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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0.4 Table of Contents

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, maeomichi.hiroyuki@lab.ntt.co.jp
0.0.1	*SEP 21 2017*	Updated alternatives, some figures, added description on validator. Hiroyuki Maeomichi, NTT, maeomichi.hiroyuki@lab.ntt.co.jp
0.0.2	*April 17 2018*	Update based on discussion in Washington meeting. Hiroyuki Maeomichi, NTT, maeomichi.hiroyuki@lab.ntt.co.jp
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, LocalIdTokenIdAssigmentDTO, 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.

1 Introduction

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).

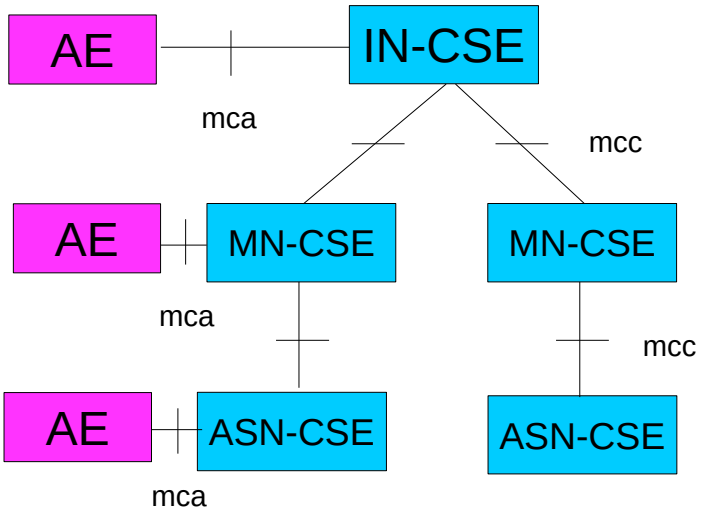
This RFP discuss the way to provide high level API (namely service layer API) for oneM2M RESTful operations hiding the difference of variety of communication methods.

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.

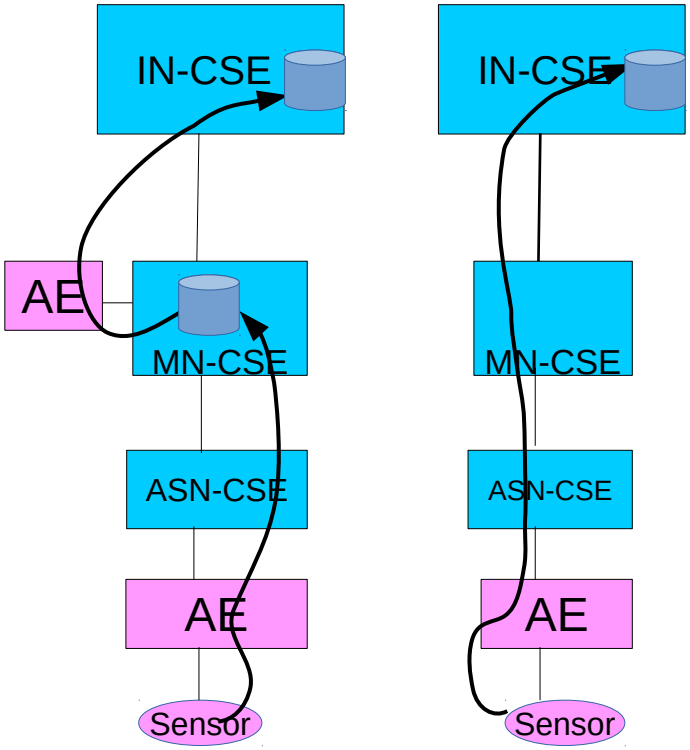


oneM2M's application, called Application Entity (AE) connects to one of CSEs. After AE connecting to the CSE, AE can access to all of CSEs, by retargeting function (similar to routing) of CSEs.

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 <*conentInstance*>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

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 programing 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.

4 Requirements

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.

5 Technical Solution

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.

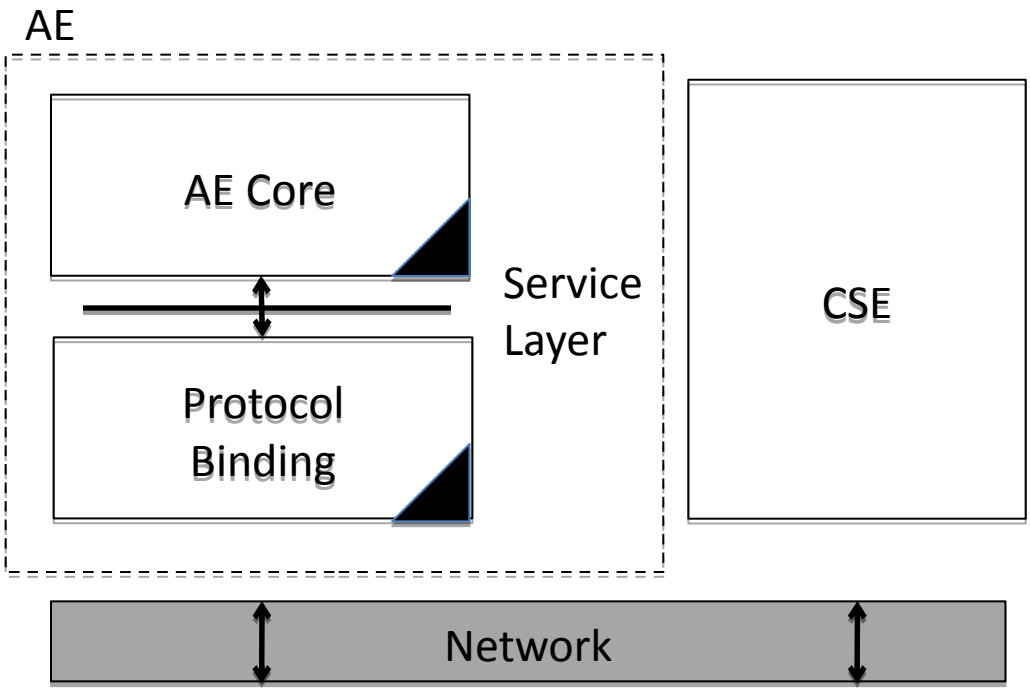
Strictly use the terminology a defined in the Problem Context.

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.

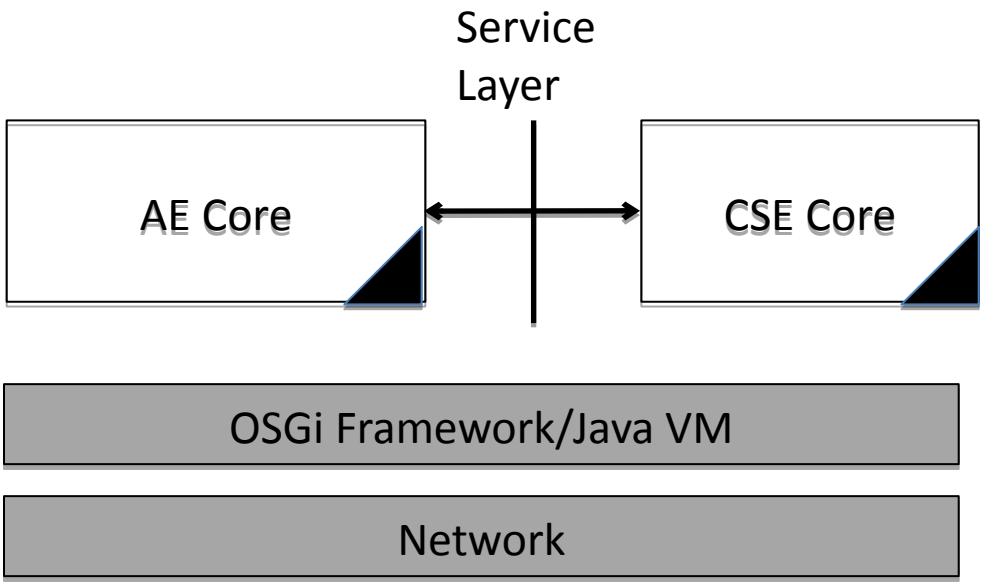
5.1 Overview for the solution

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.

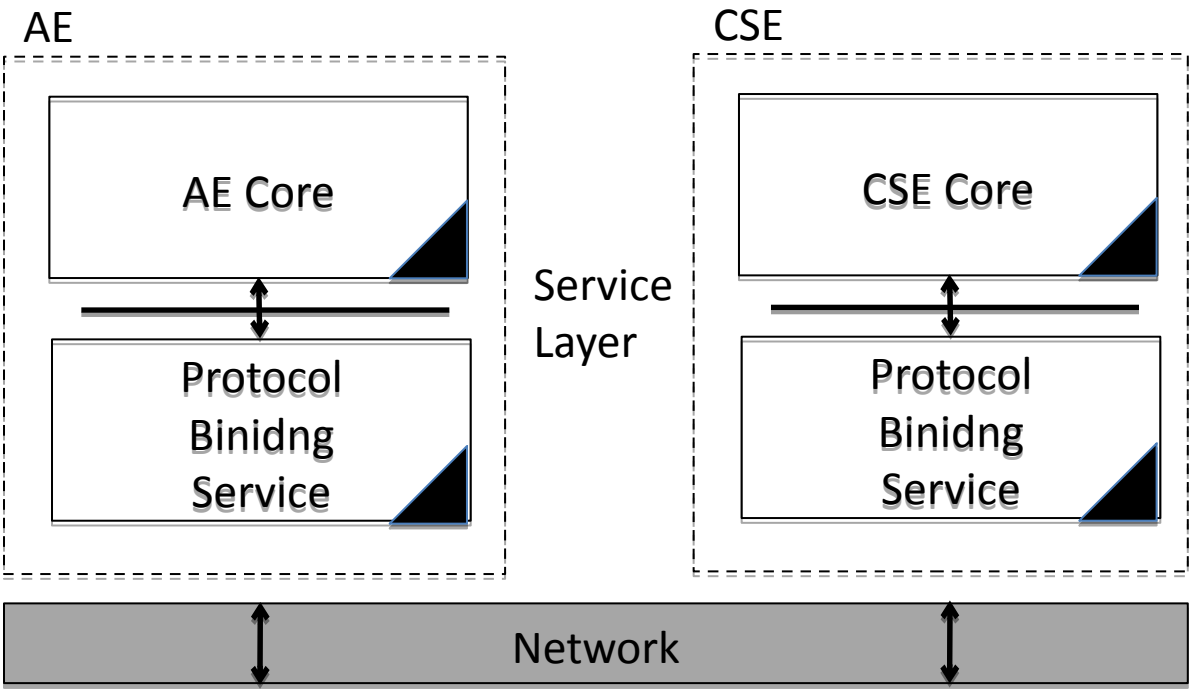


In figure, the term of Core is introduced for AE Core and CSE Core. This is for specifying parts which does not contain ProtocolBinding of AE and CSE.

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 fo 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* is defined to send request message and get 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.

5.3 OperationIF interfaces

Though Service Layer Interface enables all possible message exchanges 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
```

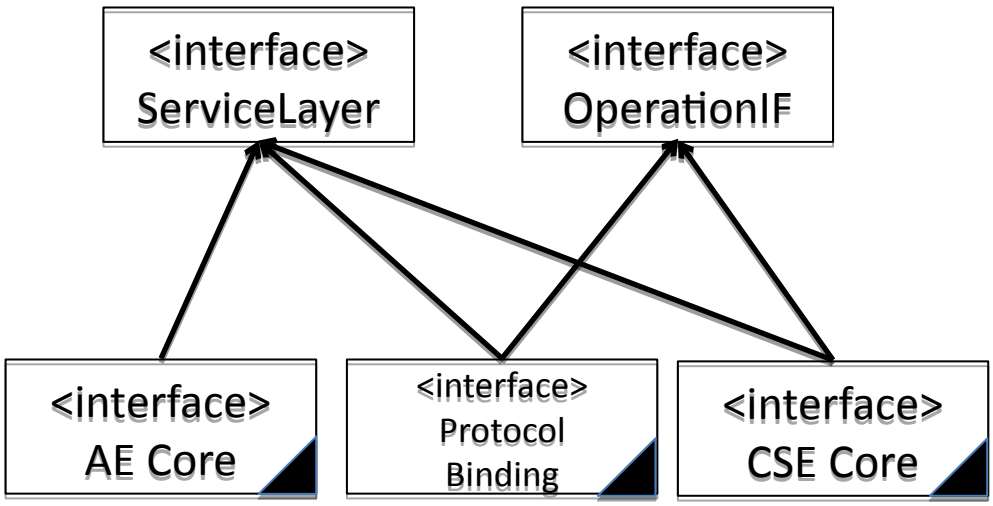
```
     */
    public Promise<Boolean> notify(String uri, NotificationDTO notification );

}
```

5.4 Concrete Interfaces

The concrete services 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
	APP-ID	String	Indicates which Application may use this service.
	POA	String[]	URIs for point of access. POA is basically set of listening protocol, port and subaddress.
CSECore	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 attributes may have different optionality depending on operations (create and 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[] findValidationProblemsForCreate(ResourceDTO resource);

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

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

	/**
	 * get Optionality of specified attribute in create operation.
	 *
	 * @param resourceType resource type
	 * @param attributeName attribute Name
	 * @return Optionality
	 */
	public Optionality getOptionalityForCreate(int resourceType, String
attributeName);

	/**
	 * get Optionality of specified attribute in update operation.
	 *
	 * @param resourceType resource type
```

```
        * @param attributeName attribute Name
        * @return Optionality
        */
       public Optionality getOptionalityForUpdate(int resourceType, String
attributeName);

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

       /**
        * return Typical Data Structure for Type of specified 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[] getCustomeAttributeNames(String containerDefinition);

	/**
	 * get optionality of specified attribute
	 *
	 * @param containerDefinition container definition
	 * @param attributeName attribute name
	 * @return optionality of the attribute
	 */
	public Optionality getOptionality(String containerDefinition, String
attributeName);

	/**
	 * 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.

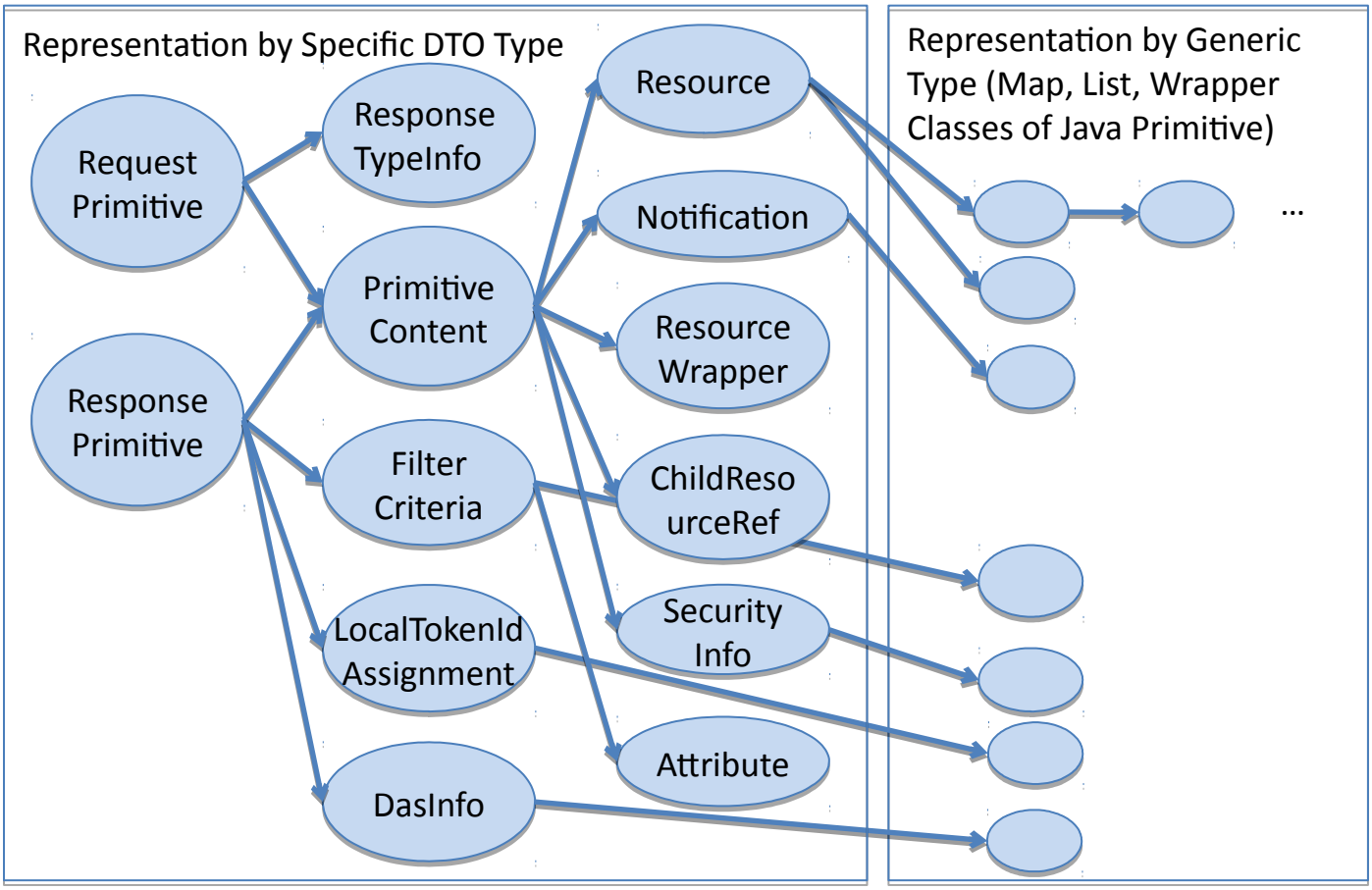
The DTOs for the design in this RFC should be described here and if there are no DTOs being defined an explanation should be given explaining why this is not applicable in this case.

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. Following figure depict reference relationship among object. (See also the considered Alternatives)

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



In figure, followed 'DTO' is ommited.

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 requestIdentifier;
	@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 requestIdentifier;
	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. There are two types of XSD are defined in oneM2M, which are longname version and shortname version. The longname version should be refered.

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,ssssss
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 an 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

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Package Summary		Page
org.osgi.service.onem2m	This package includes interfaces and Enums for service layer API for oneM2M	28
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org.osgi.service.onem2m.introspection	This package include interfaces for providing information of data structures and checking validity.	89
org.osgi.service.onem2m.old	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
AECore	Sub interface of Service Layer.	30
CSECore	CSE Core implements this interface.	30
OperationIF	OperationIF provides higher level of interface of CRUD+N operations to Application.	34
ProtocolBinding	Protocol Binding Service implements this interface.	37
ServiceLayer	Primary Interface for an oneM2M entity to send request and get response to/from other oneM2M entity.	42

Enum Summary		Page
CSEType	Enum for type of CSE.	31
ProtocolBindingType	Type of Protocol Binding. oneM2M currently defines 4 types.	37
SerializationType	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 org.osgi.service.onem2m.ServiceLayer
request

Interface CSECore

org.osgi.service.onem2m

All Superinterfaces:
OperationIF, ServiceLayer

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

CSE Core implements this interface.

Methods inherited from interface org.osgi.service.onem2m.ServiceLayer
request

Methods inherited from interface org.osgi.service.onem2m.OperationIF
create, delete, discovery, notify, retrieve, retrieve, update

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
ASN_CSE	32
IN_CSE	32
MN_CSE	32

Method Summary		Page
static CSEType	**valueOf**(String name)	33
static CSEType[]	**values**()	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<ResourceDTO>	**create**(String uri, ResourceDTO resource) create resource	34
org.osgi.util.promise.Promise<Boolean>	**delete**(String uri) delete resource	35
org.osgi.util.promise.Promise<List<String>>	**discovery**(String uri, FilterCriteriaDTO fc) find resources	35
org.osgi.util.promise.Promise<Boolean>	**notify**(String uri, NotificationDTO notification) send notification	36
org.osgi.util.promise.Promise<ResourceDTO>	**retrieve**(String uri, List<String> targetAttributes) retrieve subset of attributes.	35
org.osgi.util.promise.Promise<ResourceDTO>	**retrieve**(String uri, ResourceDTO resource) retrieve resource	35
org.osgi.util.promise.Promise<ResourceDTO>	**update**(String uri, ResourceDTO 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

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

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

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

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

```
org.osgi.util.promise.Promise<List<String>> discovery(String uri,
                                                      FilterCriteriaDTO fc)
```

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.ServiceLayer
request

Methods inherited from interface org.osgi.service.onem2m.OperationIF
create, delete, discovery, notify, retrieve, retrieve, update

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	Page
COAP	38
HTTP	38
MQTT	38
WebService	38

Method Summary		Page
static ProtocolBindingType	valueOf(String name)	39
static ProtocolBindingType[]	values()	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
CBOR	40
JSON	40
XML	40

Method Summary		Page
static SerializationType	valueOf(String name)	41
static SerializationType[]	values()	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<ResponsePrimitiveDTO>	**request**(RequestPrimitiveDTO 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
AttributeDTO	DTO expresses Attribute.	45
ChildResourceRefDTO	DTO expressing ChildResourceRef.	46
DasInfoDTO	DTO expressing DasInfo.	48
FilterCriteriaDTO	DTO expressing FilterCriteria.	49
LocalTokenIdAssignmentDTO	DTO expressing LocalTokenIdAssignment.	58
NotificationDTO	DTO expressing Notification.	59
PrimitiveContentDTO	DTO expressing Primitive Content.	62
RequestPrimitiveDTO	DTO expresses Request Primitive.	65
ResourceDTO	DTO expressing Resource.	76
ResourceWrapperDTO	DTO expressing ResourceWrapper.	78
ResponsePrimitiveDTO	DTO expressing Response Primitive.	79
ResponseTypeInfoDTO	Expressing ResponseTypeInfo	84
SecurityInfoDTO	DTO expressing Security Info.	87

Enum Summary		Page
FilterCriteriaDTO.FilterOperation		54
FilterCriteriaDTO.FilterUsage		56
ReleaseVersion	Enum expressing oneM2M specification version.	63
RequestPrimitiveDTO.DiscoveryResultType		70
RequestPrimitiveDTO.Operation		72

RequestPrimitiveDTO.ResultContent		74
ResponsePrimitiveDTO.ContentStatus		82
ResponseTypeInfoDTO.ResponseType		85

Exception Summary		Page
OneM2MException	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	**name**	45
Object	**value**	45

Constructor Summary	Page
AttributeDTO()	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	name	46
String	specializationID	46
Integer	type	46
String	uri	46

Constructor Summary	Page
ChildResourceRefDTO()	47

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

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. DAS is short for Dynamic Authorization Server.

Field Summary		Page
Map<String,Object>	dasRequest	48
String	securedDasRequest	48
String	uri	48

Constructor Summary	Page
DasInfoDTO()	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	FilterCriteriaDTO.FilterOperation	54
static enum	FilterCriteriaDTO.FilterUsage	56

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

List<String>	parentLabels	52
Integer	parentResourceType	53
List<Integer>	resourceType	51
String	semanticsFilter	52
Integer	sizeAbove	51
Integer	sizeBelow	51
Integer	stateTagBigger	50
Integer	stateTagSmaller	50
String	unmodifiedSince	50

Constructor Summary	Page
FilterCriteriaDTO()	53

Methods inherited from class org.osgi.dto.DTO
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
AND	54
OR	54

Method Summary		Page
int	getValue()	55
static FilterCriteriaDTO.FilterOperation	valueOf(String name)	55
static FilterCriteriaDTO.FilterOperation[]	values()	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	Page
ConditionalRetrival	56
DiscoveryCriteria	56
IPEOndemandDiscovery	56

Method Summary		Page
int	**getValue**()	57
static FilterCriteriaDTO.FilterUsage	**valueOf**(String name)	57
static FilterCriteriaDTO.FilterUsage[]	**values**()	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	localTokenID	58
String	tokenID	58

Constructor Summary	Page
LocalTokenIdAssignmentDTO()	58

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

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	creator	60
Map<String,Object>	ipeDiscoveryRequest	60
Map<String,Object>	notificationEvent	59
String	notificationForwardingURI	60
Boolean	subscriptionDeletion	59
String	subscriptionReference	60
Boolean	verificationRequest	59

Constructor Summary	Page
NotificationDTO()	60

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

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	cause	61
int	errorCode	61

Constructor Summary	Page
OneM2MException()	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
PrimitiveContentDTO()	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
R1_0	63
R1_1	63
R2_0	63
R2A	64
R3_0	64

Method Summary		Page
static ReleaseVersion	valueOf(String name)	64
static ReleaseVersion[]	values()	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	RequestPrimitiveDTO.DiscoveryResultType	70
static enum	RequestPrimitiveDTO.Operation	72
static enum	RequestPrimitiveDTO.ResultContent	74

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

RequestPrimitiveDTO.ResultContent	**resultContent**	67
String	**resultExpirationTimestamp**	67
String	**resultPersistence**	67
List<String>	**roleIDs**	67
Boolean	**semanticQueryIndicator**	69
String	**to**	66
List<String>	**tokenIDs**	68
Boolean	**tokenReqIndicator**	68
String	**tokens**	68
String	**verndorInformation**	69

Constructor Summary	Page
RequestPrimitiveDTO()	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
structured	70
unstructured	70

Method Summary		Page
int	**getValue**()	71
static RequestPrimitiveDTO.DiscoveryResultType	**valueOf**(String name)	71
static RequestPrimitiveDTO.DiscoveryResultType[]	**values**()	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
Create	72
Delete	73
Notify	73
Retrieve	72
Update	72

Method Summary		Page
int	**getValue**()	73
static RequestPrimitiveDTO.Operation	**valueOf**(String name)	73
static RequestPrimitiveDTO.Operation[]	**values**()	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
attributes	74
attributesAndChildResourceReferences	75
attributesAndChildResources	75
childResourceReferences	75
childResources	75
hierarchicalAddress	75
hierarchicalAddressAndAttributes	75
nothing	74
originalResource	75

Method Summary		Page
int	**getValue**()	75
static RequestPrimitiveDTO.ResultContent	**valueOf**(String name)	75
static RequestPrimitiveDTO.ResultContent[]	**values**()	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>	**attribute** Non Universal Attribute.	77
String	**creationTime**	77
List<String>	**labels**	77
String	**lastModifiedTime**	77
String	**parentID**	76
String	**resourceID**	76
String	**resourceName**	77
Integer	**resourceType**	76

Constructor Summary	Page
ResourceDTO()	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	uri	78

Constructor Summary	Page
ResourceWrapperDTO()	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	ResponsePrimitiveDTO.ContentStatus	82

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

Constructor Summary	Page
ResponsePrimitiveDTO()	81

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

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
FULL_CONTENT	82
PARTIAL_CONTENT	82

Method Summary		Page
static ResponsePrimitiveDTO.ContentStatus	valueOf(String name)	83
static ResponsePrimitiveDTO.ContentStatus[]	values()	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	ResponseTypeInfoDTO.ResponseType	85

Field Summary		Page
List<String>	notificationURI	84
ResponseTypeInfoDTO.ResponseType	responseTypeValue	84

Constructor Summary	Page
ResponseTypeInfoDTO()	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	Page
blockingRequest	85
flexBlocking	86
nonBlockingRequestAsynch	85
nonBlockingRequestSynch	85

Method Summary		Page
int	**getValue**()	86
static ResponseTypeInfoDTO.ResponseType	**valueOf**(String name)	86
static ResponseTypeInfoDTO.ResponseType[]	**values**()	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>	dasRequest	87
Map<String,Object>	dasResponse	87
byte[]	escertkeMessage	88
String	esprimObject	88
Map<String,Object>	esprimRandObject	88
Integer	securityInfoType	87

Constructor Summary	Page
SecurityInfoDTO()	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
FlexContainerIntrospector	FlexContainerInspector provides information of sub data structures and validity of data structure for FlexContainer Resource.	90
Introspector	Inspector provides information of sub data structures and validity of data structure of oneM2M, except FlexContainer.	92

Enum Summary		Page
Optionality	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

`public interface` **`FlexContainerIntrospector`**

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

Method Summary		Page
`String[]`	**`findValidationProblems`**`(ResourceDTO resource)` Execute Validation of Data Structure	90
`String[]`	**`getCustomeAttributeNames`**`(String containerDefinition)` get Possible Attributes for the given resourceType.	90
`Optionality`	**`getOptionality`**`(String containerDefinition, String attributeName)` get optionality of specified attribute	90
`Object`	**`getTemplateObject`**`(String containerDefinition, String customAttributeName)` return Typical Data Structure for Type for given attribute of resource type	91
`Class`	**`getType`**`(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 resourceType.

Returns:
array of Possible Attributes

---

getOptionality

`Optionality` **`getOptionality`**`(String containerDefinition,`
`String attributeName)`

get optionality of specified attribute

Parameters:
`containerDefinition` - container definition
`attributeName` - attribute name
Returns:
optionality of the attribute

---

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[]`	**`findValidationProblems`**`(RequestPrimitiveDTO req)` execute Validation of Data Structure	92
`String[]`	**`findValidationProblems`**`(ResponsePrimitiveDTO resp)` execute Validation of Data Structure	92
`String[]`	**`findValidationProblemsForCreate`**`(ResourceDTO resource)` execute Validation of Data Structure	93
`String[]`	**`findValidationProblemsForUpdate`**`(ResourceDTO resource)` execute Validation of Data Structure	93
`String[]`	**`getAttributeNames`**`(int resourceType)` get Possible Attributes for specified resourceType.	93
`Optionality`	**`getOptionalityForCreate`**`(int resourceType, String attributeName)` get Optionality of specified attribute in create operation.	93
`Optionality`	**`getOptionalityForUpdate`**`(int resourceType, String attributeName)` get Optionality of specified attribute in update operation.	93
`Object`	**`getTemplateObject`**`(int resourceType, String Attribute)` return Typical Data Structure for Type of specified attribute of resource type	94
`Class`	**`getType`**`(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

---

getOptionalityForCreate

```
Optionality getOptionalityForCreate(int resourceType,
                                    String attributeName)
```

get Optionality of specified attribute in create operation.

Parameters:
`resourceType` - resource type
`attributeName` - attribute Name
Returns:
Optionality

---

getOptionalityForUpdate

```
Optionality getOptionalityForUpdate(int resourceType,
                                    String attributeName)
```

get Optionality of specified attribute in update operation.

Parameters:
`resourceType` - resource type

`attributeName` - attribute Name

Returns:

Optionality

---

getType

```
Class getType(int resourceType,
              String attributeName)
```

return Java Type for given attribute of resource type

Parameters:

`resourceType` - resource type

`attributeName` - attribute Name

Returns:

expected class for the specified attribute

---

getTemplateObject

```
Object getTemplateObject(int resourceType,
                         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
Mandatory	95
NotPresent	95
Optional	95

Method Summary		Page
static Optionality	**valueOf**(String name)	96
static Optionality[]	**values**()	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
AbsRelTimestampDTO	AbsRelTimestamp	98
DynAuthTokenReqInfoDTO		99

Enum Summary		Page
ResourceType		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	Page
AbsRelTimestampDTO()	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>>	dasInfo	99

Constructor Summary	Page
DynAuthTokenReqInfoDTO()	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
accessControlPolicy	101
accessControlPolicyAnnc	105
AE	101
AEAnnc	105
container	102
containerAnnc	105
contentInstance	102
contentInstanceAnnc	105
CSEBase	102
delivery	102
dynamicAuthorizationConsultation	105
dynamicAuthorizationConsultationAnnc	106
eventConfig	102
execInstance	102
fanOutPoint	107
flexContainer	104
flexContainerAnnc	106
group	102
groupAnnc	105
latest	106
locationPolicy	102
locationPolicyAnnc	105
m2mServiceSubscriptionProfile	102
mgmtCmd	102
mgmtObj	103
mgmtObjAnnc	105
node	103
nodeAnnc	105
notificationTargetMgmtPolicyRef	104

Method Summary		Page
int	getValue()	107
static ResourceType	valueOf(String name)	107
static ResourceType[]	values()	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()
```


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

Genric 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.

10 Document Support

10.1 References

[1]. Bradner, S., Key words for use in RFCs to Indicate Requirement Levels, RFC2119, March 1997.

[2]. oneM2M TS-0001 Functional Architecture, 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

[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

10.4 End of Document