourceType locationPolicy
```

---

## m2mServiceSubscriptionProfile

```
public static final ResourceType m2mServiceSubscriptionProfile
```

---

## mgmtCmd

```
public static final ResourceType mgmtCmd
```

---

---

## mgmtObj

```
public static final ResourceType mgmtObj
```

---

## node

```
public static final ResourceType node
```

---

## pollingChannel

```
public static final ResourceType pollingChannel
```

---

## remoteCSE

```
public static final ResourceType remoteCSE
```

---

## request

```
public static final ResourceType request
```

---

## schedule

```
public static final ResourceType schedule
```

---

## serviceSubscribedAppRule

```
public static final ResourceType serviceSubscribedAppRule
```

---

## serviceSubscribedNode

```
public static final ResourceType serviceSubscribedNode
```

---

## statsCollect

```
public static final ResourceType statsCollect
```

---

## statsConfig

```
public static final ResourceType statsConfig
```

---

---

## subscription

public static final [ResourceType](#) subscription

---

## semanticDescriptor

public static final [ResourceType](#) semanticDescriptor

---

## notificationTargetMgmtPolicyRef

public static final [ResourceType](#) notificationTargetMgmtPolicyRef

---

## notificationTargetPolicy

public static final [ResourceType](#) notificationTargetPolicy

---

## policyDeletionRules

public static final [ResourceType](#) policyDeletionRules

---

## flexContainer

public static final [ResourceType](#) flexContainer

---

## timeSeries

public static final [ResourceType](#) timeSeries

---

## timeSeriesInstance

public static final [ResourceType](#) timeSeriesInstance

---

## role

public static final [ResourceType](#) role

---

## token

public static final [ResourceType](#) token

---



---

## trafficPattern

```
public static final ResourceType trafficPattern
```

---

## dynamicAuthorizationConsultation

```
public static final ResourceType dynamicAuthorizationConsultation
```

---

## accessControlPolicyAnnc

```
public static final ResourceType accessControlPolicyAnnc
```

---

## AEAnnc

```
public static final ResourceType AEAnnc
```

---

## containerAnnc

```
public static final ResourceType containerAnnc
```

---

## contentInstanceAnnc

```
public static final ResourceType contentInstanceAnnc
```

---

## groupAnnc

```
public static final ResourceType groupAnnc
```

---

## locationPolicyAnnc

```
public static final ResourceType locationPolicyAnnc
```

---

## mgmtObjAnnc

```
public static final ResourceType mgmtObjAnnc
```

---

## nodeAnnc

```
public static final ResourceType nodeAnnc
```

---

---

## remoteCSEAnnc

```
public static final ResourceType remoteCSEAnnc
```

---

## scheduleAnnc

```
public static final ResourceType scheduleAnnc
```

---

## semanticDescriptorAnnc

```
public static final ResourceType semanticDescriptorAnnc
```

---

## flexContainerAnnc

```
public static final ResourceType flexContainerAnnc
```

---

## timeSeriesAnnc

```
public static final ResourceType timeSeriesAnnc
```

---

## timeSeriesInstanceAnnc

```
public static final ResourceType timeSeriesInstanceAnnc
```

---

## trafficPatternAnnc

```
public static final ResourceType trafficPatternAnnc
```

---

## dynamicAuthorizationConsultationAnnc

```
public static final ResourceType dynamicAuthorizationConsultationAnnc
```

---

## latest

```
public static final ResourceType latest
```

---

## oldest

```
public static final ResourceType oldest
```

---

---

## fanOutPoint

```
public static final ResourceType fanOutPoint
```

---

## pollingChannelURI

```
public static final ResourceType pollingChannelURI
```

## Method Detail

### values

```
public static ResourceType[] values()
```

---

### valueOf

```
public static ResourceType valueOf(String name)
```

---

### getValue

```
public int getValue()
```

---

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---

# 8 Considered Alternatives

---

*For posterity, record the design alternatives that were considered but rejected along with the reason for rejection. This is especially important for external/earlier solutions that were deemed not applicable.*

---

## 8.1 Representation of DTO

### 8.1.1 JAXB generated Class

As alternative solution, utilization of generated Java classes by JAXB has been considered, since oneM2M provides well defined XSD for defining data format. With the following aspects, this approach is not applied.

Many classes: Currently 65 XSD files are defined in oneM2M specification and JAXB tool (xjc) generates more than 140 Java classes. Using many classes as interface could make specification more complicated than its nature.

No Uniqueness: Generated classes by xjc are not unique, because it is possible to customize generation processes.

Changeability: Depending on the version of oneM2M, XSD files differ. It is preferable to choose version independent API, as much as possible. oneM2M ensures any data can be converted to JSON and CBOR, so proposed approach can be used with out modification, even if XSD file would be changed.

### **8.1.2 Generic DTO**

Generic DTO, which has Map<String, Obj> in the top, has been discussed in Gent meeting. But it seems bad usage of defining DTO.

### **8.1.3 Specific DTO**

SpecificDTO definitions have been generated from XSD generated classes. The number of DTO exceeds 170 and Java doc pages are getting 300 pages. It is apparently too much to express data formats. So middle approach of generic DTO and specific DTO has been chosen.

---

## **8.2 Resource Types Expression**

In DTO, enum was eagerly used for clear candidates of possible values. But resource types seems more fragile because new resource types could be easily added. So Integer was chosen for resource types.

---

## **8.3 Use of Annotation defined by JAXB in DTO**

Currently annotations defined by JAXB was used in DTO. It was pointed out as confusing because it might give impression that it only support XML serialization. But it was kept in the definitions by following reasons.

1. Removing the annotations are easier than inserting.
2. It is informative to specify optionality.

New OSGI annotation specifying optionality could be possible, but it might take time because it should be published as Core specification and R7 just has released.

---

# **9 Security Considerations**

---

*Description of all known vulnerabilities this may either introduce or address as well as scenarios of how the weaknesses could be circumvented.*

---

## **9.1 ProtocolBinding Service with secure protocol configuration**

In case that ProtocolBinding Service uses secure protocols, it is expected to handle pre-shared key or certificate and other parameters. Those configuration could be very diverse. This is out of scope of this RFC and it is responsibility of bundle developer that provides ProtocolBindingService.

## 9.2 Binding of AE Core and Protocol Binding

Protocol Binding has identity information, such as a key or certificate, which represents AE, and AE core is bound to the service and use the identity. In case that unexpected AE Core is bind to the protocol binding, it would cause of spoofing. It is deployers responsibility to deploy only trustable AE core bundles, and to configure them properly.

Following honest implementation of AE could avoid problems.

1. AE Core knows it's APP-ID, letting it as "MYAPP1".
2. Bundle providing Protocol Binding Service to AE, knows about MYAPP1 and identity information of MYAPP1. It create Protocol Binding Service for MYAPP1 and register with property "APP-ID" as "MYAPP1".
3. AE Core searches Protocol binding service with property "APP-ID" is "MYAPP1" and bind it.

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# 10 Document Support

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## 10.1 References

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- [2]. oneM2M TS-0001 Functional Architecture, [http://onem2m.org/images/files/deliverables/Release2/TS-0001-%20Functional\\_Architecture-V2\\_10\\_0.pdf](http://onem2m.org/images/files/deliverables/Release2/TS-0001-%20Functional_Architecture-V2_10_0.pdf)
- [3]. oneM2M TS-0004 Service Layer Core Protocol, [http://onem2m.org/images/files/deliverables/Release2/TS-0004\\_Service\\_Layer\\_Core\\_Protocol\\_V2\\_7\\_1.zip](http://onem2m.org/images/files/deliverables/Release2/TS-0004_Service_Layer_Core_Protocol_V2_7_1.zip)
- [4]. oneM2M TS-0001 Functional Architecture Draft v3.11.0, <http://www.onem2m.org/technical/published-drafts>
- [5]. oneM2M TS-0004 Service Layer Core Protocol Draft v3.7.0, <http://www.onem2m.org/technical/published-drafts>
- [6]. XSD files for oneM2M, <https://git.onem2m.org/PRO/XSD.git>
- [7]. Software Requirements & Specifications. Michael Jackson. ISBN 0-201-87712-0  
(NOTE:Is this needed?)

*Add references simply by adding new items. You can then cross-refer to them by chosing <Insert><Cross Reference><Numbered Item> and then selecting the paragraph. **STATIC REFERENCES (I.E. BODGED) ARE NOT ACCEPTABLE, SOMEONE WILL HAVE TO UPDATE THEM LATER, SO DO IT PROPERLY NOW.***

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## **10.3 Acronyms and Abbreviations**

CSE: Common Services Entity

AE: Application Entity

CBOR: Concise Binary Object Representation

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## **10.4 End of Document**